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Medway Catchment Abstraction Management Strategy

Final Strategy
April 2005

ENVIRONMENT AGENCY

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Our work includes tackling flooding and pollution incidents, reducing industry's impacts on the environment, cleaning up rivers, coastal waters and contaminated land, and improving wildlife habitats.

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2004 Maidstone River Festival

"Don't throw away the old bucket until you know whether the new one holds water" (Swedish proverb)

Foreword

The River Medway is a river for people. Over time it has influenced the position of our towns, the type of industry present and transport links. Nowadays it provides recreation through navigation, fisheries and river walks; its flood plains give us green spaces and some of its winter flows are stored in reservoirs to give water for our everyday needs.

With all these demands being made upon it, it is imperative that we manage our water sustainably. We need to put a higher value on this natural resource, especially as we have to cope with ever increasing needs for water being created by the proposed housing development, changes to our industrial activity and climatic change.

This strategy sets out how we believe water abstraction should be managed in this area for the next six years. It provides guidance for both existing abstraction licence holders and new applicants. As this is the first Medway CAMS, we have identified actions to enable us to improve our understanding of the area before the strategy is reviewed during 2009-2011.

The success of this strategy depends on the commitment and involvement of all those who have an interest in the way our water resources are managed. I encourage you to participate in the implementation of this strategy so our vision for CAMS – a shared strategy for the sustainable management of water resources – can be realised.

Binny Buckley

Dr Binny Buckley, Kent Area Manager

Contents

Introduction

The aim of this document is two fold:

- To present the abstraction licensing strategy for the Medway catchment for the next six years
- To outline the actions that the Environment Agency will complete during the next six years.

CAMS is a national initiative

Catchment Abstraction Management Strategies (CAMS) set out how water resources are managed at a local level and are being written for river catchments across England and Wales. This process is the first time that information on water allocation and abstraction licensing practice has been made publicly available and we have formulated our licensing strategy through consultation with local community and interested parties.

Everyone who abstracts over 20m³/day of water has to apply to the Environment Agency for a licence. The CAMS process calculates how much water is available for abstraction against the environmental need for water. It then reviews whether the existing licensing strategy is still appropriate.

The CAMS production deadlines also link in with time limits now placed on all new and varied abstraction licences. Therefore the outcomes of the Medway CAMS could affect you.

The Medway CAMS is the third of five CAMS to be produced in the Kent Area of the Environment Agency. CAMS operate on a six-year cycle and the document will be reviewed in 2009 and the updated strategy will be published during 2009 to 2011.

Accompanying documents

This document should be read in conjunction with *Managing Water Abstraction*, the Medway CAMS Technical Document CD-ROM and the Regional Water Resources Strategy.

Managing Water Abstraction is the national document that supports the development of CAMS. It sets out the national policy and the regulatory framework within which CAMS operate, describes the process of developing CAMS and provides information on the structure and content of CAMS documents. This is available on the Internet at www.environment-agency.gov.uk and from either the Area or Regional offices.

A technical document for the Medway CAMS is available; this provides the detailed technical information on which the development of this strategy has been based.

In March 2001, the Agency published the Southern Region Water Resources Strategy entitled: *Water resources for the future – a strategy for Southern Region.* This strategy states how the Agency is going to meet the demands for water whilst protecting the environment over the next 25 years. The Medway CAMS incorporates the principles and polices of the Regional Strategy, but it also provides a detailed approach to sustainable management of resources at a management unit level.

If you wish to receive a copy of any of these documents please contact:
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Consultation on the Medway CAMS

Consultation is an integral part of the CAMS process; it makes the process as open as possible and gives everyone the opportunity to get involved. For us to manage water resources in a catchment effectively and sustainably, we need as much information as possible on water needs and uses. Comments and suggestions have been gathered during all stages of the development of this strategy. Consultation activities include:

- The wide circulation of an awareness-raising leaflet
- Discussions with the Medway CAMS stakeholder group
- Presentations to the Kent Area Environment Group
- Discussions with the Environment Agency's multi-disciplinary Medway CAMS project team
- The Medway CAMS Launch on 14 October 2004
- The three month formal consultation from September to December 2004

Medway CAMS Stakeholder group

The Medway CAMS stakeholder group assisted in the production of the Medway CAMS. The role of this group was to represent key interests in the catchment and to identify local issues, provide views on proposals and to consider the likely implications of different options. The members of the CAMS stakeholder group and the interests they represent were:

Dick Hodges	Chairman
Richard Moyse	Conservation (Kent Wildlife Trust)
Pauline Harvey	Conservation (English Nature)
Brian Thompson/Richard Pierce	Agriculture (NFU)
Bob Harvey	Navigation (Medway River Users Association)
Alan Turner	Strategic Planning (Kent CC)
Mark Potter/Andrew Ball	Public Water Supply (Southern Water)
Trevor Bishop (Mid Kent Water)	Public Water Supply
Paul Holmes	Public Water Supply (South East Water)
Lester Sonden	Public Water Supply (Sutton & East Surrey Water)
Roger Kiddie	Fisheries (Kent Fisheries Consultative Association)
Lynne Overett	Industry (Lafarge Cement)
Donald Charlesworth	Industry (Aylesford Newsprint)

The Medway CAMS Stakeholder Group was invaluable at all stages of the CAMS development. Copies of the meeting minutes are available on the Technical Document CD-ROM.

The CAMS area

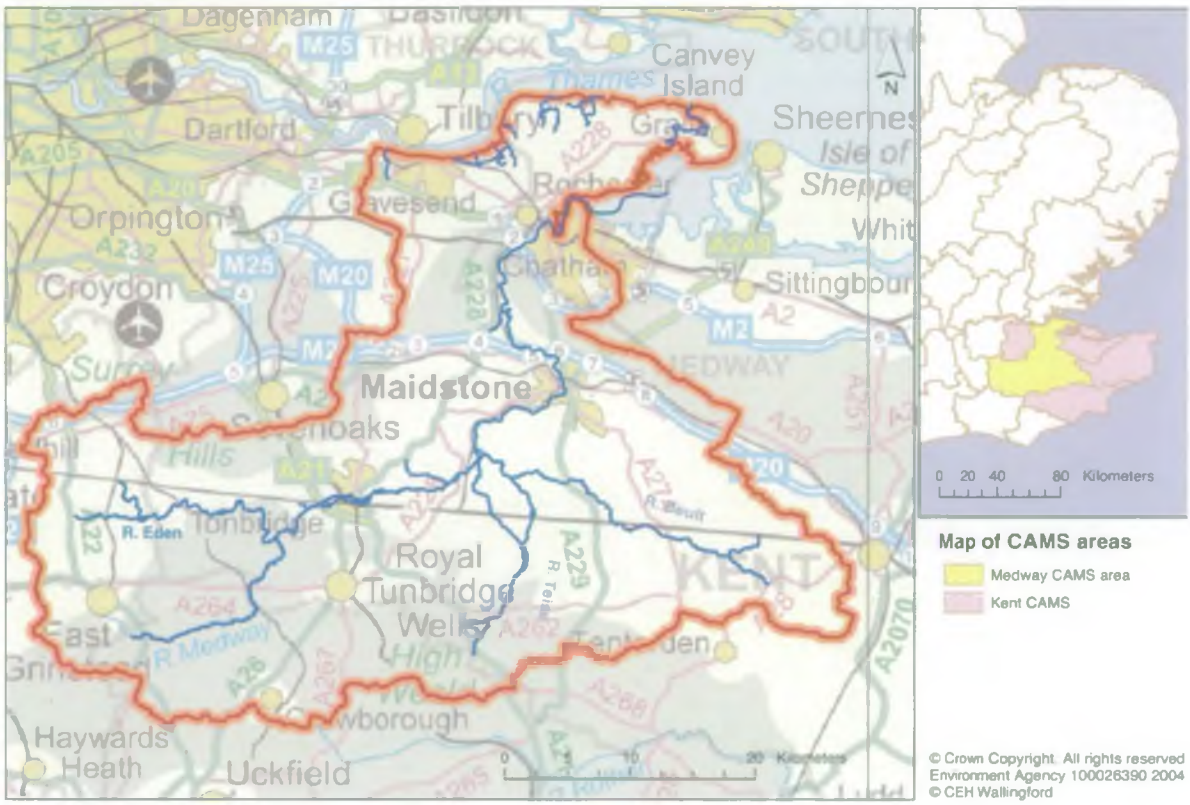


Figure 1 | Location of the Medway CAMS area

3.1. Landscape

The River Medway and the tributaries that drain this varied landscape have influenced the economy and heritage of Kent. The river provided medieval transport routes and is still navigable today downstream from Tonbridge. Crossing points at Rochester and Maidstone developed and in turn influenced the industrial composition of the catchment. Concentrations of water dominated industrial processes, including paper making, have over time located here. Special waters from springs gave rise to the spa town of Tunbridge Wells. This river is also part of our heritage and culture providing the legendary divide between 'Kentish man' (born to the west of the river) and 'man of Kent' (born to the east of the river). The principal factor affecting the development of the River Medway and its tributaries is geology.

Rocks and rivers

The River Medway flows northwards from the springs of the High Weald and crosses a clay belt (Low Weald) before it cuts through the Greensand ridge beyond Yalding. It then flows north crossing another clay vale (Vale of Homesdale) before carving a route through the Chalk downs.

Figure 2 shows how these different bands of rock create a trellis pattern of tributary rivers to the River Medway with differing geology determining the unique characteristics of each river. The main tributaries of the Medway are the Beult, Bourne, Teise and Eden. The River Beult flows over the Weald Clay, which is impermeable. Infiltration is therefore poor and run-off high creating a flashy river prone to flooding at times of high rainfall and yet vulnerable to low flows after prolonged dry periods. The upper River Medway, River Teise and River Eden all receive springflow from water stored within the Hastings Beds aquifer whilst the River Bourne receives springflow from the Lower Greensand aquifer. This baseflow ensures a flow of water throughout the year.

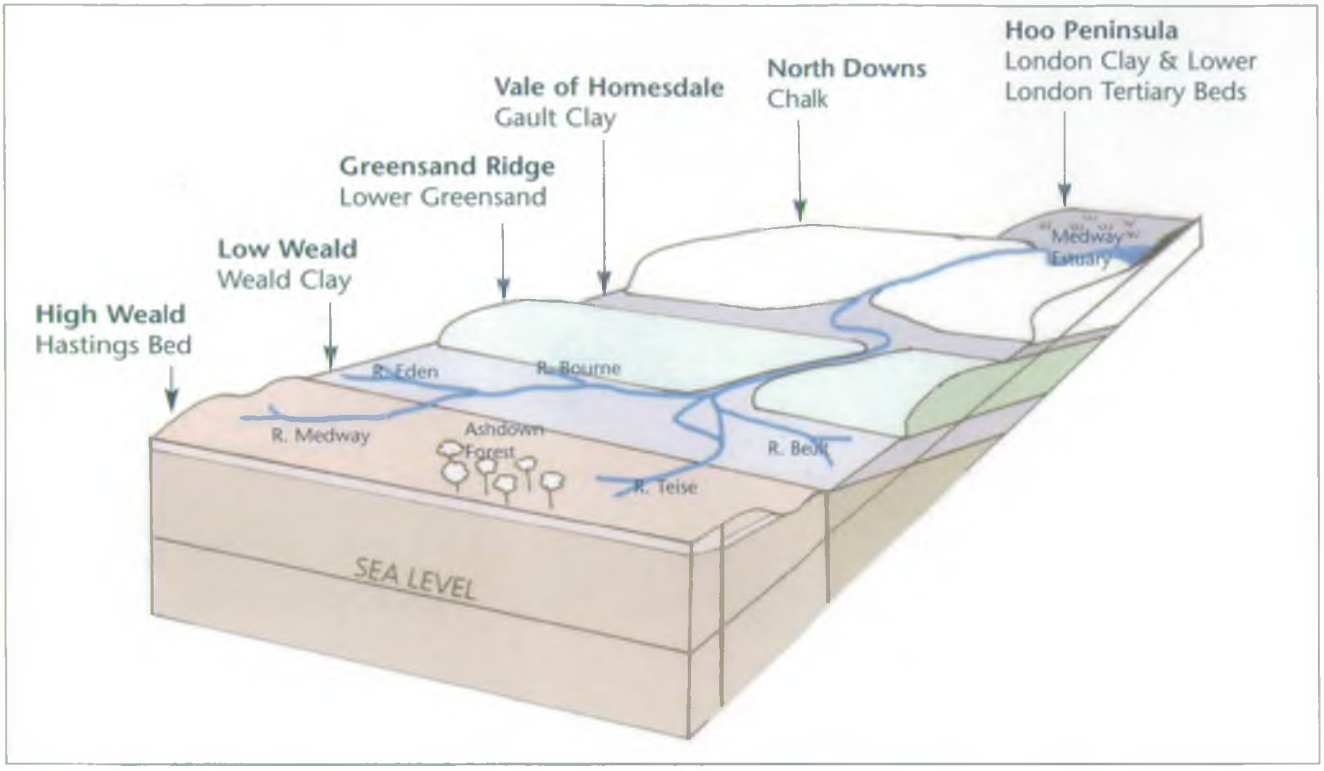


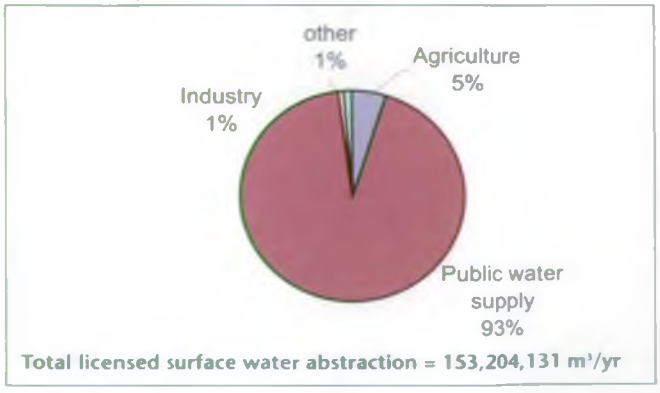
Figure 2 | Geological cross-section of the Medway catchment

