



Portsmouth Water

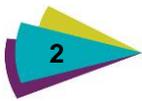
Water Resources Management Plan 2019

Habitats Regulations Assessment of the Revised WRMP



August 2018

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Document revisions

No.	Details	Date
1	Draft report for PW comment	Nov 2017
2	Review version	Feb 2018
3	Report for consultation	Feb 2018
4	Draft HRA Report for Revised WRMP for PW comment	Aug 2018

Executive summary

Background

All water companies in England and Wales must set out their strategy for managing water resources across their supply area over the next 25 years. This statutory requirement is defined under the Water Act 2003, which also sets out how water companies should publish a Water Resources Management Plan (WRMP) for consultation, setting out how they will balance supply and demand over the 25-year planning period.

Portsmouth Water (PW) is currently preparing its WRMP for the period 2020 – 2045. The WRMP process identifies potential deficits in the future availability of water, taking into account

- ▶ abstraction volumes allowed under current statutory licences, as impacted by actual source yield;
- ▶ any future reductions in abstraction expected under environmental improvement regimes (e.g. sustainability reductions required due to the Review of Consents or Water Framework Directive); and
- ▶ predicted future demand for water based on government data for population and housing growth plans.

It then proposed solutions ('Preferred Options') for maintaining the balance between water available and future demand for water. Portsmouth Water completed a draft Water Resources Management Plan (WRMP19) for the period 2020 to 2045. This was issued for a 12 week consultation beginning on 5th March 2018. Following an analysis of the submissions, and further modelling, Portsmouth Water has now produced a revised WRMP.

Regulation 63 of the *Conservation of Habitats and Species Regulations 2017* (the 'Habitats Regulations') states that if a plan or project is "(a) is likely to have a significant effect on a European site¹ or a European offshore marine site² (either alone or in combination with other plans or projects); and (b) is not directly connected with or necessary to the management of the site" then the competent authority must "...make an appropriate assessment of the implications for the site in view of that site's conservation objectives" before the plan is given effect.

The process by which Regulation 63 is met is known as Habitats Regulations Assessment (HRA)³. An HRA determines whether there will be any 'likely significant effects' (LSE) on any European site as a result of a plan's implementation (either on its own or 'in combination' with other plans or projects) and, if so, whether these effects will result in any adverse effects on the site's integrity. PW has a statutory duty to prepare its WRMP and is therefore the Competent Authority for any HRA.

PW commissioned Amec Foster Wheeler Environment & Infrastructure UK Ltd. (now Wood Environment & Infrastructure Solutions UK Ltd. (Wood)) to undertake the data collection and interpretation required to support an HRA of its WRMP for the period 2020 – 2045, and to determine whether any aspects

¹ Strictly, 'European sites' are: any Special Area of Conservation (SAC) from the point at which the European Commission and the UK Government agree the site as a 'Site of Community Importance' (SCI); any classified Special Protection Area (SPA); any candidate SAC (cSAC); and (exceptionally) any other site or area that the Commission believes should be considered as an SAC but which has not been identified by the Government. However, the term is also commonly used when referring to potential SPAs (pSPAs), to which the provisions of Article 4(4) of Directive 2009/147/EC (the 'new wild birds directive') apply; and to possible SACs (pSACs) and listed Ramsar Sites, to which the provisions of the Habitats Regulations are applied a matter of Government policy (NPPF para 118) when considering development proposals that may affect them. "European site" is therefore used in this report in its broadest sense, as an umbrella term for all of the above designated sites. Additional information on European site designations is provided in Appendix A.

² 'European offshore marine sites' are defined by Regulation 15 of *The Offshore Marine Conservation (Natural Habitats, &c.) Regulations 2007* (as amended); these regulations cover waters (and hence sites) over 12 nautical miles from the coast.

³ The term 'Appropriate Assessment' has been historically used to describe the process of assessment; however, the process is now more accurately termed 'Habitats Regulations Assessment' (HRA), with the term 'Appropriate Assessment' limited to the specific stage within the process.

of the WRMP (alone or in-combination) could have significant or significant adverse effects on the integrity of any European sites. The HRA process (as applied to the WRMP) therefore includes the following steps:

- i. A review of the Feasible Options, to assist PW's selection of Preferred Options.
- ii. An assessment of the draft Preferred Options, comprising screening and (where necessary) an 'appropriate assessment', which accompanied the draft WRMP consultation (earlier versions of this report).
- iii. A formal assessment of the post-consultation 'revised Preferred Options', which form the 'revised WRMP' and which would be intended for adoption (this report).

Assessment Summary

The draft WRMP identified a deficit in the average and peak week baseline supply/demand balance. In addition, the Water Resources in the South East (WRSE) has identified the need for further bulk supplies from Portsmouth Water to neighbouring companies. Portsmouth Water has included bulk supplies that other companies have agreed to in principle. These bulk supplies drive the supply/demand balance and the need for options to meet the demand.

A number of feasible options were identified to address this deficit. Informed by the environmental, social and economic assessments and ongoing discussion with stakeholders, the list of feasible options was refined to identify 15 draft Preferred Options, which formed the draft WRMP and which were subject to public consultation.

Following consultation on the draft WRMP and the responses from the regulators and consultees, further changes were made to the WRMP. These principally comprised alterations to the preferred 'demand-management' and 'leakage reduction' options, with four new and three revised options proposed. The 'resource management' options were unchanged. The 'revised WRMP' therefore comprises twenty-one Revised Preferred Options, which have been subject to HRA. The 'revised Preferred Options are as follows:

Table NTS1 – Portsmouth Water WRMP Revised Preferred Options

Option	Type	Option Name	Yield (MI/d)
R013	Supply-side	Havant Thicket	23.0 MI/d
R021a	Supply-side	Source O DO Recovery	1.8 MI/d
R022a	Supply-side	Source J Group – Maximising DO	12.5 MI/d
R023a	Supply-side	Source H DO Recovery	2.0 MI/d
R024a	Supply-side	Source C DO recovery scheme	5.5 MI/d
R068	Supply-side	Source S Drought Permit	8.5 MI/d
C005	Customer-side	Meters – Not for Revenue (MNFR) Switchers	0.08 MI/d
C006	Customer-side	Metering on change of occupancy - all properties	4.68 MI/d
C006a	Customer-side	Metering on change of occupancy - existing meter pits	0.28 MI/d
C026a	Customer-side	Water Efficient Appliance Subsidy	0.31 MI/d
C034	Customer-side	Water saving devices – Retrofitting existing toilets (with flush >9l)	0.11 MI/d
C040	Customer-side	Water Saving Devices – Spray Taps	0.07 MI/d
C043	Customer-side	Water saving devices - Trigger nozzles & water butts	0.06 MI/d
C046	Customer-side	Household water efficiency programme (Partnering approach, home visit)	1.23 MI/d

Option	Type	Option Name	Yield (MI/d)
C084	Customer-side	Void turnaround	0.28 MI/d
C078	Drought	Drought: Voluntary restraint & leakage action	4.3 MI/d
C079	Drought	Drought: Mandatory restraint	8.3 MI/d
C080	Drought	Imposition of Drought Direction Restrictions (mandatory commercial restraint)	8.1 MI/d
D004a	Leakage	Leakage reduction (Tranche 1) Noise Loggers	5.4 MI/d
D004b	Leakage	Leakage reduction (Tranche 2) Noise Loggers	5.4 MI/d
D005	Leakage	Leak detection - Partial district metering	5.0 MI/d

The screening and (where necessary) appropriate assessment of these options is summarised in **Table NTS2** below.

The conclusion of the HRA of the revised WRMP is that the plan will have **no adverse effects, alone or in combination**, on any European sites taking into account established scheme-level mitigation and avoidance measures that will clearly be available, achievable and likely to be effective. This conclusion does not remove the need for consideration of Regulation 63 at the project-level, which will be required to address those aspects and uncertainties that cannot be meaningfully assessed at the plan-level, such as potential 'in combination' effects with forthcoming plans or projects that may coincide with option delivery or individual leakage-reduction schemes that may be identified.

NTS 2 – Summary of plan-level assessment of options (including ‘in combination’ effects and incorporated measures)

Option	Aspect	LSE	AE	Summary of Assessment	Key avoidance / mitigation measures
Demand side options / Water efficiency / Drought	Constr.	N	-	Demand side options will not involve any construction that could result in significant effects.	-
	Oper.	N	-	Options cannot negatively affect European sites.	-
Leakage options	Constr.	U	N	Potential construction effects of leakage options cannot be identified at the plan-level (no location information) and so any assessment of the effects of individual leakage repairs can only be made at the scheme level.	Established best-practice avoidance and mitigation measures (Appendix G).
	Oper.	N	-	Options cannot negatively affect European sites.	-
R013 Havant Thicket	Constr.	U	N	Construction stage effects possible on Solent Maritime SAC and Chichester and Langstone Harbours SPA / Ramsar, but avoidable with normal best practice.	Established best-practice avoidance and mitigation measures (Appendix G), including all bespoke measures identified for the options below.
	Oper.	U	N	The operational effects of this scheme have been considered in detail through previous assessments, which have concluded either no significant effect or no adverse effect.	-
R021a: Source O DO Recovery	Constr.	U	N	Construction of this scheme will have no effects on the interest features of any European sites, due to distance, the absence of reasonable impact pathways, and the reliability of best-practice construction measures. The plan-level conclusion for this option would therefore be ‘no likely significant effects alone or in combination’.	Established best-practice avoidance and mitigation measures (Appendix G).
	Oper.	N	-	The option will not result in an increase in abstraction from the aquifer (i.e. there would be DO gain through improved borehole operation rather than increases in abstracted volumes). The plan-level conclusion for this option would therefore be ‘no likely significant effects alone or in combination’.	-
R022a Source J Group – Maximising DO	Constr.	U	N	Minor works; potential effects avoidable with normal best practice; no significant effects alone or in combination.	Established best-practice avoidance and mitigation measures (Appendix G), including all bespoke measures identified for the options below.
	Oper.	N	-	The abstraction at Source J is from the confined chalk aquifer and therefore abstraction is not expected to result in significant changes to flows in the surface water courses. Further, the Post Implementation Monitoring/Water Framework Directive investigations found that there were no significant impacts from abstraction at Source J.	-



Option	Aspect	LSE	AE	Summary of Assessment	Key avoidance / mitigation measures
R023a Source H DO Recovery	Constr.	U	N	Construction of this scheme will have no effects on the interest features of any European sites, due to distance, the absence of reasonable impact pathways, and the reliability of best-practice construction measures. The plan-level conclusion for this option would therefore be 'no likely significant effects alone or in combination'.	Established best-practice avoidance and mitigation measures (Appendix G).
	Oper.	N	-	The option will not result in an increase in abstraction from the aquifer (i.e. there would be DO gain through improved borehole operation rather than increases in abstracted volumes). The plan-level conclusion for this option would therefore be 'no likely significant effects alone or in combination'.	-
R024a Source C DO recovery scheme	Constr.	N	-	Minor works; no impact pathways; no effects.	-
	Oper.	N	-	Asset improvement scheme operating within Portsmouth Water's currently licensed volumes and therefore no operational effects on water-resource sensitive sites will occur.	-
R068 Source S Drought Permit	Constr.	-	-	The nearest European sites are Duncton – Bignor Escarpment SAC (~5km, not water resource sensitive), and Arun Valley SAC, Arun Valley SPA and Arun Valley Ramsar (~8.3km, on the far side of the River Arun). There are no water resource sensitive European sites within 5km of the borehole (and so direct effects on groundwater dependent terrestrial ecosystems due to any additional drawdown would not be expected) and the borehole is not within the catchment of any European sites (i.e. any effects on surface waters due to increased abstraction will not affect any European sites). The groundwater drawdown associated with borehole operation will not affect the Arun Valley sites (principally alluvial grazing marsh and relict raised bog). As a result, operational effects would not be expected. No construction works are proposed, although any construction required would not affect any European sites. As a result, no effects would be expected as a result of this scheme.	-



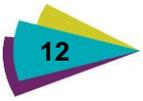
Option	Aspect	LSE	AE	Summary of Assessment	Key avoidance / mitigation measures
	Oper.	N	-	<p>The nearest European sites are Duncton – Bignor Escarpment SAC (~5km, not water resource sensitive), and Arun Valley SAC, Arun Valley SPA and Arun Valley Ramsar (~8.3km, on the far side of the River Arun). There are no water resource sensitive European sites within 5km of the borehole (and so direct effects on groundwater dependent terrestrial ecosystems due to any additional drawdown would not be expected) and the borehole is not within the catchment of any European sites (i.e. any effects on surface waters due to increased abstraction will not affect any European sites). The groundwater drawdown associated with borehole operation will not affect the Arun Valley sites (principally alluvial grazing marsh and relict raised bog). As a result, operational effects would not be expected. No construction works are proposed, although any construction required would not affect any European sites. As a result, no effects would be expected as a result of this scheme.</p>	-



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1. Introduction

Portsmouth Water (PW) is setting out its strategy for managing its water resources over the next 25 years in its Water Resources Management Plan (WRMP). This plan is subject to the *Conservation of Habitats and Species Regulations 2017* and so requires an assessment of its effects on European sites, known as ‘Habitat Regulations Assessment’ (HRA).

1.1 Portsmouth Water’s WRMP

All water companies in England and Wales must set out their strategy for managing water resources across their supply area over the next 25 years. This statutory requirement is defined under the Water Act 2003, which also sets out how water companies should publish a Water Resources Management Plan (WRMP) for consultation, setting out how they will balance supply and demand over the 25-year planning period.

The WRMP process identifies potential deficits in the future availability of water and sets out the possible solutions required to maintain the balance between water available and future demand for water. The process initially reviews as many potential solutions as possible (the ‘unconstrained list’ of options) to identify ‘feasible’ options for each Water Resource Zone (WRZ) where deficits are predicted. These ‘feasible’ options are reviewed according to an industry standard methodology to identify ‘Preferred Options’ to resolve any supply deficits in relation to financial, environmental and social costing. This preferred list is based on standard assessment methodologies set out in the WRMP, as well as the Strategic Environmental Assessment (SEA) and the Habitats Regulations Assessment (HRA). The WRMP is also linked to other water resource planning and policy documents, including the Drought Plan, Water Efficiency Strategy and Leakage Strategy.

Portsmouth Water (PW) is currently preparing its WRMP for the period 2020 – 2045. PW published a ‘draft WRMP’ for public consultation in March 2018 with its draft Preferred Options, following an assessment of unconstrained options and feasible options. Following an analysis of the consultation submissions, and further modelling, Portsmouth Water has now produced a revised WRMP. The revised WRMP will be submitted to the Secretary of State for Environment, Food and Rural Affairs. A statement of response will also be submitted containing all the consultation submissions received and Bristol Water’s response. The statement of response and revised WRMP will be set to the Environment Agency for review. A decision will then be taken as to whether the revised WRMP can be published or whether further work is required before it can be published.

1.2 Habitats Regulations Assessment

Regulation 63 of the *Conservation of Habitats and Species Regulations 2017* (the ‘Habitats Regulations’) states that if a plan or project is “(a) is likely to have a significant effect on a European site⁴ or a European offshore marine site⁵ (either alone or in combination with other plans or projects); and (b) is not directly connected with or necessary to the management of the site” then the competent authority must “...make an

⁴ Strictly, ‘European sites’ are: any Special Area of Conservation (SAC) from the point at which the European Commission and the UK Government agree the site as a ‘Site of Community Importance’ (SCI); any classified Special Protection Area (SPA); any candidate SAC (cSAC); and (exceptionally) any other site or area that the Commission believes should be considered as an SAC but which has not been identified by the Government. However, the term is also commonly used when referring to potential SPAs (pSPAs), to which the provisions of Article 4(4) of Directive 2009/147/EC (the ‘new wild birds directive’) apply; and to possible SACs (pSACs) and listed Ramsar Sites, to which the provisions of the Habitats Regulations are applied a matter of Government policy (NPPF para. 118) when considering development proposals that may affect them. “European site” is therefore used in this report in its broadest sense, as an umbrella term for all of the above designated sites. Additional information on European site designations is provided in Appendix A.

⁵ ‘European offshore marine sites’ are defined by Regulation 15 of *The Offshore Marine Conservation (Natural Habitats, &c.) Regulations 2007* (as amended); these regulations cover waters (and hence sites) over 12 nautical miles from the coast.

appropriate assessment of the implications for the site in view of that site's conservation objectives" before the plan is given effect.

The process by which Regulation 63 is met is known as Habitats Regulations Assessment (HRA)⁶. An HRA determines whether there will be any 'likely significant effects' (LSE) on any European site as a result of a plan's implementation (either on its own or 'in combination' with other plans or projects) and, if so, whether these effects will result in any adverse effects on the site's integrity. PW has a statutory duty to prepare its WRMP and is therefore the Competent Authority for any HRA.

1.3 This Report

Regulation 63 essentially provides a test that the final plan must pass; there is no statutory requirement for HRA to be undertaken on draft plans or similar developmental stages (e.g. the unconstrained or Feasible Options). However, it is accepted best-practice for the HRA of strategic planning documents to be run as an iterative process alongside plan development, with the emerging proposals or options assessed for their possible effects on European sites and modified or abandoned (as necessary) to ensure that the subsequently adopted plan is not likely to result in significant or significant adverse effects on any European sites, either alone or 'in combination' with other plans. This is undertaken in consultation with Natural England (NE), Natural Resources Wales (NRW) and other appropriate consultees.

PW commissioned Amec Foster Wheeler Environment & Infrastructure UK Ltd. (now Wood Environment & Infrastructure Solutions UK Ltd. (Wood)) to undertake the data collection and interpretation required to support an HRA of its WRMP for the period 2020 – 2045, and to determine whether any aspects of the WRMP (alone or in-combination) could have significant or significant adverse effects on the integrity of any European sites. The HRA process (as applied to the WRMP) therefore includes the following steps: :

- i. A review of the Feasible Options, to assist PW's selection of Preferred Options.
- ii. An assessment of the draft Preferred Options, comprising screening and (where necessary) an 'appropriate assessment', which accompanied the draft WRMP consultation (earlier versions of this report).
- iii. A formal assessment of the post-consultation revised Preferred Options, which form the revised WRMP and which would be intended for adoption (this report).

This report summarises Wood's assessment of PW's revised Preferred Options against the conservation objectives of any European sites that may be affected, and summarises the iterative HRA process that has been undertaken to support the WRMP and ensure that it meets the requirements of Regulation 63. The report sets out:

- ▶ the approach to HRA of WRMPs, including the key issues for these strategic plans (**Section 2**)
- ▶ a summary of the Feasible Options review (**Section 3**);
- ▶ the screening and (where required) appropriate assessment of the revised Preferred Options and WRMP as a whole, including 'in combination' assessments (**Section 4**).
- ▶ the proposed conclusion of the HRA of PW's WRMP, based on the revised version of the plan (**Section 5**).

This updated HRA report focuses on the Revised WRMP which has been modified following consultation; the updated HRA takes account of comments received from NE (and other consultees).

⁶ The term 'Appropriate Assessment' has been historically used to describe the process of assessment; however, the process is now more accurately termed 'Habitats Regulations Assessment' (HRA), with the term 'Appropriate Assessment' limited to the specific stage within the process.

2. Approach to HRA of WRMPs

WRMPs identify specific measures for addressing predicted deficits, but the strategic nature of the WRMP creates some challenges for HRA as there are fundamental limitations on the scheme details and data that are available at the plan-level. This section summarises the approach used for HRAs of WRMPs, and the mechanisms employed to address residual uncertainties.

2.1 Plan-Level HRA

An HRA involves determining whether there will be any LSEs on any European sites (see **Appendix A**) as a result of a plan's implementation, either on its own or 'in combination' with other plans or projects (referred to as 'screening'); and, if so, whether it can be concluded that these effects will not have an adverse effect on the site's integrity (referred to as 'appropriate assessment'). European Commission guidance⁷ suggests a four-stage process for HRA, although not all stages will always be required (see **Box 1**).

Box 1 – Stages of Habitats Regulations Assessment

Stage 1 – Screening:

This stage identifies the likely impacts upon a European site of a project or plan, either alone or 'in combination' with other projects or plans, and considers whether these impacts are likely to be significant.

Stage 2 – Appropriate Assessment:

Where there are likely significant effects, or where this is uncertain, this stage considers the effects of the plan or project on the integrity of the relevant European Sites, either alone or 'in combination' with other projects or plans, with respect to the sites' structure and function and their conservation objectives. Where it cannot be concluded that there will be no adverse effects on sites' integrity, it is necessary to consider potential mitigation for these effects.

Stage 3 – Assessment of Alternative Solutions:

Where adverse effects remain after the inclusion of mitigation, this stage examines alternative ways of achieving the objectives of the project or plan that avoid adverse impacts on the integrity of European sites.

Stage 4 – Assessment Where No Alternative Solutions Exist and Where Adverse Impacts Remain:

This stage assesses compensatory measures where it is deemed that the project or plan should proceed for imperative reasons of overriding public interest (IROPI). The EC guidance does not deal with the assessment of IROPI.

The 'screening' test or 'test of significance' is a low bar: a plan should be considered 'likely' to have an effect if the competent authority (in this case PW) is unable (on the basis of objective information) to exclude the possibility that the plan could have significant effects on any European site, either alone or in combination with other plans or projects; an effect will be 'significant' if it could undermine the site's conservation objectives.

An 'appropriate assessment' stage provides a more detailed examination of the plan (or its components) where the effects are significant or uncertain⁸, to determine whether there will be any 'adverse effects on integrity' (AEoI) of any sites as a result of the plan. It should be noted that the approach to the 'appropriate assessment' is not prescribed: it must simply be 'appropriate' to the plan being considered and the scale and nature of the likely effects; and be sufficient to remove any residual uncertainties regards the effect of the proposals on site and feature integrity.

The approach summarised in **Box 1** works well at the project-level where the scheme design is usually established and possible effects on European sites can be assessed (usually quantitatively) using a stepwise process and detailed scheme-specific data. In contrast, the fundamental nature of the WRMP presents a number of distinct challenges for a 'strategic' HRA and it is therefore important to understand how the WRMP

⁷ *Methodological guidance on the provisions of Article 6(3) and (4) of the Habitats Directive 92/43/EEC* (EC 2002).

