Ricardo Energy & Environment

Environmental Information to inform Water Company SEAs

Identification of potential for cumulative effects between water companies for WRMP19 SEAs

Report for WRSE
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Executive Summary

This report documents the first stage of a region wide cumulative effects assessment to support the Water Resource Management Plans (WRMPs) of each of the six water companies that form part of the Water Resources South East (WRSE) group. The report is intended to provide data and evidence so that each of the companies can establish their own cumulative effects assessments (CEA) within their own WRMPs. As such it identifies potential key inter-relationships between schemes or options that each of the companies may need to consider when defining their own programmes.

A staged process to CEA has been adopted, where the level of assessment increases as WRMP process develops to allow for integration of CEA. Due to the timing of the project the preferred programmes for WRMP19 were not available at the outset. Therefore, each water company's feasible list of options was used in the study to identify cross-company options with the potential for cumulative effects. CEA is an iterative process and the results of this study can feed into the next stage to be undertaken by the water companies.

A systematic approach to identify options with the potential for cumulative effects between water company options was adopted. Firstly, geographical information system (GIS) information was gathered from each water company regarding WRMP19 options and standardised. This facilitated the sharing of option information between the WRSE group members. Secondly, a screening approach was used which ensured a robust, consistent approach to identifying WRMP options that have the potential to result in cumulative effects. Sources and pathways were identified and described at a high level with recommendations for further cumulative effects assessment provided. To enable the consideration of CEA at the WRSE group level, a workshop was facilitated where water companies were able to discuss the options identified as having the potential for cumulative effects. Larger strategic schemes and how they should be considered at a regional scale were also discussed.

The key potential inter-relationships between schemes or options that each of the companies may need to consider in defining their own programmes have been identified and are summarised by receptor and water company in **Table A**.

Table A Summary of Potential Option Interactions by Receptor and Water Company that Require Further Assessment

Receptor	Affinity Water	Portsmouth Water	South East Water	Southern Water	SES Water	Thames Water
High value receptors						
South Downs National Park		✓	✓	✓		
North Wessex Downs AONB			✓	✓		✓
High Weald AONB			✓	✓		
Holborough to Burham Marshes SSSI			✓	✓		
Surface water catchments						
River Adur			✓	✓		
River Ouse			✓	✓		
Great Stour River and transitional water body			✓	✓		
River Medway and transitional water body			✓	✓		
River Thames and transitional water body	✓					✓
Groundwater bodies						
East Kent Chalk - Stour	✓			✓		
Epsom North Downs Chalk			✓			✓
North Kent Medway Chalk			✓	✓		✓

It is recommended that the WRSE group considers the optimum water resources solution for the south east region that would achieve the most benefit in terms of the environment. This could be done when all the individual option environmental assessments are completed and stakeholder feedback has been obtained, potentially within the consultation on their draft WRMP19s. An assessment of the balance of reservoirs, transfers, desalination and reuse options across the region to fulfil the supply demand deficits is required to ensure that decision-making is regionally optimised and that the potential for cumulative solutions that are cost beneficial and fully embed environmental benefits are selected.

Specific recommendations for the next iteration of CEAs within SEAs for WRMP 2019 are as follows:

- Further develop the understanding of the potential for in-combination effects between options using the individual option environmental assessments as a basis (as summarised in **Table A**).
- Integrate the potential for construction impacts of options within close proximity to one another and temporary drought measures into the next assessment.

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1 Introduction

1.1 Background

Water Resources South East Group (WRSE) is an alliance of the six south east water companies (Affinity Water, Portsmouth Water, South East Water, Southern Water, SES Water and Thames Water), the Environment Agency, Natural England, Ofwat, Consumer Council for Water and Defra. Its purpose is to input to the development of long term best value plans for securing water supplies in the south east.

Water companies in the WRSE undertook Strategic Environmental Assessments (SEA) of their 2014 Water Resource Management Plans (WRMPs). However, Natural England identified shortcomings with these related to consideration of potential cumulative or in combination environmental effects. Legal advice taken by the regulatory authority states that a SEA of the WRSE studies is not required[1].

With the desire to improve the SEA cumulative and in combination assessment across the WRSE region, Ricardo Energy & Environment was commissioned to produce the report "*Environmental Information to inform Company SEA*s". This report is intended as a technical guidance document for water companies on cumulative effects assessments and is not linked to the guidance for SEA content. Water companies can use outputs from this report as inputs to their own cumulative effects assessments in their respective WRMP19s.

There is no single agreed definition of cumulative effects, one of the most overarching is "*the net result of environmental impact from a number of projects and activities"*[2]. The report and Geodatabase developed as part of the project provides a compendium of environmental data and evidence presented in a consistent manner to allow it to be used by WRSE group water companies in preparation for WRMP19. The report also considers suitable methodologies for use of the data in cumulative and in combination assessments, providing WRSE water companies with approaches that can be used in their own individual SEAs for WRMP19.

1.1.1 Future Water Resources

The recent Water UK study[3] on Water Resources Long-term Planning Framework (2015-2065) develops a high-level strategy and framework for the long-term planning of water resources for public supply in England and Wales. It looks at the challenges of climate change, population growth and the need to reduce abstractions to protect the environment within a 50 year horizon. It identifies a number of key messages and recommendations important to this report including the following:

- The investment needed to increase resilience is relatively modest compared with the cost of drought;
- Large-scale transfers of water between companies and regions, supported by storage and new local resources, may offer some of the best value;
- A 'twin track' approach, of demand management and new resources (including transfers), is the most suitable strategy for providing drought resilience in the future;
- The complex, inter-regional and trans-boundary nature of water resources, combined with the uncertainty over the impact of the different future changes, suggest that it would be helpful to develop an adaptive 'road map' to support the timely availability of key strategic schemes and define key roles for large-scale planning.

The Water UK study provides the basis for assessment of potential effects from combinations of options within and between water companies that are focused on meeting future demands.

[1] There is no legislative need for the WRSE Group to undertake an SEA as WRSE is not a statutory plan, it is not subject to adoption and is therefore not subject to a statutory process. The concept of undertaking a shadow SEA for the WRSE region was considered, however, consultation suggested this was not a robust approach.
[2] Sadler (1996) *Environmental Assessment in a Changing World: Evaluating practice to Improve Performance*. International Study of the Effectiveness of Environmental Assessment Final Report. International Association for Impact Assessment and Canadian Environment Assessment Agency, Canada. Referenced in Cooper, L. (2004) Guidelines for Cumulative Effects Assessment in SEA of Plans.
[3] Water UK (2016) Water resources long-term planning framework (2015-2065. Technical Report: Atkins; Mott MacDonald; Nera; HR Wallingford; and Oxford University. Final. 20 July 2016

1.2 Strategic Environmental Assessment (SEA) Guidelines and Cumulative Effects Assessment (CEA)

1.2.1 SEA Guidelines and Process

Annex I of the SEA Directive requires that the assessment of effects include secondary, cumulative and synergistic effects. These terms are not mutually exclusive and often the term cumulative effects is taken to include secondary and synergistic effects (as it is in this report).

The standard SEA guidance, the Practical Guide,[4] describes each as the following:

> ***Secondary or indirect*** *effects are effects that are not a direct result of the plan, but occur away from the original effect or as a result of a complex pathway. Examples of secondary effects are a development that changes a water table and thus affects the ecology of a nearby wetland; and construction of one project that facilitates or attracts other developments.*
>
> ***Cumulative effects*** *arise, for instance, where several developments each have insignificant effects but together have a significant effect; or where several individual effects of the plan (e.g. noise, dust and visual) have a combined effect.*
>
> ***Synergistic effects*** *interact to produce a total effect greater than the sum of the individual effects. Synergistic effects often happen as habitats, resources or human communities get close to capacity. For instance a wildlife habitat can become progressively fragmented with limited effects on a particular species until the last fragmentation makes the areas too small to support the species at all.*

The Practical Guide as well as more specific guidance regarding SEA of WRMPs[5] and literature[6,7] all recommend integrating cumulative effects assessment (CEA) into all stages of Plan making and SEA.

The main objective of the CEA is to assess potential cumulative effects and their likely significance. Guiding principles for CEA have been developed by Cooper (2004) based on best practice in the literature and findings from case study research, which investigated approaches used by planning authorities to address cumulative effects. These include the following:

- Goals and objectives: CEA should be guided by the goals and objectives of the SEA and the development plan;
- Systematic: Adopt a systems approach in defining cumulative effects and impact relationships;
- Consideration of other actions: Consider potential cumulative effects of the plan and other plans and actions that are likely to affect important or valued environmental resources;
- Mitigation measures: Propose mitigation measures for cumulative adverse effects and suggest enhancement measures for valued resources. Assess the significance of residual impacts after mitigation;
- Monitoring and management: Monitoring of significant cumulative effects should be undertaken as part of the overall monitoring of impacts of the plan;
- Iterative process: The process should be iterative and the findings from the CEA should be fed back into the next assessment.

1.2.2 CEA Process

CEA is described as a systematic procedure for identifying and evaluating the significance of effects from multiple activities and the analysis of the causes, pathways and consequences of these impacts is an essential part of the process (Cooper, 2004). The following three elements define the complex cause-effect relationship that is central to CEA:

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[4] ODPM (2005). A Practical Guide to the Strategic Environmental Assessment Directive. Produced jointly by Office of the Deputy Prime Minister, the Scottish Executive, Welsh Assembly Government and the Department for the Environment, Northern Ireland. Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/7657/practicalguidesea.pdf

[5] UKWIR (2012) Strategic Environmental Assessment and Habitats Regulation Assessment – Guidance for Water Resources Management Plans & Drought Plans (12/WR/02/A). Prepared by Cascade Consulting.

[6] Cooper, L. (2004) Guidelines for Cumulative Effects Assessment in SEA of Plans

[7] Taylor, D. (2010) The Parameters Limiting the Effectiveness of Cumulative Effects Assessment as a Component of Strategic Environmental Assessment in Scotland.

- Identifying sources – the multiple activities that cause potential impacts or environmental change;
- Considering processes – pathways of impacts between the sources and receptors and the linkages among these impacts;
- Effects – analysis of the attributes of these effects - whether such impacts are additive, antagonistic or synergistic.

