Water for life and livelihoods

River Basin Management Plan
South West River Basin District

Annex G: Pressures and risks

Contents

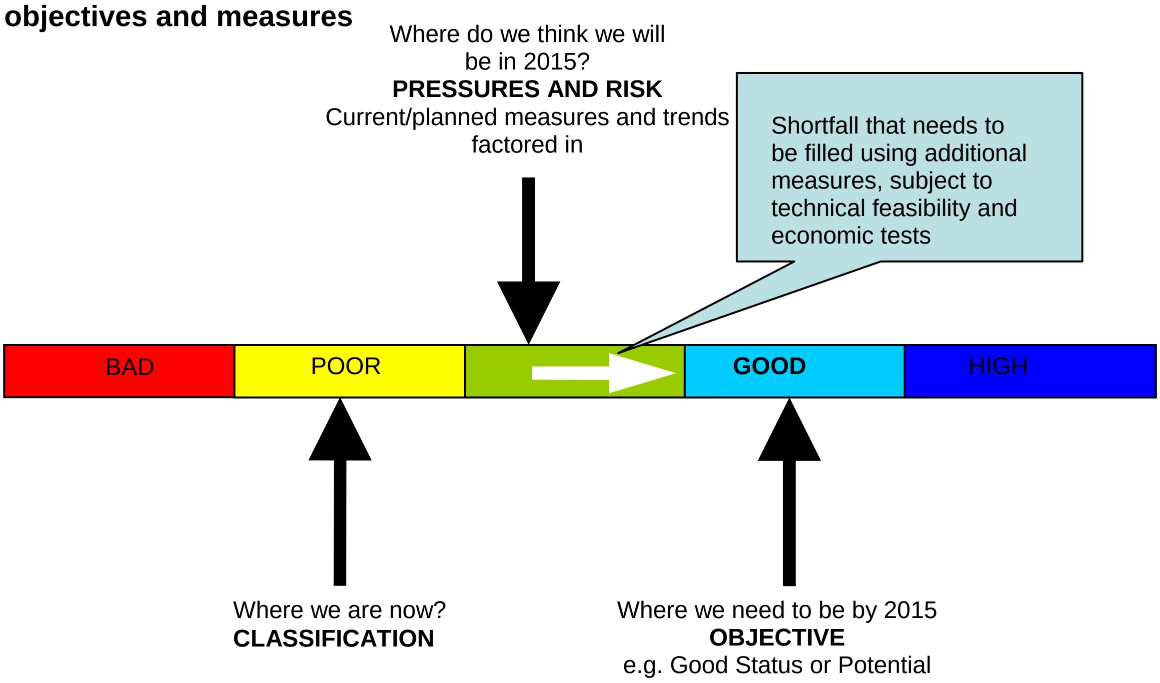
G.1 Introduction

This annex provides a summary of the significant pressures and the risks resulting from humans' activities on the status of surface water and groundwater. The Water Framework Directive requires the management of risk to the environment caused by anthropogenic pressures, not just their impacts. There is a fundamental difference in terms of the management approach required to meet these needs. Managing impact is 'reactive' whereas managing risk is 'proactive', requiring the ability to identify where an impact might occur (or is occurring) and prevent it from happening in the future. For example, the Environment Agency issues consents to discharge effluent to water or licences to abstract water that minimises the impact before it happens and is based on the risk to the water from the activity and the sensitivity of the water.

We need to assess the risks posed to the environment, in terms of failing to achieve the objectives of the Water Framework Directive (e.g. Good Status or Potential) either now or in 2015. Information on trends enables action to be taken to prevent water bodies being impacted in the future. This is critical given the timescales imposed by the Directive for achieving Good Status (see Figure G.1).

The measures in Annex C will aim to **further reduce the current impact** of pressures, ensure **no deterioration** and **reduce the risks** posed to the environment so that future impacts are less likely.

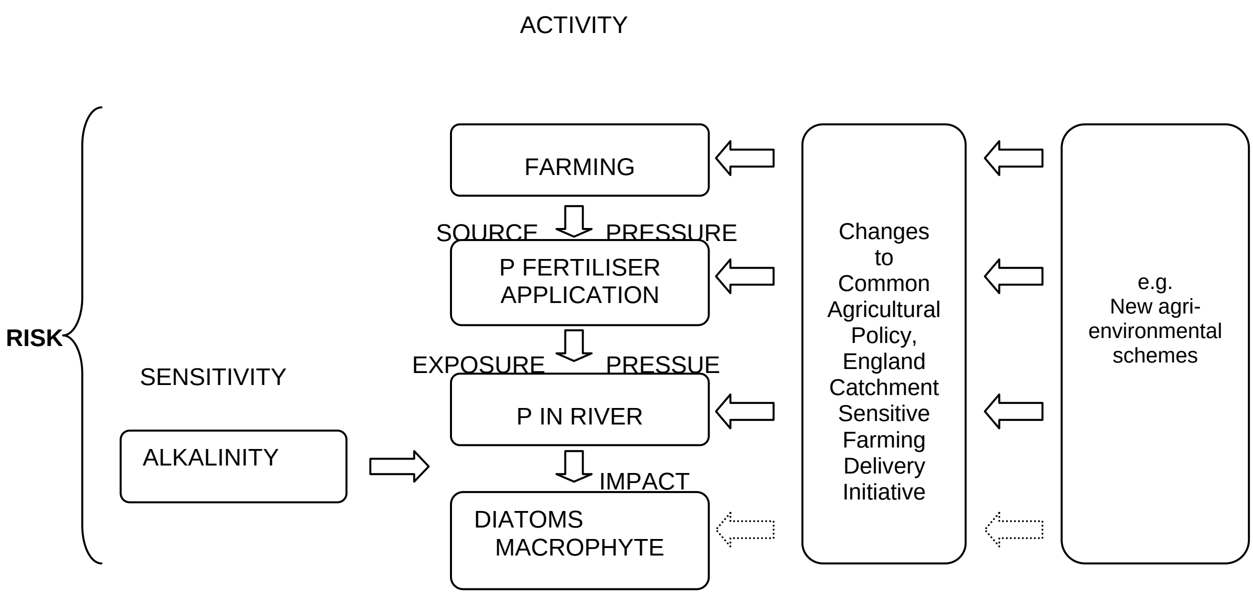
Figure G.1: **Simple overview of how classification and risk are used to define objectives and measures**



The consideration of pressures and risks (potential impacts) help build up an evidence base that can justify the objectives and the actions to deliver them (see Annex C - Programmes of Measures). Figure G.2 shows an example of the risk model used.

Further information on how the Environment Agency produced the risk assessments and the methods used can be found at http://www.environment-agency.gov.uk/research/planning/33238.aspx.

Figure G.2: **Example of conceptual risk model using example of the pressure from phosphate (P) fertilisers**



G.2 Information on significant pressures

Previously we have looked at pressures in the context of:

- Estimating point source pollution.
- Estimating diffuse source pollution, including land use.
- Estimating pressures on the quantitative status of water including abstractions.
- Analysis of other impacts of human activity on the status of water.

Risk assessments to assess the risk of not achieving the default objectives of the Water Framework Directive have been produced for different sources of pressures under these headings and can be found at http://www.environment-agency.gov.uk/research/planning/33268.aspx.

For protected areas, assessments of compliance are presented separately in Annex D.

In the River Basin Planning : Summary of Significant Water Management Issues report for the South West River Basin District, a series of environmental pressures were considered; these are listed in Figure G.3.

Figure G.3: **Pressures affecting the water environment**

WFD PRESSURES	**Specific pressures considered**
Point source pollution	• Organic pollution - including ammonia and biochemical oxygen demand • Chemicals - including priority hazardous substances, priority substances, specific pollutants • Other Pollutants - faecal indicator organisms • Acidification • Nutrients - nitrate, phosphorus • Mines and minewaters
Diffuse source pollution	• Chemicals - including priority hazardous substances, priority substances, specific pollutants (including pesticides) • Oil and hydrocarbons • Sediments
	• Organic pollution - including ammonia and biochemical oxygen demand • Other Pollutants - faecal indicator organisms • Acidification • Nutrients - nitrate, phosphorus • Mines and minewaters
Pressures on the quantitative status of water	• Abstraction and other artificial flow pressures • Physical modification – morphology
Other impacts on the status of water	• Physical modification - morphology • Invasive non-native species • Biological pressures - including fish stocking, biota removal • Sediments • "Emerging" substances such as endocrine disrupters • Urban and transport pressures • Recreation (e.g. boating, fishing) • Saline intrusion into groundwater bodies (resulting from abstraction pressures)

These are generalised categories and it is recognised that some pressures, such as ammonia, may be included in more than one category. It is also acknowledged that diffuse source pollution may also include unspecified point sources dispersed over a wide area.

The effects of climate change on the environment are another pressure that should be considered when understanding how to protect or improve the status of water bodies. Temperature changes in the environment may be linked to changes in species, habitat and water quantity and availability, for example. The source of local temperature changes may be traced to specific activities such as cooling water from power stations, as the by-product of power generation. We are still learning how we can monitor and predict the effects of temperature changes for the future. Annex H discusses the effects and impacts of climate change on the river basin scale in more detail.

For the South West River Basin District, a number of specific pressures were identified as significant water management issues:

- Sediment (rivers and lakes)
- Physical modification morphology
- Nitrate in surface water and groundwater
- Invasive non-native species
- Phosphorus in rivers and standing waters
- Abstraction and other artificial flow pressures
- Mines and minewaters
- Pesticides
- Other pollutants
- Urban and transport pressures
- Commercial fisheries (estuaries and coastal waters)
- Organic pollution (ammonia and biochemical oxygen demand)

Pressures that were found **not to** represent significant water management issues at a district level in this river basin district, but may still have a significant effect at local level are listed as follows and described further in Section G.3:

- Acidification
- Recreation

The next sections describe the significance and extent of the specific pressures which have been identified as significant water management issues in the South West River Basin District.

Note that the statistics for river water bodies include rivers, surface water transfers and canals. Lake water body statistics include lakes and Site of Special Scientific Interest (SSSI) ditches.

G.2.1 Sediment (rivers and lakes)

The term 'sediment' refers to anything that is not dissolved or in solution and which filtration or settlement can remove. The term includes solids that are floating on top of, or suspended within, the water.

Much of the sediment we are concerned with is caused by the erosion of soil. Whilst there is a natural level of erosion, it is the increased rates of erosion – caused by land based activities such as forestry, construction and, particularly, agricultural cultivation and grazing practices – that need to addressed. It is worth noting that phosphorus is often associated with sediment as it is bound to soil (unlike nitrates, which are more soluble). Metals and many toxic organic compounds can accumulate in sediments. However, in some cases (for example, estuaries) sediment is an essential component of the ecosystem to maintain mudflats and salt marsh habitats.

High concentrations of suspended solids can:

- Bury fish eggs in the stream bed or coat their surface if they are on vegetation, causing suffocation.

- Cause physical damage to fish gills which can result in death, a reduction in growth or cause a reduction in resistance to disease.
- Reduce the populations of river bed animals which are the food of fish.
- Suppress photosynthesis due to a reduction in light penetration and by coating.
- Sediment also increases turbidity, which reduces light penetration and oxygenation of water. This results in reduced productivity, direct damage to fish gills from suspended sediment and reduced organism survival, especially for fish.

Demonstrating evidence of ecological impact as a result of human influenced sediment load is, however, difficult.

Conversely insufficient sediment in rivers, estuaries, and coastal waters causes erosion of important or protected habitats such as wetlands, mudflats, salt marshes, and beaches. Erosion of riverbanks can occur, along with bank collapse and river profile degradation. There may be downstream erosion of the river bed, damaging infrastructure and resulting in morphological changes which can alter the ecology.

The indirect effects of sediment include those resulting from current and historic point and diffuse sources of pollution. Many pollutants (metals, nutrients and organic compounds such as polyaromatic hydrocarbons) can be held on and released from sediments. This can result in reduced growth and breeding success of the river bed animals (such as invertebrates) which form the basis of the aquatic food chain.

Indirect effects may be temporary in nature as contaminated sediments (for example those contaminated with metals, nutrients, and organic compounds such as polycyclic aromatic hydrocarbons, polychlorinated biphenyl, and persistent organic pollutants such as pesticides) are re-suspended at times of high flows. This may happen more often in a changing climate. This can impact on the wider environment, for example when contaminated sediment settles on floodplains following flooding.

Over 2000 soil structural surveys have been carried out in the South West by the Environment Agency. They show that 40% of our agricultural soils are severely or highly degraded, with this figure rising to almost 70% on our most vulnerable sandy soils. This agricultural land is considered to be contributing to sediment pressure, which could prevent the achievement of good ecological status. The latest characterisation maps show that 3550 km of river waterbodies (47% of total length) are at risk or probably at risk from the direct effects of sediment (see Figure G.8).

In addition, trout spawning beds in 57% of reaches surveyed across England have levels of fine sediment at which half the eggs and larvae would be expected to die. More than 40% of freshwater wetland Sites of Special Scientific Interest (SSSI) in England are in unfavourable condition, with sediment a contributory factor in most cases. The Salmon Stock Conservation Review (2004) identified sedimentation as the first, or equal first, factor identified as cause of failure in 12 of the 22 Welsh Salmon Action Plan (SAP) rivers.

G.2.2 Physical modification (morphology)

The ecology of estuarine and coastal waters in the river basin district can be affected by a number of physical habitat pressures. These include land claim, shoreline reinforcement and dredging activities. The existence of weirs or tidal sluices can limit the migration of fish such as salmon, restrict sediment movement, promote siltation, and prevent natural mixing between fresh and saline waters with consequent impacts on transitional ecological communities. Coastal defences may inhibit the inland migration and maintenance of inter-tidal habitats squeezed by sea level rise as a result of climate change.

Many lowland rivers in England and Wales have also been subject to physical alteration[1]. These modifications include channel straightening, bunding, bank re-profiling and dredging for flood prevention, drainage or navigation purposes, as well as the creation of new channels for mill leats or irrigation. Weirs, sluices and other impoundment in the river network may restrict the movement and migration of migratory and freshwater fish such as eels, salmon and lampreys, impede sediment movement, promote siltation, and disrupt the interconnections between accessible habitat, particularly during periods of low flow. Such pressures may result in ecological habitat damage or loss.

Many of our lakes and reservoirs have been subject to significant physical alteration, and the artificial manipulation of water storage and levels behind them. Some are wholly artificial, being constructed in a site where no water body existed before.

Further evidence is needed on how hydromorphological pressures influence ecology. There is extensive research being undertaken to look at this issue and also how different mitigation measures can improve the ecology of physical modifications [2].

Figure G.4: **Activities that include physical modifications to estuaries and coasts and rivers and lakes**

Significant Issue	Physical modification issues
Physical modifications	• Control structures • Dredging • Land claim • Aggregate extraction • Flood risk management • Impoundments

Our latest tests showed that for morphological pressure:

- 14 (61%) of all estuarine water bodies in the South West River Basin District are at risk or are probably at risk of failing Water Framework Directive objectives in 2015. Specific pressures include land reclamation, shoreline reinforcement, dredging and aggregate extraction; (see Figure G.11)
- 16 (64%) coastal water bodies are also at risk or probably at risk from similar pressures; (see Figure G.11)
- 2485 km (33% of total length) of rivers are at risk or probably at risk of failing Water Framework Directive objectives in 2015 due to morphological pressure; (see Figure G.9)
- 55 (87%) of lake water bodies are at risk or probably at risk from morphological pressures (see Figure G.10).

G.2.3 Nitrate in surface water and groundwater

Nitrate pollution can impact on both surface water and groundwater and comes principally from agriculture (61%) and sewage treatment works discharges (32%) (figures for England and Wales, Defra 2004). In urban areas the main inputs are from contaminated land, leaking sewers and water mains. The magnitude and balance of diffuse and point sources vary across river basin districts, as will the extent of inputs to surface water and groundwater.

[1] Environment Agency 2007, River Basin Planning, Summary of Significant Water Management Issues, Supporting document, South West River Basin District, Consultation Document 2007.

[2] Environment Agency 2007, Management strategies and mitigation of measures for Heavily Modified Water Bodies & Artificial Water Bodies in relation to ecological potential , Summary of Projects: March 2007, Internal document.

High nitrate concentrations are thought to be the main cause of eutrophication in estuarine and coastal waters and may also contribute to eutrophication in certain types of freshwaters. Eutrophication is described as the enrichment of waters by nutrients, causing excess plant and algal growth and leading to undesirable effects on the ecology, quality and/or uses of the water. High nitrate concentrations can impact on terrestrial ecosystems, such as wetlands, for example, through excessive nettle growth. High nitrate concentrations in drinking water are a threat to human health and are controlled by meeting the standards in the Drinking Water Directive (50 mg/l nitrate for water at the point of supply).

Defra has identified nitrate standards to support Good Ecological Status in saline waters. They will be applied such that targeted measures will be taken where eutrophication is occurring. There are no equivalent ecological standards for nitrate in relation to the ecological status of surface freshwaters – the 50 mg/l drinking water standard continues to drive action.

The Environment Agency's risk assessments for the Water Framework Directive indicate that less than 85km (just over 1%) of total river length are at risk of failing the 50mg/l threshold for nitrate in the South West River Basin District (see Figure G.13).

Nitrate levels in groundwater are of particular significance in the east of the river basin district, where around eighty per cent of the drinking water comes from this source[3], and there are controls on the amount of nitrate that is acceptable in drinking water. All groundwater bodies have been designated as Drinking Water Protected Areas.

Few groundwater sources for public supply received more than simple purification treatment 30 years ago. Rising nitrates in drinking water taken from groundwater have previously been dealt with by blending water from different sources to achieve the drinking water standard. With the widespread rise in nitrate concentrations, low nitrate waters for blending are becoming very limited and water supply companies are now installing treatment plants. If the current trend in increasing treatment continues, then 83% of sources in England and Wales will need treatment for nitrates by 2029.

The latest assessment shows that three groundwater bodies within the South West River Basin District are at risk of failing their environmental objectives as a result of nitrate (see Figure G.12). Two of the five tests used to assess groundwater chemical status directly consider nitrate impact – the General Chemical Test and the Drinking Water Protected Area test. Nitrate impact is also considered when carrying out the Groundwater Dependent Terrestrial Ecosystem test (wetlands). The current results of these tests are listed below:

Figure G.5: **Groundwater tests**

Test	Number (and percentage) of groundwater bodies failing the test for nitrate in the South West River Basin District
General Chemical test	4 (9.1 %)
Drinking Water Protected Area test	7 (15.9 %)
Groundwater Dependent Terrestrial Ecosystem test	0 (0 %)

In addition, nine groundwater bodies in the South West River Basin District (20.5%) had a significant and sustained increase in nitrate concentration in groundwater. This test is not part of status. There is a specific and separate objective to reverse environmentally significant upward trends in groundwater.

[3] Environment Agency 2007, River Basin Planning, Summary of Significant Water Management Issues, South West River Basin District, Consultation Document 2007.

G.2.4 Invasive non-native species

Invasive non-native species are plants and animals that have deliberately or accidentally been introduced outside their natural range, and by spreading quickly threaten native wildlife and can cause economic damage.

Some species pose serious threats to our natural biodiversity and have economic impacts for example, for flood risk management, water transfer schemes, disposal of soil as waste and fisheries management. Their presence and unabated spread can represent an important pressure on the ecological status of many water bodies. Once established they are difficult or impossible to control. Examples include the plant Japanese knotweed, the mammal American mink, the fish topmouth gudgeon and the crustacean American signal crayfish.

A number of species introduced to the UK continue to cause local and regional problems. Within the South West River Basin District invasive non-native species are widespread. The American signal crayfish has now displaced the native species in all but a handful of locations, Himalayan balsam is widespread along the rivers of Devon and Cornwall, and the American mink is hampering the recovery of the native water vole population. Many non-native invasive species are also found in our estuaries and along our coasts.

Water bodies that have a significant presence of invasive non-native species will not meet 'high ecological status' under the Water Framework Directive. Their presence, however, will not always prevent achievement of good ecological status.

