



# Water for life and livelihoods

River Basin Management Plan  
South East River Basin District

Annex A: Current state of waters

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### A.1 Introduction

This annex presents maps that show the status of water bodies and where we have environmentally significant deteriorating trends in groundwater quality. It includes maps showing the network of monitoring stations and maps showing the surface water body types that are present in the South East River Basin District. There is an overview of the types and the reference conditions of all waters at the end of this annex.

Detailed information about classification on a water body by water body basis is included in annex B.

Annex D lists protected areas established under other directives. It includes their location monitoring network and compliance with their objectives.

### A.2 Maps of classification results

Status assessment is a useful way of reporting the health of the environment. For a particular point in time a classification will show us where the quality of the environment is good, and where it may need improvement.

In 2007 the Environment Agency made a change to the way we assess the status of water bodies. For twenty years, we have been using a [General Quality Assessment](#) (GQA) scheme to assess river water quality in terms of chemistry, biology and nutrients. GQA has helped drive environmental improvements by dealing with many of the major point sources of pollutants, such as discharges from sewage treatment works or other industry. The Environment Agency now needs a more comprehensive way of assessing the whole water environment that will help us direct action to where it is most needed.

For surface waters there are two separate classifications for water bodies, ecological and chemical. For a water body to be in overall 'good' status both ecological and chemical status must be at least 'good'.

For groundwater there are two separate classifications for groundwater bodies; chemical status and quantitative status. Each must be reported in addition to the overall groundwater body status. For a groundwater body to be at good status overall both chemical status and quantitative status must be good. In addition to assessing status, there is also a requirement to identify and report where the quality of groundwater is deteriorating as a result of pollution and which may lead to a future deterioration in status.

A separate document explaining the classification process in more detail can be found at [http://www.environment-agency.gov.uk/static/documents/Research/Classification\\_Method\\_Statement\\_FINAL.pdf](http://www.environment-agency.gov.uk/static/documents/Research/Classification_Method_Statement_FINAL.pdf)

» Remember that classification is just one part the evidence base that helps to focus efforts on those water bodies where a difference needs to be made. **If you have information regarding the state of your local water environment please contact our National Customer Contact Centre on 08708 506 506.**

## **Ecological status**

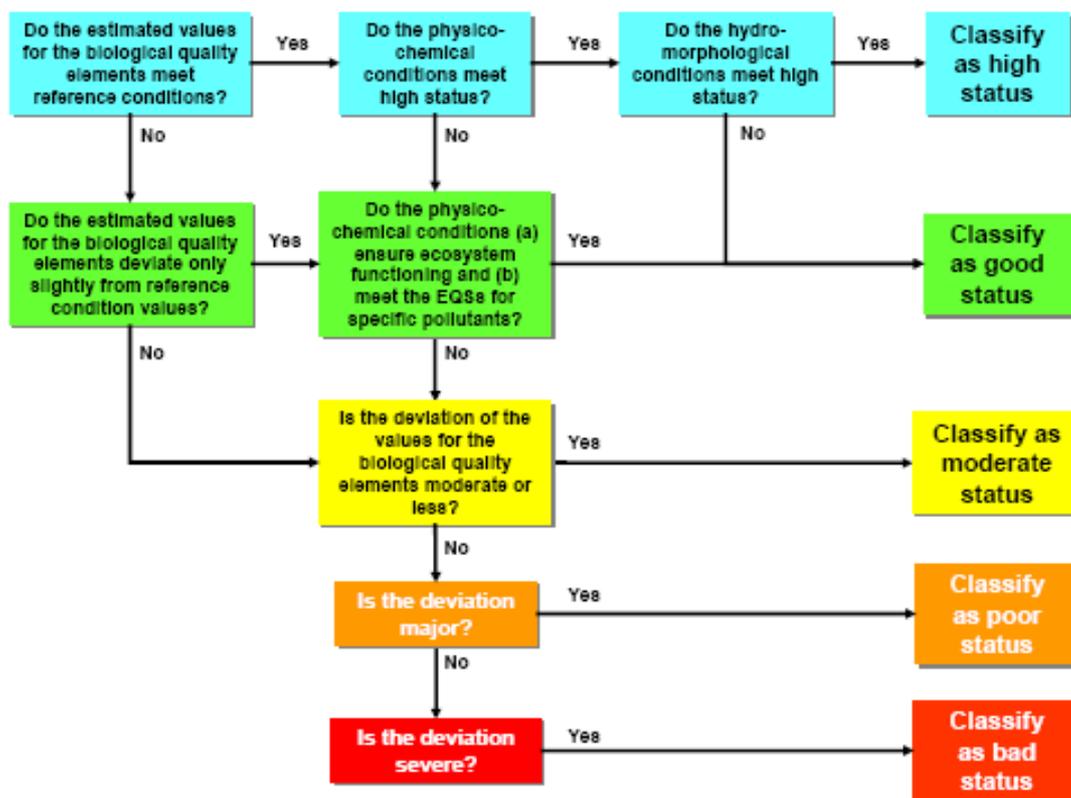
Ecological classification is summarised in figure A.1 (below) and comprises:

- The condition of biological elements, for example fish
- Concentrations of supporting physico-chemical elements, for example the oxygen or ammonia levels
- Concentrations of specific pollutants, for example copper.
- And for high status, largely undisturbed hydromorphology

Ecological status is recorded on the scale of high, good, moderate, poor or bad. 'High' denotes largely undisturbed conditions and the other classes represent increasing deviation from this natural condition – from here on described as 'reference condition'. The ecological status classification for the water body, and the confidence in this, is determined the worst scoring quality element.

In annex B the ecological status for water is accompanied by a statement of how certain the Environment Agency is that a water body is worse than good status. See section A.6 for further information.

Figure A.1: **Decision tree illustrating the criteria determining the different ecological status classes (from [UKTAG Classification Guidance](#)).**



Only biological elements are recorded on the full scale, high to bad. Supporting physico-chemical elements are not reported below moderate status. However, the UK Technical Advisory Group, (the UK-wide collaboration to develop best practice), has produced standards that distinguish between moderate, poor and bad for physico-chemical elements. The Environment Agency uses this information as part of our evidence base as well.

### Chemical status

The chemical status is assessed by compliance with environmental standards for chemicals that are priority substances and priority hazardous substances and other substances carried over from the Dangerous Substance Directive, which are listed in the Priority Substance Daughter Directive 2008/105/EC. Chemical status is recorded as good or fail. The chemical status classification for the water body, and our certainty in this, is determined by the worst scoring chemical.

An assessment of chemical status is required in water bodies where priority substances and other specific pollutants are known to be discharged in significant quantities. If a water body is labelled as "does not require assessment" it is because these pollutants are not discharged into this water body in significant quantities.

### Groundwater status –chemical and quantitative

The achievement of good status in groundwater involves meeting a series of conditions which are defined in the Water Framework Directive (2000/60/EC) and Groundwater Directive (2006/118/EC). In order to assess whether these conditions are being met, a series of tests has been designed for each of the quality elements defining good (chemical and quantitative) groundwater status.

There are five chemical and four quantitative tests. Each test is applied independently and the results combined to give an overall assessment of groundwater body chemical and quantitative status. The worst case classification from the relevant chemical status tests is reported as the overall chemical status for the groundwater body and the worst case classification of the quantitative tests reported as the overall quantitative status for the groundwater body. The worst result of these two is reported as the overall groundwater body status. Groundwater bodies are at either good or poor status.

### **Groundwater Trend assessment**

For groundwater bodies that have been identified as being at risk of failing to meet their environmental objectives for groundwater quality, there is a requirement to identify any significant and sustained upward trends in pollutant concentrations. A significant trend is one that could lead to a groundwater body failing to meet its environmental objectives before 2021 (the end of two river basin cycles) if measures are not put in place to reverse the trend.

The trend assessment process is described further in UKTAG guidance: [Groundwater Trend Assessment](#)<sup>1</sup>.

### **Ecological Potential**

For water bodies that have been designated as candidate heavily modified or artificial (HMAWBs see annex I), the Environment Agency must classify according to their ecological potential rather than status. UKTAG have adopted the 'mitigation measures approach' for classifying Heavily Modified and Artificial water bodies. This is a complicated procedure.

This approach first assesses whether actions to mitigate the impact of physical modification are in place to the extent that could reasonably be expected. If this mitigation is in place, then the water body may be classified as achieving good or better ecological potential. If this level of mitigation is not in place, then the water body will be classed as moderate or worse ecological potential.

Before an overall ecological potential classification is applied the second step is for the results of the mitigation measures assessment to be cross-checked with data from biological and physico-chemical assessments.

Where the Environment Agency have data for biological quality elements that show signs of damage from pressures other than hydromorphological alterations (for example, if the diatom or phytoplankton status is poor because of nutrient pressures) the ecological potential will be changed. To reflect this other pressure the water body will be labelled as 'Poor Ecological Potential'. This is also true where we have data for physico-chemical quality elements. As with diatoms, these are capable of picking up impacts beyond the hydromorphological pressure and must be also be reflected in the overall ecological potential result.

Where the flow conditions do not support good status (for example, due to over abstraction) it is necessary to over-ride the mitigation measures assessment so that the results of the biological surveys dictate the overall ecological potential. By doing this we will ensure we don't misrepresent the potential of a water body where, despite all mitigation measures being taken to address the physical pressures, the wildlife is suffering because of an abstraction upstream.

Finally, the Environment Agency may sometimes find that a water body has been designated as heavily modified yet the biological elements surveyed are at good ecological status. Where this is true we will remove the HMWB designation. We may be carrying out further

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<sup>1</sup> [http://www.wfduk.org/tag\\_guidance/Article\\_05/Folder.2004-02-16.5332/gw\\_trend](http://www.wfduk.org/tag_guidance/Article_05/Folder.2004-02-16.5332/gw_trend)

biological monitoring between 2010 and 2012 to confirm that it is right to remove the designation.

### **Expert Judgement**

The Environment Agency doesn't have data for from all water bodies. Where we lack data we have used expert judgement to provide an initial assessment of water body status. This expert judgement is based on the following strands of evidence:

- Risk assessments carried out as the first part of the river basin planning process (River Basin Characterisation)
- Data from other organisations, such as Natural England (Sites of Special Scientific Interest condition assessments)
- Expert opinion from national experts and local Environment Agency officers

» [Classification results based on expert judgement are clearly marked in annex B.](#)

### **A level playing field**

Some of the scorings used in ecological classification have been agreed at a European level. The process of agreement is called 'intercalibration' and it is about ensuring that we are operating on a level-playing field with the rest of Europe; our definition of good status i.e. the deviation from reference, must be comparable with the deviation used by other countries. The tools which have not been intercalibrated can still be used for classification in the UK and will go through a second phase of intercalibration. It should be noted that there is no intercalibration process for groundwater.

### **The results**

In the South East River Basin District 19 per cent of surface waters meet good ecological status or better and 19 per cent meet good overall status; 81 per cent do not meet good ecological status (334 water bodies) or good overall status. 33 per cent of groundwater bodies are at good overall status with the rest being poor status.