1.3 Purpose and Scope of the Study

In 2016 Ricardo Energy & Environment undertook the first regional cumulative effects assessment to support the WRMPs of the six water companies that form part of the WRSE group. It was done retrospectively for the final WRMP14s and was a pilot study to develop a systematic methodology for undertaking a regional scale CEA for WRMP options developed by neighbouring water companies in the South East of England. The project was in response to shortcomings in the SEAs of WRMPs produced in 2014 identified by consultees, and also to support an improved approach for WRMPs (2019).

This study builds on the pilot study and aims to identify the potential for cumulative effects between the six WRSE water companies, to support their WRMP19 and related SEAs in a regional context. The specific objectives are as follows:

- Gather and standardise GIS data from each water company regarding WRMP19 preferred programmes;
- Perform a regional or cross-company identification of potential cumulative effects to support the WRSE water companies with cumulative environmental effects assessment as part of their PR19 WRMPs and related SEAs; and
- Facilitate a workshop where water companies can discuss options identified as having the potential for cumulative effects.

The pilot study demonstrated that the CEA should be started much earlier in the WRMP process than has been done in the past and it should be used to screen out options that have the potential for significant adverse effects. Often the CEA is left until the end of the SEA assessment process when all of the individual option level assessments have been undertaken. However, this can be too late in the process to influence preferred programmes of relevant WRMPs. This project implements the main recommendations of the pilot study relating to the communication and timing of the CEA and the sharing of data, as follows:

- Continue to consider CEA at the WRSE group level throughout the WRMP19 process. Document and reference activities undertaken in this respect (such as this study) so that it can be made clear in water company SEA documentation how cumulative effects have been considered throughout so it can be clearly demonstrated where this has influenced each WRMP.
- Adopt a staged process where the level of assessment increases as WRMP process develops to allow for integration of CEA.
- Share geographical information between the WRSE group members as information about WRMP19 options becomes available. Geographical information includes: abstraction locations (surface water and groundwater), discharge locations, conveyance routes of pipeline associated with each option, and footprints of new reservoirs.

Due to the timing of the project the preferred programmes for WRMP19 were not available at the outset. Therefore, each water company's feasible list of options was used in the study to identify cross-company options with the potential for cumulative effects; to support the WRSE water companies with cumulative environmental effects assessment as part of their PR19 WRMPs and related SEAs. CEA is an iterative process and the results of this study can feed into the next stage to by undertaken by the water companies.

It is <u>important to note</u> that this project is not to undertake the CEAs for each company specific WRMP, rather to identify the schemes or options proposed by each water company that could have cumulative environmental implications with adjacent or other water companies. As more strategic schemes are identified and proposed this will undoubtedly require consideration of how major strategic schemes (inter-catchment transfers, desalination etc.) may inter-relate across the WRSE area. This study will highlight where these implications will arise, but it does not in itself undertake the CEAs. This is for the relevant companies to consider within their decision-making.

Box 1: Defining the option list for CEA

- The CEA is based on the options that form the feasible list in each water company's draft WRMP19.
- The following type of options have been omitted at this stage of the CEA process:
  - Drought options (are generally temporary measures but should be considered before the WRMPs are finalised)
  - Catchment management options (generally beneficial for the environment)
  - Demand management options (generally beneficial for the environment)
- This refined the list to a total of 305 options for inclusion in the study. This number includes some option variants.

This report documents the approach developed to systematically identify options with the potential for cumulative effects between water company options. It provides environmental information and a geodatabase, which collects the environmental geographic datasets held in a common file system folder to inform WRSE group WRMP SEAs. The methodology is presented in Section 2 and the results are presented in Section 3. Section 4 provides a summary of the results and the recommendations.

1.4 Limitations of the Study

The study predominantly relies on GIS spatial information to identify options with the highest likelihood of having cumulative effects. The quality of the GIS data can greatly influence the GIS screening results. There is potential for options to fall through screening if not all of their component parts are included in the GIS layers provided by water companies. The quality of the GIS data provided were significantly better than those for the pilot study and the risk of missing component parts is considered low.

Due to the timing and high number of feasible options it was not possible to review individual scheme environmental assessment documentation (SEA, Habitats Regulations Assessment (HRA) and Water Framework Directive (WFD)). Therefore, impacts on environmental receptors may have been identified at an individual option level but these would only be identified using the GIS screening approach if the option is located within or adjacent to the environmental receptor. The GIS screening approach cannot consider downstream effects but this was dealt with by examining options within the same WFD management catchments.

The Final Water Resource Management Planning Guideline (EA and NRW, 2016) requires that the WRMPs should include supplies that can be maintained through a design drought as appropriate to the water company area, and that the dry year annual average demand and the design droughts should link with the drought plan. There is a need for water companies to assess the cumulative effects of the drought plan options themselves with the WRMP19 options for the WRSE group once the draft preferred programmes are known and before the final WRMPs are published.

2 Methodology

2.1 Data Gathering and Processing

2.1.1 Creating a Spatial Dataset of Options

A database of the feasible supply-side options was developed from GIS files and location data provided by each water company. Three shapefiles were created which contained all of the WRSE WRMP19 scheme spatial information, including the point, line and area features. Each shapefile was populated with key attribute descriptors where they were readily available. These included:

- Water Company;
- Option ID;
- Option Name; and
- Option Type (e.g. desalination, effluent reuse, etc.).

The GIS files for WRSE WRMP19 feasible options are contained as **Appendix A**. **Figure 1** shows the distribution of WRMP19 feasible options in the WRSE region.

2.1.2 Environmental Data Review

A review of the available GIS datasets used within the company WRMP19 SEAs and those recommended in WRMP guidance[8] was undertaken as part of the pilot study. The environmental receptors that were considered to be high value on a national or international scale were prioritised and agreed with the steering group including the Environment Agency and Natural England during the pilot study on 6th September 2016. At the project inception meeting on 21st September 2017, it was agreed to use the same high value environmental receptors selected for the pilot study, which were:

- Biodiversity, flora and fauna:
  - Special Areas of Conservation (SAC) and candidate SACs;
  - Special Protected Area (SPA) candidate SPAs;
  - Ramsar Sites;
  - Sites of Special Scientific Interest (SSSI); and
  - Marine Conservation Zones.
- Landscape and visual:
  - Areas of Outstanding Natural Beauty (AONB);
  - National Parks; and
  - Heritage Coasts.

The environmental receptor GIS layers were compiled in a geodatabase for the project and this is contained in **Appendix A**. This GIS geodatabase can be utilised in the future for cumulative effects assessments. However, it is important to note that many of the datasets are updated regularly so it is important to check the original sources for updates.

[8] Defra, Welsh Government, Ofwat, Environment Agency, Natural Resources Wales (2016) Final Water Resources Planning Guideline

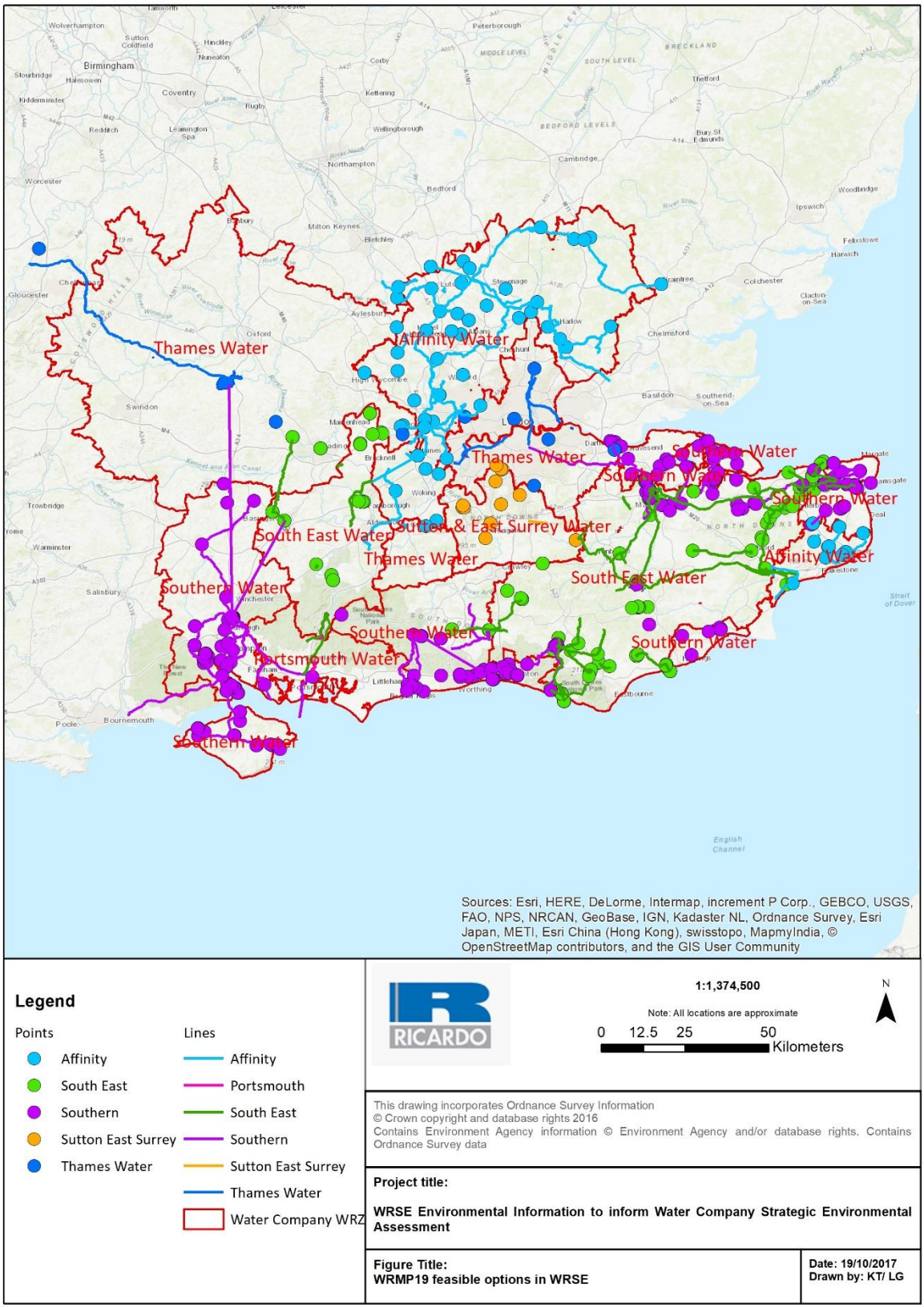

Figure 1 Overview of WRMP19 Feasible Options

2.2 GIS Cumulative Assessment Screening Tool

The WRSE WRMP19 options and the environmental baseline data were screened using the available GIS data utilising two main screening steps:

1. **High Value Key Receptors:** GIS was used to identify which between company options were located within the same high value receptors.
2. **Hydrological/ Hydrogeological connectivity**:
    a) **Hydrological:** GIS was used to select which options were within the same Water Framework Directive (WFD) management catchment[9] (the largest grouping of catchments). The list of options was refined by prioritising options with interactions with the water environment.
    b) **Hydrogeological:** GIS was used to select which options were within the same WFD groundwater body[10]. This was done for groundwater abstractions or artificial recharge schemes only.