⁸ i.e. 'likely significant effects', where the possibility of significant effects cannot be excluded.

is developed, how it would operate in practice, and hence how it might consequently affect European sites. In particular, there is a potential conflict between the specific nature of the options; the requirement that the options (and hence the plan) have 'no likely significant effects (LSE)' or 'no adverse effects'; the level of certainty that can be established at the strategic level; and the desirability of not excluding every potential solution which cannot be conclusively investigated within the WRMP development timescales.

2.2 The WRMP

The WRMP process establishes supply and demand balances for the PW WRZ, identifying potential supply deficits between water available and the projected demand. Options are then proposed to resolve these deficits. The estimation of Deployable Output (DO) is based on:

- ▶ abstraction volumes allowed under current statutory licences, as impacted by actual source yield;
- ▶ any future reductions in abstraction expected under environmental improvement regimes (e.g. sustainability reductions required due to the Review of Consents (see Appendix B) or Water Framework Directive); and
- ▶ predicted future demand for water based on government data for population and housing growth plans.

Demand forecasts are completed in accordance with the *Final Water Resources Planning Guidelines* (published by the Environment Agency and Natural Resources Wales in May 2016) and consider (*inter alia*):

- ▶ Estimates of baseline demand from:
 - ▶ household customers;
 - ▶ non-household customers;
 - ▶ water leaks;
 - ▶ any other losses or uses of water such as water taken unbilled.
- ▶ Future demands which will be subject to many influences, including:
 - ▶ population changes, including changes in occupancy;
 - ▶ changes in water use behaviour (in both household and non-household customers);
 - ▶ metering;
 - ▶ increasing water efficiency and sustainable water use practices;
 - ▶ changing design standards of devices that use water (eg more efficient washing machines);
 - ▶ changes in technology and practices for leakage detection and repair;
 - ▶ climate change; and
 - ▶ weather patterns.

The WRMP therefore accounts for these demand forecasts based on historical trends, an established growth forecast model, and a thorough review of water resource policy and planning documents.

The WRMP process initially sets out an 'unconstrained list' of possible solutions regardless of cost or technical merit. This is then refined to identify '**Feasible Options**' and subsequently the '**Preferred Options**'. This filtering process is based on a range of assessments including SEA and the principles of Habitats Regulations Assessment. The list of Feasible Options is subject to financial, environmental and social costing, with these options then reviewed and assessed to derive 'Preferred Options' for the zones that are predicted to be in deficit within the planning horizon (25 years).

Options to resolve deficits or predicted deficits can be broadly categorised as follows:

- ▶ **Production and Resource Management** - options that vary yield (e.g. new abstractions) or which reduce/ modify usage from where it is abstracted to where it enters the network;
- ▶ **Customer-side Management** - options which reduce customers' consumption; and
- ▶ **Distribution Management** - options within or affecting the distribution network, such as leakage reduction or new distribution pipelines.

These are also characterised as '**demand-side**' measures (options which reduce consumption post-treatment, such as metering or leakage reduction) or '**supply-side**' measures (options that vary yield). The HRA focuses on the supply-side options⁹ and their potential effects. The options will generally require one or more of the following:

- ▶ development of new surface or groundwater sources, or desalination of sea water ('new water');
- ▶ modification of an existing licence to alter the operational and network regime (e.g. additional abstraction);
- ▶ use of 'spare water' from existing licensed sources through operational adjustments or capital works (e.g. new treatment facilities);
- ▶ re-instatement of existing, mothballed sources (with or without current licences);
- ▶ capital works to the distribution network; or
- ▶ transferring water from adjacent water companies with a supply / demand surplus.

2.3 HRA of the WRMP

The HRA focuses on the supply-side options proposed to resolve predicted deficits. It does not assess the existing consents regime: the examination of existing individual consents was undertaken by the Environment Agency (EA) through the Review of Consents process (now through Water Framework Directive assessments) and the HRA of the WRMP cannot and should not replicate this. Any licence amendments required by RoC or WFD (see **Appendix B**) are factored into the DO calculations, and the EA has confirmed that these are valid for the planning period. Consequently, the WRMP will only affect European sites through any new resource and production-side options it advocates to resolve deficits, and not through the existing permissions regime¹⁰.

The various Options could affect European sites through their implementation (for example, construction of new pipelines) or operation (e.g. new abstractions), and these effects can broadly be categorised as:

- ▶ **direct** (activities that affect a European site directly; for example, construction of a new intake within an SPA reservoir; discharges to an SAC from a desalination plant; new or increased abstractions from an SAC river);
- ▶ **indirect** (activities that affect a European site indirectly through an impact pathway; for example, construction affecting a downstream SAC through sediment release; new abstractions entraining SAC fish species away from the SAC itself); or
- ▶ **consequential** (for example, adjusting or stopping a bulk transfer between water resource zones, or between water companies, may have indirect 'consequential' effects on distant European sites if this results in additional abstraction to make up a shortfall; this is more typically a type of 'in combination' effect).

⁹ 'Demand-side' options (i.e. options designed to reduce water use such as metering or provision of water butts) are considered unlikely to have any significant or adverse effects on any European sites (see Section 2.3).

¹⁰ It is recognised that, occasionally, the sustainability reductions agreed through the RoC process have been subsequently shown to be insufficient to address the effects of PWS abstraction on some sites (the most notable example is the River Ehen in Cumbria); PW are not aware of any current uncertainties regarding its abstractions or the RoC outcomes, although any such uncertainties that are subsequently identified can be addressed through the five-yearly WRMP review process.

The HRA of the WRMP must consider any European sites that could be affected by the implementation of the Plan, whether they are within the geographical boundaries of the PW supply area or not. When determining this it is also necessary to consider potential 'in combination' effects; these are possible cumulative effects on European sites caused by the WRMP, together with the effects of any existing or proposed projects or plans¹¹. However, it must be recognised that many of the possible 'in combination' effects (particularly with respect to water resources and land-use plans) are explicitly considered and accounted for as part of the WRMP development process (see below).

As noted, the HRA of the WRMP focuses on the 'supply-side' options only. It does not explicitly consider demand- or post-distribution options designed to reduce treated water use (such as metering or provision of water butts), or leakage reduction options, as it is considered that these cannot negatively affect any European sites¹².

The HRA process (as applied to the WRMP) therefore includes the following steps:

- i. An initial review of the Feasible Options, to assist BW's selection of Preferred Options.
- ii. An assessment of the Preferred Options, comprising screening and (where necessary) an 'appropriate assessment', which accompanies the Preferred Options consultation (earlier versions of this report).
- iii. A formal assessment of the post-consultation revised Preferred Options, which form the revised WRMP and which would be intended for adoption (this report).

For each step, the assessment identifies the location and the anticipated outcomes of each option based on the option descriptions provided by PW. GIS is then used to identify all European sites within a precautionary 15km 'zone of influence', with sites beyond this considered where reasonable impact pathways are present based on the scheme description (for example, receptors downstream of significant new abstractions). This is a suitably precautionary approach that has important advantages due to the number of Feasible Options and the benefits of a consistent approach¹³. The possible effects of each option on European sites and their interest features is then assessed, based on

- ▶ the anticipated operation of each option and predicted zone of hydrological influence¹⁴;
- ▶ any predicted construction works required for each option¹⁵;
- ▶ the European site interest features and their sensitivities; and

¹¹ *Methodological guidance on the provisions of Article 6(3) and (4) of the Habitats Directive 92/43/EEC* (EC 2002).

¹² The only realistic mechanism for a negative effect would through direct encroachment or proximal effects at the local-level (for example a leaking pipe might be located in or near a SAC), but this cannot be meaningfully assessed at the strategic level since location-specific information on the options is not available without specific investigations, which would form part of the package (i.e. the precise location and severity of most leakages is not known ahead of detection). Any assessment of these effects must necessarily be deferred to the project-level (see 'Mitigating Uncertainty and 'down the line' assessment, below) and the WRMP does not imply any approval for options or remove the need for project-level assessments.

¹³ 'Arbitrary' buffers are not generally appropriate for HRA. However, as distance is a strong determinant of the scale and likelihood of most effects the considered use of a suitably precautionary search area as a starting point for the screening (based on a thorough understanding of both the options and European site interest features) has some important advantages. Using buffers allows the systematic identification of European sites using GIS, so minimising the risk of sites or features being overlooked, and also ensures that sites where there are no reasonable impact pathways can be quickly and transparently excluded from any further screening or assessment. When assessing multiple options it also has the significant advantage of providing a consistent point of reference for consultees following the assessment process, and the 'screening' can therefore focus on the assessment of effects, rather than on explaining why certain sites may or may not have been considered in relation to a particular option.

¹⁴ Note that for groundwater sources and groundwater fed habitats, the EA consider that significant effects as a result of ground water abstractions are unlikely on European sites over 5 km from the abstraction (National EA guidance: *Habitats Directive Stage 2 Review: Water Resources Authorisations – Practical Advice for Agency Water Resources Staff*). This premise is applied to the option assessments.

¹⁵ Note that the location of some works, particularly pipelines outside PW-owned land, are only tentatively defined by the WRMP. In these instances, the 'to' and 'from' locations were identified and a broad study area used to identify any European sites that could potentially be affected by a route between these locations.

- ▶ the exposure of the site or features to the likely effects of the option (i.e. presence of reasonable impact pathways)

Data Collection

Data on the Feasible and Preferred Options are provided by PW. These data include descriptions of each option; the likely outcomes (design yields/capacities); the scheme requirements; the type and indicative location of any works; and an outline of how the option would function. Further information on general water resources was obtained from PW (groundwater (GW) and surface water (SW) abstraction locations, source operational parameters, WRZ operation, emergency or drought plan operations) and the EA.

Data on European site locations; interest features; conservation objectives; and condition assessments were collected from the Joint Nature Conservation Committee (JNCC) and Natural England (NE). These data were used to determine the locations of the sites relative to the options; the condition, vulnerabilities and sensitivities of the sites and their interest features; and the approximate locations of the interest features within each site (if reported). European sites within 15km of the PW supply area and their interest features are listed in Appendix C, although it should be noted that sites outside this area were also considered where there was a potential risk of effects from an option. **Appendix D** identifies those European site interest features considered 'water resource dependent' by the EA.

Review of Feasible Options

The Feasible Options review is reported in the following Amec Foster Wheeler Technical Notes *PW WRMP 2019: Habitats Regulations Assessment – Initial Review of Feasible Options*. Report Ref. S38322n062i2 (see Appendix E).

The Feasible Options reviews are not 'draft HRAs', 'screening', or similar assessment of the final plan and are not intended to provide a definitive conclusion on the likely effects of the WRMP or its options; rather, the assessment principles that underpin the HRA process are applied to the Feasible Options to:

- ▶ guide the selection of Preferred Options by PW; and
- ▶ inform the scope of any further assessments likely to be required as the options are refined and developed, including any data likely to be required to support the selection of an option as a Preferred Option.

A detailed 'in combination' assessment is not undertaken at the Feasible Options stage although the potential for options to operate 'in combination' with each other, and with other PW plans (e.g. the Drought Plan) is considered but not explicitly reported; the 'in combination' assessment is completed at the Preferred Options stage. The review of the Feasible Options assumes that normal best-practice project level planning, avoidance and mitigation measures (see **Appendix G**) will be employed at project delivery (see also 'Assessment Assumptions', below, in relation to the incorporation of mitigation).

Preferred and Revised Preferred Options Assessment

The Preferred and revised Preferred Options assessment employs the assessment principles used at the Feasible Option stage, with the addition of an 'in combination' assessment (see below). For each revised Preferred Option, the assessment comprises:

- ▶ a 'screening' of European sites to identify those sites and features where there will self-evidently be 'no effect' (as opposed to 'no likely significant effects') due to the option¹⁶, and those where significant effects are likely or uncertain; and
- ▶ an 'appropriate assessment' of any options where significant effects cannot be excluded.

The revised Preferred Option assessments are set out in **Section 4**. Note that the 'low-bar' principle has been used for the screening of the Preferred Options; any reasonable impact pathways identified are investigated further in an appropriate assessment rather than through a more detailed 'secondary screening'

¹⁶ Note, for options with 'no effects' there is no possibility of 'in combination' effects.

or similar. Consequently, the appropriate assessment is 'appropriate' to the nature or the WRMP, and the scale and likelihood of any effects. Undertaking an appropriate assessment does not necessarily imply a conclusion of 'significant effects' for those sites or aspects that are 'screened in' since in many cases the assessment is completed due to a residual uncertainty which the assessment is intended to resolve. The 'appropriate assessment' stage may therefore conclude that the proposals are likely to have an adverse effect on the integrity of a site (in which case they should be abandoned, modified, or otherwise mitigated); or that option will have no adverse effects (i.e. an effect pathway exists, but those effects will not undermine site integrity); or that the effects will, if re-screened, be 'not significant' (taking into account the additional assessment or perhaps additional measures proposed for inclusion in the final plan).

Assessment Assumptions

Several assumptions are made during the option assessment process; in summary, the assessments assume that

- ▶ the existing consents regime (confirmed under the RoC and taking into account any required sustainability reductions) is effectively a 'no adverse effect' baseline and that options that operate within the terms of existing licences will have 'no adverse effect';
- ▶ that there is 'water available for use' where this is confirmed by the EA through the relevant Catchment Abstraction Management Strategy; and
- ▶ that all normal licensing and consenting procedures will be employed at option delivery, including HRA.

It should be noted that that recent case law known as 'People Over Wind'¹⁷ has altered how avoidance and mitigation measures are accounted for by the HRA. The 'People Over Wind' judgement states that "...it is not appropriate, at the screening stage, to take account of the measures intended to avoid or reduce the harmful effects [mitigation] of the plan or project on that site". This contrasts with established practice in this area (based on the "Dilly Lane" judgment) where avoidance and mitigation measures have typically been accounted for during screening.

There is currently little information on the practical implementation of the 'People over Wind' judgement, particularly for strategy-level HRA, although broad guidance has been issued by the Planning Inspectorate (PINS)¹⁸. In previous WRMP rounds, HRAs of WRMPs typically assumed that established best-practice avoidance and mitigation measures (see **Appendix G**) would be employed at the project level throughout scheme design and construction to safeguard environmental receptors, including European site interest features, and accounted for this at the screening stage. However, it is arguable that an assumption such as this, albeit in relation to a lower-tier project that would itself be subject to HRA, might constitute an 'avoidance measure' that the WRMP is effectively relying on to ensure that significant effects do not occur.

In this instance, therefore:

- ▶ As the Feasible Options review has no statutory basis¹⁹ the established scheme-level best-practice avoidance and mitigation measures noted in **Appendix G** are accounted for when considering the likelihood of a European site or feature being affected by an option. This is to ensure that the HRA process provides robust, proportionate and pragmatic information for PW to factor in to its consideration of the Feasible Options and choice of Preferred Options.
- ▶ For the Preferred Options, which constitute the plan being proposed and assessed, the established best-practice avoidance and mitigation measures noted in **Appendix G** are not taken into account at screening, but are instead introduced at the 'appropriate assessment' stage (if required).

¹⁷ Case C 323/17 Court of Justice of the European Union: People Over Wind

¹⁸ PINS Note 05/2018: *Consideration of avoidance and reduction measures in Habitats Regulations Assessment: People over Wind, Peter Sweetman v Coillte Teoranta.*

¹⁹ i.e. there is no statutory requirement for HRA to be undertaken on draft plans or similar developmental stages (e.g. the unconstrained or Feasible Options).

In combination effects

HRA requires that the effects of other projects, plans or programmes be considered for effects on European sites 'in combination' with the WRMP. There is limited guidance on the precise scope of 'in combination' assessments for strategies, particularly with respect to the levels within the planning hierarchy at which 'in combination' effects should be considered. The 'two-tier' nature of the WRMP (i.e. a plan with specific schemes) also complicates this assessment.

Broadly, it is considered that the WRMP could have the following in combination effects:

- ▶ within-plan effects - i.e. separate options within the WRMP affecting the same European site(s);
- ▶ between-plan abstraction effects - i.e. effects with other abstractions, in association with or driven by other plans (for example, other water company WRMPs);
- ▶ other between-plan effects - i.e. 'in combination' with non-abstraction activities promoted by other plans – for example, with flood risk management plans.
- ▶ between-project effects – i.e. effects of a specific option with other specific projects and developments.

In undertaking the 'in combination' assessment it is critical to note that:

- ▶ the Review of Consents (RoC) process has completed an 'in combination' assessment for all currently licensed abstractions (and many unlicensed abstractions);
- ▶ the RoC underpins the WRMP, which also explicitly accounts for land-use plans, growth forecasts and population projections when calculating future water demand (and hence areas with potential deficits);
- ▶ the detailed examination of non-PW abstraction or discharge consents for 'in combination' effects can only be undertaken by the EA or NRW through their permitting procedures; and
- ▶ known major projects that are likely to increase demand (e.g. power station decommissioning) are also taken into account during the development of the WRMP.

Therefore:

- ▶ It is considered that (for the HRA) potential 'in combination' effects in respect of water-resource demands associated with known plans or projects will not occur since these demands are explicitly considered when developing the WRMP and its associated plans. The main exception to this is other water company WRMPs, which are developed concurrently with the PW WRMP and so cannot necessarily be fully assessed at the Preferred Options stage; for these, the potential for the PW Preferred Options to operate 'in combination' is assessed and (if necessary) conclusions caveated subject to the future review of the consultation versions of the other companies' WRMPs.
- ▶ With regard to other strategic plans, the list of plans included within the SEA is used as the basis for a high-level 'in combination' assessment (see Appendix F). The SEA is used to provide information on the themes, policies and objectives of the 'in combination' plans, with the plans themselves are examined in more detail as necessary. Plans are obtained from the SEA datasets or internet sources where possible.
- ▶ With regard to projects:
 - ▶ The WRMP explicitly accounts for the water-resource demands of known major projects (e.g. power station decommissioning; large-scale housing development) during its development, and so these 'in combination' effects are not considered in detail.
 - ▶ Potential 'in combination' effects between individual Options and Nationally Significant Infrastructure Projects (NSIPs) identified by The Planning Inspectorate, and other known major projects, are assessed.

- ▶ It is not possible to produce a definitive list of minor existing or anticipated planning applications within the zone of influence of each proposed option to review possible local 'in combination' effects. The nature of the WRMP and the timescales over which it operates ensure that generating a list of local planning applications at this stage would be of very little value, and this aspect can only be meaningfully undertaken at the scheme-level.

Uncertainty and determining significant or adverse effects

The WRMP is a high-level strategy for managing water resources across the PW supply area over the next 25 years. Due to its wide geographic scale and long-term outlook there are inevitably many uncertainties inherent within it. It is therefore similar, in this respect, to a typical strategic land-use plan (such as a Core Strategy), which also has inherent uncertainties around its implementation, and hence over its likely effects. Usually, with strategy-level HRAs, uncertainty is addressed by including caveats and 'avoidance measures' or mitigation within the policy text to ensure that significant or adverse effects will not occur. This is possible because the key components of the strategic plan (i.e. the policies) are inherently malleable from the outset, and can be easily abandoned or modified if required.

This approach is more difficult to apply directly to the WRMP because:

- ▶ the strategic nature of the WRMP ensures that there are fundamental limitations on the scheme details that are available for the HRA; **but**
- ▶ its principal components (the options that are proposed to resolve actual or predicted deficits) are generally specific schemes with a clear spatial component, rather than the broad policies that are characteristic of most strategies.

This means that potential effects on specific European sites are much easier to envisage or identify (due to the specific nature of the options and the known 'sensitivities' of the interest features), but often harder to quantify and assess (due to the strategic nature of the plan and frequent absence of detailed information on each option; i.e. the 'exposure' of an interest feature to a potential effect cannot necessarily be established).

Normally, where there is uncertainty over likely effects then additional data must be obtained until that uncertainty can be resolved; or 'avoidance measures' or mitigation specified that will remove the uncertainty; or the option should be abandoned and not included in the final plan. However, this can present difficulties for plans such as the WRMP since:

- ▶ the options have to solve specific deficits but are heavily constrained by existing sources and infrastructure, the availability of new resources, and the patterns of customer demand;
- ▶ it is possible that there will be several options where the precise effects are unclear, but which PW or the EA would wish to be able to explore in more detail at a later stage (and therefore would wish to include as Preferred Options within the WRMP); and
- ▶ the WRMP itself is a key component of the regulatory mechanism by which funding is secured for the detailed design, feasibility studies and investigations required for new supply-side measures.

Consequently, for some options there may be uncertainties which cannot be fully resolved at the strategic level, which in some cases would make a conclusion of 'no significant effects' or 'no adverse effects' difficult. Indeed, for some schemes it will only be possible to fully assess any potential effects at the pre-project planning stage or permit/order application stage, when certain specific details are known; for example: construction techniques or site-specific survey information. In addition, it may be several years before an option is employed, during which time other factors may alter the likely effects of the option.

For example, an option that proposes a new water transfer main between existing pumping stations will have a limited number of feasible routes. These can be theoretically assessed at a high-level for potential impacts on European sites, and routes with obvious and unavoidable 'likely significant effects' excluded from the WRMP. However, in most instances a specific route (or even a range of routes) will not be determined at the strategic level and any route would, in any case, be largely determined by design-stage constraints (e.g. land ownership; access; engineering feasibility; and so on). If the route had to cross a SAC river then 'significant effects' (at the strategic level) are clearly conceivable and arguably likely, which would suggest that the

option should be abandoned. But it is equally likely that most potential construction effects could almost certainly be avoided or suitably mitigated through project-level design (e.g. ensuring the use of existing road crossings for construction, or using trenchless techniques), which would itself be subject to an HRA at project level.

As a result, the HRA must consider and assess the specific options within the WRMP **appropriately**, whilst recognising (and mitigating) the inherent uncertainties within those options (i.e. the absence of detailed scheme design or parameters) **and** within the plan itself (i.e. so that the WRMP, as a whole, is compliant with the HRA regulations even if some residual uncertainty persists with some options). Ultimately, the plan should not create a scenario where significant adverse effects are possible ('likely') if these cannot clearly be avoided with appropriate scheme-level measures; these may be established best-practice mitigation and avoidance measures, or bespoke requirements identified at the plan-level.