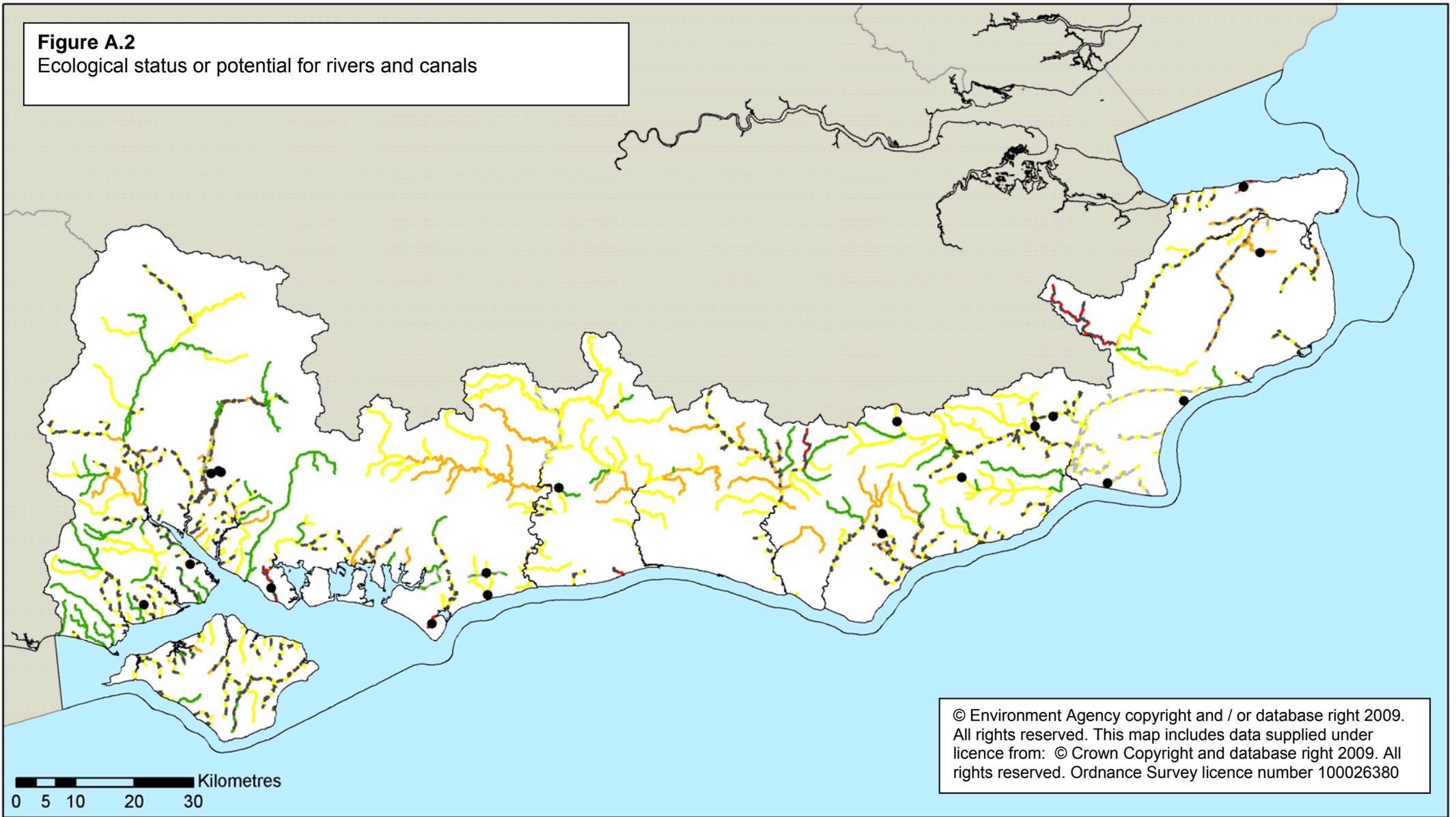
Adding surface waters and groundwater bodies together, 20 per cent of waters meet good status or potential.

The majority of surface water bodies that fail to meet good status fail because of phosphate, fish or invertebrate elements of classification. Phosphates help to assess the impact of diffuse and point source pollution to water bodies, Fish helps to assess the impact of abstraction of water and morphological alterations to water bodies; invertebrates help to assess the impact of organic enrichment, pollution by toxic chemicals, and abstraction of water.

The following maps show the classification results for this river basin district (Figure A.2 to A.7)

**Figure A.2**

Ecological status or potential for rivers and canals

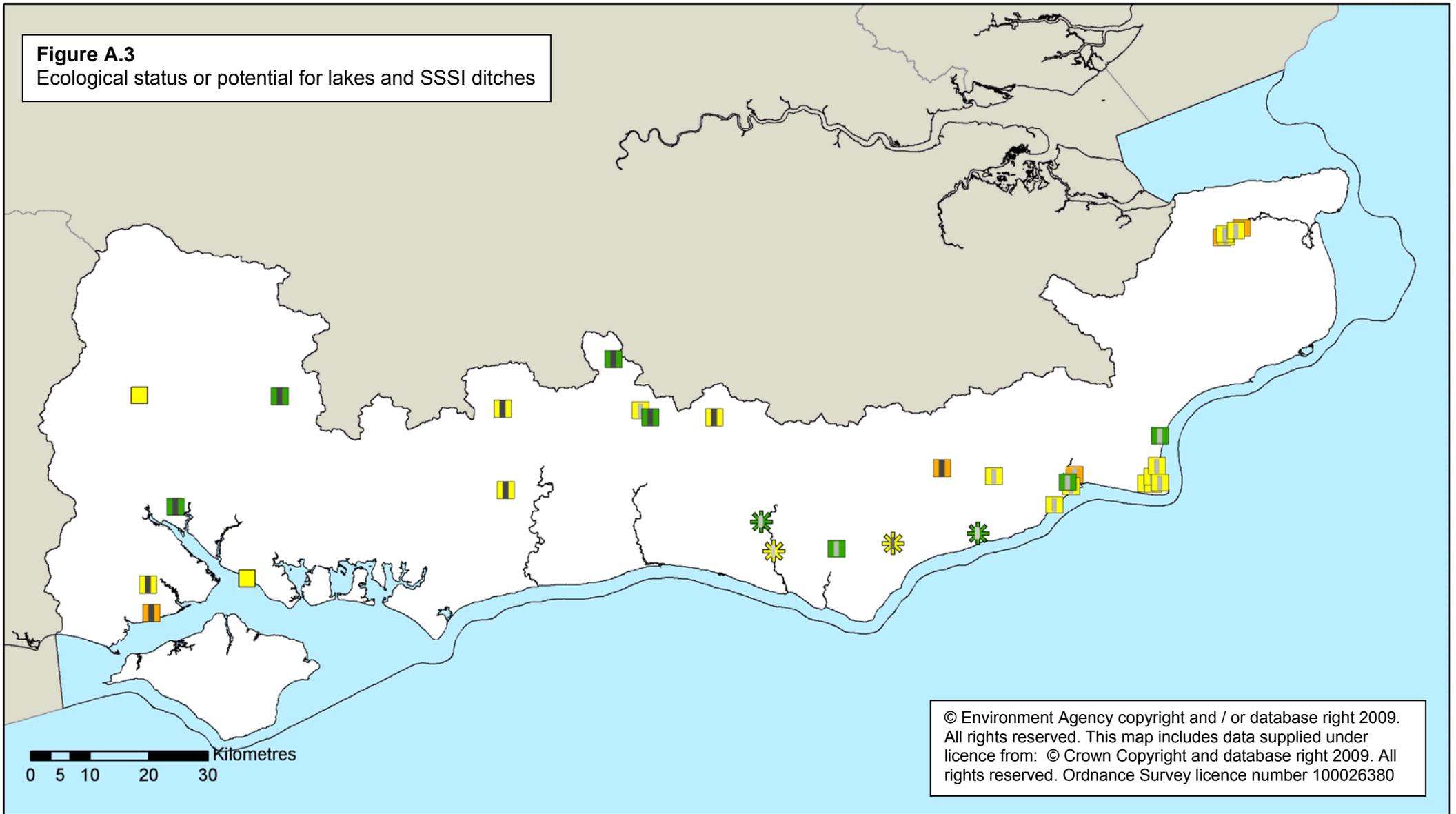


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RBD boundary	<b>River, Canal, Surface Water Transfer:</b>	<b>Ecological Status</b>	<b>Ecological Potential HMWB</b>	<b>Ecological Potential AWB</b>
Other RBDs		High Good Moderate Poor Bad	Good Moderate Poor Bad	Good Moderate Poor Bad
<b>Water body fails specific pollutants</b>				

**Figure A.3**

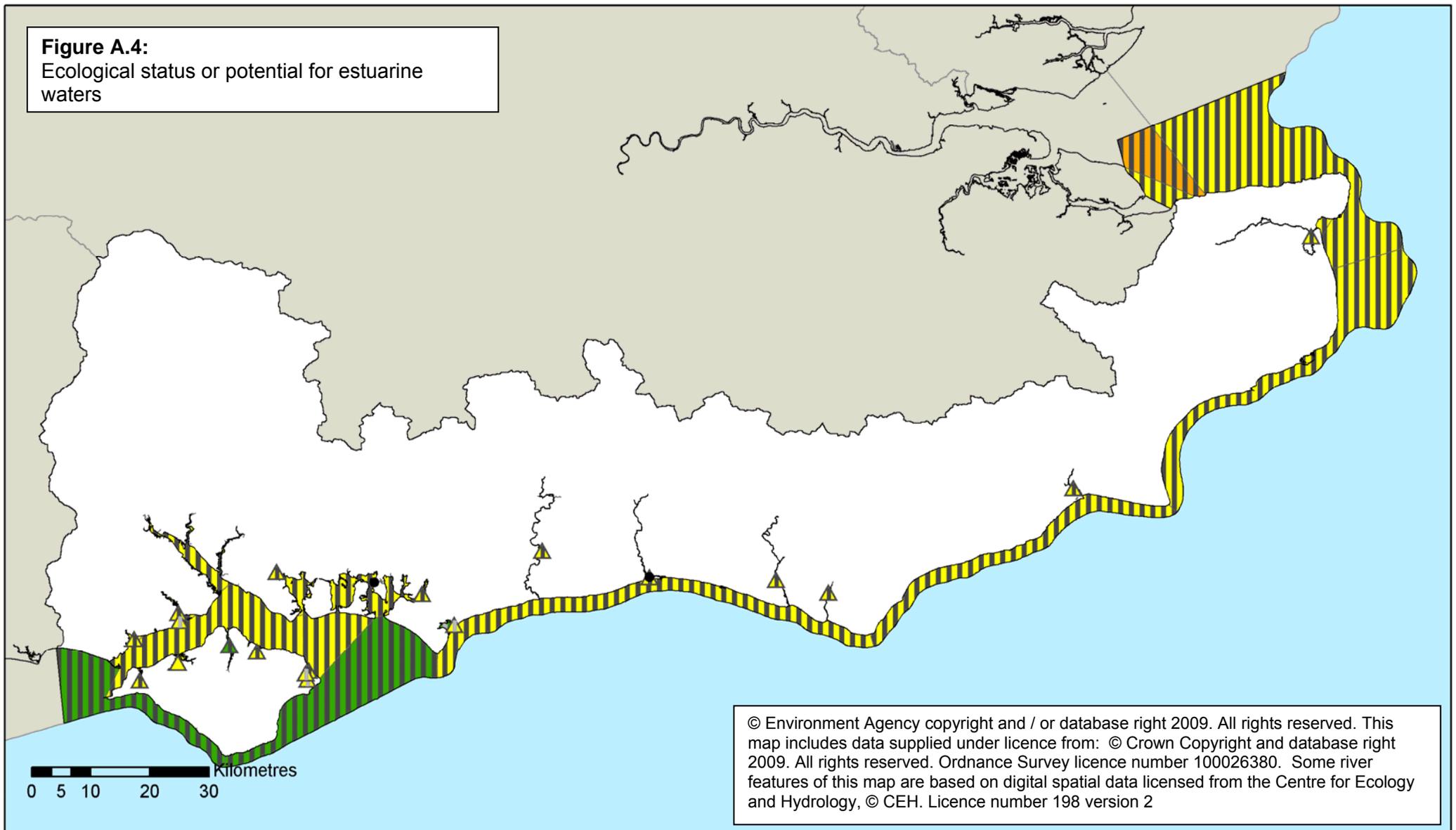
Ecological status or potential for lakes and SSSI ditches



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RBD boundary	<b>Lake: Ecological Status</b>	<b>Ecological Potential</b>		<b>SSSI ditch: Ecological Potential</b>		
Other RBDs	High	<b>HMWB</b>	<b>AWB</b>	Good	Good	Good
Water body fails specific pollutants	Good	Good	Good	Moderate	Moderate	Moderate
	Moderate	Moderate	Moderate	Poor	Poor	Poor
	Poor	Poor	Poor	Bad	Bad	Bad
	Bad	Bad	Bad			