Our risk assessments show that of 938 river water bodies in the South West River Basin District, 213 (23%) are probably at risk of failing WFD objectives in 2015 due to direct effects of invasive non-native species on the achievement of good ecological status. Out of 63 lake water bodies six (10%) are probably at risk, 15 out of 25 coastal water bodies (60%) and 13 out of 23 estuarine waters (57%) are also probably at risk. See Figures G.15, G.16 and G.17.

Additional evidence

The National Strategic Assessment flagged invasive non-native species as being a potentially significant issue requiring further research and more investigation. A robust evidence base could then be developed to support the assessment of objective impacts or targeting further measures at specific sectors. A risk-based approach is being adopted for the control of invasive non-native species. The Environment Agency is an active partner in the "Invasive non-native species framework strategy for Great Britain" (2008) which takes a risk-based approach to make the best use of available resources. The delivery of this strategy will rely on the work of local partnerships.

G.2.5 Phosphorus in rivers and standing waters

High phosphorus concentrations are the main cause of eutrophication in fresh waters. Eutrophication is the enrichment of waters by nutrients causing excess plant/algal growth and leading to undesirable effects on the ecology, quality and uses of the water. Activities that can be affected include water abstraction, water sports, angling, wildlife conservation and livestock watering. In standing fresh waters, blue-green algal blooms can occur; many such blooms are toxic and pose a hazard to humans involved in water sports and to animals that drink the water.

Defra has identified phosphate standards to support Good Ecological Status in fresh waters. They will be applied such that measures will be targeted to water bodies where there is evidence that nutrient levels are causing undesirable ecological impacts. Benefits should be seen from the planned introduction of phosphate reduction at sewage treatment works discharging to waters identified as Sensitive Areas under the Urban Waste Water Treatment Directive.

There are predicted reductions in livestock by 2015 with a general move from farming in the uplands to the lowland areas of England, which is expected to reduce the amount of phosphate entering waters. Other changes in agriculture predicted in the Business as Usual Projections of Agricultural Outputs[4] work will need to be reassessed in the light of unexpectedly large changes in commodity prices, which together with reductions in set aside, are likely to increase intensity of arable production. Reducing phosphorus pollution is one of the aims of the England Catchment Sensitive Farming Delivery Initiative, particularly where related to designated sites such as SAC and SSSI rivers.

Phosphorus has been considered to be of far less significance to groundwater (see Figure G.19). Research is currently being carried out on the impact of phosphorus on surface waters and habitats that are sensitive to groundwater seepage and spring flows.

The control measures within Nitrate Vulnerable Zones under the Nitrate Directive, although primarily designed to reduce nitrate pollution, are likely to bring indirect benefits, through improved nutrient management, in terms of reduced agricultural phosphorus pollution.

The latest combined phosphorus assessment estimates that 33% of the rivers in the South West River Basin District are at risk from phosphorus enrichment (see Figure G.18). It also tells us that 62% of the phosphorus load is derived from point sources, and 38% is derived from diffuse sources.

It is estimated that 59% of the total length of river water bodies are at risk or probably at risk from diffuse phosphorus from agricultural pollution, see Figure G.20.

A range of tools have been used to assess the risk to rivers from phosphorus to provide a broad a picture as possible of the sources and impact of the pressure. However, in order to capture the broad range of potential sources the methodologies employed to develop the two risk assessments differ. As a result the outputs for Diffuse phosphorus from agriculture risk assessment and the Combined Phosphorus risk assessments aren't directly comparable, but when considered separately the individual assessments highlight the likely relative risk from each pressure. Please refer to the method statements for each assessment for further details.

G.2.6 Abstraction and other artificial flow pressures

Periods of naturally low flows are caused by extended periods of low rainfall (e.g. during droughts) and are part of the mechanism that supports bio-diversity. Low flows can be prolonged or made worse by unsustainable levels of abstraction for public water supply, industry, agriculture or domestic use. Unsustainable abstraction from groundwater can lower groundwater levels and affect dependent river flows or wetlands, or can induce the intrusion of poorer quality water from the sea or from deeper aquifers.

Other artificial influences on flow include the discharge of treated sewage, transfer of water between catchments and the storage and release of water from reservoirs. These influences may offset some of the impacts of abstraction, or result in flows being significantly higher or lower than they would naturally be.

Flow in surface water bodies is a supporting element to biological classification for all classes other than High status, for which it is an obligatory consideration. Outflow from groundwater bodies contributes to the surface water flows required to support the biological classification.

Unsustainable rates of abstraction reduce surface water flows and may result in lower flow velocities, reduced depths and reduced flow continuity that may limit ecological status. In addition groundwater pumping may locally reduce spring flows and water levels important to retaining the ecological diversity and resilience of groundwater fed wetlands. Such impacts can be magnified in periods of reduced rainfall.

[4] Environment Agency: Business as Usual Projections of Agricultural Outputs
Centre for Rural Economics Research, University of Cambridge, Environment Agency, July 2004.
http://www.environment-agency.gov.uk/economics

Ecological impacts can also arise from water being diverted for other uses. For example, fish farms can take a substantial amount of water out of rivers and return it further downstream. The ecology in the 'deprived reach' between the inlet and outlet can be significantly affected. Flow impacts can also arise from river channels being over widened or poorly managed.

Abstraction issues are of widespread concern in the South West, particularly in the chalk rivers in the east of the district and in a number of the rivers draining from Dartmoor. Many of these areas are currently under investigation. Hydropower schemes are known to affect flows, for example on the Dart and Tavy, and flows are heavily regulated in many other rivers.

Restricted or low flows can lead to higher residence time along some river stretches. These, combined with higher concentrations of nutrients such as phosphate and nitrate, may lead to algal blooms. More frequent periods of low summer rainfall are expected under current climate change scenarios, which may increase the environmental impact of flow problems.

There are nearly 2,500 abstraction licences within the South West River Basin District authorising abstraction of almost three million megalitres of water a year (one megalitre is a million litres). These abstractions cover water taken from rivers or the ground, both from freshwater and tidal reaches.

Figure G.6: **Summary of abstractions in the South West River Basin District**

Sector	Licensed volume (Ml/ year)	Number of Licences
Water Supply	607,982	166
Agriculture	48,268	1,144
Fish and Aquaculture	763,882	192
Electricity Production	1,121,766	140
Industry	250,326	512
Other	21,285	330
Total	**2,813,509**	**2,484**

Our latest assessments of the pressure show that:

- 880 km (12% of total length) of river length is at risk or probably at risk from abstraction and flow regulation (see Figure G.22).
- Twelve of our lakes (19%) are at risk or probably at risk from abstraction and flow regulation (see Figure G.21).
- 3885 square km (24%) of groundwater are at risk or probably at risk from abstraction and flow regulation.

G.2.7 Mines and Minewaters

Minewaters are usually acidic (low pH) and the main contaminants are metals, for example copper, iron, manganese and zinc. Minewater may also contain priority substances such as cadmium and lead. These contaminants are released when oxygen in the air or water reacts with minerals in the rock found near coal seams and mineral veins. The metals are then dissolved in the groundwater which discharges back into surface water bodies, or by rain in the case of spoil heaps. Such minewater related pollution may have significant ecological impacts.

We estimate that 106 river water bodies are at risk or probably at risk from mines and minewaters (see Figure G.23). and six groundwater bodies are at risk, or probably at risk, from mines and minewaters (see Figure G.24).

Please note that there is some overlap between the pressure category 'Mines and minewaters' and some metals that are covered below in the 'Other Pollutants' section (section G.2.12). Also note that metals in minewater discharges have been designated as priority substances, priority hazardous substances and specific pollutants. The objectives for these types are described in Annex E.

G.2.8 Pesticides

'Pesticide' is a general term that includes all chemical and biological products used to kill or control pests. Pests are living organisms such as rodents, insects, fungi and plants that harm our food, our health or our environment. Pesticides are used in domestic, amenity, forestry, horticultural and agricultural scenarios. Because of their toxic nature they can cause harm to 'non-target' organisms and if they are not stored, used and disposed of properly they pose a risk to terrestrial and aquatic wildlife. As well as ecological impacts, pesticides can also contaminate surface water and groundwater bodies used as drinking water sources, thus increasing the need for treatment.

Sheep dip is a veterinary medicine used to treat parasites on sheep (e.g. scab, blowfly, ticks and lice). The two active ingredients used in sheep dip products are diazinon and cypermethrin (although the use of products containing cypermethrin is currently suspended). Both these substances are highly toxic to invertebrates and very small levels in rivers can cause severe ecological damage. Studies have shown that they can interfere with salmon reproduction by disrupting the ability of the male fish to respond to female hormones.[5 6]

Tributyltin (TBT) is a biocide. European regulatory controls now prevent its use in products for the EU market. Historically its main use was to prevent fouling on shipping; however it was also used in wood preservation, paper and pulp and textiles. Whilst its use has now been restricted it is highly persistent in the environment. It is also known to be a contaminant in PVC.

Figure G.7: **Significant issues groups that include pesticides**

Significant Issue Group	Principle source of pesticides
Diffuse pollution from rural areas	Sheep dip application, application of pesticides to crops
Diffuse pollution from urban areas and transport	Anti-foulants on boats, application of pesticides to hard surfaces for weed control.
Point sources pollution	Discharges of treated effluents from pesticide manufacturing plants (via STWs), spillage incidents.

The latest assessments for pesticides for the South West River Basin District show that:

- 1563 km (21% of total length) of rivers are at risk or probably at risk from diffuse agricultural pesticides (see Figure G.28)

[5] Moore, A. & Waring, C.P., 1995. Sub-lethal effects of the pesticide Diazinon on olfactory function in mature male Atlantic salmon (*Salmo salar* L.) parr. *Journal of Fish Biol*ogy **48,** 758-775.

[6] Moore, A. & Waring, C.P., 2001, The effects of a synthetic pyrethroid pesticide on some aspects of reproduction in Atlantic salmon. *Aquatic Toxicology* **52**, -12.

- 345 km (5% of total length) of river is at risk or probably at risk from sheep dip (see Figure G.29).

We have estimated that 2% of the total length of rivers in the South West River Basin District is at risk from point sources of pesticides (see Figure G.26).

We have estimated that one groundwater body in the South West River Basin District is at risk from pesticides (see Figure G.27).

The Environment Agency report 'The Unseen Threat to Water Quality'[7] reports the widespread failure of the EQS for tributyltin and its effects on dog whelk populations (and the knock-on effects on the wider ecosystem). The report also states that pesticides were detected in nearly one-fifth of groundwater monitored. It reported that in certain areas these concentrations were declining.

G.2.9 Urban and Transport Pressures

Various pollution issues relate to the urban environment and transport networks. These include:

- Urban drainage containing a variety of pollutants, such as:
    - phosphorus from misconnections (e.g. washing machines incorrectly plumbed into the surface water sewer instead of the foul)
    - organic waste (dog fouling) from parks and pavements
    - fertilisers used in gardens
    - sediment from construction sites
    - a range of pollutants which are present in run-off from roads including contaminated sediment, metals, organic substances
- Air emissions from vehicles which are then deposited to water or land (and in some cases can cause acidification).
- Pesticides used to control weeds on roads, pavements, railway tracks and other amenity areas such as parks and playing fields.
- Run-off from air strips that may contain de-icers and pesticides to control weeds.
- Dredging and maintenance of navigable waterways that can result in water quality issues from suspended solids and leaching of contaminants from the sediment.
- Leaching of pollutants from contaminated land.

Our latest information shows that 49 (5%) of our river water bodies are at risk, or probably at risk from urban diffuse pollution. See also the sections on sediment, phosphorus, and organic pollution for the latest detailed information.

G.2.10 Commercial fisheries (estuaries and coastal waters)

Commercial fishing and shell-fishing can represent an important pressure on the ecological status of estuarine or coastal water bodies, including the condition of EC designated Shellfish Waters (Protected Areas incorporated within the Water Framework Directive). This may involve the direct capture and removal of fish or shellfish, or the wider habitat damage that can result from some types of fishing which drag the seabed or estuary substrate. Initial characterisation (risk assessment under Article 5 of the Water Framework Directive) focused on the potential for physical habitat damage associated with fishing activities but also noted the need for a more holistic consideration of the direct impacts of fish or shellfish removal. Commercial fishing or fish farming may also have a detrimental ecological impact in fresh

[7] Environment Agency 2007, The Unseen threat to water quality, Diffuse Pollution in England and Wales, May 2007.

waters - either through the large scale netting of migratory fish such as eels or salmon, or through the influence of fish stocking or farming on natural populations. Fish farming also has associated abstraction and pollution pressures.

G.2.11 Organic pollution (ammonia and biochemical oxygen demand)

For the purposes of our assessments, organic pollution is comprised of ammonia and biochemical oxygen demand (BOD). The toxicity of ammonia to fish and other aquatic life is dependent on the pH and temperature of the water. Increasing pH increases the proportion of toxic 'free' ammonia. Biochemical oxygen demand is not a pollutant, but a measure of the amount of biodegradable organic matter present. A high concentration of biodegradable organic matter exerts a high oxygen demand on water, leading to oxygen depletion with potentially severe impacts on the whole ecosystem.

Much of the pressure from organic pollution is the result of discharges of treated sewage effluent. Tightening of discharge standards and cessation of discharges of raw sewage to coastal waters over the past 15 years has resulted in marked improvements in water quality. National classification schemes based on organic pollutants have reflected this as shown in figures for General Quality Assessment compliance from 1990 to 2007.

Our latest risk assessments show that:

- 425 km (6% of total length) of river water bodies within the South West River Basin District are at risk or probably at risk of failing the ammonia standards (see Figure G.37);
- 340 km (5% of total length) of river water bodies within the South West River Basin District are at risk of failing the biochemical oxygen demand (BOD)[8] standards (see Figure G.36).
- 4% of the estuarine water bodies and 0% of coastal water bodies within the district have been assessed as at risk or probably at risk from point sources of organic pollution.

G.2.12 Other Pollutants

Metals

Metals are naturally occurring in the environment and many are needed in small amounts by organisms to function properly. However, they can be toxic to aquatic organisms such as freshwater fish, invertebrates and marine organisms in larger quantities. Metal pollutants are covered under a number of other pressure categories including urban and transport, mines and minewaters, and chemicals, including priority hazardous, priority and specific polluting substances (section G.2 and Figure G.30).

Chemicals including priority hazardous substances, priority substances & specific pollutants (excluding pesticides)

The Environmental Quality Standards Directive designates the most polluting substances as priority substances and priority hazardous substances. The list includes pesticides (see also section G.2.8) and other synthetic organic chemicals including chlorinated hydrocarbons, but also some naturally occurring substances such as metals. The severity of their effects depends on the availability to organisms, the nature of the particular substance and the susceptibility of the biological receptor.

Severe contamination can result in lethal effects to the extent that the habitat becomes characterised by tolerant or opportunistic species. In less severe circumstances, sub-lethal impacts may affect the physiology, growth and development and reproduction of organisms in the water column and sediment. Furthermore, a number of these substances bio-accumulate and many persist in sediments. The most polluting have been termed priority hazardous substances and the aim is to eliminate discharges of these substances to the aquatic environment wherever possible.

[8] BOD is not used for classification

Information gathered to monitor environmental quality and compliance with other Directives shows that chemicals cause problems for the water environment in the South West River Basin District. The pressure from tributyltin is a concern at specific sites and is covered in discussions in relation to pesticides in section G.2.8 (see Figure G.35).

Our initial view of risk assessments reported that 40 (4%) of our river water bodies and ten (43%) of our estuarine water bodies were either at risk or probably at risk of failing Water Framework Directive objectives based on an assessment against Dangerous Substances Directive compliance. Note that the standards in the Dangerous Substances Directive will be replaced by the Environmental Quality Standards Directive (2008/105/EC). See Figures G.33 and G.34.

There are currently no groundwater bodies at risk from hazardous substances (not including pesticides) and chlorinated solvents (see Figures G.31 and G.32).

Endocrine Disrupters

Hormones control essential processes in animals and plants, such as growth, metabolism, reproduction and the functioning of various organs. Some chemicals can disrupt the normal working of the hormonal system (or endocrine system), and these are referred to as 'endocrine disrupting substances'. These substances may mimic the action of natural hormones, block their action, interfere in feedback mechanisms or have other effects.

There is considerable evidence of impacts on fish development, growth and reproduction, demonstrated particularly where male fish have become feminised. The Defra EDCAT project is currently investigating effects on fish populations and this will be completed in 2010.The severity of the effects of endocrine disrupting substances depends on a range of variables which are not yet fully understood, but include exposure to these substances (possibly at particular stages in the life cycle and the duration of that exposure), the nature of the particular substance and the susceptibility of the biological receptor.

This issue remains a concern in the South West River Basin District.

Faecal Indicator Organisms

Micro-organisms occur in vast numbers in the natural aquatic environment. The greatest waterborne risk of infection to humans is through drinking water or shellfish contaminated by pathogenic (that is, infection causing) organisms, such as bacteria or viruses, from sewage or animal excrement. However, infection (such as gastroenteritis – inflammation of stomach and gut) can also occur through ingesting contaminated seawater or freshwater during bathing.

It is impractical to test water for every known pathogen in every sample, and it has therefore become standard practice to test water for 'faecal indicator organisms'. Whilst generally harmless in themselves, their presence in water is an indicator of sewage or animal contamination and the potential for pathogenic organisms to be present.

The current European Bathing Waters Directive (1976) includes faecal indicator organisms such as faecal coliforms, total coliforms and faecal streptococci. The recently revised Bathing Waters Directive (2006), with objectives set in line with the Water Framework Directive for 2015, takes account of more recent public health research and uses the faecal coliform *Esherichia coli* and the faecal streptococci intestinal enterococci as its faecal indicator organisms. The Environment Agency monitors faecal indicator organisms in those waters identified under the EU Bathing Waters, and Shellfish Waters Directives and the Government uses the results to report the level of compliance with the Directives' faecal indicator organisms standards each year. See Annex D for details of the relevant Protected Areas (areas designated as recreational waters and areas designated for the protection of economically significant aquatic species) and their compliance.

G.3 Other water management issues

Other water management issues were identified as affecting the water environment at a local level in the River Basin Planning: Summary of Significant Water Management Issues report for the South West River Basin District. These are described below:

- Acidification
- Recreation

Acidification

Acidification is the process whereby nitrogen oxides, sulphur dioxide and ammonia released into the atmosphere are converted into acidic substances. Acidification can cause toxic metals to leach out of soils and enter surface or groundwater. Various land-use practices such as farming and forestry can lead to acidification of watercourses, causing loss of sensitive plants and animals. At present, there is no evidence of impact from acidification on the district's water bodies. Our latest view of river basin characterisation showed that 52 (6%) of river water bodies are at risk or probably at risk of failing Water Framework Directive objectives in 2015 due to acidification (see Figure G.38).

Recreation (e.g. boating and fishing)

Recreational activities on or associated with water may have a direct impact on its quality or on the ecological assemblages within it. Boating activity, if intensive in shallow river or lake waters, may be associated with raised levels of suspended solids, bank erosion and fuel related pollution. Recreational angling may also lead to impacts on fish communities unless sensitively and sustainably managed.

G.4 Mapped outputs - the current view of pressure risks

The following pages include mapped outputs for the current view of risk for the pressures described in this annex.

Understanding the maps

The results of our risk assessments are displayed through maps showing which water bodies are at risk of failing the Water Framework Directive objectives in 2015. These assessments do not reflect the current quality or status of a water body, rather the risk that they may fail objectives as a result of pressures acting on them.

The maps show the risk of failing Water Framework Directive objectives with the following colour key:

- Water body at significant risk of failing objectives - dark purple
- Water body probably at significant risk of failing objectives - light purple
- Water body probably not at risk of failing objectives - pink
- Water body not at risk of failing objectives - pale pink
- Water body not assessed – white

A water body may be "not assessed" if the risk assessment has not been applied to it. For example, where large water bodies have been split into smaller water bodies late in the river basin planning process, the risk assessment may not have been subsequently applied to the smaller water bodies. These risk assessments will be updated during the first cycle of river basin management planning.