Mitigating uncertainty and 'down the line' assessment

For most options, even at the strategic level, it will be clear if adverse effects are likely to be unavoidable and in these instances the option should not be included as a Preferred Option within the WRMP since plans should not include proposals which would be likely to fail the Habitats Regulations tests at the project application stage. For other options, however, the effects may be uncertain and it is therefore important that this uncertainty is addressed either through additional investigation or (if this is not possible) through appropriate mitigation measures that ensure that the *plan* is compliant with the Habitats Regulations.

For many options, particularly those involving construction, it is reasonable to assume that established mitigation measures which are typically successful can be employed at the project stage to avoid significant or adverse effects – for example, avoiding works near SPAs at certain times of the year. In these instances it is considered that the option can be included within the WRMP provided that any specific measures that are likely to be required are identified to ensure that they are appropriately addressed throughout the project planning process (e.g. constraints on the timing of construction activities).

Nevertheless, it is possible that the potential effects (or required mitigation) for some options cannot be clearly determined at the strategic-level. In these instances, current guidance²⁰ indicates that it may be appropriate and acceptable for some assessment to be undertaken 'down-the-line' at a lower tier in the planning hierarchy, if:

- ▶ the higher tier plan appraisal cannot reasonably predict the effects on a European site in a meaningful way; whereas
- ▶ the lower tier plan, which will identify more precisely the nature, scale or location of development, and thus its potential effects, retains sufficient flexibility over the exact location, scale or nature of the proposal to enable an adverse effect on site integrity to be ruled out (even if that would mean ultimately deleting the proposal); and
- ▶ the later or lower tier appraisal is required as a matter of law or Government policy, so it can be relied upon.

Strictly, this is less appropriate for plans that sit immediately above the project stage, although the WRMP and its options will, in most instances, meet these criteria. For some schemes – particularly those schemes requiring 'new water' or modifications to abstraction licences, but also larger construction schemes within or near European sites – there may be insufficient information available to determine 'no likely significant effects' or 'no adverse effects' with certainty at this level (i.e. meaningful assessment cannot be undertaken). All the Options will, of course be subject to project-level environmental assessment as part of the normal EIA, planning and/or EA consenting processes, which will necessarily include assessments of their potential to affect European sites during their construction or operation (i.e. HRA is required by law).

It is therefore considered acceptable to include these proposals within the WRMP, but complete the assessment of those options where uncertainty persists at a later stage, provided that:

²⁰ e.g SNH (2017). *Guidance for Plan Making Bodies in Scotland*. [Online]. Available at: <https://www.snh.scot/planning-and-development/environmental-assessment/habitat-regulations-appraisal/>

- ▶ the option is not required within the first three years of the plan period, so allowing time for additional investigations to be completed; and
- ▶ the uncertainty that this creates is mitigated by the inclusion of alternative options which:
 - ▶ will meet the required demand / deficit should the Preferred Option prove to have an unavoidable risk of adverse effects on the European sites in question; **and**
 - ▶ will not themselves have any significant or adverse effect on any European sites.

It should be noted that this flexibility is desirable in any case, since it is possible that a 'no LSE' option might be subsequently proven to have significant or adverse effects when brought to the design stage. This approach allows for the WRMP to be compliant with the Habitats Regulations, since certainty for the plan as a whole is provided by the inclusion of alternative options with no LSE.

It is also important to recognise that, in contrast to land-use plans, the statutory framework underpinning the WRMP does not provide the same implicit approval of derived, lower tier plans and projects that are 'in accordance' with it; or have the same influence over the decisions made on projects; or have the same direct or indirect legal effects for the use of land and the regulation of projects. Although the WRMP provides a framework for future water resource management it is not a rigid policy document or a set of proposals that cannot be deviated from once published. Also the WRMP itself is a key component of the regulatory mechanism by which funding is secured for the detailed design, feasibility studies and investigations required for new supply-side measures. Furthermore, the WRMP is (and must be) inherently flexible due to the formal five-yearly review process, which provides a clear mechanism for monitoring performance and an opportunity to adjust the proposals to reflect any changing circumstances. These measures can therefore be relied on to ensure that adverse effects do not occur as a result of the implementation of the WRMP.

3. Feasible Options Review

The review of the Feasible Options employed the principles of HRA to help inform PW's selection of its Preferred and revised Preferred Options, identifying those options that would appear to have an unavoidable risk of adverse effects on European sites. The Feasible Options Review is provided in Appendix F and summarised in this section.

3.1 Approach

The review of the Feasible Options is not a formal stage in the HRA process and is therefore not a 'draft HRA', 'screening', or similar assessment of the final plan. It is not intended to provide a definitive conclusion on the likely effects of the final WRMP but is primarily intended to inform PW's selection of Preferred and revised Preferred Options, by identifying:

- ▶ those options that would appear to have an unavoidable risk of adverse effects on European sites (and which should therefore be avoided if possible);
- ▶ those options where significant or adverse effects would not appear likely, assuming established avoidance and mitigation measures can be employed at the scheme level; and
- ▶ those options where effects are uncertain, which would require additional data or information on operation / construction to support their inclusion as preferred options.

The review of the Feasible Options therefore takes account of established project-level avoidance and mitigation measures that are known to be achievable, available and likely to be effective – for example, normal construction best-practice or project planning. These measures are identified in **Appendix G** to this report. For the operational aspects of supply-side options, potential avoidance measures are considered where these are apparent, although in most instances the mitigation likely to be required for an option (e.g. compensation releases; 'hands-off' flows) cannot necessarily be determined at this stage.

The review also assumes that the existing licensing regime is having no significant effects on any European sites, or if this is not the case, that any necessary licence amendments required (e.g. sustainability reductions etc.) have been included in any deficit modelling. The Feasible Options will therefore only affect European sites through any new resource and production-management options advocated to resolve deficits, and not through the existing permissions regime²¹, and it is therefore assumed that options that are 'network solutions' only (i.e. moving spare licensed volumes) will not have operational effects. The availability of water for abstraction is based on EA advice to PW and the Catchment Abstraction Management Plans (CAMS).

The Feasible Options reviews are reported in **Appendix F**. This provides a short description of each option and a narrative assessment of its likely effects, with those European sites within 15km that are most vulnerable (i.e. both exposed and sensitive) to the delivery or operation of the scheme noted in the text. It then provides broad 'recommendations' regards progressing the options as Preferred Options based on the anticipated construction and operational effects. The criteria for these recommendations are detailed in **Table 3.1** (colour coded for clarity):

²¹ It is recognised that, occasionally, agreed sustainability reductions have been subsequently shown to be insufficient to address the effects of PWS abstraction on some sites (the most notable example is the River Ehen in Cumbria).

Table 3.1 Summary of criteria for considering Feasible Options as potential

Recommend as Preferred Option?	Notes
Yes	Option appears unlikely to have any effects on European sites as features are either not exposed or not sensitive to the likely outcomes (i.e. no or no reasonable impact pathways – for example, operational effects for a 'construction only' network solution; 'dry' habitats over (say) 2km from an option; sites in different surface water catchments; upstream sites; etc.(being mindful of mobile species)). In these instances the recommendation is 'Yes', i.e. no reason not to pursue as Preferred Option.
Yes	Options where pathways for effects are clearly identifiable (such that HRA would probably be required at the scheme level) but where the potential effects can obviously be avoided or mitigated using established measures that are known to be effective, for example: <ul style="list-style-type: none"> ▶ construction near a European site (effects avoidable with normal project planning and best-practice); ▶ minor works within European sites (e.g. works to existing assets where effects unlikely to be adverse due to absence of features); ▶ major works near / within European sites that can be completed without adverse effects (e.g. crossings of SAC rivers using existing roads or directional drilling); ▶ operational effects that are avoidable with established operational mitigation (e.g. licence controls, although at this stage potential operational effects will usually lead to an 'uncertain' recommendation to flag the need for additional information). In these instances the generic measures outlined in Appendix B can be relied on if these are included within the WRMP package, although the final plan may need to include specific measures for potential 'high-impact' options (e.g. commitments to non-invasive river crossings or timing works to avoid sensitive periods).
Uncertain	Options where a potential effect is conceivable and cannot be discounted, and the likely effects are therefore uncertain at the Feasible Options stage. This is typically due to limitations on the information available, either in terms of the operation of the scheme, the mitigation that might be employed, or the data available on the interest features of the sites. These options, if pursued as Preferred Options, may require <ul style="list-style-type: none"> ▶ additional investigation to determine their effects, and there may be a risk that the risk of effects cannot be quantified satisfactorily at the strategic level (for example, substantial additional modelling or site-specific investigation may be required). ▶ the identification of specific measures or requirements for scheme delivery for inclusion with the WRMP. This category is therefore intended as a flag to identify those options where there is potentially additional 'cost' associated with their inclusion (either related to the data required to support a robust HRA and hence the option, or the need for specific mitigation commitments) which PW should consider when selecting the Preferred Options.
No	Options where significant effects (i.e. not negligible or inconsequential) on a European site are very likely or certain due to the scale/ nature/location of the option proposals, or the vulnerability and distribution of the interest features within /near the European site. Although a full appropriate assessment is not undertaken at this stage, adverse effects may be more likely (or even certain) if the scheme is taken forward as a Preferred Option and it is likely that extensive or unproven mitigation will be required following scheme-level investigations. Feasible Options in this category are not recommended for consideration as Preferred Options (although additional information may allow a re-assessment).

3.2 Summary

PW identified several Feasible Options. Almost all schemes were considered potentially suitable as Preferred Options on the basis of the review, although uncertainties were identified for some options (principally around operation) which would require additional information for assessment if progressed as a Preferred Option. The Feasible Options review was used by PW to inform the selection of Preferred and revised Preferred Options.

4. Revised Preferred Options Assessment

PW is predicting a deficit of approximately 48 MI/d by 2044/45 once bulk exports are accounted for. The final WRMP is dependent on various factors including other water company requirements and so twenty-one revised Preferred Options have been identified for the WRMP consultation stage.

4.1 Overview

Informed by the environmental, social and economic assessments and ongoing discussion with stakeholders, the list of feasible options was refined to identify the Preferred Options for inclusion in the draft WRMP. The assessment of the Preferred Options, comprising screening and (where necessary) an 'appropriate assessment' accompanied the draft WRMP consultation (earlier versions of this report).

Following consultation on the draft WRMP and the responses from the regulators and consultees, further changes were made to the revised WRMP which shows a deficit at average and peak week once bulk supplies to other water companies are included. This has led to alterations to the preferred 'demand-management' and 'leakage reduction' options, with four new and three revised options proposed. The 'resource management' options were unchanged. The 'revised WRMP' therefore comprises twenty one Revised Preferred Options, which have been subject to HRA. The 'revised Preferred Options are presented in **Table 4.1**.

Table 4.1 Portsmouth Water WRMP Revised Preferred Options

Option	Type	Option Name	Yield (MI/d)
R013	Supply-side	Havant Thicket	23.0 MI/d
R021a	Supply-side	Source O DO Recovery	1.8 MI/d
R022a	Supply-side	Source J Group – Maximising DO	12.5 MI/d
R023a	Supply-side	Source H DO Recovery	2.0 MI/d
R024a	Supply-side	Source C DO recovery scheme	5.5 MI/d
R068	Supply-side	Source S Drought Permit	8.5 MI/d
C005	Customer-side	Meters – Not for Revenue (MNFR) Switchers	0.08 MI/d
C006	Customer-side	Metering on change of occupancy - all properties	4.68 MI/d
C006a	Customer-side	Metering on change of occupancy - existing meter pits	0.28 MI/d
C026a	Customer-side	Water Efficient Appliance Subsidy	0.31 MI/d
C034	Customer-side	Water saving devices – Retrofitting existing toilets (with flush >9l)	0.11 MI/d
C040	Customer-side	Water Saving Devices – Spray Taps	0.07 MI/d
C043	Customer-side	Water saving devices - Trigger nozzles & water butts	0.06 MI/d
C046	Customer-side	Household water efficiency programme (Partnering approach, home visit)	1.23 MI/d
C084	Customer-side	Void turnaround	0.28 MI/d
C078	Drought	Drought: Voluntary restraint & leakage action	4.3 MI/d

Option	Type	Option Name	Yield (MI/d)
C079	Drought	Drought: Mandatory restraint	8.3 MI/d
C80	Drought	Imposition of Drought Direction Restrictions (mandatory commercial restraint)	8.1 MI/d
D004a	Leakage	Leakage reduction (Tranche 1) Noise Loggers	5.4 MI/d
D004b	Leakage	Leakage reduction (Tranche 2) Noise Loggers	5.4 MI/d
D005	Leakage	Leak detection - Partial district metering	5.0 MI/d
R013	Supply-side	Havant Thicket	23.0 MI/d

4.2 Demand Reduction / Leakage Options

Table 4.1 summarises the proposed leakage reduction and distribution management options. These options will have no negative operational effects on European sites as they will reduce treated water use. The only realistic mechanism for a negative effect would be through any construction required (for example the leakage reduction programme may require repair of a pipe in or near an SAC), but this cannot be meaningfully assessed at the strategic level since information on the location of leaks is not available without specific investigations, which would form part of the option package (i.e. the precise location and severity of most leakages is not known ahead of detection), and there is consequently no information on the scale (etc.) of any construction required. Therefore, from an HRA perspective, the options are 'screened in' (as an effect pathway is conceivable) but as a meaningful appropriate assessment is not possible, the assessment is necessarily deferred to the project level.

However, it is clear that the anticipated works associated with these options are not of a scale that would suggest that effects are potentially unavoidable at the project stage, and the WRMP requires that the standard avoidance measures in **Appendix G** be employed (which includes a requirement for the potential for European sites to be affected to be considered at the planning stage). The WRMP does not imply any approval for schemes that come forward under these options or remove the need for project-level assessments, although the measures noted in Appendix G will ensure that potential adverse effects can be identified and avoided at the project stage. **The distribution management and leakage-reduction options are therefore excluded from further assessment.**

4.3 Option R013: Havant Thicket

Summary of Scheme

This option would involve the development of a new pumped storage reservoir with a capacity of 8,800 MI on Portsmouth Water's land holding at Havant Thicket (170 ha.). Water would be sourced from the Source B Springs during the winter period and pumped to Havant Thicket Reservoir for use in the summer within the existing annual average licence of 98MI/d. The new reservoir would deliver 23 MI/d with a peak deployable output of 50 MI/d though this would be subject to the hands-off flows of Lake A and Stream A. Water would be abstracted using draw-off structure. Water would be transferred to and from the reservoir in a dedicated new main to Source B, where it would link in to existing infrastructure for transfer to Works A treatment works. The principal construction elements of this option would be:

- ▶ a new pumped storage reservoir with a capacity of 8,800 MI (~170 ha);
- ▶ refurbishments to pumping stations and the WTW at Source B to increase peak output from 40 MI/d to 50 MI/d (new pumps, external standby generator, and a new DAF plant for the WTW);
- ▶ a new c.8.4km single raw water main;
- ▶ treated output would flow to Works A WTW which would direct water to Reservoir A via a new c.8.4km main and Reservoir B via a new c.4km main.

It should be noted that, unlike for other options, a number of investigations have been previously undertaken to determine the likely effects of the scheme on European sites due to the long timescale over which this scheme has developed. This means that substantially more detailed information is available than for other options, which is referred to as necessary.

Likely Impact Pathways

Construction

This scheme would be a substantial and large-scale construction project, located approximately 4km north of Langstone Harbour. The principal environmental risks are therefore likely to be

- ▶ contamination of surface waters by site-derived pollutants;
- ▶ disturbance of sensitive species (e.g. from site lighting, noise, visual impact, vibration, etc.).

Operation

In most years the reservoir will stay nearly full all the year, but in dry years, when summer demand is high and rainfall is lower than average, water will be released from the reservoir for treatment and supply to customers. In very dry years, or if demand increases significantly, the reservoir could be almost emptied in the summer to be filled again the following winter, if conditions permit. The reservoir yield is estimated to be approximately 23 Ml/d. The abstraction from the Source B springs will be within the terms of the existing licence, so no operational effects would be expected in this regard.

The operation of the scheme could affect European sites through a number of potential pathways, principally:

- ▶ effects on surface waters, specifically by altering the quality of water entering the designated sites via the Hermitage Stream as a result of stagnation, nutrient enrichment and algal growth sometimes associated with large reservoirs;
- ▶ by the release of large volumes of water into nearby designated sites via the Hermitage Stream should an emergency draw-down be required;
- ▶ the potential loss of foraging habitat or functionally-linked land for certain mobile species.

Screening of European Sites

There are 8 European sites downstream or within 15km of the likely locations of the enabling works, or otherwise linked by a potential effect pathway. The sites, their interest features, and location relative to the option are set out in **Table 4.2**.

Table 4.2 European sites within 15 km of Option, or otherwise connected

Site and Interest Features	~Distance / Connectivity
Kingley Vale SAC ▶ <i>Taxus baccata</i> woods of the British Isles	12 km
Butser Hill SAC ▶ Semi-natural dry grasslands and scrubland facies on calcareous substrates (<i>Festuco-Brometalia</i>) (* important orchid sites) ▶ <i>Taxus baccata</i> woods of the British Isles	12 km
Rook Cliff SAC ▶ <i>Tilio-Acerion</i> forests of slopes, screes and ravines	13 km

Site and Interest Features	~Distance / Connectivity
<p>Solent Maritime SAC</p> <ul style="list-style-type: none"> ▶ Sandbanks which are slightly covered by sea water all the time ▶ Estuaries ▶ Mudflats and sandflats not covered by seawater at low tide ▶ Coastal lagoons ▶ Annual vegetation of drift lines ▶ Perennial vegetation of stony banks ▶ Salicornia and other annuals colonizing mud and sand ▶ <i>Spartina</i> swards (<i>Spartinion maritimae</i>) ▶ Atlantic salt meadows (<i>Glauco-Puccinellietalia maritimae</i>) ▶ Shifting dunes along the shoreline with <i>Ammophila arenaria</i> ("white dunes") ▶ Desmoulin's whorl snail <i>Vertigo moulinsiana</i> 	4 km / DS
<p>Solent and Isle of Wight Lagoons SAC</p> <ul style="list-style-type: none"> ▶ Coastal lagoons 	15 km
<p>Chichester and Langstone Harbours SPA</p> <ul style="list-style-type: none"> ▶ Common shelduck <i>Tadorna tadorna</i> ▶ Eurasian wigeon <i>Anas penelope</i> ▶ Eurasian teal <i>Anas crecca</i> ▶ Northern pintail <i>Anas acuta</i> ▶ Northern shoveler <i>Anas clypeata</i> ▶ Red-breasted merganser <i>Mergus serrator</i> ▶ Ringed plover <i>Charadrius hiaticula</i> ▶ Grey plover <i>Pluvialis squatarola</i> ▶ Sanderling <i>Calidris alba</i> ▶ Bar-tailed godwit <i>Limosa lapponica</i> ▶ Eurasian curlew <i>Numenius arquata</i> ▶ Common redshank <i>Tringa totanus</i> ▶ Ruddy turnstone <i>Arenaria interpres</i> ▶ Sandwich tern <i>Sterna sandvicensis</i> ▶ Common tern <i>Sterna hirundo</i> ▶ Little tern <i>Sterna albifrons</i> ▶ Dunlin <i>Calidris alpina alpina</i> ▶ Dark-bellied brent goose <i>Branta bernicla bernicla</i> ▶ Waterfowl assemblage 	4 km
<p>Portsmouth Harbour SPA</p> <ul style="list-style-type: none"> ▶ Red-breasted merganser <i>Mergus serrator</i> ▶ Black-tailed godwit <i>Limosa limosa islandica</i> ▶ Dunlin <i>Calidris alpina alpina</i> ▶ Dark-bellied brent goose <i>Branta bernicla bernicla</i> 	8 km
<p>Chichester and Langstone Harbours Ramsar</p> <ul style="list-style-type: none"> ▶ Crit. 1 - sites containing representative, rare or unique wetland types ▶ Crit. 5 - regularly supports 20,000 or more waterbirds ▶ Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds 	4 km
<p>Portsmouth Harbour Ramsar</p> <ul style="list-style-type: none"> ▶ Crit. 3 - supports populations of plant/animal species important for maintaining regional biodiversity ▶ Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds 	4 km

*Priority features

DS – Downstream site

Several of these sites will be unaffected by the option, primarily due to the absence of impact pathways; these sites are identified in **Table 4.3**, and are not considered further within the assessment of this option (note, for these sites it is considered that there will be 'no effects' (as opposed to 'no likely significant effects') and so there will be no possibility of 'in combination' effects).

It should be noted that the scheme has been previously subject to detailed discussions with the EA and NE. These discussions confirmed that NE considers that significant effects may potentially occur on the **Solent Maritime SAC** and the **Chichester and Langstone Harbours SPA / Ramsar** sites only; all other European sites, including the other Harbour sites, are judged to be sufficiently distant from the proposals that any effects on their favourable condition are highly unlikely.

Table 4.3 Initial screening of European sites

Site	Consider further?	Rationale
Butser Hill SAC	No	No reasonable impact pathways (distance, separate catchment).
Chichester and Langstone Harbours Ramsar	Yes	Mobile species potentially exposed; downstream receptor
Chichester and Langstone Harbours SPA	Yes	Mobile species potentially exposed; downstream receptor
Kingley Vale SAC	No	No reasonable impact pathways (distance, upland / up catchment site).
Portsmouth Harbour Ramsar	No	Not considered exposed (see above)
Portsmouth Harbour SPA	No	Not considered exposed (see above)
Rook Clift SAC	No	No reasonable impact pathways (distance, separate catchment).
Solent and Isle of Wight Lagoons SAC	No	No reasonable impact pathways (distance, separate catchment).
Solent Maritime SAC	Yes	Downstream receptor

Appropriate Assessment – Chichester and Langstone Harbours SPA

Incorporated Measures

Appropriate site- and feature-specific avoidance measures and development criteria are set out in **Appendix G** of this HRA, and are referenced by the WRMP. The WRMP requires that these measures be employed at the project-level unless scheme-specific HRAs or environmental studies demonstrate that they are not required (i.e. the anticipated effect will not occur), not appropriate, or that alternative or additional measures are more appropriate.