**Figure A.4:**  
Ecological status or potential for estuarine waters

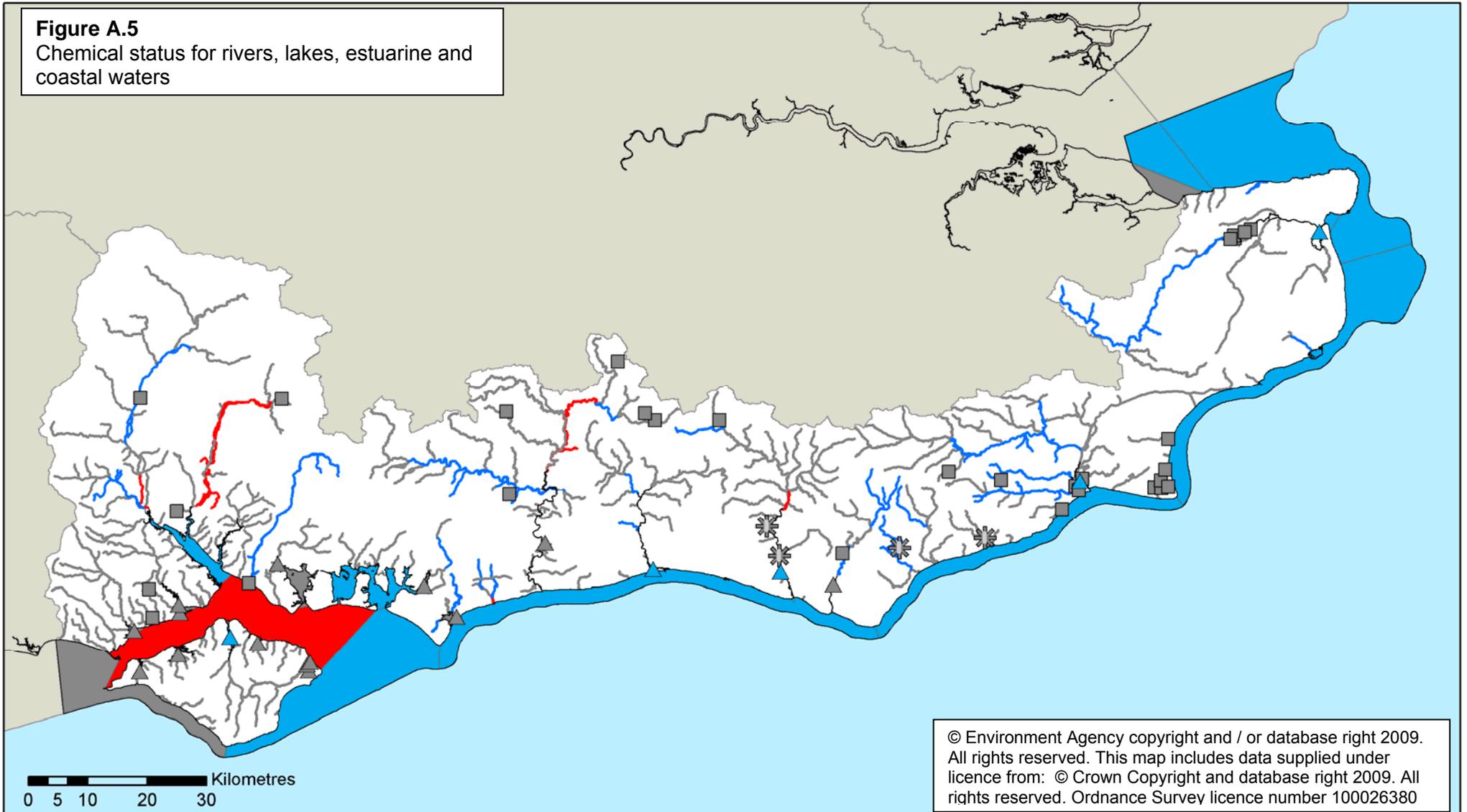


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RBD boundary Other RBDs Water body fails specific pollutants	<b>Coast &amp; Estuary:</b> <b>Ecological Status</b> High Good Moderate Poor Bad	<b>Potential:</b> <b>HMWB AWB</b>    	<b>Estuary less than 30km<sup>2</sup>:</b> <b>Ecological Status</b> High Good Moderate Poor Bad	<b>Potential:</b> <b>HMWB AWB</b>    
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**Figure A.5**

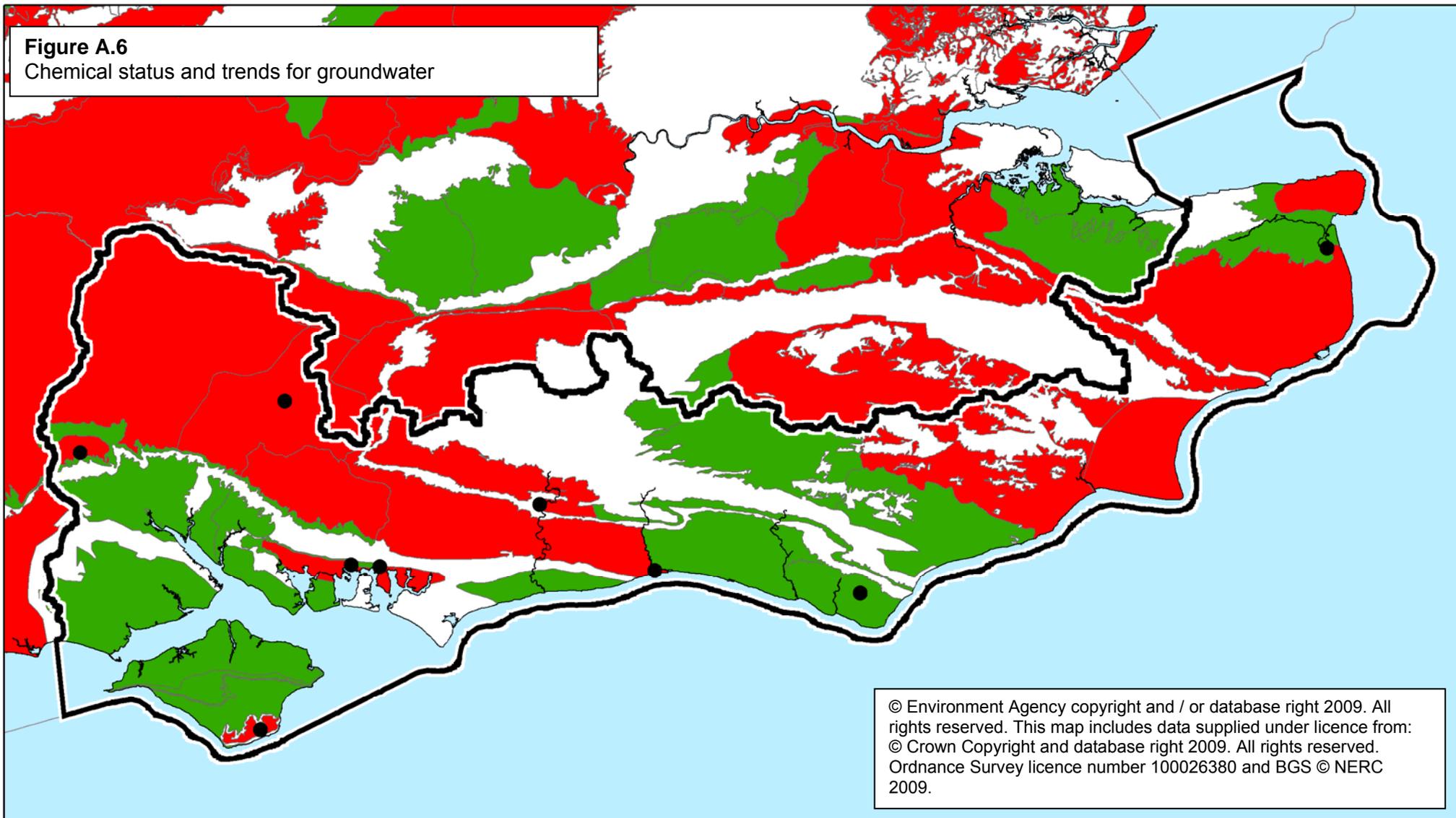
Chemical status for rivers, lakes, estuarine and coastal waters



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RBD boundary	<b>Rivers, Canals, SWTs</b>	<b>Lakes</b>	<b>SSSI ditch</b>	<b>Coasts &amp; Estuaries &gt;30km<sup>2</sup></b>	<b>Estuaries &lt;30km<sup>2</sup></b>	<b>Chemical Status</b>
Other RBDs	  	  	  	  	  	Good Failing to Achieve Good Does not require assessment

**Figure A.6**  
Chemical status and trends for groundwater



0 5 10 20 30 Kilometres

 RBD boundary  
 Other RBD boundaries

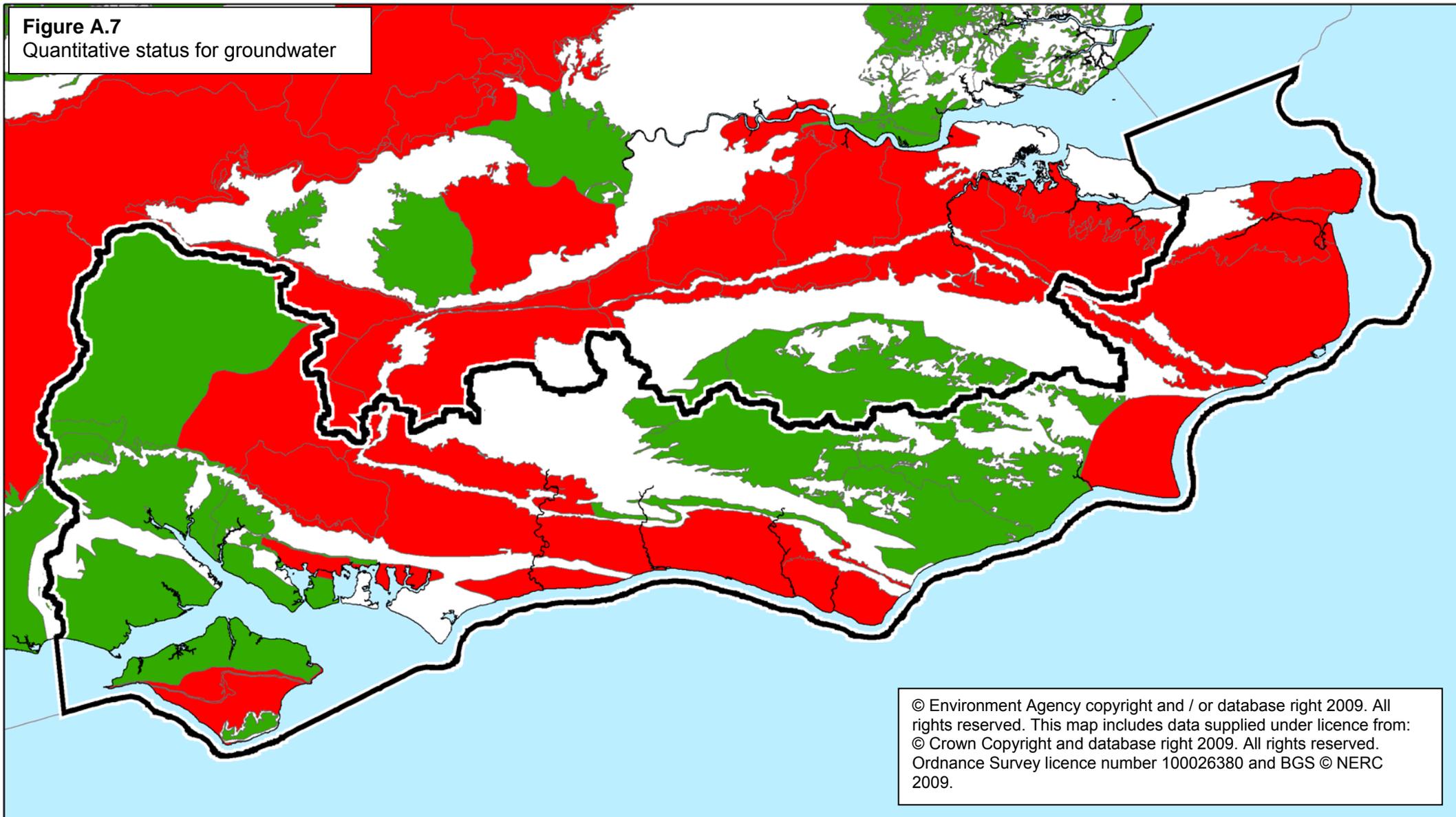
**Groundwater Chemical Status**

 Good  
 Poor  
 Not assessed (unproductive strata)

**Groundwater subject to rising trends**

 Yes  
 Trend reversed

**Figure A.7**  
Quantitative status for groundwater



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Kilometres  
0 5 10 20 30

RBD boundary  
 Other RBD boundaries

**Groundwater Quantitative Status**

Good  
 Poor  
 Not assessed (unproductive strata)

## A.3 Maps of monitoring network

In this section we show the network of monitoring stations used to establish the actual condition of all water body types within the South East River Basin District in terms of their ecology, water chemistry, and flow and groundwater level

For fresh surface waters we are using a targeted monitoring programme to classify water bodies at risk of failing to meet good status in 2015 (see annex G – Pressures and risks to the water environment). We have also established a smaller network of surveillance sites to provide information on long-term natural and anthropogenic trends. This network will also be used to validate our risk assessments.