Figure G.8 **Diffuse source pressures – Sediment (rivers)**

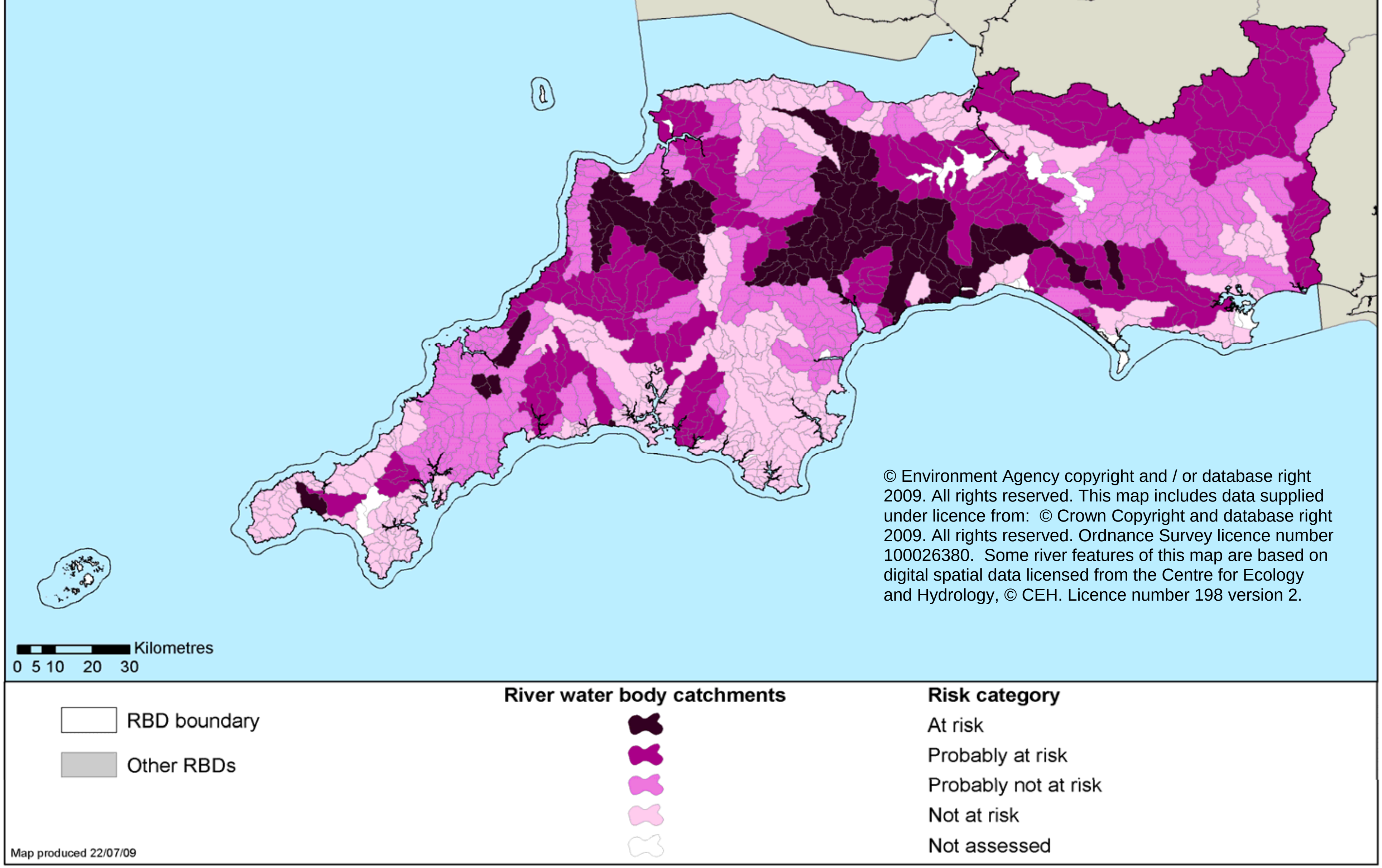


Figure G.9 **Physical or morphological alteration (rivers)**

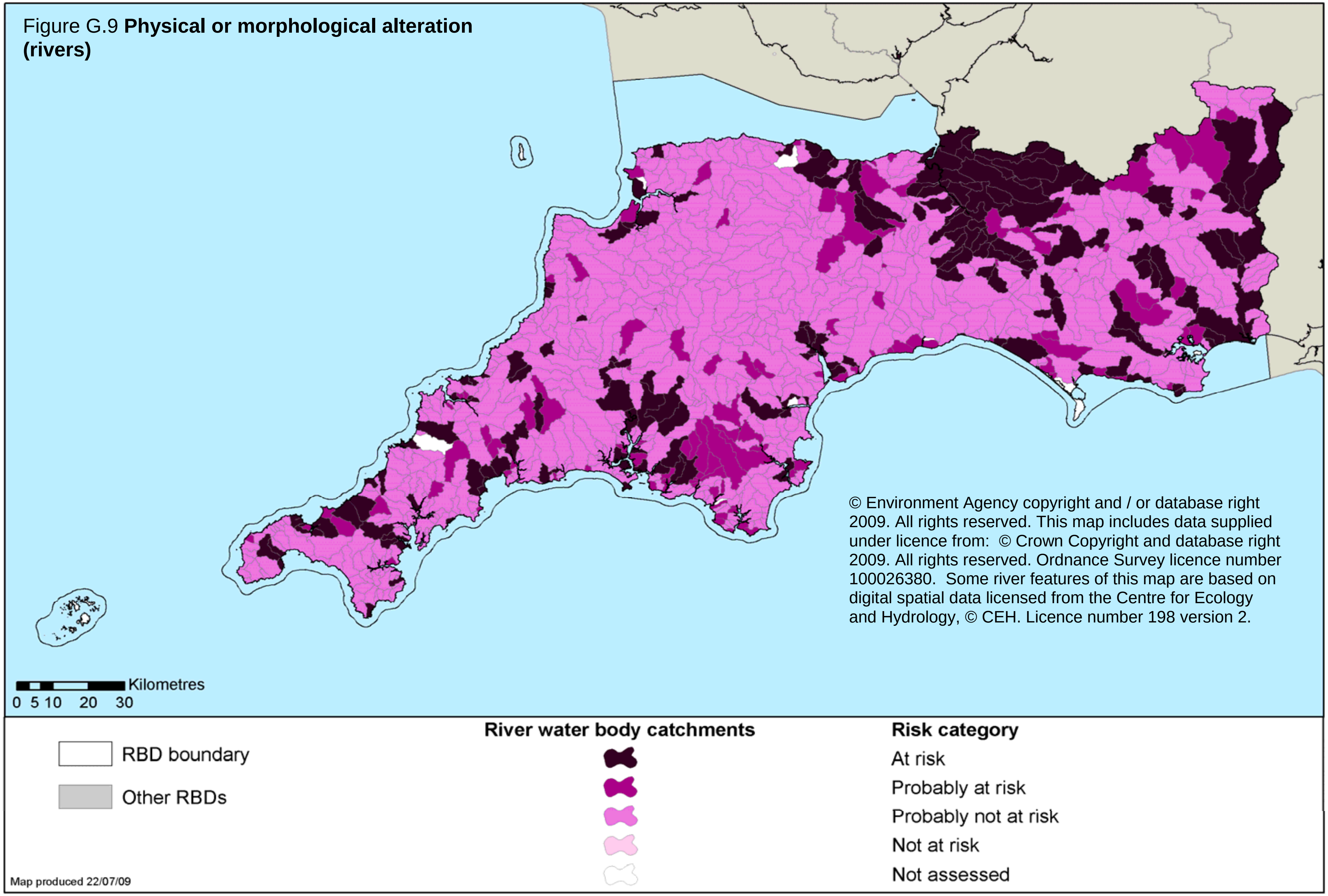


Figure G.10 **Physical or morphological alteration (lakes)**

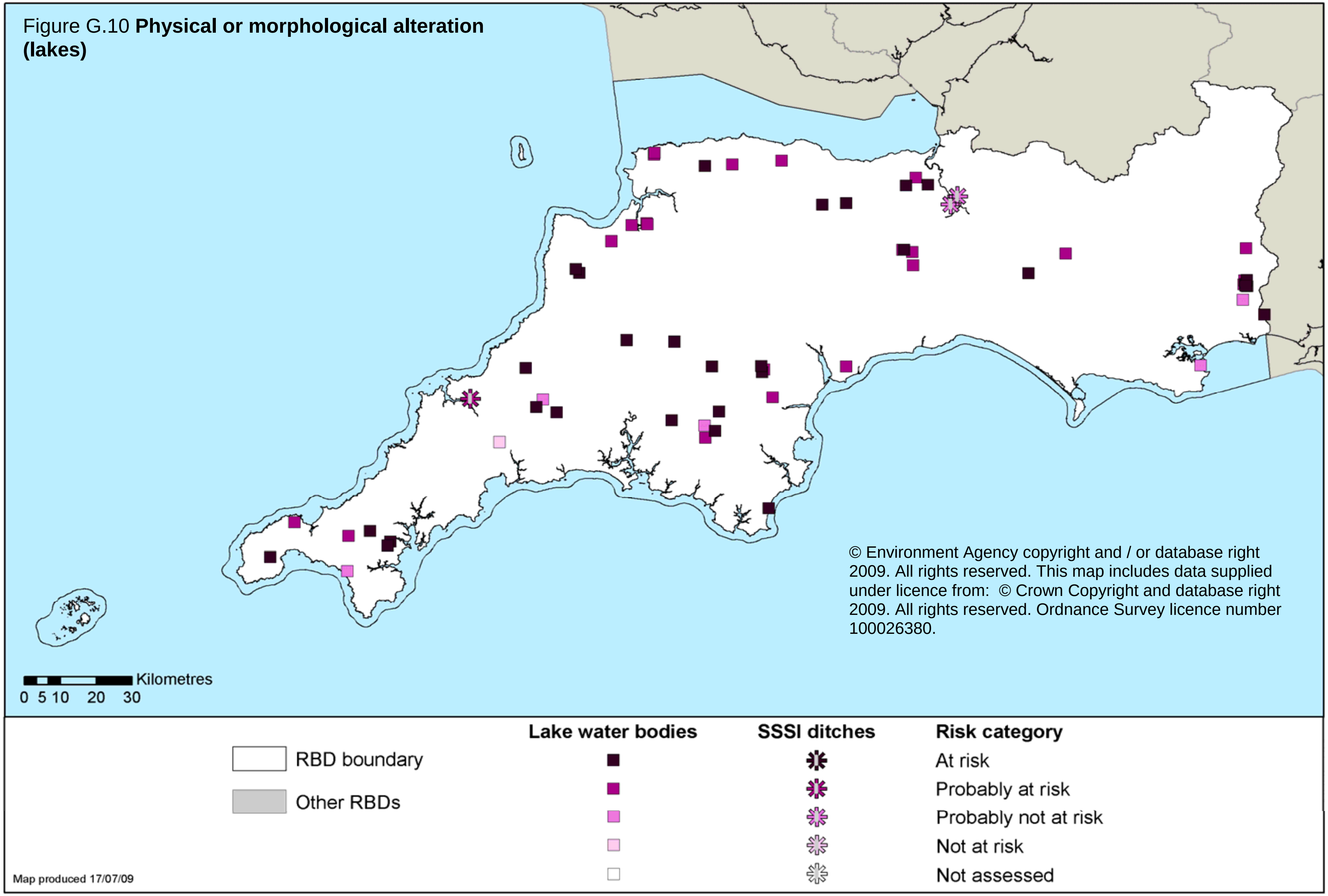


Figure G.11 **Physical or morphological alteration (estuarine and coastal waters)**