The Natural England impact risk zones GIS layer for SACs, SPAs, SSSIs could not be used in the GIS screening because the dataset did not contain attributes that linked the zones to the receptors. In addition, the GIS dataset covers most of the south east and are therefore unhelpful for prioritising higher risk areas for in-combination effects.

GIS was also used to select options that were within 5 km of another option to identify the potential for cumulative construction impacts. Due to the large number of feasible options this showed a significant number of potential interactions and therefore was not useful at this stage. It is recommended that this process is carried out again for the draft preferred programmes and the timing of construction activities is built into the assessment.

The output of the screening process were groupings of options (**Appendix B)** which are considered to have the potential to have cumulative effects on high value key receptors or within catchments or groundwater bodies.

2.3 Communication

The WRSE group has a unique opportunity to use the forum for open discussions about options with the potential for cumulative effects on the environment. The complex, inter-regional and trans-boundary nature of water resources in WRMP19, and the number of schemes or options proposed, will require timely communication between the water companies.

A project workshop meeting was held on 11th October 2017 where the initial grouping of options within the high value key receptors and the catchment areas were presented. A large number of feasible options were identified as having the potential for cumulative effects with other water company options. There was therefore a requirement to develop a more realistic view of the potential for in-combination effects between options in the WRSE water companies' preferred programmes.

The key points of discussion around the groupings of options were:

- Whether the option was likely to be on the preferred programme;
- If the option had been flagged individually as having a high risk to a receptor.

The options likely to be on the preferred programmes were flagged and any insights on their environmental effects were recorded (see **Appendix B**).

[9] WFD Management catchments are the unit of geography for which action plans are drafted for implementing the WFD. They are a group of WFD River Waterbody Catchments [these were delineated through use of flow data and a digital terrain model run through a hydrological model] and as such river water bodies should not cross the boundaries.
[10] WFD groundwater bodies are defined for the purposes of reporting under the WFD. They represent a distinct body of groundwater flow with a coherent flow unit including recharge and discharge areas with little flow across the boundaries. This has been undertaken through defining aquifers into different types and broken into catchment units at Catchment Abstraction Management Strategy (CAMS) scale and are based on BGS aquifer data.

2.4 Refinement of Option Groupings and Linkages between Options

Based on the discussions at the project workshop (**Appendix B**) the option groupings by high value key receptors and catchments were revised. Where a grouping of options no longer contained more than one water company's options the potential for cumulative effects was discounted.

For the remaining grouped options, the potential for cumulative effects was considered further with reference to the water company WRMP19 option proformas. For options likely to be in the preferred programme and grouped in the same WFD management catchment, the potential for options to impact the same river system was examined. For options that plotted on the same WFD groundwater body the likelihood of impacting the groundwater body was considered. This step involved expert judgement with assistance from the relevant water companies to specify the linkages between options and pathways of impact between the sources. Results are discussed in Section 3.

2.5 Large Strategic Schemes

There is a need to examine the impacts of larger strategic schemes on a regional basis. In particular, for common receptors that cannot be mapped spatially such as energy consumption and emissions that may impact on air quality for example. This was not possible at this stage as the preferred programmes were not known and the individual option environmental assessments had not been finalised. However, a discussion on the large strategic schemes is provided in Section 3.2. The options selected as "Large Strategic Schemes" were agreed during the pilot study and include the following option types:

- Reservoirs;
- Desalination plants;
- Effluent reuse; and
- Large inter-company, inter-zonal and company transfer options.

3 Identification of Potential for Cumulative Effects

3.1 Receptor Focused Identification of Potential for Cumulative Effects

This section presents the results of the assessment of the linkages and pathways of impact for the options. All the options on the feasible lists were grouped by high value key receptor, WFD management catchment or groundwater body. This section focusses on the options that were highlighted at the workshop as being likely to be within a water companies preferred programme (see **Appendix B**).

Note that the commentary focuses on the interaction between options that relate to associated water companies and does not attempt to address any cumulative impacts within an individual company's own plan. Each company will be responsible for its own inter-plan CEA (cumulative effects of its options) as well as the intra-plan CEA (how other company WRMPs influence its plan, and *vice versa*).

Table 1 Potential for Cumulative Effects on High Value Receptors

High Value Receptor	Water Company	Option ID	Options Name	Identifying linkages
South Downs National Park	Portsmouth	B5290	Clanfield to Tilmore Bulk Transfer	**Identifying sources and pathways:** These options are all located within South Downs National Park and therefore have the potential to affect the character, distinctiveness, access and enjoyment of the designated area. The Portsmouth Water option B5290 involves the construction of a new transfer pipeline, it is also the same option as the South East Water option RTR-15. The closest option to these is Southern Water's BR_Rog which is 8km away and is a relatively small scheme involving refurbishment onsite. The effluent reuse scheme at Peaceheaven (joint scheme South East Water EFF-30 and Southern Water PWR_WRE) appears to be in relatively close proximity to DES-8 (approximately within 2 km) and could have cumulative effects associated with the construction and its associated impacts on the landscape. The reservoir option at Hardham (RES_Har) is not in proximity to any other water company options. Considering the distances between the remaining options across the three water companies, the potential cumulative effects could be termed 'nibbling' (incremental effects resulting in gradual loss of natural areas) which could affect landscape and visual amenity. **Recommendation:** The cumulative impact of the construction of these options and any permanent effects on the landscape should be considered further by the water companies and the possibilities of route optimisation and timing of construction should be discussed. Particular attention should be given to the potential for cumulative effects between company options PWR_WRE/ EFF-35 and DES-8.
	South East	DES-8	Desalination at Newhaven (RZ2) - Mid Sussex (10Ml/d Option)	
		EFF-35	Effluent reuse to River Ouse: source Peacehaven (25Ml/d Option)	
		RTR-15	PRT to SEW RZ5 Transfer - Clanfield to Tilmore SR (10 Ml/d)	
	Southern	BS_ABO	Abingdon - Basingstoke - Otterbourne	
		ASR_SCL	Sussex Coast - Lower Greensand	
		BR_Rog	Transfer excess water for enhanced treatment at Rotherfield (Nightsfield midhurst high level WSR) with refurbishment of Rogate and BH rehabilitation.	
		IZT_Har	Hardham Winter transfer	
		PWR_BPC	Combine Budds Farm and Peel Common WwTWs to River Itchen Indirect Potable Reuse (90 Ml/d)	
		PWR_For	Ford WWTW Indirect Potable Water Reuse	
		PWR_Por	Portswood WwTW Indirect Potable Water Reuse	
		PWR_Wol	Woolston WwTW Indirect Potable Reuse	
		PWR_WRE	Peaceheaven WwTW Indirect Potable Reuse	
		RES_Har	Reservoir at Hardham	
Chilterns AONB	Affinity	AFF-CTR-WRZ2-2020	Boxted to Shakespeare Road	**Identifying sources and pathways:** Negligible risk of cumulative effects between different company options due to significant distance between them (45km). **Recommendation:** No further assessment required.
	South East	NSW-15/ NSW-16/ NSW-17	New Raw Water Abstraction from the River Thames upstream of Maidenhead, close to Reading. - 20/ 40/ 60 Ml/d options	

High Value Receptor	Water Company	Option ID	Options Name	Identifying linkages
North Wessex Downs AONB	South East	CGW-2	Septic tanks / cess pit discharge to Woodgarston	**Identifying sources and pathways:** These options are all located within North Wessex Downs AONB and therefore have the potential to affect the character, distinctiveness, access and enjoyment of the designated area. The AONB is described as open arable sweeps of chalk downs with scarp slopes, sheltered chalk river valleys, wooded areas and low-lying heath, pasture and commons. Two of the options involve the construction of transfer pipelines which would be buried and the other 4 options are expected to be relatively small scale with construction within existing site boundaries. Most of the options are more than 6km from each other. **Recommendation:** The cumulative impact of the construction of these options should be considered further by the water companies.
		NSW-15/ NSW-16/ NSW-17	New Raw Water Abstraction from the River Thames upstream of Maidenhead, close to Reading. - 20/ 40/ 60 Ml/d options	
		WTW-31	Woodgarston Nitrate Removal Plant	
	Southern	AE_Ewo	East Woodhay WSW	
		IZT_OAN	Otterbourne to Crabwood WSR to Andover to Kingsclere	
	Thames	RES-GW-MOU1-3.5	Moulsford 1	
High Weald AONB	South East	CGW-3	Targeted catchment management interventions in the Pembury area	**Identifying sources and pathways:** These options are all located within High Weald AONB and therefore have the potential to affect the character, distinctiveness, access and enjoyment of the designated area. The AONB is characterised by dispersed historic settlement, ancient routeways, an abundance of ancient woodland, wooded heaths and shaws. South East Water have 5 options in the vicinity of Bewl reservoir that may interact with Southern Water's Bewl Raising option (0.4 metres). Bewl Raising is also a joint scheme with South East Water (RES-22). Three of the South East Water options in the vicinity of Bewl are transfer options (CTR-13, CTR-17 and RTR-22) involving pipeline construction and 2 water treatment expansions (WTW-22 and WTW-29). **Recommendation:** Given the close proximity of the options and their potential to affect areas of ancient woodland, the cumulative impact of construction and raising water levels at Bewl should be considered further by the water companies.
		CTR-13	SEW RZ2 to RZ7 Transfer - Best Beech to Bewl (5Ml/d)	
		CTR-17	SEW RZ1 to RZ7 Transfer - Blackhurst to Bewl (4Ml/d)	
		CTR-18	SEW RZ7 to RZ1 Transfer - Kippings to Pembury (4Ml/d)	
		CTR-39	SEW RZ6 to RZ1 Transfer - Aylesford to Blackhurst (4Ml/d)	
		RES-22	Raise Bewl Water and abstract additional yield at Bewl Bridge WTW	
		RTR-22	SWS to SEW RZ7 Transfer - Burham WTW to Bewl WTW (14.6 Ml/d) - [Alternative Vitual Transfer Option]	
		RTR-89	SESW to SEW RZ1 Transfer - Bough Beech to Blackhurst SR (5Ml/d)	
		WTW-22	Bewl Bridge WTW Expansion - 14.6 Ml/d	
		WTW-29	Bewl-Darwell Option 1c: Transfer of 8Ml/d from Bewl to Hazards Green via a Southern Route	
		WTW-5	Crowhurst WTW recovery of process losses	
	Southern	RES_RaB	Raising Bewl by 0.4m	

