



Technical Report 4.11: Strategic Environmental Assessment (SEA) Environmental Report

Revised Draft Water Management Resources Plan 2020-2080

February 2019

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Affinity Water Revised Draft Water Resources Management Plan 2019: Strategic Environmental Assessment (SEA)

Environmental Report

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February 2019

Quality information

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Glossary

Term	Explanation
Abstraction	The process of taking water from any source, including rivers and aquifers.
Agricultural Land Classification	The Agricultural Land Classification provides a method for assessing the quality of farmland to enable informed choices to be made about its future use within the planning system.
Appropriate Assessment	Legal term used in the Habitats Directive and the associated Conservation of Habitats and Species Regulations 2010 to indicate what a competent authority must do where a plan or project is screened 'in' for further appraisal. It forms one part of the HRA and <u>may</u> follow on from the screening stage.
Area of Outstanding Natural Beauty	An area of high scenic quality which has statutory protection in order to conserve and enhance the natural beauty of its landscape. They have the same planning protection as National Parks but different purposes without a statutory duty to promote outdoor recreation.
Aquifer	A water-bearing rock that groundwater can be extracted from.
Biodiversity Action Plan	An agreed plan for a habitat or species, which forms part of the UK's commitment to biodiversity.
Catchment water transfer	Man-made transfer of water from one natural catchment or system to another.
Consultation body	In England, these are the Environment Agency, Historic England and Natural England. The consultation bodies are statutory consultees at the screening, scoping and environmental report stages of strategic environmental assessment.
Deficit	The amount of water shortage where demand exceeds supply.
Defra	Department for the Environment, Food and Rural Affairs
Designated heritage asset	A World Heritage Site, Scheduled Monument, Listed Building, Protected Wreck Site, Registered Park and Garden or Registered Battlefield
Environmental Report	The report that documents the assessment of a draft Plan and accompanies the draft Plan for consultation. The Environmental Report needs to contain certain information as set out in Schedule 2 to the SEA Regulations 2004.
Environmental Impact Assessment	A procedure to be followed for certain types of project to ensure that decisions on whether to grant development consent (e.g. planning permission) are made in light of an assessment of any likely significant effects on the environment. Evidence is presented in the form of an Environmental Statement (ES)
European site (sometimes known as 'Natura 2000' sites / network)	These comprise candidate Special Areas of Conservation, Special Areas of Conservation and Special Protection Areas, as defined in Regulation 8 of the Conservation of Habitats and Species Regulations 2010 (the Habitat Regulations).
Habitats Regulations Assessments (HRA)	This is a general term used for convenience which describes the full step-wise process required in making assessments of the impacts on European sites under the Conservation of Habitats and Species Regulations 2010, including the steps of screening for likely significant effects and making appropriate assessments (AA).
Heritage Asset	A building, monument, site, place, area or landscape identified as having a degree of significance because of heritage interest and therefore meriting consideration in planning decisions. Heritage assets include those designated nationally as well as those identified by the local planning authority (including local listing).
Impact Risk Zone	A tool/dataset which maps zones around each Site of Special Scientific Interest (SSSI) according to the particular sensitivities of the features for which they have been notified. They specify the types of development that have the potential to

	have adverse impacts at a given location.
Flood risk zone	Areas identified as being at significant risk from flooding or disruption from it.
Geomorphology	Processes of erosion, deposition and sediment transport that influence the physical form of a river and its floodplain.
Grey water	Wastewater generated from domestic activities such as laundry, dishwashing, and bathing, which can be recycled on-site for uses such as landscape irrigation and habitat creation.
Invasive species	Non-native species that out-compete native species to the detriment of an ecosystem.
Local Plan	The plan for the future development of a local area, drawn up by the local planning authority in consultation with the community. In law this is described as the development plan.
National Planning Policy Framework (NPPF)	The Framework sets out the government's national planning policies and how they are expected to be applied in plans and planning decisions.
National planning practice guidance (NPPG)	Planning practice guidance web-based resource. Important information for any user of the planning system can be found here.
Nitrate Sensitive Area	A designation applied to areas of land where the underlying groundwater is at risk of pollution from nitrate polluted water.
Nitrate Vulnerable Zone	The European Commission (EC) nitrates directive requires areas of land that drain into waters polluted by nitrates to be designated as Nitrate Vulnerable Zones (NVZs).
Priority habitat and species	Species and Habitats of Principal Importance included in the England Biodiversity List published by the Secretary of State under section 41 of the Natural Environment and Rural Communities Act 2006.
Protected landscapes	Protected landscapes refer to the statutory designations; Areas of Outstanding Natural Beauty (AONBs), the Broads Authority and National Parks (NPs), and the non-statutory areas encompassed by the Heritage Coasts.
Qualitative appraisal	Assessment based on expert judgement with reference to objectives. This is used for effects that are difficult to assign a value to on a quantitative basis.
Quantitative appraisal	Assessment method that assesses the value of environmental features in monetary or other numeric terms.
Ramsar sites	Wetland sites of International Importance, designated under the Ramsar Convention and treated in the same way as European sites as a matter of government policy.
SEA Regulations	The Environmental Assessment of Plans and Programmes Regulations 2004
Setting of heritage asset	The surroundings in which a heritage asset is experienced. Its extent is not fixed and may change as the asset and its surroundings evolve. Elements of a setting may make a positive or negative contribution to the significance of an asset, may affect the ability to appreciate that significance or may be neutral.
Significant effects	Effects that, for the purposes of the SEA Regulations 2004 (Schedule 1) are considered to be significant.
Sites of Special Scientific Interest (SSSIs)	A suite of sites, representing some of the best wildlife and geology, designated under the Wildlife and Countryside Act 1981 (as amended), and subject to national level legal protection.
Special Area of Conservation (SAC)	An area given special protection under the EU Habitats Directive, providing increased protection for a variety of habitats, animals and plants.
Special	An area given special protection under the EU Birds Directive, by virtue of its

Protection Area (SPA)	international importance for the breeding, feeding, wintering or the migration of rare and vulnerable species of birds found within the European Union.
Strategic Environmental Assessment (SEA)	A procedure (set out in the SEA Regulations) which requires the environmental assessment of certain plans and programmes which are likely to have a significant effect on the environment.
Scoping Report	A document produced as part of a SEA that is prepared as a means to establish the scope of the SEA.
Water resource management	The management of water resources and demands to minimise any deficit between the two.
Water Resource Management Plan (WRMP)	A plan designed to identify water deficits and outline measures that can reduce these.

Acronyms

Acronym	Full term
ALC	Active Leakage Control
AMP	Asset Management Plan
AONB	Area of Outstanding Natural Beauty
AQMA	Air Quality Management Area
AWSE	Affinity Water Southeast Region
BAP	Biodiversity Action Plan
CAMS	Catchment Abstraction Management Strategy
DO	Deployable output
Defra	Department for Environment, Food and Rural Affairs
DMA	District Metered Area
EA	Environment Agency
EC	European Commission
GEP	Good Ecological Potential
GES	Good Ecological Status
GIS	Geographical Information Systems
HaR	Heritage at Risk
Mld	Megalitres of water per day
NNR	National Nature Reserve

NSA	Nitrate Sensitive Area
NVZ	Nitrate Vulnerable Zone
RBMP	River Basin Management Plan
PR09	Periodic review 2009
PR14	Periodic review 2014
PR19	Periodic review 2019
RSPB	Royal Society for the Protection of Birds
PRV	Pressure Release Valve
SAC	Special Area of Conservation
SASP	Significant Areas for Sport
SEA	Strategic Environmental Assessment
SMP	Shoreline Management Plan
SPA	Special Protection Area
SSSI	Site of Special Scientific Interest
UKCIP	United Kingdom Climate Impacts Programme
UKCP	UK Climate Projections
UKWIR	UK Water Industry Research
WFD	Water Framework Directive
WRMP	Water Resource Management Plan
WRMP2014	Affinity Water's Water Resource Management Plan 2014
WRSE	Water Resources in the South East
WRZ	Water Resource Zone
dWRMP19	Affinity Water's draft Water Resource Management Plan 2019
rdWRMP19	Affinity Water's revised draft Water Resource Management Plan 2019

Executive summary

Background

Affinity Water (as a Water Company) has a statutory duty to prepare and maintain a Water Resources Management Plan (WRMP) identifying how they intend to maintain the balance between water supply and demand over a minimum period of 25 years. Affinity Water's revised draft Water Resource Management Plan 2019 (rdWRMP19) will set out the preferred programme (comprising a range of options) to reduce any deficit through implementation of both supply and demand options.

AECOM was appointed by Affinity Water to assist in undertaking a Strategic Environmental Assessment (SEA) for the WRMP19. The requirement to undertake a SEA arises from European Directive 2001/42/EC 'on the assessment of the effects of certain plans and programmes on the environment' (the 'SEA Directive'). The SEA Directive is transposed into English law through the Environmental Assessment of Plans and Programmes Regulations 2004 (the 'SEA Regulations'). The SEA Directive and associated regulations require a SEA to be undertaken for certain plans and programmes, which are likely to have significant effects on the environment.

The purpose of SEA is to provide for a high level of protection of the environment and to contribute to the integration of environmental considerations into the preparation of plans with a view to promoting sustainable development. It is a systematic assessment tool to support and inform decision-making. This is a summary of the Environmental Report and supporting appendices for the rdWRMP19, which sets out the detailed method, findings and recommendations for the SEA process.

Scope

The first task was to set out the context for the SEA, and this is commonly referred to as 'scoping'. A review of the baseline environment was carried out as well as a review of other plans and programmes that may have implications for the emerging rdWRMP19 and the SEA. This allowed the identification of key environmental problems or issues within and surrounding Affinity Water's operating area. A number of SEA objectives and assessment questions were then developed to address those key issues and provide a methodological 'framework' for undertaking the assessment of the rdWRMP19 and any reasonable alternatives.

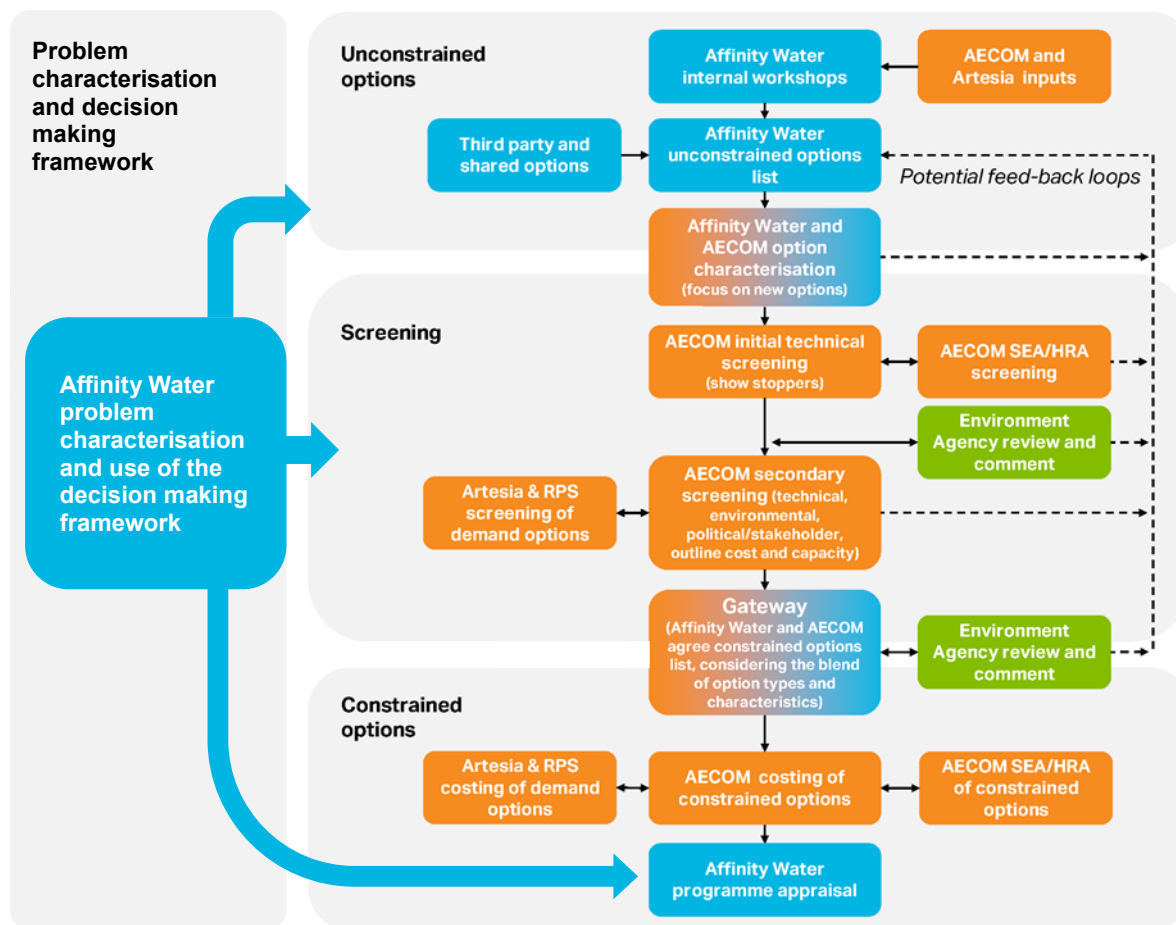
This information was presented in a SEA Scoping Report that was sent to key stakeholders (including the Environment Agency, Historic England and Natural England) in December 2017 for review and comment. Any representations received were taken into account as part of the iterative SEA process and the scoping information updated where necessary.

SEA of alternatives

There is a requirement for the SEA to explain what work was undertaken to develop and then appraise reasonable alternatives for the rdWRMP19. It must set out how the findings of the SEA informed Affinity Water's decision-making and the selection of the preferred programme of options proposed within the rdWRMP19.

Affinity Water's option appraisal process for the rdWRMP19 is summarised in **Figure 1** below.

Figure 1: Affinity Water options appraisal process



The SEA has informed decision-making at each key stage in the Affinity Water options appraisal process. The key stages are briefly explained below.

Unconstrained options

The first stage in Affinity Water's options appraisal process was to identify a long list of supply and demand management options to help meet future demands over the planning horizon. These are options yet to be constrained by factors such as environmental or planning restrictions, health and safety regulations, legal restrictions, promotability or risk. Referred to as 'unconstrained options', they were subjected to a two stage screening assessment (which included SEA criteria) to determine if they were technically feasible and therefore suitable to progress to the next stage of Affinity Water's options appraisal process further consideration.

Constrained options

Each constrained option was assessed against the full SEA Framework of objectives and assessment questions established during scoping. The SEA found that the demand options were not site-specific and generally involve reducing water use and loss through water efficiency measures, metering, reuse and leakage control. It was concluded that there are no significant differences between the options in terms of the SEA objectives and that none are likely to arise in a significant effect.

A range of different supply-side option types were considered through the SEA process, which included options for the abstraction of water from surface and groundwater bodies as well as new pipelines to transfer water within and outside Affinity Water's operating area. The SEA found that while there is the potential for significant negative effects for some options during construction and operation, it is highly likely that the significance of these effects can be reduced during detailed planning and design of schemes. The assessment found that negative effects during construction primarily arise as a result of the requirement for new infrastructure and the significance of this effect is

dependent on the presence of, or pathways to, sensitive receptors. Negative effects during operation generally relate to potential changes in water levels/ flows as a result of increased abstraction and indirect effects on biodiversity.

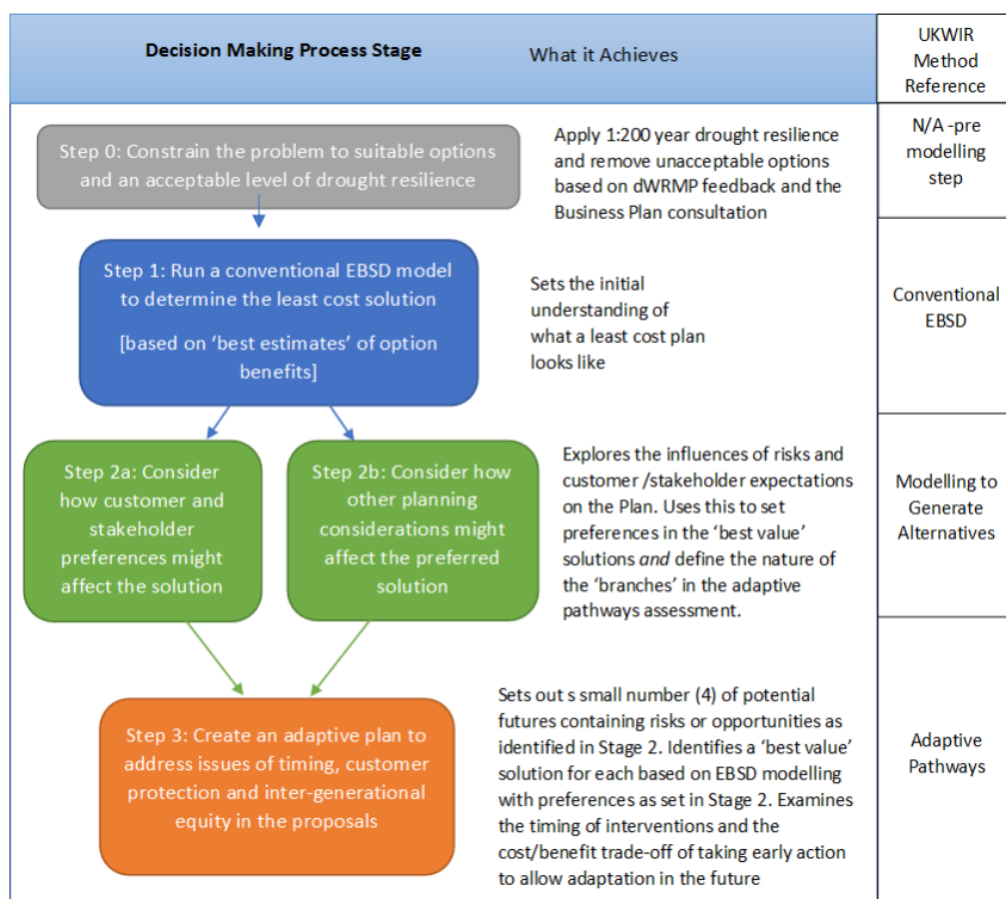
The drought options are essentially groundwater options that involve increasing peak (and in the case of prolonged drought, average) abstraction above existing licensed volumes or drought related environmental (river flow or groundwater level) constraints. The assessment found that there are no significant effects likely to arise as a result of the drought options as they would be temporary in nature, and are predicted to only have small impacts compared to natural drought impacts.

Alternative Programmes and Revised Draft WRMP19 Decision Making

The final task in Affinity Water's option appraisal process (see **Figure 1**) is the programme appraisal. Essentially the aim of the programme appraisal process is to find the 'best value' programme of supply and/ or demand management options to secure a supply-demand balance across the Affinity Water supply area.

To address the concerns raised during the consultation for the dWRMP19 in 2018, a revised decision making process has been used for the rdWRMP19. The process developed and used by Affinity Water is fully compliant with both the Environment Agency Water Resources Planning Guidance, and the modelling processes and tools described within the UKWIR Decision Making Method guidance. A summary of the revised decision-making process used (covering stages 6 to 8 of the UKWIR guidance) is provided in **Figure 2** below.

Figure 2: Summary of the Selected Decision Making Process



The SEA process was integrated into the programme appraisal stage and informed decision making as follows:

- The SEA findings for individual constrained options were converted into a metric that was fed into the computer model.

- Step 0, removed options associated with new Chalk groundwater abstractions in the Central Region to align with the findings of the SEA, HRA and WFD as well as feedback received from stakeholders, including statutory consultees.
- Step 2, the SEA findings informed the 'bottom up' multi-criteria analysis to determine where the key risks and uncertainties lie in the Plan. The SEA findings along with the customer and stakeholder preferences were used to structure the Adaptive Pathways analysis at the next stage. As a result, reduced yield was explored for a number of schemes identified as having the potential for impacts on surface and/ or groundwater levels/ flows.
- Following Step 2 a comparative assessment of all reasonable alternative programmes/ adaptive futures was carried out and the findings informed the selection of the preferred programme and adaptive futures in Step 3.

Affinity Water identified nine reasonable alternative programmes (essentially nine different packages of supply and demand management schemes to address certain planning scenarios/ model parameters) for further consideration through the SEA process. These programmes were considered to be reasonable alternatives as they met the primary and secondary objectives of the rdWRMP19.

SEA of the reasonable alternative programmes

An assessment of each of the reasonable alternative programmes was carried out against the SEA objectives. The programmes are all based on different model conditions, which include varying levels of demand management savings (optimistic, expected and lower) as well as the number of supply-side schemes available for selection. As a result, there are differences between the programmes in terms of the overall number of supply-side schemes selected as well as differences between the individual schemes selected.

The programmes that are based on expected or lower demand management savings, or where strategic supply-side schemes (with +50MI/d benefit) are removed from consideration tend to result in a greater number of supply-side schemes being selected for delivery. This includes the Expected Future (23 supply-side schemes), Demand-side Challenging (21 supply-side schemes), AD_2 (20 supply-side schemes), AD_3 (23 supply-side schemes) and Supply-side Challenging (22 supply-side schemes). The Environmental Adaptive Run includes the fewest supply-side schemes at 13 as a number of schemes could not be selected based on the criteria adopted for this run (i.e. excluding options with moderate or major adverse effects as identified by the SEA).

All of the programmes propose the delivery of the same five supply-side schemes in the first five years of the plan period in AMP7 and with the same delivery date:

- AFF-RTR-WRZ7-0639: Deal Continuation After 2020 (Delivery in 2020)
- AFF-RTR-WRZ7-0909: Barham Continuation (After 2019/20) (Delivery in 2020)
- AFF-EGW-WRZ7-0629: Lye Oak Licence Variation (Delivery in 2021)
- AFF-CTR-WRZ4-4001: Egham to Iver (Delivery in 2022)
- AFF-RNC-WRZ7-0900: Dover Constraint Removal (Delivery in 2022)

All these schemes propose minimal new infrastructure and as a result, they are not identified as having the potential for a significant negative effect either during construction or operation through the SEA, HRA or the WFD assessment.

All of the programmes except for the Environmental Adaptive Run include the delivery of AFF-NGW-WRZ3-1068: Runley Wood (AMP7 LGS Borehole) and AFF-NGW-WRZ3-1053: Kings Walden. Both of these schemes are identified through the assessment as having the potential for a moderate negative effect on SEA objectives relating to WFD status and surface and groundwater levels/ flows. This was informed by the WFD assessment for the rdWRMP19, which identifies that the groundwater abstractions may influence local water balance in Woburn Sands groundwater body depending on extent of confined Lower Greensand (LGS) abstraction influence.

All of the programmes select the delivery of AFF-NGW-WRZ3-1068: Runley Wood (AMP7 LGS Borehole) first and then AFF-NGW-WRZ3-1053: Kings Walden shortly after in the following AMP. The

Supply-side Challenging Future Adaptive programme proposes the earliest delivery of AFF-NGW-WRZ3-1068: Runley Wood (AMP7 LGS Borehole)) in AMP7. Four programmes propose it for delivery in AMP8 (Expected Future, Demand-side challenging, AD_2 and AD_3), two in AMP10 (AD_1 and Optimistic) and one in AMP12 (Aspirational). The early delivery of the schemes through the Supply-side Challenging Future Adaptive programme restricts the amount of time available for further investigative work and assessment.

The assessment found that there is the potential for a moderate negative effect against SEA objectives relating to WFD status and surface and groundwater levels/ flows for AFF-NGW-WRZ4-0624: Canal & River Trust and GSK Slough Boreholes. All of the programmes except the Environmental Adaptive Run include the delivery of AFF-NGW-WRZ4-0624: Canal & River Trust and GSK Slough Boreholes. The earliest delivery is proposed through the Supply-side Challenging programme in AMP8. Two programmes propose it for delivery in AMP10 (Expected Future and Demand-side challenging), four in AMP11 (AD_1, AD_2, AD_3 and Optimistic) and one in AMP14 (Aspirational).

The assessment identified potential issues and uncertainties in relation to AFF-RES-WRZ4-0832: Brent Reservoir. During operation the scheme proposes the release of water from the Brent Reservoir, which is also a SSSI. More detailed hydrological investigations need to be carried out in order to determine the extent and frequency of drawdown as a result of this scheme and how the hydrological conditions affect the wetland habitats and birds they support. Six of the programmes include AFF-RES-WRZ4-0832: Brent Reservoir, with four proposing it for delivery in AMP9 (Expected Future, Demand-side challenging, AD_2 and AD_3), one in AMP11 (AD_1) and in AMP13 (Aspirational). The three remaining programmes (Supply-side challenging, Optimistic and Environmental) do not include this scheme. Given that the earliest this scheme is proposed for delivery is AMP9, it is considered that there is sufficient time to investigate this issue further.

Four programmes (Expected Future, AD_2, AD_3 and Supply-side Challenging) include the delivery of AFF-RES-WRZ5-0809: Birds Green Reservoir, which is also identified through the assessment as having the potential for a moderate negative effect against SEA objectives relating to WFD status and surface and groundwater levels/ flows. The assessment also identifies the potential for moderate positive effects during operation as once established the raw water reservoir will provide new opportunities for recreation as well as opportunities for biodiversity net gain. The four programmes all propose the delivery of this scheme late in the planning horizon in either AMP17 or 18, as a result it is considered that there is sufficient time to investigate this issue further and identify more detailed mitigation measures if necessary.

It is important to note that the Environmental Adaptive Run does not include any of the schemes identified above as potentially having issues relating to WFD status and surface and groundwater levels/ flows. Furthermore, the Supply-side Challenging Future Adaptive Run cut the yield of these schemes by 50% to help mitigate the risks flagged through assessment as well as help to explore potential alternatives. It is likely that reducing their yield would help to reduce the significance of/ potential risk of residual negative effects identified during operation but this is uncertain at this stage.

The assessment also identifies potential issues during operation in terms of WFD status and surface and groundwater levels/flows for AFF-EFF-WRZ3-0180: Stevenage STW - Effluent Reuse and AFF-RES-WRZ3-0814: Honeywick Rye Reservoir. The assessment also found that there are potential benefits associated with the delivery of a new raw water reservoir in relation to recreation and biodiversity net gain. Only programmes AD_2 and AD_3 include these schemes as a result of restricting the selection of any strategic supply-side schemes. They are both proposed for delivery at the end of the planning horizon in AMP18.

The model parameters associated with programmes AD_2, AD_3 and the Environmental Adaptive Run mean that they generally do not include any strategic supply-side schemes. The only exception to this is the inclusion of AFF-RTR-WRZ3-4016: Minworth Strategic Transfer (100 MI/d) within programmes AD_3 and the Environmental Adaptive Run. The Minworth scheme is not identified through the SEA as being likely to have significant negative effects during operation¹ and no significant issues are highlighted through the HRA or WFD assessment.

¹ Except relating to SEA Objective 8 which deals with carbon.