For groundwater we have established two monitoring networks to classify groundwater bodies. We have a groundwater quality monitoring network that meets the surveillance and operational monitoring requirements for chemical status and trend assessment, and a groundwater level monitoring network to meet the requirements of quantitative status assessment.

We have also established surveillance monitoring in our coastal and estuarine water bodies.

Where ever possible we have supplemented data from the new ecological monitoring programmes with data from our monitoring programmes established for other purposes.

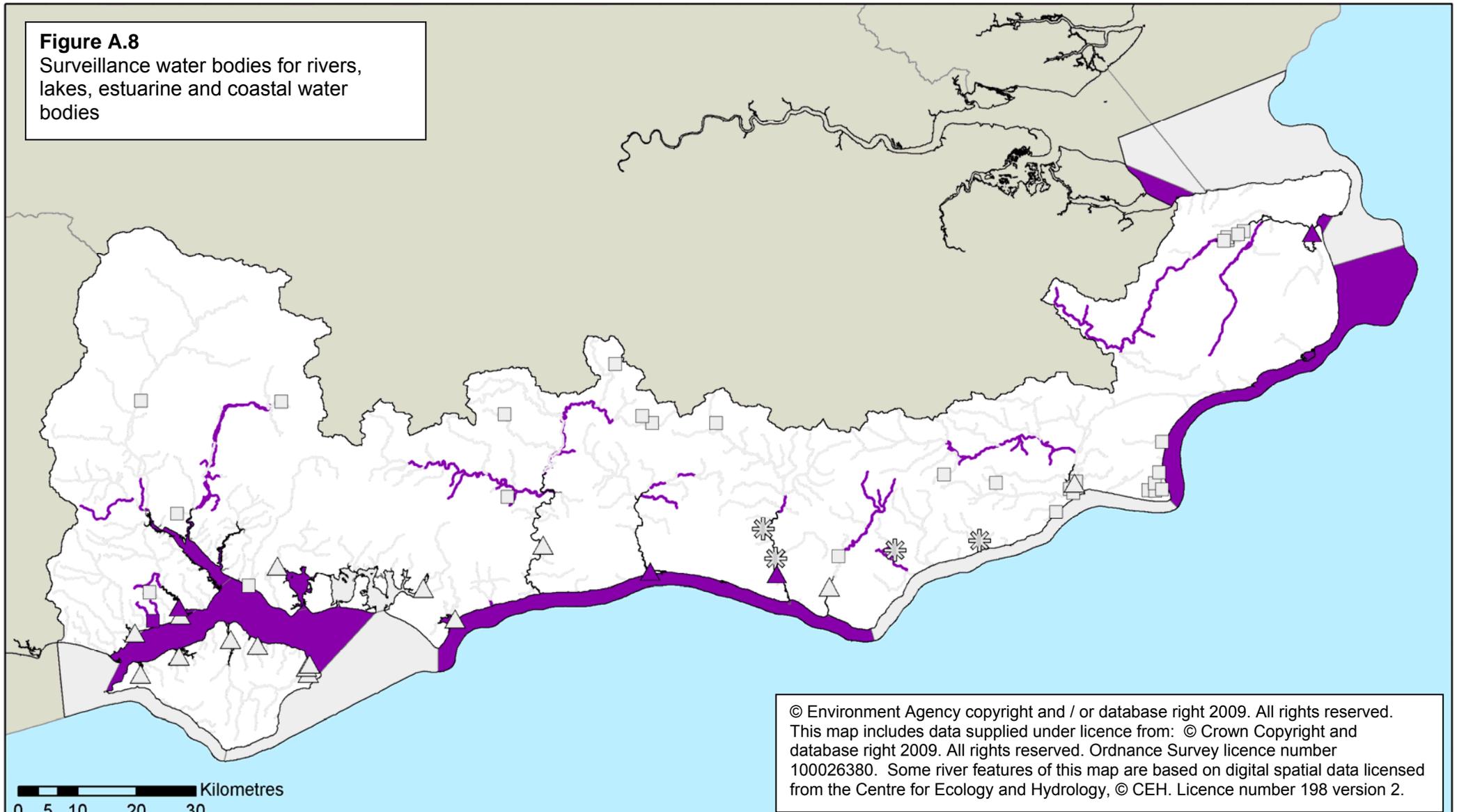
More information on the monitoring and classification techniques can be found at

<http://www.wfduk.org/UKCLASSPUB/>

The following maps show our monitoring programme that we have used to classify water bodies (Figure A.8 to A.11).

**Figure A.8**

Surveillance water bodies for rivers, lakes, estuarine and coastal water bodies

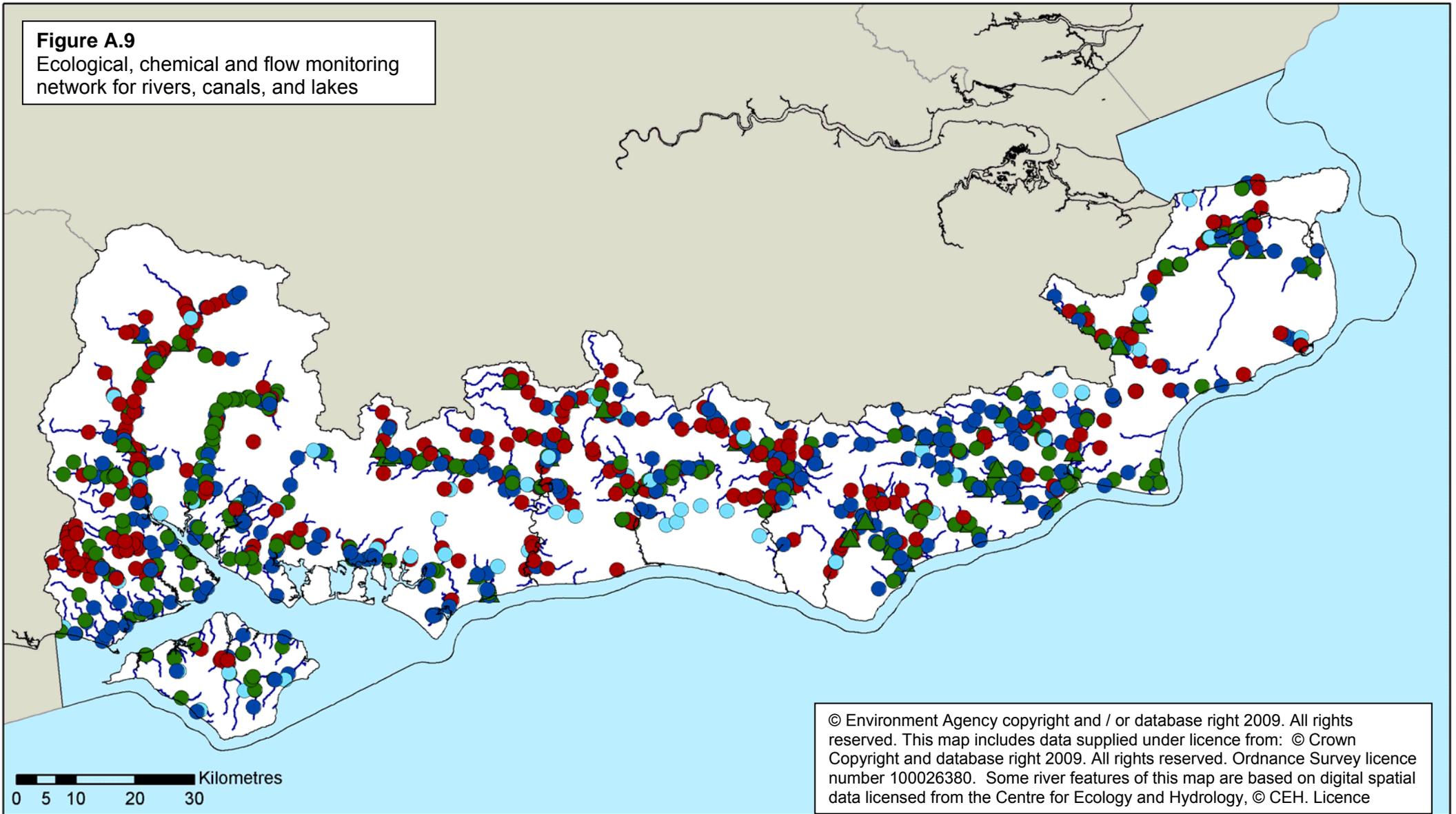


0 5 10 20 30 Kilometres

RBD boundary	<b>Rivers, Canals, SWTs</b>	<b>Lakes</b>	<b>SSSI ditch</b>	<b>Coasts &amp; Estuaries &gt;30km<sup>2</sup></b>	<b>Estuaries &lt;30km<sup>2</sup></b>	
Other RBDs	 	 	 	 	 	Surveillance water body  Non-surveillance water body