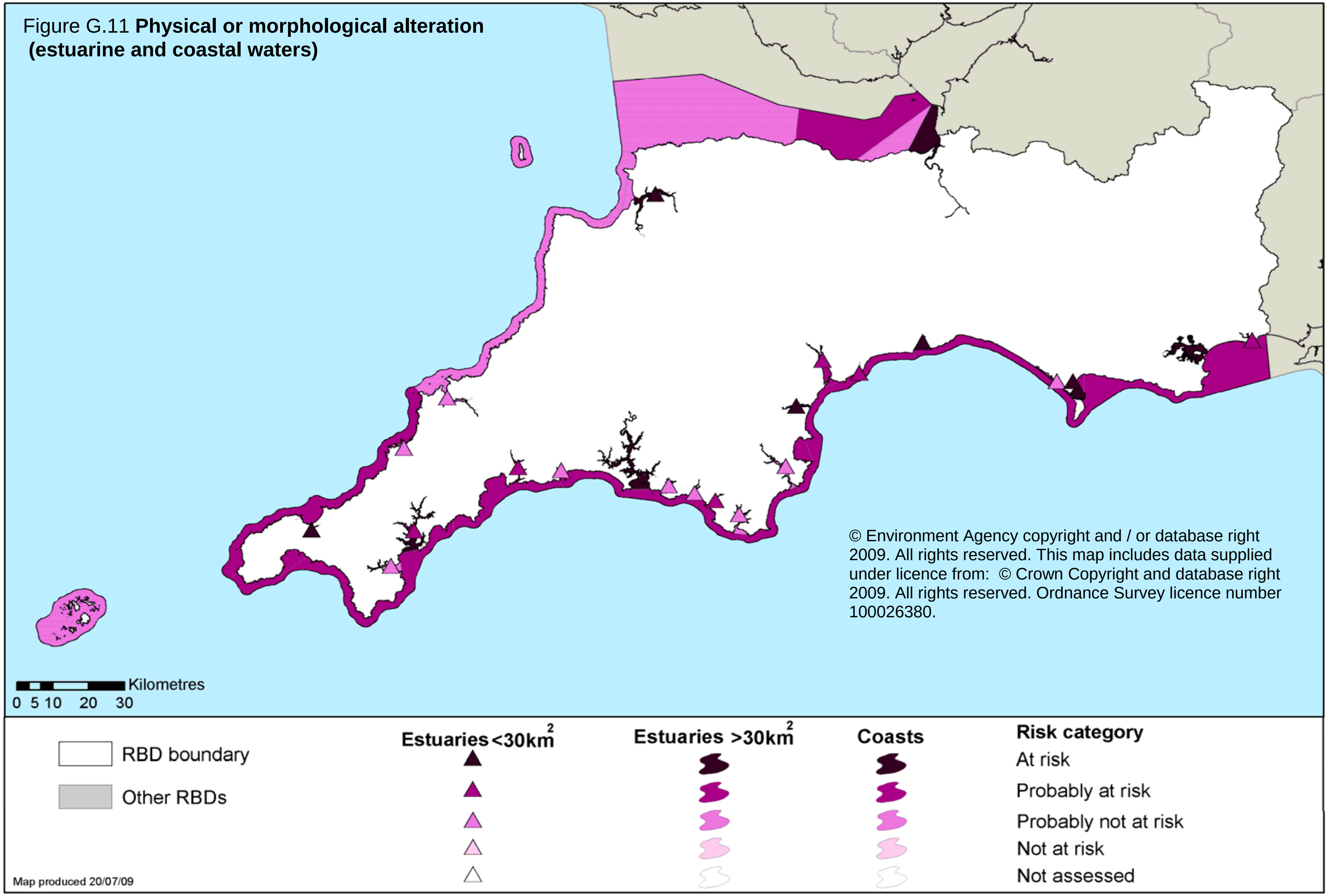


Figure G.12 **Diffuse source pressures - Nitrates (groundwater)**

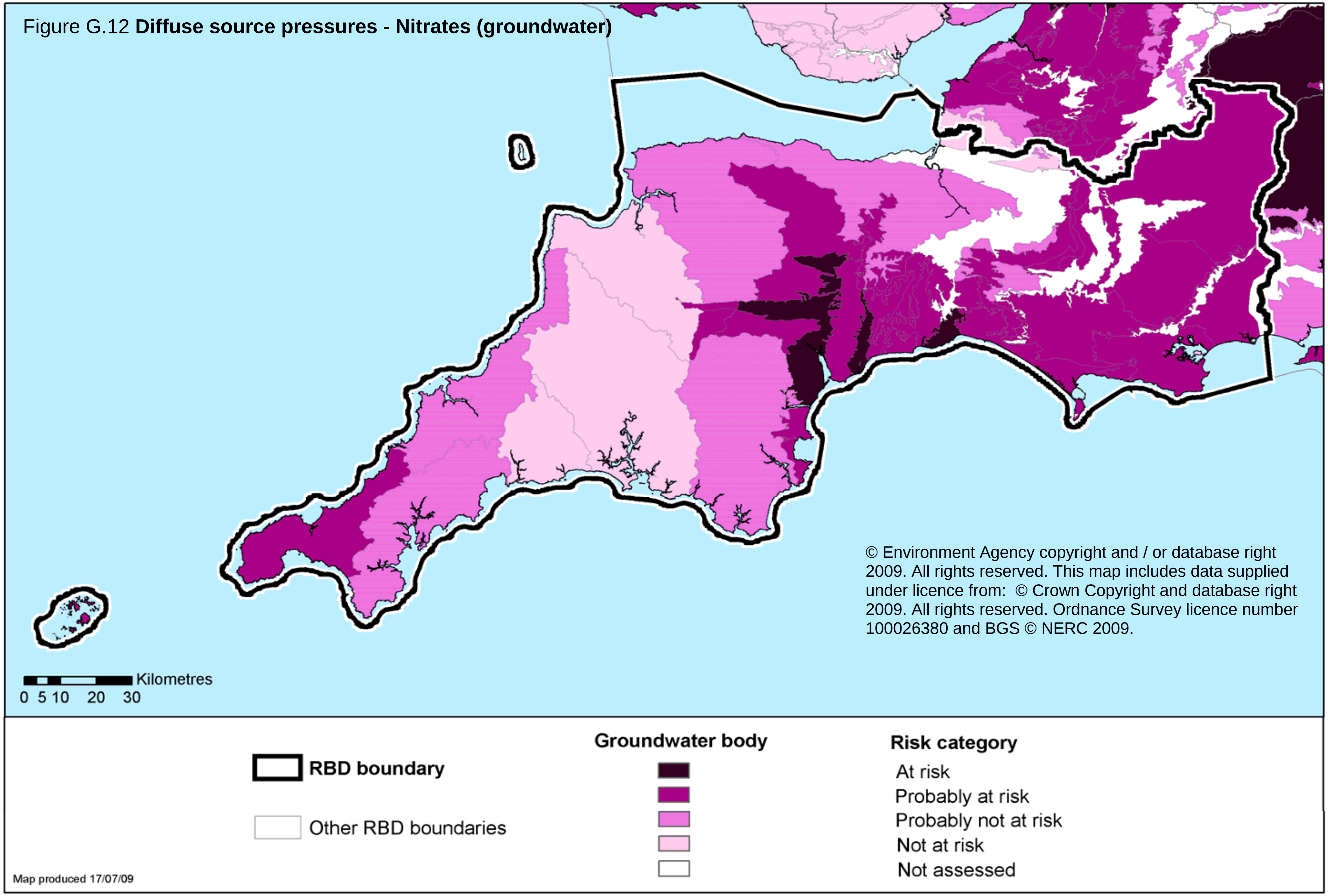


Figure G.13 **Combined source pressures - Total oxidised nitrogen (rivers)**

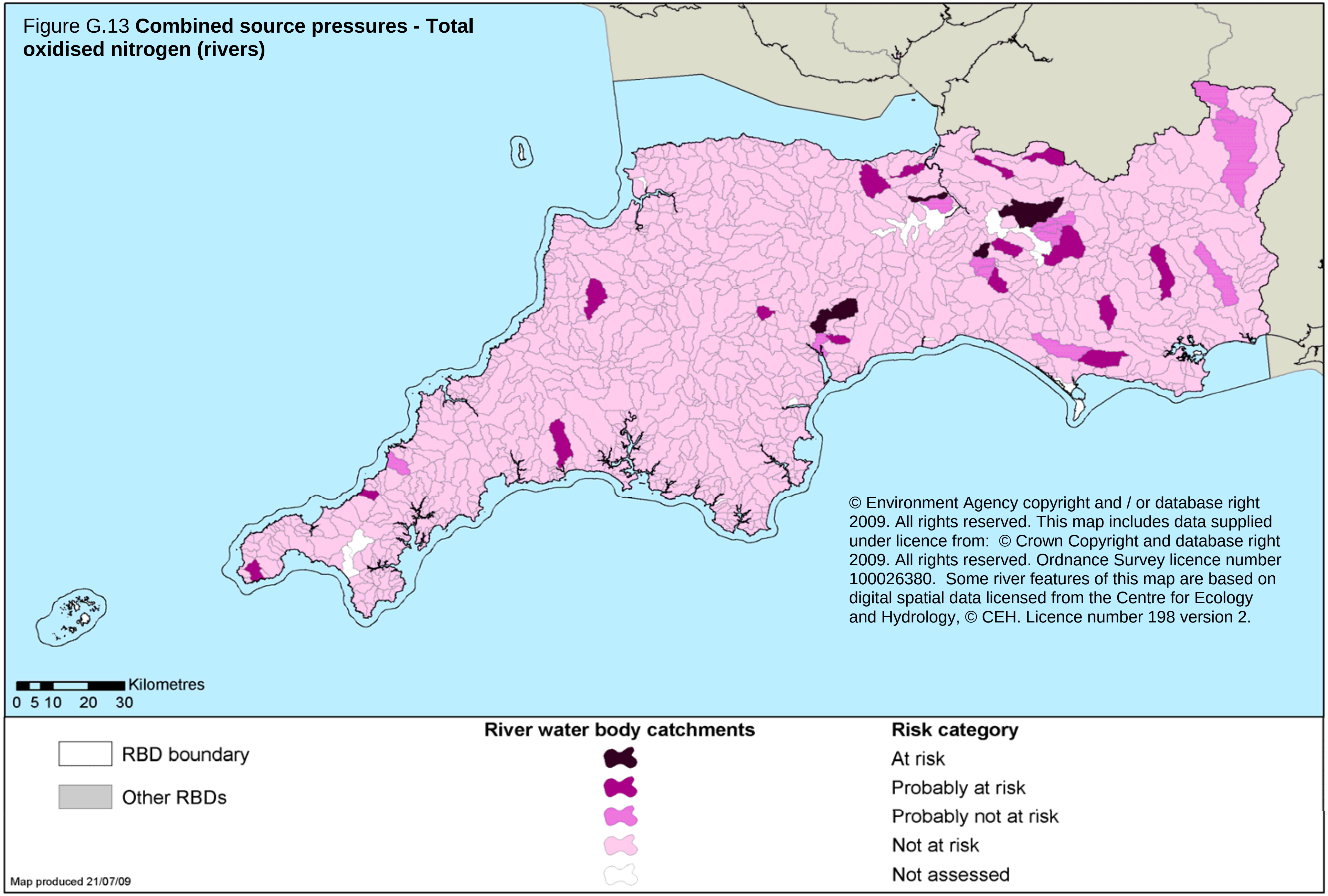
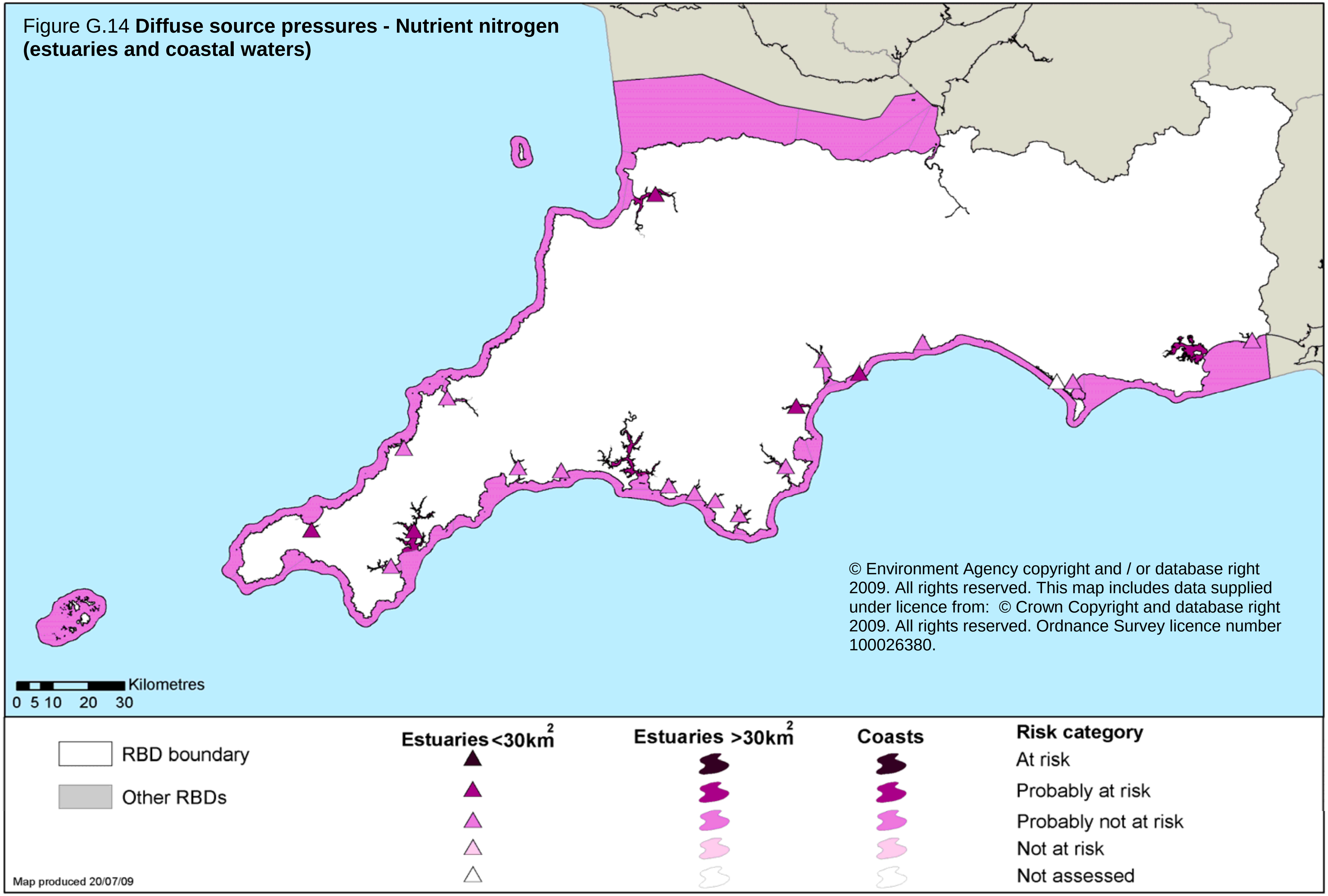


Figure G.14 **Diffuse source pressures - Nutrient nitrogen (estuaries and coastal waters)**



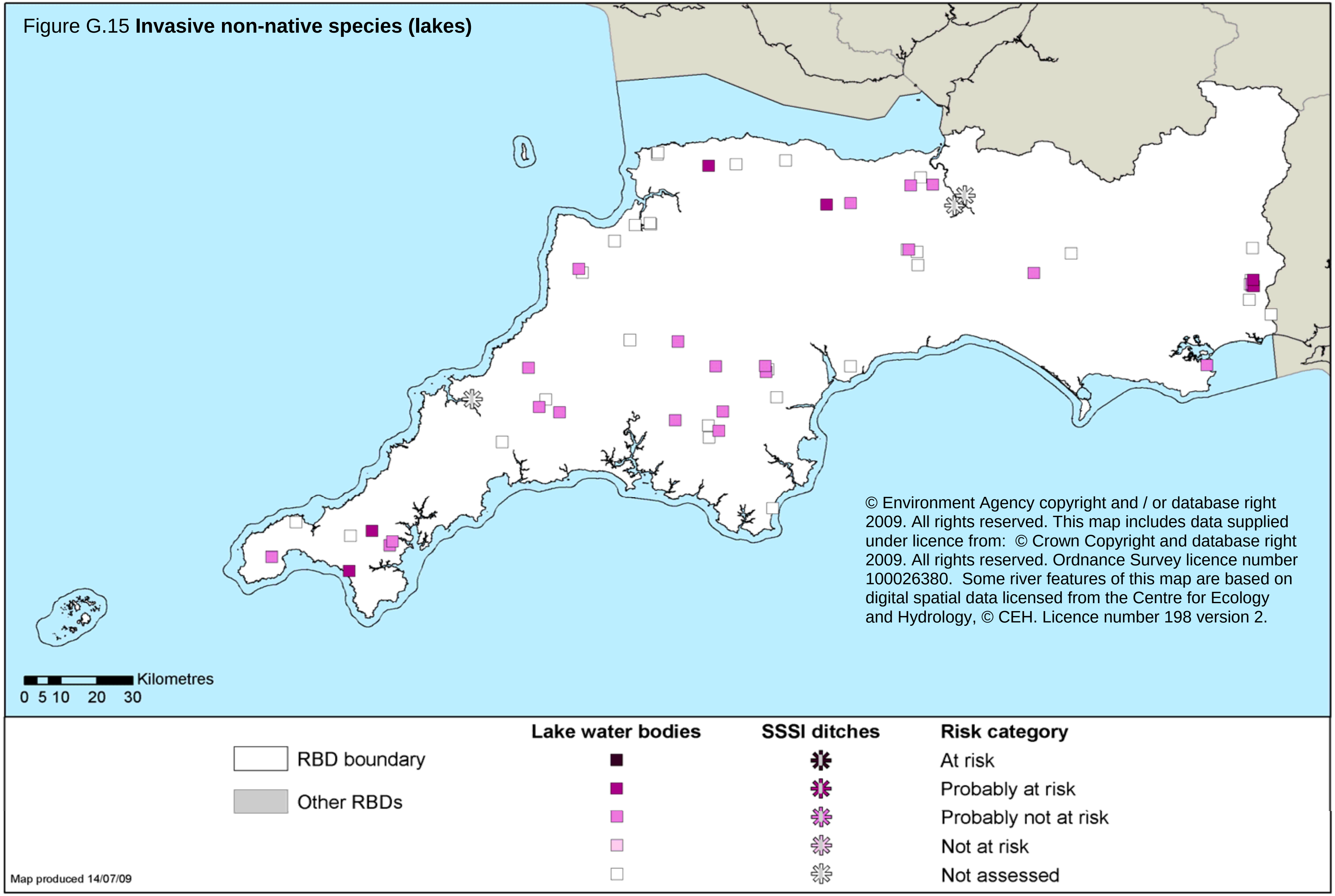


Figure G.15 **Invasive non-native species (lakes)**
© Environment Agency copyright and / or database right 2009. All rights reserved. This map includes data supplied under licence from: © Crown Copyright and database right 2009. All rights reserved. Ordnance Survey licence number 100026380. Some river features of this map are based on digital spatial data licensed from the Centre for Ecology and Hydrology, © CEH. Licence number 198 version 2.
Kilometres
0 5 10 20 30
RBD boundary
Other RBDs
Lake water bodies
SSSI ditches
Risk category
At risk
Probably at risk
Probably not at risk
Not at risk
Not assessed
Map produced 14/07/09