Assessment of Effects – Construction

This scheme would be a substantial and large-scale construction project, located approximately 4km north of Langstone Harbour; however, direct effects on the mobile interest features of estuary will not occur due to distance, and it is likely that any indirect effects can be adequately managed through the normal project planning process and standard best-practice measures (see **Appendix G**).

Assessment of Effects – Operation

The scheme has been previously subject to detailed discussions with the EA and NE. These discussions confirmed the following points.

- ▶ NE considers that significant effects may potentially occur on the Solent Maritime SAC and the Chichester and Langstone Harbours SPA / Ramsar sites only; all other European sites, including the other Harbour sites, are judged to be sufficiently distant from the proposals that any effects on their favourable condition are highly unlikely.
- ▶ The key risks to the integrity of these sites presented by the scheme are related to:

- ▶ the abstraction from the Source B Springs (possible effects of flow reduction on site interest features).
- ▶ any potential change in water quality as a result of water from the reservoir entering the designated site via the Hermitage Stream.
- ▶ the impact of increased flow to the Harbour which might occur during the emergency draw-down of the reservoir, should this ever be required.
- ▶ the potential for the reservoir site to support Brent geese feeding areas (this SPA species tends to feed at large, open grassland habitats close to the coast and therefore is vulnerable to effects away from the SPA boundaries).

Abstraction from Source B Springs

Abstraction from the springs would be in winter only, when flows are greatest, in accordance with the current abstraction licence which was reviewed and confirmed by the RoC (EA 2005). No new abstraction licence, nor any variation to the existing licence, will be required for the HTWSR project. However, the reservoir embankments will cut off the natural flow from approximately 2 km² of the Hermitage Stream catchment, which includes drainage from three small water courses which would otherwise enter the harbour. This flow will be maintained by appropriate compensatory discharges, conditioned by the EA as part of any Impounding Licence that is issued. The abstraction consents for the spring currently require that a minimum flow of 70 l/s (approx. 6.08Ml/d) be maintained in the Hermitage Stream at low-tide and this would be achieved through the monitoring of abstraction rates and stream flows during the reservoir refill periods, and by agreed compensation releases from the reservoir as part of its operating licence. The EA have confirmed that the nature of the compensation flow required from the reservoir was a matter that would be considered and addressed after the planning permission has been granted, at the Impounding Licence stage.

It should also be noted that:

- ▶ not all of the springs in the Source B Springs complex are utilised for public water supply, and a number flow directly in to the Brockhampton Stream, Hermitage Stream or the Lavant Stream which ensures a constant supply of freshwater to Langstone Harbour as a whole; and
- ▶ excess water from the all of the springs which are connected to the PW raw water collection pipe work is captured and discharged into the Hermitage Stream via two overflows, or in to the Brockhampton Stream via a third overflow.

It is therefore considered that the HTWSR project would not result in any significant changes to the flow volumes or profiles of freshwater discharges via the Hermitage Stream.

Furthermore, although past work at other estuary sites in the UK has suggested that there may be a relationship between certain waterbirds and intertidal freshwater flows or channels, harbour bird surveys commissioned by Portsmouth Water (Entec 2006; Entec 2007; Ecosa 2012; provided to Amec Foster Wheeler to review and available from PW) demonstrated that:

- ▶ SPA birds were not preferentially using freshwater channels for feeding, but freshwater channels were used for bathing; and
- ▶ the location of bird feeding areas was related more to weather (especially wind direction) and impacts of disturbance rather than being related to freshwater flow²²

Water quality changes

In theory, the reservoir could alter the quality of water entering the designated sites via the Hermitage

²² Numerous studies have shown that these relationships are in reality complex, involving intricate and often indirect relationships between the SPA birds, their behaviour, their invertebrate prey, the tidal and freshwater flow regimes, geomorphological processes, substrate characteristics, the geographical location, roost sites, and the degree of disturbance by predators or human activity. However, it is generally accepted that the volume of flow is not the critical factor, and that the integrity of estuarine SPA sites can be maintained (in respect of intertidal freshwater flows) by ensuring that water is flowing within the channels.

Stream as a result of stagnation, nutrient enrichment and prolific algal growth (often associated with large reservoirs). This would be an important issue if nitrate loading to the harbour (in particular) was increased. Portsmouth Water commissioned a detailed modelling assessment of the likely water quality impacts of the reservoir in 2011 (Walls 2011); this considered

- ▶ the effects on water quality of mixing flows from the three small Havant Thicket water courses with chalk groundwater from the Source B Springs, using a blending model and reasonable worst case scenario to assess the impact;
- ▶ potential seasonal effects which might arise; and
- ▶ the effects on specific key parameters identified by the EA (ammonium, biological oxygen demand (BOD), calcium, dissolved oxygen (DO), nitrate, phosphate, suspended solids and temperature).

The key conclusions of the modelling are that

- ▶ the water from the springs is of very good and fairly consistent quality;
- ▶ the majority of water in the reservoir will derive from the Source B Springs which will provide a buffering effect for iron and manganese derived from the three small streams and ensure that the water discharged from the reservoir is of a more consistent quality;
- ▶ phosphate, ammonium, suspended solids and most metal concentrations (including magnesium) will be reduced;
- ▶ for DO and BOD the streams will not only meet the 'good' classification required by the EA for this catchment, but would be expected to meet the 'high' classification set out in the River Basin District Direction 2010 (this is due to the greater opportunity for oxidation of organic matter whilst water is resident in the reservoir).
- ▶ the reservoir will be oligotrophic (77% probability).
- ▶ the reservoir will have low phosphate levels and there will be a low risk of algal blooms occurring;
- ▶ the reservoir will act as a stilling basin for sediment washed in from the upper catchment; .
- ▶ pumping Source B Spring water to the reservoir will reduce nitrogen load entering the harbour via the Hermitage Stream will by up to 61 kg/d;
- ▶ thermal stratification is unlikely to occur, although a precautionary approach has been adopted for the reservoir design including multiple level draw off points and provision for an aeration plant (if necessary).

It is therefore considered that the HTWSR project would not result in any significant changes to the water quality of freshwater discharges via the Hermitage Stream, or consequent impacts on the European sites.

Emergency drawdown

During an emergency, such as a breach in the reservoir embankments, there may be a need to drawdown water very rapidly in order to avoid large-scale flooding. This water would be discharged into the harbour via the Riders Lane Stream and the Hermitage Stream. Such an event could in theory result in significant local changes to the channel morphology near the Hermitage Stream, potentially including the removal of interest features that may be present in the area.

It must be noted that an emergency drawdown or catastrophic failure of the reservoir are extremely unlikely to occur due to design and construction measures, and monitoring of both the filling process and operation. The reservoir would be filled slowly and carefully monitored; and piezometers would be installed in the embankment to give an early warning of any problems to allow further inspection / action to be taken promptly. This will ensure that in the very unlikely event that a problem was detected a slow drawdown could take place, without the need to trigger an emergency drawdown. In addition, the design will include provision of a structure to adsorb energy prior to discharge to minimise any impact on the stream.

It should also be noted that the magnitude of the flow in the lower reaches of the Hermitage Stream from the emergency drawdown (estimated at 14m³/s, or 1m reduction in reservoir depth per day) is only likely to be comparable to a natural storm event with a return period of 10 to 15 years, based on flood risk assessment work in the Hermitage Stream catchment undertaken by the EA (Atkins 2008). This would not constitute an adverse effect. Furthermore, the lower reaches of the Hermitage Stream (south of the A27) are man-made and armoured with solid concrete walls or concrete blocks²³. This includes the first section of channel within the SAC. The channel through Langstone Harbour to the mouth of the Hermitage Stream is also dredged to maintain a deep water channel for ships accessing the gravel wharf south off Harts Farm Way.

In summary:

- ▶ a catastrophic failure or emergency drawdown is extremely unlikely;
- ▶ an emergency drawdown would provide flows to the estuary roughly equivalent to a natural storm event with a return period of 10 to 15 years;
- ▶ the lower reaches of the Hermitage Stream, including the point of entry to the SAC, are heavily protected (armoured).

Therefore, any such drawdown will have no significant effect on the morphology of the harbour or the interest features of the European sites.

SPA birds away from the estuary

NE identified the potential for the reservoir site to support Brent geese feeding areas, since this SPA species tends to feed at large, open grassland habitats close to the coast and therefore is vulnerable to land-use change away from the SPA boundaries. Portsmouth Water undertook wintering bird surveys at the HTWSR site in 2005/06 (6 visits) and 2008/09 (3 visits). No Brent geese were observed at the HTWSR site, and it is considered unlikely that this area would be particularly suitable for them based on these data and information in the *Solent Waders and Brent Goose Strategy 2010* (King (2010))²⁴. Therefore, it is considered that the scheme will have no significant effect on important SPA bird habitat resources away from the SPA

Conclusion

The analysis above demonstrates that the operation of the scheme will have no significant effects on the interest features of the site:

- ▶ flows from the Hermitage Stream will be unaffected, and maintained by appropriate licence conditions;
- ▶ water quality within the Hermitage Stream will not deteriorate and may improve;
- ▶ an emergency drawdown is very unlikely, and would in any case be of a magnitude similar to a 10 -15 year return period storm event;
- ▶ the lower reaches of the Hermitage Stream are heavily protected/armoured, so scour (etc.) is unlikely.

Appropriate Assessment – Solent Maritime

Incorporated Measures

Appropriate site- and feature-specific avoidance measures and development criteria are set out in **Appendix G** of this HRA, and are referenced by the WRMP. The WRMP requires that these measures be employed at the project-level unless scheme-specific HRAs or environmental studies demonstrate that they are not

²³ This armouring is required due to the presence of a landfill, and the need to prevent erosion of the landfill into the harbour.

²⁴ In addition, the *Solent Waders and Brent Goose Strategy 2010* did not identify Havant Thicket as a potentially suitable site for future use by this species.

required (i.e. the anticipated effect will not occur), not appropriate, or that alternative or additional measures are more appropriate.

Assessment of Effects

Six of the features at the site will not be exposed to the likely effects of this scheme due to their locations in the SAC relative to the zone of influence of the option; these are **Atlantic salt meadows; Annual vegetation of drift lines; Vegetated shingle; Shifting dunes with marram; Coastal lagoons; and Desmoulin's whorl snail.**

Construction of the scheme is considered unlikely to have any significant effects on the remaining interest features (**Estuaries; *Spartina* swards; Sub-tidal sandbanks; Intertidal mudflats and sandflats; Salicornia and other annuals**) as potential incidental effects (run-off, pollution incidents, etc) can be controlled by normal best-practice construction measures.

The analysis above demonstrates that the operation of the scheme will have no significant effects on the habitat interest features of the site:

- ▶ flows from the Hermitage Stream will be unaffected, and maintained by appropriate licence conditions;
- ▶ water quality within the Hermitage Stream will not deteriorate and may improve;
- ▶ an emergency drawdown is very unlikely, and would in any case be of a magnitude similar to a 10 -15 year return period storm event;
- ▶ the lower reaches of the Hermitage Stream are heavily protected/armoured, so scour (etc.) is unlikely.

Chichester and Langstone Harbours Ramsar

Incorporated Measures

Appropriate site- and feature-specific avoidance measures and development criteria are set out in **Appendix G** of this HRA, and are referenced by the WRMP. The WRMP requires that these measures be employed at the project-level unless scheme-specific HRAs or environmental studies demonstrate that they are not required (i.e. the anticipated effect will not occur), not appropriate, or that alternative or additional measures are more appropriate.

Assessment of Effects

The Ramsar site is designated for its estuarine basins and suite of intertidal mudflats, saltmarsh, sand and shingle spits and sand (Criterion 1); its wintering waterbird assemblage, which had a 5-year peak mean (1998/99-2002/2003) of 76480 waterfowl (Criterion 5); and its waterbird species / populations occurring at levels of international importance (Criterion 6). These features are considered to be the same as the SAC and SPA features for assessment purposes, and therefore the effects of the scheme on the Ramsar site are as for the SAC and SPA (i.e. no significant effects).

4.4 Option R021a: Source O DO Recovery

Summary of Scheme

This option would increase deployable output from three boreholes at Source O which are connected by adits. The existing boreholes are connected with horizontal adits which are at a relatively high level; as the water level is drawn down in dry conditions the adit is exposed and sediment causes water quality problems. The proposed solution is to extend the casing at the top of Borehole No2, to block off the adits, and then to deepen the borehole by 24 m so that it matches borehole No1. The borehole pump would then be re-installed at a lower level to give greater drought resilience and to increase the ADO from 3.7 MI/d to the

recent actual figure of 5.5 MI/d. This is well below the average licence and no changes are required to above ground pipework or to treatment capacity. The option would not require any changes to the existing licence.

Likely Impact Pathways

Construction

This scheme would be a relative small-scale construction project, requiring construction work round the existing boreholes; these are located over 3 km from the nearest designated sites (those coincident with Chichester harbour) and so the principal environmental risks are therefore likely to be contamination of surface waters by site-derived pollutants only.

Operation

The operation of the scheme would be essentially neutral; there will be no change to the licence and the DO gain would be through improved borehole operation rather than increases in abstracted volumes; operational effects would not therefore be expected.

Screening of European Sites

There are 10 European sites downstream or within 15km of the likely locations of the construction works, or otherwise linked by a potential effect pathway. The sites, their interest features, and location relative to the option are set out in **Table 4.4**. Distances are stated from Source O.

Table 4.4 European sites within 15 km of Option, or otherwise connected

Site and Interest Features	~Distance / Connectivity
Kingley Vale SAC ▶ <i>Taxus baccata</i> woods of the British Isles	2.2km
Butser Hill SAC ▶ Semi-natural dry grasslands and scrubland facies on calcareous substrates (<i>Festuco-Brometalia</i>) (* important orchid sites) ▶ <i>Taxus baccata</i> woods of the British Isles	12.9km
Rook Cliff SAC ▶ <i>Tilio-Acerion</i> forests of slopes, screes and ravines	9.8km
Solent Maritime SAC ▶ Sandbanks which are slightly covered by sea water all the time ▶ Estuaries ▶ Mudflats and sandflats not covered by seawater at low tide ▶ Coastal lagoons ▶ Annual vegetation of drift lines ▶ Perennial vegetation of stony banks ▶ <i>Salicornia</i> and other annuals colonizing mud and sand ▶ <i>Spartina</i> swards (<i>Spartinion maritimae</i>) ▶ Atlantic salt meadows (<i>Glauco-Puccinellietalia maritimae</i>) ▶ Shifting dunes along the shoreline with <i>Ammophila arenaria</i> ("white dunes") ▶ Desmoulin's whorl snail <i>Vertigo moulinsiana</i>	3.4km / DS
Singleton and Cocking Tunnels SAC ▶ Barbastelle <i>Barbastella barbastellus</i> ▶ Bechstein's bat <i>Myotis bechsteini</i>	9.1 km
Solent and Isle of Wight Lagoons SAC	12.6km

Site and Interest Features	~Distance / Connectivity
▶ Coastal lagoons	
Chichester and Langstone Harbours SPA	3.4km / DS
<ul style="list-style-type: none"> ▶ Common shelduck <i>Tadorna tadorna</i> ▶ Eurasian wigeon <i>Anas penelope</i> ▶ Eurasian teal <i>Anas crecca</i> ▶ Northern pintail <i>Anas acuta</i> ▶ Northern shoveler <i>Anas clypeata</i> ▶ Red-breasted merganser <i>Mergus serrator</i> ▶ Ringed plover <i>Charadrius hiaticula</i> ▶ Grey plover <i>Pluvialis squatarola</i> ▶ Sanderling <i>Calidris alba</i> ▶ Bar-tailed godwit <i>Limosa lapponica</i> ▶ Eurasian curlew <i>Numenius arquata</i> ▶ Common redshank <i>Tringa totanus</i> ▶ Ruddy turnstone <i>Arenaria interpres</i> ▶ Sandwich tern <i>Sterna sandvicensis</i> ▶ Common tern <i>Sterna hirundo</i> ▶ Little tern <i>Sterna albifrons</i> ▶ Dunlin <i>Calidris alpina alpina</i> ▶ Dark-bellied brent goose <i>Branta bernicla bernicla</i> ▶ Waterfowl assemblage 	
Pagham Harbour SPA	10.9km
<ul style="list-style-type: none"> ▶ Ruff <i>Philomachus pugnax</i> ▶ Common tern <i>Sterna hirundo</i> ▶ Little tern <i>Sterna albifrons</i> ▶ Dark-bellied brent goose <i>Branta bernicla bernicla</i> 	
Chichester and Langstone Harbours Ramsar	3.4km / DS
<ul style="list-style-type: none"> ▶ Crit. 1 - sites containing representative, rare or unique wetland types ▶ Crit. 5 - regularly supports 20,000 or more waterbirds ▶ Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds 	
Pagham Harbour Ramsar	10.9km
<ul style="list-style-type: none"> ▶ Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds 	

*Priority features
DS – Downstream site

Several of these sites will be unaffected by the option, primarily due to the absence of impact pathways; these sites are identified in **Table 4.5**, and are not considered further within the assessment of this option (note, for these sites it is considered that there will be ‘no effects’ (as opposed to ‘no likely significant effects’) and so there will be no possibility of ‘in combination’ effects).

Table 4.5 Initial screening of European sites

Site	Consider further?	Rationale
Butser Hill SAC	No	No reasonable impact pathways (distance, separate catchment).
Kingley Vale SAC	No	No reasonable impact pathways (distance, upland / up catchment site).
Rook Clift SAC	No	No reasonable impact pathways (distance, separate catchment).
Singleton and Cocking Tunnels SAC	No	No effects on habitats of site (distance); scheme construction likely to be very limited, associated with existing boreholes, and potential effects on mobile species from this site can easily be avoided with normal best practice.

Site	Consider further?	Rationale
Solent and Isle of Wight Lagoons SAC	No	No reasonable impact pathways (distance)
Solent Maritime SAC	Yes	Downstream receptor
Chichester and Langstone Harbours SPA	Yes	Downstream receptor
Pagham Harbour SPA	No	No reasonable impact pathways (distance, separate catchment).
Chichester and Langstone Harbours Ramsar	Yes	Downstream receptor
Pagham Harbour Ramsar	No	No reasonable impact pathways (distance, separate catchment).

Appropriate Assessment – Solent Maritime SAC; Chichester and Langstone Harbours SPA / Ramsar

Incorporated Measures

Appropriate site- and feature-specific avoidance measures and development criteria are set out in **Appendix G** of this HRA, and are referenced by the WRMP. The WRMP requires that these measures be employed at the project-level unless scheme-specific HRAs or environmental studies demonstrate that they are not required (i.e. the anticipated effect will not occur), not appropriate, or that alternative or additional measures are more appropriate. No specific measures (over the requirements for normal project-level planning and best-practice) are considered necessary at the plan-level for the other European sites potentially exposed to the likely effects of the option.

Assessment – Construction

The mobile interest features of the SPA and Ramsar sites (wintering / breeding birds) will not be directly exposed to the potential effects of the option due to the distance from the construction areas. However, the supporting habitats (specifically, from the SAC, those habitats associated with the upper reaches of the Chichester harbour, i.e. **Estuaries; Mudflats and sandflats not covered by seawater at low tide; Salicornia and other annuals colonizing mud and sand; *Spartina* swards (*Spartinion maritimae*); and Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)**) may be affected by construction of the scheme if appropriate measures are not employed. Substantial effects on these habitats could affect dependent species of the SPA and Ramsar. The construction works associated with the option would be small scale, associated with existing borehole assets some distance from the coast, and so potential effects can be certainly avoided using the normal best-practice measures outlined in **Appendix G**. **No effects** would be anticipated (and so no risk of ‘in combination’ effects).

Assessment – Operation

As noted, this option will achieve DO gain through improved borehole operation rather than increases in abstracted volumes, and so no operational effects on the European sites would not be expected (i.e. abstraction would be within the terms of the existing licence, which was assessed under Review of Consents). **No effects** would be anticipated (and so no risk of ‘in combination’ effects).

Conclusion

This option will have **no effects** on the interest features of any European sites, due to distance, the absence of reasonable impact pathways, and the reliability of best-practice construction measures. As no effects are anticipated there is no risk of ‘in combination’ effects, and so the conclusion is that this scheme will have **no adverse effects, alone or in combination**.

4.5 Option R022a: Source J Group - Maximising DO

Summary of Scheme

This option would involve the development of two new boreholes at the existing Source J WTW site. The approximate locations of the two new boreholes would be within a 300m radius of the existing WTW and pumping station. The boreholes would be 140 m deep with additional pumps and new raw water mains (300m) connecting the boreholes to the existing raw water network. Implementation of the scheme would also require modifications to the WTW's treatment processes regarding additional chlorine and orthophosphoric acid treatment. Once operational, the new boreholes will abstract a cumulative 12.5 MI/d thus increasing the facility's overall abstraction volume to 25 MI/d which would remain within the peak existing licence (25.20 MI/d).

This Option would involve maximising deployable output of the Source J group source within the terms of the existing abstraction licence (i.e. no changes to the current licence would be required). Some construction of additional boreholes and associated pipework would be required, in order to provide the additional 12.5 MI/d required to enable the full benefit of the existing licences to be delivered.

Likely Impact Pathways

Construction

The construction works required are relatively small-scale, mostly associated with existing assets, and so potential construction-related effects will be localised and short duration. The principal environmental risks are therefore likely to be

- ▶ contamination of surface waters by site-derived pollutants;
- ▶ disturbance of sensitive species (e.g. from site lighting, noise, visual impact, vibration, etc.).

Operation

With regard to European sites, this is effectively a network solution operating within Portsmouth Water's currently licensed volumes and therefore no operational effects on water-resource sensitive sites will occur.

Screening of European Sites

There are 7 European sites downstream or within 15km of this option, or otherwise linked by a potential effect pathway. The sites, their interest features, and location relative to the option are set out in **Table 4.6**.