3.2. Water for people

Water abstraction

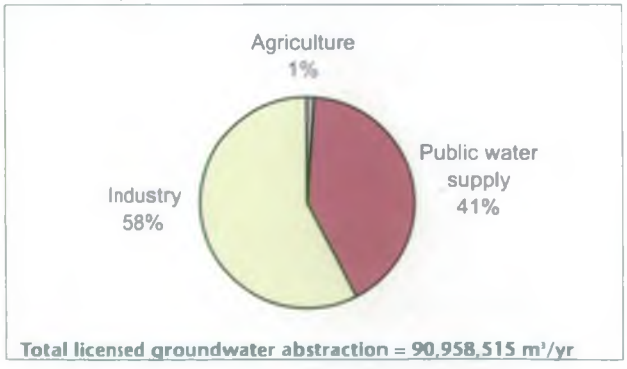
Figure 3a shows that 93% of the water abstracted from (non-tidal) rivers in this catchment is for public water supply (PWS). This high volume is primarily used to fill the three reservoirs within this CAMS area. Bough Beech and Bewl Water reservoirs are pumped storage schemes, whereby water is pumped from a downstream point into the reservoir located in the upper parts of the catchment. Weir Wood reservoir is on-line, capturing excess runoff from the upper Medway catchment. Surface water abstraction is already highly regulated, with 88% of the licensed volume of surface water abstraction tied to a hands-off flow (HOF) condition. More information on our current licensing policies and measures to restrict abstraction is given in Chapter 5 'Licensing strategy'.

Figure 3a | Surface water abstraction



Groundwater abstraction is primarily from the two major aquifers in the catchment, the Chalk and Lower Greensand. Abstraction from the Hastings Beds is usually of low quantities limited by difficult drilling conditions and high iron content of the water. The largest users of groundwater are industrial proceses (chemical and pharmaceutical manufacturing, cement works and paper making) accounting for over 50% of total abstraction. These industries are concentrated along the Medway Estuary, north of Maidstone and in the Northfleet area.

Figure 3b | Groundwater abstraction



Agricultural abstraction makes up less than 5% of total abstraction. This helps to sustain the 'Garden of England' through intensive fruit growing. This abstraction distribution is varied depending upon soil type and river flow. However, in some parts of the Medway CAMS area it can be the prime reason for abstracting water. For example, almost all the water abstracted from the River Beult is used for agriculture. In these areas farmers have overcome summer water shortages through the use of winter storage reservoirs.

The Medway Scheme is the most important strategic public water abstraction within this catchment. It is owned and operated jointly by Southern Water Services and Mid Kent Water since its installation in 1977 and serves the Medway towns and west Kent. At the heart of this scheme is Bewl Water reservoir, where water abstracted from the River Medway at Yalding and the River Teise at Smallbridge is pumped and stored. Water is then released back into the River Medway to support abstraction from Springfield pumping station (near Maidstone). These releases take account of travel times and compensation requirements. Water from Bewl Water reservoir can also be pumped southwards to support increasing water demand on the south coast.

Dilution of effluent

The Agency consent and regulate 71 Waste Water Treatment Works (WWTW) in the Medway catchment area. Figure 4 shows biological water quality, a good indicator of the condition of the aquatic environment. In the Medway CAMS area biological quality is generally satisfactory, but ranges from very good to poor. Low classifications are usually due to the impact of sewage effluents on small streams, which have low flows and dilute irregularly. In addition, diffuse pollutants from runoff or consented discharges from urban areas can be washed into rivers or leached into groundwater with potential impacts on fish and wildlife.

The decreased water quality of the River Beult is noteworthy and is partly a result of an increase in effluent discharge from WWTW and increased runoff (diffuse pollution) from agriculture. The slow flowing, sluggish nature of the River Beult limits reoxygenation, exacerbating this problem.

Water quality varies throughout the Estuary. 80% of the Estuary is identified by the National Water Classification water quality scheme as 'fair to good' quality. This is primarily caused by dissolved oxygen and to a lesser extent ammonia. When the temperature of water increases, for instance from discharges, this reduces the solubility of gases in water and increases the metabolic rate of fish and other aquatic species. There is, therefore, less oxygen available leading to a greater oxygen demand. The water quality of the Estuary has improved considerably over the last 15 years, as industries and the Agency have worked together to improve the quality of discharges into the Estuary.

From a CAMS viewpoint, it is important to maintain freshwater flow over Allington weir, the tidal limit of the River Medway, for dilution, reoxygenation and the discharge of pollutants to sea. Although estuarine water quality has been investigated, no Minimum Acceptable Flow (or hands-off flow) for Allington has been set.

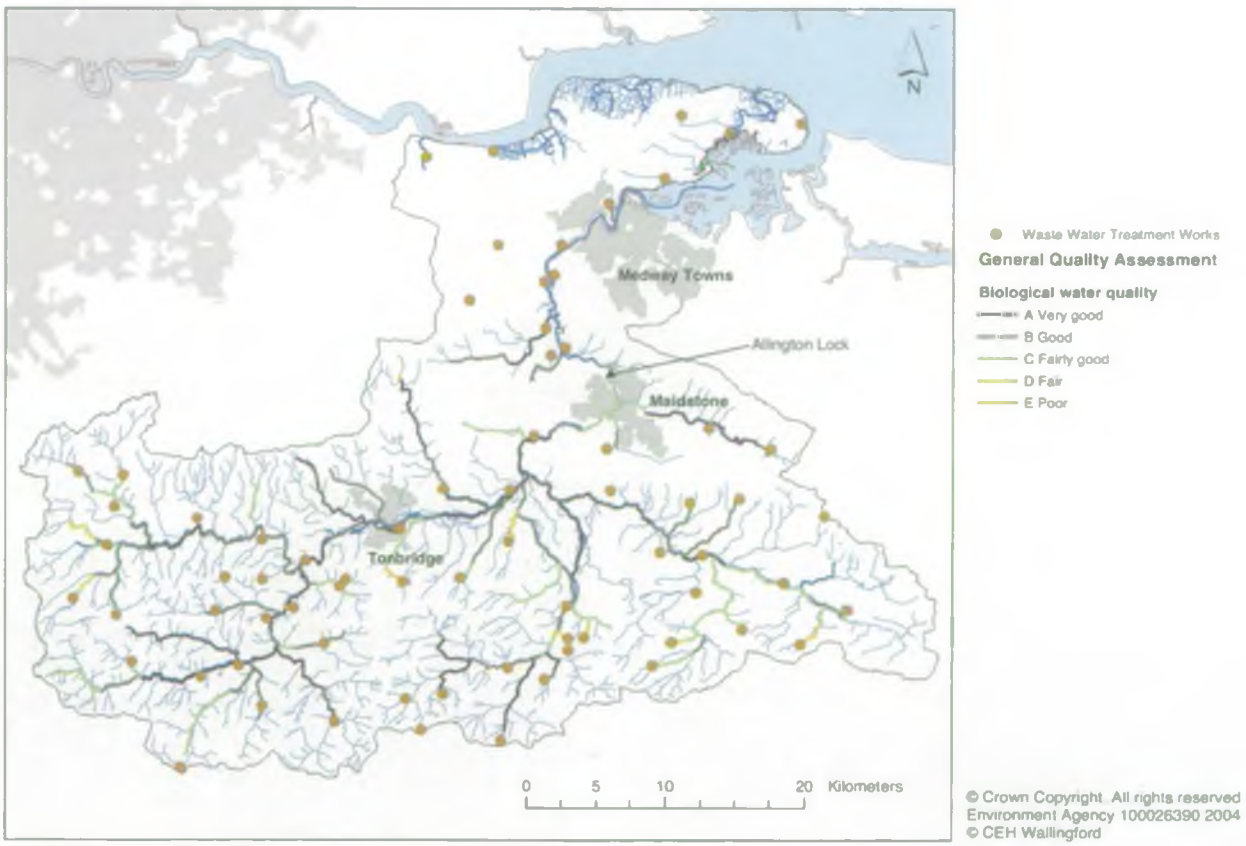


Figure 4 | Water quality and discharges

Protection of groundwater

The protection of groundwater is vital to ensure these sources do not become contaminated. The vulnerability of groundwater is prioritised by the Agency in terms of Source Protection Zones (SPZs). These zones provide an indication of the risk to groundwater supplies that may result from potentially polluting activities or the accidental release of pollutants. These zones are based on the travel times of pollutants and the furthest extent that the source draws water from. SPZ I indicates those areas most vulnerable to pollution, whilst SPZ III indicates those areas of least vulnerability.

The Medway catchment is one of high agricultural productivity and pesticides and herbicides originating from intensive farming methods have affected river water quality. Nitrate Vulnerable Zones (NVZs) have been identified in parts of the Chalk, Lower Greensand and Hastings Beds aquifers. These are designated to protect the groundwater from pollution arising from agricultural sources.

The Agency has no evidence that groundwater quality currently limits abstraction in this CAMS area.

Water for navigation and recreation

The River Medway has been used by craft from time immemorial, and as early as the 16th Century attempts were made to make the river navigable upstream of Maidstone. Today the principal usage of the river is for recreation and the ten locks between Allington and Tonbridge ensure water levels are maintained throughout the year.

The Medway Navigation extends 31km (19 miles) upstream of the tidal limit at Allington. The Agency is responsible for maintaining this navigation, but does not guarantee that the whole of the navigation will be useable for a full year.

Teston Lock on the river Medway navigation

3.3. Water for nature

Protected habitats and species

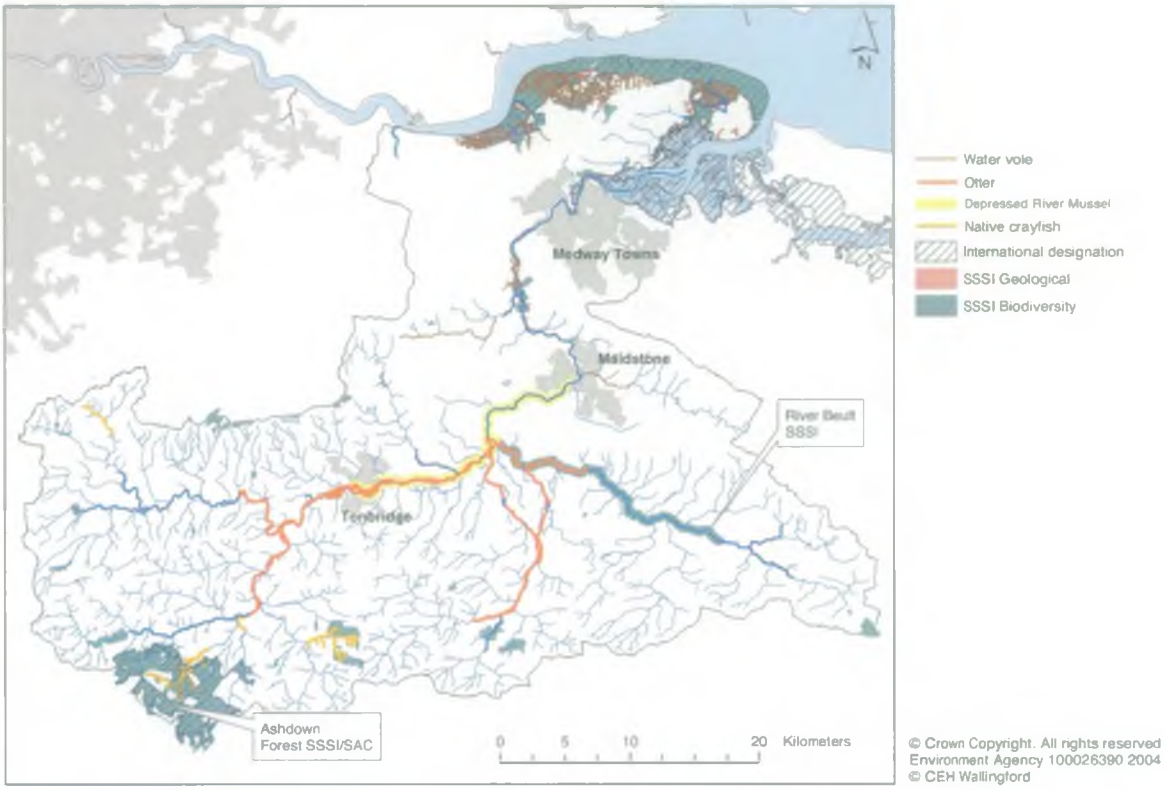


Figure 5 | Water related conservation designations

The principal area of international conservation importance is the Ashdown Forest designated as a SSSI, SPA and SAC. The Ashdown Forest is one of the longest single continuous blocks of valley bog in south-east England. It is therefore important to ensure that there is sufficient spring flow from the underlying Hastings Beds to maintain the ecological value of this site.