Figure G.16 **Invasive non-native species (rivers)**

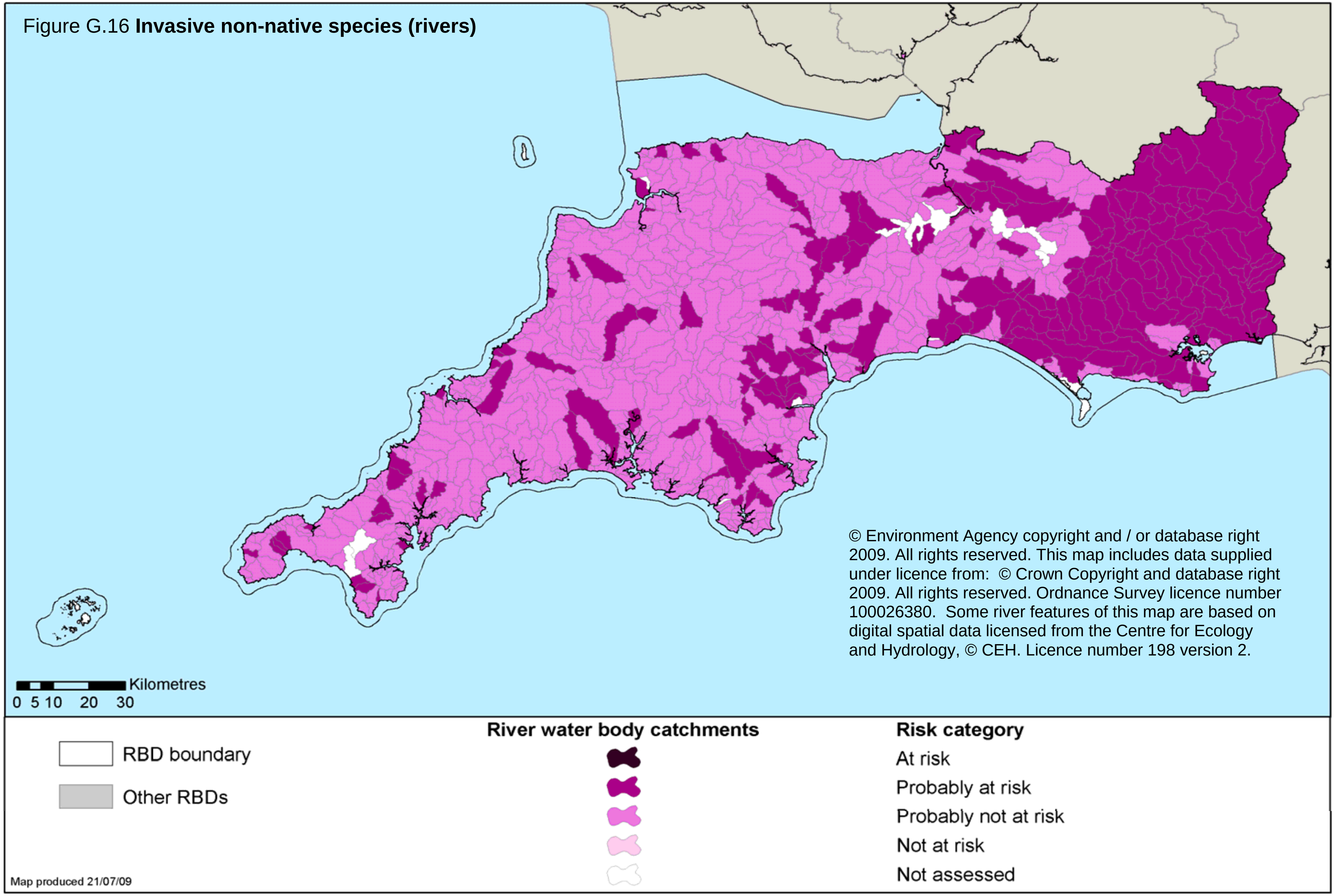


Figure G.17 **Invasive non-native species (estuaries and coastal waters)**

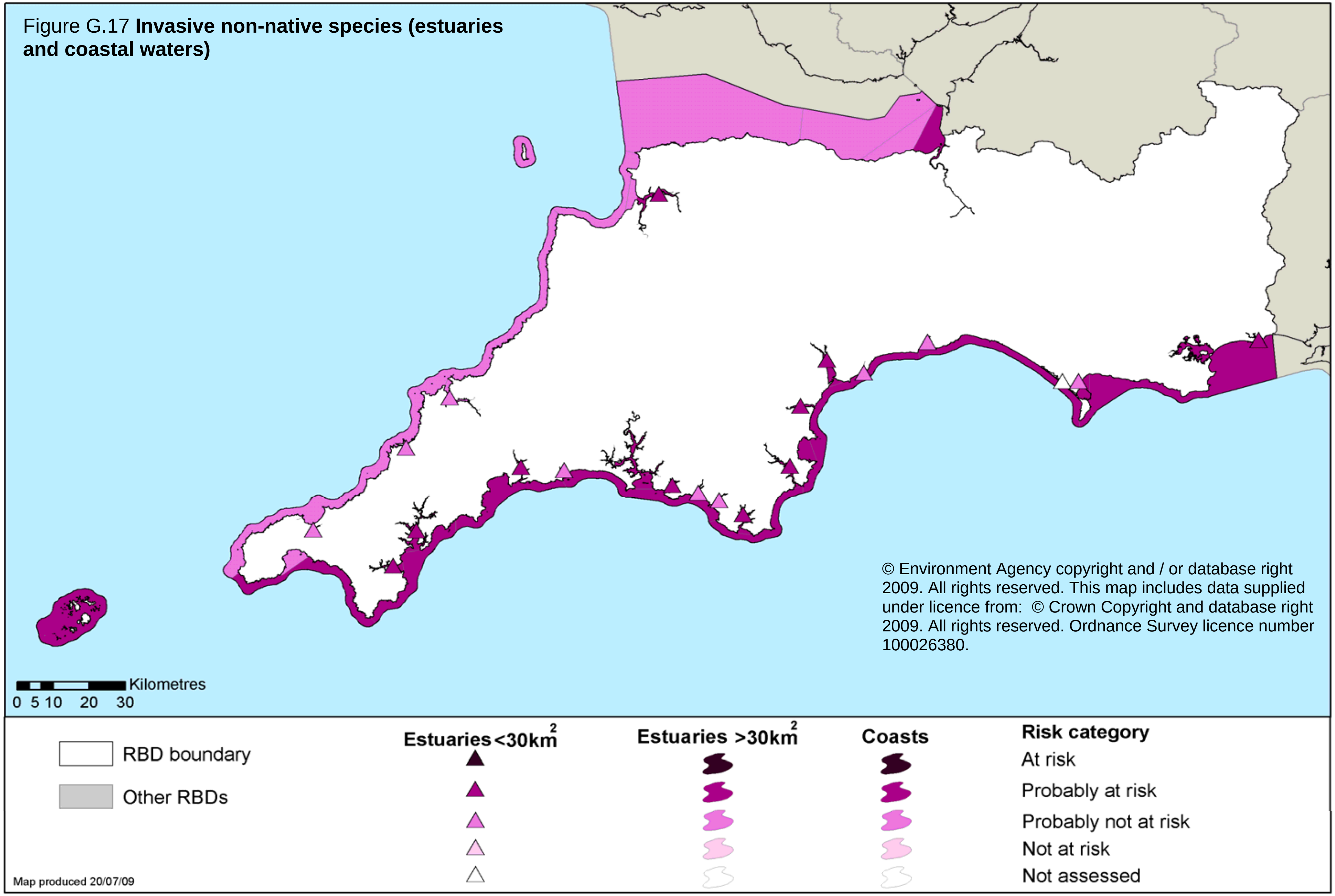


Figure G.18 **Combined source pressures - Phosphorus (rivers)**

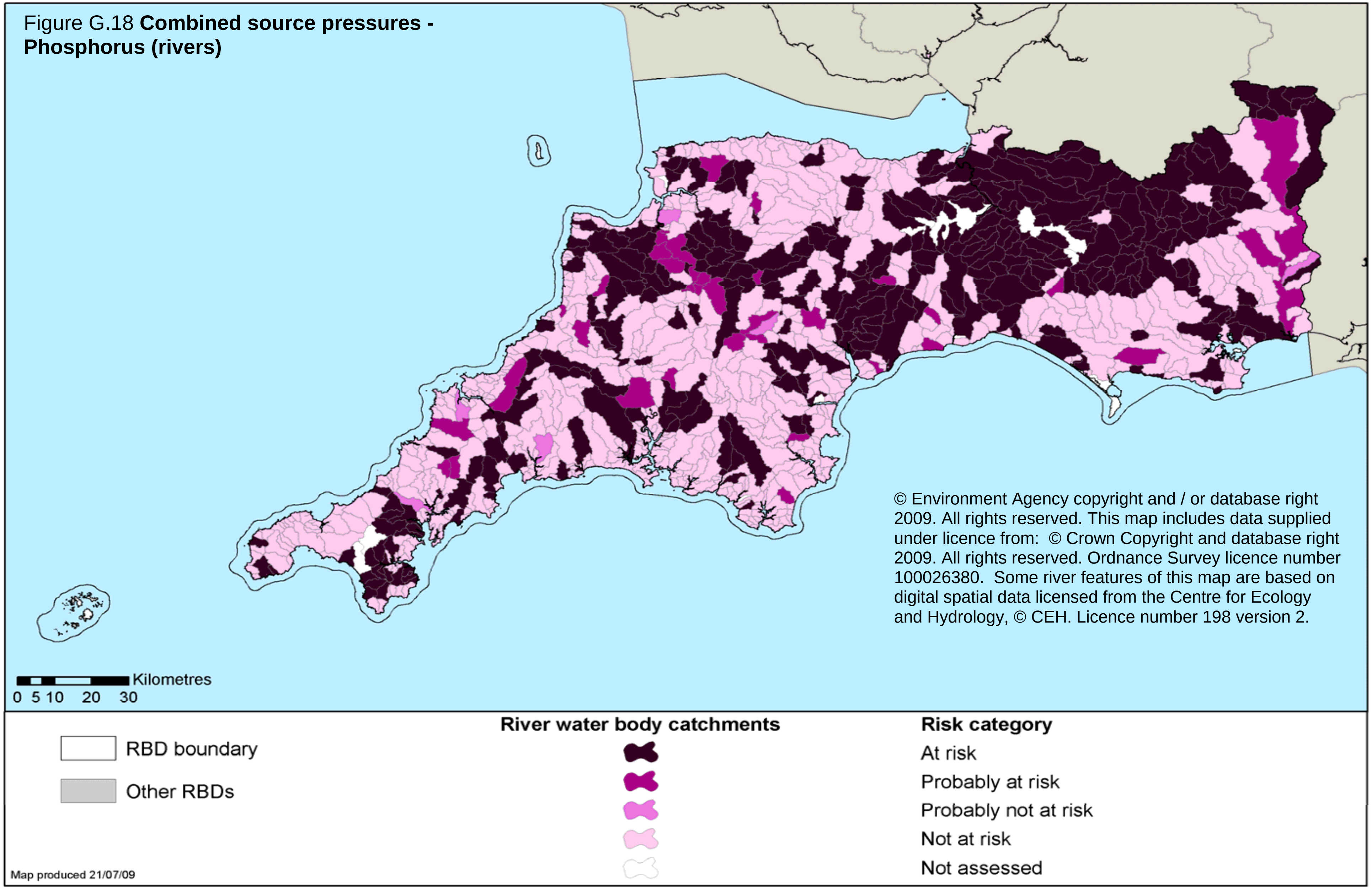


Figure G.19 **Diffuse source pressures - phosphate (groundwater)**

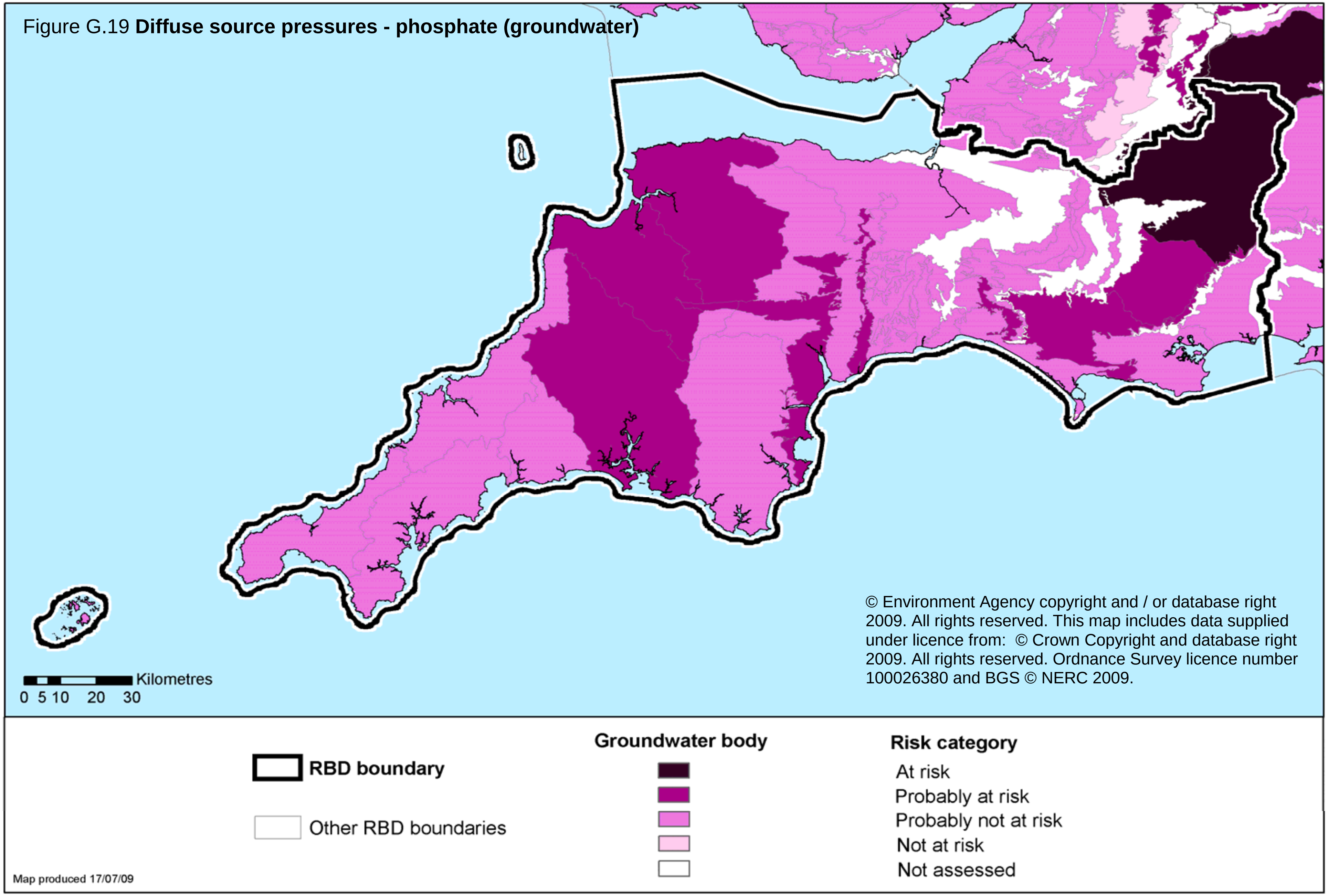


Figure G.20 **Diffuse source pressures - Phosphorus from agriculture (rivers)**

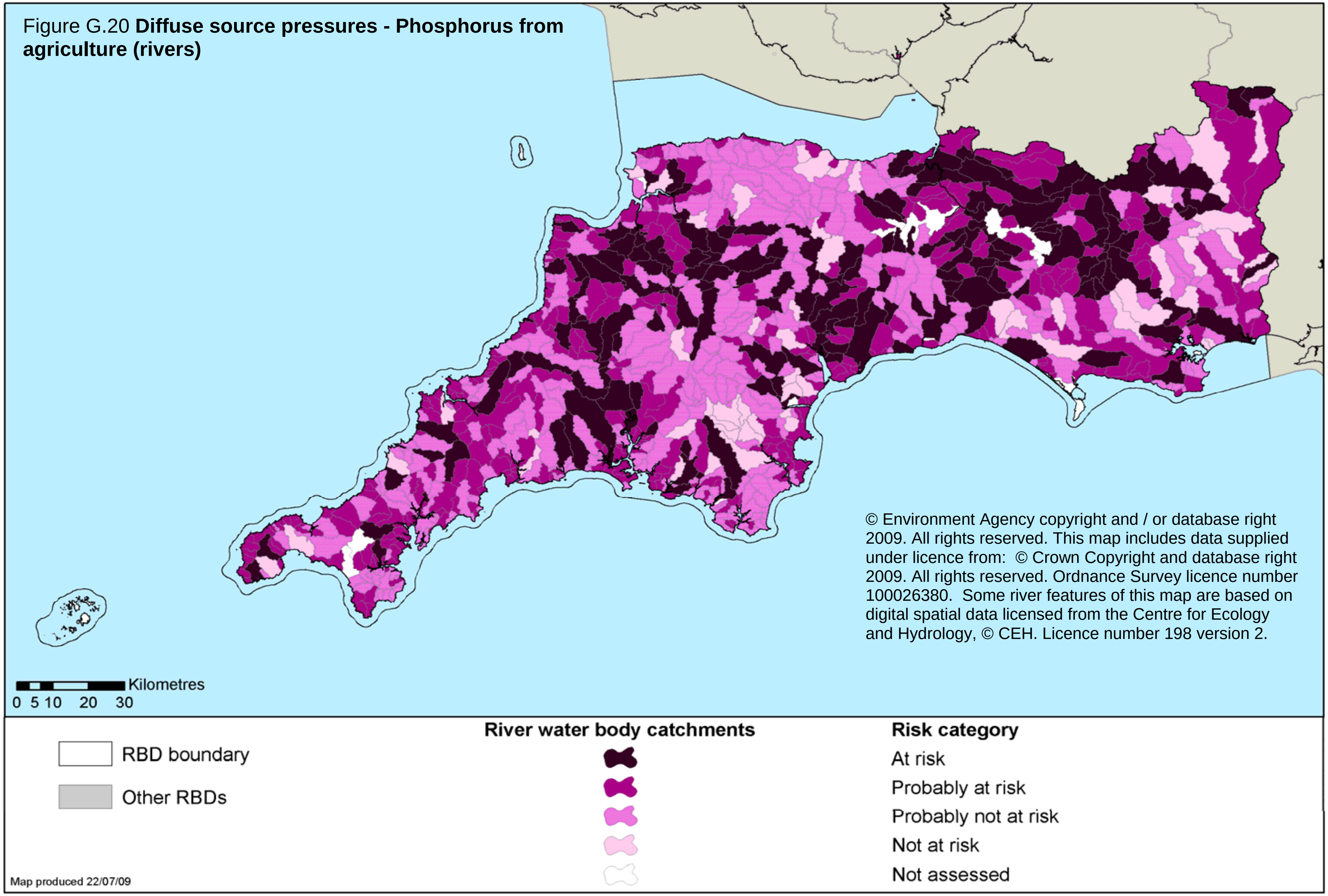


Figure G.21 **Abstraction and other artificial flow pressures (lakes)**

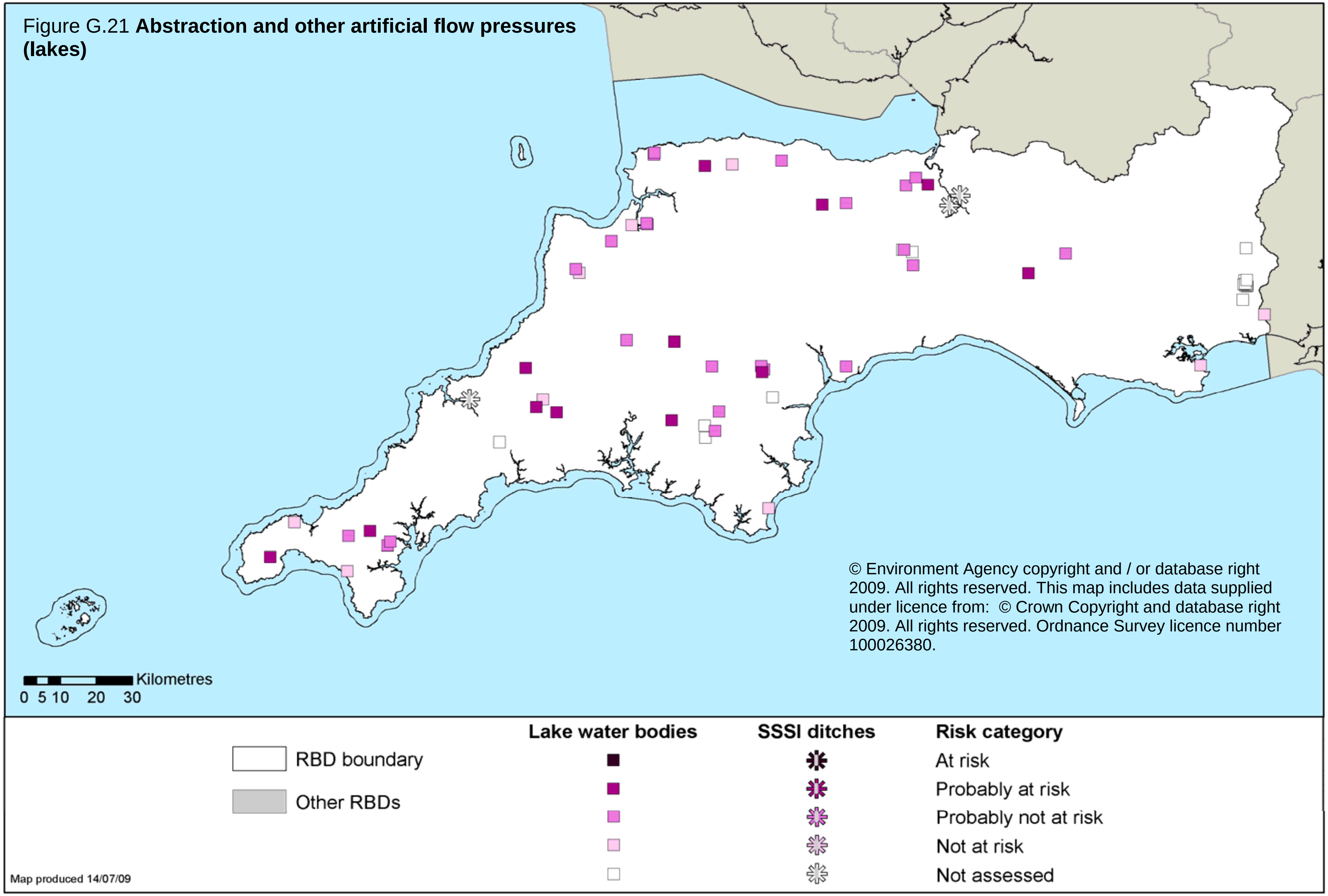


Figure G.22 **Abstraction and other artificial flow pressures (rivers)**

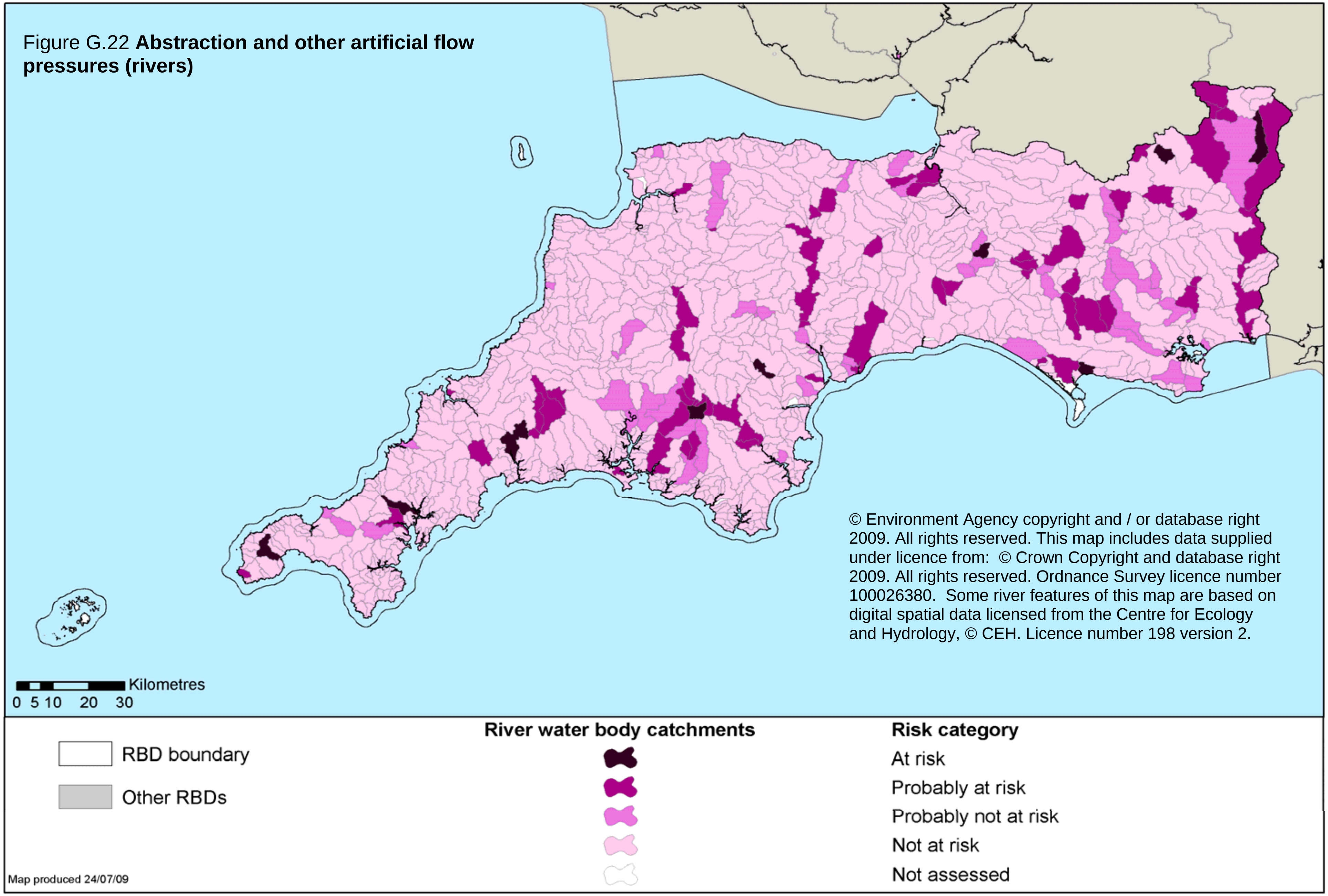


Figure G.23 **Diffuse source pressures - Mines and minewaters (rivers)**

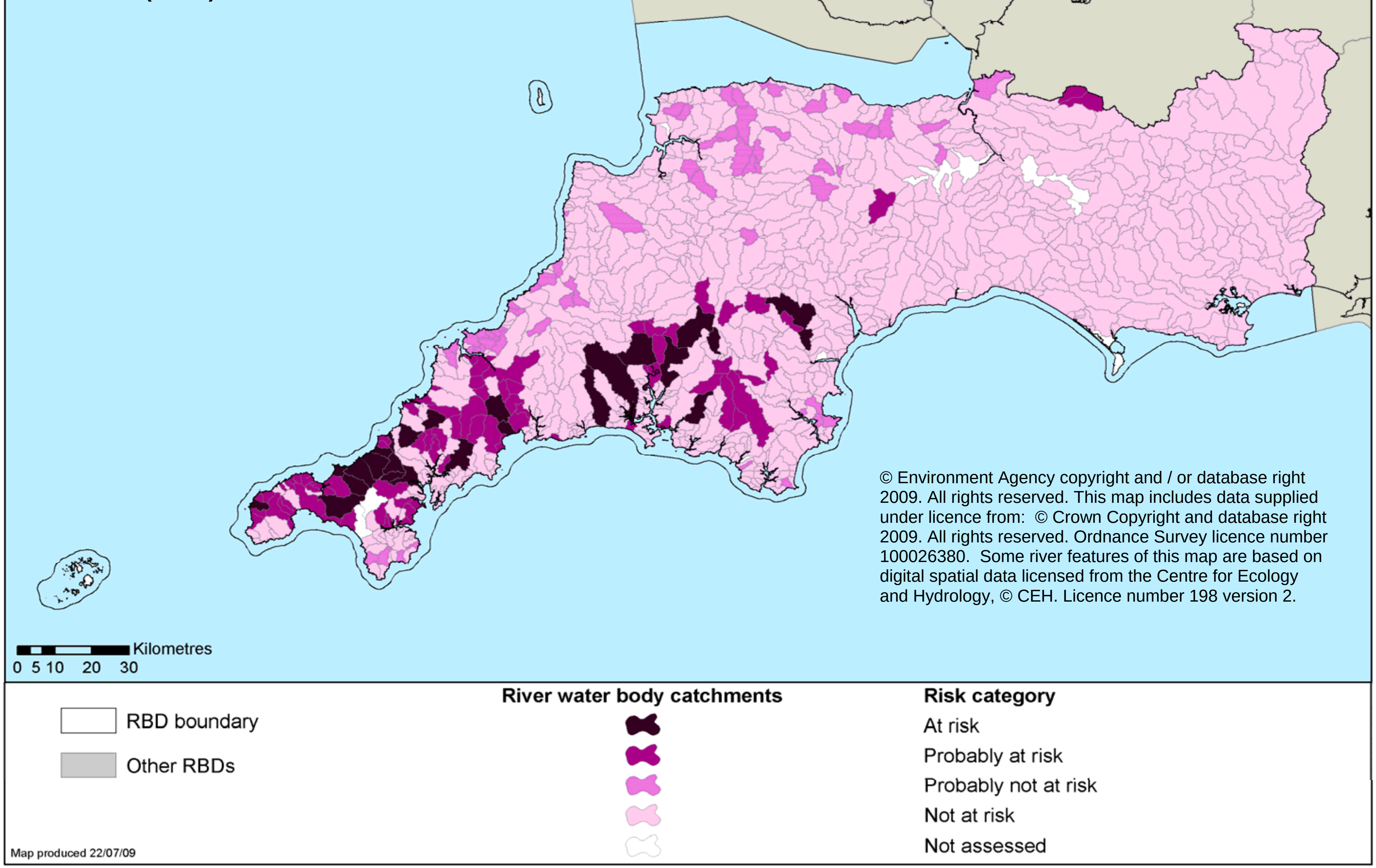


Figure G.24 Diffuse source pressures - Mines and Minewaters (groundwater)