AD_2, AD_3 and the Environmental Adaptive Run do not include any schemes related to the delivery of the South East Strategic Reservoir. The other programmes all include two schemes that are linked to the delivery of the SESR. AFF-RTR-WRZ4-4011: Abingdon to Iwer 2 (50MI/d) is proposed for delivery first under all the programmes and is then followed by AFF-RTR-WRZ1-4010: Abingdon Reservoir to Harefield Transfer (50MI) at a later date. The Demand-side Challenging programme proposes the earliest delivery of AFF-RTR-WRZ4-4011: Abingdon to Iwer 2 (50MI/d) in AMP10 followed by Supply-side Challenging and Expected Future in AMP11, Optimistic and AD_1 in AMP12 and Aspirational in AMP14. The assessment has highlighted for a number of significant negative as well as positive effects as a result of these schemes.

All of the programmes propose a variety of demand management measures throughout the planning horizon and the assessment found that these will generally perform positively or have a residual neutral effect against the majority of SEA objectives. Some of the leakage options would require construction works to repair or replace pipes and this could have local, temporary and short term minor negative effects; however, these are not likely to be significant.

Outline reasons for the selection and rejection of the reasonable alternative programmes

As described in Section 5.2, Affinity Water has progressed with an adaptive modelling approach to help inform decision-making on the preferred programme and manage future uncertainties given the long planning horizon of the WRMP. This includes recognition of points in time whereby they would have to make a decision based on the realisation of benefits from demand-side and leakage measures. This decision-making point could take them down one of a number of adaptive futures.

At this stage, taking account of a wide range of factors, including the findings of the SEA (and associated HRA and WFD assessment), the Expected Future Run is selected by Affinity Water as the preferred programme and is based on expected demand management savings and leakage targets. It contains a suitable range of supply-side schemes throughout the planning horizon to minimise risk and enhance the resilience of the plan.

While it is recognised that the SEA and associated WFD assessment have highlighted a number of potential issues for schemes that are proposed under this programme, it is considered that there is sufficient time before they are implemented to allow for further investigation, assessment and consultation to be carried out in relation to the identified issues. This will establish the likelihood and significance of impacts as well as any detailed mitigation measures that are necessary. All but one of the schemes flagged by WFD are to be delivered in AMP8 or later. The one scheme that has been flagged through this assessment which is scheduled for AMP7 delivery is in the last year of the AMP, and has been recognised by the PR19 business planning process as a key area for investigation. We have already undergone works to investigate and study this particular area and have ongoing discussions with the local EA teams on this topic. To ensure we have all future eventualities covered however, our Challenging Supply-Side Future simulates what would happen if the volumes from this scheme were not able to be materialised as part of an adaptive future.

Alongside the Expected Future Run the following reasonable alternatives have also been progressed as possible adaptive futures under the rdWRMP19:

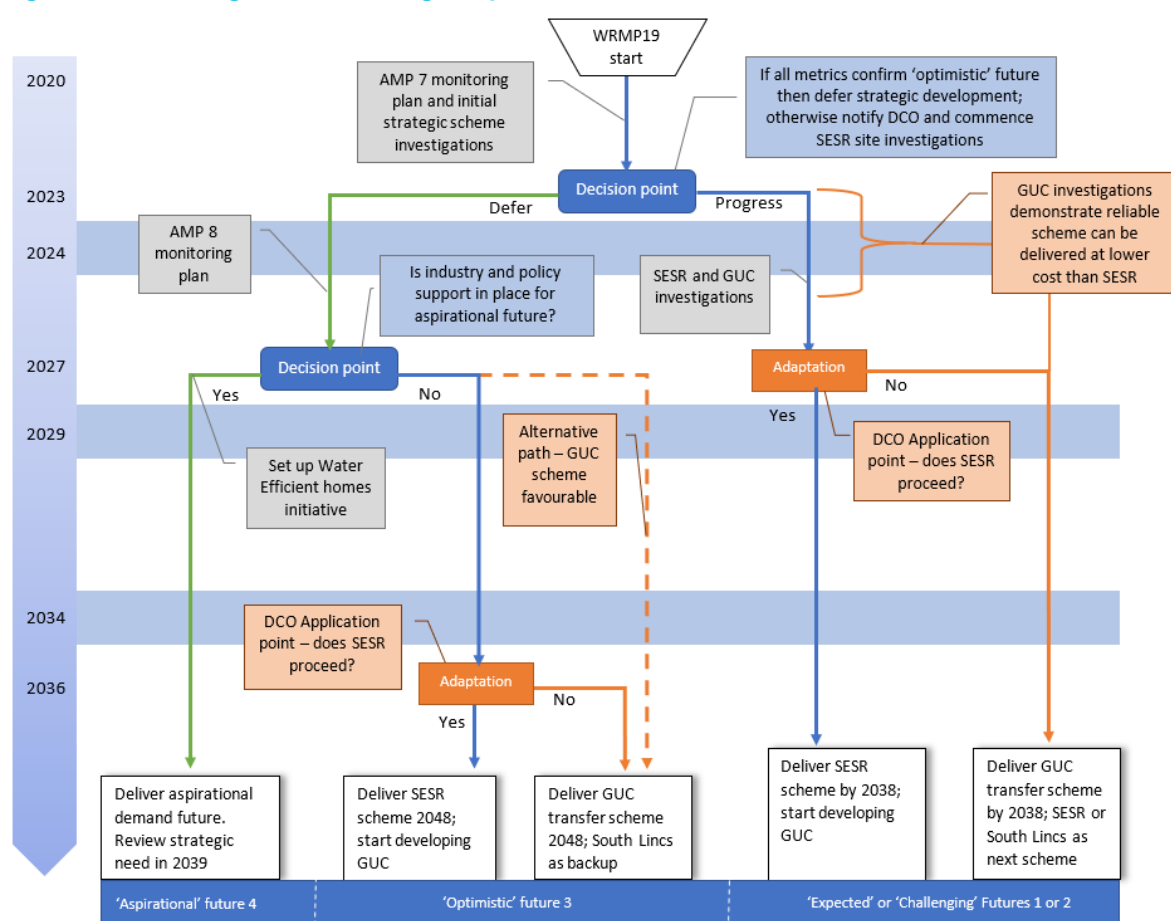
- Aspirational Future;
- Demand-side Challenging Future;
- Supply-side Challenging Future; and
- Optimistic Future.

As noted above, given the adaptive planning approach there are points in the future (**Figure 5.3**) where a decision will be made, based on the evidence available, to determine if it would be more appropriate to progress down the Challenging (supply-side or demand) Future, Optimistic Future or Aspirational Future programmes. Affinity Water's adaptive approach will dictate which of these programmes is progressed as a result of meeting the leakage and/ or demand-side targets set (or conversely not meeting these targets). The four adaptive programmes to our Expected Future are necessary to highlight the different pathways our future could materialise depending upon the

realisation of demand management benefits and leakage reduction. They show that if the benefits of these measures are not realised, we will need to bring forward the delivery of specific supply-side schemes to compensate in order to maintain supply to our customers. Conversely, they also show the effect on the same supply-side schemes should we achieve optimistic levels of demand management savings and leakage reduction, which results in these schemes being pushed further into the future.

Figure 3 shows each of these four adaptive futures in relation to a WRMP19 start point. For the majority of AMP7, the plan will continue along one pathway until 2023 whereby Affinity Water will meet a decision point. For the previous years, the demand management and leakage results will have been tracked so once Affinity Water meet this decision point it can then be determined if these demand-side measures are on track or not in delivering demand savings. If the proposed demand management and leakage schemes deliver their expected demand benefits (central/ expected estimate) as opposed to the more optimistic forecast benefits, Affinity Water will progress down the Expected Future which involves developing a strategic source for delivery in 2041. This is represented by the right hand 'flow' direction from the first decision point in **Figure 3**.

Figure 3: Flow diagram illustrating adaptive futures



Under the Adaptive Run process, there is the ability to switch between strategic sources depending upon the success of the DCO application. There is also an ability to bring forward the construction of either strategic source option on the grounds of Challenging Supply-Side, or Challenging Demand-Side Futures. These Challenging Futures take consideration of possibilities such as demand management options not performing at their expected levels, or reduced yield of supply options as flagged by the WFD assessment. All schemes flagged by WFD as potentially having adverse impacts on status and where further investigation is required had their yields cut by 50% under the Challenging Supply-Side Future to mitigate the flagged risks and highlight which alternative schemes would be implemented earlier and/ or introduced.

If, at the AMP7 decision point, Affinity Water finds they are on track with demand management or leakage targets, they can defer the construction of a strategic option and continue to monitor through AMP8. Another decision point would then be reached in 2027. If at this point Affinity Water finds the

more ambitious, long term targets are not likely to be met, they have the ability to then construct a strategic option albeit a bit later than the expected and challenging futures.

Alternatively, if Affinity Water finds the demand management and leakage targets are being met at the 2027 decision point, they can continue down the Aspirational Future pathway with the view to reviewing the need for a strategic option in 2039.

The Environmental Adaptive Run, AD_1, AD_2 and AD_3 alternative programmes have all been rejected for the reasons set out below.

The Environmental Adaptive Run is a viable alternative programme which will not select options that the SEA has flagged as being potentially negative without mitigation. This is a reasonable alternative programme; however, on the grounds that there are not enough options under the conditions of this model run, additional levels of leakage reduction are selected to infill the gap left by the supply-side options excluded. This generates a programme with quite a high level of risk and dependency on meeting leakage reduction targets and does not consider that further investigation and more detailed mitigation at the detailed design stage could remove or further reduce the significance of negative effects identified through the SEA. By doing this, we generate a programme with a high level of risk associated with meeting extremely ambitious levels of leakage reduction. We do not deem this to be an acceptable level of risk and have such removed this from our process.

Similarly, AD_2 and AD_3 meet the plan objectives. The intention of these modelling runs was to understand what a programme of options would look like, should a strategic source option not be available. We recognise through our rdWRMP19 modelling that forecasted growth in the rdWRMP19 is so significant that Affinity Water consistently need between 100Ml/d and 150Ml/d of strategic imports into their supply region. Therefore, options which satisfy this need have a great deal of weight, so by undertaking AD_2 and AD_3 Affinity Water can understand the implications of not having one of these schemes available.

AD_2 and AD_3 were removed from the process because they were overly pessimistic. Our Challenging Future runs cover the eventualities of investigations flagging potential reasons to not progress with a particular strategic source, or events like DCO applications being unsuccessful, by allowing for an alternative strategic option to be selected rather than simply not selecting any strategic options. These runs were still useful to allow us to understand the weight of these options on our future ability to provide supply.

AD_1 was rejected because it was superseded by our Optimistic Future. Both runs had optimistic demand management futures involved; however, the long term targets (i.e. leakage reduced by 50% in 2044/45) exist in the Optimistic Future but not in AD_1. This was not a secondary or primary objective, so we were not able to rule AD_1 out of the process, but the run was not required further on the basis that the Optimistic Future does what AD_1 does, and goes further in line with long term targets raised by stakeholders as desirable.

SEA of the rdWRMP19 and adaptive futures

Building on the assessment work carried out for the constrained options, the SEA found that the majority of supply and demand options or 'schemes' proposed through the rdWRMP19 and adaptive futures are unlikely to have a significant effect during either construction or operation against the majority of SEA objectives.

Some schemes were identified as having the potential for a significant negative effect and that mitigation or further investigation would be required. These schemes are identified in the **Table 1** below along with any mitigation or further assessments proposed through the SEA.

Table 1: Schemes with the potential for a significant negative effect

Scheme	Potential impact	Mitigation / further investigation
AFF-RES-WRZ4-0832 (BREN Reservoir)	The scheme proposes the release of water from the Brent Reservoir, which is designated as a SSSI. There is uncertainty at this stage with regard to the extent and frequency of drawdown in the reservoir as a result of this proposed scheme.	There ongoing discussions between Affinity Water and the Rivers and Canals Trust who operate the reservoir. More detailed hydrological investigations need to be carried out in order to determine the extent and frequency of drawdown as a result of this scheme and how the hydrological conditions affect the wetland habitats and birds they support. The assessment proposes that the water levels in the Brent Reservoir are monitored to inform the need and use of hands-off flow conditions to restrict the release of water when levels are low. Furthermore, the release of water could also be restricted during the breeding/ nesting seasons (broadly March to July). The Challenging Adaptive Future explored the potential for reducing the yield of this scheme by 50% to mitigate the extent and frequency of any drawdown.
AFF-NGW-WRZ4-0624 (Canal & River Trust and SGSK Boreholes)	The WFD assessment found that the cessation of discharge could cause deterioration in status of the Salthill Stream surface water body.	The discharge volume needs to be quantified and further WFD assessment undertaken to determine if could impact the status of the Salthill Stream surface water body. Given that the delivery date of this scheme is 2039 there is sufficient time to investigate this issue further. Mitigation could include the use of hands-off flow conditions when water levels/ flows are low. The Challenging Adaptive Future explored the potential for reducing the yield of this scheme by 50% to mitigate the extent and frequency of any drawdown.
AFF-RES-WRZ5-0809 : Birds Green Reservoir	The WFD assessment found that there the scheme could reduce water flow and levels as well as quality in the Lower Roding (Cripsey Brook to Loughton) Surface Water Body	The WFD assessment recommends that further assessments and discussions with the EA are required to explore the need for and potential of compensatory flows. Given that the delivery date of this scheme is 2078 there is sufficient time to investigate this issue further. Mitigation could include the use of hands-off flow conditions when water levels/ flows are low. The Challenging Adaptive Future explored the potential for reducing the yield of this scheme by 50% to mitigate the extent and frequency of any drawdown.
AFF-NGW-WRZ3-1053 : Kings Walden	The WFD assessment identifies that the two schemes have the potential for impacts on surface water (River Ivel) if abstraction from confined Lower Greensand affects Woburn Sands groundwater body input to surface water.	Further investigations should be carried out, including a more detailed WFD assessment. There should also be discussions with the Environment Agency to ensure compliance with the WFD. Mitigation could include the use of hands-off flow conditions when water levels/ flows are low. The Challenging Adaptive Future explored the potential for reducing the yield of this scheme by 50% to mitigate the extent and frequency of any drawdown.
AFF-NGW-WRZ3-1068 : Runley Wood (AMP7 LGS Borehole)	Abstraction may impact Restoring Sustainable Abstraction (RSA) programme	
AFF-RTR-WRZ1-4010 : Abingdon Reservoir to Harefield Transfer (50MI)	The HRA identified that there is the potential for a likely significant effect on the South West London Waterbodies SPA/ Ramsar site	The HRA concluded that there would not be any adverse effects on the integrity of any European sites if the following recommendations are included in the rdWRMP19:
AFF-RTR-WRZ4-4011 : Abingdon to Iwer 2 (50MI/d)		It is recommended that the inclusion of this option within the WRMP is accompanied by an explicit commitment to ensure that the programming and construction processes for this scheme take into account the proximity of the SPA and that construction works on the short section of pipeline adjacent to the SPA are programmed to avoid the winter (October to March) period entirely or are accompanied by an impact

Scheme	Potential impact	Mitigation / further investigation
		assessment including noise modelling and mitigation in line with British Standard BS5228 as required in order to ensure that noise levels can be maintained at an acceptable level.
		As a precaution, it is recommended that the inclusion of this option within the WRMP is accompanied by an explicit commitment to carefully design the pipeline, informed by geotechnical and hydrogeological investigations as necessary, to ensure that there is no requirement for dewatering of the excavation, or that any dewatering that is required is returned immediately to ground. These would enable the pipeline to be installed at a suitable depth and in a suitable manner that groundwater continuity to the gravel pits would not be disrupted and groundwater quality would be protected.
AFF-RTR-WRZ1-1066: Grand Union Canal (GUC - Berkhamstead/Hemel Hempstead)	The WFD assessment identifies that the abstraction has the potential for impacts during operation on water levels/ flows and quality in the Tame (R Rea to R Blythe and from R Blythe to River Anker) surface water body.	Further investigations should be carried out, including a more detailed WFD assessment. There should also be discussions with the Environment Agency to ensure compliance with the WFD. Mitigation could include the use of hands-off flow conditions when water levels/ flows are low. It is anticipated that these schemes would be delivered later in the planning horizon, i.e. after AMP8, so there is sufficient time to undertake further investigations.
AFF-RTR-WRZ1-4020: Grand Union Canal (GUC - Berkhamstead/Hemel Hempstead 100 MI/d)		

While the potential for minor negative effects were identified for schemes against a number of SEA objectives, it is highly likely that the significance of these can be reduced further during detailed planning and design of schemes. Negative effects during construction primarily arise as a result of the requirement for new infrastructure and the significance of this effect is dependent on the presence of, or pathways to, sensitive receptors.

Cumulative effects

Intra-plan cumulative effects

It is a requirement for the SEA to also consider potential interactions between the proposed rdWRMP19 and adaptive future schemes as well as with other plans and programmes, which could result in cumulative effects.

Overall, it was concluded that there is a low risk arising for cumulative effects during construction of the schemes. The delivery dates of the schemes and infrastructure proposed mean that the potential for interactions is low and there is suitable mitigation to ensure that residual effects are not significant.

During operation there is the potential for some schemes to interact and have impacts on the same water body. The majority of the interactions present a low risk to waterbodies, where the recommended mitigation, including CoPC and best practice for design, construction and operations, is likely to ensure that residual effects are not significant. Two schemes however interact (AFF-NGW-WRZ3-1053 and AFF-NGW-WRZ3-1068) and present a medium risk of cumulative adverse effects on the Upper Bedford Ouse Woburn Sands Groundwater Body, where further hydrogeological assessment to consider linkage between deep Lower Greensand aquifer and Upper Bedford Ouse Woburn Sands is required. It is also recommended that water levels/ flows in the Upper Bedford Ouse Woburn Sands Groundwater Body are monitored and mitigation could include a hands-off flow condition to prevent abstraction if water levels/ flows drop below a certain level.

During operation there is also the potential for some schemes to interact and have positive effects for the River Thames as a result of improved flow rates, improved habitats and chemistry.

Overall, it was concluded that there is the potential for some schemes to interact and have impacts on the same sensitive receptor. The delivery dates of the schemes and infrastructure proposed mean

that the potential for interactions is low and there is suitable mitigation to ensure that residual effects are not significant. It will be important for any new visible infrastructure to be sensitively designed and adhere to the aims and policies of any relevant AONB Management Plan.

The HRA for the rdWRMP19 recommended a number of mitigation measures in relation to the schemes AFF-RTR-WRZ1-4010 (2053) and AFF-RTR-WRZ4-4011 (2041) which will need to be taken into consideration during construction and operation to minimise the risks associated with the European designated sites (South West London Waterbodies Ramsar and SPA). This mitigation includes an explicit commitment to ensure that the programming and construction processes for the schemes take into account the proximity of the SPA and that construction works on the short section of pipeline adjacent to the SPA are programmed to avoid the winter (October to March) period entirely or are accompanied by an impact assessment including noise modelling and mitigation in line with British Standard BS5228 as required in order to ensure that noise levels can be maintained at an acceptable level.

When considering the potential additional schemes under the adaptive future approach, another potential cumulative adverse effect (over and above the effects explored above) arises. Scheme AFF-CTR-WRZ3-0028 interacting with rdWRMP19 scheme AFF-RTR-WRZ1-4010 has the potential for cumulative adverse effects during construction in relation to Ruislip Woods SSSI. Given the interest features of the SSSI (lowland acid grassland, woodland and invertebrate assemblage) impacts are most likely to occur as a result of emissions of dust and changes to water quality and levels during construction. During the detailed design stage the pipelines should be routed to avoid coming within 500m of the interest features sensitive to emissions of dust during earthworks. Otherwise, standard dust suppression measures should be introduced in line with the relevant British Standard. Careful design and construction of the pipeline, informed by further geotechnical and hydrogeological investigations, would enable it to be installed at a suitable depth and in a suitable manner (including return of any dewatering volumes immediately back to ground) that water levels and quality on the SSSI would not be significantly affected. This would need to be developed further during detailed scheme design.

Inter-plan cumulative effects

Water Resources for the South East (WRSE) carried out a study to identify potential cumulative effects arising as a result of interactions between schemes being proposed through emerging dWRMPs (2019) within their area. The study identified eight schemes proposed within Affinity Water's rdWRMP19 that could interact with schemes proposed in other WRMPs to have a cumulative effect.

These potential cumulative effects were explored in greater detail and were largely found to present a low risk. None of the schemes interact to pose a significant risk of deterioration in the overall status of waterbodies as most impacts were considered to be minimal, localised and/ or temporary. Of greatest significance; the WFD assessment found that AFF-RES-WR5-0809 has the potential to result in the deterioration in the status of the Lower and Upper Roding surface water bodies during operation. As a result, there is the potential for cumulative effects on the Thames (wider catchment). The WFD assessment recommends that further assessments and discussions with the EA are required. It is important to note that the delivery date for this scheme is 2078; it is therefore considered that there is ample time to undertake further investigations (including a more detailed WFD assessment) and identify specific mitigation measures to reduce the likelihood and significance of any residual cumulative effects.

In line with recommendations within the WRSE study, the SEA suggests that further discussions between Affinity Water and the relevant neighbouring water companies should continue to take place as each WRMP is finalised and moves to implementation. Once proposed schemes and their delivery dates are confirmed through the next stages of delivery of the WRMPs, it will allow for a more informed consideration of potential interactions and the likelihood for cumulative effects to arise.

The potential for interactions with other plans and programmes, including other Affinity Water plans, were explored and it was found that there is a low risk for cumulative effects, predominantly arising through the delivery of new infrastructure proposed through other plans during the construction phase of rdWRMP19 schemes. In the majority of cases the delivery dates for the schemes and infrastructure mean that cumulative effects will be avoided. A key response in terms of mitigation will be ongoing and effective communication between the relevant authorities' (local planning, transport,

minerals and waste authorities) and key stakeholders (Environment Agency, Historic England and Natural England).

The WRSE study identified one scheme (AFF-RTR-WRZ7-0842) proposed under the Adaptive Futures that could interact with schemes proposed in other WRMPs (Southern Water) as well as five other schemes proposed in the rdWRMP19 within WRZ7 to have a cumulative effect on the Kent Downs AONB.

Given the scale of the schemes and potential mitigation available, including screening/ planting, it is considered unlikely that there will be any significant cumulative effects with options being proposed through Southern Water's WRMP19 on the AONB. Any schemes that propose new infrastructure should ensure that it is sensitively designed and is in conformity with the Kent Downs AONB Management and Local Plans.

The potential for interactions with other plans and programmes, including other Affinity Water plans, were explored and it was found that there is a low risk for cumulative effects with the schemes proposed under the rdWRMP19 or the adaptive futures.

Next steps and monitoring

The rdWRMP19 and revised Environmental Report will be sent to the Department for Environment, Food and Rural Affairs (Defra) for review and published for wider consultation. Any comments received will be taken into account when finalising the WRMP19.

Once the final WRMP19 is approved by the Secretary of State, published and adopted, Affinity Water will publish a SEA Post Adoption Statement, describing how the SEA and the responses to consultation have been taken into account during the preparation of the WRMP19.

At the current time, there is a need only to present 'measures envisaged concerning monitoring'. The SEA Regulations expect monitoring and mitigation to be linked, and that the focus should be on any significant negative effects identified through the assessment. The UKWIR SEA guidance recommends that existing arrangements for monitoring should be used where possible to avoid duplication of effort.

Based on the findings of the SEA at this stage, the following monitoring measures are proposed:

Table 3: Proposed monitoring measures

SEA topic	Potential indicator	rdWRMP19 and adaptive future schemes
Water	Groundwater levels/ flows/ quality and WFD status for the Lower Greensand (already monitored by the Environment Agency);	<ul style="list-style-type: none"> AFF-NGW-WRZ4-0624 : Canal and Rivers Trust and GSK Slough Boreholes AFF-NGW-WRZ3-1053 : Kings Walden AFF-NGW-WRZ3-1068 : Runley Wood (AMP7 LGS Borehole)
	Surface water levels/ flows/ quality and WFD status for the Salthill stream (already monitored by the Environment Agency);	<ul style="list-style-type: none"> AFF-NGW-WRZ4-0624 : Canal and Rivers Trust and GSK Slough Boreholes
	Surface water levels/ flows/ quality and WFD status for the Lower Roding (Crispey Brook to Loughton) (already monitored by the Environment Agency);	<ul style="list-style-type: none"> AFF-RES-WRZ5-0809 : Birds Green Reservoir
	Surface water levels/ flows/ quality and WFD status for the River Ivel (already monitored by the Environment Agency);	<ul style="list-style-type: none"> AFF-NGW-WRZ3-1053 : Kings Walden
	Groundwater levels/ flows/ quality and WFD status for the Woburn Sands (already monitored by the Environment Agency);	<ul style="list-style-type: none"> AFF-NGW-WRZ3-1053 : Kings Walden AFF-NGW-WRZ3-1068 : Runley Wood (AMP7 LGS Borehole)
	Surface water levels/ flows/ quality and WFD status for the River Flit (already monitored by the Environment Agency);	<ul style="list-style-type: none"> AFF-NGW-WRZ3-1068 : Runley Wood (AMP7 LGS Borehole)

SEA topic	Potential indicator	rdWRMP19 and adaptive future schemes
	the Environment Agency);	
	Groundwater levels/ flows/ quality and WFD status for the East Kent Chalk Stour (already monitored by the Environment Agency);	<ul style="list-style-type: none"> AFF-EGW-WRZ7-0629: Lye Oak Licence Variation
	Brent Reservoir water levels (already monitored by the Canal & River Trust);	<ul style="list-style-type: none"> AFF-RES-WRZ4-0832 : Brent Reservoir
	Surface water levels/ flows/ quality and WFD status for the Tame (R Rea to R Blythe and from R Blythe to River Anker) surface water body (already monitored by the Environment Agency);	<ul style="list-style-type: none"> AFF-RTR-WRZ1-1066 : Grand Union Canal (GUC - Berkhamstead/Hemel Hempstead) AFF-RTR-WRZ1-4020 : Grand Union Canal (GUC - Berkhamstead/Hemel Hempstead 100 MI/d)
Biodiversity	Brent Reservoir SSSI condition status (already monitored by Natural England);	<ul style="list-style-type: none"> AFF-RES-WRZ4-0832 : Brent Reservoir
	South West London Waterbodies Ramsar and SPA as well as the Wraysbury No.1 Gravel Pit SSSI condition status (already monitored by Natural England).	<ul style="list-style-type: none"> AFF-RTR-WRZ1-4010 : Abingdon Reservoir to Harefield Transfer (50MI) AFF-RTR-WRZ4-4011 : Abingdon to Iver 2 (50MI/d)
	Roding Valley SSSI condition status (already monitored by Natural England);	<ul style="list-style-type: none"> AFF-RES-WRZ5-0809 : Birds Green Reservoir
	Lydden and Swingfield Woods SSSI	<ul style="list-style-type: none"> AFF-EGW-WRZ7-0629: Lye Oak Licence Variation
Landscape	Number of objections from AONB management boards in relation to new schemes.	<ul style="list-style-type: none"> AFF-RTR-WRZ1-4010 : Abingdon Reservoir to Harefield Transfer (50MI) AFF-RTR-WRZ4-4011 : Abingdon to Iver 2 (50MI/d) AFF-RTR-WRZ1-1066 : Grand Union Canal (GUC - Berkhamstead/Hemel Hempstead) AFF-RTR-WRZ1-4020 : Grand Union Canal (GUC - Berkhamstead/Hemel Hempstead 100 MI/d) TR-WRZ3-1099 : Boxted to Chaul End AFF-NGW-WRZ3-1068 : Runley Wood (AMP7 LGS Borehole) All schemes proposing new visible infrastructure within WRZ 7.
Historic Environment	Number of objections from Historic England in relation to new schemes.	<ul style="list-style-type: none"> AFF-RTR-WRZ1-4010 : Abingdon Reservoir to Harefield Transfer (50MI) AFF-RTR-WRZ4-4011 : Abingdon to Iver 2 (50MI/d) General for all schemes that propose new visible infrastructure.
	Condition of buried archaeology would be monitored during construction works as part of a Watching Brief and associated response measures as set out in the Environmental Management Plan agreed as part of the planning permission process.	<ul style="list-style-type: none"> AFF-RTR-WRZ1-4010 : Abingdon Reservoir to Harefield Transfer (50MI) AFF-RTR-WRZ4-4011 : Abingdon to Iver 2 (50MI/d) General for all schemes that propose new visible infrastructure.
	Reference to Historic England's monitoring of heritage assets such as Listed Buildings and Scheduled Monuments, Registered Battlefields, Registered Parks and Gardens, in particular the 'Heritage at risk' register.	<ul style="list-style-type: none"> AFF-RTR-WRZ1-4010 : Abingdon Reservoir to Harefield Transfer (50MI) AFF-RTR-WRZ4-4011 : Abingdon to Iver 2 (50MI/d) General for all schemes that propose new visible infrastructure.