High Value Receptor	Water Company	Option ID	Options Name	Identifying linkages
Holborough to Burham Marshes SSSI	South East	DES-5	Desalination of River Medway tidal water at Aylesford/Snodland. (10 Ml/d Option)	**Identifying sources and pathways:** This SSSI site lies along the flood plain of the River Medway. It contains a variety of habitats including reedbeds, open water, fen, grassland, scrub and woodland. The site is approximately 15 ha in area. These options all appear to involve construction of segments of pipelines within the SSSI which have the potential to negatively impact the habitats. However, DES-5 is the only option that appears to have the pipeline directly through the site. **Recommendation:** The cumulative impact of the construction of these options should be considered further by the water companies and the possibilities of route optimisation and timing of construction should be considered.
		EFF-37	Aylesford effluent re-use at Aylesford	
	Southern	BS_Hon	Honour Oak (London Water Ring Main) to Burham WTW	

Table 2 Potential for Cumulative Effects on within WFD Management Catchments

Surface water catchment	Water Company	Option ID	Options Name	Identifying linkages
Adur and Ouse Catchment (and Sussex Coastal water body)	South East	DES-8	Desalination at Newhaven (RZ2) - Mid Sussex (10Ml/d Option)	**Identifying sources and pathways:** Two new reservoirs are proposed in the west of the catchment that are about 11km apart. Both appear to propose new abstraction intakes on the River Adur East. The cumulative effects of these abstractions will need to be considered further by the water companies. In the east of the catchment, South East Water is proposing two new reservoirs with abstraction intakes on the River Ouse (RES-24 and Res-26). In addition, there is a joint effluent reuse scheme at Peacehaven (PWR_WRE and EFF-35) which proposes to discharge treated effluent to the River Ouse. Two desalination plants are proposed within the Sussex Coastal water body. They are located approximately 24 km apart. It is likely that dispersion characteristics of the discharge of any saline brine will be favourable and therefore a cumulative impact on the water body is unlikely. However, the possibility of other cumulative effects of having new desalination plants in such close proximity should be examined. **Recommendation:** The cumulative impact of the abstractions on the River Adur and the abstractions on the River Ouse, as well as the effluent discharge need to be assessed by the water companies.
		EFF-35	Effluent reuse to River Ouse: source Peacehaven (25Ml/d Option)	
		RES-24	New Arlington Reservoir	
		RES-26	Broyle Place Reservoir	
		RES-27	Goose Green Reservoir	
	Southern	DES_Sho	Coastal Desalination - Shoreham Harbour	
		PWR_WRE	Peaceheaven WwTW Indirect Potable Reuse	
		RES_Bla	Blackstone Reservoir	
Medway Catchment	South East	DES-13	Desalination of River Medway tidal water at Aylesford/Snodland. (30Ml/d Option)	**Identifying sources and pathways:** Bewl Raising is a joint scheme between Southern Water (RES_RaB) and South East Water (RES-22). Any changes in the operational pattern of the reservoir would need to be understood and the potential for impacts on the Teise and Lesser Teise River and the River Medway should be considered. Southern Water (PWR_Ayl) and South East Water (EFF-37) are also proposing a joint effluent reuse scheme at Aylesford on the River Medway, which could interact with the desalination scheme proposed on the tidal River Medway (DES-13). PWR_Ecc is a variation of the PWR_Ayl scheme which would involve diverting effluent away from the tidal River Medway. **Recommendation:** The cumulative impact of options and their interactions on the River Medway, its tributaries and estuary needs to be assessed by the water companies.
		EFF-37	Aylesford effluent re-use at Aylesford	
		RES-22	Raise Bewl Water and abstract additional yield at Bewl Bridge WTW	
	Southern	PWR_Ayl	Aylesford WWTW Indirect Potable Water Reuse - Medway	
		PWR_Ecc	Aylesford WWTW Indirect Potable Water Reuse - Eccles Lake	
		RES_RaB	Raising Bewl by 0.4m	

Surface water catchment	Water Company	Option ID	Options Name	Identifying linkages
Stour Catchment	Affinity	AFF-EFF-WRZ7-0910	Deal Supply Scheme	**Identifying sources and pathways:** Southern Water's SWA_Plu involves an abstraction on the Stour transitional water body. PWR_Plu involves the discharge of treated effluent about 5km upstream of an existing abstraction on the Stour at Plucks Gutter. South East Water are proposing a new winter storage reservoir, where raw water is proposed to be abstracted from the Great Stour at Plucks Gutter. South East Water are also proposing three effluent reuse schemes (EFF-19, EFF-30, EFF38) which could affect the Great Stour. EFF-38 would treat effluent from Southern Water's Weatherlees WwTW. EFF-19 involves treating wastewater effluent from Faversham WwTW and transferring it to the Great Stour River. EFF-30 involves treating wastewater effluent from Hythe WwTW and transferring it inland to the East Stour River. AFF-EFF-WRZ7-0910 involves the removal of network constraints for an existing groundwater source and therefore the impact on the Stour is negligible. **Recommendation:** The cumulative impact of the abstractions and discharges on the Stour should be assessed by Southern Water and South East Water.
	South East	EFF-19	Effluent Reuse, EA Stour regional study - Faversham WwTW	
		EFF-30	Effluent Reuse Hythe to East Stour	
		EFF-38	Indirect Use of effluent from Weatherlees WwTW - into Great Stour	
		RES-31	Broad Oak - larger reservoir size - 5,126 Ml (36m AOD)	
	Southern	PWR_Plu	Weatherlees WWTW Indirect Potable Water Reuse	
		SWA_Plu	Plucks Gutter WSW	
Upper Lee	Affinity	AFF-EGW-WRZ2-0087	Shakespeare Road Source Optimisation	**Identifying sources and pathways:** There are three options within the Upper Lee catchment that are considered due to the upstream location's relevance to the Thames wider catchment. AFF-EGW-WRZ2-0087 involves the disaggregation, upgrading pumps and treatment of a source in the Mid-Chilterns Chalk groundwater body and is unlikely to impact on the River Lee. AFF-NGW-WRZ3-1053 proposes to drill a new 200m borehole in the Lower Greensand aquifer. It is unclear if the option would impact on any surface water features but considered unlikely. AFF-NTW-WRZ3-1042 is a new treatment works which is dependent on an import from Anglian Water. It is considered unlikely that these options in the Upper Lee catchment would cumulatively impact on the River Lee and therefore the downstream Thames catchment. **Recommendation:** No further assessment required relating to cumulative effects between companies.
		AFF-NGW-WRZ3-1053	Kings Walden	
		AFF-NTW-WRZ3-1042	Sundon New Treatment Work	

Surface water catchment	Water Company	Option ID	Options Name	Identifying linkages
Thames (wider catchment)	South East	NSW-16	New Raw Water Abstraction from the River Thames upstream of Maidenhead, close to Reading. - 40Ml/d option	**Identifying sources and pathways:** Thames Water have several schemes that interact with the River Thames and transitional water, and will assess the cumulative impact for their programme. One Affinity Water option and one South East Water option have been highlighted as having the potential to interact with the River Thames, either directly or due to proposals for upstream water bodies. AFF-RES-WRZ4-0832A is a scheme to import water from the Canals & Rivers Trust reservoir at Brent which would be transmitted via the River Brent and the Grand Union Canal to an existing WTW for abstraction and subsequent treatment at a new WTW. The existing reservoir is about 14km upstream of the Thames Upper transitional water body. The River Brent discharges about 2km downstream of the Mogden waste water treatment works which forms part of the Thames Teddington Direct River Abstraction (DRA) option (CON-RA-MOG-TED, CON-RA-TED-TLT, RES-DRA-TED). NSW-16 is a new abstraction linked with the Thames strategic schemes for the River Thames (CON-RWT-DEH-CLM-300 and RES-RRR-ABI-150) and therefore the impact is being considered under the Thames Water programme. **Recommendation:** The assessment of the potential impact of the Affinity Water option AFF-RES-WRZ4-0832 on the River Thames downstream should be communicated with Thames Water. Both companies should then consider the potential for cumulative effects on the Thames transitional water body.
	Affinity	AFF-RES-WRZ4-0832	Brent Reservoir	
	Thames Water	CON-RA-MOG-TED	Mogden to Teddington 300 MLD	
		CON-RU-BEC-LCK	Beckton Reuse to Lockwood	
		CON-RU-DPH-KGV	Deephams to KGV Intake 60Ml/d	
		CON-RWS-KGV-360	KGV Res Intake Capacity Increase	
		CON-RWS-KGV-BPT-300	KGV to BPT South of William Girling 300Ml/d	
		CON-RWS-LCK-KGV-800	TLT extension from Lockwood to KGV - 800Ml/d	
		NET-DES-BEC-COP	Beckton Desalination to Coppermills Main Tunnel	
		RES-RU-DPH	Deephams Water Treatment Site	
		RES-DES-BEC-150	Beckton Desalination Site	
		RES-RU-BEC-150	Beckton Reuse 150	
		CON-RWT-DEH-CLM-300	Raw Water Transfer Deerhurst to Culham 300 MLD	
		RES-RRR-ABI-150	Abingdon 150	
		WTW-SWOX-ABI	Abingdon WTW Site	