The Thames Estuary and Marshes and the Medway Estuary and Marshes, within the Medway CAMS area, are designated as SSSI, SPA and Ramsar sites. The complex mosaic of habitats and species found within these designations are influenced by freshwater flows and may be vulnerable to groundwater abstraction.

The River Beult is the only riverine SSSI in Kent. It was notified as a SSSI in 1994 because it is regarded as an outstanding example of a clay river, outside Central England (the normal distribution for this river type), that has retained characteristic flora and fauna and a relatively natural course. Flow is maintained during dry periods by weirs and pen boards, which result in some stretches of slow flow. The citation extends from Smarden to the Medway confluence, a total length of almost 25km. The Beult is deemed to be in 'unfavourable condition' because of failure to meet phosphorous targets and chemical and biological quality concerns. Under AMP3 (Asset Management Plan) phosphate stripping of the main sewage discharges is scheduled by 2005.

Other water dependent SSSIs within the CAMS area are sensitive to changes in water levels and flows as stated on the SSSI list of Potentially Damaging Operations.

The Medway catchment supports some aquatic priority habitats and species for conservation listed under the UK Biodiversity Action Plan (BAP), many of which are afforded protection under the Wildlife & Countryside Act 1981 (as amended) and the Conservation (Natural Habitats, & c.) Regulations 1994. These habitats and species are potentially vulnerable to changes in water level and river flows associated with abstraction.

Table 1 lists each of the main water related habitats and species present in this catchment. This list is not exhaustive, as there are a number of other species, which are dependent upon a healthy wetland system, such as kingfishers, reed warblers, dragonflies and damsonflies.

Table 1 | Aquatic requirements of habitats and species present in this CAMS area

Habitat / Species	Status			Aquatic requirements
	BAP	W & C Act 1981	Hab. Regs. 1994	
Grazing Marsh	✓			• Sensitive to lowered river flows, water levels and lowered water levels in wetlands. • Sensitive to reductions in water quality associated with eutrophication and reduced flows. • Changes to seasonal hydrological regime (for example through winter flooding) are likely to reduce the ecological value of this habitat type.
Reedbed	✓			• Sensitive to reductions in groundwater level and reductions in water level as a result of management and river flows. • Changes to seasonal hydrological regime (for example through winter flooding) are likely to reduce the ecological value of this habitat type.
Wet Woodland	✓			• Sensitive to reductions in groundwater level, water level within wetlands and river flow. • Changes to seasonal hydrological regime (for example through winter flooding) are likely to reduce the ecological value of this habitat type.
Saline Lagoons	✓			• The salinity regime of this habitat type is often determined by freshwater inputs from groundwater and surface water sources. Therefore sensitive to reductions in groundwater level and river flows.
Lowland Heathland	✓			• Sensitive to a reduction in groundwater levels, river flows and poor water quality.
Otter	✓	✓	✓	• Require healthy functioning wetland ecosystems and good prey availability (for example recruiting fish populations). Therefore indirectly sensitive to reductions in water level and water quality which may affect habitat quality and prey availability.
Water Vole	✓	✓		• Sensitive to water level changes, however can live in channels with low flow provided sufficient water depth is maintained.
White Clawed Crayfish	✓	✓	✓	• Sensitive to water level changes and low flows as a consequence of increased siltation and a reduction in the wetted area of the channel. • A change from perennial to ephemeral flows will adversely affect native crayfish. • Require good water quality.
Depressed River Mussel	✓			• Sensitive to drought as a consequence of siltation and smothering and a reduction in the wetted area of the channel. • A reduction in water quality will adversely affect populations on the River Medway.

W & C 1981 = Wildlife & Countryside Act 1981
Hab. Regs. 1994 = Habitat Regulations. European Directive on the conservation of natural habitats and wild flora and fauna.

Resource assessment and resource availability status

4.1. Introduction

This chapter summarises the resource assessment methodology (RAM) used to assess the sustainability of abstraction in the CAMS area and outlines results obtained. For more detailed information please refer to the Medway Technical Document CD-ROM.

To manage water resources effectively, we need to understand how much water is available and where it is located. This is achieved by undertaking an integrated resource assessment, covering both surface water and groundwater.

Water is used for many purposes, the principal categories being public water supply, industrial use, and agriculture. For each different use, the amount of water that is returned to the water environment close to where it is abstracted may vary considerably. When an abstraction causes a loss of water to the catchment, the Agency considers the abstraction to be consumptive as it may restrict the availability of water to other users. Likewise, if there is no or little loss to the system the abstraction is considered to be non-consumptive.

Nationally, a classification system has been developed to provide information on the availability of water resources within a catchment. This "**resource availability status**" indicates the relative balance between committed and available resources in a particular area. It will highlight where abstraction needs to be reduced and show where additional abstraction may be possible. It should be noted that this resource availability status is indicative only and does not replace the licence determination process that is applied to all licence applications. More information on the determination process is given in Annex 2 of 'Managing Water Abstraction'.

Table 3 shows the categories of resource availability status, each with an assigned colour.

Table 3 | Resource availability status categories.

Indicative resource availability status	Definition
Water available	Water likely to be available at all flows including low flows. Restrictions may apply.
No water available	No water available for further licensing at low flows although water may be available at higher flows with appropriate restrictions.
Over licensed	Current actual abstraction is resulting in no water available at low flows. If existing licences were used to their full allocation they would have the potential to cause unacceptable environmental impact at low flows. Water may be available at high flows with appropriate restrictions.
Over abstracted	Existing abstraction is causing unacceptable environmental impact at low flows. Water may still be available at high flows with appropriate restrictions.

Fisheries

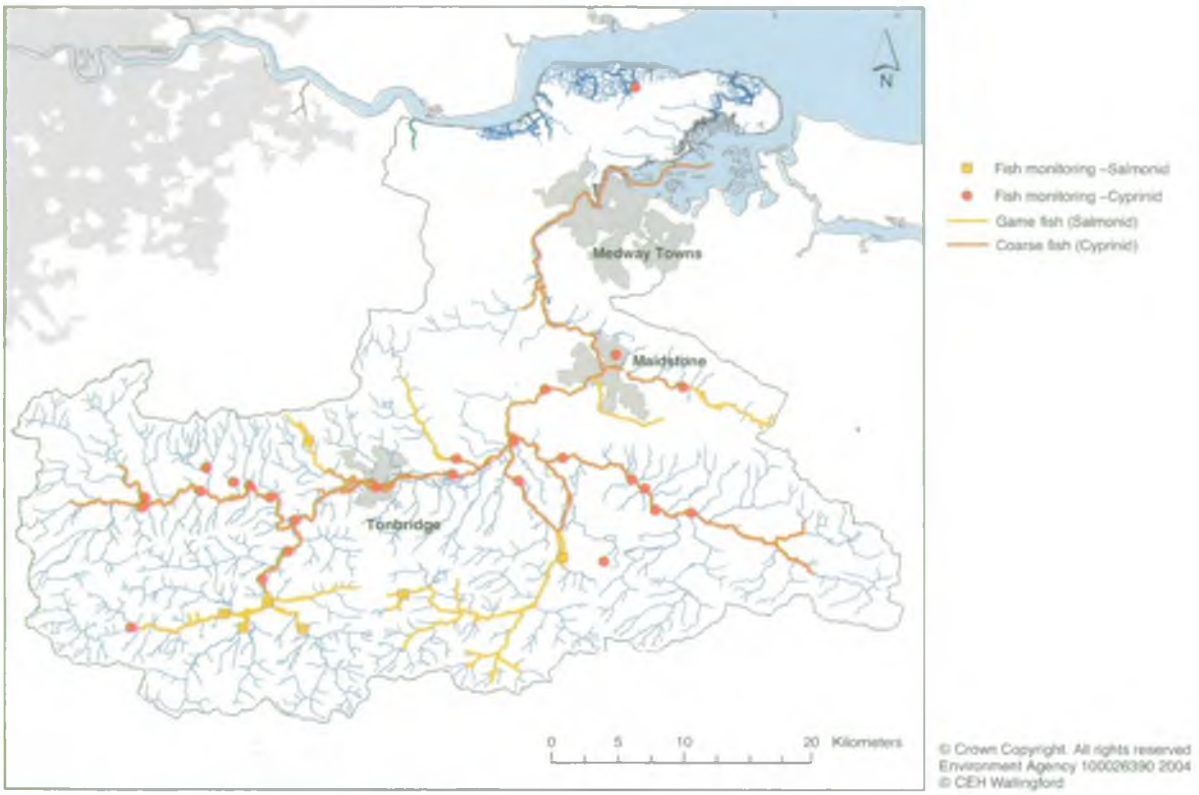


Figure 6 | Fisheries monitoring network

Fish communities are predominately mixed coarse, characteristic of slow flowing, lowland rivers with a general abundance of roach, chub, bream, bleak, perch, and pike. There are over 20 coarse fish species found, including tench, specimen barbel and carp.

Brown Trout are the main game fish found in the rivers of the Medway catchment. They are found in the upper reaches of the Rivers Medway, Len, Teise, Bourne and Eridge Stream, Loose Stream and other High and Low Weald streams. The occasional sea trout has been caught as far upstream as Hadlow and Tonbridge and the Teise, but generally the sluices restrict fish migration. As these sluices are replaced fish passes are installed. There is also a strong population of grayling on the upper Medway and the Teise is regularly stocked with rainbow trout.

The spatial diversity of coarse and game fisheries within the Medway is summarised in the diagram below; note how the species of fish relates to the physical nature of the river channel and river flow.

Table 2 | The basic links between fisheries and river habitat.

Location	Physical characteristics	Fish species	Tolerance
Upper catchment e.g. High Weald	Steeper gradients, fast flowing, lower temperature and higher oxygen content	Brown Trout	High environmental requirements and low tolerance to pollution and specific needs.
		Barbel zone	
Lower catchment e.g. Medway navigation	Lower gradients, slow flowing, higher temperature and lower oxygen content	Coarse fish	Lower environmental requirements and higher tolerance to pollution. Easier to please!

The Medway Estuary supports important commercial fisheries (including eel, plaice, sole, bass, mullet) and shell fisheries.

4.2. National Framework for Resource Assessment and Management (RAM)

The RAM framework is a standard methodology applied to all catchments within England and Wales. This consistent approach still retains a measure of flexibility so that it can be applied to a range of catchments.

Within any river catchment there are variations in ecology, hydrology and hydrogeology and so in order to measure, manage and regulate effectively, we need to break catchments down into smaller areas, recognising similarities in characteristics. In areas where groundwater resources are significant, **Groundwater Management Units** (GWMUs) are defined reflecting the separate aquifers in a catchment. For surface water, **Assessment Points** (APs) are located on the river network where a change in river characteristics are observed, usually at or close to a monitoring site. These river APs and GWMUs are the focus of our resource assessment and abstraction licensing.

The CAMS area has been broken down into the following river reaches and associated APs and GWMUs. These are illustrated in Figure 7.

Both the Chalk and the Lower Greensand aquifers have been split into a Western and Eastern section because it is assumed that the River Medway acts as a divide and little if any groundwater will flow from one to another.