Monitoring measures will be given further consideration and set out within the SEA Post Adoption Statement.

1. Introduction

AECOM has been commissioned to undertake the Strategic Environmental Assessment (SEA) of Affinity Water's emerging Water Resource Management Plan for Periodic Review 2019 (WRMP19).

1.1 What is SEA?

The requirement to undertake a SEA arises from EC Directive 2001/42/EC 'on the assessment of the effects of certain plans and programmes on the environment' (the 'SEA Directive'). The SEA Directive is transposed into English law through the Environmental Assessment of Plans and Programmes Regulations 2004 (the 'SEA Regulations'). The SEA Directive and associated regulations require a SEA to be undertaken for certain plans and programmes, which are likely to have significant effects on the environment. The overarching objective of the SEA Directive is:

"To provide for a high level of protection of the environment and to contribute to the integration of environmental considerations into the preparation and adoption of plans...with a view to promoting sustainable development, by ensuring that, in accordance with this Directive, an environmental assessment is carried out of certain plans...which are likely to have significant effects on the environment."

SEA Directive (Article 1)

UK Water Industry Research (UKWIR) guidance states that:

"SEA is a qualitative process. Its outputs are often based on qualitative judgements of the significance of varying types of impacts on different receptors"

UKWIR 2012²

European Commission (EC) guidance states that:

"the essential thing is that the likely significant effects of the plan or programme and the alternatives are identified, described and evaluated in a comparable way."

European Commission 2004³

There are two key procedural requirements of the SEA Directive, which are:

1. When deciding on 'the scope and level of detail of the information' to be presented in the assessment, the SEA consultation bodies⁴ must be provided with the relevant information and given five weeks to comment on the proposed scope and the level of detail the assessment will enter into.
2. A report (the 'Environmental Report') is published for consultation alongside the draft plan – in this case the rdWRMP19 – that presents an assessment of the plan as published (i.e. discusses 'likely significant effects' that would result from implementation of the rdWRMP19) and any reasonable alternatives.

The SEA process is covered in more detail in three guidance documents: 'A Practical Guide to the Strategic Environmental Assessment Directive'⁵ (the 'Practical Guide'); 'Strategic Environmental Assessment and Habitats Regulations Assessment - Guidance for Water Resources Management

² Cascade Consulting (2012) Strategic Environmental Assessment and Habitats Regulations Assessment – Guidance for Water Resources Management Plans and Drought Plans.

³ European Commission (2004) Implementation of Directive 2001/42 on the assessment of the effects of certain plans and programmes on the environment [online] @ http://ec.europa.eu/environment/archives/eia/pdf/030923_sea_guidance.pdf. Accessed October 2016

⁴ In England these are the Environment Agency, Historic England and Natural England.

⁵ ODPM now DCLG (2006) A practical guide to the Strategic Environmental Assessment Directive [online] Available at: <http://www.communities.gov.uk/publications/planningandbuilding/practicalguidesea> Accessed September 2016

Plans and Drought Plans’;⁶ and ‘Implementation of Directive 2001/42 on the assessment of the effects of certain plans and programmes on the environment’⁷. The SEA process is split into five main stages:

- Stage A: Setting the context and objectives, establishing the baseline and deciding on the scope;
- Stage B: Developing and refining alternatives and assessing effects;
- Stage C: Preparing the Environmental Report;
- Stage D: Consulting on the dWRMP19 and the Environmental Report; and
- Stage E: Monitoring the significant effects of implementing the dWRMP19 on the environment.

Figure 1.1 illustrates how the SEA, Habitats Regulations Assessment (HRA) (see Section 1.2.1 below) and WRMP19 processes are integrated. This figure has been adapted from the UKWIR SEA guidance. This Environmental Report (highlighted in red in **Figure 1.1**) is the main output from Stage C of the SEA process.

1.1.1 Meeting regulatory requirements

Water companies in England are legally required to supply water to private consumers and businesses within their area. As set out in the Water Industry Act 1991, Affinity Water must prepare and maintain a Water Resources Management Plan (WRMP) that sets out how the company intends to maintain the balance between water supply and demand.

The WRMP must take a long term view, setting a planning period that is appropriate to the risks in relation to supply and demand, but which covers at least the minimum statutory period of 25 years.

The WRMP is complemented by Affinity Water’s Drought Plan, which sets out the short-term operational steps to be taken during a drought to enhance available water supplies, manage customer demand and minimise environmental impacts.

The SEA is undertaken in parallel with the HRA and Water Framework Directive (WFD) assessment of the WRMP19. This ensures an integrated approach to environmental assessment, such that environmental considerations are integral to the development of the ‘best value programme’ of options for each Water Resource Zone (WRZ)⁸ under consideration.

1.1.2 The need for Strategic Environmental Assessment

The Water Resource Planning Guideline suggests that water companies investigate “*whether a Strategic Environment Assessment (SEA) is required (if options are needed to balance a supply-demand deficit) and carry out an SEA if required.*”⁹ Affinity Water will be identifying both supply options to address a forecast deficit and demand options to manage consumption and leakage.

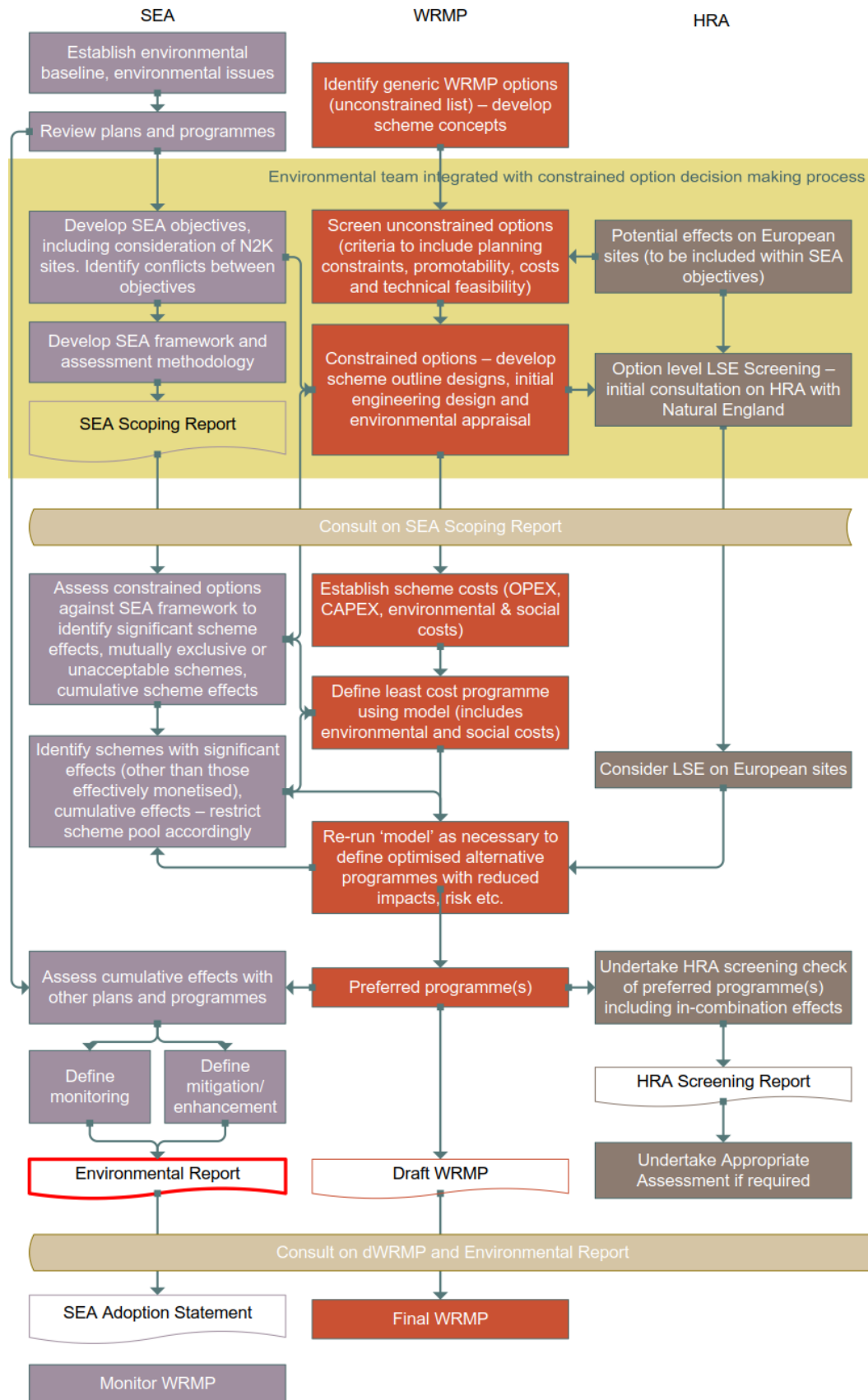
Furthermore, the supply options are likely to include projects that would require assessment under the requirements of Directive 2011/92/EU (as amended in 2014 by Directive 2014/52/EU) ‘on the assessment of the effects of certain public and private projects on the environment’ (the Environmental Impact Assessment (EIA) Directive) or could have significant effects on the environment. It has therefore been determined by Affinity Water that SEA is required.

⁶ UKWIR (2012) Strategic Environmental Assessment and Habitats Regulations Assessment – Guidance for Water Resources Management Plans and Drought Plans.

⁷ http://ec.europa.eu/environment/archives/eia/pdf/030923_sea_guidance.pdf

⁸ A Water Resource Zone is the largest possible zone in which all resources, including external transfers, can be shared and hence the zone in which all customers experience the same risk of supply failure from a resource shortfall.

⁹ Environment Agency and Natural Resources Wales (2016) Final Water Resource Planning Guideline.

Figure 1.1. SEA and HRA aligned with the WRMP process¹⁰

¹⁰ 'N2K sites are those sites designated as part of the Habitats and Birds Directives (part of the Natura 2000 network of sites). This report refers to all such designated sites as 'European Sites'. LSE refers to Likely Significant Effect.

1.2 Compliance with other environmental legislation

1.2.1 Habitats Regulations

The Affinity Water Operating Area contains sites designated under Directive 92/43/EEC 'on the conservation of natural habitats and of wild fauna and flora' (the Habitats Directive') and Directive 2009/147/EC 'on the conservation of wild birds' (the 'Birds Directive'). These are Special Areas of Conservation (SACs) and Special Protection Areas (SPAs) respectively. Along with Ramsar sites these are all collectively referred to as 'European sites'.

If a plan is likely to have a 'significant effect' on a European site, an assessment is required under the Conservation of Habitats and Species Regulations 2010 (as amended) (the 'Habitats Regulations'). This assessment is more commonly referred to as a Habitat Regulations Assessment (HRA). The HRA process has four stages:

- **Stage 1** – Establishing whether the Habitats Regulations apply to the plan or project;
- **Stage 2** – A determination of a Likely Significant Effect (LSE): To determine whether, in view of a European site's conservation objectives, the plan or project (either alone or in combination with other projects and plans) would have a likely significant effect on the site. If adverse impacts are anticipated, potential mitigation measures to alleviate impacts should be proposed and assessed;
- **Stage 3** – Appropriate Assessment: Assess whether the plan or project will have an adverse effect (or risk of this) on the integrity of a European Site. If so, there should be an examination of whether the plan or project could be consented subject to certain conditions or restrictions that would avoid an LSE; and
- **Stage 4** – A determination of whether to proceed despite an LSE: If an LSE is identified and adverse impacts remain, but it can be clearly shown that no alternative solutions exist, the plan or project may be allowed to proceed in exceptional circumstances (i.e. where there are imperative reasons of overriding public interest and no available alternatives). In the event of exceptional circumstances being demonstrated, compensatory measures would be required to offset negative impacts.

The responsibility for undertaking an HRA falls to the relevant 'competent authority' for the purposes of the Habitats Regulations. Water companies are classed as statutory undertakers and hence are competent authorities. This means that Affinity Water is responsible for ensuring the WRMP19 is developed in compliance with the Habitats Regulations. AECOM has been commissioned to undertake the HRA process for the WRMP19 and the findings of this work are available separately and have informed the SEA process.

1.2.2 Water Framework Directive

Consideration of the WRMP19 in relation to EC Directive 2000/60/EC 'establishing a framework for Community action in the field of water policy' (the 'Water Framework Directive' (WFD)) is required. The WFD is designed to protect and improve the environmental condition of all waters, including rivers, lakes, groundwaters, estuaries and coastal waters out to one nautical mile. The fundamental objectives of the WFD are to prevent any deterioration in the existing status of waters and to achieve at least 'good status' in relation to all waters (or 'good potential' status in heavily modified water bodies by 2015. The WFD recognises that this may not be achieved in some cases and, subject to the criteria set out in the Directive, aims to achieve good status or good ecological potential by 2027.

The WFD is implemented through river basin planning, which involves setting environmental objectives for all groundwater and surface water bodies within a river basin district and then devising a programme of measures and actions to meet those objectives. The WRZs for Affinity Water fall within the bounds of the Thames River Basin Management Plan (RBMP), Anglian RBMP and the South East RBMP. AECOM has been commissioned by Affinity Water to undertake the WFD assessment of Affinity Water's WRMP19 and the findings of this work are available separately and informed the SEA process.

1.3 Purpose and structure of this Environmental Report

This Environmental Report has been prepared to meet the requirements of the SEA Regulations¹¹ and to facilitate consultation with relevant stakeholders. It sets out the findings of the SEA process in relation to the revised draft WRMP19 (rdWRMP19).

The Environmental Report is structured as follows:

- **Chapter 1** (this chapter) - sets out the need for an SEA and any other relevant assessments;
- **Chapter 2** - sets out the background to the WRMP;
- **Chapter 3** - provides a summary of the proposed SEA scope and sets out the key issues and SEA Framework;
- **Chapter 4** - sets out how options (supply and demand schemes) were developed, presents the method and findings of the assessment;
- **Chapter 5** - explains the programme appraisal stage, identifies reasonable alternative programmes and sets out the findings the assessment and outline reasons for the selection of the preferred programme and adaptive futures;
- **Chapter 6** - sets out the key findings for the rdWRMP19 and any additional schemes that have a reasonable prospect of coming forward under the adaptive futures;
- **Chapter 7** - sets out the findings of the cumulative effects assessment for the rdWRMP19 (and any additional schemes that have a reasonable prospect of coming forward under the adaptive futures) with other plans, programmes and projects;
- **Chapter 8** - sets out the mitigation identified for the rdWRMP19 (and any additional schemes that have a reasonable prospect of coming forward under the adaptive futures) along with areas for further investigation; and
- **Chapter 9** - sets out next steps along with proposed indicators for monitoring.

¹¹ Regulation 12 (5)

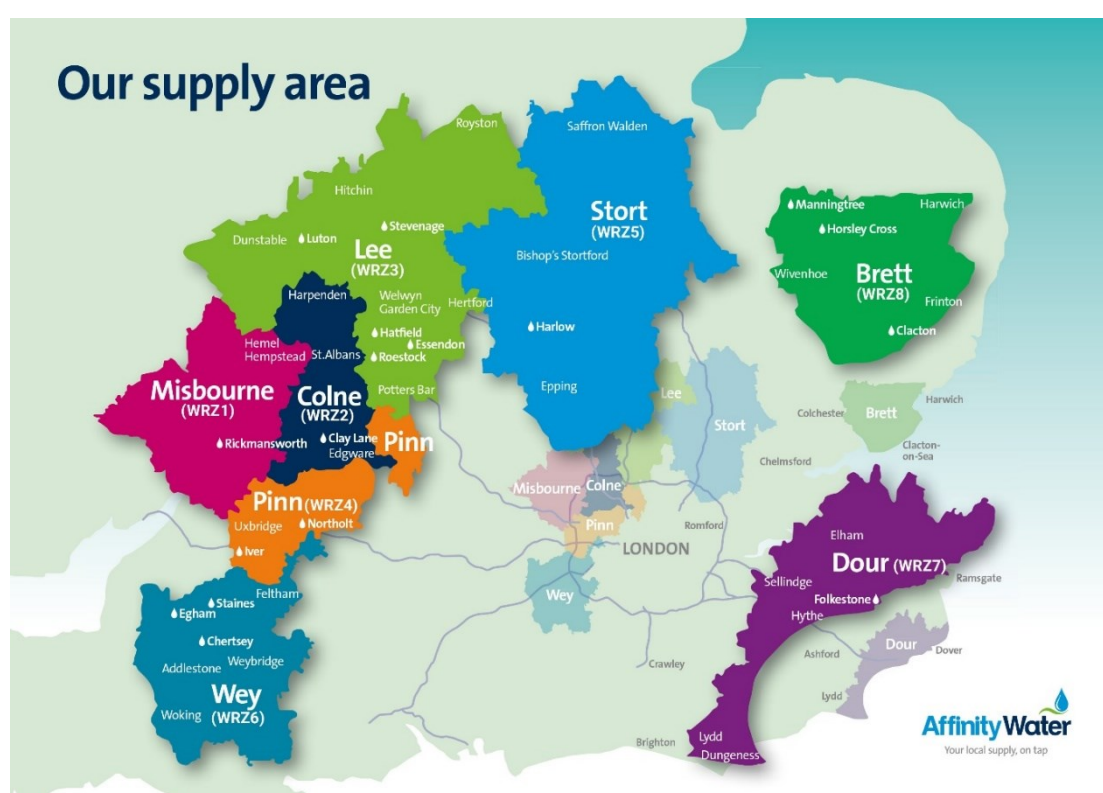
2. The Water Resource Management Plan

2.1 Introduction to Affinity Water

Affinity Water serves a population of over 3.6 million people in 1.4 million properties in the South East and East of England. This amounts to the provision of around 900 million litres of water every day through 16,500 km of water mains. Affinity Water currently has 130 groundwater sources and 96 Water Treatment Works with groundwater making up 65% of supply.

The Operating Area is split into three geographical regions: Central, East, and Southeast. These geographic regions are further subdivided into eight water resource zones (WRZs). WRZs are broadly integrated areas in which customers are supplied by a common pipe network from a number of local water sources. WRZs are created to facilitate assessment of the supply/ demand balance - see **Figure 2.1**.

Figure 2.1: Affinity Water communities and WRZs



The major demand zones and trunk mains for transferring water across regions are shown in **Figures 2.2, 2.3 and 2.4**. These maps represent the transfers between Affinity Water's WRZs and Hydraulic Demand Zones (HDZs) and the connections they have with neighbouring water company areas. Affinity Water also has the capacity to transfer water between zones to allow for operational flexibility.

Figure 2.2: Map of Demand Zones and Strategic Links in the Central region

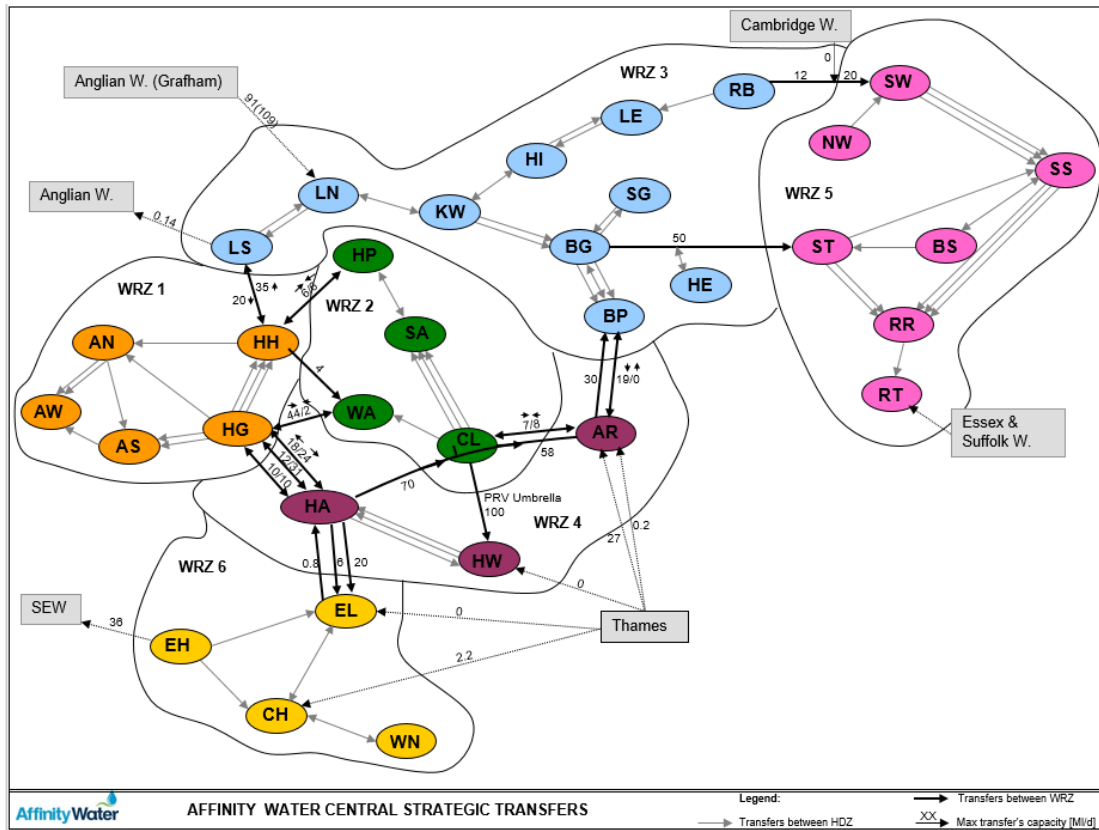


Figure 2.3: Map of Demand Zones and Strategic Links in the Southeast region

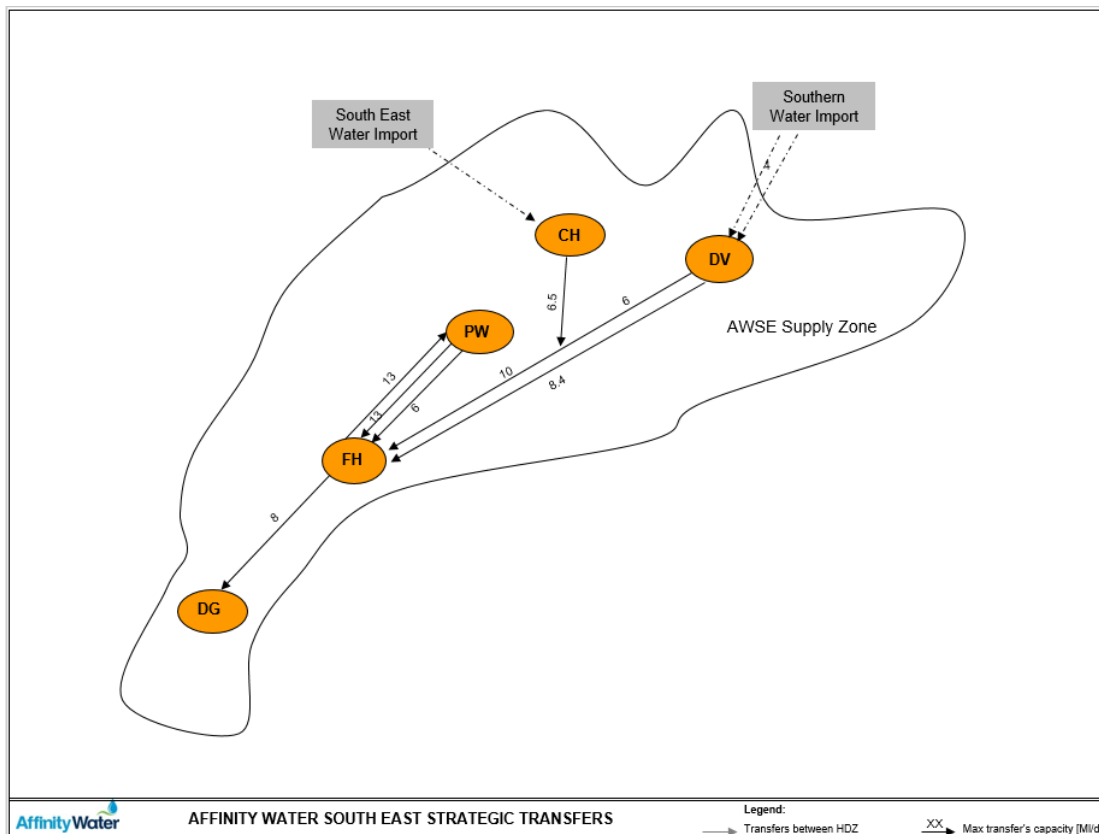
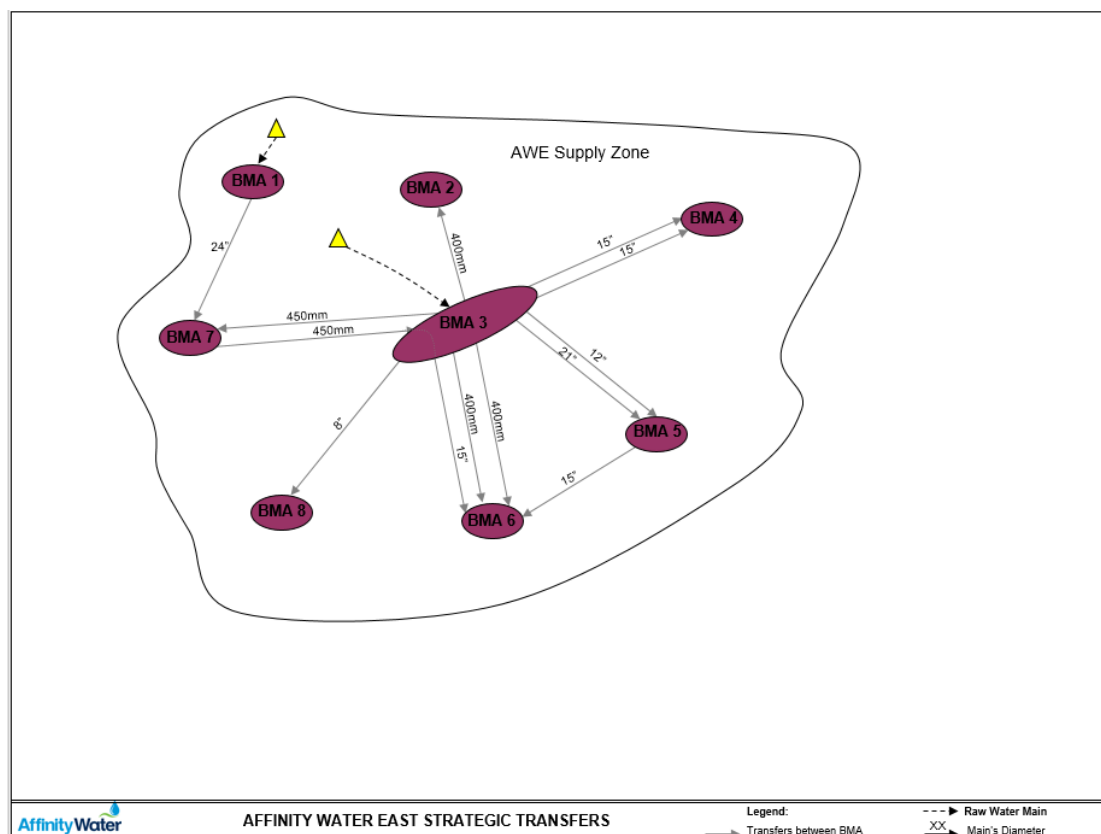


Figure 2.4: Map of Demand Zones and Strategic Links in the East region



2.1.1 Central region

The Central region is split into six WRZs and provides water to the north London boroughs. The region extends into rural parts of Essex, Hertfordshire and Buckinghamshire and supplies a population of about 3.3 million people.