Table 3 Potential for Cumulative Effects on within WFD Groundwater bodies

Groundwater body	Water Company	Option ID	Options Name	Identifying linkages
East Kent Chalk - Stour groundwater body	Affinity	AFF-EGW-WRZ7-0306	Cow Lane Upgrade	**Identifying sources and pathways:** GWA_Fle involves the aggregation of licences at Flemings and Woodnesborough boreholes. AFF-EGW-WRZ7-0306 is a scheme to upgrade the existing Cow Lane source to deploy its full licensed quantity. AFF-EGW-WRZ7-0629 is a scheme is to obtain a licence variation to allow Affinity Water to increase abstraction by 0.14Ml/d consistent with the volume of water is returned via soakaways. AFF-EGW-WRZ7-0908 is a scheme to bring back a disused groundwater source within an existing licence group. Therefore, there is a potential that the overall increase in abstraction could adversely affect the groundwater body's quantitative status (which is poor status in 2016). **Recommendation:** The water companies should consider the cumulative impact of the increase in abstractions upon the groundwater body and dependant rivers and habitats.
		AFF-EGW-WRZ7-0629	Lye Oak Licence Variation	
		AFF-EGW-WRZ7-0908	Tappington South - Licence Variation	
	Southern	GWA_Fle	Flemings and Woodnesborough WSW licence variation	
East Kent Tertiaries groundwater body	South East	DES-15	Reculver RO Desalination of brackish groundwater (30 Ml/d Option)	**Identifying sources and pathways:** GWA_Fle involves the aggregation of licences at Flemings and Woodnesborough boreholes. It predominantly abstracts from the East Kent Chalk – Stour groundwater body. The DES-15 scheme proposes to abstract brackish groundwater from new boreholes. Hydrogeological conditions indicate that the options between the two water companies are unlikely to interact. **Recommendation:** No further assessment required, unless site specific hydrogeological information indicates otherwise.
	Southern	GWA_Fle	Flemings and Woodnesborough WSW licence variation	
Lower Thames Gravels and Twyford Tertiaries groundwater bodies	Affinity	AFF-NGW-WRZ4-0624	Canal and Rivers Trust and GSK Slough Boreholes	**Identifying sources and pathways:** AFF-NGW-WRZ4-0624 is a proposal to obtain supplies from existing Lower Greensand boreholes that are currently owned by the Canals and River Trust and GSK via boreholes approximately 300 m deep. ASR-4 scheme involves the storage of treated water in the confined chalk aquifer lying in in winter, when there is surplus water available, for use in summer providing an increase in peak resource capacity. Both schemes are within the confined chalk aquifer and therefore unlikely to impact on surface water features and habitats. **Recommendation:** No further assessment required, unless site specific hydrogeological information indicates otherwise.
	South East	ASR-4	ASR Chalk Confined Aquifer (Beenhams Heath/White Waltham)	

Groundwater body	Water Company	Option ID	Options Name	Identifying linkages
Epsom North Downs Chalk groundwater body	SES Water	SES-EGW-SES-R22	Outwood Lane	**Identifying sources and pathways:** The two SES Water options involve increasing capacity at existing groundwater sources and the Thames Water option involves an increase in abstraction to existing licence limits. Therefore, there is a potential that the overall increase in abstraction could adversely affect the groundwater body's quantitative status (which is poor status in 2016). **Recommendation:** The water companies should consider the cumulative impact of the increase in abstractions upon the groundwater body and dependant rivers and habitats.
		SES-EGW-SES-R28	Lowering pumps at Kenley and Purley	
	Thames Water	RES-GW-ADD-1	Addington WTW	
North Kent Medway Chalk groundwater body	South East	LIC-20	EA licence No: 9/40/02/0064/B/GR	**Identifying sources and pathways:** LIC-20 involves the trading of an existing groundwater licence. RES-GW-SOU-8 involves the disaggregation of an abstraction licence group. BR_Lug involves the recommissioning of a licensed source that is currently out of service. Therefore, there is a potential that the overall increase in abstraction could adversely affect the groundwater body's quantitative status (which is poor status in 2016). **Recommendation:** The water companies should consider the cumulative impact of the increase in abstractions upon the groundwater body and dependant rivers and habitats.
	Southern	BR_Lug	Recommission Luddesdown Greensand groundwater source	
	Thames Water	RES-GW-SOU-8	Southfleet/Greenhithe disaggregation	
Effingham Tertiaries groundwater body	Affinity	AFF-NGW-WRZ6-0005	Horsley source recommissioning	**Identifying sources and pathways:** The SES Water options are located within the Dorking North Downs Chalk groundwater body and the Affinity option is within the Guildford Chalk groundwater body. Hydrogeological conditions indicate that the options between the two water companies are unlikely to interact. **Recommendation:** No further assessment required, unless site specific hydrogeological information indicates otherwise.
	SES Water	SES-EGW-SES-N4	Leatherhead licence increase	
		SES-EGW-SES-R5	New borehole (Mole Valley Chalk) - Fetcham Springs	

Groundwater body	Water Company	Option ID	Options Name	Identifying linkages
Berkshire Downs Chalk groundwater body	Southern	AE_Ewo	East Woodhay WSW	**Identifying sources and pathways:** The AE_Ewo scheme will increase the yield of the East Woodhay source within the existing licence by removing the present constraint imposed by mains leaving the site. The abstraction is from the confined chalk aquifer and less likely to interact with surface features. RES-GW-MOU1-3.5 involves a new borehole near to the River Thames, which has the potential to impact the flows. Hydrogeological conditions indicated that the options between the two water companies are unlikely to interact. **Recommendation:** No further assessment required, unless site specific hydrogeological information indicates otherwise.
	Thames Water	RES-GW-MOU1-3.5	Moulsford 1	

3.2 Discussion of Large Strategic Schemes

This sub section identifies the larger strategic schemes within WRSE on a regional WRSE basis for the entire feasible option lists for each water company. **Table 4** provides a list of all the water company options on the feasible list by option category. It provides a high level overview of the options for indicative purposes only as some of the options were difficult to categorise (e.g. an effluent reuse option may involve a transfer). What is apparent however is that over 50% of the options on the feasible lists are what can be considered larger strategic schemes (desalination, effluent reuse, reservoirs and transfers), rather than local water sources. Note that some of the desalination and effluent reuse schemes on the feasible lists had relatively small deployable outputs (e.g. 5 Ml/d).

Table 4 WRSE WRMP19 Feasible Options by Category

Option type	Affinity Water	Portsmouth Water	South East Water	Southern Water	SES Water	Thames Water	Total
Desalination	3		5	12		2	22
Effluent reuse	2		10	13		3	28
Storage Reservoir	6	1	9	4	1	1	22
Transfers	34	2	25	20	2	1	84
Groundwater	30		11	9	8	5	63
Water treatment works	4		13	3	2	6	28
Licensing			2				2
Network	2					7	9
Conjunctive Use			4				4
Conveyance						5	5
Surface water	2		2	2	3		9

One of the key messages from the Water UK study[11] on Water Resources Long-term Planning Framework document was that WRMP19 would have more large-scale transfers of water between companies and regions, which could be supported by reservoir storage and new local resources, as these strategies may offer the best value. **Figure 2** shows the distribution and type of transfer and/or reservoir options that are on water company feasible lists for WRMP19.

In contrast, it has also been observed that there are a relatively high number of high energy usage options such as effluent reuse and desalination on the feasible lists, as shown in **Figure 3.** In the analysis to date there appears to be less reliance on new local surface water and groundwater schemes.

Both **Figure 2** and **Figure 3** show the complex, inter-regional and trans-boundary nature of water resources. It is apparent that a mix of solutions that are beneficial for the water companies and the region are needed.

However, in the absence of a clear and specific government water resource supply options strategy, it is difficult for the regional optimisation of water resource supply schemes to be undertaken, whilst taking into account environmental and social factors. Regional water resource modelling is currently underway to optimise water resource option selection to balance supply and demand. These outputs are not yet available to consider alongside the cumulative environmental and social effects.

Decision-making processes are therefore made at an individual company level. This will deliver the least cost solutions that are environmentally beneficial at a specific water company level. However, to develop the optimum solution for WRSE, it may also be important to consider at a regional scale how the best value and most environmentally beneficial options are selected in order to deliver WRMPs that

[11] Water UK (2016) Water resources long-term planning framework (2015-2065. Technical Report: Atkins; Mott MacDonald; Nera; HR Wallingford; and Oxford University. Final. 20 July 2016

achieve the most suitable suite of supply and demand management options. This could include consideration of the mix of reservoirs, transfers, desalination and reuse across the WRSE region to meet the supply deficits.