**Figure A.9**

Ecological, chemical and flow monitoring network for rivers, canals, and lakes



□ RBD boundary

■ Other RBDs

**Monitoring sites  
(already visited)**

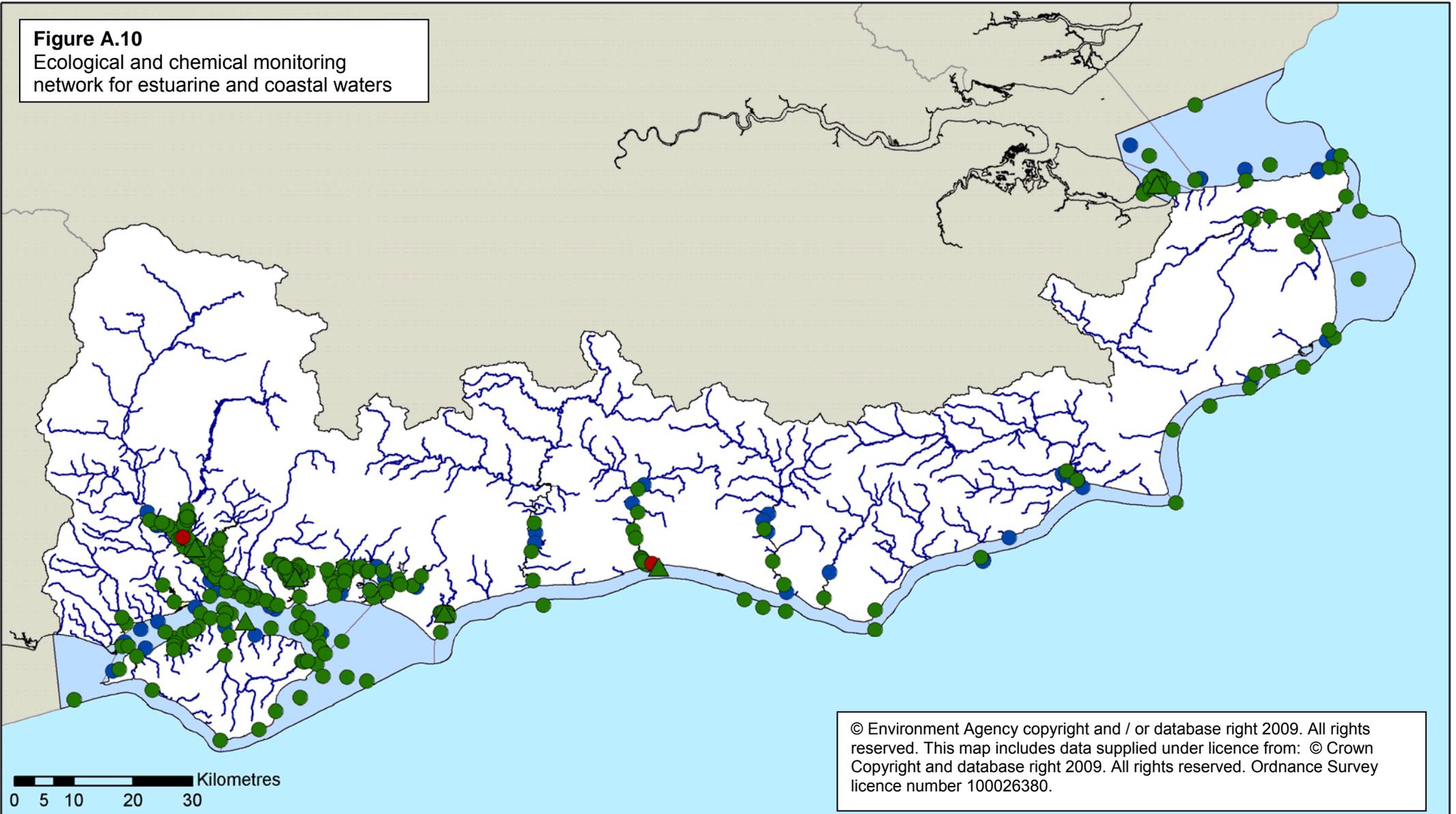
- Fish
- Biology
- Chemistry
- Flow

**Monitoring sites  
(due to be visited)**

- ▲ Biology

**Figure A.10**

Ecological and chemical monitoring network for estuarine and coastal waters



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□ RBD boundary  
■ Other RBDs

**Monitoring sites  
(already visited)**

- Fish
- Biology
- Chemistry
- Flow

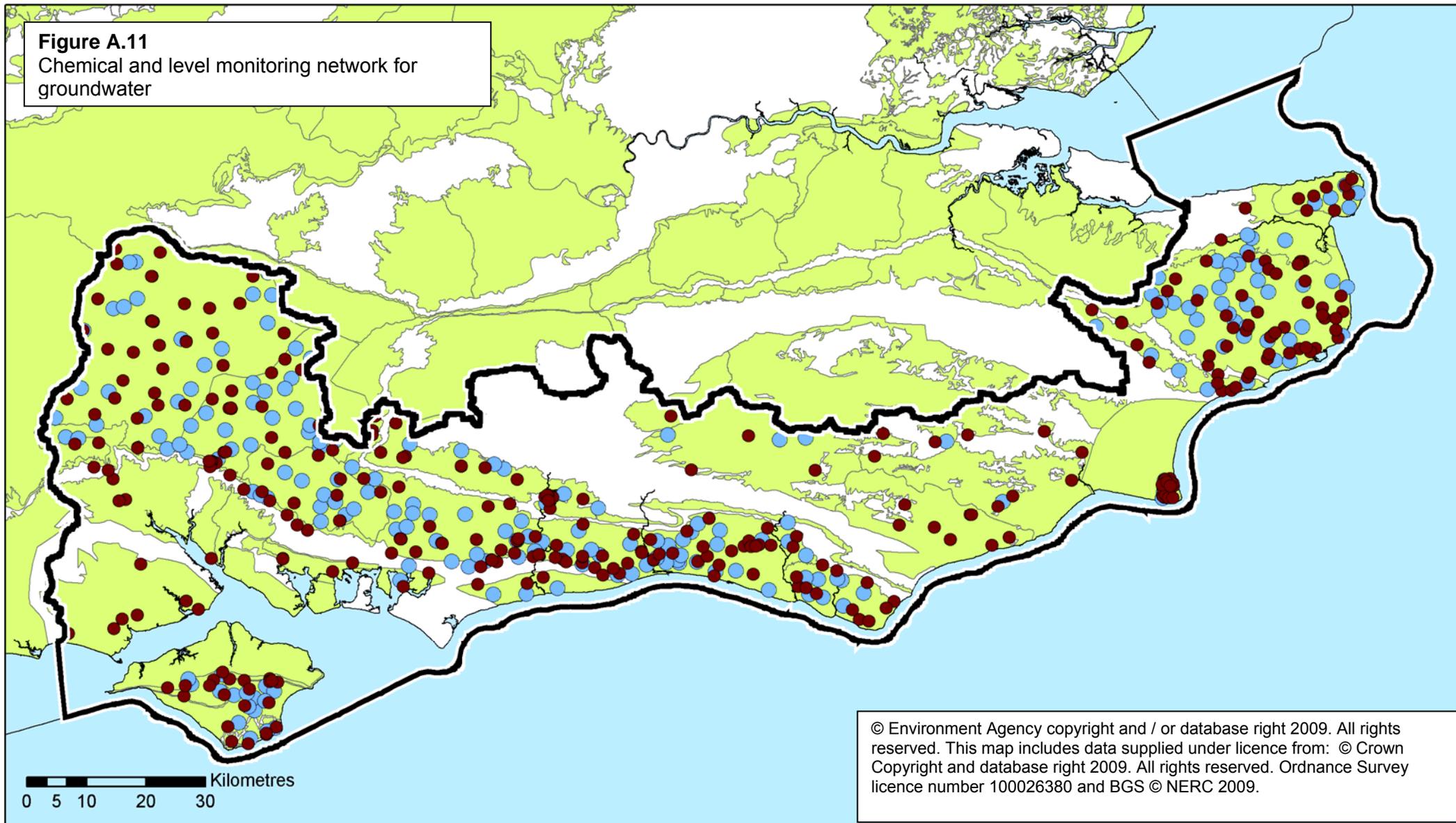
**Monitoring sites  
(due to be visited)**

- ▲ Biology

Estuaries

Coastal waters

**Figure A.11**  
Chemical and level monitoring network for groundwater



 RBD boundary

 Groundwater Body

 Groundwater Quality Monitoring Point

 Unproductive strata

 Groundwater Quantity Monitoring Point

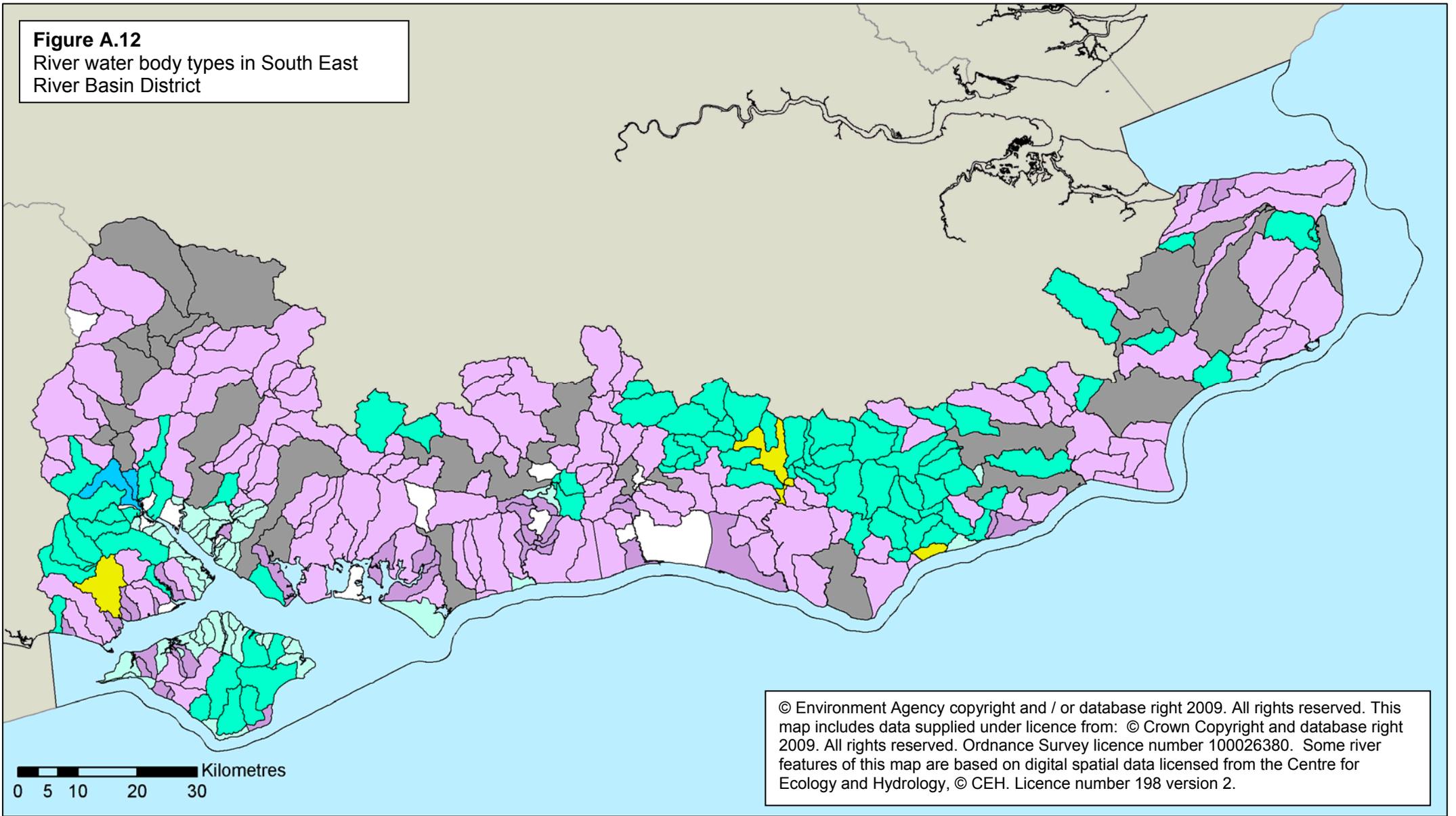
## **A.4 Maps of surface water body types**

Because the sorts of animals and plants found in upland, rocky, fast-flowing streams are very different to those found in lowland, slow flowing, meandering rivers, surface water bodies are grouped into different types according to their physical and chemical characteristics. The types described below dictate, in very general terms, the sorts of plants and animals likely to be present in water bodies of that type.

Further information on water types in the South East River Basin District and the associated reference conditions are included in section A.5 of this annex.

The surface water body types that are found in the South East River Basin District are illustrated in the maps shown below in Figures A.12 to A.15.