Table 4 | Assessment points

AP number	River reach	Assessment point
1	upper River Medway	Chafford AP
2	River Eden	Penshurst AP
3	River Bourne	Hadlow AP
4	upper River Teise	Stonebridge AP
5	River Beult	Stilebridge AP
6	middle River Medway	Teston AP
7	River Len	Lenside AP
8	River Medway from Teston to the tidal limit	Allington AP

Table 5 | GWMUs

Western Chalk
Eastern Chalk
Western Lower Greensand
Eastern Lower Greensand
Hastings Beds

Further details on how the river reaches, APs and GWMUs were defined are provided in the Medway CAMS Technical Document CD-ROM.

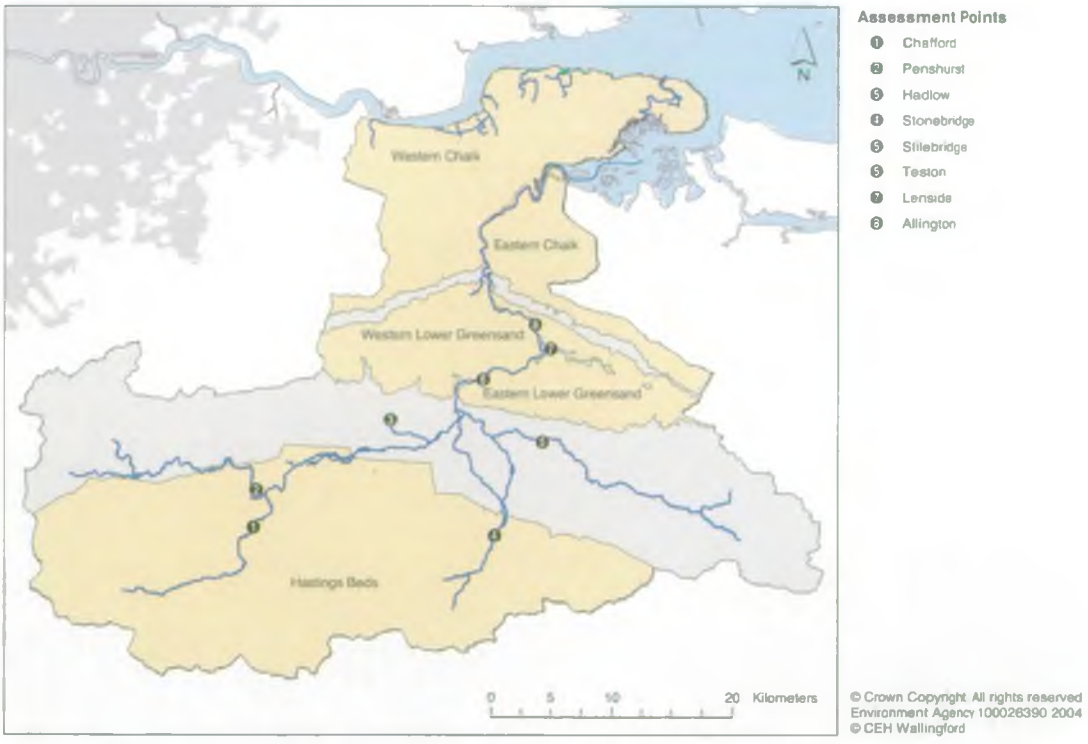


Figure 7 | River APs and GWMUs in the Medway CAMS area

4.3. Surface water assessment

This gauging station is at Stilebridge on the River Beult. In CAMS we use flow data to calculate benchmark flow

Method

To assess the surface water availability status three component parts are calculated:

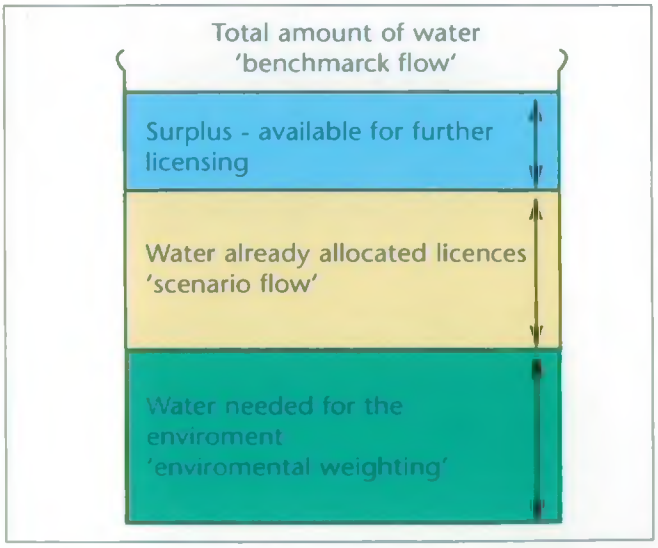
'Benchmark flow' - the total amount of water at an AP in natural conditions, that is, without abstractions and discharges. This is a reflection of the hydrological behaviour of the catchment.

'Environmental weighting' - the amount of water needed for the environment.

'Scenario flow' - the amount of water already allocated to licences and added through consented discharges.

Figure 8 shows a beaker of water illustrating the total amount of water in a river reach.

Figure 8 | The component parts of the surface water RAM



Environmental weighting

There are four components used to calculate the amount of water needed to the environment:

1. Physical characteristics
2. Fisheries
3. Macrophytes (river plants)
4. Macroinvertebrates (insect larvae)

Environmental need is based on the sensitivity of these components to variations in river flow, in other words, their vulnerability to abstraction impacts. For example, a spring fed stream with a good population of brown trout and associated flora and fauna is assigned a higher weighting than a highly managed, lowland river with a limited coarse fish population. This weighting represents the minimum flow that we are aiming to protect.

River reaches are banded according to their sensitivity to abstraction, either very high (VH), high (H), moderate (M), low (L) or very low (VL), VH being most sensitive to abstraction and VL being the least sensitive. Table 6 shows the environmental sensitivity of each river reach identified in the Medway CAMS area.

Table 6 | Environmental weighting results in the Medway CAMS area

Assessment point	Assessment point name	River	Environmental weighting score
1	Chafford	upper River Medway	high (H)
2	Penshurst	River Eden	high (H)
3	Hadlow	River Bourne	high (H)
4	Stonebridge	upper River Teise	high (H)
5	Stilebridge	River Beult	moderate (M)
6	Teston	River Medway	moderate (M)
7	Lenside	River Len	moderate (M)
8	Allington	River Medway	moderate (M)

Upper Medway downstream of Hartfield, in the High Weald area. River flow is measured at Chafford AP. This reach has a high environmental weighting score.

Surface water availability status

By combining the benchmark flow, scenario flow and the environmental need for water it is possible to identify if there is a surplus, balance or deficit of water. The size of this surplus/deficit determines the resource availability status of the unit considered. Figure 8 shows a sustainable unit where there is a surplus of water. The greater this surplus the more sustainable abstraction within that unit is. However, where a deficit of water is identified abstractions are thought to be unsustainable. If in balance abstractions from a unit are at a 'sustainable balance'.

Figure 9 shows surface water availability in the Medway CAMS area.

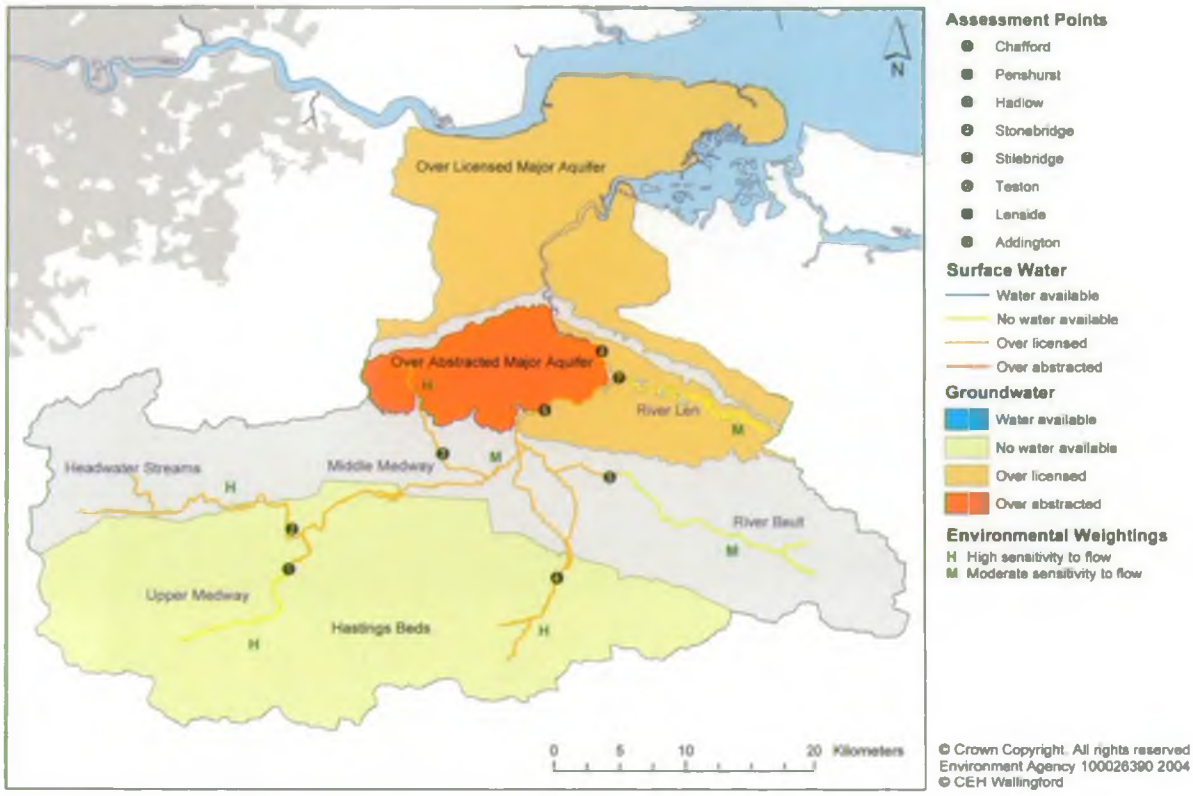


Figure 9 | Water resource availability for assessed river reaches and GWMUs

4.4. Groundwater assessment

Using the RAM framework, the resource availability of each GWMU is determined by applying up to five tests to each unit. These tests are:

- Test 1: Comparison of inputs (recharge and lateral groundwater flow) to outputs (abstraction).
- Test 2: Comparison of environmentally acceptable summer baseflow to actual summer baseflow.
- Test 3: Identification of trends in groundwater level or quality monitoring data.
- Test 4: Research, using historical maps or other evidence.
- Test 5: Optional local tests (in addition to other tests) as a further check on the groundwater resource balance.

For more information on each test please refer to the accompanying Technical Document CD-ROM.

4.5. Integrating surface and ground water assessments

Resource availability has to be treated in the context of the whole catchment area, whether it is linking groundwater with surface water or the status of upstream units to downstream units. Due to the nature of the geology of the Medway CAMS, the major aquifers and surface waters have little connectivity, therefore groundwater and surface water assessments have not been integrated. However, the assessments of the headwater streams of the River Bourne and River Len had to be adjusted to ensure downstream demands can be met. Figure 9 shows these integrated results.

4.6. Using these results to decide our licensing policy

After calculating the water availability within the catchment at low flows, we carried out a sustainability appraisal. This process assessed the advantages and disadvantages of various management options against the current baseline situation. This assessment can been viewed on the Technical Document CD-ROM. The outcomes of this appraisal coupled with the comments from the consultation and discussion with the Medway CAMS Stakeholder and Project groups allowed us to formulate the following licensing strategy and actions table.