Table 4.6 European sites within 15 km of Option, or otherwise connected

Site and Interest Features	~Distance / Connectivity
Butser Hill SAC <ul style="list-style-type: none"> ▶ Semi-natural dry grasslands and scrubland facies on calcareous substrates (<i>Festuco-Brometalia</i>) (* important orchid sites) ▶ <i>Taxus baccata</i> woods of the British Isles 	
Solent Maritime SAC	

Site and Interest Features	~Distance / Connectivity
<ul style="list-style-type: none"> ▶ Sandbanks which are slightly covered by sea water all the time ▶ Estuaries ▶ Mudflats and sandflats not covered by seawater at low tide ▶ Coastal lagoons ▶ Annual vegetation of drift lines ▶ Perennial vegetation of stony banks ▶ Salicornia and other annuals colonizing mud and sand ▶ <i>Spartina</i> swards (<i>Spartinion maritimae</i>) ▶ Atlantic salt meadows (<i>Glauco-Puccinellietalia maritimae</i>) ▶ Shifting dunes along the shoreline with <i>Ammophila arenaria</i> ("white dunes") ▶ Desmoulin's whorl snail <i>Vertigo moulinsiana</i> 	
Solent and Isle of Wight Lagoons SAC	
<ul style="list-style-type: none"> ▶ Coastal lagoons 	
Chichester and Langstone Harbours SPA	
<ul style="list-style-type: none"> ▶ Common shelduck <i>Tadorna tadorna</i> ▶ Eurasian wigeon <i>Anas penelope</i> ▶ Eurasian teal <i>Anas crecca</i> ▶ Northern pintail <i>Anas acuta</i> ▶ Northern shoveler <i>Anas clypeata</i> ▶ Red-breasted merganser <i>Mergus serrator</i> ▶ Ringed plover <i>Charadrius hiaticula</i> ▶ Grey plover <i>Pluvialis squatarola</i> ▶ Sanderling <i>Calidris alba</i> ▶ Bar-tailed godwit <i>Limosa lapponica</i> ▶ Eurasian curlew <i>Numenius arquata</i> ▶ Common redshank <i>Tringa totanus</i> ▶ Ruddy turnstone <i>Arenaria interpres</i> ▶ Sandwich tern <i>Sterna sandvicensis</i> ▶ Common tern <i>Sterna hirundo</i> ▶ Little tern <i>Sterna albifrons</i> ▶ Dunlin <i>Calidris alpina alpina</i> ▶ Dark-bellied brent goose <i>Branta bernicla bernicla</i> ▶ Waterfowl assemblage 	
Portsmouth Harbour SPA	
<ul style="list-style-type: none"> ▶ Red-breasted merganser <i>Mergus serrator</i> ▶ Black-tailed godwit <i>Limosa limosa islandica</i> ▶ Dunlin <i>Calidris alpina alpina</i> ▶ Dark-bellied brent goose <i>Branta bernicla bernicla</i> 	
Chichester and Langstone Harbours Ramsar	
<ul style="list-style-type: none"> ▶ Crit. 1 - sites containing representative, rare or unique wetland types ▶ Crit. 5 - regularly supports 20,000 or more waterbirds ▶ Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds 	
Portsmouth Harbour Ramsar	
<ul style="list-style-type: none"> ▶ Crit. 3 - supports populations of plant/animal species important for maintaining regional biodiversity ▶ Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds 	

*Priority features

DS – Downstream site

These sites will all be unaffected by the option, primarily due to the absence of impact pathways (see Table 4.7) and are not considered further within the assessment of this option (note, for these sites it is considered that there will be 'no effects' (as opposed to 'no likely significant effects') and so there will be no possibility of 'in combination' effects).

Table 4.7 Initial screening of European sites

Site	Consider further?	Rationale
Butser Hill SAC	No	No reasonable impact pathways (distance, separate catchment).
Chichester and Langstone Harbours Ramsar	No	Operation within terms of existing licence; Source J approximately 15 km upstream of Portsmouth Harbour and therefore effects on this the Chichester and Langstone Harbours SPA will be negligible. Direct or indirect construction effects unlikely for same reason and can reliably be avoided/mitigated by normal construction best-practice (see Appendix G).
Chichester and Langstone Harbours SPA	No	Operation within terms of existing licence; Source J approximately 15 km upstream of Portsmouth Harbour and therefore effects on this the Chichester and Langstone Harbours SPA will be negligible. Direct or indirect construction effects unlikely for same reason and can reliably be avoided/mitigated by normal construction best-practice (see Appendix G).
Portsmouth Harbour Ramsar	No	Not considered exposed (see above)
Portsmouth Harbour SPA	Yes	Operation within terms of existing licence; Source J approximately 15 km upstream of Portsmouth Harbour and so effects on this SPA will be negligible due to other water inputs. Direct or indirect construction effects unlikely and can reliably be avoided/mitigated by normal construction best-practice (see Appendix G).
Solent and Isle of Wight Lagoons SAC	No	Operation within terms of existing licence; no reasonable impact pathways for works associated with construction.
Solent Maritime SAC	No	Operation within terms of existing licence and so will not affect those interest features within the SAC that are sensitive to WR permissions. Note that Source J source does not drain directly to this SAC.

Appropriate Assessment – Portsmouth Harbour SPA

Incorporated Measures

Appropriate site- and feature-specific avoidance measures and development criteria are set out in **Appendix G** of this HRA, and are referenced by the WRMP. The WRMP requires that these measures be employed at the project-level unless scheme-specific HRAs or environmental studies demonstrate that they are not required (i.e. the anticipated effect will not occur), not appropriate, or that alternative or additional measures are more appropriate. No additional specific measures (over the requirements for normal project-level planning and best-practice) are considered necessary at the plan-level for the other European sites potentially exposed to the likely effects of the option.

Assessment of Effects

Operation of the scheme is within the terms of the existing licence and so no effects are expected through this mechanism. It should be noted that the abstraction at Source J is from the confined chalk aquifer and therefore abstraction is not expected to result in significant changes to flows in the surface water courses. Further, the Post Implementation Monitoring/Water Framework Directive investigations found that there were no significant impacts from abstraction at Source J.

With regard to construction, Source J is approximately 15 km upstream of Portsmouth Harbour; direct or indirect construction effects due to (e.g.) site-derived pollutants can reliably be avoided/mitigated by normal construction best-practice (see **Appendix G**), and the distance downstream will also ensure attenuation of any pollutants that incidentally enter local watercourses.

Conclusion

The appropriate assessment concludes that this scheme will have **no adverse effects** (alone) on any European sites as a result of either its construction or operation.

4.6 Option R023a: Source H DO Recovery

Summary of Scheme

The ADO at Source H is 7.1 MI/d although this is constrained by water quality problems at higher flows. The proposed solution is to use air lift pumps in the existing boreholes after a maximum flow pumping test; this should clean the boreholes of sediment and return the source ADO to the average licence figure of 9.1 MI/d, so recovering approximately 2 MI/d. No changes are required to the pipework or treatment works, or to the licenced abstraction volumes.

Likely Impact Pathways

Construction

This scheme would involve very small scale modifications to the borehole, which is located over 1.5 km from the nearest European site; the principal environmental risks are therefore likely to be contamination of surface waters by site-derived pollutants only, although there are no surface water courses in close proximity to the borehole.

Operation

The operation of the scheme would be essentially neutral; there will be no change to the licence and the DO gain would be through improved borehole operation rather than increases in abstracted volumes; operational effects would not therefore be expected. However, it should be noted that abstractions affecting the River Meon have been previously investigated for their potential to affect the Titchfield Haven SSSI (and hence the Solent and Southampton Water SPA), and the EA has suggested that there may be possible 'deterioration' of water quality in the River Meon under the WFD. In addition, the Solent and Southampton Water SPA includes some intertidal habitat areas which may be exposed also.

Screening of European Sites

There are 13 European sites downstream or within 15km of the likely locations of the construction works, or otherwise linked by a potential effect pathway. The sites, their interest features, and location relative to the option are set out in **Table 4.8**.

Table 4.8 European sites within 15 km of Option, or otherwise connected

Site and Interest Features	~Distance / Connectivity
Solent and Southampton Water SPA <ul style="list-style-type: none"> ▶ Ringed plover <i>Charadrius hiaticula</i> ▶ Mediterranean gull <i>Larus melanocephalus</i> ▶ Black-tailed godwit <i>Limosa limosa islandica</i> ▶ Little tern <i>Sterna albifrons</i> ▶ Roseate tern <i>Sterna dougallii</i> ▶ Dark-bellied brent goose <i>Branta bernicla bernicla</i> ▶ Sandwich tern <i>Sterna sandvicensis</i> ▶ Eurasian teal <i>Anas crecca</i> ▶ Common tern <i>Sterna hirundo</i> ▶ Waterfowl assemblage 	1.3km / DS
Solent and Southampton Water Ramsar	1.3km / DS

Site and Interest Features	~Distance / Connectivity
<ul style="list-style-type: none"> ▶ Crit. 1 - sites containing representative, rare or unique wetland types ▶ Crit. 2 - supports vulnerable, endangered, or critically endangered species or threatened eco. communities ▶ Crit. 5 - regularly supports 20,000 or more waterbirds ▶ Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds 	
<p>New Forest Ramsar</p> <ul style="list-style-type: none"> ▶ Crit. 1 - sites containing representative, rare or unique wetland types ▶ Crit. 3 - supports populations of plant/animal species important for maintaining regional biodiversity ▶ Crit. 2 - supports vulnerable, endangered, or critically endangered species or threatened eco. communities 	11.2km
<p>The New Forest SAC</p> <ul style="list-style-type: none"> ▶ Oligotrophic waters containing very few minerals of sandy plains (<i>Littorelletalia uniflorae</i>) ▶ Oligotrophic to mesotrophic standing waters with vegetation of the <i>Littorelletea uniflorae</i> and/or of the <i>Isoëto-Nanojuncetea</i> ▶ Northern Atlantic wet heaths with <i>Erica tetralix</i> ▶ European dry heaths ▶ <i>Molinia</i> meadows on calcareous, peaty or clayey-silt-laden soils (<i>Molinion caeruleae</i>) ▶ Transition mires and quaking bogs ▶ Depressions on peat substrates of the <i>Rhynchosporion</i> ▶ Alkaline fens ▶ Atlantic acidophilous beech forests with <i>Ilex</i> and sometimes also <i>Taxus</i> in the shrublayer (<i>Quercion robri-petraeae</i> or <i>Ilici-Fagenion</i>) ▶ <i>Asperulo-Fagetum</i> beech forests ▶ Old acidophilous oak woods with <i>Quercus robur</i> on sandy plains ▶ Bog woodland ▶ Alluvial forests with <i>Alnus glutinosa</i> and <i>Fraxinus excelsior</i> (<i>Alno-Padion</i>, <i>Alnion incanae</i>, <i>Salicion albae</i>) ▶ Great crested newt <i>Triturus cristatus</i> ▶ Southern damselfly <i>Coenagrion mercuriale</i> ▶ Stag beetle <i>Lucanus cervus</i> 	11.2km
<p>New Forest SPA</p> <ul style="list-style-type: none"> ▶ Wood warbler <i>Phylloscopus sibilatrix</i> ▶ Wood lark <i>Lullula arborea</i> ▶ Dartford warbler <i>Sylvia undata</i> ▶ Hen harrier <i>Circus cyaneus</i> ▶ European nightjar <i>Caprimulgus europaeus</i> ▶ Eurasian hobby <i>Falco subbuteo</i> ▶ European honey-buzzard <i>Pernis apivorus</i> 	11.2km
<p>River Itchen SAC</p> <ul style="list-style-type: none"> ▶ Water courses of plain to montane levels with the <i>Ranunculion fluitantis</i> and <i>Callitriche-Batrachion</i> vegetation ▶ Brook lamprey <i>Lampetra planeri</i> ▶ Atlantic salmon <i>Salmo salar</i> ▶ Bullhead <i>Cottus gobio</i> ▶ Southern damselfly <i>Coenagrion mercuriale</i> ▶ White-clawed (or Atlantic stream) crayfish <i>Austropotamobius pallipes</i> ▶ Otter <i>Lutra lutra</i> 	5.3km
<p>Solent Maritime SAC</p> <ul style="list-style-type: none"> ▶ Sandbanks which are slightly covered by sea water all the time ▶ Estuaries ▶ Mudflats and sandflats not covered by seawater at low tide ▶ Coastal lagoons ▶ Annual vegetation of drift lines ▶ Perennial vegetation of stony banks ▶ Salicornia and other annuals colonizing mud and sand ▶ <i>Spartina</i> swards (<i>Spartinion maritimae</i>) ▶ Atlantic salt meadows (<i>Glauco-Puccinellietalia maritimae</i>) ▶ Shifting dunes along the shoreline with <i>Ammophila arenaria</i> ("white dunes") ▶ Desmoulin's whorl snail <i>Vertigo moulinsiana</i> 	3.7km
<p>Bridlesford Copses SAC</p>	14.3km

Site and Interest Features	~Distance / Connectivity
▶ Bechstein's bat <i>Myotis bechsteini</i>	
Solent and Isle of Wight Lagoons SAC	10.7km
▶ Coastal lagoons	
Chichester and Langstone Harbours SPA	12.3km
<ul style="list-style-type: none"> ▶ Common shelduck <i>Tadorna tadorna</i> ▶ Eurasian wigeon <i>Anas penelope</i> ▶ Eurasian teal <i>Anas crecca</i> ▶ Northern pintail <i>Anas acuta</i> ▶ Northern shoveler <i>Anas clypeata</i> ▶ Red-breasted merganser <i>Mergus serrator</i> ▶ Ringed plover <i>Charadrius hiaticula</i> ▶ Grey plover <i>Pluvialis squatarola</i> ▶ Sanderling <i>Calidris alba</i> ▶ Bar-tailed godwit <i>Limosa lapponica</i> ▶ Eurasian curlew <i>Numenius arquata</i> ▶ Common redshank <i>Tringa totanus</i> ▶ Ruddy turnstone <i>Arenaria interpres</i> ▶ Sandwich tern <i>Sterna sandvicensis</i> ▶ Common tern <i>Sterna hirundo</i> ▶ Little tern <i>Sterna albifrons</i> ▶ Dunlin <i>Calidris alpina alpina</i> ▶ Dark-bellied brent goose <i>Branta bernicla bernicla</i> ▶ Waterfowl assemblage 	
Chichester and Langstone Harbours Ramsar	12.3km
<ul style="list-style-type: none"> ▶ Crit. 1 - sites containing representative, rare or unique wetland types ▶ Crit. 5 - regularly supports 20,000 or more waterbirds ▶ Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds 	
Portsmouth Harbour SPA	4.1km
<ul style="list-style-type: none"> ▶ Red-breasted merganser <i>Mergus serrator</i> ▶ Black-tailed godwit <i>Limosa limosa islandica</i> ▶ Dunlin <i>Calidris alpina alpina</i> ▶ Dark-bellied brent goose <i>Branta bernicla bernicla</i> 	
Portsmouth Harbour Ramsar	4.1km
<ul style="list-style-type: none"> ▶ Crit. 3 - supports populations of plant/animal species important for maintaining regional biodiversity ▶ Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds 	

*Priority features
DS – Downstream site

Several of these sites will be unaffected by the option, primarily due to the absence of impact pathways; these sites are identified in **Table 4.9**, and are not considered further within the assessment of this option (note, for these sites it is considered that there will be ‘no effects’ (as opposed to ‘no likely significant effects’) and so there will be no possibility of ‘in combination’ effects).

Table 4.9 Initial screening of European sites

Site	Consider further?	Rationale
Solent and Southampton Water SPA	Yes	Downstream receptor
Solent and Southampton Water Ramsar	Yes	Downstream receptor

Site	Consider further?	Rationale
New Forest SPA	No	No reasonable impact pathways (distance, separate catchment).
The New Forest SAC	No	No reasonable impact pathways (distance, separate catchment).
New Forest Ramsar	No	No reasonable impact pathways (distance, separate catchment).
River Itchen SAC	No	No reasonable impact pathways (distance, separate catchment).
Solent Maritime SAC	No	No reasonable impact pathways (distance, separate catchment).
Bridlesford Copses SAC	No	No reasonable impact pathways (distance; theoretical possibility of effects on mobile species effects easily avoidable with normal best practice)
Solent and Isle of Wight Lagoons SAC	No	No reasonable impact pathways (distance)
Chichester and Langstone Harbours SPA	No	No reasonable impact pathways (distance, separate catchment).
Portsmouth Harbour SPA	No	No reasonable impact pathways (distance, separate catchment).
Chichester and Langstone Harbours Ramsar	No	No reasonable impact pathways (distance, separate catchment).
Portsmouth Harbour Ramsar	No	No reasonable impact pathways (distance, separate catchment).

Appropriate Assessment – Solent and Southampton Water SPA / Ramsar

Incorporated Measures

Appropriate site- and feature-specific avoidance measures and development criteria are set out in **Appendix G** of this HRA, and are referenced by the WRMP. The WRMP requires that these measures be employed at the project-level unless scheme-specific HRAs or environmental studies demonstrate that they are not required (i.e. the anticipated effect will not occur), not appropriate, or that alternative or additional measures are more appropriate. No specific measures (over the requirements for normal project-level planning and best-practice) are considered necessary at the plan-level for the other European sites potentially exposed to the likely effects of the option.

Context

Most areas of the Solent and Southampton Water SPA and Solent and Southampton Water Ramsar sites will not be directly exposed to the likely effects of this option due to their location relative to the borehole. The exceptions to this are as follows:

- ▶ The components of these sites that coincide with Titchfield Haven SSSI; the SPA / Ramsar in this area comprises an extensive area of marshland, waterbodies, reedbed and meadows (formerly the River Meon estuary before it silted-up in the Middle Ages). The SSSI is notable for its wintering populations of wigeon and teal, and the other wintering features of the SPA (**ringed plover; dark-bellied brent geese; black-tailed godwit; waterfowl assemblage**) are likely to also make periodic use of the area (dark-bellied brent geese have been previously recorded foraging on fields within and near the site, although this behaviour is dependent on the management of the fields which is not always consistent outside the SSSI). The breeding features of the SPA are not thought to make significant use of this SSSI.
- ▶ The intertidal areas of the SPA and Ramsars sites immediately around Hill Head, where the Meon flows to the Solent via tidal valves. Past work at other estuary sites in the UK has suggested that there may be a relationship between certain waterbirds and intertidal freshwater flows or channels (Ravenscroft *et al.* (1997), Ravenscroft (1998, 1999), Ravenscroft & Beardall

(2002) & Ravenscroft & Emes (2004)). Broadly, these studies concluded that the number and densities of waterbirds around some freshwater flows were consistently greater than across associated mudflats and that several species showed significant preferences for freshwater flow areas over mudflats. However, the causal relationships between bird distributions and freshwater flows are not clear. Research suggests that association of birds with creeks cannot be explained simply by food availability and the exact mechanism appears relatively complex, involving intricate and often indirect relationships between the SPA birds, their behaviour, their invertebrate prey, the tidal and freshwater flow regimes, geomorphological processes, substrate characteristics, the geographical location, roost sites, and the degree of disturbance by predators or human activity. There is also much evidence that the association may be with the creek rather than the freshwater *per se*.

The lower reaches of the Meon have a long history of management and intervention, with the result that the Meon no longer has an estuary; the flow of the Meon into the Solent is controlled by tidal valves at Hill Head. The former estuarine areas now comprise the marshes of the Titchfield Haven SSSI, which are fed by the Meon and local water courses; water levels in the marshes are therefore controlled and managed via sluices and valves.

Assessment of Effects – Construction

This scheme would involve very small scale modifications to the borehole, which is located in Titchfield over 1.5 km from the Solent and Southampton Water SPA / Ramsar, and there are no surface water courses in close proximity to the borehole. It is certain that construction these risks can be adequately managed through the normal project planning process and standard best-practice measures (see **Appendix G**), and no effects would be anticipated (and so no risk of 'in combination' effects).

Assessment of Effects – Operation

As noted, the operation of the scheme would be essentially neutral; there will be no change to the licence and the DO gain would be through improved borehole operation rather than increases in permitted abstraction volumes; operational effects would not therefore be expected.

It is worth noting that the effects of PWS abstraction on the Titchfield Haven component of the SPA and the associated intertidal habitats at Hill Head were previously investigated by the EA and PW in 2013 (Amec 2013)²⁵. In summary, the 2013 analysis looked at the potential influence of a fully licensed abstraction regime on the supporting habitats of Titchfield Haven and Hillhead Harbour through development of a hydrological model of Titchfield Haven. This represented flows out of the scrapes within the SSSI (which are considered to be the key actively-managed water-dependent habitat in the site), as well as total flow to Hillhead Harbour. The analysis demonstrated that a fully licensed PWS abstraction regime, based on maximum annual average abstraction rates, would allow some flow to continue to Hillhead Harbour at all times. Flow from the scrapes would also, in theory, have remained above zero in all except a very small number of days in the summer of 1976. The only water level management practice taken account of in the model was an assumed split of flow between the river and canal of 70%-30% (it may be noted that shifting this proportion in favour of the canal would prevent flows from the scrapes from reaching zero in 1976). No other water level management within the site was accounted for, and the tidal influence at the lower end of the site was ignored (so arguably under-representing the water available in reality, and the positive influence of water level management practices). However, a risk was identified for very dry years for spray irrigation abstractions from the river and canal within Titchfield Haven, which have relatively high daily maximum limits and tend to abstract for short periods at high rates; during a period of exceptional low flows (such as those experienced in the summer of 1976) this has the potential to significantly limit water availability to the habitats of Titchfield Haven and Hillhead Harbour, albeit for a limited period. As a result, sustainability reductions have been imposed on abstractions for spray irrigation, and there is a requirement for the provision of raw water augmentation to the River Meon from PW's Source G source (under low flow conditions).

²⁵ The relevant chapter from this report is included in Appendix H, and provides a detailed analysis of the hydrological functioning of the Titchfield Haven and potential effects on the SPA and Ramsar sites from the currently licensed abstraction regime.

With regard to the preferred option, PW have not received any notifications from the EA regards the Source H licence, and the licence has not been included in the Water Industry National Environment Programme (WINEP); the licenced volumes are therefore considered available for use, and will be realised through borehole improvements (although it should be noted that abstraction to the licenced volumes will rarely be required). Abstraction is not currently identified as an issue affecting this area of the SPA / Ramsar; in particular:

- ▶ The SSSI condition assessment notes that water levels can be managed independently of the river, and all but one of the Titchfield Haven SSSI units are in 'unfavourable recovering' condition; water levels or abstraction are not noted as issues affecting the site in the condition assessment.
- ▶ The outflow of the River Meon from Titchfield Haven is via tidal flaps at low tide to Hillhead Harbour, from where it flows in a defined channel towards the low tide level; flow and salinity surveys (see Amec 2013) on this channel at a range of flows (including at a time when flows at Mislingford fell as low as Q96) showed that a relatively freshwater outflow was maintained at a significant rate at low tide, probably due to the storage that builds up behind the tidal flaps at high tide, and illustrates that the current hydrological regime of the river (including existing impacts of abstraction on flows) allows minimum requirements regarding flow through this channel to be met.
- ▶ The potential issues with the flows in the Meon are associated with water quality and low flows in the summer periods.