**Figure A.12**  
River water body types in South East  
River Basin District

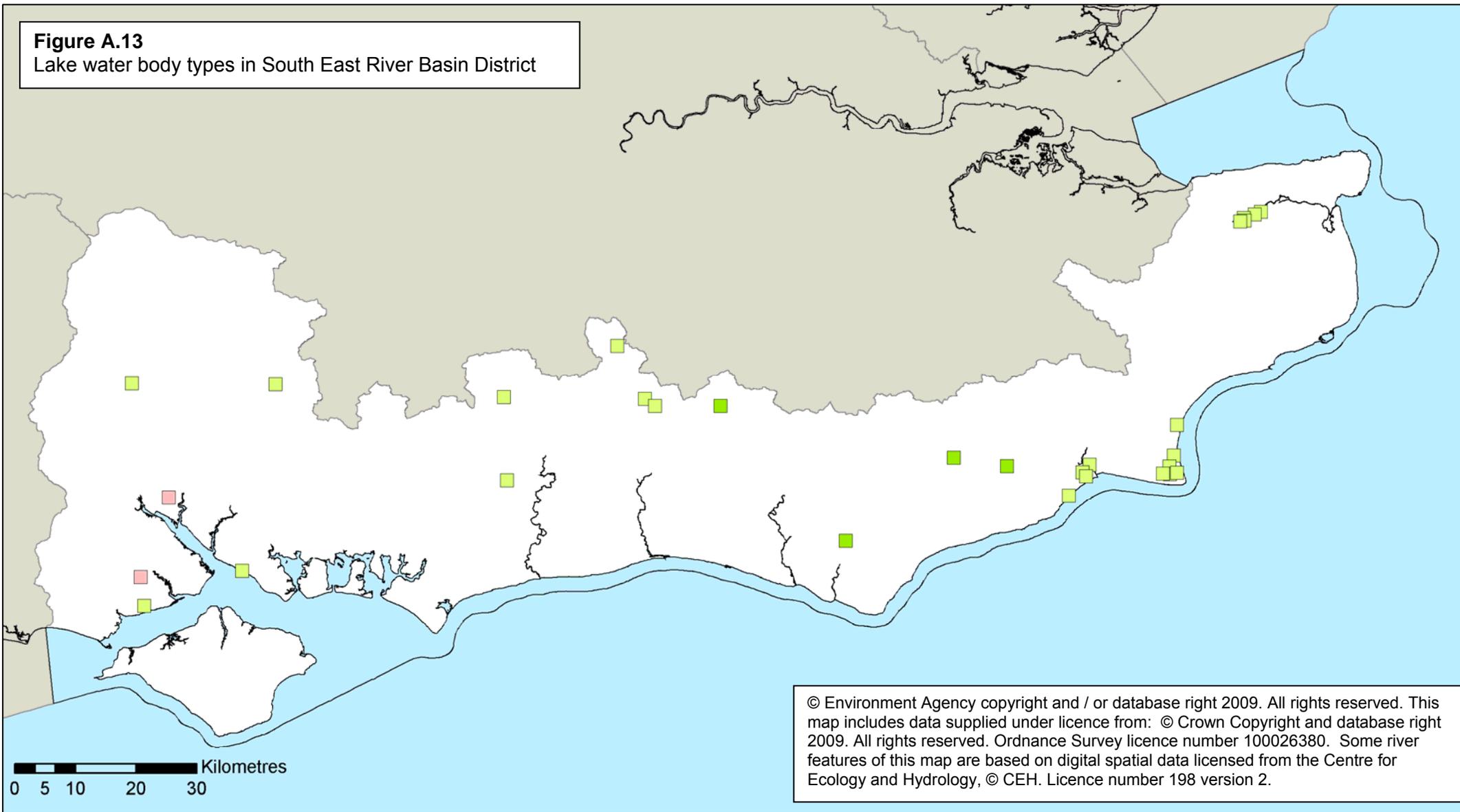


 RBD boundary  
 Other RBDs

**River Catchment Typology (altitude, size, geology)**

- |   |  |
|---|--|
|  Low, Small, Siliceous   |  Low, Large, Calcareous       |
|  Low, Small, Calcareous  |  Low, Extra Small, Siliceous  |
|  Low, Medium, Siliceous  |  Low, Extra Small, Calcareous |
|  Low, Medium, Calcareous |  Untyped                      |

**Figure A.13**  
Lake water body types in South East River Basin District



□ RBD boundary

■ Other RBDs

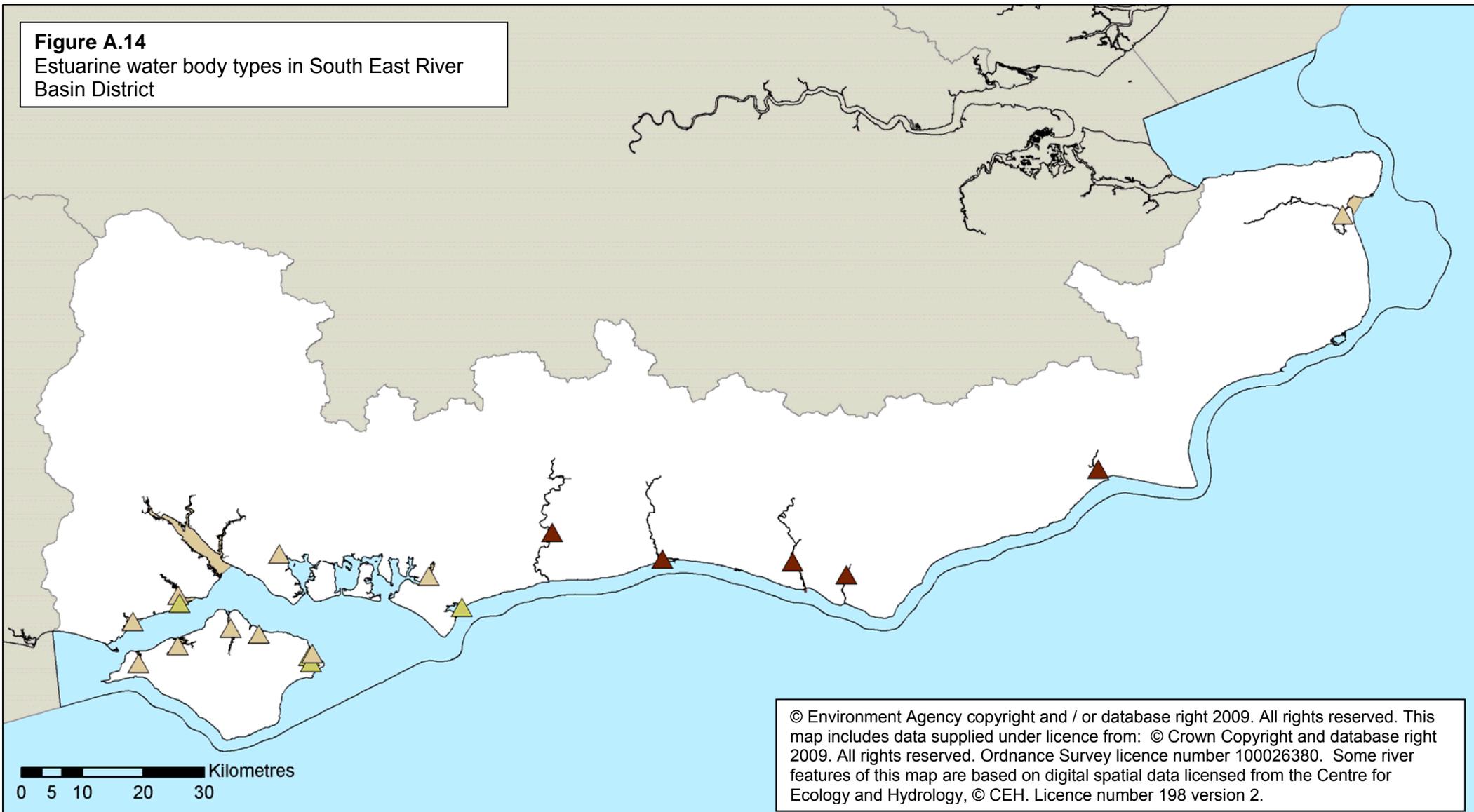
### Lake Typology

■ Low Alkalinity, Very shallow

■ High Alkalinity, Shallow

■ High Alkalinity, Very shallow

**Figure A.14**  
 Estuarine water body types in South East River  
 Basin District



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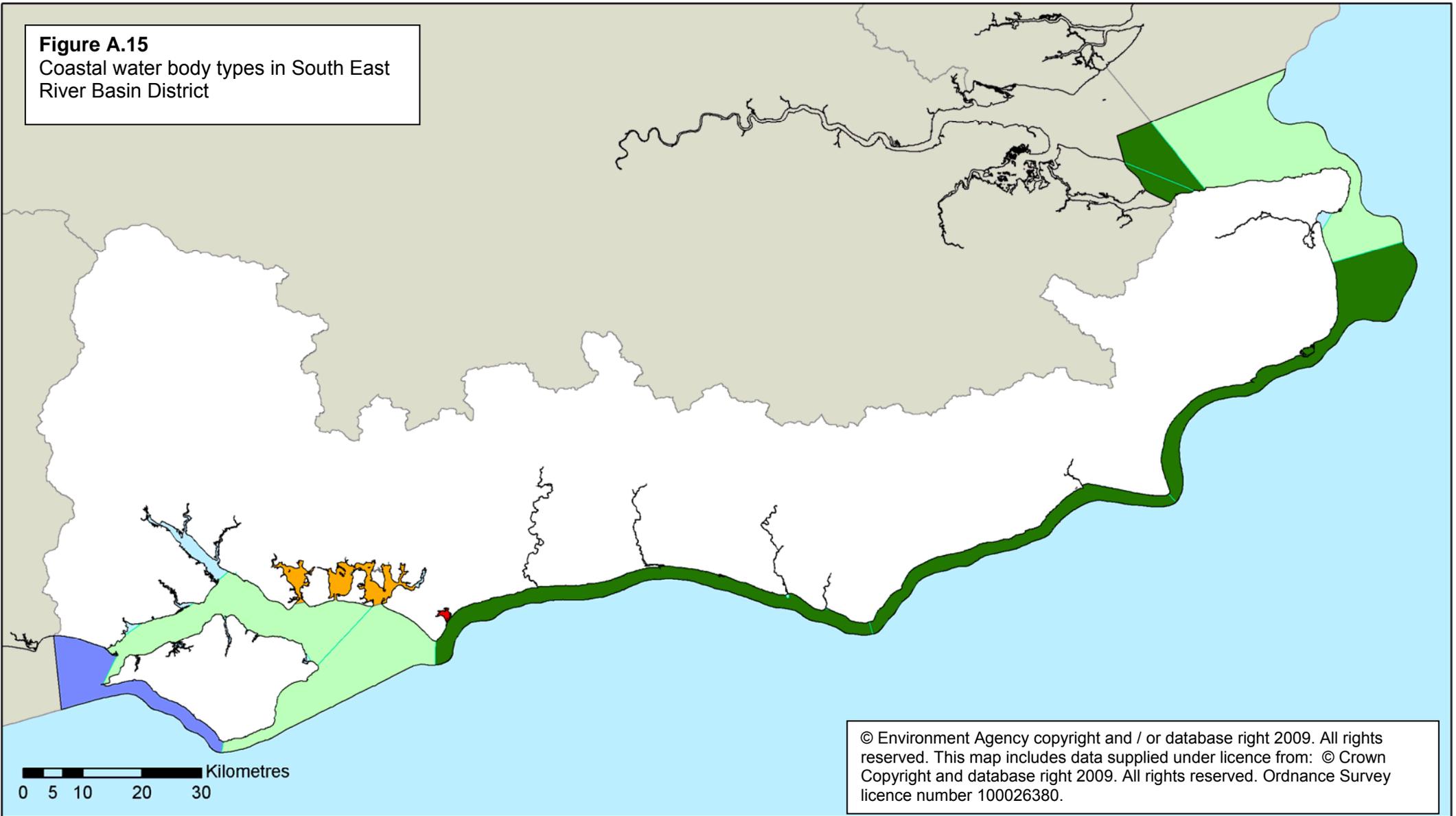
 RBD boundary  
 Other RBDs

**Estuarine typology**

Estuary	Estuary less than 30km <sup>2</sup>	
		Partly mixed, macro
		Mixed, meso, extensive intertidal
		Transitional Lagoon

**Figure A.15**

Coastal water body types in South East River Basin District



Coastal Typology

 RBD boundary

 Other RBDs

 Exposed, Mesotidal

 Moderately exposed, Macrotidal

 Moderately exposed, Mesotidal

 Sheltered, Macrotidal

 Sheltered, Mesotidal

 Lagoon

## A.5 Surface water body types and reference conditions

In the South East River Basin District there are seven river types, three lakes types, three estuarine water types and six coastal water types. A descriptive overview for each of these water body types is given below.