Figure 2 WRMP19 Large Strategic Feasible Options: Transfers

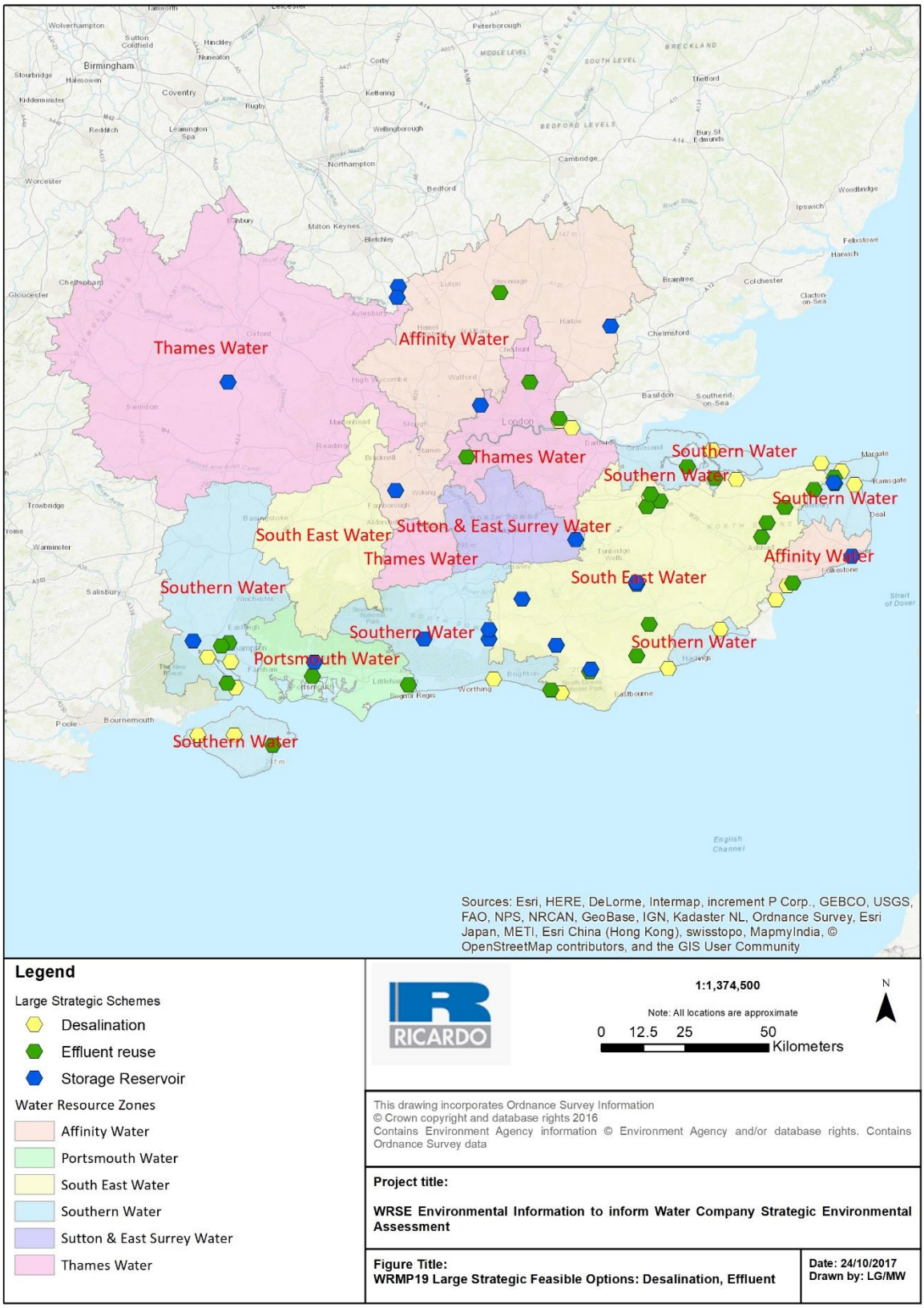

Figure 3 WRMP19 Large Strategic Feasible Options: Desalination, Effluent Reuse and Reservoirs

4 Summary and Recommendations

A region-wide cumulative effects assessment to support the Water Resource Management Plans (WRMPs) of each of the six water companies that form part of the Water Resources South East (WRSE) group has been carried out. The study has used supply side options within each company's WRMP19 feasible list. Data and evidence have been compiled so that each of the companies can establish their own cumulative effects assessment (CEA) within their own WRMP and associated SEAs. As such the key potential inter-relationships between schemes or options that each of the companies may need to consider in defining their own programmes have been identified and are summarised by receptor and water company in **Table 5**. The table shows that most of the interactions between options between water companies are between South East Water and Southern Water. Also compared with the pilot study, similar receptors and catchments have been highlighted for the consideration of cumulative effects (i.e. South Downs National Park, High Weald AONB, River Ouse, River Medway, River Thames) with some additional receptors.

Table 5 Summary of Potential Option Interactions by Receptor and Water Company that Require Further Assessment

Receptor	Affinity Water	Portsmouth Water	South East Water	Southern Water	SES Water	Thames Water
High value receptors						
South Downs National Park		✓	✓	✓		
North Wessex Downs AONB			✓	✓		✓
High Weald AONB			✓	✓		
Holborough to Burham Marshes SSSI			✓	✓		
Surface water catchments						
River Adur			✓	✓		
River Ouse			✓	✓		
Great Stour River and transitional water body			✓	✓		
River Medway and transitional water body			✓	✓		
River Thames and transitional water body	✓					✓
Groundwater bodies						
East Kent Chalk - Stour	✓			✓		
Epsom North Downs Chalk			✓			✓
North Kent Medway Chalk			✓	✓		✓

It is recommended that the WRSE group considers the optimum water resources solution for the south east region that would achieve the most benefit in terms of the environment. This could be done when all the individual option environmental assessments are completed and stakeholder feedback has been obtained, potentially within the consultation on their draft WRMP19s. An assessment of the balance of reservoirs, transfers, desalination and reuse options across the region to fulfil the supply demand deficits should be carried out, to ensure that decision-making is regionally optimised and that the potential for cumulative solutions that are cost beneficial and fully embed environmental benefit are selected.

The following specific recommendations are made to feed into the next iteration of cumulative effects assessments within SEAs for WRMP 2019:

- Continue to consider CEA at the WRSE group level throughout the WRMP19 process. Document and reference activities undertaken in this respect (such as this study) so that it can be made clear in water company SEA documentation how cumulative effects have been considered throughout and help demonstrate where this has influenced decisions within each WRMP.
- CEA is a staged process and the next steps for water companies would be further develop the understanding of the potential for in-combination effects between options using the individual option environmental assessments as a basis, as summarised in **Table 5**. Where it is recommended that the cumulative effects on a water body should be considered by the water companies, this further assessment should include the effects on associated protected areas (e.g. SACs, SPAs etc.).
- Drought options should be integrated and screened for potential cumulative effects on the environment in-combination with WRMP19 options.
- The potential for construction impacts of options located in close proximity should be carried out for the draft preferred programmes with the timing of construction activities built into the assessment.

Appendices

Appendix A	Environmental Information Data and GIS Geodatabase
Appendix B	Initial Options Grouping Showing Potential for Cumulative Effects between Water Companies

Appendix A Environmental Information Data and GIS Geodatabase

Supplied electronically.

Appendix B Initial Options Grouping Showing Potential for Cumulative Effects between Water Companies

Receptor	Water company	Option ID	Option name	Status confirmed on 11/10/2017	Comments option status from 11/10/2017	Water company comments on risk to the environment for the individual option from 11/10/2017
South Downs National Park	Portsmouth	B5290	Clanfield to Tilmore Bulk Transfer	Y	same as RTR-15	
	South East	DES-3	Desalination at Newhaven (RZ3) - Eastbourne (10Ml/d Option)	N	mutually exclusive with DES-8	
		DES-8	Desalination at Newhaven (RZ2) - Mid Sussex (10Ml/d Option)	Y		
		EFF-35	Effluent reuse to River Ouse: source Peacehaven (25Ml/d Option)	Y	same as PWR_WRE	
		RTR-15	PRT to SEW RZ5 Transfer - Clanfield to Tilmore SR (10 Ml/d)	Y	same as BS290	
		RTR-18	PRT to SEW RZ5 Transfer - Farlington WTW to Tilmore SR (20 Ml/d)	N		
		WTW-27	Oakhanger Replacement of option EGW-27 + NGW-13	N		low risk - just onsite expansion
	Southern	BS_ABO	Abingdon - Basingstoke - Otterbourne	Y		
		ASR_SCL	Sussex Coast - Lower Greensand	Y		
		BR_Rog	Transfer excess water for enhanced treatment at Rotherfield (Nightsfield midhurst high level WSR) with refurbishment of Rogate and BH rehabilitation.	Y		
		DES_Shl	Desalination plant at Sholing	N	unlikely	
		IZT_Har	Hardham Winter transfer	Y		
		PWR_BPC	Combine Budds Farm and Peel Common WwTWs to River Itchen Indirect Potable Reuse (90 Ml/d)	Y		
		PWR_For	Ford WWTW Indirect Potable Water Reuse	Y		
		PWR_Por	Portswood WwTW Indirect Potable Water Reuse	Y		
		PWR_Wol	Woolston WwTW Indirect Potable Reuse	Y		
		PWR_WRE	Peaceheaven WwTW Indirect Potable Reuse	Y		
		RES_Har	Reservoir at Hardham	Y		
Chilterns AONB	Affinity	AFF-CTR-WRZ2-2020	Boxted to Shakespeare Road	Y		
		AFF-CTR-WRZ3-1099	Boxted to Chaul End	n/a		
		AFF-NGW-WRZ1-1050	Canals & Rivers Trust - Cow Roast	n/a		
		AFF-NTW-WRZ3-1042	Sundon New Treatment Work	n/a		
		AFF-RES-WRZ3-0815	Edelsborough Reservoir	n/a		
		AFF-RTR-WRZ3-0860	New Anglian Water Imports	n/a		
		AFF-RTR-WRZ3-1067	Grand Union Canal (GUC) (Pitsford Transfer)	n/a		
	South East	NSW-15/ NSW-16/ NSW-17	New Raw Water Abstraction from the River Thames upstream of Maidenhead, close to Reading. - 20/ 40/ 60 Ml/d options	Y	If BS_Ott was selected it could follow a similar route to minimise impacts.	
North Wessex Downs AONB	South East	CGW-2	Septic tanks / cess pit discharge to Woodgarston	Y		
		NSW-15/ NSW-16/ NSW-17	New Raw Water Abstraction from the River Thames upstream of Maidenhead, close to Reading. - 20/ 40/ 60 Ml/d options	Y	If BS_Ott was selected it could follow a similar route to minimise impacts.	
		WTW-31	Woodgarston Nitrate Removal Plant	Y		
	Southern	AE_Ewo	East Woodhay WSW	Y		
		BS_Ott	Transfer from UTMRD to Otterbourne	N	Unlikely to be selected	Crosses the North Wessex Downs, there would be a risk of impact at an individual option level. A cumulative impact assessment would be required if the option were selected.
		IZT_OAN	Otterbourne to Crabwood WSR to Andover to Kingsclere	Y		
	Thames	RES-GW-MOU1-3.5	Moulsford 1	Y		
High Weald AONB	South East	CGW-3	Targeted catchment management interventions in the Pembury area	Y		Catchment management option - likely to have enviornmentally benificial effects
		CON-9	Conjunctive Use of Surface Water & Groundwater - Upper Rother	N		
		CTR-13	SEW RZ2 to RZ7 Transfer - Best Beech to Bewl (5Ml/d)	Y		
		CTR-14	SEW RZ7 to RZ2 Transfer - Bewl to Best Beech (5Ml/d)	N		
		CTR-17	SEW RZ1 to RZ7 Transfer - Blackhurst to Bewl (4Ml/d)	Y		
		CTR-18	SEW RZ7 to RZ1 Transfer - Kippings to Pembury (4Ml/d)	Y		
		CTR-27	SEW RZ8 to RZ7 Transfer - Kingsnorth to Bewl (7Ml/d)	N		
		CTR-39	SEW RZ6 to RZ1 Transfer - Aylesford to Blackhurst (4Ml/d)	Y		
		CTR-40	SEW RZ1 to RZ6 Transfer - Blackhurst to Aylesford (4Ml/d)	N		
		EFF-36	Effluent reuse to Wallers Haven: source - Bexhill	N		
		EFF-5	Indirect use of effluent from Ashford Bybrook WwTW - into River Beult	N		Red flag option.
		EGW-9	Enhance sources at Balcombe	n/a	drought option	
		NSW-1	Transfer Adur to Ardingly Reservoir	N		
		RES-22	Raise Bewl Water and abstract additional yield at Bewl Bridge WTW	Y	Same as RES_RaB. Not currently in but left in because SW option is in. Would be 25% of the SW scheme.	
		RES-29	Broad Farm Reservoir	N		
		RES-30	Raise Ardingly Reservoir	N		Red flag option.
		RTR-21	SWS to SEW RZ7 Transfer - Burham WTW to Bewl WTW (14.6 Ml/d)	N		
		RTR-22	SWS to SEW RZ7 Transfer - Burham WTW to Bewl WTW (14.6 Ml/d) - [Alternative Vitual Transfer Option]	Y	mutually exclusive with RTR-21	This involves a higher take of water at Bewl and upgrading the existing works
		RTR-88	SESW to SEW RZ1 Transfer - Bough Beech to Blackhurst SR (10Ml/d)	N		