Conclusion

This option requires minor upgrades to an existing borehole to allow abstraction up to the currently licenced volumes, if required. The operation of the scheme would be essentially neutral; there will be no change to the licence and the DO gain would be through improved borehole operation rather than increases in permitted abstraction volumes, and so 'no effects' would be anticipated; no construction effects will occur. On this basis, the option will have **no adverse effects** on the Solent and Southampton Water SPA / Ramsar, alone or in combination.

4.7 Option R024a: Source C DO recovery scheme

Summary of Scheme

This option would primarily involve the infrastructural modification of Source C WTW's treatment process through the installation of disposable cartridge filters in order to reduce turbidity at the WTW. Implementation of the new disposable cartridge filters is expected to recover between 4MI/d (ADO) and 5.5MI/d (PDO).

Likely Impact Pathways

Construction

The construction works required are small-scale associated with existing assets, and so potential construction-related effects will be localised and short duration. The principal environmental risks are therefore likely to be

- ▶ contamination of surface waters by site-derived pollutants;
- ▶ disturbance of sensitive species (e.g. from site lighting, noise, visual impact, vibration, etc.).

Operation

With regard to European sites, this is an asset improvement scheme operating within Portsmouth Water's currently licensed volumes and therefore no operational effects on water-resource sensitive sites will occur.

Screening of European Sites

There is one European site within 15km of the likely locations of the enabling works, or otherwise linked by a potential effect pathway (River Itchen SAC; see **Table 4.10**).

Table 4.10 European sites within 15 km of Option, or otherwise connected

Site and Interest Features	~Distance / Connectivity
River Itchen SAC <ul style="list-style-type: none"> ▶ Water courses of plain to montane levels with the <i>Ranunculion fluitantis</i> and <i>Callitricho-Batrachion</i> vegetation ▶ Southern damselfly <i>Coenagrion mercuriale</i> ▶ Bullhead <i>Cottus gobio</i> ▶ White-clawed (or Atlantic stream) crayfish <i>Austropotamobius pallipes</i> ▶ Brook lamprey <i>Lampetra planeri</i> ▶ Atlantic salmon <i>Salmo salar</i> ▶ Otter <i>Lutra lutra</i> 	7 km

*Priority features

DS – Downstream site

The River Itchen will be unaffected by the option, due to the absence of impact pathways (river is in a separate catchment and over 7km from the WTW). Note, for this site it is considered that there will be '**no effects**' (as opposed to 'no likely significant effects') and so there will be no possibility of 'in combination' effects).

Incorporated Measures

Appropriate site- and feature-specific avoidance measures and development criteria are set out in Appendix G of this HRA, and are referenced by the WRMP. The WRMP requires that these measures be employed at the project-level unless scheme-specific HRAs or environmental studies demonstrate that they are not required (i.e. the anticipated effect will not occur), not appropriate, or that alternative or additional measures are more appropriate. No additional specific measures (over the requirements for normal project-level planning and best-practice) are considered necessary at the plan-level for the other European sites potentially exposed to the likely effects of the option.

Conclusion

The scheme is a relatively minor upgrade within an existing operational site. There will be no changes to abstraction and operational effects would not be expected. Direct or indirect construction effects are also unlikely given the distance to the nearest European site (River Itchen SAC, >6km), and can reliably be avoided/mitigated by normal construction best-practice. The screening concludes that this scheme will have **no effects** on any European sites as a result of either its construction or operation.

4.8 Option R068: Source S Drought Permit

Summary of Scheme

This option would involve increasing the licenced daily abstraction limit of Source S borehole and WTW from 2.5 Ml/d to 11 Ml/d under severe drought conditions via a new drought permit in order to provide an additional 8.5 Ml/d for public consumption. The Source S source is located within the chalk aquifer which also feeds Swanbourne Lake.

Likely Impact Pathways

Construction

No construction works would be required for this option.

Operation

The increase in the abstraction licence is likely to increase drawdown under drought conditions, which may affect groundwater dependent terrestrial ecosystems or surface waters connected to the aquifer. In general, EA guidance suggests that significant effects as a result of ground water abstractions are unlikely on European sites over 5 km from the abstraction (National EA guidance: *Habitats Directive Stage 2 Review: Water Resources Authorisations – Practical Advice for Agency Water Resources Staff*).

Screening of European Sites

There are 12 European sites downstream or within 15km of this option, or otherwise linked by a potential effect pathway. The sites, their interest features, and location relative to the option are set out in **Table 4.11**.

Table 4.11 European sites within 15 km of Option, or otherwise connected

Site and Interest Features	~Distance / Connectivity
Kingley Vale SAC ▶ <i>Taxus baccata</i> woods of the British Isles	13.5 km
Arun Valley SAC ▶ Ramshorn snail <i>Anisus vorticulus</i>	8.0 km
Arun Valley SPA ▶ Tundra swan <i>Cygnus columbianus bewickii</i> ▶ Waterfowl assemblage Waterfowl assemblage	8.0 km
Arun Valley Ramsar ▶ Crit. 2 - supports vulnerable, endangered, or critically endangered species or threatened eco. communities ▶ Crit. 3 - supports populations of plant/animal species important for maintaining regional biodiversity ▶ Crit. 5 - regularly supports 20,000 or more waterbirds	8.0 km
Solent Maritime SAC ▶ Sandbanks which are slightly covered by sea water all the time ▶ Estuaries ▶ Mudflats and sandflats not covered by seawater at low tide ▶ Coastal lagoons ▶ Annual vegetation of drift lines ▶ Perennial vegetation of stony banks ▶ Salicornia and other annuals colonizing mud and sand ▶ <i>Spartina</i> swards (<i>Spartinion maritimae</i>) ▶ Atlantic salt meadows (<i>Glauco-Puccinellietalia maritimae</i>) ▶ Shifting dunes along the shoreline with <i>Ammophila arenaria</i> ("white dunes") ▶ Desmoulin's whorl snail <i>Vertigo moulinsiana</i>	12.8 km
Dunston to Bignor Escarpment SAC ▶ <i>Asperulo-Fagetum</i> beech forests	4.8km
Chichester and Langstone Harbours SPA	12.8 km

Site and Interest Features	~Distance / Connectivity
<ul style="list-style-type: none"> ▶ Common shelduck <i>Tadorna tadorna</i> ▶ Eurasian wigeon <i>Anas penelope</i> ▶ Eurasian teal <i>Anas crecca</i> ▶ Northern pintail <i>Anas acuta</i> ▶ Northern shoveler <i>Anas clypeata</i> ▶ Red-breasted merganser <i>Mergus serrator</i> ▶ Ringed plover <i>Charadrius hiaticula</i> ▶ Grey plover <i>Pluvialis squatarola</i> ▶ Sanderling <i>Calidris alba</i> ▶ Bar-tailed godwit <i>Limosa lapponica</i> ▶ Eurasian curlew <i>Numenius arquata</i> ▶ Common redshank <i>Tringa totanus</i> ▶ Ruddy turnstone <i>Arenaria interpres</i> ▶ Sandwich tern <i>Sterna sandvicensis</i> ▶ Common tern <i>Sterna hirundo</i> ▶ Little tern <i>Sterna albifrons</i> ▶ Dunlin <i>Calidris alpina alpina</i> ▶ Dark-bellied brent goose <i>Branta bernicla bernicla</i> ▶ Waterfowl assemblage 	
<p>Pagham Harbour SPA</p> <ul style="list-style-type: none"> ▶ Ruff <i>Philomachus pugnax</i> ▶ Common tern <i>Sterna hirundo</i> ▶ Little tern <i>Sterna albifrons</i> ▶ Dark-bellied brent goose <i>Branta bernicla bernicla</i> 	12.3 km
<p>Chichester and Langstone Harbours Ramsar</p> <ul style="list-style-type: none"> ▶ Crit. 1 - sites containing representative, rare or unique wetland types ▶ Crit. 5 - regularly supports 20,000 or more waterbirds ▶ Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds 	12.8 km
<p>Pagham Harbour Ramsar</p> <ul style="list-style-type: none"> ▶ Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds 	12.3 km
<p>Singleton and Cocking Tunnels SAC</p> <ul style="list-style-type: none"> ▶ Barbastelle <i>Barbastella barbastellus</i> ▶ Bechstein's bat <i>Myotis bechsteini</i> 	10.3 km
<p>The Mens SAC</p> <ul style="list-style-type: none"> ▶ Atlantic acidophilous beech forests with <i>Ilex</i> and sometimes also <i>Taxus</i> in the shrublayer (<i>Quercion robur-petraeae</i> or <i>Ilici-Fagenion</i>) ▶ Barbastelle <i>Barbastella barbastellus</i> 	14.9 km

*Priority features

DS – Downstream site

No sites will be affected by this option, primarily due to the absence of impact pathways (see **Table 4.12**) (note, for these sites it is considered that there will be 'no effects' (as opposed to 'no likely significant effects') and so there will be no possibility of 'in combination' effects).

Table 4.12 Initial screening of European sites

Site	Consider further?	Rationale
Kingley Vale SAC	No	No reasonable impact pathways (distance, separate catchment).

Site	Consider further?	Rationale
Arun Valley SAC	No	The habitats of the site (alluvial grazing marsh and relict raised bog) will not be exposed to the effects of the scheme due to the location of the SAC relative to the borehole (approx. 8 km from borehole, on far side of River Arun, so no hydrological connectivity), and will not be particularly sensitive to direct groundwater drawdown. The feature of the site (Ramshorn snail) will not be affected.
Arun Valley SPA	No	The habitats of the site (alluvial grazing marsh and relict raised bog) will not be exposed to the effects of the scheme due to the location of the SAC relative to the borehole (approx. 8 km from borehole, on far side of River Arun, so no hydrological connectivity), and will not be particularly sensitive to direct groundwater drawdown. The features (waterbird assemblage and Tundra swan) will not be affected.
Arun Valley Ramsar	No	As for Arun Valley SPA / SAC
Solent Maritime SAC	No	No reasonable impact pathways (distance, separate catchment).
Chichester and Langstone Harbours Ramsar	No	No reasonable impact pathways (distance, separate catchment).
Chichester and Langstone Harbours SPA	No	No reasonable impact pathways (distance, separate catchment).
Pagham Ramsar	No	No reasonable impact pathways (distance, separate catchment).
Pagham Harbour SPA	No	No reasonable impact pathways (distance, separate catchment).
Duncton to Bignor Escarpment SAC	No	No reasonable impact pathways (distance, separate catchment); no construction and mobile species not to likely effects.
Singleton & Cocking Tunnels SAC	No	No reasonable impact pathways (distance, separate catchment).
The Mens SAC	No	No reasonable impact pathways (distance, separate catchment).

Incorporated Measures

Appropriate site- and feature-specific avoidance measures and development criteria are set out in **Appendix G** of this HRA, and are referenced by the WRMP. The WRMP requires that these measures be employed at the project-level unless scheme-specific HRAs or environmental studies demonstrate that they are not required (i.e. the anticipated effect will not occur), not appropriate, or that alternative or additional measures are more appropriate. No additional specific measures (over the requirements for normal project-level planning and best-practice) are considered necessary at the plan-level for the other European sites potentially exposed to the likely effects of the option.

Conclusion

The nearest European sites are Duncton – Bignor Escarpment SAC (~5km, not water resource sensitive), and Arun Valley SAC, Arun Valley SPA and Arun Valley Ramsar (~8.3km, on the far side of the River Arun). There are no water resource sensitive European sites within 5km of the borehole (and so direct effects on groundwater dependent terrestrial ecosystems due to any additional drawdown would not be expected) and the borehole is not within the catchment of any European sites (i.e. any effects on surface waters due to increased abstraction will not affect any European sites). The groundwater drawdown associated with borehole operation will not affect the Arun Valley sites (principally alluvial grazing marsh and relict raised bog). As a result, operational effects would not be expected. No construction works are proposed, although any construction required would not affect any European sites. As a result, **no effects** would be expected as a result of this scheme.

4.9 In Combination Effects

The assessment of 'in combination' effects in the following sections covers potential interactions between the preferred options and other schemes as individual projects, and the wider potential interactions associated with other strategies and plans.

Effects between Preferred Options

The 'in combination' assessment does not include 'demand management' options (e.g. leakage, drought, efficiency, other demand-side) as these will either not negatively affect any European sites, or (where construction might be required) cannot be meaningfully assessed (although it is certain that normal best-practice can ensure that significant or significant adverse effects are avoided due to the small-scale of any works associated with these options). The assessment therefore focuses on options R013, R022a, R024a, R068, R023a and R021a (see **Table 4.1**).

Table 4.14 summarises all of the European sites that are within 15km of **at least two options**, and which were therefore included in the screening process. It then indicates the conclusion of the screening and appropriate assessment stages detailed above for each option. The sites / options are then screened for potential for 'in combination' effects, again taking into account established project-level measures that are known to be effective. The colour key of the table is as follows:

Table 4.13 Key to Table 4.14

Key	
0	Options with no effect (alone) on any European sites due to absence of impact pathways.
N	Options with effect pathways but which will clearly have no significant effect alone at project-level.
N	Options with effect pathways but which can clearly avoid adverse effects at project-level with mitigation / avoidance measures.
U	Options where adverse effects cannot be categorically excluded at the plan-level.
?	Uncertain effect options – options that are not defined.
	European sites where there will be no 'in combination' effects between options.
	European sites where potential 'in combination' effect pathways exist, but which are clearly avoidable at the project-level.
	European sites where in combination effects between options cannot be categorically excluded at the plan-level.
	European sites where there are likely to be significant adverse in combination effects between options.

Table 4.14 Between-option 'in combination' assessment

European site	Effects of options 'alone' on each site						In combination effects?
	R013	R022a	R024a	R068	R021a	R023a	
Butser Hill SAC	0	0			0		Options will have no effect on this site so no i/c effects
Chichester and Langstone Harbours Ramsar	N	0		0	N		Potential i/c effects if options constructed simultaneously but avoidable with normal measures.
Chichester and Langstone Harbours SPA	N	0		0	N		Potential i/c effects if options constructed simultaneously but avoidable with normal measures.
Kingley Vale SAC	0				0		Options will have no effect on this site so no i/c effects
Pagham Harbour Ramsar				0	0		Options will have no effect on this site so no i/c effects
Pagham Harbour SPA				0	0		Options will have no effect on this site so no i/c effects
Portsmouth Harbour Ramsar	N	N					Options will have no significant effects alone and are will not operate in combination due to nature of options and likely timing.
Portsmouth Harbour SPA	N	N					Options will have no significant effects alone and are will not operate in combination due to nature of options and likely timing.
Rook Clift SAC	0				0		Options will have no effect on this site so no i/c effects
Singleton & Cocking Tunnels SAC				0	0		Options will have no effect on this site so no i/c effects
Solent and Isle of Wight Lagoons SAC	0	0			0		Options will have no effect on this site so no i/c effects
Solent Maritime SAC	N	N		0	N	N	Options will have no significant effects alone and are will not operate in combination due to nature of options and locations / zones of influence relative to each other.

Effects with major projects

Known major projects that are likely to increase demand have been taken into account during the development of the WRMP and determination of future deficits; this is in addition to the growth scenarios used to determine the effects of local plans/housing growth (etc). By modelling these major projects when determining deficits and proposals, the WRMP can ensure that LSE 'in combination' with these projects is unlikely (in terms of water resources availability). These projects are also unlikely to have 'in combination' effects in relation to construction, assuming normal construction best practice, due to the relative locations of these projects and the Preferred Options.

Reference has been made to the Planning Inspectorates National Infrastructure Projects database²⁶ which includes major projects, subject to the requirements of the Planning Act 2008. It includes project:

- ▶ Where the developer has advised the Planning Inspectorate in writing that they intend to submit an application to us in the future
- ▶ Where an application has already been made to the Planning Inspectorate and is undergoing the development consent process
- ▶ Where a proposal has been decided.

Currently there are no Nationally Significant Infrastructure Project proposed in or within 15km of the PWOA.

Minor projects

It has not been possible to produce a definitive list of existing (minor) planning applications near the likely zones of influence of the WRMP options, and in reality the timescales for construction of the Preferred Options are such that generating a list at this stage would be of little value. Since the WRMP has been based on the most recent ONS growth projections and developed with reference to local plans, the combined effect of any minor developments on water demand has been accounted for within the WRMP projections. As a result, it is considered that there will be no impacts in terms of water resource availability (i.e. it is unlikely that a substantial water-using development or industry would come online that had not been considered by the WRMP). It is possible that there will be 'in combination' scheme-specific construction effects associated with future planning applications, although this can only be assessed nearer the time of construction.

Effects with other strategic plans and water resource demand

The WRMP explicitly accounts for growth forecasts when calculating future water demand (and hence areas with potential deficits). This means that 'in combination' water-resource effects with growth promoted by other plans or projects are considered and accounted for during the WRMP development process and its deficit calculations. Potential 'in combination' effects in respect of water-resource demands due to other plans or projects are therefore unlikely since these demands are explicitly modelled when determining deficit zones and hence developing Feasible Options. As a result (in respect of water resources) the WRMP is not likely to make non-significant effects in other plans significant (indeed, other plans are arguably the 'source' of any potential effects in respect of water demand, with the WRMP having to manage potential effects that are not generated by the WRMP itself).

Obviously local plans are not all consistent with regard to planned growth and this arguably introduces some uncertainty. However, with regard to water resources and planning uncertainty it is important to note the following:

- ▶ The WRMP safeguards against uncertainty in option yield and timing through 'Target Headroom'; this is an allowance provided in the planning process (i.e. designed-in spare capacity) that ensures that any supply-demand deficit will still be met if there is an underperforming demand side measure or growth exceeds predicted levels. It is therefore

²⁶ <https://infrastructure.planninginspectorate.gov.uk/projects/>

extremely unlikely that additional demand or a poorly-performing option would ‘suddenly’ result in a deficit that might affect a European site; and (in any case);

- ▶ The WRMP is revised on a five-yearly cycle, which allows any changes in demand forecasts (e.g. as new plans come forward) to be accounted for, and for timely intervention should a measure not be performing as expected. It is also informally reviewed on an annual basis.

It is therefore considered that the revised Preferred Options will not have significant ‘in combination’ effects with local plans in respect of water resources.

Effects with other strategic plans and development pressure

Regional and local plans have been reviewed at a high level to determine whether there are any likely significant ‘in combination’ effects (see **Appendix F**), with allocation sites identified where possible. This review has not indicated any potential or likely ‘in combination’ effects that could occur as a result of cumulative development pressure, and in reality the timescales involved in the revised Preferred Options and the absence of detail on allocation proposals makes any ‘in combination’ assessment difficult and potentially meaningless. However, the revised Preferred Options are not of a scale or type that would make ‘in combination’ effects likely.

New water and existing consents

Where ‘new water’ is required (i.e. a new or modified abstraction) ‘in combination’ water-resource demands are possible with existing abstractions. As noted, the WRMP does not explicitly consider the potential ‘in combination’ effects of non-PW abstraction or discharge consents since this is addressed by the EA RoC process or the licence application process (which will be subject to HRA). However, it must be recognised that the water potentially available from a source is determined by the EA, NRW and PW, based on various assessments and data sources including the relevant CAMS; options are only proposed where there is a reasonable likelihood of water being available. In most instances the potential ‘in combination’ effects can only be meaningfully assessed as part of the investigation works that are required for a new licence or amendment (for example, if new boreholes are required to assist with the modelling of a groundwater resource). However, none of the options would require the development of a new resource.

PW’s Drought Plan

The Drought Plan identifies those European sites that may be at risk and provides a mechanism for additional studies to quantify this risk and identify potential solutions that avoid or minimise adverse effects. However, it must be recognised that the Drought Plan is only ever deployed *in extremis*, when conditions are such that European sites are likely to be affected independently of the Drought Plan’s operation. PW is currently revising its Drought Plan, which will itself be subject to HRA. Whilst the Drought Plan and WRMP are written to complement each other the Drought Plan may result in significant or adverse effects on water resource sensitive sites on its own due to the fundamental nature of the plan and the options.

However, potential ‘in combination’ effects between the Drought Plan and the WRMP cannot be meaningfully identified and assessed at this level. This is because the WRMP options cannot, in theory, operate in combination with the DP options: if the WRMP options are implemented then they will become a part of the baseline against which the effects of the DP options will be assessed (with the DP options then permitted or not at the application stage); until the point of implementation, the DP options would operate ‘alone’ in a drought situation. Furthermore, the implementation of a WRMP option will invariably require that the DP for that WRZ be revised, since the fundamental operational parameters of the WRZ will have changed. Finally, the impacts will depend entirely on the nature of the drought situation.

In theory, if a WRMP option results in less ‘spare’ water being available to water-resource sensitive sites then drought conditions may occur more frequently, and require a longer period for recovery from any temporary effects (depending on the hydrological functioning of the system); however, this type of effect is managed through licence conditions and minimum flow requirements which are designed to protect sites under a range of conditions, and DP options to alter such flow requirements would only be deployed after substantial additional study.

Other Water Company WRMPs

The draft WRMPs from the neighbouring water companies (Southern Water, South East Water and Wessex Water) have been reviewed for potential 'in combination' effects with the PW Revised Preferred Options. Based on the draft Preferred Options proposed, and the HRAs of these WRMPs, it is considered that there is no potential for 'in combination' effects with other water company WRMPs, principally as:

- ▶ Wessex Water are predicting a supply-demand surplus for the planning period;
- ▶ none of the options advocated by South East Water will affect European sites that are also exposed to potential effects associated with the PW plan; and
- ▶ sites potentially exposed to effects due to Southern Water's plan (principally the River Itchen SAC, in association with the 'Candover groundwater scheme', and the Arun Valley SAC / SPA / Ramsar sites, in association with the 'Ford WwTW effluent transfer scheme') will not be affected by the PW plan (i.e. the PW plan will have 'no effects' on these sites, and so 'in combination' effects with the SW WRMP cannot occur).