The Central region obtains 60% of its supply from groundwater sources, with boreholes abstracting from chalk and gravel aquifers. The remaining 40% of the supply is from surface water sources, and imports from neighbouring water companies; Thames Water (including sewage), Anglian Water (including sewage) and Cambridge Water. Water is exported to South East Water and Cambridge Water.

2.1.2 Southeast region

The Southeast region provides water to the towns of Folkestone and Dover, together with surrounding rural areas including Romney Marsh and Dungeness. In the Southeast region, Affinity Water supplies a population of about 170,000 people. Water is imported into the Southeast region from two adjoining water companies: Southern Water and South East Water.

In the Southeast region Affinity Water abstracts 90% of its water from chalk and greensand groundwater boreholes, with a minor component from the Denge Gravels.

2.1.3 East region

In the East region Affinity Water provides water to north east Essex including Harwich and Clacton on Sea. Affinity Water supplies a population of approximately 156,000 people in this region. The East region is bordered by Anglian Water (including sewage) with which it shares a reservoir.

The Affinity Water East region normally takes 100% of its water supply from groundwater sources, but there is the flexibility to also import water from a nearby reservoir which is jointly owned with Anglian Water.

2.2 About the WRMP

Water companies in England and Wales are required by law (the Water Act 2003) to produce a WRMP every five years. The WRMP must set out how a water company intends to maintain the balance between water supply and demand over at least a 25-year period. The WRMP19 must be prepared in accordance with the Water Resources Planning Guideline (WRPG)¹² which was developed by government and water industry regulators. It must also take account of, and support, government policy and aspirations for providing secure, sustainable and affordable water supplies to customers.

The Affinity Water rdWRMP19 will set out the preferred programme (comprising a range of options) to reduce any deficit through implementation of both supply and demand options. The key challenges and issues are similar in nature to those experienced for the last plan (WRMP14) but Affinity Water's understanding of how they differ in scale and complexity has changed and are consistent with the feedback received in relation to the dWRMP19 consultation. These are illustrated in Figure 2.5 below.

Figure 2.5: rdWRMP19 key themes for customers and stakeholders

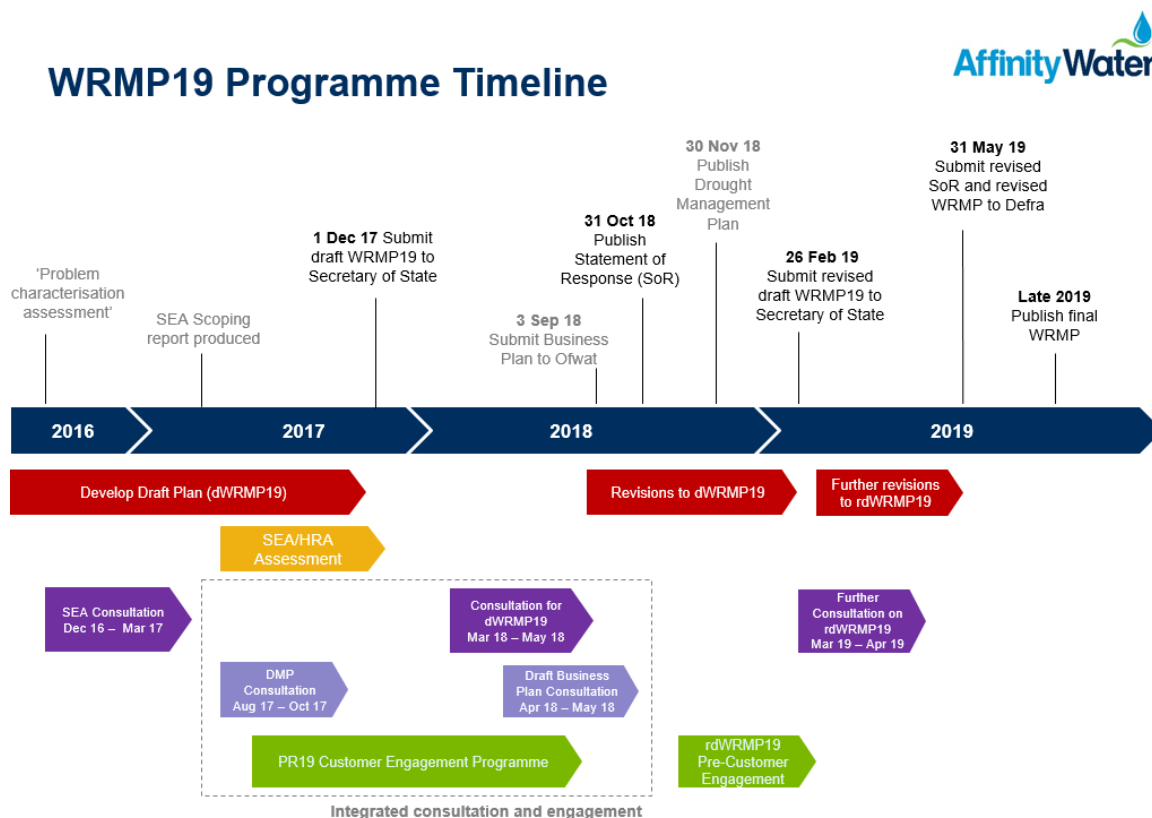


¹² Environment Agency and Natural Resources Wales (2016) Final Water Resource Planning Guideline.

2.3 Development of the WRMP19

The preparation of the rdWRMP19 follows the current Water Resources Planning Guideline. The WRMP19 timeline is shown in Figure 2.6 below.

Figure 2.6: WRMP19 Programme Timeline



2.4 Sustainability reductions

The Environment Agency is responsible for issuing licences for water abstractions from both groundwater and surface water. It also has the power to amend existing licences or to enter into operating agreements to limit abstraction where this is having a negative effect on the environment.

In response to European and national legislation, the Environment Agency introduced the Water Industry National Environment Programme (WINEP) to ensure that water companies meet European and national targets related to water. The WINEP is a list of environmental improvement schemes which water companies include in their five-yearly Business Plans. It includes requirements for water companies to undertake improvement schemes or, where more evidence is required, to investigate a particular problem. Possible reductions in abstractions (sustainability reductions) for Affinity Water are currently being discussed with the Environment Agency.

3. Scoping Information

3.1 Introduction

The aim of this chapter is to introduce the reader to the scope of the SEA, i.e. the key issues and objectives that should be a focus for assessment. Further information on the scope of the SEA - i.e. a more detailed review of key issues / objectives as highlighted through a review of the 'policy context' and 'baseline' - is presented in **Appendix II**.

It is important to emphasise that the rdWRMP19 is strategic in nature. Even the selection of schemes through the rdWRMP19 should also be considered a strategic undertaking, i.e. a process that omits consideration of some detailed issues (in the knowledge that they can be addressed at the detailed design stage). The strategic nature of the rdWRMP19 is reflected in the scope of the SEA.

3.2 Consultation on the scope

The SEA Regulations require that “*When deciding on the scope and level of detail of the information that must be included in the Environmental Report [i.e. the SEA scope], the responsible authority shall consult the consultation bodies*”. In England, the consultation bodies are the Environment Agency, Historic England and Natural England.¹³ A Scoping Report (2016) was sent to the statutory consultation bodies, along with other key stakeholders, for review and comment in December 2017. Further comments on the scoping information were submitted by the statutory consultees in response to the consultation for the dWRMP19 and accompanying Environmental Report in 2018. The consultation responses received and how they have been taken into account are set out in **Appendix III**. The scoping information presented in **Appendix II** has been updated to reflect these representations.

3.3 Spatial scope

The Central (WRZs 1 to 6), Southeast (WRZ 7) and East (WRZ 8) regions have been scoped into the SEA as there are predicted deficits during the 25 year statutory plan period and supply-side options may therefore be required. These areas are illustrated in Annex D of **Appendix II**. Where necessary, the SEA also considers the influence of the rdWRMP19 and alternatives outside of these areas where there are potential pathways for effects to occur.

3.4 Temporal scope

The rdWRMP19 sets out how Affinity Water plan to maintain the balance between supply and demand for water not just during the statutory planning period of 25 years (2020 to 2045) but going beyond this, up to 60 years into the future (up to 2080). This enables Affinity Water to address their long term strategic needs to ensure a secure and sustainable supply of water to the supply area based on a unique set of challenges.

The current and future baseline for Affinity Water's supply area and beyond (where necessary), is set out in **Appendix II**. Given the 60 year planning period there is a significant level of uncertainty as to how the environmental and social baseline as well as wider policy context will evolve. It is important to remember that water companies in England and Wales are required by law to produce a WRMP every five years. As a result, schemes proposed later in the planning period, i.e. beyond the 2024, will be subject to further assessment (including SEA, HRA and WFD assessment) and consultation with stakeholders.

¹³ In-line with Article 6(3) of the SEA Directive, these consultation bodies were selected because ‘by reason of their specific environmental responsibilities, [they] are likely to be concerned by the environmental effects of implementing plans and programmes.’

3.5 Key issues

The detailed policy context and baseline information (see **Appendix II**) led to the identification of a number of key issues, which are set out in the table below. It should be noted that the key issues were subject to minor revisions in order to reflect the inclusion of the East Region (WRZ 8) within the scope of the SEA.

Table 3.1: SEA topics and key issues

SEA topics	Key issues:
Population, Economy and Human Health	<ul style="list-style-type: none"> • The Central region, in particular, may experience high levels of development and growth; • All three regions have 'hotspots' of deprivation. Vulnerable people may be at disproportionate risk of effects of changes in the cost of water; • The Study Area will experience a combination of the impacts of climate change, population increase, sustainability reductions and water stress. All of these factors create a challenging environment for Affinity Water to deliver a sustainable water supply; and • It is important to note that human health and wellbeing have strong inter-relationships with all of the other topics in the scope of the SEA.
Tourism and Recreation	<ul style="list-style-type: none"> • Tourism and recreation provide both valuable benefits to health and wellbeing and also contribute towards local economies. There are a number of significant areas for sport and tourism 'hotspots' in the Study Area; • Tourism, particularly in the summer months when it can coincide with lower water supplies, can place a strain on water resources and therefore have implications for water resources management; and • The future for tourism is uncertain; levels could go up or down.
Material Assets	<ul style="list-style-type: none"> • The Central and Southeast regions have significant infrastructure that needs a consistent water supply; and • The ongoing infrastructure developments of HS2 and Crossrail (and expansion at Heathrow) have the potential to disrupt water supply operations and generate increases in demand.
Biodiversity, Flora and Fauna	<ul style="list-style-type: none"> • A number of non-native species are found in the Study Area and there is potential for the dWRMP19 to contribute to the restoration of habitats affected by the presence of these non-native species; • Rivers and lakes within the Southeast region are vulnerable to low flows and poor water quality; • The Thames Estuary supports over 120 different fish species, and the River Dour is noted to have an important population of Brown Trout within the context of Kent rivers. These are important both ecologically and economically; • A number of SSSIs in the Study Area have deteriorated in condition since WRMP 2014; and • There is the potential for further habitat fragmentation and species loss through development activities.
Landscape, Townscape and Visual Amenities	<ul style="list-style-type: none"> • There are a range of designated areas of landscape value in both regions. • The landscape in both regions is facing a range of challenges from climate change and other factors.
Air Quality and Noise	<ul style="list-style-type: none"> • Air quality in Central region is poor in some urban areas as highlighted by the number of AQMAs in place (Dover, Saffron Walden, Luton, Hitchin, Sawbridgeworth, Gerrard's Cross and the northwest of London). • Increased development is likely to lead to increased emissions, particularly in urban areas.
Climate	<ul style="list-style-type: none"> • The Study Area is one of the driest parts of the UK and also one of the most populated; • Summers in the South East are predicted to become hotter and drier, while winters become warmer and wetter. This has implications for summer supply shortages and winter flooding; • The water industry contributes to 0.8 % of annual UK GHG emissions. The dWRMP19 has the potential to play its part in reducing this contribution; and

	<ul style="list-style-type: none"> Affinity Water is predicted to reduce its carbon footprint over the WRMP2014 life time; however, the rate of reduction is likely to decrease towards the later end of the plan period.
Water	<p>For surface water:</p> <ul style="list-style-type: none"> 40% of the water used within Central region comes from surface water; There is a requirement to ensure there is no further deterioration in the quality of surface waters; There are no major rivers or surface water storage areas in the Southeast region, and therefore no possibility of surface water abstractions; No surface water is abstracted in the East region; and There are three Flood Risk Areas completely or partly located within the Central region. <p>For groundwater:</p> <ul style="list-style-type: none"> A large proportion of groundwater supplies within the Affinity Water Operating Area are under severe stress; There is a requirement to ensure there is no further deterioration in the quality of ground waters; and There is a high level of reliance on groundwater supplies (60% of the water used within Central region comes from groundwater while 90% of water in the Southeast region is abstracted from groundwater Chalk aquifers and normally 100% of water used in the East region is abstracted from groundwater sources).
Heritage assets and archaeology	<ul style="list-style-type: none"> There are no internationally designated sites (World Heritage Sites) within the Study Area; The Central region has a large quantity of heritage assets at risk which are dispersed over a large area; and The Southeast region has considerable volumes of military defence and maritime heritage assets focused around Dover and Folkestone. The East region has a number of heritage assets, including five conservation areas considered to be 'at risk'.
Geology and soils	<ul style="list-style-type: none"> Soil and therefore agriculture is threatened by the effects of climate change though: <ul style="list-style-type: none"> erosion; new and emerging pests and diseases; and increases or decreases in local soil moisture content.

3.6 SEA objectives

Table 3.2 below presents the SEA objectives and assessment questions established through scoping, i.e. in-light of context/ baseline review, the key issues identified and the consultation. Taken together, these objectives and assessment questions provide a methodological 'framework' for undertaking the assessment.¹⁴

¹⁴ N.B. It is important to note that the objectives and assessments questions are often closely linked and there are direct and indirect interrelationships between them.

Table 3.2: SEA Framework

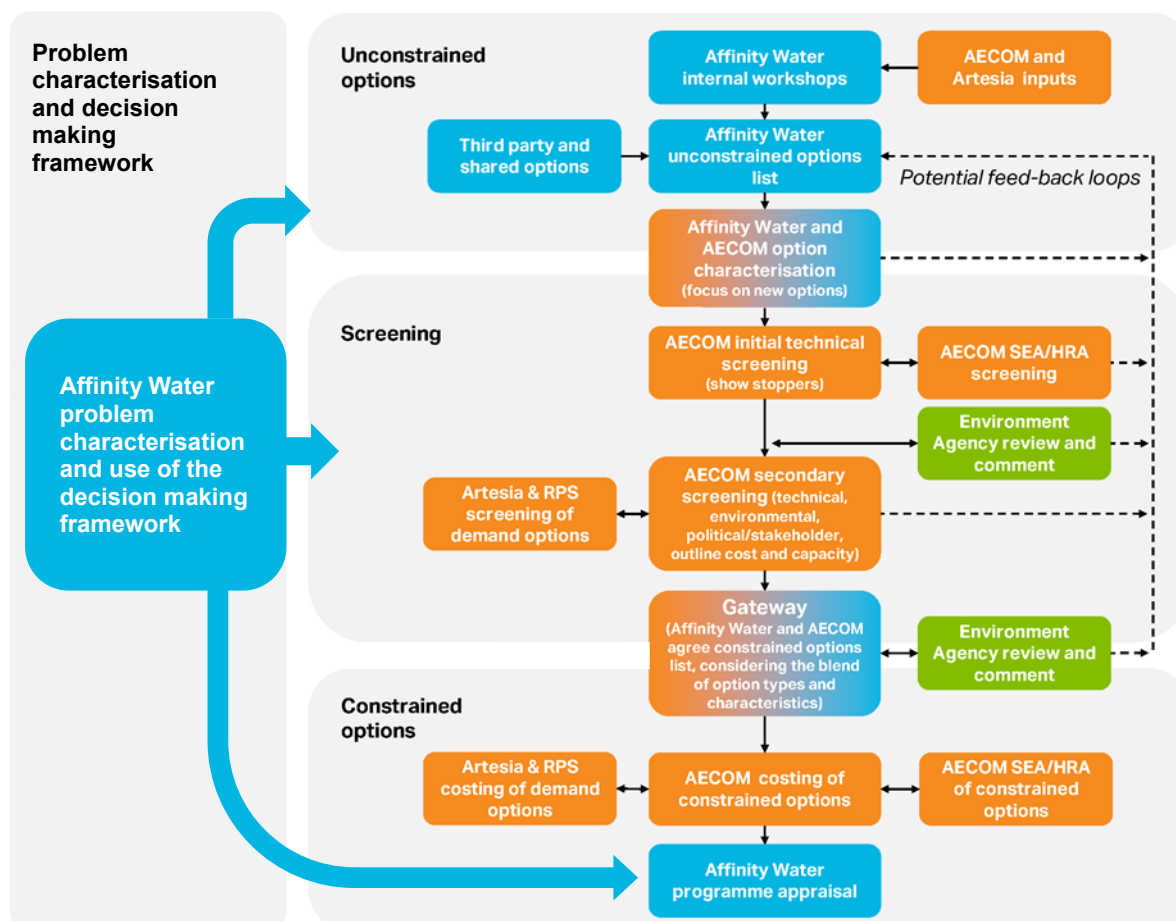
SEA Objective	Assessment questions (would the options / programme...?)
1. Ensure the availability of adequate supply, and quality, of water to support health and hygiene and the regeneration ambitions of the study area?	1.a. Provide affordable access to clean water adequate to support health? 1.b. Ensure that customers are not disproportionality affected by cost? 1.c. Enable the growth ambitions of the study area to be realised?
2. Protect and enhance (and ensure access to) tourism, recreation and amenity facilities.	2.a. Result in increased water-based recreational opportunities or new tourist attractions? 2.b. Alter water levels that affect water-based recreation assets? 2.b. Sever public rights of way or the enjoyment of other land-based recreation or amenity assets?
3. Maintain key infrastructure in support of the local economy?	3.a. Impact on strategic transport infrastructure such as airports, major roads and railway lines? 3.b. Impact on critical services and industries e.g. energy productions and hospitals?
4. Reduce material consumption and the generation of waste?	4.a. Require significant new construction or demolition of existing assets? 4.b. Result in higher levels of reuse of waste?
5. Protect and enhance biodiversity including designated and other important habitats and species?	5.a. Impact on European sites? 5.b. Lead to the loss or degradation of priority habitats / species or lead to the creation of new priority habitats? 5.c. Impact on non-native species? 5.d. Affect the condition of SSSIs, particularly those that have a trend of declining condition? 5.e. Provide opportunities for biodiversity enhancement?
6. Conserve and enhance landscape character and visual amenity?	6.a. Impact views from public rights of way, designated landscapes, parks or other valued places? 6.b. Provide opportunities for landscape enhancement?
7. Minimise the effects of the option / plan on air quality and noise?	7.a. Impact an AQMA?
8. Minimise the carbon footprint of the Company?	8.a. Reduce / increase predicted carbon footprint? 8.b. Maximise the company's resilience to a changing climate?
9. Adapt to climate change?	9.a. Affect the resilience of the local environment and Affinity Water assets to climate change?
10. Protect and improve surface and groundwater body status?	10.a. Contribute to the naturalisation of water bodies, for example through the removal of artificial structures or channel modifications? 10.b. Improve water treatment and water quality before it returns to surface water bodies? 10.c. Alter water table levels and amount of water within aquifers? 10.d. Increase the risk of saline intrusion or other pollution risks to the aquifers?
11. Avoid adverse impact on surface and groundwater levels and flows?	11.a. Protect or restore adequate levels of flow in rivers and streams?
12. Minimise the risk of flooding taking account of climate change?	12.a. Lead to the loss of floodplain and / or potentially increase rates of surface water run-off (e.g. due to additional areas of hard standing)?
13. Conserve and enhance the historic environment, heritage assets and their settings?	13.a. Conserve and / or enhance heritage assets and the historic environment? 13.b. Alter the hydrological conditions of water-dependent heritage assets, including paleo-environmental deposits?
14. Minimise loss of soil quality and sterilisation of mineral resources?	14.a. Impact upon best and most versatile agricultural land (agricultural land classification grades 1 - 2)?

4. SEA of Options

4.1 Introduction

As part of the WRMP19 process, Affinity Water must identify and assess all realistic demand management and supply-side options that could help to meet predicted demands during the planning period. Affinity Water's option appraisal process for the rdWRMP19 is summarised in **Figure 4.1** below.

Figure 4.1: Affinity Water options appraisal process



The SEA has informed decision-making at each key stage in the Affinity Water options appraisal process. The key stages are explained below along with a summary of the SEA findings.

4.2 Unconstrained options

The first stage in Affinity Water's options appraisal process was to identify a list of so-called 'unconstrained options' for consideration. The aim of this stage is to identify a full set of technically feasible options for balancing supply and demand over the planning horizon, which are yet to be constrained by factors such as environmental or planning restrictions, health and safety regulations, legal restrictions, promotability or risk. The Unconstrained Option Study Reports (supply-side¹⁵ and demand management¹⁶ available separately) set out the approach and method for identifying unconstrained options and this is not repeated here.

A long list of unconstrained options were identified to be screened through the next stage of the options appraisal process.

¹⁵ Affinity Water (2017) Unconstrained Options Study (Supply-Side Options).

¹⁶ Affinity Water (2017) Unconstrained Options Study (Demand Management Options).

4.2.1 Unconstrained supply-side options

A high-level traffic light shading system was used for the screening stage to assess the rdWRMP19 unconstrained list of supply-side options:

- **Green** - no major issues or sensitivities identified for this option.
- **Amber** - some issues or sensitivities identified, which may not be show stoppers but which could result in risks or complicated design and implementation strategies. For example, this could be an option located within an Area of Outstanding Natural Beauty (AONB), where the option might need to be designed in a more sensitive way to gain approval.
- **Red** - significant issues or sensitivities that affect the ability to implement this option. This could include options in areas where there is no further water available or where the option might have a significant detrimental impact on a designated site.

The methodology for the screening stage included two key steps. The first initial screening task sought to identify any 'show stoppers' in order to determine if the unconstrained options were technically feasible. This includes consideration of the status of water for licensing purposes, the percentage of time water is available for abstraction as well as the status of the water body under current Environment Agency environmental programmes. If no show stoppers were identified then the option passed on to the secondary screening step.

It is important to recognise that in some instances an option passed the initial screening, but then failed upon reconsideration of the criteria at a later stage; for example, following improved characterisation of the option during secondary screening (explained below), or through subsequent stakeholder engagement (e.g. updated opinions from the Environment Agency, other water companies or third party). This is represented by the feedback loops shown on **Figure 4.1**.

Where the initial technical screening suggested an option might be feasible, additional assessments were carried out under the secondary screening headings of 'Technical', 'Environmental' and 'Stakeholder Acceptability'. The environmental feasibility of options was assessed as follows:

- **Option status with respect to environmental designations (including SEA and HRA considerations)** - a review of whether statutory designations of sites such as Special Areas of Conservation (SAC) and Sites of Special Scientific Interest (SSSIs) were likely to affect the feasibility of the option. This was undertaken using a GIS based approach as part of the SEA screening. Where designated sites were located within a set distance of a proposed option, a specialist assessed whether the option was likely to impact the sites based on an understanding of impact pathways. Green shading indicated there were no designations of relevance; red shading was used where there were overlaps or an option was in close proximity to a designated site, implying significant challenges.
- **Overall SEA screening** - this criterion was used to identify if there were any concerns with respect to the wider SEA screening (sustainability), with red shading used to identify significant risks.
- **Water Framework Directive (WFD)** - River Basin Management Plan (RBMP) water body status was identified and any risks to 'no-deterioration' or 'future objectives' were identified. This test was used as an initial consideration of whether the option might lead to a downward change in the ecological status of a water body (e.g. through a reduction in river flows), or prevent a water body reaching good status (e.g. via obstructions in rivers).
- **Environmental Impact Assessment (EIA) and Planning** - identification of the likely need for EIA as part of the planning process. A high level assessment of whether the option type might require EIA and a planning application (e.g. a new reservoir would be shaded red, but a simple enhancement at a groundwater source would be green).

The detailed SEA screening criteria that were used to inform the secondary screening along with any data limitations are presented in **Appendix IV** of this report. It is important to note that red shading for a secondary screening criterion was not used to identify show stoppers, although a large number of criteria with red shading would increase the likelihood of an option not being selected for the constrained list at the gateway stage.

The table below sets out the number of unconstrained supply-side options identified for each option type and how many were progressed through the screening stage as constrained options.