Licensing strategy

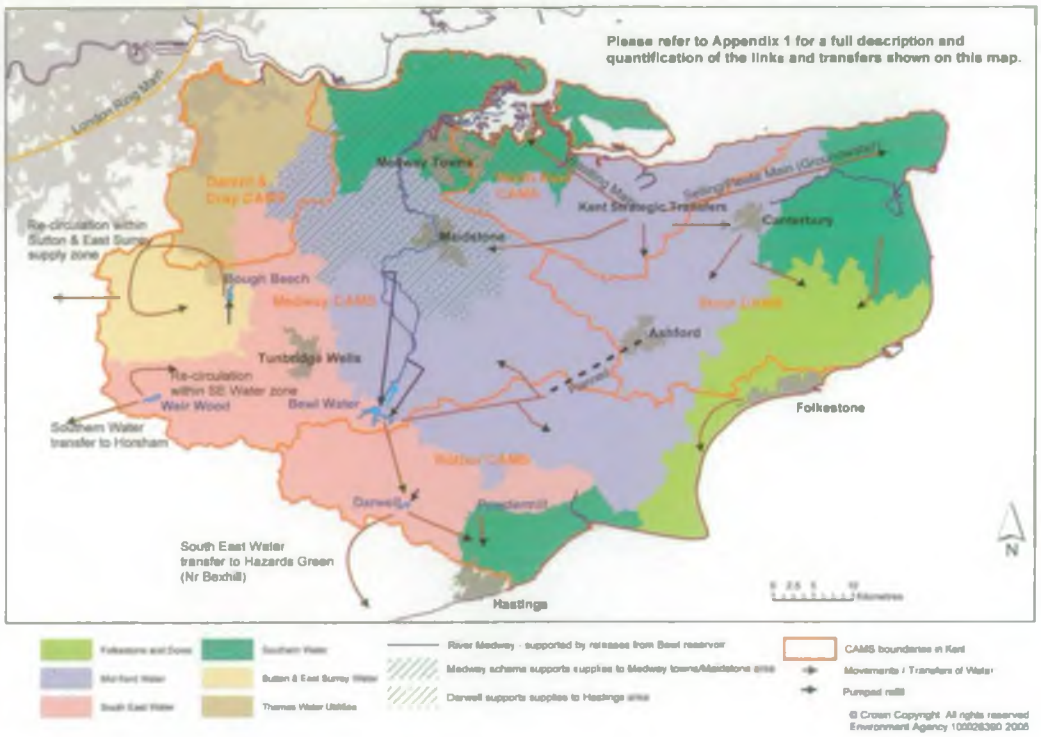


Figure 10 | Major transfers of water

5.1. Licensing strategy

It is important to consider the strategic nature of water resources in the Medway catchment relative to the growth in demand expected from the Thames Gateway, Medway Towns, Maidstone and Ashford. As well as supporting Darwell reservoir, the Medway Scheme supports transfers of groundwater resource to the east of the county (Thanet). Also, two further small reservoirs in the upper Medway (Bough Beech and Weir Wood) support supplies in East Surrey, North East Sussex and North West Sussex.

Figure 10 shows these strategic links and the shared resources between water companies. These links are described and quantified in more detail in Appendix 1, however the overall impact on the River Medway is a net benefit at low flows.

In the future, given the high demand and limited supply of water in the South East, it is likely that more resources will need to be found whether from additional transfers or enhancing/building new water supply reservoirs. For example, water companies currently foresee that Bewl reservoir should be enlarged by 2014/15 to meet anticipated demand.

5.2. Catchment wide policies

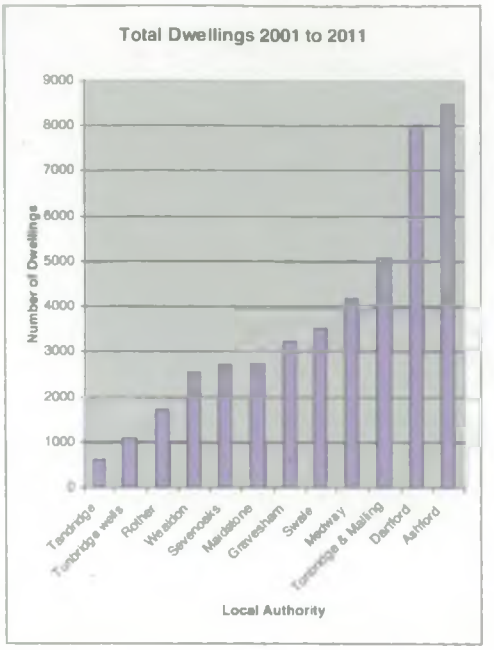
The following policies will apply across the whole Medway CAMS area.

a) Promoting water efficiency

We have a duty to ensure the proper use of water resources. In this area, water resources are stressed and rates of water abstraction are currently unsustainable, so making best use of this scare resource is imperative.

We expect an ongoing, proactive approach to the efficient use of water throughout the Medway CAMS area, particularly in any new housing development. Figure 11 shows that the Thames Gateway to the north and Ashford to the east, both identified as large growth areas, are located in this catchment.

The Kent Structure Plan identifies housing growth across the county to be of the order of 6,000 units per annum over the next 20 years, amounting to 120,000 new homes. Assuming average occupancy rates and with average water consumption estimated within Southern Region at 159 litres/person/day



The graph above shows the number of dwellings planned for the period 2001 to 2011.

Figure 11 | Future development

(OFWAT) this is a substantial amount of water and will need to be found from somewhere.

Around 8 21% per capita water consumption may be saved in new houses and up to 80% water savings can be made from businesses, which will all help to reduce the impact of any new developments on our natural resources and aquatic environment. We will review industrial water needs through Pollution Prevention and Control permitting system where appropriate.

In determining all abstraction licence applications we will assess whether the applicant is making best use of available water resources eg. Employing leakage control measures; demand management or re-cycling grey water.

For more information on how you can save water, please refer to Appendix 2.

b) Encouraging winter storage

We will encourage potential abstractors to apply to take water in the winter and provide reservoir storage for subsequent re-use during summer months. This allows abstractors to use water for consumptive purposes during summer months when other surface water resources are unavailable.

c) Use of the "precautionary principle"

Where there is uncertainty over the impacts of a proposed abstraction, we have the power to refuse licences on the grounds of the 'precautionary principle'.

d) Revocation of unused abstraction licences

Under the Water Act 2003, we will not have to pay compensation if we revoke a licence that has not been used for 4 years. This only applies to those licences where the period of non-use started after April 2004. For all other abstractions, where the period of non-use started before April 2004, the 7 year rule will still apply.

The revocation of licences will only take place after prior consultation with the licence holder. In some cases it might be more appropriate to reduce licence quantities if the volumes stated on the licence are unable to be achieved or if there have been changes in water need.

e) Southern Regional Policy Guidance for the Irrigation of Golf Courses

In assessing abstraction licences for golf courses, we generally allow only sufficient water for irrigating greens and tees. There is a "presumption against" the irrigation of fairways and approaches. As with all

licence applications this allocation of water will have to be backed by reasonable need.

f) Time limits

All new and varied abstraction licences in the Medway CAMS area will have a common end date of 31st March 2018, this links into the six-year CAMS cycle.

Time limited licences carry a presumption of renewal, provided the three renewal tests can be satisfied and there are no other legal obstacles.

The three renewal tests are:

- Environmental sustainability
- Continued justification of need
- Efficient use of wate

For more information on time limiting of licences and these renewal tests, please refer to *Managing Water Abstraction*.

5.3. Licensing strategy for surface water abstractions

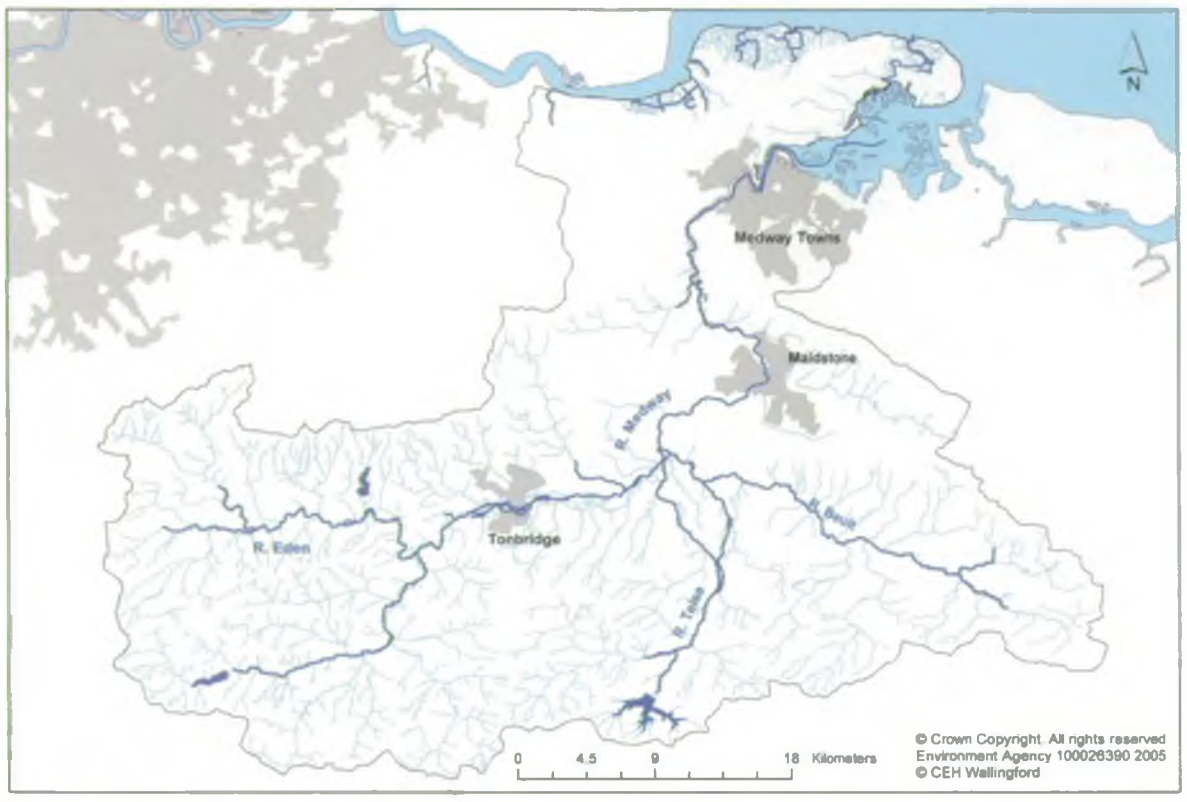


Figure 12 | The surface water area

The CAMS has identified some watercourses to be under stress from abstraction (refer to chapter 4); we will seek to secure downward variations of existing licences in these areas by using the criteria for the renewal of time limited licences.

Medway hands-off flow condition (Medcon)

Surface water abstractions in the Medway CAMS area, with the exception of Licences of Right, are subject to the 'Medway Condition' (MedCon)'. This 'hands-off flow' (HOF) condition restricts licensed abstractions when gauged river flows fall below a specified level. This level is derived from the Teston minimum residual flow (MRF) and is varied according to the issue date and location of the licence. HOF values applied to licences range from 275 Ml/d to 890 Ml/d, newer licences have stricter HOF conditions.

Table 7 | Proportion of licenses at each Teston HOF Range

Teston HOF Range (Ml/d)	% No. Licences
< 800	33
500 – 600	9
400 – 500	55
300 – 400	1
> 200	2

At the MRF at Teston of 275 Ml/d there is normally sufficient freshwater flow into the Estuary to satisfy water quality demands and the environmental requirements of the Estuary. MedCon is implemented every year, for approximately four to five months from early summer, however this can be longer when winter rainfall has been low. Letters are sent to licence holders to inform them that MedCon is in operation when the river flow falls to 275Ml/d and again, when the flow is greater than the HOF.

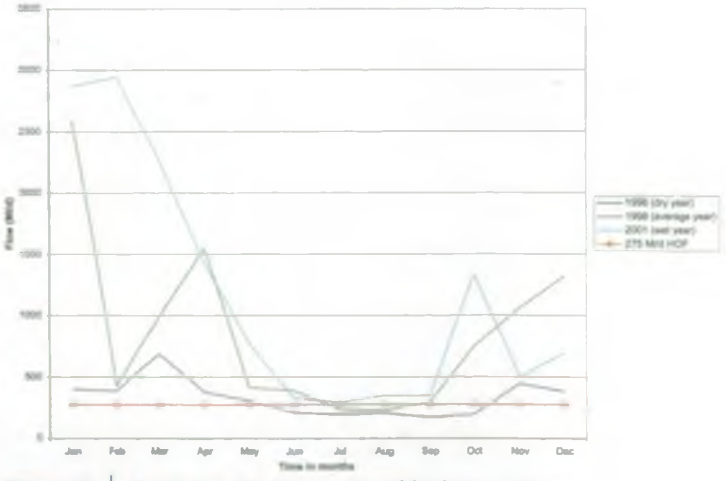


Figure 13 | Graph showing Average Monthly Flows at Teston and MedCon HOF Condition