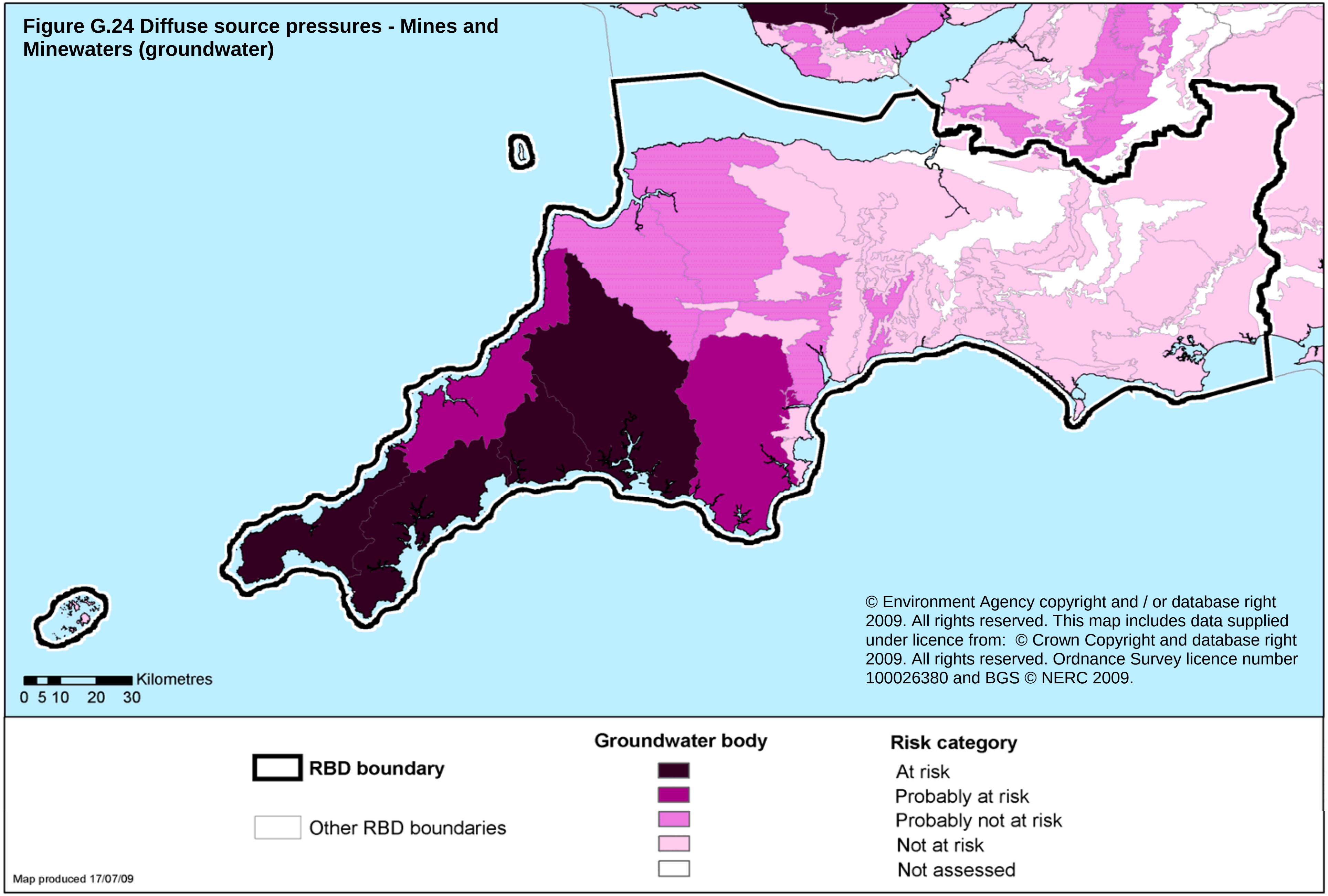


Figure G.25 **Diffuse source pressures - Mines and minewaters (estuarine waters)**

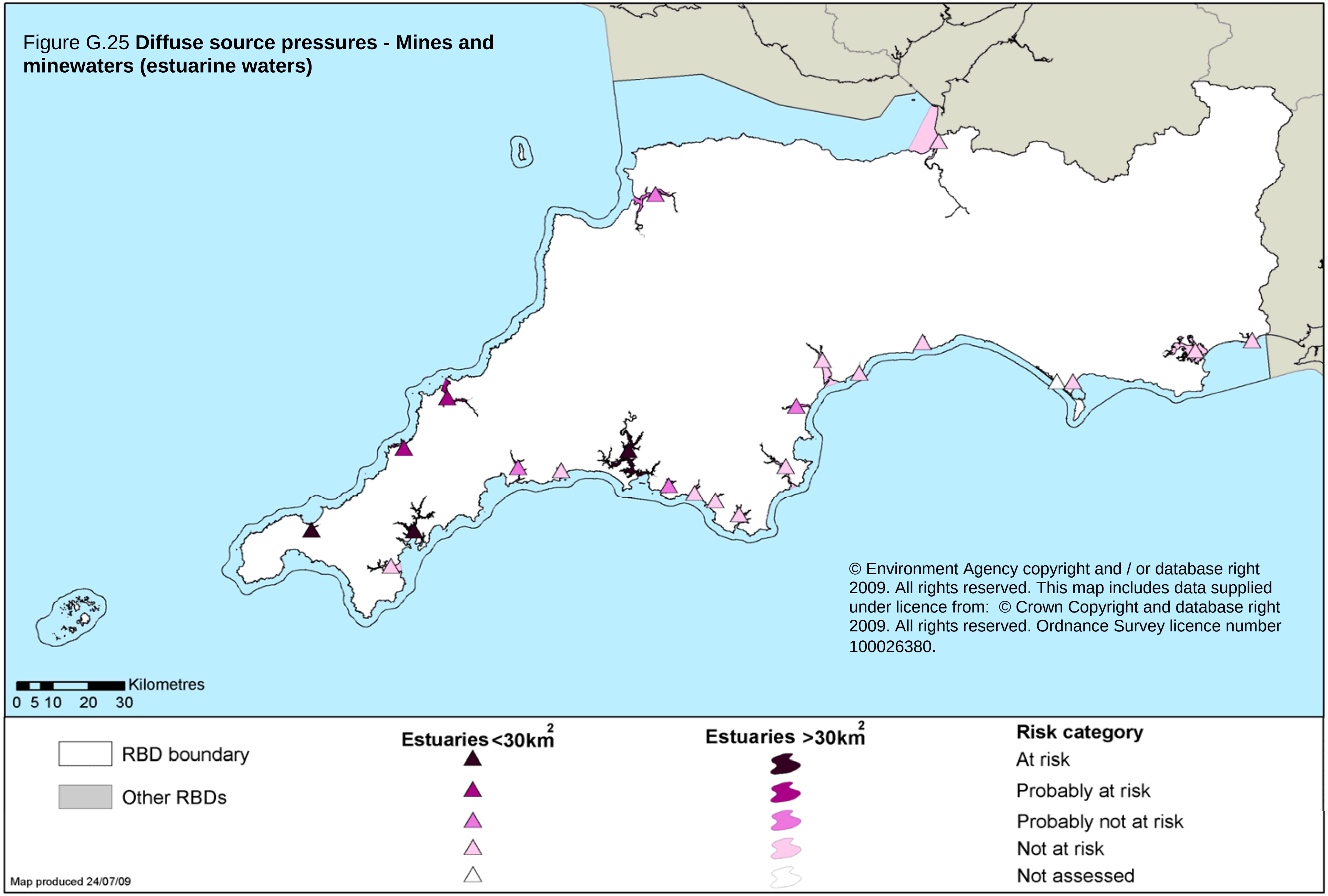


Figure G.26 **Point source pressures - pesticides (rivers)**

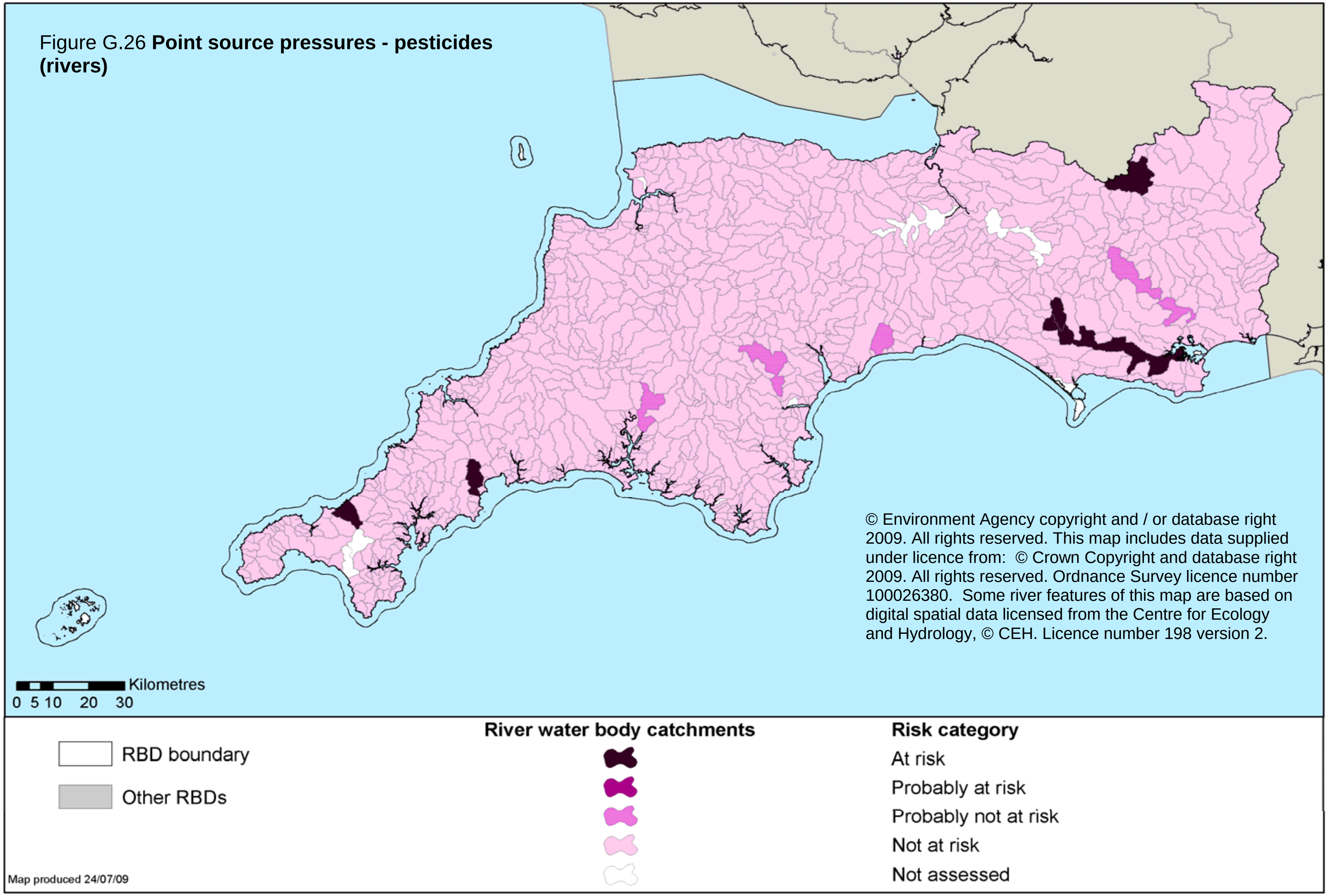
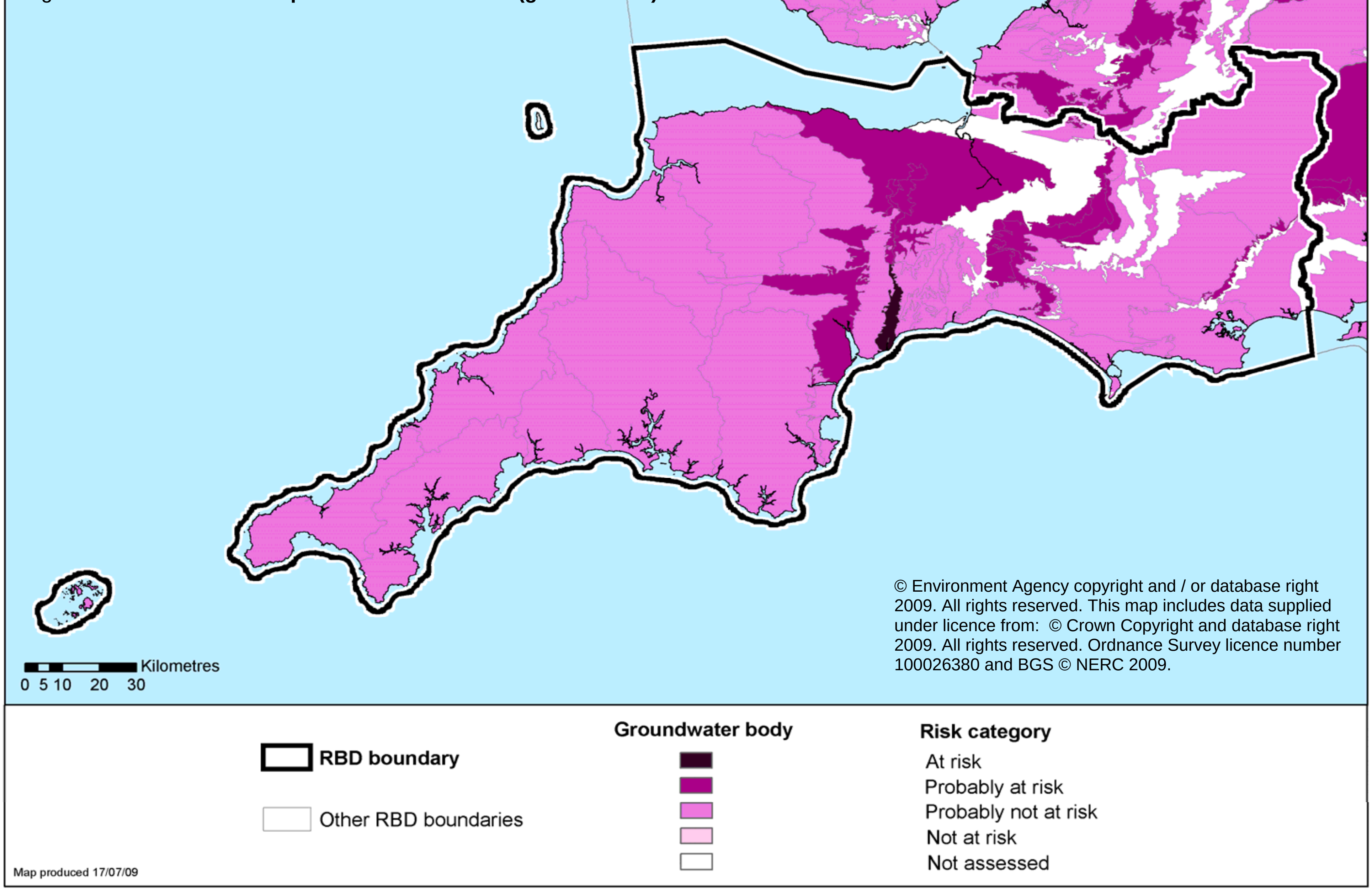


Figure G.27 **Diffuse source pressures - Pesticides (groundwater)**



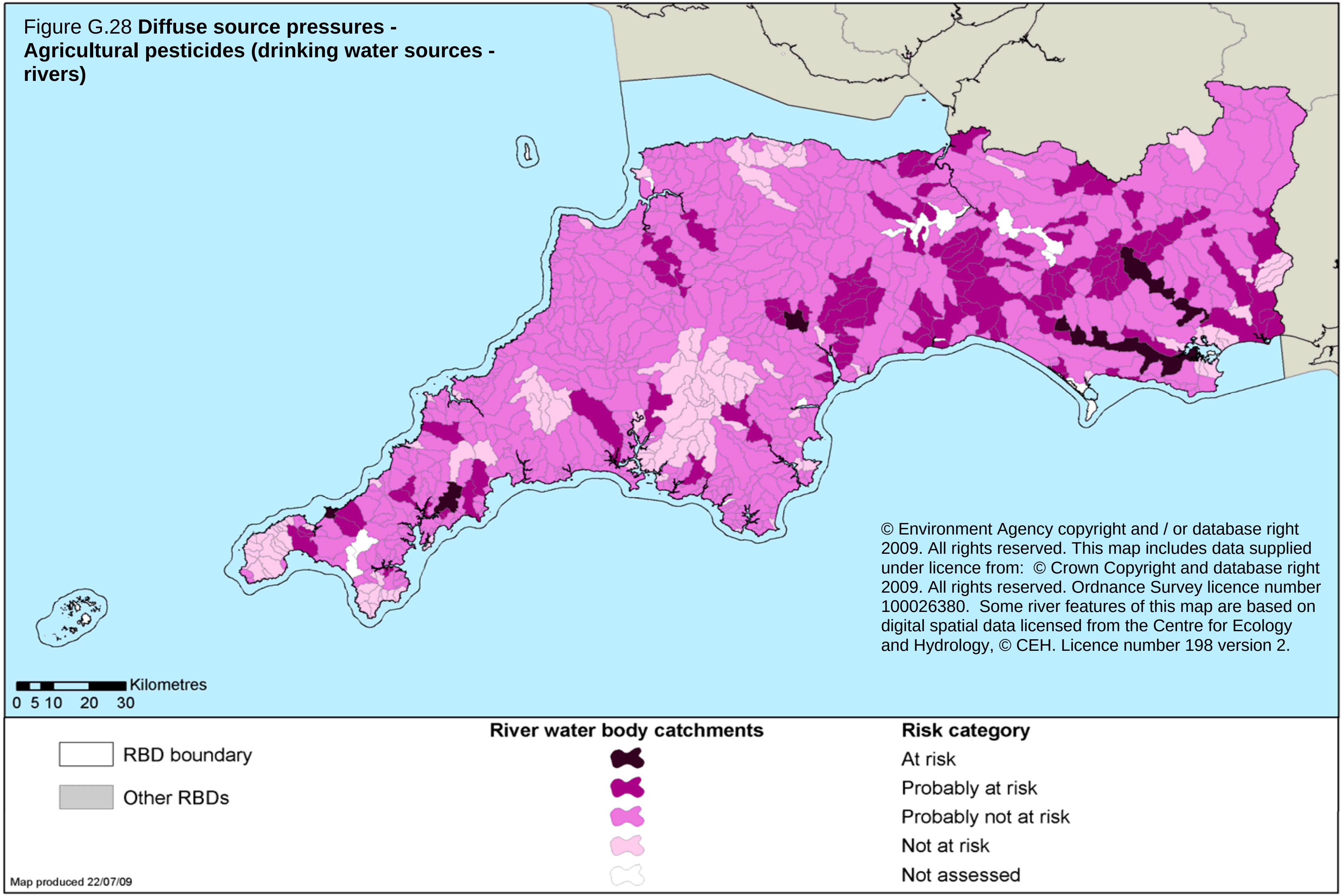


Figure G.28 **Diffuse source pressures - Agricultural pesticides (drinking water sources - rivers)**
Kilometres
0 5 10 20 30
River water body catchments
Risk category
RBD boundary
Other RBDs
At risk
Probably at risk
Probably not at risk
Not at risk
Not assessed
Map produced 22/07/09