Table 4.1: No. of unconstrained supply-side options¹⁷

Option type	Total number of unconstrained options	Options screened out	Constrained options	Merged with other option	Comments
Outage	4	4	0	0	Considered to be placeholders and not taken forward
Catchment Management	1	1	0	0	Catchment management options are dealt with outside of the WRMP options appraisal (see Affinity Water, April 2017)
Desalination	18	14	4	0	Affinity Water WRZ7 (AWSE) & WRZ8 (AWE) options
Groundwater	111	81	29	2	These include the majority of the third party options.
Effluent Reuse	10	7	2	1	Affinity Water WRZ7 options (AWSE) plus Stevenage STW option
Surface Water	56	47	8	1	Numerous options screened out owing to a lack of available water within AWC and AWSE catchments
Transfer	133	75	55	2	Constrained options have been selected to provide a coherent strategy.
Treatment	17	11	6	0	Standalone water treatment works that are dependent on the implementation of other options
Total	350	240	104	6	

The detailed findings of the screening stage and reasons for rejecting unconstrained supply-side options are set out in the Supply-side Constrained Options Report (Volume 1) which is available separately.¹⁸

Any options that passed through the screening were progressed to the gateway stage (see **Figure 4.1**) which included a number of workshops with the Environment Agency (area offices and the Environment Agency's lead for Affinity Water) to present and discuss the unconstrained options and screening results. The feedback from these workshops was used to inform the selection of options for the constrained options list.

4.2.2 Unconstrained demand management options

A set of qualitative screening criteria were used to screen the long list of unconstrained demand management options. The screening was undertaken by technical specialists from Affinity Water and Artesia using qualitative methods to score options against the criteria, and this was based on a simple five point scale. Criteria relevant to the SEA process are set out in **Table 4.2** below.

¹⁷ Affinity Water (2019) Supply-side Constrained Options Report - Volume 1.

¹⁸ Affinity Water (2019) Supply-side Constrained Options Report - Volume 1.

Table 4.2: Relevant screening criteria for unconstrained demand management options

Criteria	Description	Scoring Scale
Environmental impact	Will the option result in environmental impacts? <i>Impacts on biodiversity, landscape, heritage. Use of materials, generation of waste or pollution.</i>	Very positive (1) positive (2) neutral (3) negative (4) very negative (5) impacts
Sustainability	What is the impact of the option on wider sustainability? <i>The scheme's impacts on energy use, social effects, carbon footprint etc.</i>	1 (very sustainable) to 5 (very unsustainable)

An initial long list of 144 unconstrained demand management options were identified. A number of options were then rejected by Artesia prior to the qualitative screening in order to:

- Remove duplicates, or very similar options that had been sourced from different locations;
- Remove options that were considered unjustified, such as metering sewage flow;
- Some options were removed as Affinity Water is already in the process of delivering these as part of Water Saving Programme (WSP) and Home Water Efficiency Checks (HWEK); and
- Remove options which were considered very unlikely to pass through the qualitative screening, for example an option to participate in a national media campaign.

This reduced the initial list of unconstrained options from 144 to 69. Option evaluation workshops and subsequent discussions then took place whereby each option was evaluated in turn and this led to the progression of 26 feasible demand management options. The detailed findings of the screening stage and the reasons for rejecting unconstrained demand management options are set out in the Unconstrained Options Study (demand management options) which is available separately.¹⁹

4.3 Constrained options

4.3.1 SEA method for constrained options

Each constrained option (including supply-side, demand management and drought) was assessed against the full SEA Framework of objectives and assessment questions presented in Chapter 3.

The likely significant effects for each constrained option during the construction and operational phase were evaluated against the baseline (see scoping information set out in Chapter 3 and **Appendix II**). The assessment matrix clearly set out and considered the characteristics of the effects (probability, duration and permanence) set out in Schedule 1 of the SEA Regulations. The nature and significance of effects was categorised according to the symbols set out in the **Table 4.3** below.

Table 4.3: Significance key

Symbol	Effect
3	Major positive effect
2	Moderate positive effect
1	Minor positive effect
0	Neutral effect
-1	Minor negative effect
-2	Moderate negative effect
-3	Major negative effect
?	Uncertain effect

Numbers were used instead of symbols, such as a '+', to more effectively input findings from the SEA into the final stage in Affinity Water's option appraisal process (see **Figure 4.1**), the programme appraisal. In order to determine the significance of the effect, the magnitude of the impact and the sensitivity of the receptor was taken into account, see **Table 4.4** below.

¹⁹ Affinity Water (2017) Unconstrained Options Study (Demand Management Options).

Table 4.4: Effect significance scale

Magnitude/ Scale of impact	Sensitivity					
	Low (Local designations)		Medium (Regional)		High (International / national)	
None - negligible	0		0		0	
Minor loss or change to receptor	Negligible		Minor		Moderate	
	N	N	1	-1	2	-2
Moderate loss or change to receptor	Minor		Moderate		Major	
	1	-1	2	-2	3	-3
Significant loss or change to receptor	Moderate		Major		Major	

The assessment predicted the likely residual effect, taking mitigation into account, for each assessment question during construction and operation. It is important to note that any effects identified as 'moderate' or 'major' were considered to be 'significant' in terms of the definition set out in the SEA Regulations.

Every effort was made to predict effects accurately; however, this is inherently challenging given the high level nature of SEA. The ability to predict effects accurately is also limited by the availability of information and the length of the planning period (60 years). In light of this, there was a need to make considerable assumptions regarding how options would be implemented 'on the ground' and what the effect on particular receptors would be. Where there are significant uncertainties these are reflected in the assessment by using a '?'.

From the predicted residual operational effects identified for each assessment question, a 'worst case' operational effect was also derived for each SEA Objective for input to the model (see Chapter 5 in this report for further information).

It is important to reiterate that the rdWRMP19 and SEA process are strategic in nature. It is recognised that there is the potential to avoid or provide further mitigation at the detailed design stage for schemes, which will remove or reduce the significance of predicted negative effects.

4.3.2 SEA findings for constrained options

A detailed assessment of each feasible demand management, supply-side and drought option was undertaken to determine the likelihood for significant effects when considered against the SEA Framework, taking into account the baseline. The detailed assessment matrices are presented in **Appendix V** and summary findings are presented below. The SEA objectives and assessment questions are presented in Chapter 3 and the significance key provided in **Table 4.3** above. The predicted residual effects of the options during construction and operation are represented in the summary tables (**Tables 4.6, 4.8 to 4.15 and 4.17**) and by a 'C' and 'O'.

4.3.2.1 Demand management options

A description of each of the constrained demand management options subject to detailed assessment is provided in the table below.

Table 4.5: Constrained demand management options subject to SEA

ID	Option title	Description
Water efficiency		
567	Community water efficiency scheme	Based on the outcomes of the Neighbourhood water efficiency project results to help quantify savings and behavioural changes from changes made to water use. To be focused on areas of low water availability and based upon the "Save Water Swindon" model.
569	Housing Associations - Targeted water efficiency promotion	Liaison works with housing associations on an ongoing basis to promote water efficiency to residents. An initial assessment and advice is followed up with regular communications and mini-projects as new techniques and devices enter the market.
901	Comprehensive household water audit & retrofit	Customers selected on a "most to save". Company agent conducts comprehensive survey, installs devices free of charge and offers others at cost via 3rd party. Supporting literature given to customer at time of survey. Follow-up literature sent periodically after visit.
990	Sustainable new homes (a,b,c)	This option was encouraged by regulators and provides a more innovative option that would lead to more ambitious PCC reduction. It also becomes more feasible with additional information available around new developments.
1000	Water Audits - Retail (Non-process)	Commercial water audits delivered by retail arm, and funded by wholesale to target specific activities (CWEC).
1050	Concerted action on Water Efficiency	This was a business requirement for more innovative options, that would allow more ambitious PCC reduction. The options would allow WEFF options that are largely outside of Affinity Water's direct control to be implemented more rapidly leading to earlier savings.
Metering		
186	Change of Owner Metering	The Company pursued a policy of metering on change of occupier during AMP5. Current strategy is for no COH in AMP6 - any additional metering above and beyond metering optants is assumed to be made up from street by street metering. Might be feasible for AWE zone.
532	Metering of "left over" Commercials	There are currently around 8,600 unmeasured non-household properties in the supply area. These are believed to be a mix of small, mixed use and "difficult to meter" properties. Scheme is to enforce existing powers and to install meters for 8,500 of these remaining properties. (Issue of wholesale retail split)
904	Compulsory metering - fixed network	All customers have fixed network meters installed, to reach 90% meter penetration. This is for zones 4 & 6 the so far unmetered zones. Additional to the WSP currently allowed for in AMP7
1002	Conversion of AMR drive-by to fixed network	Conversion of AMR drive-by installed under WSP feasible from 2020. AMP 6 meters retrofitted. Linked to option 904.
1010	Enhanced use of WSP meters	Smart use of existing WSP meters to identify supply pipe leaks / high consumption when leakage techs go into a DMA to identify leakage locations. (Partial DMA water balance)
Reuse		
603	Communal rainwater reuse	Speculative scheme to fit rainwater recycling systems (with dual network) in a new housing development, at a community scale. After basic disinfection, the rainwater to be used for toilet flushing, clothes washing and outdoor use. The installation of a recycling system could be promoted through different water incentives: capital cost subsidizing, block tariff. Domestic properties so not subjected to retail competition.
606	Large user water recycling scheme (Stansted Airport)	Exploratory scheme involving water recycling within Stansted airport's facility. The recycled water would come from greywater and / or surface waters. Study required to establish savings and detailed design.
620	Large user - rainwater harvesting (Luton Airport)	Implementation of rainwater harvesting system in Terminal and Hangar Buildings. Installation of rainwater tanks on roofs, storage tank - water for toilets flushing only.

ID	Option title	Description
		Study required to establish the detailed design.
621	Large user - surface water reuse (Luton Airport)	Use of water coming from run-off and collected into central drainage pipework, then reaccepted in a contact tank, then treated via Reed Beds Filter and finally stored in a tank. This water would be used for non-potable usage such as toilet flushing and ground surface cleaning. Study required to establish the scale of the project.
Leakage		
423	Leakage reduction - pressure management with new PRVs	Still scope to do this.
424	Leakage control - better control of PRVs/boosters	PRV upgrades. Fixed outlet PRVs changed to 2 stage or fully modulated. Expand to zone 8.
637	Leakage reduction by 1 MI/d	Extensive Active Leakage Control (ALC) to meet any deficit gap. Assumes that ALC increase is possible. These options need to be condensed down to ALC option (for RPS). Extend to Zones 7 and 8.
955	Leakage detection - District metering - reduction of DMA size to less than 1500 properties per DMA. RZ 7	A second version to be worked up for reduction at night. Factor in extra costs on finding leaks as bets savings recovered from AMP6.
1006	Leakage detection - District metering - reduction of DMA size to less than 2000 properties per DMA RZ8	Creation of 5 DMA's in rest of area zone, encompassing small villages <2000 props.
1007	Enhanced SP free repair policy	This would require funds for free repairs and/or enhancement of the waste notice process.
1008	CP replacements as part of mains renewals	
1009	DMA complete renewal (DM, CP)	This is a combination of 935 and 270. 2 DMA's/year for 5 years = ~40km/year for 5 years.
1010	Enhanced use of WSP meters	Smart use of existing WSP meters to identify supply pipe leaks / high consumption when leakage techs go into a DMA to identify leakage locations. (Partial DMA water balance).
1011	Trunk Mains Leakage	Improvements in distribution of correlation points on trunk mains (increased frequency) - better ways of measuring trunk mains leakage using air valves.
1012	Asset Renewal on specific DMAs	

The summary findings of the SEA for these demand options are presented in **Table 4.6** below. The detailed assessment tables are provided in **Appendix V**.

Table 4.6: SEA summary findings for demand management options

Option	SEA Objectives and assessment questions																																					
	1			2			3			4			5					6		7	8			9	10					11	12	13		14				
	1a	1b	1c	2a	2b	2c	3a	3b	4a	4b	5a	5b	5c	5d	5e	6a	6b	7a	8a	8b	9a	10a	10b	10c	10d	11a	12a	13a	13b	14a								
	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O
Water efficiency																																						
WEFF567	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WEFF569	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WEFF901	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WEFF1000	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WEFF990	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WEFF1050	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Metering																																						
MET186	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MET531	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MET904	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MET1002	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MET1010	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Reuse																																						
REUSE603	0	0	0	-1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
REUSE606	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
REUSE620	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
REUSE621	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Leakage																																						
LE423	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LE424	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LE637	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LE955	0	0	0	0	0	1	0	0	0	0	-1	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LE1006	0	0	0	0	0	1	0	0	0	0	-1	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LE1007	-1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LE1008	-1	0	0	0	0	1	0	0	0	0	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LE1009	-1	0	0	0	0	1	0	0	0	0	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LE1010	-1	0	0	0	0	1	0	0	0	0	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LE1011	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LE1012	-1	0	0	0	0	1	0	0	0	0	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

As illustrated **Table 4.6** above there are no significant differences between the demand management options in terms of likely effects against the SEA Framework. No significant negative effects are predicted and there is the potential for a significant (moderate) positive effect for the metering options against assessment question 8a (Reduce/increase predicted carbon footprint?) through a medium term carbon saving associated with the reduced water requirement. Some minor differences between the options have been identified and these are highlighted below:

- Some of the leakage options would require construction works to repair or replace pipes and this could have a short term minor negative effect on assessment questions relating to water supply (1a) and transport infrastructure (3a), as there could be temporary disruption of supply and disturbance through increased traffic on the road network during construction.
- The collection of rainwater and its reuse (options 603 to 621) could result in a minor long term positive effect against assessment question 4b (Result in higher levels of reuse of waste?).
- A minor negative effect is predicted during operation for 603 against assessment question 1b (ensure that customers are not disproportionality affected by cost) as the fitting of rainwater recycling systems to a new housing development could affect housing costs.
- There is no minor negative effect predicted for 637 against assessment question 8a (Reduce / increase predicted carbon footprint?) during construction as this option does not appear to require the use or installation of any new materials / infrastructure.

4.3.2.2 Supply-side options

The ID, name and type of each constrained supply-side option subject to detailed assessment through the SEA is provided in the table below. For a more detailed description of each option please refer to the Supply-side Constrained Options Report (Volume 1) which is available separately.²⁰

Table 4.7: Constrained supply-side options subject to SEA

Option ID	Option Name	Option ID	Option Name
Option Type: Groundwater			
AFF-ASR-WRZ6-0174	Egham ASR	AFF-NGW-WRZ1-1050	Canals & Rivers Trust - Cow Roast
AFF-EGW-WRZ1-0613	Gerrards Cross Peak Licence Scheme	AFF-NGW-WRZ2-0120	Poorsfield, Ruislip & Northwood Scheme
AFF-EGW-WRZ2-0087	Shakespeare Road Source Optimisation	AFF-NGW-WRZ2-0610	Poorsfield Borehole
AFF-EGW-WRZ2-0090	Stonecross source optimisation	AFF-NGW-WRZ3-0548	Hartham borehole replacement for Porthill
AFF-EGW-WRZ2-0622	Hilfield Park Dual Pump Option	AFF-NGW-WRZ3-1053	Kings Walden
AFF-EGW-WRZ3-0502	Musley Lane Peak Licence Scheme	AFF-NGW-WRZ3-1068	Runley Wood (AMP7 LGS Borehole)
AFF-EGW-WRZ5-0882	Wenden Upgrade	AFF-NGW-WRZ3-1075	Nomansland Increased Abstraction
AFF-EGW-WRZ5-1057	Roydon Peak Scheme	AFF-NGW-WRZ4-0624	Canals & Rivers Trust Slough borehole
AFF-EGW-WRZ6-0173	Clandon Source Optimisation	AFF-NGW-WRZ5-0342	Essex Confined Aquifer - No Storage
AFF-EGW-WRZ7-0306	Cow Lane Upgrade	AFF-NGW-WRZ5-0496	Debden Road Peak Licence Scheme
AFF-EGW-WRZ7-0322	Tilmanstone Pump & Treat	AFF-NGW-WRZ5-0877	Essex Confined Chalk Aquifer, with ASR
AFF-EGW-WRZ7-0629	Lye Oak	AFF-NGW-WRZ6-0005	Horsley source recommissioning
AFF-EGW-WRZ7-0908	Tappington South	AFF-TPO-WRZ3-0134	Vauxhall (IBC Vehicles) Groundwater
AFF-NGW-WRZ1-0062	Chartridge Relocation	AFF-TPO-WRZ6-1083	Surrey University (Guildford Site)
AFF-TPO-WRZ4-0412	Hillingdon Hospital boreholes		
Option Type: Surface Water			
AFF-ESW-WRZ6-0801	Chertsey Reservoir upgrade	AFF-RES-WRZ4-0832	Brent Reservoir
AFF-NSW-WRZ6-0462	Egham 182 Peak Scheme	AFF-RES-WRZ5-0809	Birds Green Reservoir
AFF-RES-WRZ3-0814	Honeywick Rye Reservoir	AFF-RES-WRZ6-0829	West End Reservoir
AFF-RES-WRZ3-0815	Edelsborough Reservoir	AFF-RES-WRZ7-0839	Dover Docks Reservoir
Option Type: Transfers			
AFF-CTR-WRZ1-0751	Iver to Harefield	AFF-RTR-WRZ3-0860	New Anglian Water Imports

²⁰ Affinity Water (2019) Supply-side Constrained Options Report - Volume 1 Asset Strategy.

Option ID	Option Name	Option ID	Option Name
AFF-CTR-WRZ1-1097	Batchworth to Boxted (Strat B)	AFF-RTR-WRZ3-1028	Lowerfields supply -3rd dry winter
AFF-CTR-WRZ2-2020	Boxted to Shakespeare Road	AFF-RTR-WRZ3-1067	Grand Union Canal (Pitsford Transfer)
AFF-CTR-WRZ3-0028	Iver Arkley Transfer Upgrade	AFF-RTR-WRZ4-0654	Kempton Park to Iver
AFF-CTR-WRZ3-0076	Bulls Green to Preston	AFF-RTR-WRZ4-1029	Kempton to Iver upgrade
AFF-CTR-WRZ3-0349	Bulls Green to Sacombe additional trunk main (10MI/d)	AFF-RTR-WRZ4-1038	Sunnymeades to Iver 2 (50 MI/d capacity)
AFF-CTR-WRZ3-0707	Iver to Harrow to Arkley	AFF-RTR-WRZ4-1040	Sunnymeades to Iver 2 (100 MI/d capacity)
AFF-CTR-WRZ3-1099	Boxted to Chaul End	AFF-RTR-WRZ5-0161	Lowersfield Bulk Import Increase
AFF-CTR-WRZ3-2001	Chaul End to Preston	AFF-RTR-WRZ5-0849	Brentwood to Harlow transfer
AFF-CTR-WRZ4-0716	North Surrey North	AFF-RTR-WRZ5-1047	Braintree to Sibleys
AFF-CTR-WRZ4-0750	Iver Upgrade and Transfer to Harrow	AFF-RTR-WRZ6-0752	Ladymead Optimisation
AFF-CTR-WRZ5-0753	Uttlesford Bridge to Sibleys Link Main	AFF-RTR-WRZ6-1094	Egham to Surrey Hills Reduction (10MI/d)
AFF-CTR-WRZ5-0869	Preston to Wicker Hall Transfer	AFF-RTR-WRZ7-0301	Barham Import Increase (of 2MI/d) to 4 MI/d
AFF-CTR-WRZ5-1043	Bulls Green to Hadham Mill	AFF-RTR-WRZ7-0639	Deal continuation after 2020
AFF-CTR-WRZ5-2006	Hadham Mill to Ryehill (Strat A & B)	AFF-RTR-WRZ7-0842	Aldington to Saltwood Import Increase 3MI/d
AFF-RNC-WRZ7-0626	Broome Network Improvement	AFF-RTR-WRZ7-0909	Barham Continuation (After 2019/20)
AFF-RNC-WRZ7-0900	Dover Constraint Removal	AFF-RTR-WRZ7-0910	Deal Supply Scheme
AFF-RTR-WRZ1-1007	Sunnymeades to Harefield Transfer (50 MI)	AFF-RTR-WRZ1-1066	Grand Union Canal Berkhamstead/Hemel Hempstead)
AFF-CTR-WRZ4-4001	Egham to Iver	AFF-CTR-WRZ4-4002	Blackford Re-lift to Ickenham BPS
AFF-CTR-WRZ2-4003	Ickenham to Oxheywood	AFF-CTR-WRZ4-4004	Bushey to Arkley
AFF-CTR-WRZ3-4005	Arkley North	AFF-CTR-WRZ3-4006	Bi-directional Resilience Infrastructure (Lee Community)
AFF-RTR-WRZ1-4010	Abingdon Reservoir to Harefield Transfer (50 MI/d)	AFF-RTR-WRZ4-4011	Abingdon to Iver 2 (50 MI/d)
AFF-RTR-WRZ4-4012	Abingdon to Iver 2 (100 MI/d)	AFF-RTR-WRZ3-4013	South Lincs Res (50 MI/d)
AFF-RTR-WRZ3-4014	South Lincs Res (100 MI/d)	AFF-RTR-WRZ3-4015	Minworth Strategic Transfer (50 MI/d)
AFF-RTR-WRZ3-4016	Minworth Strategic Transfer (100 MI/d)	AFF-RTR-WRZ4-4017	Severn Thames Transfer (Iver 2 – 50 MI/d)
AFF-RTR-WRZ4-4018	Severn Thames Transfer (Iver 2 – 100 MI/d)	AFF-RTR-WRZ4-4019	Severn Thames Transfer (Harefield – 50 MI/d)
AFF-RTR-WRZ1-4020	Grand Union Canal (GUC – Berkhamsted / Hemel Hempstead, 100 MI/d)	AFF-RTR-WRZ8-4022	Clacton Resilience Link
AFF-RTR-WRZ4-4023	Fortis Green Increased Import		
Option Type: Treatment			
AFF-EGW-WRZ4-1064	Ickenham Groundwater	AFF-NTW-WRZ4-1003	Iver ("2") - New Treatment Works (50 MI/d)
AFF-NTW-WRZ1-1011	Harefield New Treatment Works (50MI)	AFF-NTW-WRZ4-1005	Iver ("2") - New Treatment Works (100 MI/d)
AFF-NTW-WRZ3-1042	Sundon Treatment Works - New	AFF-NTW-WRZ4-1088	Replacement Iver Treatment Works (450 MI)
Option Type: Desalination			
AFF-DES-WRZ7-0008	Hythe Beach Wells RO Desalination (brackish water)	AFF-DES-WRZ7-0396	Desalination Plan (Option C) Hythe Beach Well
AFF-DES-WRZ7-0309	Full Desalination Scheme	AFF-DES-WRZ8-4021	Tendring Desalination
Option Type: Reuse			
AFF-EFF-WRZ3-0180	Stevenage STW	AFF-EFF-WRZ7-0605	Hythe Effluent Reuse Scheme

Further details on the different variations of option types and their IDs are set out below.

Groundwater

- ASR (Aquifer Storage and Recovery);
- TPO (Third Party Option, to buy or lease an existing borehole or buy part of the abstracted volume);
- NGW (New Groundwater Scheme); and

- EGW (Existing Groundwater scheme e.g. closing the yield gap to licence, licence transfer / variation, borehole re-commissioning).

Surface water

- RES (Reservoir options);
- NSW (New Surface Water schemes); and
- ESW (Existing Surface Water scheme).

Transfers

- CTR (Internal Transfers),
- RNC (Network Improvement); and
- RTR (External Transfers).

Treatment

- New water treatment options were classified using the code 'NTW'.

Desalination

- DES (Desalination)

Reuse

- EFF (sewage treatment works effluent reuse)

The summary findings of the SEA for supply-side options are presented in **Tables 4.8 to 4.15** below and structured according to WRZs. The detailed assessment tables are provided in **Appendix V**.