5.4. Licensing strategy for groundwater abstractions

Chalk

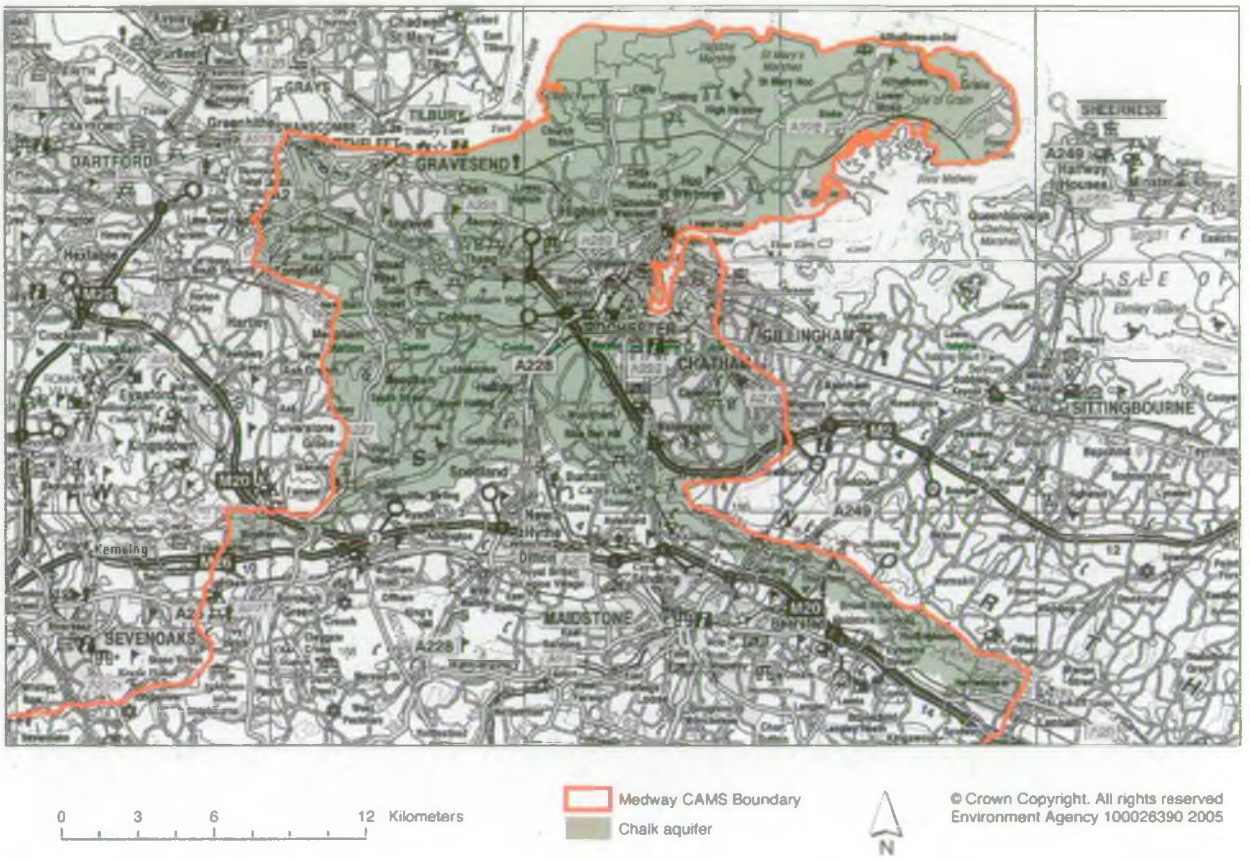


Figure 14 | The Chalk aquifer

Spring flow from the Chalk supports the Thames Estuary and Marshes SPA and Ramsar sites and the Medway Estuary and Marshes SPA and Ramsar sites. These sites consist of an extensive mosaic of grazing marsh interspersed with some freshwater pools, supporting outstanding numbers of waterfowl and wintering birds with total counts regularly exceeding 20,000. Therefore, here there are greater requirements for abstraction licences to meet environmental need.

The resource assessment has identified the Chalk aquifer is under stress from abstraction. Our licensing policy for the Chalk will therefore continue to be that there is a "presumption against" the granting of licences for abstraction from the Chalk for consumptive-use. We will also seek to secure downward variations of existing licences, by using the criteria for the renewal of time limited licences. The Chalk aquifer is shown in the map above.

Lower Greensand

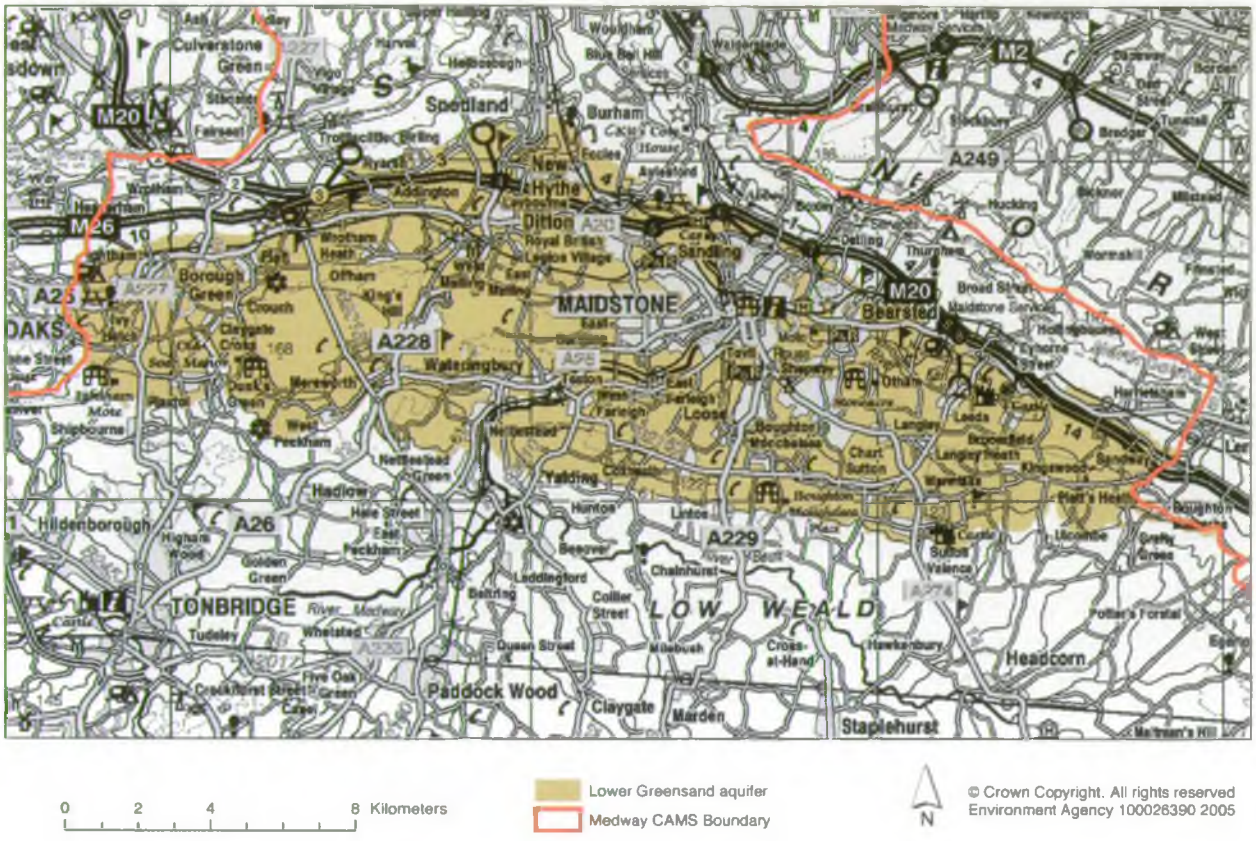


Figure 15 | The Lower Greensand aquifer

This formation comprises the Folkestone Sands and Hythe Beds. As the Lower Greensand aquifer has been identified to be under stress from abstraction, we will seek to secure downward variations of existing licences, by using the criteria for the renewal of time limited licences.

Our licensing policy for the Lower Greensand will continue to be that there is a "presumption against" the granting of licences for abstraction for consumptive-use. The Lower Greensand aquifer is shown in the map above.

Hastings Beds

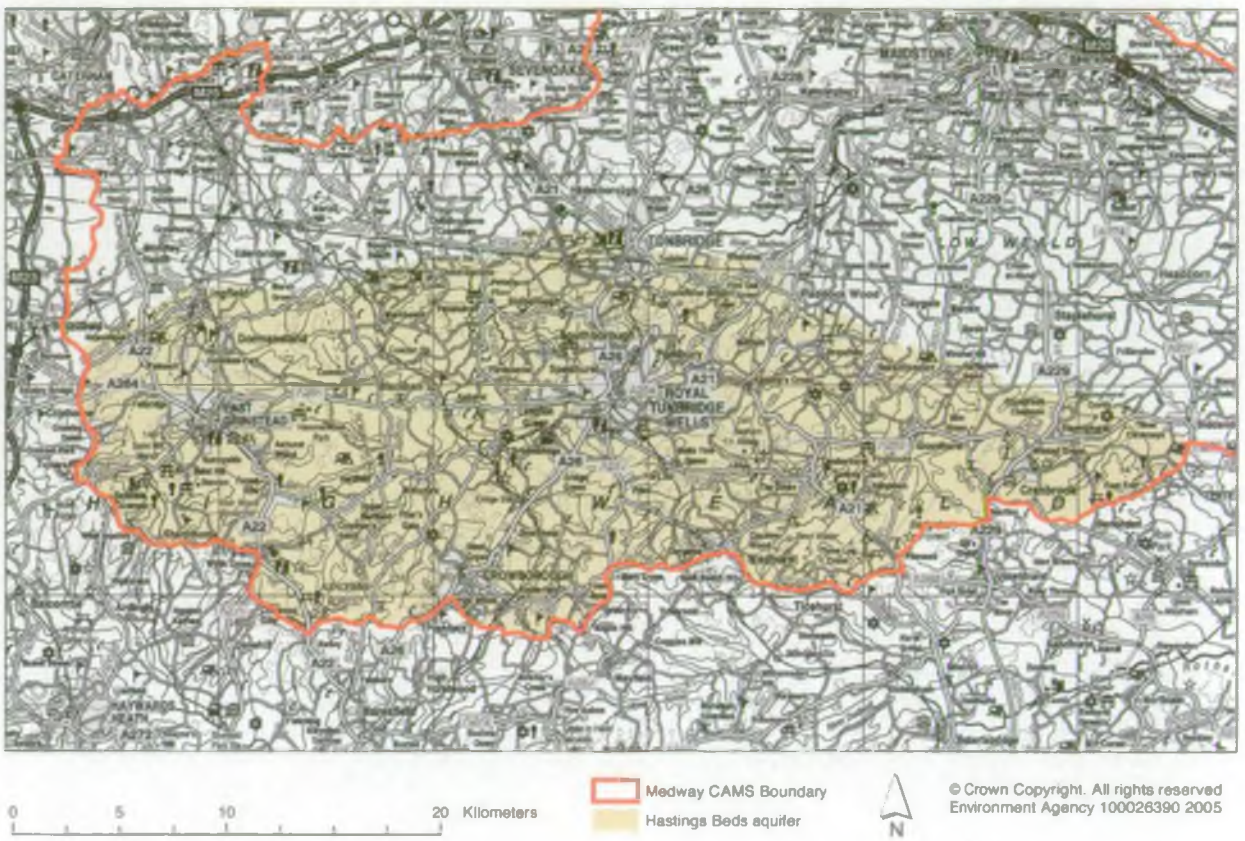


Figure 16 | The Hastings Bed aquifer

This formation comprises the Tunbridge Wells Sands and Ashdown Beds and is heavily faulted into distinctive blocks. Due to the complexities of calculating the availability of water resources within this aquifer our policy for new and varied licences follows the "precautionary principal" and is as follows:

a) All new and varied licences will have an *Antecedent Winter recharge* condition. This is where the total volume of abstraction authorised for any water year will be dependent on both the current and antecedent winter recharge. For clarification, this can be exemplified as follows:

- If 100% or more of the long term average rainfall (1961-1990) is recorded then 100% of the annual quantity may be abstracted.
- If 75% of the long term average rainfall is recorded then 75% of the annual quantity may be abstracted
- If 50% of the long term average rainfall is recorded then 50% of the annual quantity may be abstracted.
- The maximum reduction will be 50% of the annual quantity.

Therefore, the usage of any new or varied groundwater abstraction from this aquifer will be carefully managed in any one year. The Environment Agency will notify abstractors before 1 May of each year of the preceding total winter rainfall and the permitted abstraction volume.

b) There is a "presumption against" the granting of licences for abstraction from the Tunbridge Wells Sands and Ashdown Beds which will adversely affect the flow regime of headwater streams draining the outcrop. This will often be where the abstraction point is in close proximately to a watercourse.

5.5. The impact of the Water Act 2003

Following the first major review of the abstraction licensing system since its inception in 1963, the Government set out, in 1999, a new framework for managing water resources. The CAMS process and the move to time limited licences are key elements of the new framework, which is completed by revisions to the statutory framework introduced by the Water Act 2003. The Act updates the Water Resources Act 1991 in several key areas:

- Deregulation of small abstractions
- New controls on previously exempt abstractions for mine and quarry dewatering, trickle and other forms of irrigation, transfers into canals and internal drainage districts
- Stronger powers for water resources planning and management
- Changes to the legal status of abstraction licences
- More flexibility to the licensing regulations to improve its efficiency and to encourage trading
- Stronger powers on water conservation

The removal of exemptions is expected to take place in early 2006. The details of how this will happen will be contained in secondary legislation called Regulations and it is expected that there will be further consultation on these by Defra during 2005.