Receptor	Water company	Option ID	Option name	Status confirmed on 11/10/2017	Comments option status from 11/10/2017	Water company comments on risk to the environment for the individual option from 11/10/2017
		RTR-89	SESW to SEW RZ1 Transfer - Bough Beech to Blackhurst SR (5Ml/d)	Y	With potential for 10Ml/d. Mutually exclusive with RTR-88	
		WTW-22	Bewl Bridge WTW Expansion - 14.6 Ml/d	Y	With RTR-22	
		WTW-24	Bewl Bridge WTW Expansion - 5 Ml/d	N		
		WTW-29	Bewl-Darwell Option 1c: Transfer of 8Ml/d from Bewl to Hazards Green via a Southern Route	Y		
		WTW-30	Bewl-Darwell Option 7a: A new WTW at Bewl Bridge and supply of treated water to SEW at Hazards Green and SW at Brede and Beauport	N		
		WTW-5	Crowhurst WTW recovery of process losses	Y		low risk - just upgrades onsite
	Southern	DES_Cam	Camber Desalination near Rye Bay 5 Ml/d	N		
		PWR_Dar	Bexhill and Hastings WWTW effluent to augment storage in Darwell Reservoir	N		
		RES_RaB	Raising Bewl by 0.4m	Y	Same as RES-22.	
Holborough to Burham Marshes SSSI	South East	DES-5	Desalination of River Medway tidal water at Aylesford/Snodland. (10 Ml/d Option)	Y		
		DES-12	Desalination of River Medway tidal water at Aylesford/Snodland. (20 Ml/d Option)	N		
		DES-13	Desalination of River Medway tidal water at Aylesford/Snodland. (30 Ml/d Option)	N		Red flag option.
		EFF-37	Aylesford effluent re-use at Aylesford	Y	Same as PWR_Ayl	
	Southern	BS_Hon	Honour Oak (London Water Ring Main) to Burham WTW	Y		
		DES_Med	River Medway Desalination, up as far as Allington Lock	N		
Basingstoke Canal SSSI	Affinity	AFF-RES-WRZ6-0829	West End Reservoir	N		
	South East	CTR-33	SEW RZ4 to RZ5 Transfer - Surrey Hills SR to Ewshot SR (23Ml/d)	N		
Broadmoor to Bagshot Woods and Heaths SSSI	Affinity	AFF-RTR-WRZ6-1094	Egham to Surrey Hills Reduction (10Ml/d)	Y		Just a reduction in bulk supply.
	South East	CTR-33	SEW RZ4 to RZ5 Transfer - Surrey Hills SR to Ewshot SR (23Ml/d)	N		
Lewes Brooks SSSI	South East	EFF-35	Effluent reuse to River Ouse: source Peacehaven (25Ml/d Option)	n/a		
	Southern	PWR_WRE	Peaceheaven WwTW Indirect Potable Reuse	n/a		
Sandwich Bay to Hacklinge Marshes SSSI	South East	EFF-38	Indirect Use of effluent from Weatherlees WwTW - into Great Stour	Y		
	Southern	DES_Sto	River Stour Desalination	N	Unlikely. Would only be an option if SEW could not promote their own option.	
Thanet Coast & Sandwich Bay SPA & Ramsar & SSSI	South East	DES-7	Reculver RO Desalination of brackish groundwater (10 Ml/d Option)	N		
		DES-14	Reculver RO Desalination of brackish groundwater (20 Ml/d Option)	N		
		DES-15	Reculver RO Desalination of brackish groundwater (30 Ml/d Option)	Y		
	Southern	DES_Sto	River Stour Desalination	N	Unlikely. Would only be an option if SEW could not promote their own option.	
		DES_Tha	Desalination in Thanet	N		
Outer Thames Estuary SPA & Thanet Coast MCZ	South East	DES-7	Reculver RO Desalination of brackish groundwater (10 Ml/d Option)	N		Red flag option.
		DES-14	Reculver RO Desalination of brackish groundwater (20 Ml/d Option)	N		Red flag option.
		DES-15	Reculver RO Desalination of brackish groundwater (30 Ml/d Option)	Y		Red flag option.
	Southern	DES_Tha	Desalination in Thanet	N		
Thames Basin Heaths SPA	Affinity	AFF-RTR-WRZ6-1094	Egham to Surrey Hills Reduction (10Ml/d)	N		
	South East	ASR-2	ASR- Confined Chalk around Farnborough	Y		Not within the WFD water body as it is a confined aquifer. Negligible risk.
		CTR-33	SEW RZ4 to RZ5 Transfer - Surrey Hills SR to Ewshot SR (23Ml/d)	N		
Thames Estuary MCZ	Southern	DES_Swa	River Thames Desalination: Desalination plant adjacent to Swancombe WwTW with abstraction from the Thames Estuary and transfer to Singlewell WSR	N		
	Thames Water	NET-TWRM-COP-HON	Coppermills to Honor Oak	Y		Will be tunnelled under the river so no impacts on the MCZ are anticipated.
		RES-DES-BEC-150	Beckton Desalination Site	Y	Unlikely option but leave in.	
		RES-RU-BEC-150	Beckton Reuse 150	Y		
Adur and Ouse Catchment	South East	CON-7	Conjunctive Use of Surface Water & Groundwater - River Ouse	N		
		DES-10	Desalination at Newhaven (RZ3) - Eastbourne (20Ml/d Option)	N		
		DES-11	Desalination at Newhaven (RZ3) - Eastbourne (30Ml/d Option)	N		
		DES-16	Desalination at Newhaven (RZ2) - Mid Sussex (20Ml/d Option)	N		
		DES-17	Desalination at Newhaven (RZ2) - Mid Sussex (30Ml/d Option)	N		
		DES-3	Desalination at Newhaven (RZ3) - Eastbourne (10Ml/d Option)	N		
		DES-8	Desalination at Newhaven (RZ2) - Mid Sussex (10Ml/d Option)	Y		
		EFF-35	Effluent reuse to River Ouse: source Peacehaven (25Ml/d Option)	Y	same as PWR_WRE	
		EFF-39	Effluent reuse to River Ouse: source Peacehaven (50Ml/d Option)	N		
		NSW-1	Transfer Adur to Ardingly Reservoir	N		
		RES-24	New Arlington Reservoir	Y		Abstracting from the Ouse
		RES-26	Broyle Place Reservoir	Y	Mutually exclusive with RES-24	Abstracting from the Ouse
		RES-27	Goose Green Reservoir	Y		Abstracting from the Adur
		RES-28	Halland Reservoir (near Laughton)	N		
		RES-29	Broad Farm Reservoir	N		
		RES-30	Raise Ardingly Reservoir	N		
	Southern	DES_Sho	Coastal Desalination - Shoreham Harbour	Y		