WRZ 1	SEA Objectives and assessment questions																																																													
	1						2						3				4				5										6				7		8				9				10								11		12		13				14	
	1a		1b		1c		2a		2b		2c		3a		3b		4a		4b		5a		5b		5c		5d		5e		6a		6b		7a		8a		8b		9a		10a		10b		10c		10d		11a		12a		13a		13b		14a			
	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O						
Transfer																																																														
AFF-CTR-WRZ1-1097 : Batchworth to Boxted	0	1	0	1	0	1	0	0	0	0	0	-1	0	-1	0	-1	0	-1	0	0	0	-1	0	?	?	-1	0	?	?	-1	0	?	?	0	0	-1	-1	0	1	0	-1	-1	0	0	0	0	0	0	0	0	0	0	0	-1	0	0	0	-1	0			
AFF-CTR-WRZ1-0751 : Iver upgrade and transfer to Harefield	0	1	0	1	0	1	0	0	0	-1	0	-3	0	-1	0	-3	0	-1	-1	0	0	-1	?	?	?	-1	?	?	?	-1	0	?	?	-1	0	-2	-2	0	1	0	0	-1	0	0	0	-1	0	0	-1	0	0	-2	0	0	0	-1	0					
AFF-RTR-WRZ1-1007 : Sunnymeads to Harefield Transfer (50MI)	0	2	0	2	0	2	0	0	0	0	0	-1	0	-1	0	-1	0	-1	-1	?	?	-1	-1	?	?	-1	0	0	0	0	0	-1	-1	0	2	0	-2	-1	-2	-1	-2	0	-2	-1	-2	0	-2	0	0	-1	0	0	0	-1	0							
AFF-RTR-WRZ1-4020 : Grand Union Canal (GUC - Berkhamstead/Hemel Hempstead ; 1	0	3	0	3	0	3	0	0	0	0	0	-1	0	-1	0	-2	0	-1	-1	0	0	-1	0	?	-1	0	0	?	?	-2	-1	?	?	0	0	-1	-1	0	3	0	-1	0	0	-1	-2	0	-2	0	0	0	-2	0	0	-1	0	0	0					
AFF-RTR-WRZ1- 4010 : Abingdon Reservoir to Harefield Transfer (50MI/d)	0	2	0	2	0	2	0	2	0	-1	-2	1	-2	-1	-1	0	-3	0	-1	0	-2	-1	-2	-1	?	?	-2	-1	?	2	-3	-2	?	2	-2	-1	-3	-3	0	2	0	-1	-1	-1	-1	-1	0	-1	-1	-1	-1	0	-1	-3	-1	-2	-1	-2	-1			
AFF-RTR-WRZ1-1066 : Grand Union Canal (GUC - Berkhamstead/Hemel Hempstead)	0	2	0	2	0	2	0	0	0	0	0	-1	0	-1	0	-2	0	-1	-1	0	0	-1	0	?	-1	0	0	?	?	-2	-1	?	?	0	0	-2	-2	0	2	0	0	0	0	-1	-2	0	-2	0	0	0	-2	0	0	-1	0	0	0	0	0			
Groundwater																																																														
AFF-NGW-WRZ1-0062 : Chartridge Relocation	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	-1	0	-1	0	0	0	0	0	?	?	0	?	?	?	0	0	?	?	0	0	-1	-1	0	1	0	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
AFF-NGW-WRZ1-1050 : Canals & Rivers Trust - Cow Roast	0	1	0	1	0	1	0	0	0	0	0	-1	0	-1	0	-1	0	-1	0	0	0	-1	0	?	?	-1	0	?	?	-2	0	?	?	0	0	-1	-1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-1	0	0	0	0			
AFF-EGW-WRZ1-0613 : Gerrards Cross Peak Licence Scheme	0	1	0	1	0	1	0	0	0	?	0	0	0	0	0	-1	0	-1	0	0	0	-1	?	?	?	?	-1	?	?	0	0	?	?	0	0	-1	0	0	1	0	-1	0	0	0																		

WRZ 2	SEA Objectives and assessment questions																																																												
	1						2						3				4				5										6				7	8			9	10				11	12	13		14													
	1a		1b		1c		2a		2b		2c		3a		3b		4a		4b		5a		5b		5c		5d		5e		6a		6b		7a	8a		8b		9a	10a		10b		10c		10d		11a	12a	13a	13b	14a								
	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O									
Transfer																																																													
AFF-CTR-WRZ2-2020 : Boxted to Shakespeare Road	0	1	0	1	0	1	0	0	0	0	0	0	-1	0	-1	0	-2	0	-1	0	0	0	-1	0	?	?	-1	0	?	?	-1	-1	?	?	0	0	-2	-2	0	2	0	0	-1	-1	0	0	0	0	0	0	0	0	0	0	-1	0	0	0	-1	0	
AFF-CTR-WRZ2-4003 : Ickenham to Oxheywood	0	3	0	3	0	3	0	0	0	0	0	0	-1	0	-1	0	-1	0	-1	0	0	0	-1	0	?	?	0	0	?	?	-1	0	?	?	-1	0	-1	-1	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-1	0	0	0	-1	0
Groundwater																																																													
AFF-EGW-WRZ2-0087 : Shakespeare Road Source Optimisation	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	-1	0	-1	0	0	0	0	0	?	?	0	0	?	?	0	0	?	?	0	0	-1	0	0	1	0	-1	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	
AFF-EGW-WRZ2-0090 : Stonecross Source Optimisation	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-1	?	?	0	0	?	?	0	0	?	?	0	0	-1	0	0	1	0	-1	0	0	0	0	0	-1	0	0	0	0	0	0	0	0	0	0	0			
AFF-EGW-WRZ2-0622 : Hilfield Park Dual Pump Option	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	-1	0	-1	-1	0	0	-1	-1	?	?	0	0	?	?	-1	0	?	?	0	0	-1	-1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
AFF-NGW-WRZ2-0120 : Poorsfield, Ruislip & Northwood Treatment Scheme	0	1	0	1	0	1	0	0	0	0	-1	0	-1	0	0	0	-1	0	-1	0	0	0	-1	0	?	?	-1	-1	?	?	-1	0	?	?	0	0	-1	-1	0	1	0	-1	0	0	0	0	-2	0	0	0	-1	0	0	-1	0	0	0	0	0		
AFF-NGW-WRZ2-0610 : Poorsfield Borehole	0	1	0	1	0	1	0	0	0	0	0	0	-1	0	-1	0	-1	0	-1	0	0	0	-1	?	?	?	-1	-1	?	?	-1	0	?	?	0	0	1	1	0	1	0	-1	0	0	0	0	-2	0	0	0	-1	0	0	-1	0	0	0	0	0	0	

Table 4.10: SEA summary findings for supply-side options in WRZ 3

WRZ 3	SEA Objectives and assessment questions																																																											
	1			2			3			4			5					6		7	8			9	10				11	12	13		14																											
	1a	1b	1c	2a	2b	2c	3a	3b	4a	4b	5a	5b	5c	5d	5e	6a	6b	7a	8a	8b	9a	10a	10b	10c	10d	11a	12a	13a	13b	14a																														
	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O																						
Transfer																																																												
AFF-CTR-WRZ3-0028 : Iver Arkley Transfer Upgrade	0	1	0	1	0	1	0	0	0	0	-1	0	-2	0	-1	0	-2	0	?	?	-1	0	?	?	-1	0	?	?	-1	0	-2	-1	0	1	0	0	0	0	-1	0	0	0	0	0	0	0	-1	0	0	0	-2	0								
AFF-CTR-WRZ3-0076 : Bulls Green to Preston	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	-1	0	-1	0	0	0	0	0	?	?	-1	0	?	?	-1	0	-1	-1	0	1	0	1	0	0	0	0	0	0	0	0	0	-1	0	-1	0	0	-1	0							
AFF-CTR-WRZ3-0349 : Bulls Green to Sacombe additional trunk main	0	1	0	1	0	1	0	0	0	0	-1	0	-1	0	-1	0	-1	0	?	?	0	0	?	?	-1	0	?	?	0	0	-1	-1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	-1	0	0	0	0	0							
AFF-CTR-WRZ3-1099 : Boxted to Chaul End	0	1	0	1	0	1	0	0	0	0	-1	0	-1	0	-1	0	-1	0	?	?	0	0	?	?	-2	-1	?	?	0	0	-1	-1	0	1	0	0	-1	0	0	0	0	0	-1	0	0	0	0	-1	0	0	0	0	0							
AFF-CTR-WRZ3-2001 : Chaul End to Preston	0	1	0	1	0	1	0	0	0	0	-1	0	-1	0	-1	0	-1	0	?	?	-1	0	?	?	-1	0	?	?	0	0	-1	-1	0	2	0	0	-1	-1	0	0	0	0	0	0	0	0	0	-1	0	0	0	0	0							
AFF-CTR-WRZ3- 4015 : Minworth Strategic Transfer (50MI/d)	0	2	0	2	0	2	0	0	0	0	-1	0	-3	0	-1	0	-3	0	?	?	-1	-1	0	?	?	-3	-1	?	?	-2	0	-3	-3	0	2	0	0	-1	0	-1	0	0	0	-1	0	0	0	-1	0	0	0	-1	0							
AFF-CTR-WRZ3- 4016 : Minworth Strategic Transfer (100MI/d)	0	3	0	3	0	3	0	0	0	0	-1	0	-3	0	-1	0	-3	0	?	?	-1	-1	0	?	?	-3	-1	?	?	-2	0	-3	-3	0	3	0	0	-1	0	-1	0	0	0	-1	0	0	0	-1	0	0	0	-1	0							
AFF-CTR-WRZ3- 4005 : Arkley North	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	-1	0	-1	0	0	0	0	?	?	0	0	?	?	-1	0	?	?	-1	0	-1	-1	0	1	0	0	0	0	0	0	0	0	0	0	0	-1	0	0	0	0	0					
AFF-CTR-WRZ3-4006 : New Cell at Bulls Green, BPS Bulls Green to Preston, BPS Pres	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	-2	0	-1	0	0	0	-1	0	?	?	0	0	?	?	-1	-1	?	?	0	0	-2	-1	0	1	0	0	0	0	0	0	0	0	0	0	0	-1	-1	0	0	-1	0				
AFF-CTR-WRZ3-0707 : Iver to Harrow to Arkley	0	1	0	1	0	1	0	0	0	0	-1	0	-2	0	-1	0	-3	0	0	0	0	0	-1	0	?	?	0	0	?	?	-2	0	?	?	0	0	-2	-2	0	1	0	0	-1	0	0	0	0	-1	0	0	0	-2	0							
AFF-RTR-WRZ3-0860 : New Anglian Water Imports	0	2	0	2	0	2	0	0	0	0	-1	0	-1	0	-1	0	-1	0	?	?	-1	-1	0	?	?	-3	-1	?	?	0	0	-2	-1	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-2	0	0	0	-1	0					
AFF-RTR-WRZ3-1028 : Lowerfields supply 3rd dry winter	0	1	0	1	0	1	0	0	0	0	-1	0	-1	0	-1	0	-1	0	?	?	0	0	?	?	-1	0	?	?	0	0	-1	-1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
AFF-RTR-WRZ3-1067 : Grand Union Canal (GUC) (Pitsford Transfer)	0	2	0	2	0	2	0	0	0	0	0	0	0	0	0	-1	0	-1	0	-2	0	-1	0	0	0	-1	0	?	?	-1	0	0	?	?	-3	-1	?	?	0	0	-2	-1	0	2	0	0	0	0	0	0	0	0	0	0	-1	0				
AFF-RTR-WRZ3- 4013 : South Lincs Res (50MI/d)	0	2	0	2	0	2	0	0	0	0	-1	0	-2	0	-2	0	-3	0	-1	0	0	0	-1	0	?	?	-2	-2	?	?	-3	-1	?	?	-1	0	-3	-3	0	2	0	-1	-1	0	-1	-1	0	-1	-1	0	-1	-1	0	-1	-1					
AFF-RTR-WRZ3- 4014 : South Lincs Res (100MI/d)	0	3	0	3	0	3	0	0	0	0	-1	0	-2	0	-2	0	-3	0	-1	0	0	0	-1	0	?	?	-2	-2	?	?	-3	-1	?	?	-1	0	-3	-3	0	3	0	-1	-1	0	-1	-1	0	-1	-1	0	-1	-1	0	-1	-1					
AFF-TPO-WRZ3-0134 : Vauxhall (IBC Vehicles) Groundwater	0	1	0	1	0	1	0	0	0	?	0	0	-1	0	-1	0	-1	0	-1	0	0	?	-1	-1	?	?	0	0	?	?	-1	0	?	?	0	0	-1	-1	0	1	0	-1	0	0	0	-2	0	-1	0	0	0	-2	0	0	-1	0	0	0	0	0
Groundwater																																																												
AFF-NGW-WRZ3-0548 : Hartham borehole replacement for Porthill	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	-1	0	-1	0	0	?	0	-1	?	?	0	-1	?	?	0	0	?	?	0	0	-1	-1	0	1	0	-1	0	0	0	0	0	-2	0	0	0	-1	0	0	0	0	0	0	0	0	
AFF-NGW-WRZ3-1053 : Kings Walden	0	1	0	1	0	1	0	0	0	?	0	0	0	0	0	0	0	-1	-1	0	0	0	?	?	?	?	0	?	?	?	-1	0	?	?	0	0	-1	-1	0	1	0	?	0	0	0	-2	0	-2	0	0	0	-2	0	0	0	0	0	0	0	
AFF-NGW-WRZ3-1068 : Runley Wood (AMP7 LGS Borehole)	0	1	0	1	0	1	0	0	0	?	-1	0	?	0	0	0	0	-1	-1	0	0	?	?	?	?	0	?	?	?	-1	0	?	?	0	0	-1	-1	0	1	0	?	0	0	0	-1	0	-2	0	0	0	-2	0	0	0	0	0	0	0	0	
AFF-NGW-WRZ3-1075 : Nomansland Increased Abstraction	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	-1	0	-1	0	0	-1	-1	0	?	?	0	0	?	?	0	0	-1	-1	0	1	0	-1	0	0	0	0	0	-2	0	-2	0	-2	0	0	0	0	0	0	0	0	0	0	0		
AFF-EGW-WRZ3-0502 : Musley Lane Peak Licence Scheme	0	1	0	1	0	1	0	0	0	-1	0	0	0	0	0	-1	0	-1	-1	?	?	?	?	?	?	?	?	0	0	?	?	0	0	-1	-1	0	1	0	-1	0	0	0	-2	0	-2	0	0	0	-2	0	0	0	-2	0	0	0	0	0		
Surface water																																																												
AFF-RES-WRZ3-0814 : Honeywick Rye Reservoir	0	1	0	1	0	1	0	1	0	?	-1	0	-1	0	-1	0	-1	0	-1	0	0	0	-1	0	?	-1	-1	?	?	2	-2	-1	?	1	-1	0	-2	-2	0	1	0	-1	-1	-2	0	-2	0	-2	0	0	0	-2	0	0	-1	-1	0	0	0	0
AFF-RES-WRZ3-0815 : Edelsborough Reservoir	0	1	0	1	0	1	0	1	0	?	-1	0	-1	0	-1	0	-1	0	-1	-1	0	0	-1	-1	?	?	0	0	?	2	-2	-2	?	1	-1	0	-2	-2	0	1	0	-1	-1	-2	-1	-2	0	-2	0	0	0	-2	0	0	-2	-1	0	0	-2	0
Reuse																																																												
AFF-EFF-WRZ3-0180 : Stevenage STW - Effluent Reuse	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	-1	0	-1	0	0	0	-1	0	?	?	0	0	?	?	-2	-1	?	?	0	0	-2	-1	0	1	0	-1	0	0	0	-1	0	2	0	-2	0	2	0	0	-1	0	0	0	0	0	

WRZ 4	SEA Objectives and assessment questions																																																															
	1						2						3				4				5										6				7		8				9		10								11		12		13				14					
	1a		1b		1c		2a		2b		2c		3a		3b		4a		4b		5a		5b		5c		5d		5e		6a		6b		7a		8a		8b		9a		10a		10b		10c		10d		11a		12a		13a		13b		14a					
C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O									
Transfer																																																																
AFF-CTR-WRZ4-0716 : North Surrey North	0	1	0	1	0	1	0	0	0	0	-1	0	-2	0	-1	0	-1	0	0	0	-1	?	-1	?	?	?	-1	-1	?	?	0	0	?	?	0	0	-1	-1	0	0	0	0	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-2	0	0	0	0	-3
AFF-CTR-WRZ4- 4004 : Bushey to Arkley	0	2	0	2	0	2	0	0	0	0	0	0	-1	0	-1	0	-1	0	-1	0	0	0	0	0	?	?	0	0	?	?	-1	0	?	?	-1	0	-1	-1	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-1	0	0	0	-1	0	
AFF-CTR-WRZ4- 4002 : Blackford Re-lift to Ickenham BPS	0	1	0	1	0	1	0	0	0	0	-1	0	-1	0	-1	0	-1	0	-1	0	0	0	-1	0	?	?	0	0	?	?	-1	0	?	?	0	0	-1	-1	0	1	0	0	-1	0	0	0	0	0	-1	0	-1	0	0	0	-1	0	0	0	-1	0				
AFF-CTR-WRZ4-4001 : Egham to Iver	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	?	?	0	0	?	?	0	0	?	?	0	0	-1	-1	0	1	0	0	0	0	0	0	0	-1	0	0	0	0	0	0	0	0	0	0	0	0	0					
AFF-CTR-WRZ4-0750 : Iver Upgrade and Transfer to Harrow	0	1	0	1	0	1	0	0	0	0	-1	0	-3	0	-1	0	-2	0	0	0	-1	0	?	?	0	0	?	?	-2	0	?	?	0	0	-2	-2	0	1	0	0	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	-2	0	0	0	-3	0				
AFF-RTR-WRZ4-1029 : Kempton to Iver Upgrade	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	?	?	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
AFF-RTR-WRZ4-1038 : Sunnymeads to Iver 2 (50Ml/d)	0	2	0	2	0	2	0	0	0	?	0	0	-1	0	-1	0	-1	0	-1	0	-1	0	-1	-1	?	?	-2	-1	?	?	-1	0	?	?	0	0	-1	-1	0	2	0	-2	-1	-2	-1	-2	0	-2	0	0	-1	0	0	0	-2	0								
AFF-RTR-WRZ4-1040 : Sunnymeads to Iver 2 (100Ml/d)	0	3	0	3	0	3	0	0	0	?	0	0	-1	0	-1	0	-1	0	-1	0	-1	0	-1	-1	?	?	-2	-1	?	?	-1	0	?	?	0	0	-1	-1	0	3	0	-1	-1	-2	-1	-2	0	-2	-1	-2	0	0	0	0	-2	0								
AFF-RTR-WRZ4-0654 : Kempton Park to Iver	0	1	0	1	0	1	0	0	0	0	0	0	-1	0	-1	0	-1	0	-1	0	-1	0	?	?	-1	-1	?	?	-1	0	?	?	-1	0	-2	-1	0																											

WRZ 5	SEA Objectives and assessment questions																																																										
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	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O																											
Transfer																																																											
AFF-CTR-WRZ5-0869 : Preston to Wicker Hall Transfer	0	1	0	1	0	1	0	0	0	0	0	-1	0	-1	0	-1	0	0	0	-1	0	?	?	-1	0	?	?	-1	0	?	?	0	0	-1	-1	0	1	0	-1	-1	0	0	0	0	0	0	0	0	0	0	-1	0	0	0	-1	0			
AFF-CTR-WRZ5-0753 : Uttlesford Bridge to Sibleys Link Main	0	1	0	1	0	1	0	0	0	0	0	-1	0	-1	0	-1	0	0	0	-1	0	?	?	-2	0	?	?	-1	0	?	?	0	0	-1	-1	0	1	0	-1	-1	0	0	0	0	0	0	0	0	0	0	0	-1	0	0	0	-1	0		
AFF-CTR-WRZ5-1043 : Bulls Green to Hadham Mill	0	2	0	2	0	2	0	0	0	0	0	-1	0	-1	0	-1	0	0	0	-1	-1	?	?	0	0	?	?	-1	-1	?	?	0	0	-2	-1	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	-1	0	0	-1	0				
AFF-CTR-WRZ5-2006 : Hadham Mill to Ryehill (Strat A & B)	0	2	0	2	0	2	0	0	0	0	-1	0	-1	0	-2	0	-1	0	0	0	-1	0	?	?	-1	0	?	?	0	0	?	?	0	0	-1	-1	0	2	0	0	-1	-1	0	0	0	0	0	0	0	0	0	-1	0	0	-1	0			
AFF-RTR-WRZ5-0161 : Lowersfield Bulk Import Increase	0	1	0	1	0	1	0	0	0	0	0	-1	0	-1	0	-1	0	0	0	0	0	?	?	0	0	?	?	-1	0	?	?	0	0	-1	-1	0	1	0	0	-1	0	0	0	0	0	0	0	0	0	0	0	0	-1	0	0	-1	0		
AFF-RTR-WRZ5-0849 : Brentwood to Harlow Transfer	0	1	0	1	0	1	0	0	0	0	0	-1	0	-1	0	-1	0	-1	0	-1	0	?	?	-1	0	?	?	-1	0	?	?	0	0	-1	-1	0	1	0	0	-1	0	0	0	0	0	0	0	0	0	0	0	-1	0	0	0	0			
AFF-RTR-WRZ5-1047 : Braintree to Sibleys	0	1	0	1	0	1	0	0	0	0	-1	0	-1	0	-1	0	-1	0	0	0	-1	0	?	?	-1	0	?	?	0	0	?	?	0	0	-1	-1	0	1	0	0	-1	0	0	0	0	0	0	0	0	0	0	0	0	-2	0	0	0	-1	0
Groundwater																																																											
AFF-EGW-WRZ5-0882 : Wenden Upgrade	0	1	0	1	0	1	0	0	0	?	0	0	-1	0	-1	0	-1	0	0	0	-1	?	?	?	0	0	?	?	-1	0	?	?	0	0	-1	-1	0	1	0	-1	0	0	-1	-2	0	-2	0	0	0	-2	0	0	-1	0	0	0	-1	0	
AFF-EGW-WRZ5-1057 : Roydon Peak Scheme	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	?	-1	?	?	?	-1	-1	?	?	0	0	0	0	0	0	-1	-1	0	1	0	-1	0	0	-2	0	-2	0	0	0	-1	0	0	0	0	0	0	0	0		
AFF-NGW-WRZ5-0342 : Essex Confined Aquifer - No Storage	0	1	0	1	0	1	0	0	0	?	0	0	-1	0	-1	0	-1	0	0	0	-1	-1	?	?	-1	-1	?	?	-1	0	?	?	0	0	-1	-1	0	1																					

[illegible]

WRZ 7	SEA Objectives and assessment questions																																																															
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	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O								
Transfer																																																																
AFF-RTR-WRZ7-0301 : Barham Import Increase (of 2M/d) to 4 M/d	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	-1	0	-1	0	0	0	-2	0	?	?	0	0	?	?	-2	-1	?	?	0	0	-1	-1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-1	0	0	0	-1	0		
AFF-RTR-WRZ7-0639 : Deal Continuation After 2020	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
AFF-RTR-WRZ7-0842 : Aldington to Saltwood Import Increase by 3Mld	0	1	0	1	0	1	0	0	0	0	-1	0	-1	0	-1	0	-1	0	-1	0	0	0	-1	-1	?	0	0	?	?	-2	-1	?	?	0	0	-2	-1	0	1	0	-1	0	0	-1	-1	0	0	-1	-1	0	0	0	0	-2	0	0	0	-2	0					
AFF-RTR-WRZ7-0909 : Barham Continuation (After 2019/20)	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
AFF-RNC-WRZ7-0626 : Broome Network Improvement	0	1	0	1	0	1	0	0	0	0	0	0	-1	0	-1	0	-1	0	-1	0	0	0	-1	0	?	?	0	0	?	?	-1	-1	?	?	0	0	-1	-1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-1	0	0	0	-1	0			
AFF-RNC-WRZ7-0900 : Dover Constraint Removal	0	1	0	1	0	1	0	0	0	0	0	0	-1	0	-1	0	-1	0	-1	0	0	0	-1	0	?	?	0	0	?	?	-1	0	?	?	0	0	-1	-1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
AFF-EFF-WRZ7-0910 : Deal Supply Scheme	0	1	0	1	0	1	0	0	0	0	0	0	-1	0	-1	0	-1	0	-1	0	0	0	-1	0	?	?	0	0	?	?	-1	-1	?	?	0	0	-1	-1	0	1	0	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-1	0	0	0	-1	0	
Groundwater																																																																
AFF-EGW-WRZ7-0306 : Cow Lane Upgrade	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	-1	0	-1	0	0	0	-1	0	?	?	0	0	?	?	0	0	?	?	0	0	-1	0	0	1	0	0	0	0	0	0	0	0	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AFF-EGW-WRZ7-0322 : Tilmanstone Pump & Treat (Minewater)	0	1	0	1	0	1	0	0	0	?	0	0	-1	0	-1	0	-1	0	-																																													

WRZ 8	SEA Objectives and assessment questions																																																																					
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Transfer																																																																						
AFF-RTR-WRZ8-4022 : Clacton Resilience Link	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	-1	0	-1	0	-3	0	-1	0	0	0	-1	0	?	?	0	0	?	?	-1	0	?	?	-1	0	-2	-2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-1	0	0	0	0	-1	0		
Desalination																																																																						
AFF-DES-WRZ8-4021 : Tendring Desalination	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	-1	0	-1	0	-2	0	-1	0	-3	?	-2	0	?	?	-2	0	?	?	-2	-1	?	?	0	0	-2	-2	0	1	0	-1	-1	0	-1	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-2	-1	0	0	0	-1	0

4.3.2.3 Drought options

The ID, name and type of each drought option subject to detailed assessment through the SEA is provided in **Table 4.16** below. For a more detailed description of each option please refer to the Supply-side Constrained Options Report (Volume 1)²¹ and the Drought Plan (2018) which are available separately.

The drought options are essentially groundwater options across a number of Affinity Water WRZs that involve increasing peak (and in the case of prolonged drought, average) abstraction above existing licensed volumes or drought related environmental (river flow or groundwater level) constraints.

Table 4.16 Drought options

Option ID	Option Name	Description
AMER	WRZ1 drought permit	increase abstraction to pre-sustainability reduction levels
BOWB	WRZ2 drought permit	increase abstraction with re-instatement of a borehole
FRIA	WRZ2 drought permit	increase abstraction to pre-sustainability reduction levels
FULL	WRZ3 drought permit	increase abstraction to pre-sustainability reduction levels
HUGH	WRZ1 drought permit	increase abstraction to pre-sustainability reduction levels
HUNT	WRZ1 drought permit	increase abstraction with re-instatement of borehole
OUGH	WRZ3 drought permit	re-direct abstraction for flow augmentation to supply
PICC	WRZ1 drought permit	increase abstraction to pre-sustainability reduction levels
SBUC	WRZ7 drought permit	increase abstraction above licensed quantities but maintain augmentation
SHOL	WRZ7 drought permit	maintain non-drought levels of abstraction despite environmental flow / level being triggered
SDRE	WRZ7 drought permit	maintain non-drought levels of abstraction despite environmental flow / level being triggered
SLYE	WRZ7 drought permit	maintain non-drought levels of abstraction despite environmental flow / level being triggered
THUN	WRZ5 drought permit	maintain non-drought levels of abstraction despite environmental flow / level being triggered
UTTIL	WRZ5 drought permit	re-direct abstraction for flow augmentation to supply
WELL	WRZ3 drought permit	re-direct abstraction for flow augmentation to supply
WHIH	WRZ3 drought permit	increase abstraction to pre-sustainability reduction levels

The summary findings of the SEA for the drought options are presented in **Table 4.17** below. The detailed assessment tables are provided in **Appendix V**. The assessment found that there are no significant effects likely to arise as a result of the drought options against the SEA objectives.

²¹ Affinity Water (2019) Supply-side Constrained Options Report - Volume 1 Asset Strategy.

5. SEA of the Alternative Programmes and revised draft WRMP19 Decision Making

5.1 Introduction

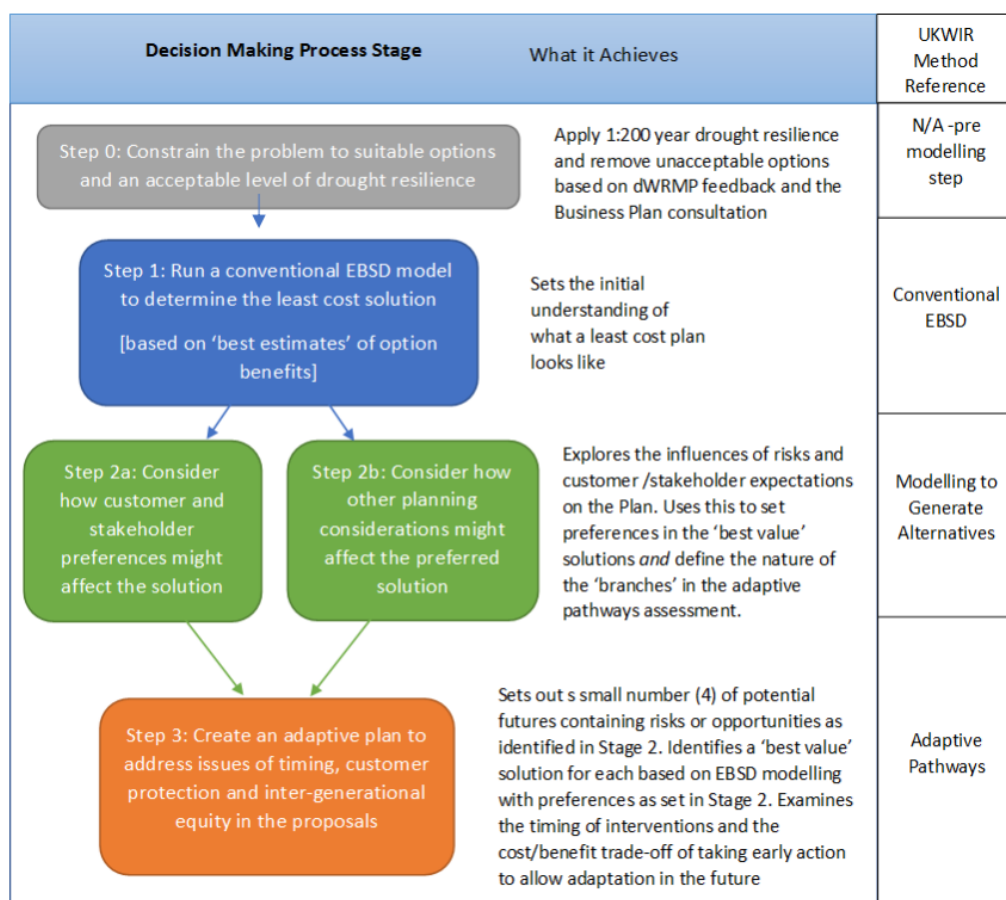
The final task in Affinity Water's option appraisal process (see **Figure 4.1**) is the programme appraisal. Essentially the aim of the programme appraisal process is to find the 'best value' programme of supply and/ or demand management options to secure a supply-demand balance across the Affinity Water supply area.