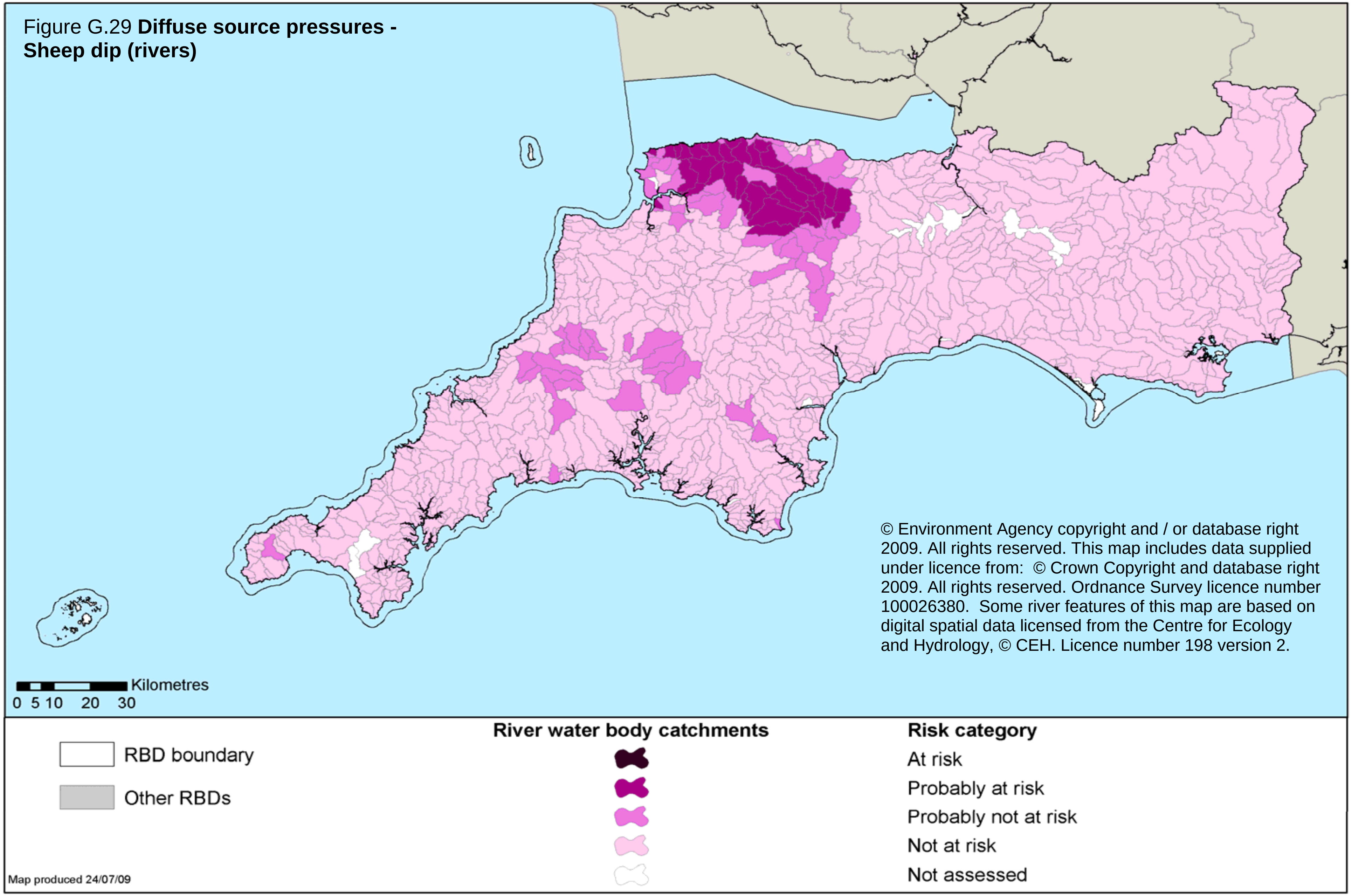


Figure G.29 **Diffuse source pressures - Sheep dip (rivers)**
© Environment Agency copyright and / or database right 2009. All rights reserved. This map includes data supplied under licence from: © Crown Copyright and database right 2009. All rights reserved. Ordnance Survey licence number 100026380. Some river features of this map are based on digital spatial data licensed from the Centre for Ecology and Hydrology, © CEH. Licence number 198 version 2.
Kilometres
0 5 10 20 30
RBD boundary
Other RBDs
River water body catchments
Risk category
At risk
Probably at risk
Probably not at risk
Not at risk
Not assessed
Map produced 24/07/09

Figure G.30 **Point source pressures - metals (rivers)**

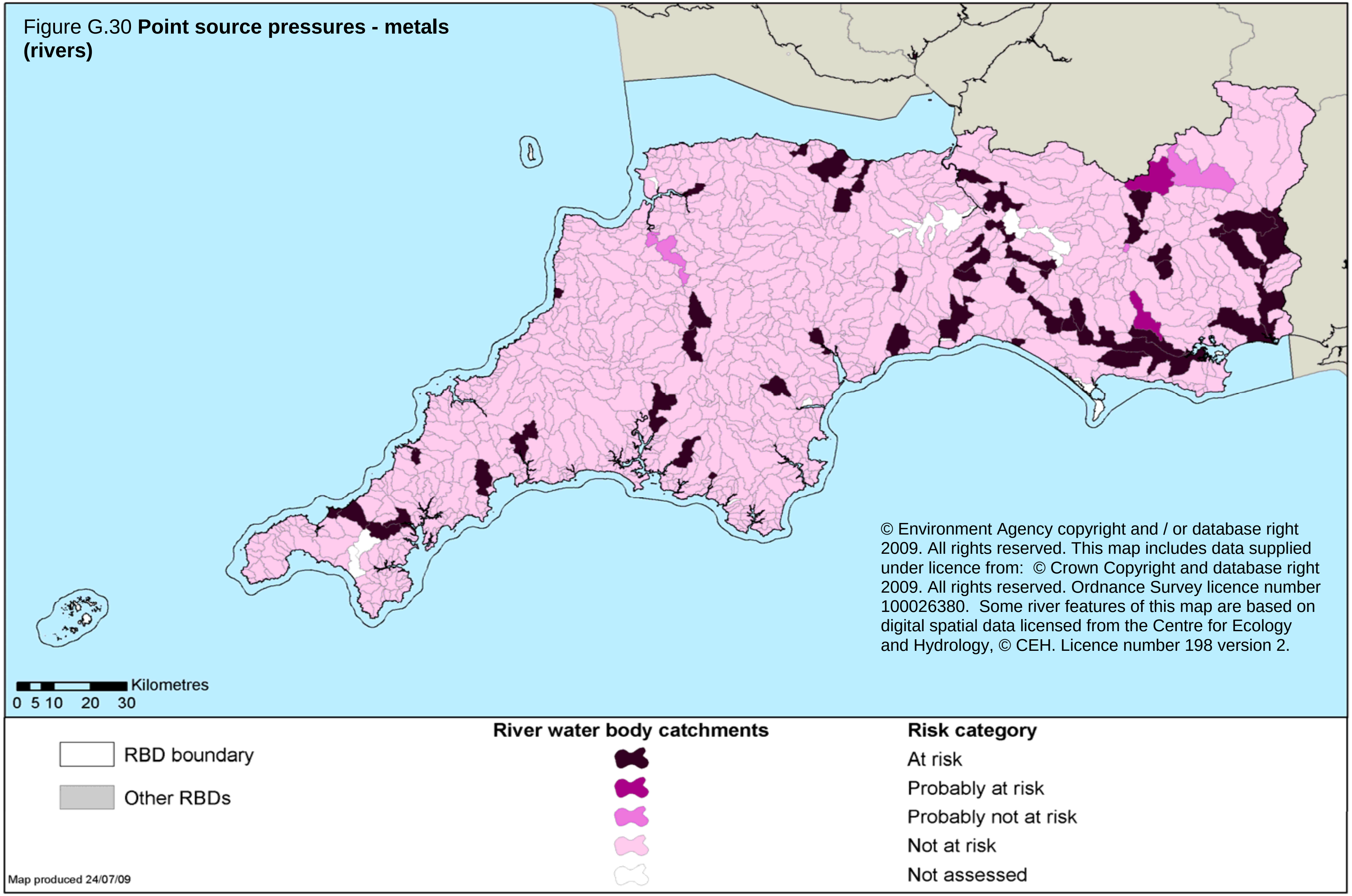


Figure G.31 **Hazardous substances (not including pesticides) (groundwater)**

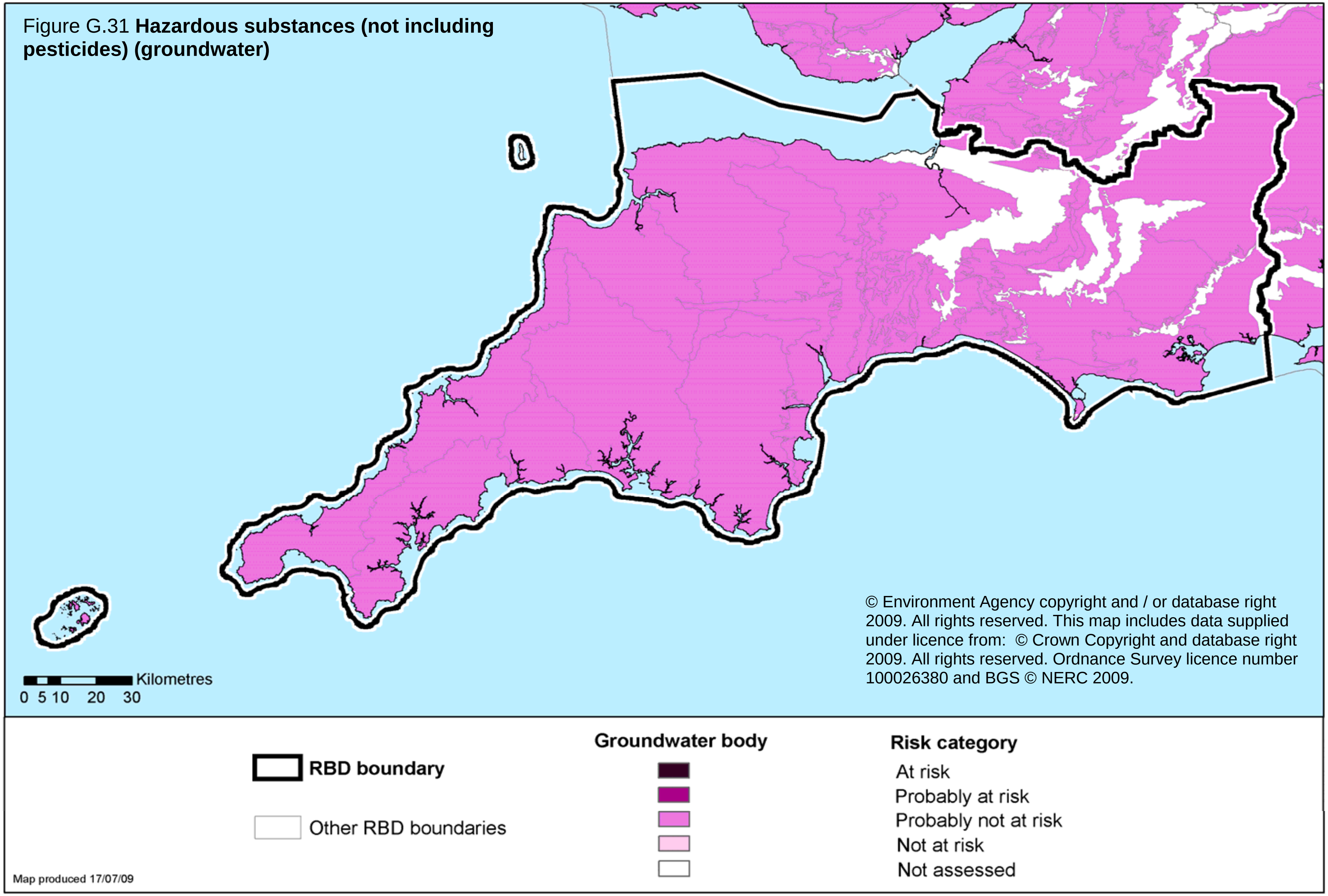


Figure G.32 **Chlorinated solvents (groundwater)**

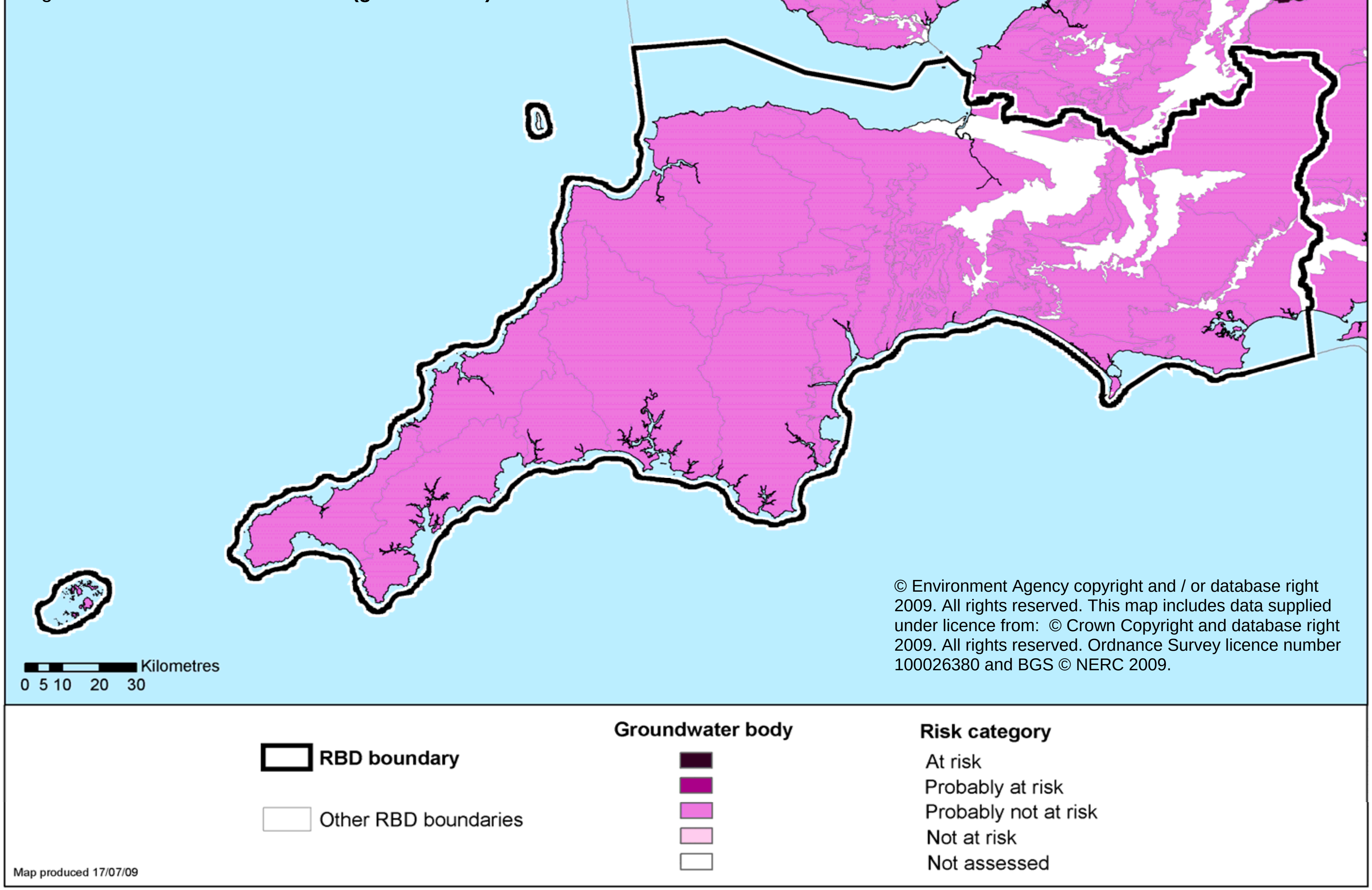


Figure G.33 **Point source pressures - Dangerous Substances Directive compliance (rivers)**

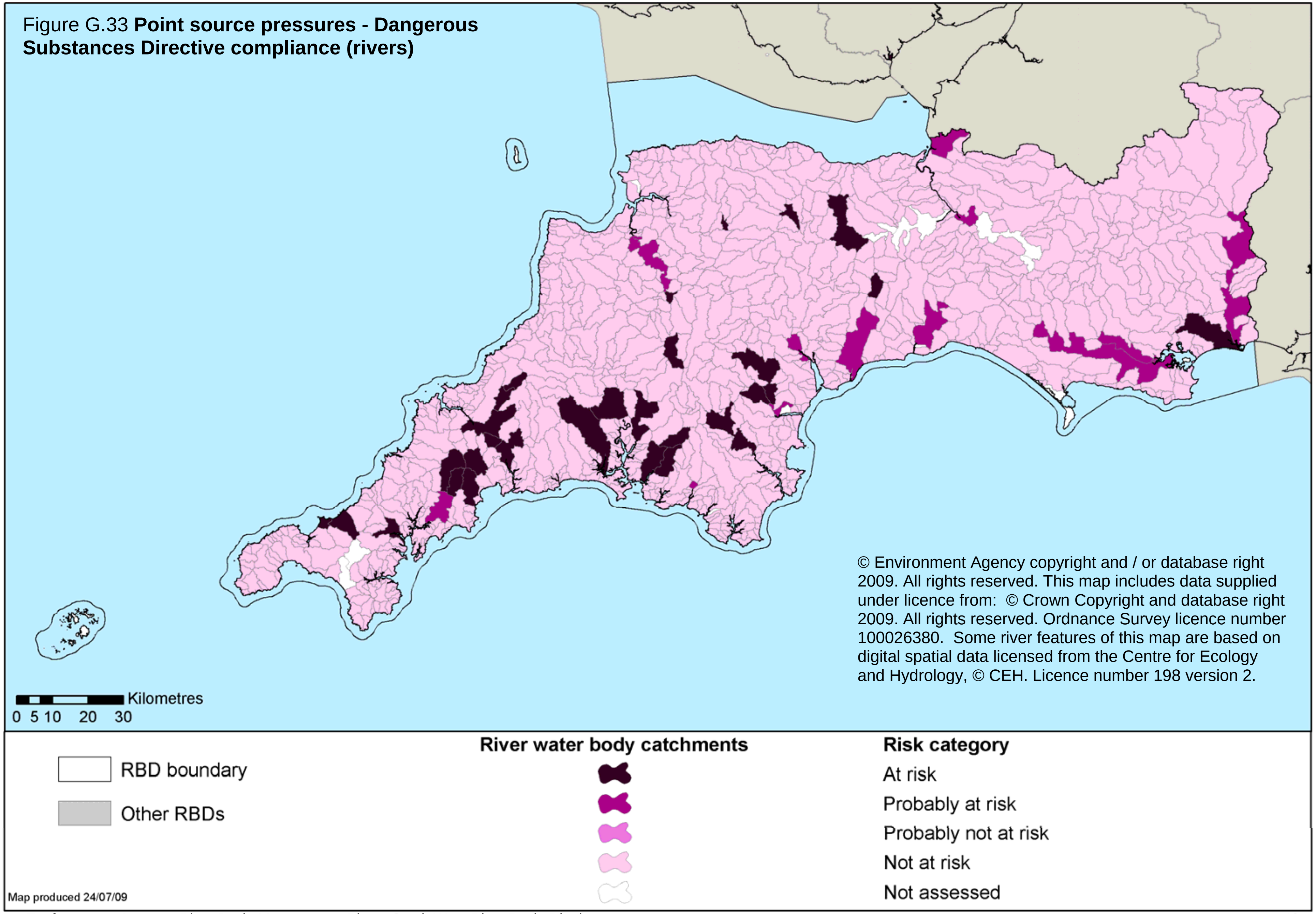


Figure G.34 **Point source pressures - Dangerous Substances Directive compliance (estuaries and coastal waters)**