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		DES_Sto	River Stour Desalination	N		
		PWR_WRE	Peaceheaven WwTW Indirect Potable Reuse	Y	same as EFF_35	
		RES_Bla	Blackstone Reservoir	Y		
Medway	South East	DES-12	Desalination of River Medway tidal water at Aylesford/Snodland. (20Ml/d Option)	N		
		DES-13	Desalination of River Medway tidal water at Aylesford/Snodland. (30Ml/d Option)	Y		
		DES-5	Desalination of River Medway tidal water at Aylesford/Snodland. (10Ml/d Option)	N		
		EFF-37	Aylesford effluent re-use at Aylesford	Y	Same as PWR_Ayl	
		EFF-5	Indirect use of effluent from Ashford Bybrook WwTW - into River Beult	N		
		LIC-20	EA licence No: 9/40/02/0064/B/GR	Y	Trading of licence of an existing groundwater source	
		RES-22	Raise Bewl Water and abstract additional yield at Bewl Bridge WTW	Y	Same as RES_RaB. Not currently in but left in because SW option is in. Would be 25% of the SW scheme.	
	Southern	DES_IoS	Marchwood desalination 150 Ml/d with brine discharge into Solent via Fawley outfall	N		
		DES_Med	River Medway Desalination, up as far as Allington Lock	N		
		DES_Swa	River Thames Desalination: Desalination plant adjacent to Swancombe WwTW with abstraction from the Thames Estuary and transfer to Singlewell WSR	N		
		PWR_Ayl	Aylesford WWTW Indirect Potable Water Reuse - Medway	Y	same as EFF_37	
		PWR_Ecc	Aylesford WWTW Indirect Potable Water Reuse - Eccles Lake	Y		
		PWR_Mot	Motney Hill WWTW Indirect Potable Water Reuse	N		
		RES_RaB	Raising Bewl by 0.4m	Y	Same as RES-22	
	SES Water	SES-RES-SES-R1	Raising of Bough Beech reservoir	N		
Rother (eastern) catchment	Affinity	AFF-DES-WRZ7-0008	Hythe Beach Wells RO Desalination (brackish water)	N		Reg flag for HRA
		AFF-DES-WRZ7-0309	Full Desalination Scheme	N		Reg flag for HRA
		AFF-DES-WRZ7-0396	Hythe Beach Wells RO Desalination (brackish water)	N		Reg flag for HRA
		AFF-EFF-WRZ7-0605	Hythe Effluent Reuse Scheme	N		
	South East	EFF-30	Effluent Reuse Hythe to East Stour	Y		
		CON-9	Conjunctive Use of Surface Water & Groundwater - Upper Rother	N		
	Southern	DES_Cam	Camber Desalination near Rye Bay 5 Ml/d	N		
		PWR_Dar	Bexhill and Hastings WWTW effluent to augment storage in Darwell Reservoir	N		
Stour Catchment	Affinity	AFF-EFF-WRZ7-0910	Deal Supply Scheme	Y	Existing scheme, increase in peak abstraction to 4ML/d (0.07ML/d) on average)	
		AFF-RES-WRZ7-0839	Dover Docks Reservoir - Broomfield Banks Effluent Reuse	N		
	South East	CON-13	Conjunctive Use of Surface Water & Groundwater - Great Stour	N		
		EFF-19	Effluent Reuse, EA Stour regional study - Faversham WwTW	Y		
		EFF-2	Recharging Chalk Aquifers with Treated Sewage Effluent	N		
		EFF-28	Effluent Reuse Swalecliffe to tributary of Great Stour	N		
		EFF-30	Effluent Reuse Hythe to East Stour	Y		
		EFF-38	Indirect Use of effluent from Weatherlees WwTW - into Great Stour	Y		
		EFF-5	Indirect use of effluent from Ashford Bybrook WwTW - into River Beult	N		
		RES-23	Broad Oak Reservoir - Alternative 1b (2,815 Ml; 32.5m AOD) - Reduced size	N		
		RES-31	Broad Oak - larger reservoir size - 5,126 Ml (36m AOD)	Y	New reservoir, abstracts from Plucks Gutter	
	Southern	PWR_Plu	Weatherlees WWTW Indirect Potable Water Reuse	Y		
		SWA_Plu	Plucks Gutter WSW	Y		
Kent North Coastal water body	South East	DES-7	Reculver RO Desalination of brackish groundwater (10 Ml/d Option)	N		Red flag option.
		DES-14	Reculver RO Desalination of brackish groundwater (20 Ml/d Option)	N		Red flag option.
		DES-15	Reculver RO Desalination of brackish groundwater (30 Ml/d Option)	Y		Red flag option.
	Southern	DES_Sto	River Stour Desalination	N		
		DES_Tha	Desalination in Thanet	N		
Sussex Coastal water body	South East	DES-8	Desalination at Newhaven (RZ2) - Mid Sussex (10 Ml/d Option)	Y		
		DES-16	Desalination at Newhaven (RZ2) - Mid Sussex (20 Ml/d Option)	N		
		DES-17	Desalination at Newhaven (RZ2) - Mid Sussex (30 Ml/d Option)	N		
		DES-3/ DES-10/ DES-11	Desalination at Newhaven (RZ3) - Eastbourne (10/ 20 / 30 Ml/d Option)	N		
	Southern	DES_Aru	Tidal River Arun Desalination	N		
		DES_Sho	Coastal Desalination - Shoreham Harbour	Y		
East Kent Chalk - Stour groundwater body	Affinity	AFF-EGW-WRZ7-0306	Cow Lane Upgrade	Y		
		AFF-EGW-WRZ7-0322	Tilmanstone Pump & Treat (Minewater)	N		
		AFF-EGW-WRZ7-0629	Lye Oak Licence Variation	Y		

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		AFF-EGW-WRZ7-0908	Tappington South - Licence Variation	Y		
	South East	CON-13	Conjunctive Use of Surface Water & Groundwater - Great Stour	N		
		EFF-2	Recharging Chalk Aquifers with Treated Sewage Effluent	N		
	Southern	GWA_Fle	Flemings and Woodnesborough WSW licence variation	Y		
East Kent Tertiaries groundwater body	South East	CON-13	Conjunctive Use of Surface Water & Groundwater - Great Stour	N		
		DES-7	Reculver RO Desalination of brackish groundwater (10 Ml/d Option)	N		Red flag option.
		DES-14	Reculver RO Desalination of brackish groundwater (20 Ml/d Option)	N		Red flag option.
		DES-15	Reculver RO Desalination of brackish groundwater (30 Ml/d Option)	Y		Red flag option.
	Southern	GWA_Fle	Flemings and Woodnesborough WSW licence variation	Y		
Lower Thames Gravels groundwater body	Affinity	AFF-NGW-WRZ4-0624	Canal and Rivers Trust and GSK Slough Boreholes	Y	Scheme is late in the programme 2063.	Boreholes approximately 300 m deep in the confined Lower Greensand.
		AFF-TPO-WRZ4-0412	Hillingdon Hospital boreholes	N		
	South East	ASR-4	ASR Chalk Confined Aquifer (Beenhams Heath/White Waltham)	Y		Not within the WFD water body as it is a confined aquifer. Negligable risk.
Epsom North Downs Chalk groundwater body	SES Water	SES-EGW-SES-R22	Outwood Lane	Y		
		SES-EGW-SES-R28	Lowering pumps at Kenley and Purley	Y		
	Thames Water	RES-GW-ADD-1	Addington WTW	Y		
North Kent Medway Chalk groundwater body	South East	LIC-20	EA licence No: 9/40/02/0064/B/GR	Y	Trading of licence of an existing groundwater source	
		NGW-24	Halling - New Licence / redistribution of licence wrt Halling Lake	n/a	Drought option	
	Southern	BR_Lug	Recommission Luddesdown Greensand groundwater source	Y		
	Thames Water	RES-GW-SOU-8	Southfleet/Greenhithe disaggregation	Y		
Effingham Tertiaries groundwater body	Affinity	AFF-NGW-WRZ6-0005	Horsley source recommissioning	Y		
	SES Water	SES-EGW-SES-N4	Leatherhead licence increase	Y		
		SES-EGW-SES-R5	New borehole (Mole Valley Chalk) - Fetcham Springs	Y		
Twyford Tertiaries groundwater body	Affinity	AFF-NGW-WRZ4-0624	Canal and Rivers Trust and GSK Slough Boreholes	Y	Scheme is late in the programme 2063.	Boreholes approximately 300 m deep in the confined Lower Greensand.
	South East	ASR-4	ASR Chalk Confined Aquifer (Beenhams Heath/White Waltham)	Y		Not within the WFD water body as it is a confined aquifer. Negligible risk.
Berkshire Downs Chalk groundwater body	Southern	AE_Ewo	East Woodhay WSW	Y		
	Thames Water	RES-GW-MOU1-3.5	Moulsford 1	Y		
Thames (wider catchment)	South East	NSW-15	New Raw Water Abstraction from the River Thames upstream of Maidenhead, close to Reading. - 20Ml/d option	N		
		NSW-16	New Raw Water Abstraction from the River Thames upstream of Maidenhead, close to Reading. - 40Ml/d option	Y	A new abstraction considered under the Thames Water programme	
		NSW-17	New Raw Water Abstraction from the River Thames upstream of Maidenhead, close to Reading. - 60Ml/d option	N		
	Affinity	AFF-RES-WRZ4-0832	Brent Reservoir	Y	An exisitng asset (Canal and River Trust)	
		AFF-RES-WRZ5-0809	Birds Green Reservoir	N		
	Thames Water	CON-RA-MOG-TED	Mogden to Teddington 300 MLD	Y		
		CON-RU-BEC-LCK	Beckton Reuse to Lockwood	Y		
		CON-RU-DPH-KGV	Deephams to KGV Intake 60Ml/d	Y		
		CON-RWS-KGV-360	KGV Res Intake Capacity Increase	Y		
		CON-RWS-KGV-BPT-300	KGV to BPT South of William Girling 300Ml/d	Y		
		CON-RWS-LCK-KGV-800	TLT extension from Lockwood to KGV - 800Ml/d	Y		
		NET-DES-BEC-COP	Beckton Desalination to Coppermills Main Tunnel	Y		
		RES-DES-CRO	Crossness Desalination	N		
		RES-RU-DPH	Deephams Water Treatment Site	Y		
		RES-DES-BEC-150	Beckton Desalination Site	Y		
		RES-RU-BEC-150	Beckton Reuse 150	Y		
Upper Lee	Affinity	AFF-EFF-WRZ3-0180	Stevenage STW - Effluent Reuse	N		
		AFF-EGW-WRZ2-0087	Shakespeare Road Source Optimisation	Y		
		AFF-EGW-WRZ3-0502	Musley Lane Peak Licence Scheme	N		
		AFF-EGW-WRZ5-1057	Roydon Peak Scheme	N		
		AFF-NGW-WRZ3-1053	Kings Walden	Y		
		AFF-NGW-WRZ5-0877	Essex Confined Chalk Aquifer, with Artificial Recharge and Storage	N		
		AFF-NTW-WRZ3-1042	Sundon New Treatment Work	Y		
		AFF-RES-WRZ3-0814	Honeywick Rye Reservoir	N		
		AFF-RES-WRZ3-0815	Edelsborough Reservoir	N		
		AFF-RES-WRZ5-0809	Birds Green Reservoir	N		

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