This Chapter provides a summary of Affinity Water's programme appraisal process and explains how the findings of the SEA for the constrained options were taken into account to inform decisions on the development of the WRMP. It also sets out the findings of the SEA for the reasonable alternative programmes and provides outline reasons for their selection or rejection.

5.2 Affinity Water's Decision Making Process

To address the concerns raised during the consultation for the dWRMP19 in 2018, a revised decision making process has been used for the rdWRMP19. The process developed and used by Affinity Water is fully compliant with both the Environment Agency Water Resources Planning Guidance, and the modelling processes and tools described within the UKWIR Decision Making Method guidance. A summary of the revised decision-making process used (covering stages 6 to 8 of the UKWIR guidance) is provided in **Figure 5.1** below.

Figure 5.1: Summary of the Selected Decision Making Process



In essence, the approach comprised a pre-modelling definition step and three stages of modelling, which are summarised below.

Step 0: Defining the Problem Constraints. Prior to the modelling process Affinity Water incorporated high level customer and stakeholder feedback to constrain the scope of the rdWRMP analysis. Specifically, they:

- a) adopted the drought resilience and environmental sustainability objectives that were contained within the 'alternative plan' that was consulted on following the dWRMP and included within the Business Plan. This was reflected in our baseline supply/ demand balance.
- b) removed options associated with new Chalk groundwater abstractions in the Central Region to align with the findings of the SEA, HRA and WFD as well as feedback received from our customers and statutory consultees (in particular from Natural England), these included:
 - AFF-EGW-WRZ1-0613 : Gerrards Cross Peak Licence Scheme
 - AFF-EGW-WRZ2-0087 : Shakespeare Road Source Optimisation
 - AFF-EGW-WRZ2-0622 : Hilfield Park Dual Pump Option
 - AFF-EGW-WRZ3-0502 : Musley Lane Peak Licence Scheme
 - AFF-EGW-WRZ4-1064 : Ickenham Groundwater
 - AFF-EGW-WRZ5-0882 : Wenden Upgrade
 - AFF-EGW-WRZ5-1057 : Roydon Peak Scheme
 - AFF-EGW-WRZ7-0306 : Cow Lane Upgrade
 - AFF-EGW-WRZ7-0322 : Tilmanstone Pump & Treat (Minewater)
 - AFF-ESW-WRZ6-0801 : Chertsey Reservoir upgrade
 - AFF-NGW-WRZ1-0062 : Chartridge Relocation
 - AFF-NGW-WRZ1-1050 : Canals & Rivers Trust - Cow Roast
 - AFF-NGW-WRZ2-0120 : Poorsfield, Ruislip & Northwood Treatment Scheme
 - AFF-NGW-WRZ2-0610 : Poorsfield Borehole
 - AFF-NGW-WRZ3-0548 : Hartham borehole replacement for Porthill
 - AFF-NGW-WRZ3-1075 : Nomansland Increased Abstraction
 - AFF-NGW-WRZ5-0342 : Essex Confined Aquifer - No Storage
 - AFF-NGW-WRZ5-0496 : Debden Road Peak Licence Scheme
 - AFF-NGW-WRZ5-0877 : Essex Confined Chalk Aquifer, with Artificial Recharge and Storage
 - AFF-TPO-WRZ3-0134 : Vauxhall (IBC Vehicles) Groundwater

Step 1: Derivation of the economic Least Cost Plan. At this stage, Affinity Water generated the basic output that is expected for the WRMP. All changes from that to the 'best value' preferred plan need to be supported by evidence and suitable decision-making methods. They therefore used the 'EBSD' economic model that we initially developed for WRMP14 to generate this starting point plan. It should be noted that the EBSD model uses the same economic modelling principles as the regional Water Resources in the South-East model.

Step 2: Refinement of customer and stakeholder preferences, and analysis of non-monetised risks. At this stage, Affinity Water analysed feedback from customers and stakeholders to determine how this might affect the plan. In practical terms, this meant they used the detailed feedback from the dWRMP and Business Plan customer consultation, dWRMP customer and stakeholder responses, further customer pre-consultation for this rdWRMP and a few other data sources to understand how they could amend the options inputs to the Plan to better reflect customer and stakeholder preferences.

They also used a 'bottom up' multi-criteria analysis to determine where the key risks and uncertainties lie in the Plan and used these, along with the customer and stakeholder preferences, to structure the Adaptive Pathways analysis in the next stage. The SEA findings helped to inform this stage as Affinity Water evaluated the environmental and yield scoring on the multi-criteria analysis, where any schemes scoring a 4 or 5 were identified as potentially high risk. As a result of that analysis key uncertainties were raised around the potential yield benefits that might be realised from the Runley Wood, Kings Walden and Brent Reservoir options. For Runley Wood and Kings Walden Lower Greensand, these were identified as potentially posing a WFD compliance risk if abstractions start to affect the northwards flow of groundwater, which is a long-term risk that can only be ascertained through monitoring. This would be mitigated through reduction in abstraction licence or possibly not developing the Kings Wood source. For the Brent Reservoir there is uncertainty around how much yield could be obtained without affecting the benefits from the river support that is currently effectively provided by the reservoir. In both cases the WFD risk can therefore be addressed through a reduction in yield, and is not an unavoidable feature of the scheme. These yield risks were therefore incorporated into the adaptive pathways analysis.

Step 3: Adaptive Pathways Analysis. The adaptive pathways analysis used the step 2 outputs to develop the versions of the future that could occur and need to be solved if Affinity Water is going to be able to resiliently plan supplies over the next 60 years. They carried out Economics of Balancing Supply and Demand (EBSD) modelling for each future, modified to account for delivery risks and customer preferences, to determine the 'best value' plan for that future. Affinity Water then examined when key investments and decisions (so called 'trigger points') need to be made to ensure that they can respond in a timely way under each future. This then allowed Affinity Water to determine which actions they need to take in AMP7 to enable their adaptive plan. They then carried out a 'least regrets' analysis where they compared the adaptive plan against a 'wait and see' alternative that did not include the relevant enabling actions and hence lower cost, long lead time strategic options, to confirm whether or not the longer-term benefits of the enabling actions outweigh the shorter-term costs, on an economic, probability weighted basis.

All reasonable alternative programmes/ adaptive futures identified by Affinity Water were assessed through the SEA process. This included consideration of potential cumulative effects between schemes under each programme as well as with other WRMPs. The findings of this work informed Affinity Water's decision of which programmes/ adaptive futures to progress.

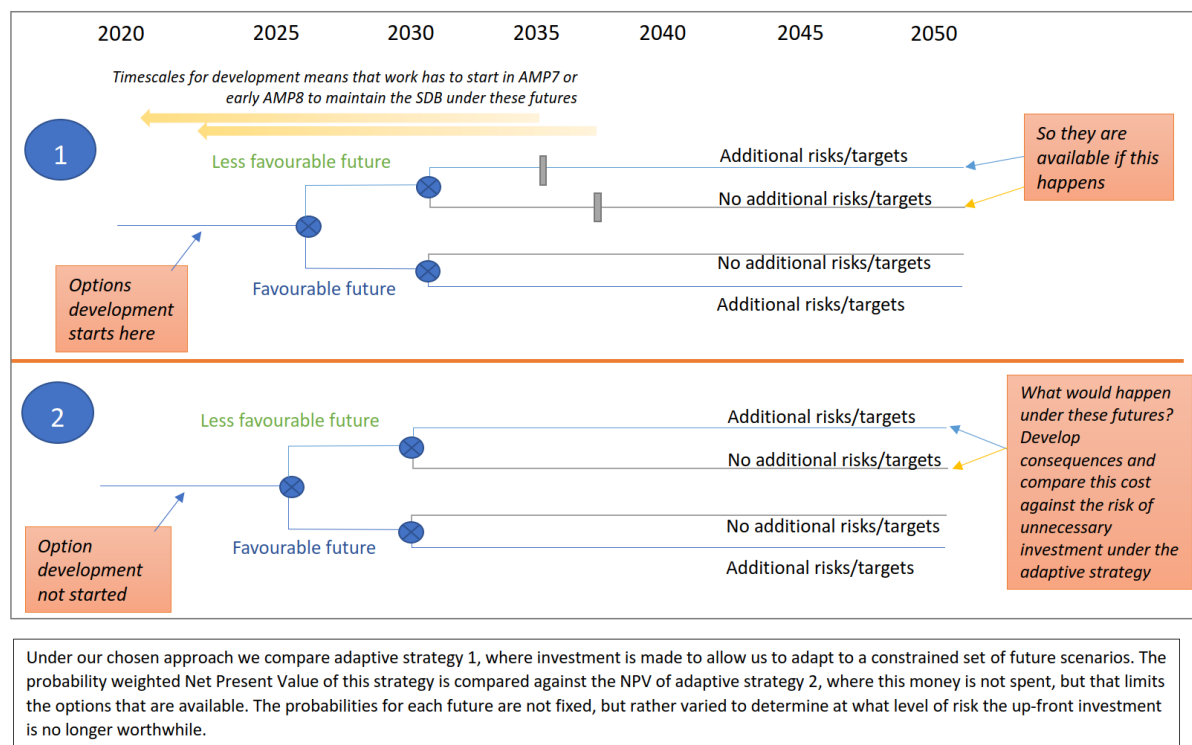
Because Adaptive Pathways Planning is potentially a very complex form of modelling, Affinity Water used the analyses contained in Step 1 (least cost economic modelling) and Step 2 (customer preference and MCA impact analysis) to identify which uncertainties had the most impact on the best value plan. The uncertainties were then packaged into a relatively small number of future branches, which represented the plausible futures that Affinity Water might have to adapt to within the 2080 time horizon.

Whilst the methodology that Affinity Water has adopted is innovative, which is necessary to address the significant problems that they face (large forecast deficits, uncertainties of ambitious long-term demand management activities and the long lead times on our strategic supply side solutions), it was made sure that it complies with regulatory guidance and is transparent to stakeholders. Specifically, the decision-making process incorporated the following elements:

- It maintains the 'least cost' EBSD modelling as the initial stage of assessment and demonstrates how and why Affinity Water have changed from that in our final 'best value' Plan.
- It provides a reasoned justification for the decision on the preferred solution, which is supported by stages customer and stakeholder analysis and appropriate, conventional economic modelling.
- The adaptive pathways analysis component demonstrates the ability of the solution to cover a range of possible futures and provide resilience, whilst at the same time fully demonstrating (using 'least regrets' analysis) that the benefits of the proposed enabling actions are cost beneficial in the medium and long term.

Each of the adaptive pathways shown in **Figure 5.2** were modelled within EBSD with various stipulations applied to the modelling conditions to simulate different futures. For example, the less favourable future will see less demand management reduction as to represent a pessimistic view, and the futures with additional risks/ targets will include 50% leakage reduction and/ or low PCC targets fixed into the modelling.

Figure 5.2: Summary of the Selected Decision Making Process



For further details on the programme appraisal and Affinity Water's decision-making process for the rdWRMP please refer to the separate Decision Making Report (2019).

5.2.1 Integration of SEA into the programme appraisal

Affinity Water, AECOM (SEA consultants) and DecisionLab (who created the model) worked closely to develop an integrated approach to programme modelling for the rdWRMP19. In line with extant guidance, it is important to ensure that the SEA effectively influences the decision making process for the rdWRMP19.

As demonstrated in the **Section 4.3** and **Appendix V** of this Environmental Report, each constrained option (including supply-side, demand management and drought) were assessed against the full SEA Framework of objectives. From the predicted residual operational effects identified for each assessment question, a 'worst case' operational effect was also derived for each SEA Objective for input to the model. It should also be noted that Affinity Water had view of the detailed assessments for each of the constrained options, i.e. the likely significant effects during construction and operation, throughout the programme appraisal stage.

In their own right the findings of the assessment for each option and the twelve SEA objectives cannot be effectively utilised in the EBSD modelling, so a collation approach was developed. The collated score was simply calculated by counting the number of "moderate" or "major" positives and "moderate" or "major" negatives ($\geq +2$ or ≤ -2). That means the maximum and minimum scores would be ± 12 . It was discussed if more weighting should be applied to specific SEA objectives (i.e. some objectives are more important than others) but it was determined that this depends on an individual's perspective and would mean that we risk introducing arbitrary weightings so it was agreed that an un-weighted approach should be used.

As an example an option that had the following scores across the 12 categories would result in a positive $+2$ and negative -3 output, so would score -1 overall.

4 are 0
 3 are -1
 2 are +2
 2 are -2
 1 is -3

These SEA scorings were converted into an overall metric score using the matrix shown in Table 15.

Table 5.1: Effect on significance scale

Negative

SEA Score	0	-1 to -3	-4 to -6	-7 to -9	-9 to -12
Environmental Score	1	2	3	4	5

Positive

SEA Score	0	+1 to +3	+4 to +6	+7 to +9	+9 to +12
Environmental Score	-1	-2	-3	-4	-5

It is important to note that this approach and proposed method for integrating the SEA into the programme appraisal stage was set out in the Environmental Report (2018) that accompanied the dWRMP19 on consultation in 2018. No objections to the proposed approach were received from statutory consultees.

As well as the findings being fed into the computer model/ programme appraisal stage, the SEA also informed Affinity Water's decision making (Figure 5.1) at a number of key points.

Step 0 - At this stage a number of options/ supply-side schemes were removed from consideration to reflect the findings of the SEA, HRA and WFD as well as feedback received from customers and statutory consultees. These schemes related to new chalk groundwater schemes in the Central Region.

Step 2 - During this stage the SEA findings informed the 'bottom up' multi-criteria analysis to determine where the key risks and uncertainties lie in the Plan. The SEA findings along with the customer and stakeholder preferences were used to structure the Adaptive Pathways analysis at the next stage. Affinity Water evaluated the environmental and yield scoring on the multi-criteria analysis, where any schemes scoring a 4 or 5 were identified as potentially high risk. As a result of that analysis key uncertainties were raised around the potential yield benefits that might be realised from the Runley Wood (AFF-NGW-WRZ3-1068), Kings Walden (AFF-NGW-WRZ3-1053) and Brent Reservoir (AFF-RES-WRZ4-0832) schemes. For Runley Wood and Kings Walden Lower Greensand, these were identified as potentially posing a WFD compliance risk if abstractions start to affect the northwards flow of groundwater, which is a long-term risk that can only be ascertained through monitoring. This would be mitigated through reduction in abstraction licence or possibly not developing the Kings Wood source. For the Brent Reservoir there is uncertainty around how much yield could be obtained without affecting the benefits from the river support that is currently effectively provided by the reservoir. In both cases Affinity Water considered that the WFD risk can therefore be addressed through a reduction in yield, and is not an unavoidable feature of the scheme. These yield risks were therefore incorporated into the adaptive pathways analysis as part of Step 3 in Affinity Water's decision-making process (Figure 5.1).

Step 3 - Following Step 2 a comparative assessment of all reasonable alternative programmes/ adaptive futures was carried out and the findings of this informed the selection of the preferred programme and adaptive futures in Step 3 of the decision-making process.

It is important to remember that SEA is an assessment tool that is used to inform plan/ decision making. Decisions are not solely based on the findings of the SEA and are also informed by wider assessments, consultation responses and business considerations.

5.2.2 Integration of Ecosystem Services

The potential to undertake a high level ecosystem services assessment to feed into the programme modelling was explored by Affinity Water and AECOM at an early stage in plan-making. An initial approach was set out within the SEA Scoping Report published in December 2016.

The UK National Ecosystem Assessment²² (NEA) classification of ecosystem services was discussed as a starting point for potentially undertaking a high level ecosystem services assessment. The UK NEA provides an assessment of the ecosystem services delivered by different habitat types on a national scale. To try and tailor this assessment more closely to the Study Area, it was proposed that the UK NEA information could be combined with habitat information from relevant Natural England National Character Area (NCA) summaries.

Following further discussions between AECOM and Affinity Water a proposed method was refined and the following steps were identified:

1. Identify the significant effects of the each constrained option through the SEA;
2. For any constrained option identified as having the potential for a residual moderate (2 or -2) or major (3 or -3) effect during operation:
 - a. Undertake an high level analysis linking the option effects to ecosystem services by identifying the:
 - i. habitats affected by the option (e.g. waterways);
 - ii. the ecosystem services associated with those habitats (e.g. provision of water supply, recreation, fish stocks);
 - iii. relative importance of the habitats in delivering ecosystem services (e.g. waterways are essential for supporting fish stocks whereas grasslands are not); and
 - iv. direction of change of the ecosystem service associated with the habitat (e.g. fish stocks are generally declining).
3. Provide a qualitative assessment or commentary on the potential implications of implementing the option on identified habitats and services.

The high level ecosystem service assessment to be undertaken in Step 2 would be based on information from the UK NEA (UNEP-WCMC, 2014) and National Character Area profiles (Natural England, 2014) for the relevant geographic locations.

Once an option has been subjected to further assessment under Part 2 above, an overall ecosystem services score would be provided and this would be informed by the evidence available and based on professional judgment. A three point scoring system +1, 0, and -1 would be used. A positive score would reflect an ecosystems service benefit whereas a negative score would reflect an adverse effect on ecosystem service provision. A '0' would reflect a neutral effect or indicate uncertainty if there is insufficient evidence to make a judgement in terms of a positive or negative effect. The ESS would reflect the predicted effects in the long-term during the operational phase rather than short-term or temporary effects arising during construction. The intention was that the ecosystem services score would be incorporated separately into the modelling to provide more 'levers' for the model to adjust.

Following a more detailed review and consideration of evidence, it was determined that there was insufficient data available to undertake a meaningful assessment in terms of the impact of constrained options on ecosystem services. The limited data available in relation to habitats present within the footprint of constrained options and the services they provide would mean that the assessment would not add any value to what was already being considered through the SEA and other assessments, including environmental costs.

To allow for the integration of ecosystem services in the future as part of the next Periodic Review it is recommended that:

- Further data is gathered about the habitats present within Affinity Water's operating area and the ecosystem services and natural capital they provide; and
- Hold discussions with the Environment Agency and Natural England to identify and address potential data gaps, as well as agree an approach for the consideration of ecosystem services and natural capital as part of Affinity Water's decision-making framework.

²² UK National Ecosystem Assessment (2011) The UK National Ecosystem Assessment: Synthesis of Key Findings. UNEP-WCMC, Cambridge [online] @ <http://uknea.unep-wcmc.org/Resources/tabid/82/Default.aspx>

5.3 Identifying reasonable alternative programmes

The SEA Directive states in Article 5 that “*an environmental report shall be prepared in which the likely significant effects on the environment of implementing the plan or programme, and reasonable alternatives taking into account the objectives and the geographical scope of the plan or programme, are identified, described and evaluated*”.

Whilst the rdWRMP19 has a number of objectives, it is clear that meeting the water supply needs of customers over the next 25 years is at the heart of the plan. It is the key issue to be addressed, and taken to be the primary objective of the plan. This is reflected in Environment Agency’s WRP (2018), which states in Section 3 that, “*If there is a deficit you must identify options to increase supply or reduce demand so that you achieve a secure supply of water*”.

There are a number of important secondary objectives that have been derived as a result of the guidance and/ or customer, stakeholder or regulator representations to the Affinity Water draft WRMP19 submission in 2018. The secondary objectives are as follows:

1. 1 in 200 Deployable Output (DO Drought Resilience);
2. WINEP3 Sustainability Reductions;
3. No drought options post 2024;
4. To not include source options that pose a risk to the environment in our Central region (no new chalk groundwater options, these are listed earlier in this Chapter);
5. Headroom at 95th percentile;
6. Plan based growth forecast; and
7. AMP7 Leakage Reduction of 18.5%.
8. Strive to reduce PCC (beyond dWRMP19 levels)

For a programme to be considered a reasonable alternative for the purposes of the SEA it must meet the primary and secondary objectives set out above. **Table 5.2** below identifies the model scenarios (and resultant programmes) that were not taken forward in the modelling process and provides outline reasons why they are not considered to represent reasonable alternative programmes.

Table 5.2: Outline reasons for programmes identified as not reasonable

Model scenarios	Outline reasons for rejection
Worst Historic DO	Fails to meet objective 1 as this model scenario would not provide the additional level of DO resilience.
1 in 80 DO	Fails to meet objective 1 as this model scenario would not provide the additional level of DO resilience.
1 in 40 DO	Fails to meet objective 1 as this model scenario would not provide the additional level of DO resilience.
1 in 20 DO	Fails to meet objective 1 as this model scenario would not provide the additional level of DO resilience.
1 in 10 DO	Fails to meet objective 1 as this model scenario would not provide the additional level of DO resilience.
SELL leakage reduction target	SELL provides a much lower leakage reduction than the regulator supported 18.5% AMP7 target. Fails to meet objective 7.
Headroom at 90th percentile	This headroom percentile did not meet secondary objectives which received stakeholder support and fails to meet objective 5.
Headroom at 85th percentile	This headroom percentile did not meet secondary objectives which received stakeholder support and fails to meet objective 5.
Headroom at 80th percentile	This headroom percentile did not meet secondary objectives which received stakeholder support and fails to meet objective 5.
Headroom at 75th percentile	This headroom percentile did not meet secondary objectives which

	received stakeholder support and fails to meet objective 5.
90% WINEP3	This scenario would not meet the requirements of the secondary objective to meet WINEP3. Fails to meet objective 2.
85% WINEP3	This scenario would not meet the requirements of the secondary objective to meet WINEP3. Fails to meet objective 2.
80% WINEP3	This scenario would not meet the requirements of the secondary objective to meet WINEP3. Fails to meet objective 2.
75% WINEP3	This scenario would not meet the requirements of the secondary objective to meet WINEP3. Fails to meet objective 2.
70% WINEP3	This scenario would not meet the requirements of the secondary objective to meet WINEP3. Fails to meet objective 2.
65% WINEP3	This scenario would not meet the requirements of the secondary objective to meet WINEP3. Fails to meet objective 2.
60% WINEP3	This scenario would not meet the requirements of the secondary objective to meet WINEP3. Fails to meet objective 2.
55% WINEP3	This scenario would not meet the requirements of the secondary objective to meet WINEP3. Fails to meet objective 2.
50% WINEP3	This scenario would not meet the requirements of the secondary objective to meet WINEP3. Fails to meet objective 2.
Grafham full licence from 2020	This scenario is not technically feasible to deliver within the timescale. This scenario therefore fails to meet the water supply needs of customers and fails the primary objective of the plan.
Grafham full licence from 2030	Though this scenario is feasible, it would not meet the secondary objective to remove drought options from 2024 onwards. Fails to meet objective 3.
No Ardleigh agreement revert	This scenario poses a risk to the WRZ8 supply demand balance and uncertain WINEP in the future. Fails to meet objective 2.
Trend based growth forecast	Not in line with recent growth pattern. Fails to meet objective 6.
Econometric based growth forecast	Not in line with recent growth pattern. Fails to meet objective 6.
Hybrid growth forecast	Not in line with recent growth pattern. Fails to meet objective 6.
Chalk groundwater options available	Does not meet the secondary objective to not include options that pose a risk to the environment. Fails to meet objective 4.
LC_1 Least Cost	Does not meet appropriate levels of demand management expected of Affinity Water by representations to the draft WRMP19, nor the 15% AMP7 leakage target that is a secondary objective. Fails to meet objective 7.

The model scenarios identified above and their subsequent programmes have not been carried forward for further consideration in the SEA process as they are not reasonable alternatives, in that they do not meet the objectives of the rdWRMP19.

The model runs and resultant programmes identified by Affinity Water as meeting the objectives (primary and secondary) of the rdWRMP19 are set out below:

- **LC_2** - This is a least cost run with 2025 targets on leakage and PCC.
- **ATL_1** - This run introduced four metrics into our modelling process based on the data collated through the optioneering. Each option was scored against these metrics which were based on Risk, Resilience, Environment and Deliverability. The purpose of this approach was to be able to have the functionality to model different 'priorities' within a least cost model. We could allow the model to select options which only allow for low risk for example, and see to what extent that would change the outputs, or with a certain level of environmental benefit required etc. This run was ultimately not taken forward as it excluded key demand management and leakage options on the basis of risk whereby these options would be required to meet specific targets.

- **DMT_1** - This run explores the utilisation of a relatively high amount of water efficiency schemes.
- **AD_1** - This run contains optimistic demand management savings with an expected supply-side future i.e. no supply side restrictions.
- **AD_2** - This run contains expected levels of demand management savings, and also will not allow any strategic options (Options with +50MI/d benefit) to be selected. This model run has an otherwise expected supply-side future. This would help to simulate what options would be required if Affinity Water were unable to progress with a strategic option. It should be noted that the model could not balance supply and demand with no strategic options selected under this scenario. As a result, Affinity Water allowed the selection of AFF-RTR-WRZ3-4016: Minworth Strategic Transfer (100 MI/d) based on the findings of the SEA, WFD and HRA as it was not identified as having any significant negative effects during operation (apart from the carbon related SEA objective).
- **AD_3** - This run contains low levels of demand management savings, and also will not allow any strategic options (Options with +50MI/d benefit) to be selected. This would help to simulate what options would be required if Affinity Water were unable to progress with a strategic option.
- **Aspirational Adaptive Run** - This run contains optimistic levels of demand management savings and the expected supply-side future; however, it looks towards long-term 'stretch' targets. These targets are a reduction in PCC to 110 l/p/d and a 50% reduction in leakage by 2050.
- **Expected Future Adaptive Run** - This run is Affinity Water's central, expected future. This contains the levels of demand management option savings that Affinity Water would expect to see, as well as an expected supply-side future, i.e. no restrictions.
- **Demand-side Challenging Future Adaptive Run** - This run looks to simulate a challenging demand-side future by using lower levels of demand management savings. All of the supply-side options are available, including strategic options (Options with +50MI/d benefit).
- **Supply-side Challenging Future Adaptive Run** - This run includes expected levels of demand management savings, but is challenging on the supply-side as it looks to simulate greater levels of Sustainability Reductions to determine potential solutions, and the yields of some schemes flagged by the WFD assessment for the rdWRMP19 have been halved to understand the impact this would have.
- **Optimistic Adaptive Run** - This run is an adaptation of the **Aspirational Adaptive Run** which incorporates the 50% leakage reduction target, but does not assume policy support for some key demand management options.
- **Environmental Adaptive Run** - This run is an adaptation of the **Expected Future Adaptive Run** and focuses on minimising environmental effects taking account of the findings of the SEA. Options which are identified in the SEA (see Section 4) as having the potential for a moderate (-2) or major negative (-3) effect during operation are not selected for this run²³. This run includes expected levels of demand management savings.

It should be noted that demand management options could have an upper (optimistic), central (expected) and lower (reliable) levels of savings. So they have 3x potential savings. Utilisation of supply side options can vary (from 100% maximum to 0%), whereas demand side options are simply used or not used, hence this ability to change the savings.