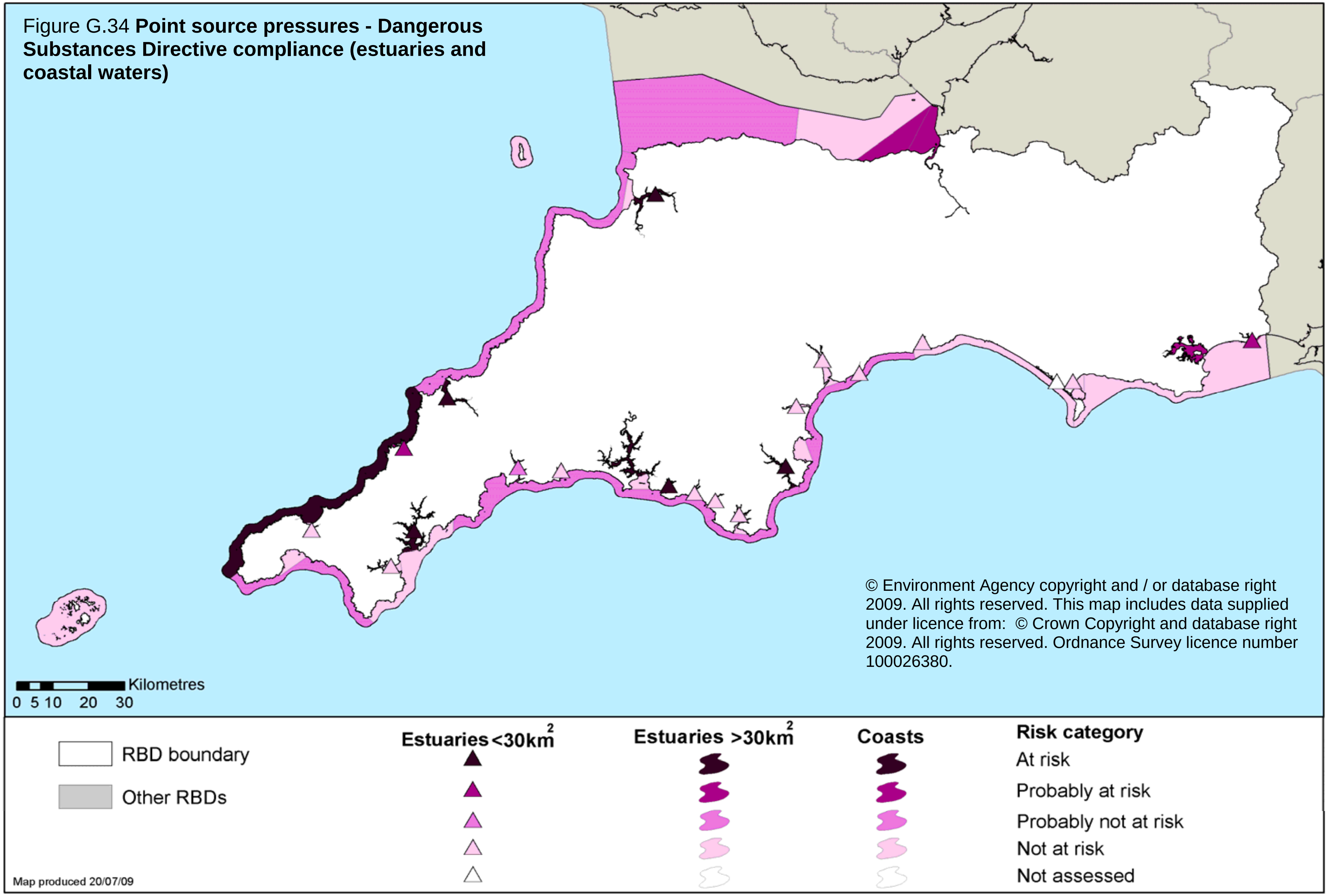


Figure G.35 **Diffuse source pressures - Pesticides (tributyl tin) (estuaries and coastal waters)**

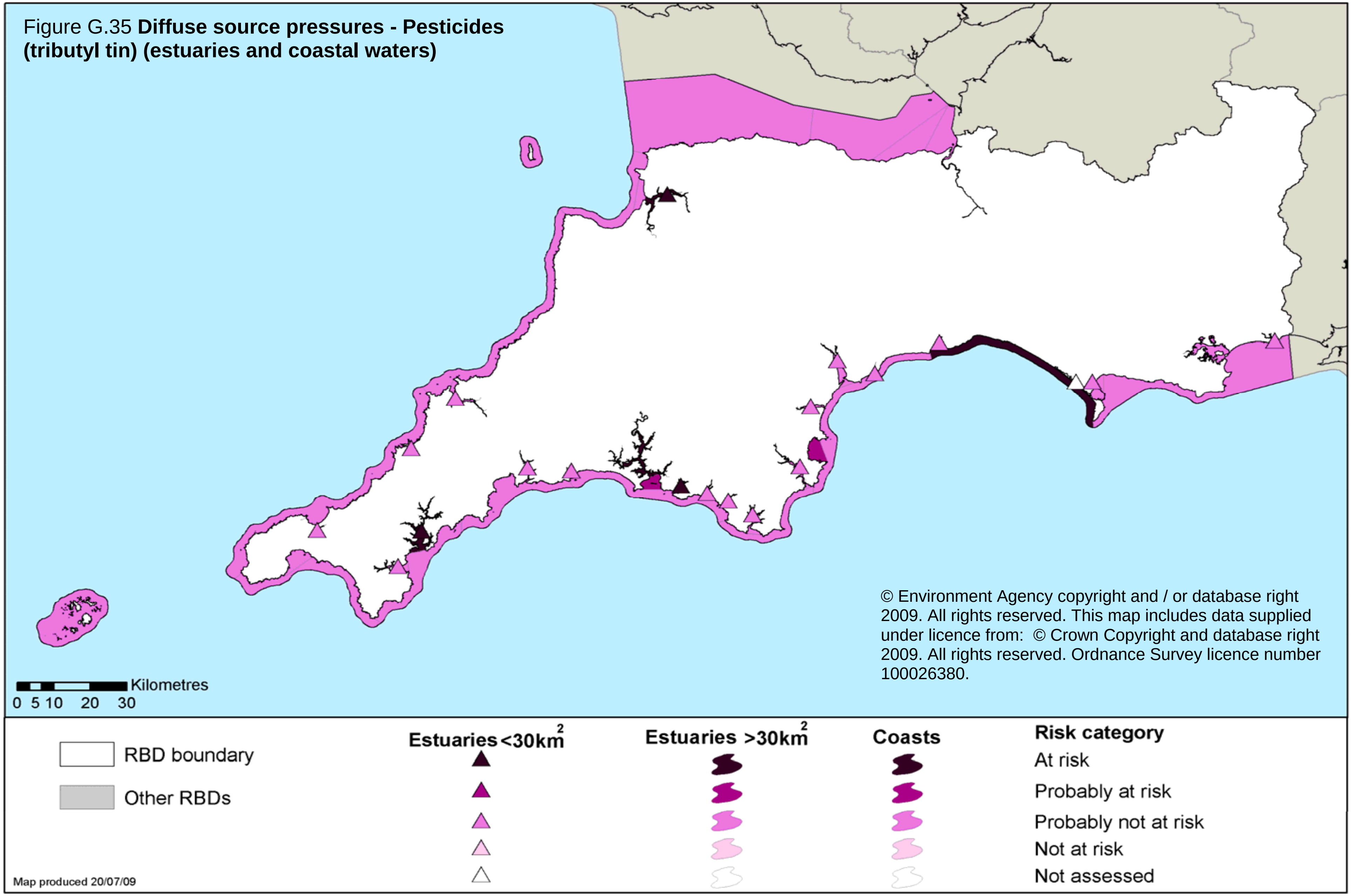


Figure G.36 **Combined source pressures - Biochemical oxygen demand (rivers)**

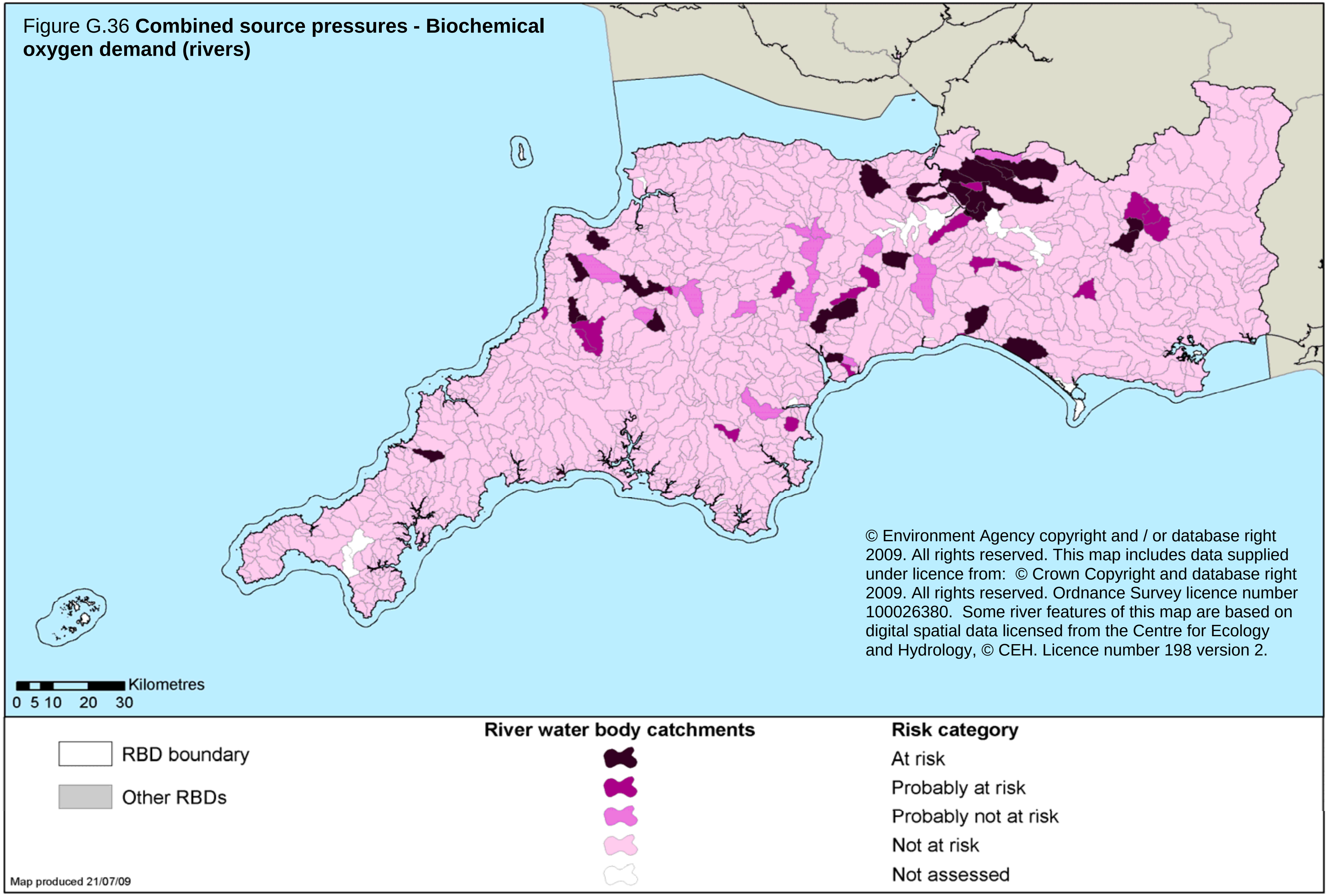
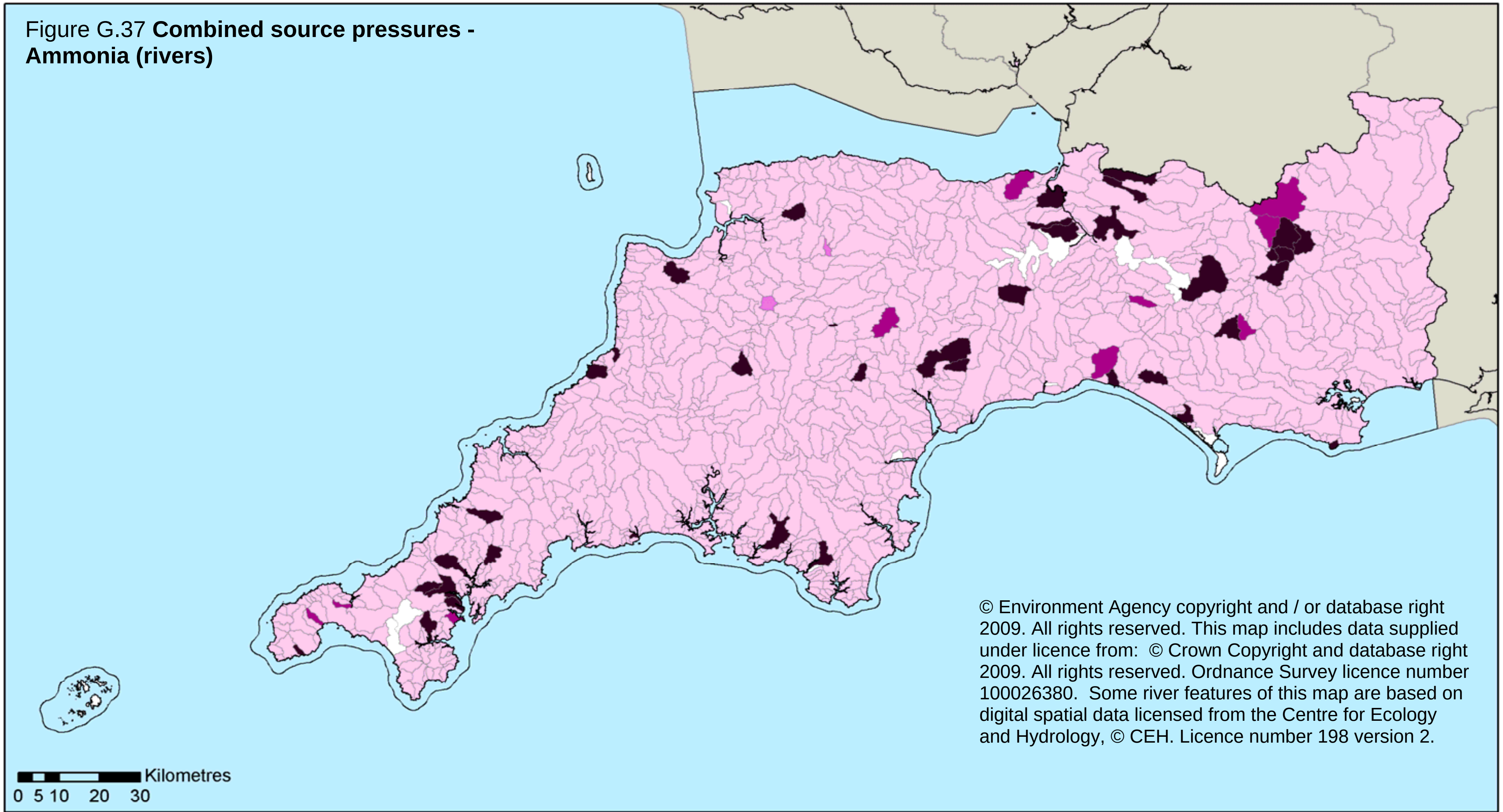


Figure G.37 **Combined source pressures - Ammonia (rivers)**



RBD boundary

Other RBDs

River water body catchments

Risk category

At risk

Probably at risk

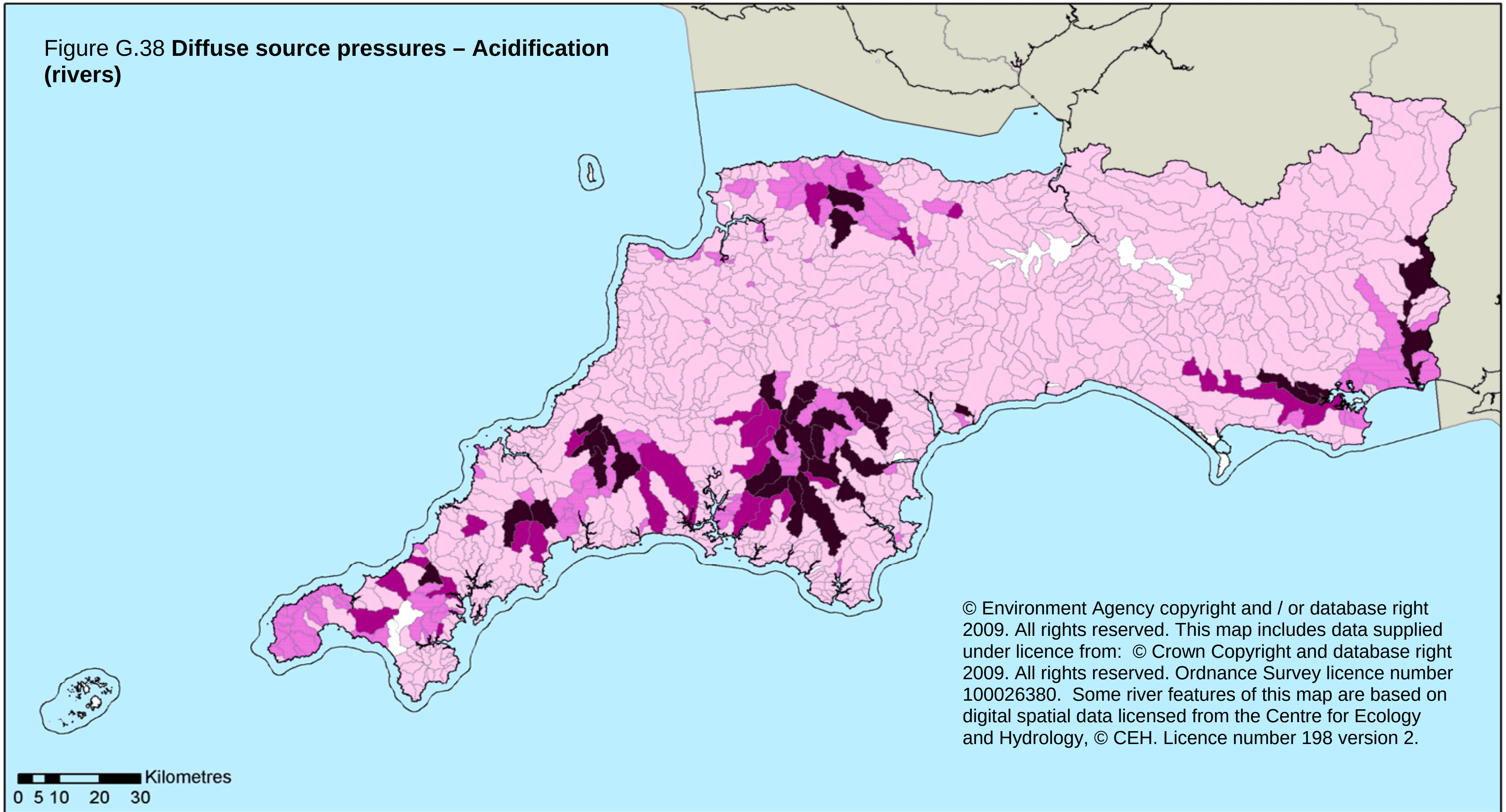
Probably not at risk

Not at risk

Not assessed

Map produced 21/07/09

Figure G.38 **Diffuse source pressures – Acidification (rivers)**



RBD boundary

Other RBDs

River water body catchments | **Risk category**

At risk

Probably at risk

Probably not at risk

Not at risk

Not assessed

Map produced 22/07/09