Reference condition descriptions covering the sorts of plants and animals expected to be found in the different types of water bodies in undisturbed conditions have been produced for each type or group of types (see references below). These types are the ones that have been used in the initial characterisation of each river basin district. In some cases there are no examples of reference condition in the UK and descriptions are based on similar types in other Member States, or extrapolation from modelling studies, or historic data.

Reference conditions and the conditions found in high status waters are the same thing. For example, if a classification tool shows that the diatom community in water body is at high status, then the species composition and abundance of diatoms in that type of water body are what would be expected under reference or undisturbed conditions. The way reference values have been determined for each of the biological elements is given in the UKTAG Assessment Methodologies which can be found on the UKTAG website ([UKTAG website](#))

The Ministerial Directions on Environmental Standards (reference) give the values for high status for both biological and physico-chemical elements and include screening approaches for high status hydrology and morphology. It is important to understand, that to be in overall reference condition a water body would need to comply with all the criteria including hydrological regime and morphological criteria. There are very few of these in England and Wales using the current criteria

The reference conditions descriptions are given in detail on the UK Technical Advisory Group website:

For rivers at:

[WFD UK TAG - Type Specific Reference Conditions for Rivers](#)

For lakes at:

[WFD UK TAG - Type Specific reference conditions for Lakes](#)

For estuarine and coastal waters at:

[WFD UK TAG - Reference conditions for Estuarine and Coastal Waters](#)

### Types of water in the river basin district

#### Rivers

**River Type 1: small catchment area (10-100km<sup>2</sup>), mean catchment altitude- low (<200m), with a predominantly siliceous geology.**

**Type overview:** in England and Wales, this type of river is predominantly found in the South West (particularly Cornwall), Kent/Sussex, around the New Forest in Hampshire, the western part of Wales, Anglesey and in the Lake District. In the South East River Basin District, this type of river is predominantly found around the New Forest in Hampshire and the catchments of the Ouse, Cuckmere and Rother in East Sussex and Kent. Across Great Britain it covers 11% of the typed river length.

**Flora and fauna:** Typically around 30 plant taxa occur in a 1km reach. The large emergent species are represented mainly by *Phalaris arundinacea* and to a lesser extent *Sparganium erectum* and *Oenanthe crocata*. Elsewhere banks are often lined by *Juncus effusus* or *J. acutiflorus*. Small marginal species are widespread, the most typical being the grasses *Agrostis stolonifera*, *Glyceria fluitans* plus *Caltha palustris*, *Mentha aquatica*, *Myosotis stolonifera*, *Veronica beccabunga*, *Juncus articulatus* and *Ranunculus flammula*. Towards the east and south of England in the middle and lower reaches, chub and dace are likely to predominate rather than trout, and are often associated with gudgeon, pike, and possibly perch, roach and/or barbel. The invertebrate fauna of this type is diverse, with a good complement of mayfly, stonefly and caddis larvae.

**River Type 2: small catchment area (10-100km<sup>2</sup>), mean catchment altitude- low (<200m), with a predominantly calcareous geology.**

**Type overview:** In England and Wales, this river type is found in virtually all lowland regions. In the South East River Basin District, it is predominantly found in the tributaries of the River's Itchen and Test in Hampshire and the Western Rother in Sussex. It is the most common type covering 26% of typed river length across Great Britain.

**Flora and fauna:** These streams have many of the characteristics of Type 1 with an increased emphasis on species typical of more base- and nutrient-rich situations and are correspondingly slightly more species rich (c.35 species per 1km reach). Amongst the larger emergent species *Phalaris arundinacea* and *Sparganium erectum* are almost ubiquitous while *Epilobium hirsutum*, *Oenanthe crocata* and more rarely *Iris pseudacorus*, *Glyceria maxima*, *Schoenoplectus lacustris* and *Carex acutiformis* are less frequent but often abundant. Towards the east and south of England, chub and dace are likely to predominate in the middle and lower reaches, together with gudgeon, pike, eel, ruffe and possibly perch, roach, spined loach and/or barbel. The fauna will be diverse with a good complement of molluscs, mayflies and caddis that thrive in calcareous conditions. Hydrobiidae, Sphaeriidae, Oligochaeta, Gammaridae, Baetidae, Elmidae and Chironomidae are almost always present

**River Type 4: medium sized catchment area (100-1000 km<sup>2</sup>), mean catchment altitude- low (<200m), with a predominantly siliceous geology.**

**Type overview:** in England and Wales this river type is found in hilly areas of the South, West and North. Uncommon in South East River Basin District, this type of river is found around the New Forest in Hampshire and in the central part of the Ouse catchment in Sussex. It covers less than 2% of the typed river length across Great Britain.

**Flora and fauna:** There are many similarities with Type 1 streams but bryophytes are generally more frequent and extensive in these rivers, accounting for much of their species richness (average 32 species per reach). The aquatic component is often dominated by bryophytes and macroalgae of which *Fontinalis antipyretica* and *Rhynchostegium riparioides* are almost ubiquitous. *Conocephalum conicum*, *Pellia epiphylla*, *Chiloscyphus polyanthos* and the lichen *Verrucaria* all occur in more than half the sites in this type. In England and Wales fish populations are likely to be dominated by brown trout together with bullhead, minnow and brook lamprey. Where there are no natural barriers to migratory fish, salmon and/or sea trout and eel are to be expected together with river and or sea lamprey. The fauna will be diverse with a good complement of rithral taxa, particularly rich in caddis.

**River Type 5: medium size catchment area (100-1000 km<sup>2</sup>), mean catchment altitude- low altitude (<200m), with a predominantly calcareous geology**

**Type overview:** in England and Wales, this type of river is widespread in all but the most upland areas. It is the third most common type and covers 12% of the typed river length across Great Britain. In the South East River Basin District, the river's Itchen and Test in

Hampshire and the Great Ouse in Kent come are examples of this type. This river type covers 12% of the typed river length across Great Britain.

**Flora and fauna:** Due to more stable flows and substrate vascular plants dominate, cover is high and both aquatic and emergent vegetation is diverse with sites typically containing c. 45 species per reach. In terms of aquatic species shallow reaches dominated by coarse sand and gravel typically feature a mix of *Ranunculus penicillatus pseudofluitans*, *Berula erecta*, *Apium nodiflorum*, *Oenanthe fluviatilis*, *Fontinalis antipyretica* and *Callitriche* sp (especially *C. obtusangula*). Towards the east and south of England in the middle and lower reaches, chub and dace are likely to predominate, together with gudgeon, pike, and possibly perch, roach and/or barbel. The fauna will be diverse with a good complement of taxa characteristic of base-rich waters. Significant regional variations in composition and diversity are likely to occur across Great Britain however Hydrobiidae, Sphaeriidae, Oligochaeta, Glossiphoniidae, Gammaridae, Baetidae, Elmidae, Leptoceridae and Chironomidae are almost always present

**River Type 8: large catchment area (>1000 km<sup>2</sup>), mean catchment altitude- low (<200m), catchments with a predominantly calcareous geology**

**Type overview:** This type occurs exclusively in England and Wales. In the South East River Basin District, the Lower Test in Hampshire is the only example of this type.

**Flora and fauna:** There are many similarities with the composition of the vegetation of Type 5 rivers and species richness is typically very high (>c.45 species per reach). The main differences are in the increased emphasis on species characteristic of deep water, fine sediment microhabitats and the corresponding reduced frequency of some species more typical of shallow water, gravel bed habitats. Thus, species such as *Potamogeton perfoliatus*, *P. lucens*, *P. pectinatus*, *Sparganium emersum*, *Myriophyllum spicatum*, *Nuphar lutea* and *Ceratophyllum demersum* are commoner here. The upstream sections of this type are dominated by salmonids whilst the middle sections more commonly support a mixture of coarse and salmonid species. Coarse fish dominate the lower reaches, with typical species including eel roach, bream, tench, perch, silver bream, bleak, ruffe, rudd, pike and 3 spined stickle-back. The fauna will be diverse with a good complement of taxa characteristic of base-rich waters. Species of Hydrobiidae, Sphaeriidae, Oligochaeta, Asellidae, Gammaridae, Baetidae, Caenidae, Leptoceridae and Chironomidae are almost always present.

**River Type 37: extra small size catchment area (<10 km<sup>2</sup>), mean catchment altitude - low altitude (<200m), with a predominantly siliceous geology.**

**Type overview:** In the South East River Basin District, the coastal streams of South Hampshire and the Isle of Wight are examples of this river type.

**River Type 40: extra small size catchment area (<10 km<sup>2</sup>), mean catchment altitude - low altitude (<200m), with a predominantly calcareous geology.**

**Type overview:** In the South East River Basin District, the coastal streams of North Kent and a number of the tributaries of the Lower Arun in Sussex are examples of this river type.

## Lakes

**Standing Water Type: High Alkalinity, shallow and very shallow.**

**Type overview:** These lake types are productive and support a rich macrophyte assemblage. The majority occur in low lying areas of the Midlands and northern England with scattered sites in Wales. Typical underlying geology includes limestone, chalk and red sandstones, which provide a basal influence. Most lakes are formed on soft rocks but wave-washed rocky shores can form an important part of the habitat on larger lakes. Extensive beds of submerged macrophytes and reed fringes characterise these lakes. Examples of shallow types in the South East River Basin District include Ardingly Reservoir in West

Sussex and Darwell Reservoir in East Sussex. Very shallow types include Westbere Lakes in Kent & Sowley Pond in Hampshire

### **Standing Water Type: Low Alkalinity, very shallow**

**Type overview:** This is an uncommon type distributed in western Wales and southern England. Due to the shallow nature, there will be no summer thermal stratification. The water bodies falling into this type all occur at low and medium altitudes being formed as kettle holes or a combination of glacial erosion and deposition respectively. Examples of this type in the South East River Basin District include Hatchet Pond in Hampshire

## **Estuarine Waters (Estuaries)**

### **Estuarine Type 1**

**Type overview:** Type 1 estuarine waters are partly mixed or stratified, with a tendency for salinity to be moderately brackish (mesohaline) or brackish (polyhaline). They have tidal ranges normally between 4 and 6 metres (macrotidal). They are sheltered, intertidal or shallow subtidal estuaries that have a predominantly sand and mud substratum. Examples of this type in the South East River Basin District include Cuckmere, Ouse and Arun estuaries.

**Flora and fauna:** A mosaic of habitats occur within transitional waters, influenced by tidal streams, sediment deposition and salinity ranges, and a wide variety of benthic invertebrate communities exist; Fish species will utilise a range of habitat types dependent upon state of tide, season and life stage. Numbers of freshwater species tend to be low and concentrated towards the transitional water/river interface

### **Estuarine Type 4.**

**Type overview:** Type 4 estuarine waters are fully mixed or stratified, with a tendency for salinity to be predominantly brackish (polyhaline). They are moderate tidal ranges, normally of between 2 and 4 metres (mesotidal), sheltered, intertidal or shallow subtidal estuaries that have a predominantly sand and mud substratum. Examples of this type in the South East River Basin District include Southampton Water and the Medina and Beaulieu river estuaries.

**Flora and fauna:** A mosaic of habitats occur within transitional waters, influenced by tidal streams, sediment deposition and salinity ranges, and a wide variety of benthic invertebrate communities exist; Fish species will utilise a range of habitat types dependent upon state of tide, season and life stage. Faunal assemblage tends to be dominated by estuarine resident species such as *Agonus cataphractus*, *Ammodytes tobianus*, *Pomatoschistus microps*, *Pomatoschistus minutus* & *Platichthys flesus*.

### **Estuarine Type 6**

**Type overview:** Type 6 waters are estuarine lagoons. These are sheltered bodies of water, which are oligohaline to brackish (polyhaline). They may be partly mixed or stratified. Examples of this type in the South East River Basin District include Pagham Lagoon and Bembridge Harbour Lagoon.