5. Summary and Conclusions

PW has completed its modelling of the supply-demand balance for the WRMP planning period. However, the final WRMP is dependent on various factors including other water company requirements. Twenty one revised Preferred Options have been identified for the revised WRMP; these options have been subject to HRA. This section summarises the conclusions of the HRA of the revised WRMP.

5.1 Summary

The 'plan-level' assessment of the options is summarised in **Table 5.1**. This incorporates the 'in combination' assessment conclusions and takes account of the general and option-specific mitigation or avoidance measures that will be employed at the project-level. **Table 5.1** also provides a 'conclusion' for the effects of each option. In summary, the conclusions for all of the options is either 'no likely significant effect alone or in combination' (typically due to the absence of impact pathways) or 'no adverse effects alone or in combination' (as there is no evidence to suggest that the revised Preferred Options will have any effects that are of a scale or type that cannot be reliably avoided or mitigated using the normal project-level controls identified). With regard to R013 Havant Thicket Havant, which is a substantially larger scheme, previous investigations have concluded that there will be either no significant effect or no adverse effect on any European sites, alone or in combination.

5.2 Conclusion

The conclusion of the HRA of the revised WRMP is that the plan will have **no adverse effects, alone or in combination**, on any European sites taking into account established scheme-level mitigation and avoidance measures that will clearly be available, achievable and likely to be effective. This conclusion does not remove the need for consideration of Regulation 63 at the project-level, which will be required to address those aspects and uncertainties that cannot be meaningfully assessed at the plan-level, such as potential 'in combination' effects with forthcoming plans or projects that may coincide with option delivery or individual leakage-reduction schemes that may be identified.

Table 5.1 Summary of plan-level assessment of options (including 'in combination' effects and incorporated measures)

Option	Aspect	LSE	AE	Summary of Assessment	Key avoidance / mitigation measures
Demand side options / Water efficiency / Drought	Constr.	N	-	Demand side options will not involve any construction that could result in significant effects.	-
	Oper.	N	-	Options cannot negatively affect European sites.	-
Leakage options	Constr.	U	N	Potential construction effects of leakage options cannot be identified at the plan-level (no location information) and so any assessment of the effects of individual leakage repairs can only be made at the scheme level.	Established best-practice avoidance and mitigation measures (Appendix G).
	Oper.	N	-	Options cannot negatively affect European sites.	-
R013 Havant Thicket	Constr.	U	N	Construction stage effects possible on Solent Maritime SAC and Chichester and Langstone Harbours SPA / Ramsar, but avoidable with normal best practice.	Established best-practice avoidance and mitigation measures (Appendix G), including all bespoke measures identified for the options below.
	Oper.	U	N	The operational effects of this scheme have been considered in detail through previous assessments, which have concluded either no significant effect or no adverse effect.	-
R021a: Source O DO Recovery	Constr.	U	N	Construction of this scheme will have no effects on the interest features of any European sites, due to distance, the absence of reasonable impact pathways, and the reliability of best-practice construction measures. The plan-level conclusion for this option would therefore be 'no likely significant effects alone or in combination'.	Established best-practice avoidance and mitigation measures (Appendix G).
	Oper.	N	-	The option will not result in an increase in abstraction from the aquifer (i.e. there would be DO gain through improved borehole operation rather than increases in abstracted volumes). The plan-level conclusion for this option would therefore be 'no likely significant effects alone or in combination'.	-
R022a Source J Group – Maximising DO	Constr.	U	N	Minor works; potential effects avoidable with normal best practice; no significant effects alone or in combination.	Established best-practice avoidance and mitigation measures (Appendix G), including all bespoke measures identified for the options below.
	Oper.	N	-	The abstraction at Source J is from the confined chalk aquifer and therefore abstraction is not expected to result in significant changes to flows in the surface water courses. Further, the Post Implementation Monitoring/Water Framework Directive investigations found that there were no significant impacts from abstraction at Source J.	-

Option	Aspect	LSE	AE	Summary of Assessment	Key avoidance / mitigation measures
R023a Source H DO Recovery	Constr.	U	N	Construction of this scheme will have no effects on the interest features of any European sites, due to distance, the absence of reasonable impact pathways, and the reliability of best-practice construction measures. The plan-level conclusion for this option would therefore be 'no likely significant effects alone or in combination'.	Established best-practice avoidance and mitigation measures (Appendix G).
	Oper.	N	-	The option will not result in an increase in abstraction from the aquifer (i.e. there would be DO gain through improved borehole operation rather than increases in abstracted volumes). The plan-level conclusion for this option would therefore be 'no likely significant effects alone or in combination'.	-
R024a Source C DO recovery scheme	Constr.	N	-	Minor works; no impact pathways; no effects.	-
	Oper.	N	-	Asset improvement scheme operating within Portsmouth Water's currently licensed volumes and therefore no operational effects on water-resource sensitive sites will occur.	-
R068 Source S Drought Permit	Constr.	-	-	The nearest European sites are Duncton – Bignor Escarpment SAC (~5km, not water resource sensitive), and Arun Valley SAC, Arun Valley SPA and Arun Valley Ramsar (~8.3km, on the far side of the River Arun). There are no water resource sensitive European sites within 5km of the borehole (and so direct effects on groundwater dependent terrestrial ecosystems due to any additional drawdown would not be expected) and the borehole is not within the catchment of any European sites (i.e. any effects on surface waters due to increased abstraction will not affect any European sites). The groundwater drawdown associated with borehole operation will not affect the Arun Valley sites (principally alluvial grazing marsh and relict raised bog). As a result, operational effects would not be expected. No construction works are proposed, although any construction required would not affect any European sites. As a result, no effects would be expected as a result of this scheme.	-

Option	Aspect	LSE	AE	Summary of Assessment	Key avoidance / mitigation measures
	Oper.	N	-	<p>The nearest European sites are Duncton – Bignor Escarpment SAC (~5km, not water resource sensitive), and Arun Valley SAC, Arun Valley SPA and Arun Valley Ramsar (~8.3km, on the far side of the River Arun). There are no water resource sensitive European sites within 5km of the borehole (and so direct effects on groundwater dependent terrestrial ecosystems due to any additional drawdown would not be expected) and the borehole is not within the catchment of any European sites (i.e. any effects on surface waters due to increased abstraction will not affect any European sites). The groundwater drawdown associated with borehole operation will not affect the Arun Valley sites (principally alluvial grazing marsh and relict raised bog). As a result, operational effects would not be expected. No construction works are proposed, although any construction required would not affect any European sites. As a result, no effects would be expected as a result of this scheme.</p>	-



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Appendix A

Summary of European Site Designations

Table A1 European sites and associated designations

Designation	Abbreviation	Summary
European sites	-	Strictly, 'European sites' are: any Special Area of Conservation (SAC) from the point at which the European Commission and the UK Government agree the site as a 'Site of Community Importance' (SCI); any classified Special Protection Area (SPA); any candidate SAC (cSAC); and (exceptionally) any other site or area that the Commission believes should be considered as an SAC but which has not been identified by the Government. However, the term is also commonly used when referring to potential SPAs (pSPAs), to which the provisions of Article 4(4) of Directive 2009/147/EC (the 'new wild birds directive') apply; and to possible SACs (pSACs) and listed Ramsar Sites, to which the provisions of the Habitats Regulations are applied a matter of Government policy when considering development proposals that may affect them. "European site" is therefore used as an umbrella term for all of the above designated sites.
Special Area of Conservation	SAC	Designated under the EU <i>Council Directive 92/43/EEC on the Conservation of natural habitats and of wild fauna and flora</i> , and implemented in the UK through the <i>Conservation of Habitats and Species Regulations 2017</i> , and the <i>Conservation (Natural Habitats, & c.) Regulations (Northern Ireland) 1995</i> (as amended).
Site of Community Importance	SCI	Sites of Community Importance (SCIs) are sites that have been adopted by the European Commission but not yet formally designated by the government of each country. Although not formally designated they are nevertheless fully protected by <i>Council Directive 92/43/EEC on the Conservation of natural habitats and of wild fauna and flora</i> , the <i>Conservation of Habitats and Species Regulations 2017</i> , and the <i>Conservation (Natural Habitats, & c.) Regulations (Northern Ireland) 1995</i> (as amended).
Candidate SAC	cSAC	Candidate SACs (cSACs) are sites that have been submitted to the European Commission, but not yet formally adopted. Although these sites are still undergoing designation and adoption they are still fully protected by <i>Council Directive 92/43/EEC on the Conservation of natural habitats and of wild fauna and flora</i> , the <i>Conservation of Habitats and Species Regulations 2017</i> and the <i>Conservation (Natural Habitats, & c.) Regulations (Northern Ireland) 1995</i> (as amended).
Possible SACs	pSAC	Sites that have been formally advised to UK Government, but not yet submitted to the European Commission. The Governments in England, Scotland and Wales extend the same protection to these sites in respect of new development as that afforded to SACs as a matter of policy.
Draft SACs	dSAC	Areas that have been formally advised to UK government as suitable for selection as SACs, but have not been formally approved by government as sites for public consultation. These are not protected (unless covered by some other designation) and it is likely that their existence will not be established through desk study except through direct contact with the relevant statutory authority; however, the statutory authority is likely to take into account the proposed reasons for designation when considering potential impacts on them.
Special Protection Area	SPA	Designated under <i>EU Council Directive 79/409/EEC on the Conservation of Wild Birds</i> (the 'old Wild Birds Directive') and <i>Directive 2009/147/EC on the Conservation of Wild Birds</i> (the 'new Wild Birds Directive, which repeals the 'old Wild Birds Directive'), and protected by Article 6 of <i>Directive 92/43/EEC on the Conservation of natural habitats and of wild fauna and flora</i> . These directives are implemented in the UK through the <i>Wildlife & Countryside Act 1981</i> (as amended), the <i>Conservation of Habitats and Species Regulations 2017</i> , the <i>Wildlife (Northern Ireland) Order 1985</i> , the <i>Nature Conservation and Amenity Lands (Northern Ireland) Order 1985</i> and <i>The Conservation (Natural Habitats, &C.) (Northern Ireland) Regulations 1995</i> (as amended) and the <i>Offshore Marine Conservation (Natural Habitats & c.) Regulations 2007</i> .

Designation	Abbreviation	Summary
Potential SPA	pSPA	These are sites that are still undergoing designation and have not been designated by the Secretary of State; however, ECJ case law indicates that these sites are protected under Article 4(4) of <i>Directive 2009/147/EC</i> (which in theory provides a higher level of protection than the Habitats Directive, which does not apply until the sites are designated as SPAs), and as a matter of policy the Governments in England, Scotland and Wales extend the same protection to these sites in respect of new development as that afforded to SPAs, and they may be protected by some other designation (e.g. SSSI).
Ramsar	-	The <i>Convention on Wetlands of International Importance especially as Waterfowl Habitat</i> (Ramsar Convention or Wetlands Convention) was adopted in Ramsar, Iran in February 1971. The UK ratified the Convention in 1976. In the UK Ramsar sites are generally underpinned by notification of these areas as Sites of Special Scientific Interest (SSSIs) (or Areas of Special Scientific Interest (ASSIs) in Northern Ireland). Ramsar sites therefore receive statutory protection under the <i>Wildlife & Countryside Act 1981</i> (as amended), and the <i>Nature Conservation and Amenity Lands (Northern Ireland) Order 1985</i> . However, as a matter of policy the Governments in England, Scotland and Wales extend the same protection to listed Ramsar sites in respect of new development as that afforded to SPAs and SACs.

Appendix B

Sustainability Reductions and the Review of Consents

The WRMP accounts for any reductions or alterations to licences that are required under the Review of Consents (or the Water Framework Directive) when calculating 'Deployable Output' (DO). The Review of Consents (RoC) process was a detailed evidence-led examination of the effects (alone and in combination) of all abstraction licences and discharge consents that potentially affect European designated sites and features. This was then used as a basis for affirming or, if necessary, varying or revoking the existing consents (known as 'sustainability reductions') to protect these sites from adverse effects.

The sustainability reductions required by the RoC are fully accounted for within the modelled scenarios underpinning the WRMP (i.e. they explicitly form part of the assessment that determines which zones are in deficit). Under the RoC process and the WRMP process, the RoC changes (and non-changes to licences) are considered to be valid over the planning period (to 2044). PW use Water Available for Use (WAFU) from existing licences only (reduced through RoC and not reduced) when assessing the supply-demand balance over the planning period, incorporating increases in demand (the methods by which this is established are outlined in the WRMP). If deficits are shown, intervention options are required and implemented accordingly in the planning period.

This means that the Plan (and its underlying assumptions regarding the availability of water and sustainability of existing consents) is compliant with the RoC and so the Plan will only affect European sites through any new resource and production-side options it advocates to resolve deficits, and not through the existing permissions regime²⁷. The examination of existing individual consents can only be undertaken by NRW (in Wales) or the Environment Agency (EA) through the RoC process and the HRA of the WRMP cannot and should not replicate this.

Having said that, new permissions could obviously operate 'in combination' with the existing regime. The water potentially available from a source is determined by the EA, NRW and PW, based on various assessments and set out in the Catchment Abstraction Management Strategies, and PW must rely on these assessments when identifying options as in most cases the detailed examination of a resources can only be undertaken as part of preparatory works for a new licence (for example, if new boreholes are required to assist with the modelling of a groundwater resource). In short, options are only proposed where there is a reasonable likelihood of water being available, based on information from NRW and the EA.

²⁷ It is recognised that, occasionally, the sustainability reductions agreed through the RoC process have been subsequently shown to be insufficient to address the effects of PWS abstraction on some sites (the most notable example is the River Ehen in Cumbria); PW are not aware of any current uncertainties regarding its abstractions or the RoC outcomes, although any such uncertainties that are subsequently identified can be addressed through the five-yearly WRMP review process.

Appendix C

European sites within 15km of the PW supply area

Table C1 SACs and Interest Features (based on www.jncc.gov.uk) (Note: I = Annex I Habitat; II = Annexe II Species; * = Feature that is Primary Reason for site selection; all other features are Qualifying Features)

SAC	Interest Features	
Arun Valley	Ramshorn snail (<i>Anisus vorticulus</i>)	II*
Bridlesford Copses	Bechstein's bat (<i>Myotis bechsteini</i>)	II*
Butser Hill	Semi-natural dry grasslands and scrubland facies: on calcareous substrates (<i>Festuco-Brometalia</i>)	I
	<i>Taxus baccata</i> woods of the British Isles	I
Dunton to Bignor Escarpment	<i>Asperulo-Fagetum</i> beech forests	I*
East Hampshire Hangers	<i>Asperulo-Fagetum</i> beech forests	I*
	<i>Tilio-Acerion</i> forests of slopes, screes and ravines	I*
	Semi-natural dry grasslands and scrubland facies: on calcareous substrates (<i>Festuco-Brometalia</i>)	I
	<i>Taxus baccata</i> woods of the British Isles	I
	Early gentian (<i>Gentianella anglica</i>)	II
Ebernoe Common	Atlantic acidophilous beech forests with <i>Ilex</i> and sometimes also <i>Taxus</i> in the shrublayer (<i>Quercion robori-petraeae</i> or <i>Ilici-Fagenion</i>)	I*
	Barbastelle Bat (<i>Barbastella barbastellus</i>)	II*
	Bechstein's bat (<i>Myotis bechsteini</i>)	II*
Emer Bog	Transition mires and quaking bogs	I*
Isle of Wight Downs	Vegetated sea cliffs of the Atlantic and Baltic coasts	I*
	European dry heaths	I*
	Semi-natural dry grasslands and scrubland facies: on calcareous substrates (<i>Festuco-Brometalia</i>)	I*
	Early gentian (<i>Gentianella anglica</i>)	II*
Kingley Vale	<i>Taxus baccata</i> woods of the British Isles	I*
	Semi-natural dry grasslands and scrubland facies: on calcareous substrates (<i>Festuco-Brometalia</i>)	I
River Itchen	Water courses of plain to montane levels with the <i>Ranunculion fluitantis</i> and <i>Callitriche-Batrachion</i> vegetation	I*
	Southern damselfly (<i>Coenagrion mercuriale</i>)	II*
	Bullhead (<i>Cottus gobio</i>)	II*
	White-clawed crayfish (<i>Austropotamobius pallipes</i>)	II
	Brook lamprey (<i>Lampetra planeri</i>)	II
	Atlantic salmon (<i>Salmo salar</i>)	II
	Otter (<i>Lutra lutra</i>)	II
Rook Cliff	<i>Tilio-Acerion</i> forests of slopes, screes and ravines	I*



Shortheath Common	Transition mires and quaking bogs	I*
	European dry heaths	I
	Bog woodland	I

Table C1 (continued) SACs and Interest Features (based on www.jncc.gov.uk) (Note: I = Annex I Habitat; II = Annexe II Species; * = Feature that is Primary Reason for site selection; all other features are Qualifying Features)

SAC	Interest Features	
Singleton and Cocking Tunnels	Barbastelle bat (<i>Barbastella barbastellus</i>)	II*
	Bechstein's bat (<i>Myotis bechsteini</i>)	II
Solent & Isle of Wight Lagoons	Coastal lagoons	I*
Solent Maritime	Estuaries	I*
	<i>Spartina</i> swards (<i>Spartinion maritimae</i>)	II*
	Atlantic salt meadows (<i>Glauco-Puccinellietalia maritimae</i>)	I*
	Sandbanks which are slightly covered by sea water all the time	I
	Mudflats and sandflats not covered by seawater at low tide	I
	Coastal lagoons	I
	Annual vegetation of drift lines	I
	Perennial vegetation of stony banks	I
	Salicornia and other annuals colonising mud and sand	I
	Shifting dunes along the shoreline with <i>Ammophila arenaria</i> ("white dunes")	I
Desmoulins whorl snail (<i>Vertigo moulinsiana</i>)	II	
South Wight Maritime	Reefs	I*
	Vegetated sea cliffs of the Atlantic and Baltic coasts	I*
	Submerged or partially submerged sea caves	I*
The Mens	Atlantic acidophilous beech forests with <i>Ilex</i> and sometimes also <i>Taxus</i> in the shrublayer (<i>Quercion robori-petraeae</i> or <i>Ilici-Fagenion</i>)	I*
	Barbastelle bat (<i>Barbastella barbastellus</i>)	II
The New Forest	Oligotrophic waters containing very few minerals of sandy plains (<i>Littorelletalia uniflorae</i>)	I*
	Oligotrophic to mesotrophic standing waters with vegetation of the <i>Littorelletea uniflorae</i> and/or of the <i>Isoëto-Nanojuncetea</i>	I*
	Northern Atlantic wet heaths with <i>Erica tetralix</i>	I*
	<i>Asperulo-Fagetum</i> beech forests	I*
	Old acidophilous oak woods with <i>Quercus robur</i> on sandy plains	I*
	Bog woodland	I*
	Alluvial forests with <i>Alnus glutinosa</i> and <i>Fraxinus excelsior</i> (<i>Alno-Padion</i> , <i>Alnion incanae</i> , <i>Salicion albae</i>)	I*
	Transition mires and quaking bogs	I
	Alkaline fens	I
	Southern Damselfly (<i>Coenagrion mercuriale</i>)	II*
	Stag beetle (<i>Lucanus cervus</i>)	II*
	Great crested newt (<i>Triturus cristatus</i>)	II

Table C1 (continued) SACs and Interest Features (based on www.jncc.gov.uk) (Note: I = Annex I Habitat; II = Annexe II Species; * = Feature that is Primary Reason for site selection; all other features are Qualifying Features)

SAC	Interest Features	
Woolmer Forest	Natural dystrophic lakes and ponds	I*
	European dry heaths	I*
	Depressions on peat substrates of the <i>Rhynchosporion</i>	I*
	Northern Atlantic wet heaths with <i>Erica tetralix</i>	I
	Transition mires and quaking bogs	I

Table C2 SPAs and Interest Features (based on www.jncc.gov.uk)

SPA	Interest Features	Art	B	W	A	P	R
Arun Valley	Bewick's swan <i>Cygnus columbianus bewickii</i>	4.1	✓				
	An internationally important assemblage of birds	4.2			✓		
Chichester and Langstone Harbours	Little Tern <i>Sterna albifrons</i>	4.1	✓				
	Common Tern <i>Sterna hirundo</i>	4.1	✓				×
	Sandwich Tern <i>Sterna sandvicensis</i>	4.1	✓				
	Bar-tailed godwit <i>Limosa lapponica</i>	4.1		✓			
	Pintail <i>Anas acuta</i>	4.2		✓			×
	Shoveler <i>Anas clypeata</i>	4.2		✓			×
	Teal <i>Anas crecca</i>	4.2		✓			×
	Wigeon <i>Anas penelope</i>	4.2		✓			×
	Turnstone <i>Arenaria interpres</i>	4.2		✓			×
	Brent Goose <i>Branta bernicla bernicla</i>	4.2		✓			
	Sanderling <i>Calidris alba</i>	4.2		✓			×
	Dunlin <i>Calidris alpina alpina</i>	4.2		✓			
	Ringed Plover <i>Charadrius hiaticula</i>	4.2		✓		✓	+
	Red-breasted merganser <i>Mergus serrator</i>	4.2		✓			×
	Curlew <i>Numenius arquata</i>	4.2		✓			×
	Grey plover <i>Pluvialis squatarola</i>	4.2		✓			
	Shelduck <i>Tadorna tadorna</i>	4.2	✓	✓			×
Redshank <i>Tringa totanus</i>	4.2	✓	✓				
An internationally important assemblage of birds	4.2	✓	✓				
Little Egret <i>Egretta garzetta</i>	4.1	✓			✓	+	
Black-tailed Godwit <i>Limosa limosa islandica</i>	4.2	✓				+	

Table C2 (continued) SPAs and Interest Features (based on www.jncc.gov.uk)