We recognise that these exempt abstractions have been taking place entirely lawfully. There is therefore an expectation that where possible, licences will be granted until a common end date, in line with other abstractions within the catchment. This will allow reviews to take place with existing licences. This is seen as equitable. There will be cases where in exceptional circumstances we will curtail operations or refuse applications.

Following the removal of exemptions, such operators would be entitled to claim compensation should their applications be refused or constrained in some way. *Taking Water Responsibly* (1999) states that if operations commenced after the publication of this document (where the Government had stated its intentions in relation to the removal of exemptions), then this would be considered to be a factor in determining the appropriate levels of compensation to be paid where operations have commenced contrary to Agency advice.

5.6. Opportunities for licence trading in the Medway CAMS area

A guidance leaflet *Water Rights Trading* was published and sent to licence holders towards the end of 2002 explaining the scope for water rights trading within current legislation. Consultation on more detailed proposals followed in 2003. After considering the responses to this consultation exercise, further information will be made on the detailed framework within which water rights trading will take place. This information and guidance will be timed to coincide with the expected implementation of the sections of the Water Act 2003 that are most relevant to trading. Further information on water rights trading is available on the Environment Agency Internet site.

5.7. Climate change

Climate change is an important issue facing water resources management. The latest climate change scenarios from the UK Climate Impacts Programme suggest that temperatures will rise across England and Wales. By the 2050s, in southern England summers will become drier and winters will be wetter. This has important implications for water availability, as it will change groundwater and river regimes. For instance, rainfall is becoming both more seasonal and of increasing intensity, so this could lead to higher runoff and less water able to percolate into the aquifers which supply the bulk of public water supply in this area.

It is likely that direct abstractions will become less reliable in summer, which means that farmers and industries who rely on these will have to consider adapting in some way if they wish to maintain current levels of reliability – this will increase the importance of using water wisely. The impact on public water supply is less clear but recent modelling work suggests that the deployable output of some systems will be reduced.

The Middle Medway Flood Risk Management Strategy 2004 has explored sites for a number of on/off line flood storage reservoirs. It may become economically viable to design these for dual use, given increasing flood risk and water resource pressures.

For more information on the Agency's ongoing work on climate change, please refer to Appendix 1 of the Regional Water Resources Strategy. More details on climate change scenarios are available at www.ukcip.org.uk/scenarios.

Actions

During the development of this strategy, some uncertainties arose. The Table 8 outlines the actions that will be carried out to reduce these unknowns. We aim to complete all these actions by 2009, which is when we will start to review this Medway CAMS licensing strategy. For more information on the CAMS cycle please refer to *Managing Water Abstraction.*

As the Medway CAMS Stakeholder group has now disbanded, the Kent Area Environment Group will be updated on the progress of these actions and an annual update will be available via our internet site: www.environment-agency.gov.uk/cams.

Table 8 | Action table

No	Actions	Who by?	When?
1	In all Over licensed and Over abstracted units we will seek to secure downward variations of existing licences, by using the criteria for the renewal of time limited licences. E.g. Environmental sustainability Continued justification of need Efficient use of water	Environment Agency	ongoing
Surface water			
2	Assess the yield of Bough Beech Reservoir and licence appropriately, as the resource assessment showed that the original licence needed verification.	Sutton & East Surrey Water Company Environment Agency	By next CAMS cycle
3	Investigate the value of alternative Hands Off Flow (HOF) to the MedCon as a management tool. This is to discover whether a separate HOF on tribuataries to the River Medway would give a more appropriate control measure.	Environment Agency	By next CAMS cycle
4	Investigate a more effective method of communicating the MedCon condition to licence holders, so that the range of HOF values can be enforced more effectively. This will involve the consideration of costings and practicalities.	Environment Agency	By next CAMS cycle
5	Investigate the impact of removing stop boards in the River Beult on the flow regime, in order to discover whether this will assist the River Beult SSSI in achieving a 'favourable status'.	Environment Agency English Nature	By next CAMS cycle
6	Investigate the yield and environmental impact of the proposal to enlarge Bewl Reservoir	Environment Agency Southern Water Mid Kent Water	By 2008/9
7	Quantify the effluent discharges in the catchment and evaluate their impact on the low flow regime of the individual rivers.	Environment Agency	By next CAMS cycle
Groundwater			
8	Investigate the Lower Tunbridge Wells Sand aquifer. This will increase our understanding of the springflow into the Middle Medway.	Environment Agency South East Water	By next CAMS cycle
9	Investigate the contribution of base-flow from the Lower Greensand into the Middle Medway. Greater understanding of groundwater will help us to assess more accurately the availability of groundwater for abstraction.	Environment Agency through development of a groundwater model	By next CAMS cycle

Appendix 1: Major transfers of water

To be read in conjunction with Figure 10 Major transfers of water

The impact of public water supply schemes upon the River Medway

The largest abstractions from the Medway catchment are for Public Water Supply. This water is not simply used within the Medway catchment but forms part of the region's water supply system, satisfying demand in neighbouring areas as well. We have reviewed the main public water supply operations affecting the Medway catchment and the summarise details below. (A fuller, more technical summary is available in the Technical Document CD-ROM).

a) Bewl Water

The flow characteristics of the upper parts of the Bewl Stream were altered when Bewl Water was built in 1977. Prior to that, the annual average flow downstream of the dam site was measured as 28 Ml/d and the flow of 3.5 Ml/d was equalled or exceeded 95% of the time (Q95). Southern Water must ensure that the Q95 volume is released continually (compensation release) to the river downstream of the dam.

b) Releases from Bewl Water and abstraction of water at Springfield

Southern Water abstracts water from the River Medway at Springfield, in Maidstone. It is allowed to abstract up 136 Ml/d, although the average abstraction rate is approximately 50 Ml/d. The company releases water from Bewl Water to allow the abstraction to take place all year round - most of the time these releases equate to the volume abstracted. However, when the river flow as measured at Teston falls below 275 Ml/d an extra 20% of water is released from Bewl purely for the river. This release enhances the natural dry weather flow of the Medway at Teston by 25%, although the benefit can be as much as 50% at times of lowest flow. The fresh water flow into the estuary can be enhanced by up to15%

c) Transfer of water from Bewl Water to Darwell Reservoir

Southern Water operates a pipeline capable of transferring up to 35 Ml/d southwards from Bewl Water to Darwell reservoir. This transfer is used to support storage recovery in Darwell reservoir during late summer and early autumn. In other words, it is using water that had been stored in Bewl from the previous winter. In some years it may not need be used at all. The removal of water from Bewl at that period enables the operator to maximise the storage potential of Bewl Water, that is, allowing for more water to be stored the following winter; this procedure makes the best use of the resources of the Medway. The transfer does not have any direct impact on the summer flows of the river Medway.

d) Pumped winter refill of Bewl Water

Southern Water has abstraction points at Yalding and Smallbridge on the River Medway to pump water into Bewl Water, helping to refill the reservoir in the winter. We have set conditions so that these abstractions can only be operated when river flows are relatively high.

e) Darwell Reservoir

This reservoir is owned by Southern Water and is primarily filled from natural inflows and pumped water from the River Rother at Robertsbridge. It does not have any direct impact on the flow characteristics of the River Medway.

f) Direct abstraction from Bewl Water

Mid Kent Water has a licence to abstract up to 20 Ml/d directly from Bewl Water to supply across its Weald supply zone. Approximately 70% of this zone is within the Medway catchment and so this water is returned to the Medway river system via effluent discharges. The remaining 30% is diverted into the Rother Catchment. Mid Kent Water do have plans to extend the supply from Bewl towards Ashford (Stour catchment); as yet it is unknown if the associated effluent discharges will be into the Medway catchment.

g) Weir Wood Reservoir

This impounding reservoir is owned by Southern Water and is refilled by direct catchment runoff. Compensation releases are variable depending upon the season, being 5.46 Ml/d during May to October and 3.64 Ml/d between November to April. These releases replace the estimated Q95 flow before the reservoir was built. Water from the reservoir contributes to water supply in two supply zones, namely Southern Water's North West Sussex supply zone and South East Water's Mid Sussex supply zone. None of the water used by Southern Water (between 3 to 6 Ml/d) is returned to the Medway catchment whereas South East Water's supply of 5.9 Ml/d is used within the Medway catchment. South East Water also import water from sources sited outside the Medway catchment to supply customers within the Medway catchment:

h) Bough Beech Reservoir

This reservoir is a pumped storage winter fill reservoir owned and managed by Sutton & East Surrey Water. Like Weir Wood, it has a seasonal compensation flow of not less than 0.32 Ml/d between the 30th April and the 1st November and 0.14 Ml/d for the remaining period. These values are very small as they reflect the small size of the natural catchment upstream of the dam. Bough Beech reservoir is filled mainly by abstraction from the River Eden, which is pumped into the reservoir. We only allow this abstraction during the winter months. Approximately 30% of the East Surrey supply zone falls within the Medway catchment and so there will be some effluent return of water into the River Eden. With this and the compensation release, one can assume a net benefit in volume of flow during the summer months.

i) Belmont Scheme

Both Southern Water and Mid Kent Water abstract water from the Chalk aquifer of the North Downs. Some of this water is fed into the Eastling and Selling-Fleete Mains to supply areas in East Kent. Mid Kent Water transfers some of this groundwater abstraction into the Medway catchment to augment its sources near Maidstone.

It is not possible to assess the *exact* impact of these schemes on the flow regime of the Medway rivers, due to the complexity of water supply distribution system relative to points of effluent discharge. However, it is clear that compensation releases from the reservoirs maintain the natural low flows below reservoirs and these in turn are augmented by effluent discharges downstream. Also, releases from Bewl Water to support abstraction at Springfield are very beneficial to flow levels in the Medway and our summary highlights the imports of water into the Medway catchment

In future, as the Water Companies build more major mains and transfers, more flexibility will be introduced into the system and will allow conjunctive schemes to be developed. These schemes should allow the water companies to optimise the use of winter water and possibly move abstraction away from areas where we have concerns about environmental damage.

Appendix 2: Water efficiency contacts

General / all sectors

Environment Agency

The Environment Agency provides a range of free guidance on water efficiency, including best practice case studies for agriculture, business, industry, public sector and the domestic consumer. Consult www.environment-agency.gov.uk/savewater or telephone 01903 832275.

Water companies

For local water efficiency advice, contact your water company.

Mid Kent Water
www.midkentwater.co.uk

Southern Water
www.southernwater.co.uk

Sutton and East Surrey Water
www.waterplc.com

South East Water
www.southeastwater.co.uk.

Water Regulations Advisor Service

WRAS provides advice on the Water Supply (Water Fittings) Regulations which prevents waste, misuse, undue consumption or contamination of wholesome water. Consult www.wras.co.uk or telephone 01495 248454.

Business / Commercial

Envirowise

Envirowise is a Government programme offering free, independent advice on practical ways for industrial and commercial SME's (Small and Medium sized Enterprise) to minimise waste and convert turnover into profit. Envirowise has a specific water section on their site called 'Waternet', which includes links to guidance published around the world and a benchmarking tool. Consult www.envirowise.gov.uk/waternet or telephone the Environment & Energy helpline: 0800 585 794.

Public sector

Watermark

Watermark is an initiative from OCGbuying.solution (part of the Office of Government Commerce in the Treasury) for public sector organisations. It has produced benchmarks for a wide range of public sector buildings and offers access to a shared savings scheme for the installation of new, water efficient, devices. Consult www.watermark.gov.uk

Water in the School

Water in the School is a website supported by a number of water companies aimed at National Curriculum Key Stage 2 and 3 pupils and their teachers. It provides a wealth of information for pupils on how to make savings. Consult www.waterintheschool.co.uk

Hospitals

Water UK

Water UK has collaborated with NHS Estates and Watermark to produce *Water Efficient Hospitals*, an information pack to help hospitals use water wisely and save money by cutting both water and energy bills. Consult www.water.org.uk/index.php?cat=3-4701

Agriculture & Horticulture

UK Irrigation Association (UKIA)

The UKIA provides information on irrigation to its members and runs technical workshops. Consult www.ukia.org

DEFRA's Rural Development Service (RDS)

DEFRA's Rural Development Service provides grants for agricultural water resources management schemes under its Rural Enterprise Scheme. Consult www.defra.gov.uk/erdp/default.htm or telephone 0845 9335577.

Linking Environment & Farming (LEAF)

LEAF promote and develop integrated farm management, this includes whole farm water savings. Consult www.leafuk.org or telephone the Kent LEAF office 01580 712488.

Glossary of Terms

Abstraction
Removal of water from a source of supply (surface water or groundwater).