**Flora and fauna:** Transitional lagoons are typified by their ephemeral nature and very variable salinity. Characterising species are therefore difficult to catalogue. As a general guide, a lagoon with a salinity range of 6 to 10 will be dominated by *chironomid* (midge) larvae and *Sigara* (water boatmen, Corixid bugs). A lagoon with a range of 18-24 will be dominated by the amphipod *Corophium volutator*, the polychaete *Hediste diversicolor* and *mysid* shrimp *Neomysis integer*. For fish, it is likely that estuarine residents and/or marine juveniles would dominate these lagoons. There would also be the occasional presence of marine adventitious species.

## Coastal waters

### Coastal Type 2

**Type overview:** Type 2 is widespread in the south-west English Channel coast. These are sea waters (euhaline waters), and generally moderate tidal ranges, normally of between 2 and 4 metres (mesotidal) and exposed. In the South East River Basin District, they occur on the south-west coast of the Isle of Wight and coast along the Dorset/Hampshire border.

**Flora and fauna:** Littoral rock, sub-littoral rock and other hard substrate will support a diverse community of red, green and brown seaweeds. Fine sands in the shallow sublittoral, may be characterised by the polychaete *Nephtys cirrosa* and amphipod *Bathyporeia* spp. Littoral rock very exposed to wave action communities dominated by barnacles and limpets. *Patella* spp. cover extensive areas of the upper and mid shore on very exposed to moderately exposed rocky shores.

### Coastal Type 4

**Type overview:** Type 4 waters are sea waters (euhaline waters), have tidal ranges normally between 4 and 6 metres (macrotidal) and moderately exposed. In the South East River Basin District, they occur on the Kent and Sussex coasts.

**Flora and fauna:** Littoral rock, sub-littoral rock and other hard substrate will support a diverse community of red, green and brown seaweeds with a mosaic pattern of various seaweeds and sessile invertebrates cover, but there is no one dominant algal species or pattern. Fine sands in the shallow sublittoral, may be characterised by the polychaete *Nephtys cirrosa* and amphipod *Bathyporeia* spp. The diversity can be reduced due to physical disturbance from strong tidal streams or wave action. Circalittoral rock or mixed substrata in moderately exposed conditions typically support a prominent turf of bryozoans and hydroids. On moderately exposed shores, where there is a plentiful supply of sediment, the tube forming polychaete worm *Sabellaria alveolata* may form honeycomb reefs on boulders and low-lying bedrock on the mid to lower shore.

### Coastal Type 5

**Type overview:** Type 5 is widespread around the coasts of the whole of the UK. These areas are sea waters (euhaline waters), moderate tidal ranges, normally of between 2 and 4 metres (mesotidal) and moderately exposed. In the South East River Basin District, the North Kent coast, the eastern Isle of Wight and the Solent are examples of this type.

**Flora and fauna:** Littoral rock, sub-littoral rock and other hard substrates will support a diverse community of red, green and brown seaweeds with a mosaic pattern of various seaweeds and sessile invertebrates cover, but there is no one dominant algal species or pattern. Fine sands in the shallow sublittoral, may be characterised by the polychaete *Nephtys cirrosa* and amphipod *Bathyporeia* spp. The diversity can be reduced due to physical disturbance from strong tidal streams or wave action. Circalittoral rock or mixed substrata in moderately exposed conditions typically support a prominent turf of bryozoans and hydroids. On moderately exposed shores, where there is a plentiful supply of sediment, the tube forming polychaete worm *Sabellaria alveolata* may form honeycomb reefs on boulders and low-lying bedrock on the mid to lower shore.

### Coastal Type 7

**Type overview:** Type 7 occurs only in small areas of North and South Wales and the Bristol Channel. These areas are sea waters (euhaline), macrotidal and sheltered. Pagham Harbour is the only example of this type in the South East River Basin District.

**Flora and fauna:** Littoral and sub-littoral rock will support a diverse community of red, green and brown seaweeds with a more or less continuous cover of large seaweeds. Sedimentary littoral or sublittoral substrata, sheltered or extremely sheltered from strong tides and

currents, can support beds of seagrass. Littoral sediments support beds of *Zostera noltii* and/or *Zostera angustifolia* and sublittoral sediments support *Zostera marina*. Muddy sands or slightly mixed sediments in sheltered environments, may support communities comprised of bivalves such as *Abra*, *Nucula* and *Corbula*, and polychaetes, *Lagis* and *Nephtys*. In sheltered areas, the substrate will typically be fine muddy sand which remains saturated throughout the tidal cycle. The community consists of abundant polychaetes and bivalves and less commonly, oligochaetes and the amphipod *Bathyporeia sarsi*.

### Coastal Type 8

**Type overview:** This coastal type is of sea waters (euhaline waters), moderate tidal ranges, normally of between 2 and 4 metres (mesotidal) and sheltered. Though uncommon in the United Kingdom, Chichester, Langstone and Portsmouth Harbours are examples of this type in the South East River Basin District.

**Flora and fauna:** Littoral and sub-littoral rock will support a diverse community of red, green and brown seaweeds with a more or less continuous cover of large seaweeds. Sedimentary littoral or sublittoral substrata, sheltered or extremely sheltered from strong tides and currents, can support beds of seagrass. Littoral sediments support beds of *Zostera noltii* and/or *Zostera angustifolia* and sublittoral sediments support *Zostera marina*. Muddy sands or slightly mixed sediments in sheltered environments, may support communities comprised of bivalves such as *Abra*, *Nucula* and *Corbula*, and polychaetes, *Lagis* and *Nephtys*. In sheltered areas, the substrate will typically be fine muddy sand which remains saturated throughout the tidal cycle. The community consists of abundant polychaetes and bivalves and less commonly, oligochaetes and the amphipod *Bathyporeia sarsi*. Polychaetes include *Nephtys hombergii*, *Scoloplos armiger*, *Pygospio elegans* and *Spio filicornis*.

### Coastal Type 10

**Type overview:** Coastal Lagoons, which occur in many parts around the UK coast. They are sea waters (euhaline waters) and sheltered. There are a number of this type in the South East River Basin District including Ternery Pool, near Rye, Sussex and Sowley Marsh, near Lymington, Hampshire.

**Flora and fauna:** On fully saline, sedimentary substrata, sheltered or extremely sheltered from strong tides and currents, one or more species of seagrass may be found. Coastal lagoon benthic fauna are essentially sublittoral and are tolerant of a wide range of salinity (e.g. 10-45). Lagoon specialists include sea fans, anemones, sea mats, polychaete worms, sea slugs, snails, bivalves and shrimps. Very common specialists include the lagoon cockle, *Cerastoderma glaucum*, the lagoon slater, *Idotea chelipes* and the snakelocks anemone - *Anemone viridis*. In very shallow extremely sheltered very soft muds, *Arenicola marina* may form very conspicuous casts.

## A.6 Confidence and precision of monitoring

### Surface waters

Our assessments of water body status are accompanied by a description of how certain we can be that the water body is below good status. These assessments can be found in annex B for each quality element in each water body, and for the overall water body status.

The Environment Agency has used three expressions to describe how certain we are that a water body does not achieve the objective of good status. Although the terms confidence and certainty can be interchangeable, the Environment Agency has taken the decision to use an expression of *certainty* to describe all surface water classifications.

<b>How certain we are that the water body is less than good status</b>	<b>Threshold</b>
Very certain	≥95% certain that the water body does not meet the objective of good status
Quite certain	≥75to ≤95% certain that the water body does not meet the objective of good status
Uncertain	>50% to <75% certain that the water body does not meet the objective of good status

This description of certainty takes account of the precision of our results. Precision is influenced by natural variation in the data over time, as well as errors in the assessment process. The Environment Agency can assess how the probability of misclassification changes in relation to the amount of sampling for each biological element. This allows us to estimate the most likely levels certainty we can achieve with a given sampling effort. For example, a diatom sample from spring and autumn will allow no more than a 70% certainty of being at a particular status, but often gives high certainty (>95% ) of being somewhere below good status.

In some situations our expression of certainty is based on weight of evidence or expert opinion. There are three examples of this.

- The way different water bodies respond to nutrient enrichment can be complicated. Sometimes we find that the water body does not meet the required standard for phosphorus but the biological community shows no sign of damage. In such situations it would be misleading to say we are very certain that the water body is at less than good status. In other situations, the water body does not meet the required standard for phosphorus, and the biological community – the diatoms and macrophytes – also show signs of damage: The result for each element on its own may be uncertain. But the fact that all elements suggest the same thing – weight of evidence that there is an impact – means that we become more certain that there is a problem.
- As our monitoring programme for estuarine and coastal water bodies is new, certainty in our draft classifications for these water bodies is partly based on the amount of data available for each of the classification tools. We say we are uncertain where our data sets are limited. Our marine monitoring programme will continue to provide more data, so the certainty of our assessments in estuarine and coastal waters should steadily improve over time.
- Where expert judgement (see section A.2) has been used to provide a classification we can only ever be uncertain in our assessment.

» The confidence of the results from both programmes (taking precision into account) are stated in annex B of the river basin plans.

### **Groundwater status**

Groundwater classification comprises 4 quantitative and 5 chemical status tests (ref UKTAG paper 11b(i) and 11b (ii)). Each of the status test results is reported as a face value class accompanied by an assessment of our confidence in the result.

For groundwater confidence is reported as a qualitative statement, and is used as an indicator for prioritising action. All poor status classifications for groundwater, irrespective of

confidence, will require some form of action. This is because the classification criteria for both chemical and quantitative status comprise a rigorous weight of evidence approach.

Confidence in poor status will be reported as either “high” or “low”, depending on the test. These terms are defined as follows:

- “High” confidence will usually mean that competent authorities can proceed immediately to considering restorative action, or, for example, improvement to existing measures, according to procedures in the Directive. In some cases there may be “high” confidence in the poor status, but uncertainty over the measures that should be implemented, and an options appraisal of measures/objectives will be required
- “Low” confidence will usually mean that further investigation should be carried out as a priority to improve confidence and measures taken in the first River Basin Cycle where appropriate.

It is stressed that the assessment of confidence in status should not be used as the only driver for instigating measures. Good status groundwater bodies may require higher priority attention if they are predicted to fail either the trend objective in the long term or some other measure of the risk of future deterioration in status.

Confidence in good status will be reported as either “high” or “low”, depending on the test. These terms are defined as follows:

- “High” confidence will usually mean that the only requirement is to assess potential future deterioration using surveillance monitoring.
- “Low” confidence is associated with a more limited evidence base, often in groundwater bodies that are at risk. Further operational monitoring will be required to improve the level of confidence.

The decisions on which level of confidence to assign to each status test are reached by using a combination of statistical and weight of evidence criteria. The principles for this are outlined in the UKTAG paper - Reporting Confidence in Groundwater Status Assessments<sup>5</sup>

As a principle guiding the assessment of confidence in each of the individual status tests, the key criteria are: a) the strength of the overall “weight of evidence” supporting the status assessment, and b) a combined assessment of the monitoring data in terms of the magnitude of overall departure from the poor/good status boundary and the variability of the data.

Confidence in chemical status and quantitative status will be determined and reported separately. For poor status groundwater bodies, the highest level of confidence from each of the individual tests should be reported. For good status groundwater bodies, the lowest level of confidence from each of the individual tests should be reported. An example is provided in Figure A.16.

Figure A.16. **Classification and Confidence: example results and procedure for defining overall confidence.**

Quality Element (Status Test)	Status result	Confidence
No saline or other intrusions	Good	High
Drinking Water Protected Areas (DWPA).	Good	Low
Groundwater Dependent Terrestrial Ecosystem (GWDTE).	Poor	Low
No significant diminution of surface water chemistry and ecology	Poor	High
General Chemical Test	Poor	Low

} Overall Chemical Status: Poor Status (High Confidence)

Quality Element (Status Test)	Status result	Confidence
Water Balance Test	Good	High
Surface Water Element	Good	High
Groundwater Dependent Terrestrial Ecosystem (GWDTE).	Good	Low
No saline or other intrusions	Good	High

} Overall Quantitative Status: Good Status (Low Confidence)