SPA	Interest Features	Art	B	W	A	P	R
New Forest	Nightjar <i>Caprimulgus europaeus</i>	4.1	✓				
	Wood lark <i>Lullula arborea</i>	4.1	✓				
	Honey-buzzard <i>Pernis apivorus</i>	4.1	✓				
	Dartford warbler <i>Sylvia undata</i>	4.1	✓				
	Hen harrier <i>Circus cyaneus</i>	4.1		✓			
	Hobby <i>Falco subbuteo</i>	4.2	✓				×
	Wood warbler <i>Phylloscopus sibilatrix</i>	4.2	✓				×
Pagham Harbour	Little Tern <i>Sterna albifrons</i>	4.1	✓				
Pagham Harbour	Common Tern <i>Sterna hirundo</i>	4.1		✓			×
	Ruff <i>Philomachus pugnax</i>	4.1			✓		
	Brent Goose <i>Branta bernicla bernicla</i>	4.2			✓		×
	Pintail <i>Anas acuta</i>	4.2			✓		+
Portsmouth Harbour	Brent Goose <i>Branta bernicla bernicla</i>	4.2		✓			
	Dunlin <i>Calidris alpina alpina</i>	4.2		✓			×
	Black-tailed Godwit <i>Limosa limosa islandica</i>	4.2		✓			×
	Red-breasted merganser <i>Mergus serrator</i>	4.2		✓			×
Solent & Southampton Water	Mediterranean gull <i>Larus melanocephalus</i>	4.1	✓				
	Little Tern <i>Sterna albifrons</i>	4.1	✓				
	Roseate Tern <i>Sterna dougallii</i>	4.1	✓				
	Common Tern <i>Sterna hirundo</i>	4.1	✓				
	Sandwich Tern <i>Sterna sandvicensis</i>	4.1	✓				
	Teal <i>Anas crecca</i>	4.2		✓			
	Brent Goose <i>Branta bernicla bernicla</i>	4.2		✓			
	Ringed Plover <i>Charadrius hiaticula</i>	4.2		✓			
	Black-tailed Godwit <i>Limosa limosa islandica</i>	4.2		✓			
	An internationally important assemblage of birds	4.2		✓		✓	
Wealden Heaths Phase II	Nightjar <i>Caprimulgus europaeus</i>	4.1	✓				
	Wood lark <i>Lullula arborea</i>	4.1	✓				
	Dartford warbler <i>Sylvia undata</i>	4.1	✓				

KEY

Art. 4.1 Article 4.1 Qualification

A Assemblage Qualification

Art. 4.2 Article 4.2 Qualification

P On Passage

B Breeding

R+ Species added in SPA review

W Wintering

R× Species removed in SPA review

Table C3 Ramsar Sites Considered During HRA

Ramsar Site	Cri.	Features
Arun Valley	2	The site holds seven wetland invertebrate species listed in the British Red Data Book as threatened. One of these, <i>Pseudamnicola confusa</i> , is considered to be endangered. The site also supports four nationally rare and four nationally scarce plant species.
	3	In addition to the Red Data Book invertebrate and plant species, the ditches intersecting the site have a particularly diverse and rich flora. All five British duckweed <i>Lemna</i> species, all five water-cress <i>Rorippa</i> species, and all three British water milfoils (<i>Myriophyllum</i> species), all but one of the seven British water dropworts (<i>Oenanthe</i> species), and two-thirds of the British pondweeds (<i>Potamogeton</i> species) can be found on site.
	5	13774 waterfowl (5 year peak mean 1998/99-2002/2003)
Chichester and Langstone Harbours	1	Two large estuarine basins linked by the channel which divides Hayling Island from the main Hampshire coastline. The site includes intertidal mudflats, saltmarsh, sand and shingle spits and sand dunes.
	5	76480 waterfowl (5 year peak mean 1998/99-2002/2003)
	6	Species with peak counts in spring/autumn: Ringed plover <i>Charadrius hiaticula</i> , Black-tailed godwit <i>Limosa limosa islandica</i> , Common redshank <i>Tringa totanus totanus</i> . Species with peak counts in winter: Dark-bellied brent goose <i>Branta bernicla bernicla</i> , Common shelduck <i>Tadorna tadorna</i> , Grey plover <i>Pluvialis squatarola</i> , Dunlin <i>Calidris alpina alpina</i> .
New Forest	1	Valley mires and wet heaths are found throughout the site and are of outstanding scientific interest. The mires and heaths are within catchments whose uncultivated and undeveloped state buffer the mires against adverse ecological change. This is the largest concentration of intact valley mires of their type in Britain.
	2	The site supports a diverse assemblage of wetland plants and animals including several nationally rare species. Seven species of nationally rare plant are found on the site, as are at least 65 British Red Data Book species of invertebrate.
	3	The mire habitats are of high ecological quality and diversity and have undisturbed transition zones. The invertebrate fauna of the site is important due to the concentration of rare and scarce wetland species. The whole site complex, with its examples of semi-natural habitats is essential to the genetic and ecological diversity of southern England.
Pagham Harbour	6	Dark-bellied brent goose <i>Branta bernicla bernicla</i>
Portsmouth Harbour	3	The intertidal mudflat areas possess extensive beds of eelgrass <i>Zostera angustifolia</i> and <i>Zostera noltei</i> which support the grazing dark-bellied brent geese populations. The mud-snail <i>Hydrobia ulvae</i> is found at extremely high densities, which helps to support the wading bird interest of the site. Common cord-grass <i>Spartina anglica</i> dominates large areas of the saltmarsh and there are also extensive areas of green algae <i>Enteromorpha</i> spp. and sea lettuce <i>Ulva lactuca</i> . More locally the saltmarsh is dominated by sea purslane <i>Halimione portulacoides</i> which gradates to more varied communities at the higher shore levels. The site also includes a number of saline lagoons hosting nationally important species.
	6	Dark-bellied brent goose <i>Branta bernicla bernicla</i>
Solent & Southampton Water	1	The site is one of the few major sheltered channels between a substantial island and mainland in European waters, exhibiting an unusual strong double tidal flow and has long periods of slack water at high and low tide. It includes many wetland habitats characteristic of the biogeographic region: saline lagoons, saltmarshes, estuaries, intertidal flats, shallow coastal waters, grazing marshes, reedbeds, coastal woodland and rocky boulder reefs.
	2	The site supports an important assemblage of rare plants and invertebrates. At least 33 British Red Data Book invertebrates and at least eight British Red Data Book plants are represented on site.
	5	51343 waterfowl (5 year peak mean 1998/99-2002/2003)
	6	Species with peak counts in spring/autumn: Ringed plover <i>Charadrius hiaticula</i> Species with peak counts in winter: Dark-bellied brent goose <i>Branta bernicla bernicla</i> , Eurasian teal <i>Anas crecca</i> , Black-tailed godwit <i>Limosa limosa islandica</i>



Table C3 (continued) Ramsar Sites Considered During HRA

NOTES ON RAMSAR CRITERIA	
1	Contains a representative, rare, or unique example of a natural or near-natural wetland type found within the biogeographic region.
2	Supports vulnerable, endangered, or critically endangered species or threatened ecological communities.
3	Supports populations of plant and/or animal species important for maintaining the biodiversity of a particular biogeographic region.
4	Supports plant and/or animal species at a critical stage in their life cycles, or provides refuge during adverse conditions.
5	Regularly supports 20,000 or more waterbirds.
6	Regularly supports 1% of the individuals in a population of one species or subspecies of waterbird.
7	Supports a significant proportion of indigenous fish subspecies, species or families, life-history stages, species interactions and/or populations that are representative of wetland benefits and/or values and thereby contributes to global biological diversity.
8	An important source of food for fish, spawning ground, nursery and/or migration path on which fish stocks, either within the wetland or elsewhere, depend.
9	Regularly supports 1% of the individuals in a population of one species or subspecies of wetland-dependent non-avian animal species.



Appendix D

Water-resource dependent interest features



Appendix E

Feasible options review



Appendix F

Summary of 'in combination' assessment with other strategic plans

Plan	Summary	In combination effects with Preferred Options?	In combination effects with WRMP	Conclusion
<p>Environment Agency (various) Drought Plans</p>	<p>Drought Plans prepared by the EA: outline how the EA will manage water resources during a drought and defines their role and responsibilities; aim to reconcile the competing interests of the environment, the need for public water supply and other abstractions; show what additional environmental monitoring the EA will carry out; provide a framework for liaison with water companies, awareness campaigns and determination of drought permits; range from high-level activities where they co-ordinate drought management over England and Wales to a local level where they outline specific operational activities. Those plans particularly relevant to the Welsh Water area include the Head Office Drought Plan (covering England and Wales), Drought Plans for Wales and the Midlands as well as area plans for south east, south west and north Wales and the west Midlands.</p>	<p>Potential 'in combination' effects between other Drought Plans and the WRMP options cannot be meaningfully identified and assessed at this level. This is because the WRMP options cannot, in theory, operate in combination with the DP options: if the WRMP options are implemented then they will become a part of the baseline against which the effects of the DP options will be assessed (with the DP options then permitted or not at the application stage).</p>	<p>Potential 'in combination' effects between the Drought Plans and the WRMP options cannot be meaningfully identified and assessed at this level. This is because the WRMP options cannot, in theory, operate in combination with the DP options: if the WRMP options are implemented then they will become a part of the baseline against which the effects of the DP options will be assessed (with the DP options then permitted or not at the application stage).</p>	<p>No likely significant effects.</p>
<p>The South Marine Plan (Draft for Consultation, 2016)</p>	<p>The South Marine Plan includes the south inshore and the south offshore marine plan areas. The South Inshore Marine Plan area covers inshore waters to 12nm from Folkestone to the river Dart. The South offshore Marine Plan area covers the area from 12nm to the borders with France and the Channel Islands. Each plan area totals approximately 10,000sq km. Marine plans form a part of the government's long-term vision for the environment. Marine plans provide long-term policy signals and legal clarity to underpin confidence for marine investment decisions. They provide transparent and streamlined decision-making, reducing the regulatory burdens on industry and providing certainty for developers, while safeguarding the environment. For marine developments, marine plans will reduce the time from concept to consent, helping to operationalise investments sooner so they can make an earlier contribution to the economy.</p>	<p>The SMP is a high-level policy document that does not identify specific schemes (etc) that could be reviewed for possible interactions with the WRMP options, and so assessment is not possible at the plan-level. In reality the WRMP options are of a scale whereby significant effects in combination effects would not be expected.</p>	<p>The SMP is a high-level policy document that does not identify specific schemes (etc) and which has limited possibilities for interaction with the WRMP. No additional interactions with these plans would be expected at the plan-level.</p>	<p>No likely significant effects.</p>

Plan	Summary	In combination effects with Preferred Options?	In combination effects with WRMP	Conclusion
Water Company (various) Drought Plans	<p>Drought Plans set out the steps that each water company will take through the stages of developing drought, drought, severe drought and recovery from drought to ensure their supply of water resources. Drought Plans must be produced by all water companies to fulfil their requirements under the Water Act 2003. Those Drought Plans relevant to the WRMP are:</p> <ul style="list-style-type: none"> • Southern Water Drought Plan; • South East Water Drought Plan; • Wessex Water Drought Plan. 	<p>None of the options are likely to interact significantly with the drought plan options, although it should be noted that this assessment can only be made at the project level when the DP option is implemented. It should be noted that in theory, operate in combination with the DP options: if the WRMP options are implemented then they will become a part of the baseline against which the effects of the DP options will be assessed (with the DP options then permitted or not at the application stage).</p>	<p>Potential 'in combination' effects between the Drought Plans and the WRMP cannot be meaningfully identified and assessed at this level. This is because the WRMP options cannot, in theory, operate in combination with the DP options: if the WRMP options are implemented then they will become a part of the baseline against which the effects of the DP options will be assessed (with the DP options then permitted or not at the application stage).</p>	<p>No likely significant effects.</p>
Water Company (various) Water Resources Management Plans	<p>Water companies in England and Wales, are required to prepare, maintain and publish a WRMP under the Water Industry Act 1991, updated by the provisions in section 37A-D of the Water Act 2003 and the Water Act 2014 and the Environment (Wales) Act 2016. The plan must set out how a water company intends to maintain the balance between supply and demand for water over a minimum of a 25 year period. This is complemented by a water company drought plan, which sets out the short-term operational steps a company will take as a drought progresses. Those neighbouring Water Resource Management Plans relevant to the plan are:</p> <ul style="list-style-type: none"> Southern Water South East Water Wessex Water. 	<p>The draft WRMPs from the neighbouring water companies (Southern Water, South East Water and Wessex Water) have been reviewed for potential 'in combination' effects with the PW Revised Preferred Options. Based on the draft Preferred Options proposed, and the HRAs of these WRMPs, it is considered that there is no potential for 'in combination' effects with other water company WRMPs</p>	<p>No additional interactions with these plans would be expected at the plan-level. Water company plans are catchment-specific, and designed to be complementary.</p>	<p>-</p>
Environment Agency (2016) South East River Basin District, Flood Risk Management Plan 2015-2021	<p>Flood Risk Management Plans (FRMPs) give an overview of the flood risk across each river catchment. They recommend ways of managing those risks now and over the next 50-100 years. FRMPs consider all types of inland flooding, from rivers, ground water, surface water and tidal flooding, but not flooding directly from the sea, (coastal flooding), which is covered in Shoreline Management Plans. They also take into account the likely impacts of climate change, the effects of how we use and manage the land, and how areas could be developed to meet our present day needs without compromising the ability of future generations to meet their own needs.</p>	<p>The preferred options have the potential to interact with the South East FRMP. However, based on a review of the FRMP it is not possible to identify specific in combination risks (the FRMP has broad policy positions for sections of river (e.g. Maintain existing defences and inspection regime) but does not identify specific schemes); and in reality the WRMP options are of a scale whereby significant effects in combination effects would not be expected.</p>	<p>No additional interactions with these plans would be expected at the plan-level.</p>	<p>No likely significant effects.</p>

Plan	Summary	In combination effects with Preferred Options?	In combination effects with WRMP	Conclusion
<p>Environment Agency South East River Basin Management Plan</p>	<p>River Basin Management Plans (RBMPs) set out how the water environment will be managed and provide a framework for more detailed decisions to be made. RBMPs set out a more integrated approach to river basin management based on the following principles:</p> <ul style="list-style-type: none"> Integrate and streamline plans and processes; Set out a clear, transparent and accessible process of analysis and decision-making; Focus at the river basin district level; Work in partnership with other regulators; Encourage active involvement of a broad cross-section of stakeholders; Make use of the alternative objectives to deliver sustainable development; Use Better Regulation principles and consider the cost-effectiveness of the full range of possible measures; Seek to be even handed across different sectors of society and sectors of industry; Seek to be even handed and transparent in the management of uncertainty; Develop methodologies and refine analyses as more information becomes available. <p>RBMPs in the United Utilities area are the North West, Solway Tweed and Dee.</p>	<p>The preferred options have the potential to interact with the South East RBMP. However based on a review of the RBMP it is not possible to identify specific in combination risks (RBMPs have broad policy positions but do not identify specific schemes, and the HRA of the RBMPs concluded that project detail was not sufficient for meaningful assessment). In reality the WRMP options are of a scale whereby significant effects in combination effects would not be expected.</p>	<p>No additional interactions with these plans would be expected at the plan-level.</p>	<p>No likely significant effects.</p>
<p>Environment Agency Catchment Abstraction Management Strategies</p>	<p>CAMS is the approach used by the Environment Agency to assess the amount of water available for further abstraction licensing taking account of the needs of the environment. The relevant Catchment Abstraction Management Strategies (CAMS) within the Bristol Water supply area:</p> <ul style="list-style-type: none"> • Arun and Western Streams abstraction licensing strategy • Test and Itchen abstraction licensing strategy <p>The aims of the CAMS include:</p> <ul style="list-style-type: none"> • make information on water resource availability and the catchment licensing strategy more readily available • provide a consistent and structured approach to local water resource management • recognise both the abstractor's reasonable need for water and environmental needs • provide results which ensure the relevant Water Framework Directive objectives are met 	<p>The CAMS do not necessarily provide a mechanism for 'in combination' effects with the Options, but are used to guide the choice of options particularly where 'new water' may be required.</p>	<p>The WRMP explicitly accounts for the CAMS when calculating future water availability (and hence areas with potential deficits). This means that 'in combination' water-resource effects with the CAMS will not occur.</p>	<p>No likely significant effects.</p>



Plan	Summary	In combination effects with Preferred Options?	In combination effects with WRMP	Conclusion
SMP 13 Selsey Bill to Hurst Spit (North Solent) SMP	Shore Line Management Plans are prepared in England and Wales. They are developed by Coastal Groups with members drawn from local authorities and other stakeholders. They identify the most sustainable approach to managing the flood and coastal risks to the coastline in the short term (up to 20 years), medium term (20 to 50 years) and long term (50 to 100 years).	The preferred options have the potential to interact with the Selsey Bill to Hurst Spit (North Solent) SMP. Based on a review of this plans it is not possible to identify specific in combination risks (the SMPs have broad policy positions for sections of coast (e.g. hold the line; managed re-alignment) but do not identify specific schemes); and in reality the WRMP options are of a scale whereby significant effects in combination effects would not be expected as the SMPs cover shoreline areas that are some distance from the location of the options.	No additional plan-level interactions with the SMPs would be expected.	No likely significant effects.



Appendix G

Standard avoidance measures and best-practice

Overview

The 'avoidance measures' that may be applied to the options are detailed below, and are grouped as follows:

- ▶ General Measures (established construction best-practice, etc.) which will be applied to all options;
- ▶ Option-specific Measures (established and reliable measures identified to avoid specific potential effects on European sites, such as in relation to mobile species from the sites).

These measures will be applied unless project-level HRAs or scheme-specific environmental studies demonstrate that they are not required (i.e. the anticipated effect will not occur), not appropriate, or that alternative or additional measures are necessary or more appropriate.

Note that these measures are not exhaustive or exclusive and must be reviewed at the project stage, taking into account any changes in best-practice as well as scheme-specific survey information or studies.

General Measures and Principles

Scheme Design and Planning

All options will be subject to project-level environmental assessment as they are brought forward, which will include assessments of their potential to affect European sites during their construction or operation. These assessments will consider or identify (inter alia):

- ▶ opportunities for avoiding potential effects on European sites through design (e.g. alternative pipeline routes; micro siting; etc);
- ▶ construction measures that need to be incorporated into scheme design and/or planning to avoid or mitigate potential effects - for example, ensuring that sufficient working area is available for pollution prevention measures to be installed, such as sediment traps;
- ▶ operational regimes required to ensure no adverse effects occur (e.g. compensation releases - although note that these measures can only be identified through detailed investigation schemes and agreed through the abstraction licensing process).

Pollution Prevention

The habitats of European sites are most likely to be affected indirectly, through construction-site derived pollutants, rather than through direct encroachment. There is a substantial body of general construction good-practice which is likely to be applicable to all of the proposed options and can be relied on (at this level) to prevent significant or adverse effects on a European site occurring as a result of construction site-derived pollutants. The following guidance documents detail the current industry best-practices in construction that are likely to be relevant to the proposed schemes:

- ▶ Environment Agency Pollution Prevention Guidance Notes²⁸, including:
 - ▶ PPG1: General guide to the prevention of pollution (May 2001);
 - ▶ PPG5: Works and maintenance in or near water (October 2007);

²⁸ Note, the Environment Agency Pollution Prevention Guidance Notes have been withdrawn by the Government, although the principles within them are sound and form a reasonable basis for pollution prevention measures.

- ▶ PPG6: Pollution prevention guidance for working at construction and demolition sites (April 2010);
- ▶ PPG21: Pollution incident response planning (March 2009);
- ▶ PPG22: Dealing with spillages on highways (June 2002);
- ▶ Environment Agency (2001) Preventing pollution from major pipelines [online]. Available at www.environment-agency.gov.uk/static/documents/Business/pipes.pdf. [Accessed 1 March 2011];
- ▶ Venables R. et al. (2000) Environmental Handbook for Building and Civil Engineering Projects. 2nd Edition. Construction Industry Research and Information Association (CIRIA), London.

The best-practice procedures and measures detailed in these documents will be followed for all construction works derived from the WRMP as a minimum standard, unless scheme-specific investigations identify additional measures and/or more appropriate non-standard approaches for dealing with potential site-derived pollutants.

General measures for species

Most species-specific avoidance or mitigation measures can only be determined at the scheme level, following scheme-specific surveys, and 'best-practice' mitigation for a species will vary according to a range of factors that cannot be determined at the strategic (WRMP) level. In addition, some general 'best-practice' measures may not be relevant or appropriate to the interest features of the European sites concerned (for example, clearing vegetation over winter is usually advocated to avoid impacts on nesting birds; however, this is unlikely to be necessary to avoid effects on some SPA species (such as overwintering estuarine birds) and the winter removal of vegetation might actually have a negative effect on these species through disturbance). However, the following general measures will be followed to minimise the potential for impacts on species that are European site interest features unless project level environmental studies or HRA indicate that they are not required or not appropriate, or that alternative or additional measures are more appropriate/necessary:

- ▶ Scheme design will aim to minimise the environmental effects by 'designing to avoid' potential habitat features that may be used by species that are European site interest features when outside the site boundary (e.g. linear features such as hedges or stream corridors; large areas of scrub or woodland; mature trees; etc.) through scheme-specific routing studies.
- ▶ The works programme and requirements for each option will be determined at the earliest opportunity to allow investigation schemes, surveys and mitigation to be appropriately scheduled and to provide sufficient time for consultations with NE.
- ▶ Night-time working, or working around dusk/dawn, should be avoided to reduce the likelihood of negative effects on nocturnal species.
- ▶ Any lighting required (either temporary or permanent) will be designed with an ecologist to ensure that potential 'displacement' effects on nocturnal animals, particularly SAC bat species, are avoided.
- ▶ All compounds/pipe stores etc. will be sited, fenced or otherwise arranged to prevent vulnerable SAC species (notably otters) from accessing them.
- ▶ All materials will be stored away from commuting routes/foraging areas that may be used by species that are European site interest features.
- ▶ All excavations will have ramps or battered ends to prevent species becoming trapped.
- ▶ Pipe-caps must be installed overnight to prevent species entering and becoming trapped in any laid pipe-work.



Option-Specific Measures

No option-specific avoidance measures have been identified.



Appendix H

Extract from PIM / WFD report relevant to Titchfield Haven