Abstraction – Actual
The volume of water actually abstracted as opposed to the volume of water that may be abstracted under the terms of an abstraction licence. Individual abstraction records are reported to the Environment Agency each year.

Abstraction Licence
The authorisation granted by the Environment Agency under section 38 of the Water Resources Act 1991 to permit water abstraction.

Aquifer
A geological formation, group of formations or part of a formation that can store and transmit water in significant quantities.

Asset Management Plan (AMP)
AMP are produced by the water companies for OFWAT and set out the investment programme for the water industry. These plans are drawn up through consultation with the Environment Agency and other bodies to cover a five year period.

Biodiversity Action Plan (BAP)
Established at a National level in 1995 as part of the Government's commitment to conserving biodiversity made at the 'Earth Summit' held in Rio in 1992. The plan identified over 100 species and 14 habitats for targeted action for protection. This national plan has now been translated into local actions and the Kent Biodiversity Action Plan (BAP) focuses on habitats and species listed in the plan found in the local area.

Borehole
Well sunk into a water bearing rock from which water will be pumped.

Catchment
The area from which precipitation and groundwater will collect and contribute to the flow of a specific river system.

Chalk
A soft white fine-grained limestone which forms a major aquifer.

Conjunctive use
A water supply system which relies on more than one source of water. This can include systems containing both surface water and groundwater sources.

Cyprinid fish
Fish of the family Cyprinidae, e.g. roach, carp, within the order of the Osteichythye. Almost entirely inhabiting freshwater, with over 3,000 species including Characins, Loaches and Carps.

Consumptive Abstraction/Use
Use of water which results in a significant proportion of water abstracted not being returned either directly or indirectly to a source of supply e.g. spray irrigation.

Demand Management
The implementation of policies or measures which serve to control or influence the consumption or waste of water.

Deployable Output
The output of a commissioned source or group of sources or of bulk supply as constrained by:

- Environment
- Licence, if applicable
- Pumping plant and /well/aquifer properties
- Raw water mains and/or aqueducts
- Transfer and/or output main
- Treatment
- Water quality

Derogation
In legal terms, the taking away of protected rights under the Water Resources Act due to the granting of a new licence.

Discharge Consent
A statutory document issued by the Environment Agency, which defines the legal limits and conditions on the discharge of an effluent into controlled waters.

Drought
A general term for prolonged periods of below-average rainfall resulting in low river flows and/or low recharge to groundwater, imposing significant strain on water resources and potentially the environment.

Effluent
Liquid waste from industrial, agricultural or sewage plants.

Environmental Weighting
An assessment of a river's sensitivity to abstraction based on physical characteristics, fisheries, macrophyte and macro-invertebrates for a catchment/sub-catchment

Flood plain
Land adjacent to a watercourse that is subject to flooding.

Gauging Station
A site here the flow of a river is measured.

Groundwater
Water which is contained in underground rocks (aquifers).

Groundwater Management Unit (GWMU)
An area of aquifer delineated to allow the assessment of groundwater resources.

Groundwater Protection Policy
Environment Agency policy relating to groundwater recharge areas to control activities having the potential to pollute underground water.

Habitat
Place in which a species or community of species live, with characteristic plants and animals.

Habitats Directive
The European Directive on the Conservation of Natural Habitats and of Wild Flora and Fauna - known as the Habitats Directive - was adopted by the European Commission in 1992. The Directive is implemented in the UK by the Conservation (Natural Habitats & c.) Regulations 1994 - commonly known as the 'Habitats Regulations'.

Hands-Off Flow (HOF)/ Minimum residual flow (MRF)
A condition attached to the abstraction licence so that if the flow in the river falls below the flow specified on the licence then the abstractor may be required to stop or reduce the abstraction.

Hydrogeology
Branch of geology concerned with water within the Earth's crust.

Hydrology
The study of water on and below the earth's surface.

Hydrometry
The measurement of water on or below the earth's surface.

Hydrometric Network
A system of sites monitoring rainfall, river flow, groundwater levels, river and lake levels and some climatic parameters. The data is used extensively for water resources management and planning, water quality and ecological protection and improvement, flood defence, flood forecasting and flood warning.

Irrigation
Supply (land) with water by means of artificial canals, ditches etc, especially to promote the growth of food crops.

Licence of Right
Licence granted under section 23 of the Water Resources Act 1963 in respect of an abstraction that was already in operation when that Act was implemented in 1965.

Low flow
Low flows are defined by the river flow (Q) which, under benchmark or natural conditions would be exceeded for 95% of the time (95). This is referred to as Q95.

Main river
The watercourse shown on the statutory "Main River Maps" held by the Agency and Defra. The Agency has permissive powers to carry out works of maintenance and improvements on these rivers.

Naturalisation
Process of converting gauged flows to natural flows by removing abstraction and discharge impacts - this will produce the benchmark flow.

Nitrate Vulnerable Zone (NZV)
Farmers located within these NVZs are required to adhere to an action programme of measures to ensure that the amount of nitrate lost from their land to the polluted waters is reduced.

Non-Consumptive Abstraction
Abstraction where the water used is returned to a source close to or at the point of supply, e.g. hydropower generation, fish farming etc.

Outflows
The movement of water out (losses) of a defined area of an aquifer. These include spring flows, baseflow to surface waters and movement of underground water past a defined boundary.

Percolation
The decent of water through soil pores and rock crevices.

Permeability
The characteristic of a rock or soil that determines the rate at which fluids pass through the rock or soil under the influence of differential pressure.

Precautionary Principle
It cannot be taken for granted that a licence will be issued for abstraction from this area. A licence application will be fully assessed and it is highly likely that it will have some constraints.

Presumption against
It cannot be taken for granted that a licence will be issued for abstraction from this area. A licence application will be fully assessed and it is highly likely that it will have some constraints.

Public Water Supply (PWS)
Term used to describe the supply of water provided by a water undertaker.

Q95
The flow of a river which is exceeded on average for 95% of the time.

RAM Framework
Resource Assessment and Management Framework – a technical framework for resource assessment (for the definition and reporting of CAMS) and subsequent resource management (including abstraction licensing).

Ramsar
A site of international conservation importance classified at the 'Convention on Wetlands of International Importance' 1971, ratified by the UK Government in 1976.

Recharge
Water which percolates downward from the surface into groundwater.

Revocation
Cancellation of a licence and associated rights and benefits.

Salmonids
Members of the family salmonidae, include salmon, trout and char.

Site of Nature Conservation Importance (SNCI)
Sites designated by Local Authorities for planning purposes as locally important for conservation interests.

Site of Special Scientific Interest (SSSI)
A site given a statutory designation by English Nature or the Countryside Council for Wales because of its importance to nature conservation.

Special Area of Conservation (SAC)
Internationally important nature conservation site designated under the EU Habitats Directive (92/43/EEC).

Special Protection Area (SPA)
Internationally important nature conservation site designated under the EU Wild Birds Directive (79/409/EEC).

Spray Irrigation
The irrigation of land or plants (including seeds) by water emerging from apparatus designed or adapted to eject water into the air in the form of jets or spray.

Spring
A surface watercourse that occurs where the water table intersects the ground surface.

Surface Water
This is a general term used to describe all above ground water features such as rivers, streams, springs, ponds and lakes.

Sustainable Development
Development that meets the needs of the present without compromising the ability of future generations to meet their own needs. This involves meeting four objectives simultaneously:

- social progress which recognises the needs of everyone;
- effective protection of the environment;
- prudent use of natural resources;
- maintenance of high and stable levels of economic growth and employment.

Time Limited Licence
An abstraction licence with specified end date.

Trickle irrigation
The watering of crops by slow release of small amounts of water through holes in pipes laid on the ground.

Water Resource Management Unit (WRMU)
An area that has similar groundwater and or surface water characteristics defined for the local management of water resources.

Water Resources Strategies
Strategy for water resource planning in England and Wales over the next 25 years to ensure sustainable use and sufficient water for all human uses with an improved water environment. The strategies predict demand using different social and economic scenarios.

List of Acronyms, Abbreviations and Units

AP
Assessment Point

BAP
Biodiversity Action Plan

CAMS
Catchment Abstraction Management Strategy

DEFRA
Department for Environment, Food and Rural Affairs (formally DETR)

EU
European Union

GWMU
Groundwater Management Unit

HOF
Hands Off Flow

km^2
Square kilometers

m
Meters

Ml/d
Megalitres (million litres) per day

MRF
Minimum Residual Flow

NWA
No water available

OA
Over abstracted

OFWAT
Office of Water Services

OL
Over licensed

PWS
Public Water Supply

RAM
Resource Assessment and Management

SAC
Special Area of Conservation

SNCI
Site of Nature Conservation Importance

SPA
Special Protection Area

SSSI
Site of Special Scientific Interest

UKCIP
United Kingdom Climate Impacts Programme

WA

Water available

WRMU
Water Resource Management Unit

WWTWs
Waste Water Treatment Works.

Notes

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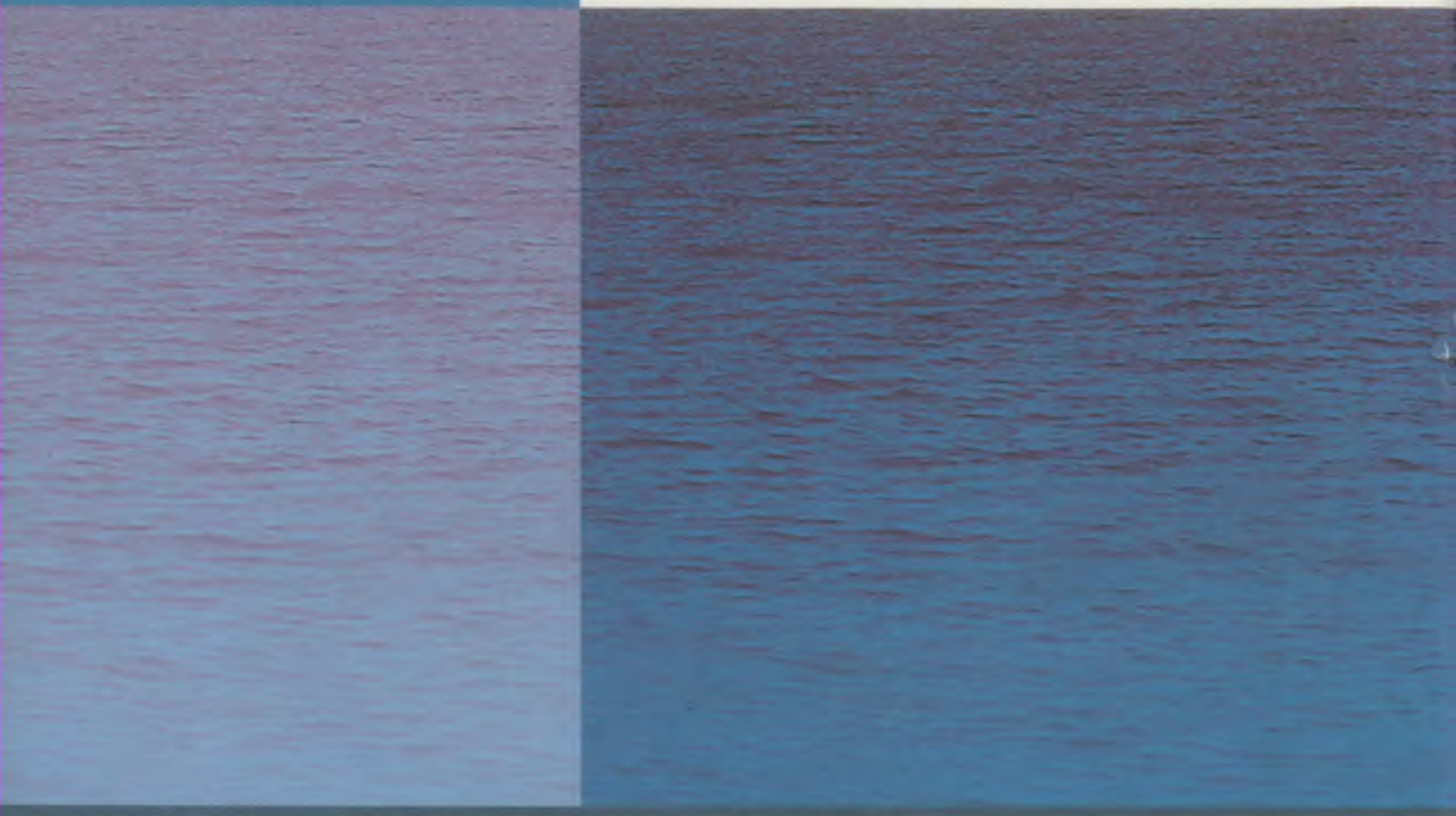

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