Not all of the programmes identified above were carried forward for further assessment through the SEA process:

- **LC_2** was not progressed as it is not ambitious enough in terms of demand management levels expected of Affinity Water as informed by the representations to the draft WRMP19 and as a result, this programme was deemed to not meet secondary objectives 4 and 7.
- **DMT_1** was not carried forward as it includes the selection and utilisation of a relatively high amount of water efficiency schemes, which in combination are recognised to generate a high

²³ In line with extant SEA guidance for WRMPs, schemes identified as having a moderate (-2) or major (-3) major negative effect during operation against SEA Objective 8 (Carbon Footprint) were not excluded as part of this run to avoid double counting. Carbon impacts and costs are already monetised through the programme appraisal stage.

level of delivery risk. Affinity Water deems this level of risk to be unacceptable with regards to meeting the primary objective of the plan; meeting the supply needs of customers. For this reason, it was not progressed as a reasonable alternative programme for the rdWRMP19.

- **ATL_1** was not taken further in the modelling process as it involved metric scoring (explained earlier), which excluded key demand management options on the basis of risk. In reality, Affinity Water are willing to accept the level of risk associated with these excluded demand management options and have covered this within their final plan headroom allocation. As these demand management schemes were excluded in this run, the programme of options lacked the ambition our stakeholders and customers requested through the draft WRMP19 consultation and for this reason this programme did not meet secondary objective 8.

It should be noted that, based on expected levels of demand management savings, the **Environmental Adaptive Run** would result in supply deficits near the end of the planning horizon from 2070. This is due to the removal of a number of key supply-side schemes based on the criteria used for this programme of excluding options identified in the SEA as having the potential for moderate (-2) or major negative (-3) effects during operation. This could be mitigated by expecting optimistic levels of demand management savings but this then reduces the flexibility and resilience of this programme. As a result of the supply deficit late in the plan period, it could be argued that the **Environmental Adaptive Run** is not a reasonable alternative because it does not meet the primary objective of the rdWRMP19. Despite this, the programme was carried forward for further consideration through the SEA process as it provides a useful comparison to the other programmes, in particular the **Expected Future Adaptive Run**.

Taking the above into account, the following programmes were considered further through the SEA reasonable alternative programme assessment process:

- AD_1;
- AD_2;
- AD_3;
- Aspirational Adaptive Run;
- Expected Future Adaptive Run;
- Demand-side Challenging Future Adaptive Plan;
- Supply-side Challenging Future Adaptive Run;
- Optimistic Adaptive Run; and
- Environmental Adaptive Run.

5.4 SEA of reasonable alternative programmes for the revised draft WRMP19

5.4.1 Introduction

Nine programmes were identified as reasonable alternatives and carried forward for further consideration through the SEA process. The supply-side schemes and their delivery dates (DD) proposed under each of the reasonable alternative programmes are presented in **Table 5.3** below and are structured according to WRZs.

It should be noted that the adaptive plan ‘futures’ that are presented here as stand-alone alternatives, rather than as an integrated set of actions. For the adaptive plan itself the Brent Reservoir scheme is included in the expected future, and a minimum leakage target is set based on the economics within that run. Both of these apply to all the alternative futures. That means the dates of some subsequent schemes for the ‘challenging and ‘optimistic’ futures are delayed by 1 or 2 years in the main rdWRMP compared to some of the dates described in the table below.

Table 5.3: Supply-side schemes under each reasonable alternative programme

Supply-side scheme	AD_1		Aspirational		Expected Future		Demand-side Challenging		AD_2		AD_3		Supply-side Challenging		Optimistic		Environmental	
	DD	AMP	DD	AMP	DD	AMP	DD	AMP	DD	AMP	DD	AMP	DD	AMP	DD	AMP	DD	AMP
WRZ1																		
AFF-RTR-WRZ1-4010: Abingdon Reservoir to Harefield Transfer (50MI)	2059	14	2068	16	2053	13	2073	17					2054	13	2057	16		
AFF-RTR-WRZ1-1066: GUC (GUC - Berkhamstead/Hemel Hempstead)	2070	17			2065	16							2062	15	2069	16		
WRZ2																		
AFF-EGW-WRZ2-0090 : Stonecross Source Optimisation			2051	13	2052	13	2050	13	2071	17	2071	17	2039	10			2069	16
WRZ 3																		
AFF-NGW-WRZ3-1068 : Runley Wood (AMP7 LGS Borehole)	2035	10	2046	12	2025	8	2026	8	2025	8	2025	8	2024	7	2037	10		
AFF-NGW-WRZ3-1053 : Kings Walden	2040	11	2051	13	2030	9	2031	9	2030	9	2030	9	2029	8	2042	11		
AFF-CTR-WRZ3-1099 : Boxted to Chaul End	2067	16			2065	15							2059	14	2065	16		
AFF-CTR-WRZ3-4005 : Arkley North	2046	12	2056	14	2041	11	2035	9					2034	9	2045	12		
AFF-CTR-WRZ3-0028 : Iver Arkley Transfer Upgrade			2074	17														
AFF-RTR-WRZ3-4016 : Minworth Strategic Transfer (100 MI/d)							2051	13			2042	11					2034	9
AFF-EFF-WRZ3-0180 : Stevenage STW - Effluent Reuse									2075	18	2075	18						
AFF-RES-WRZ3-0814 : Honeywick Rye Reservoir									2077	18	2077	18						
WRZ 4																		
AFF-CTR-WRZ4-4001 : Egham to Iver	2022	7	2022	7	2022	7	2022	7	2022	7	2022	7	2022	7	2022	7	2022	7
AFF-RES-WRZ4-0832 : Brent Reservoir	2042	11	2052	13	2034	9	2032	9	2031	9	2031	9						
AFF-NGW-WRZ4-0624 : C&R Trust and GSK Slough Boreholes	2044	11	2055	14	2039	10	2035	10	2040	11	2040	11	2026	8	2043	11		
AFF-RTR-WRZ4-4011 : Abingdon to Iver 2 (50MI/d)	2047	12	2056	14	2041	11	2037	10					2037	10	2045	12		
AFF-TPO-WRZ4-0412 : Hillingdon Hospital boreholes			2067	16	2064	15	2050	13	2041	11	2037	10	2065	16			2058	14

	AD_1		Aspirational		Expected Future		Demand-side Challenging		AD_2		AD_3		Supply-side Challenging		Optimistic		Environmental	
Supply-side scheme	DD	AMP	DD	AMP	DD	AMP	DD	AMP	DD	AMP	DD	AMP	DD	AMP	DD	AMP	DD	AMP
WRZ 5																		
AFF-RES-WRZ5-0809 : Birds Green Reservoir					2078	18			2072	17	2072	17	2078	18				
WRZ 6																		
AFF-TPO-WRZ6-1083 : Surrey University (Guildford Site)					2076	18	2071	17	2074	18	2074	17	2076	18	2079	18	2076	18
AFF-RTR-WRZ6-0752 : Ladymead Optimisation					2077	18		2076	18	2076	18	2076	18					
AFF-EGW-WRZ6-0173 : Clandon Source Optimisation					2079	18		2076	18	2076	18			2079	18	2076	18	
AFF-ASR-WRZ6-0174 : Egham ASR							2072	17			2074	17	2077	18				
AFF-NGW-WRZ6-0005 : Horsley source recommissioning											2079	18						
WRZ 7																		
AFF-RTR-WRZ7-0639 : Deal Continuation After 2020	2020	7	2020	7	2020	7	2020	7	2020	7	2020	7	2020	7	2020	7	2020	7
AFF-RTR-WRZ7-0909 : Barham Continuation (After 2019/20)	2020	7	2020	7	2020	7	2020	7	2020	7	2020	7	2020	7	2020	7	2020	7
AFF-EGW-WRZ7-0629 : Lye Oak Licence Variation	2021	7	2021	7	2021	7	2021	7	2021	7	2021	7	2021	7	2021	7	2021	7
AFF-RNC-WRZ7-0900 : Dover Constraint Removal	2022	7	2022	7	2021	7	2022	7	2022	7	2022	7	2022	7	2022	7	2022	7
AFF-EGW-WRZ7-0908 : Tappington South - Licence Variation	2059	14	2074	17	2044	11	2041	11	2044	11	2044	11	2049	12	2057	14	2048	12
AFF-RTR-WRZ7-0301 : Barham Import Increase (of 2MI/d) to 4 MI/d	2071	17			2057	14	2053	13	2068	16	2068	16	2061	15				
AFF-RNC-WRZ7-0626 : Broome Network Improvement					2066	16	2063	15	2057	14	2057	14	2070	17	2069	16	2058	14
AFF-RTR-WRZ7-0842 : Aldington to Saltwood Import Increase by 3MI/d							2020	7									2072	17
Total number of supply-side options	16		16		23		21		20		23		22		17		13	

5.4.2 SEA of AD_1

This run contains optimistic demand management savings with an expected supply-side future i.e. no supply side restrictions. The supply-side schemes proposed under this programme are set out in the table below along with their delivery dates.

Table 5.4: AD_1 supply-side schemes

Supply scheme	Delivery date	AMP
AFF-RTR-WRZ7-0639 : Deal Continuation After 2020	2020	7
AFF-RTR-WRZ7-0909 : Barham Continuation (After 2019/20)	2020	7
AFF-EGW-WRZ7-0629 : Lye Oak Licence Variation	2021	7
AFF-CTR-WRZ4-4001 : Egham to Iver	2022	7
AFF-RNC-WRZ7-0900 : Dover Constraint Removal	2022	7
AFF-NGW-WRZ3-1068 : Runley Wood (AMP7 LGS Borehole)	2035	10
AFF-NGW-WRZ3-1053 : Kings Walden	2040	11
AFF-RES-WRZ4-0832 : Brent Reservoir	2042	11
AFF-NGW-WRZ4-0624 : Canal and Rivers Trust and GSK Slough Boreholes	2044	11
AFF-CTR-WRZ3-4005 : Arkley North	2046	12
AFF-RTR-WRZ4-4011 : Abingdon to Iver 2 (50MI/d)	2047	12
AFF-RTR-WRZ1-4010 : Abingdon Reservoir to Harefield Transfer (50MI)	2059	14
AFF-EGW-WRZ7-0908 : Tappington South - Licence Variation	2059	14
AFF-CTR-WRZ3-1099 : Boxted to Chaul End	2067	16
AFF-RTR-WRZ1-1066 : Grand Union Canal (GUC - Berkhamstead/Hemel Hempstead)	2070	17
AFF-RTR-WRZ7-0301 : Barham Import Increase (of 2MI/d) to 4 MI/d	2071	17

5.4.2.1 Assessment findings

A summary of the key findings for the supply-side schemes under this programme is provided below in **Table 5.5**.

Table 5.5: AD_1 summary SEA findings

Supply scheme	Delivery date	AMP	SEA Objectives and assessment questions																																		
			1			2			3			4		5					6		7	8		9	10				11	12	13		14				
			1a	1b	1c	2a	2b	2c	3a	3b	4a	4b	5a	5b	5c	5d	5e	6a	6b	7a	8a	8b	9a	10a	10b	10c	10d	11a	12a	13a	13b	14a					
AFF-RTR-WRZ7-0639 : Deal Continuation After 2020	2020	7	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O			
AFF-RTR-WRZ7-0909 : Barham Continuation (After 2019/20)	2020	7	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
AFF-EGW-WRZ7-0629 : Lye Oak Licence Variation	2021	7	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
AFF-CTR-WRZ4-4001 : Egham to Iwer	2022	7	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
AFF-RNC-WRZ7-0900 : Dover Constraint Removal	2022	7	0	1	0	1	0	0	0	0	-1	0	-1	0	-1	0	-1	0	0	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
AFF-NGW-WRZ3-1068 : Runley Wood (AMP7 LGS Borehole)	2035	10	0	1	0	1	0	0	0	?	-1	0	?	0	0	0	0	-1	-1	0	?	?	?	?	?	-1	0	?	0	-1	-1	0	0	0	0		
AFF-NGW-WRZ3-1053 : Kings Walden	2040	11	0	1	0	1	0	0	0	?	?	0	0	0	0	0	0	-1	-1	0	0	?	?	?	?	?	?	?	0	-1	-1	0	0	0	0		
AFF-RES-WRZ4-0832 : Brent Reservoir	2042	11	0	1	0	1	0	0	0	?	-1	0	-1	0	-1	0	-2	0	-1	-1	0	0	-1	-1	0	0	-1	-1	0	0	0	0	-2	-1	0	0	
AFF-NGW-WRZ4-0624 : Canal and Rivers Trust and GSK Slough Boreholes	2044	11	0	1	0	1	0	0	0	?	-1	0	-1	0	-1	0	0	-1	0	0	0	?	-1	0	?	?	-1	0	-1	-1	0	0	-1	-2	0	0	
AFF-CTR-WRZ3- 4005 : Arkley North	2046	12	0	1	0	1	0	0	0	0	0	0	-1	0	-1	0	0	0	0	0	0	?	?	?	?	?	?	-1	0	-1	-1	0	0	0	0		
AFF-RTR-WRZ4- 4011 : Abingdon to Iwer 2 (50M/d)	2047	12	0	2	0	2	0	2	0	-1	-2	1	-2	-1	0	-3	0	-1	0	-2	-1	?	?	-2	-1	?	2	-3	-2	?	2	-2	-1	-3	-3	0	0
AFF-RTR-WRZ1- 4010 : Abingdon Reservoir to Harefield Transfer (50M/d)	2059	14	0	2	0	2	0	2	0	-1	-2	1	-2	-1	0	-3	0	-1	0	-2	-1	?	?	-2	-1	?	2	-3	-2	?	2	-2	-1	-3	-3	0	0
AFF-EGW-WRZ7-0908 : Tappington South - Licence Variation	2059	14	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	?	?	?	?	?	?	0	0	-1	0	0	0	0	0	0	
AFF-CTR-WRZ3-1099 : Boxed to Chaul End	2067	16	0	1	0	1	0	0	0	-1	0	-1	0	-1	0	0	-1	0	-1	0	0	?	?	?	?	?	?	0	0	-1	-1	0	0	-1	0	0	
AFF-RTR-WRZ1-1066 : Grand Union Canal (GUC - Berkhamstead/Hemel Hempstead)	2070	17	0	2	0	2	0	0	0	0	-1	0	-1	0	-1	0	0	-1	0	-1	0	?	?	?	?	?	?	-2	-1	?	?	0	0	-2	-2	0	0
AFF-RTR-WRZ7-0301 : Barham Import Increase (of 2M/d) to 4 M/d	2071	17	0	1	0	1	0	0	0	0	0	0	0	0	0	0	-2	0	?	?	?	?	?	?	?	?	?	?	0	0	-1	-1	0	0	0	0	

AMP7 (2020-25)

The five supply-side schemes to be delivered within the first five years (2020-25) of the plan period during AMP7 all propose minimal new infrastructure. As a result, they are not identified as having the potential for a significant negative effect either during construction or operation through the SEA, HRA or the WFD assessment.

AFF-RTR-WRZ7-0639: Deal Continuation After 2020 and **AFF-RTR-WRZ7-0909: Barham Continuation (After 2019/20)** propose the continuation of current agreements with Southern Water and South East Water respectively for the import of water. No new infrastructure is required for either of these schemes and no negative effects identified through the assessment.

AFF-EGW-WRZ7-0629: Lye Oak Licence Variation involves a negotiation to increase the abstraction license at Lye Oak. The increase in abstraction would be by 0.14MI/d consistent with the volume of the “returned” water (around 4% of the abstraction). The assessment found that there is the potential for minor negative effects during operation against SEA objectives relating to East Kent Chalk Stour groundwater levels given the increased abstraction; however, this is likely to be local and minor given the small increase. As a result of this there is also some uncertainty identified against the SEA objective relating to biodiversity as a result of the potential for indirect effects and close proximity of the Lydden and Swingfield Woods SSSI. However, it is again considered that given the small increase in abstraction there is unlikely to be any significant negative effects. Mitigation could include a hands-off flow condition to prevent abstraction at low flows below a certain level. As a result it is recommended that the water level in the East Kent Chalk Stour groundwater body and condition status of the Lydden and Swingfield Woods SSSI are monitored.

AFF-RNC-WRZ7-0900: Dover Constraint Removal involves the removal of network constraints by construction of a new main from Primrose Treatment Works to The Cricketer's Public House with connection into the existing network; this will allow increased abstraction from the groundwater sources and transfer to Folkestone. The scheme involves minimal new infrastructure with a new 1.19km main and 1 x 1 m3 Surge Vessel. Minor negative effects are identified during construction against SEA objectives relating to recreation/ tourism, road infrastructure, biodiversity and landscape primarily as a result of the delivery of the new pipeline. Impacts will be temporary, local and minor and good practice construction methods should ensure that there are no significant negative effects.

AFF-CTR-WRZ4-4001: Egham to Iwer involves the installation of a new booster station on an existing site, which will allow 17 MI/d to be pushed through the existing main. This will allow transfer of 17 MI/d from Egham to Harefield, which will allow use of the existing surplus within the Wey community (WRZ4). The scheme involves minimal new infrastructure and the assessment found that there would be a residual neutral effect against the majority of SEA objectives during construction and operation. Standard construction practices should ensure that there are no significant impacts during the construction phase.

AMP10 (2035-40)

Under this programme no further supply-side options would be delivered until 2035 in AMP10. The only scheme proposed during this period is **AFF-NGW-WRZ3-1068: Runley Wood (AMP7 LGS Borehole)** - a scheme to license a new borehole in the Lower Greensand aquifer within the existing Runley Wood site boundary to allow an increased abstraction at this site. The assessment found that there is the potential for a moderate negative effect for SEA objectives 10 (WFD status) and 11 (surface/ ground water levels and flows). This was informed by the WFD assessment for the rdWRMP19, which identifies that the groundwater abstraction may influence local water balance in Woburn Sands groundwater body depending on extent of confined Lower Greensand (LGS) abstraction influence. It suggests that this needs to be confirmed through further hydrogeological survey work. There is also the potential to affect groundwater body input to the River Flit which could have impacts on water levels/ flow and quality. The WFD assessment recommends that further information and assessment required. Given the delivery date of this scheme in 2035, there would be sufficient time to undertake further investigative work and detailed assessments to determine the likelihood and significance of effects along with suitable mitigation measures. Mitigation could include a hands-off flow condition to prevent abstraction at low flows below a certain level. As a result it is recommended that the water level in the Woburn Sands groundwater body is monitored.

As a result of the above, the assessment also identifies that there is some uncertainty in terms of indirect effects on biodiversity (SEA objective 5) reliant on the River Flit during operation although it is unlikely that this would be of significance. The assessment also identified that there is also the potential for a negative effect on SEA objective 5 (biodiversity) during construction. The scheme requires the delivery of a short 580m pipeline to connect the borehole/ LGS WTW to the Chaul End Reservoir and this crosses over some priority habitat (deciduous woodland). Given the location of the scheme it is unlikely that the route of the pipeline could be altered to avoid the habitat, given that the borehole and reservoir are separated by the M1 and the priority habitats run along either side of the motorway. Pipe jacking/ directional drilling could be used to avoid any loss of the habitat but the feasibility of this is uncertain at this stage and should be explored further at the detailed design stage.

AMP11 (2040-45)

Three supply-side schemes are proposed for delivery during AMP11 under this programme. As for **AFF-NGW-WRZ3-1068: Runley Wood (AMP7 LGS Borehole)** in AMP10, similar issues are also identified through the assessment for **AFF-NGW-WRZ3-1053: Kings Walden**. This scheme proposes a Lower Greensand borehole to be drilled on the existing site at Kings Walden for an output of 3MI/d. The existing site already has a Chalk groundwater source. This water could then be used for blending with the chalk source on site that suffers from high nitrates.

The assessment found that there is the potential for a moderate negative effect for SEA objectives 10 (WFD status) and 11 (surface/ ground water levels and flows). This was informed by the WFD assessment for the rdWRMP19, which identifies that the groundwater abstraction may influence local water balance in Woburn Sands groundwater body depending on extent of confined Lower Greensand (LGS) abstraction influence. However, the WFD assessment notes that the LGS aquifer becomes unconfined more than 13 km north of the abstraction point, therefore any impact would be naturally mitigated due to the distance. It suggests that this needs to be confirmed through further hydrogeological survey work. There is also the potential to affect groundwater body input to the River Ivel which could have impacts on water levels/ flow and quality at a local scale.

The WFD assessment recommends that further information and assessment required. Given the delivery date of this scheme in 2040, there would be sufficient time to undertake further investigative work and detailed assessments to determine the likelihood and significance of effects along with suitable mitigation measures. Mitigation could include a hands-off flow condition to prevent abstraction at low flows below a certain level. As a result it is recommended that the water level in the Woburn Sands groundwater body is monitored.

As a result of the above, the assessment also identifies that there is some uncertainty in terms of indirect effects on biodiversity (SEA objective 5) reliant on the River Ivel during operation although it is unlikely that this would be of significance. The mitigation identified above would reduce the potential for any residual negative effects in the medium to long-term.

AFF-RES-WRZ4-0832: Brent Reservoir proposes the import of water from the Canal & River Trust reservoir at Brent. The water would be transmitted via the River Brent and the Grand Union Canal to the existing Iver Water Treatment Works for abstraction and subsequent treatment at a new Iver 2 WTW. The option includes upgraded storage at a new Harrow Service Reservoir within WRZ4.

The assessment identified that during the construction phase there is the potential for negative effects on SEA objectives 6 (landscape) and 13 (historic environment). The scheme includes a new Harrow service reservoir at Harrow on the Hill, which is an important local area of open/ green space surrounded by the existing built area that provides areas for recreation and contributes to the character of the landscape/ townscape. The new reservoir is also situated in close proximity to the Harrow Park Registered Park and Garden. Potential for moderate negative effects during construction against SEA objectives relating to the landscape and historic environment. The assessment recommends the retention of hedgerows, trees, walls wherever possible and the re-instatement of soil/ land following construction of the pipeline. It also proposes the use of construction methods and barriers/ hoardings that are sympathetic to the aesthetics of the surrounding landscape. Where possible any opportunities to merge the reservoir embankment into the landscape should be explored.

During operation **AFF-RES-WRZ4-0832: Brent Reservoir** proposes the release of water from the reservoir, which is also a SSSI. The Brent Reservoir SSSI is currently in a favourable condition and is

designated for breeding wetland birds, in particular for significant numbers of nesting great crested grebe, as well as wetland plant communities. There is uncertainty at this stage with regard to the extent and frequency of drawdown in the reservoir as a result of this proposed scheme. The Great Crested Grebe nest in reed beds and the Passerines (bullfinch, greenfinch, jay, willow warbler and wren) nest in willow woodland broadly between March and July so higher/ lower water levels in these periods could affect them. The wintering birds (Pochard, Gadwall, Snipe, Jack snipe and Smew) could also be affected as again; changing water levels could affect the amount of terrestrial habitat surrounding the waterbody that could be available for them to rest on when out of the water. The wetland plant species are sensitive to changes in water levels. It will be important to prevent the water levels from fluctuating significantly and frequently as this could displace plants as they move up/ or down in the inundation zone.

There are ongoing discussions between Affinity Water and the Canal & River Trust who operate the reservoir. More detailed hydrological investigations need to be carried out in order to determine the extent and frequency of drawdown as a result of this scheme and how the hydrological conditions affect the wetland habitats and birds they support. The assessment proposes that the water levels in the Brent Reservoir are monitored to inform the need and use of hands-off flow conditions to restrict the release of water when levels are low. Furthermore, the release of water could also be restricted during the breeding/ nesting seasons (broadly March to July). The condition status of the Brent Reservoir SSSI should also be monitored.

AFF-NGW-WRZ4-0624: Canal & River Trust and GSK Slough Boreholes option involves obtaining supplies from existing Lower Greensand boreholes that are currently owned by third parties in the Slough area. The Lower Greensand water is to be pumped via a new pipeline along the Grand Union Canal towpath for treatment at a new Iver 2 WTW location (the existing Iver WTW is at full capacity). A new pipeline will then take the water to existing Iver for onward transfer to an upgraded Harrow Service Reservoir for use in WRZ4 (or WRZ2).

The assessment identifies the potential for a moderate negative effect against SEA objectives relating to surface and groundwater body status and flows. The WFD assessment notes that the GSK abstraction is/ was discharged to the Salthill stream following its use as non-evaporative cooling. As a result the WFD assessment found that there is a potential for a reduction in water returned to the surface water body that may lead to deterioration of status and flows. The proposed scheme may involve diverting this discharge to Affinity Water for consumptive use. The WFD assessment recommends that further information and assessment required. The discharge volume needs to be quantified and further WFD assessment undertaken to determine if could impact the status of the Salthill Stream surface water body. Given that the delivery date of this scheme is 2044 there is sufficient time to investigate this issue further.

AMP12 (2045-50)

Two supply-side schemes are proposed for delivery during AMP12 under this programme. The first of these, **AFF-CTR-WRZ3-4005: Arkley North**, will be delivered in 2046. This scheme allows for the bypass of Arkley 2 Reservoir and seeks to improve the interconnectivity between reservoirs. It involves minimal new infrastructure (50m of new main) and is not identified in the SEA, HRA or WFD assessment as having the potential for a significant negative effect during construction or operation. The potential for minor negative effects are identified during construction of the new pipeline but it is considered that there is suitable mitigation available through standard construction practices to ensure that there are no residual significant negative effects.

The second supply-side is a strategic scheme to be delivered in 2047. **AFF-RTR-WRZ4-4011: Abingdon to Iver 2 (50MI/d)** involves an increased abstraction from the River Thames at Sunnymeads, onwards transfer by a new main for treatment at Iver 2 WTW. Water will be discharged from a new South East Strategic Reservoir (within the Thames Water Supply Area) to augment river flows to support the downstream abstraction at Sunnymead. The increased abstraction will provide an additional 50 MI/d during both peak and average conditions for use within WRZ4.

During construction the assessment found that there is the potential for significant negative (moderate and major) effects against a number of SEA objectives as a result of this scheme due to the scale of new infrastructure required. This includes:

- Major negative effects for SEA objectives relating to material consumption and carbon footprint due to the scale of infrastructure.
- Moderate negative effects for SEA Objective 3 due to temporary disruption to local and strategic transport infrastructure, including public rights of way and major roads.
- Moderate negative effects also anticipated for SEA Objective 7 relating to Hillingdon AQMA and Marcham AQMA given the level of traffic anticipated during construction.
- Moderate negative effects for SEA Objective 5 due to temporary and permanent disruption to biodiversity, including internationally and nationally designated sites and other important habitats and species.
- Major negative effects for SEA Objective 6 given the construction of Abingdon reservoir is likely to have significant effects on the landscape. This includes impact on the setting of the North Wessex Downs AONB, and extensive disruption to views, visual amenity and landscape character.
- Major negative effects for SEA Objective 13 as a result of the heritage assets located within close proximity to the new reservoir and pipeline (including archaeological assets).

During operation the assessment found that there is the potential for significant negative (moderate and major) effects against a number of SEA objectives as a result of this scheme due to the scale of new infrastructure required. This includes:

- Moderate negative effects for SEA Objective 6 given that the new reservoir ancillary infrastructure would be a prominent new feature in the landscape. Notably, three towers will be seen against the visual context of the North Wessex Downs AONB to the south and east.
- Major negative effects for SEA Objective 8 relating to carbon footprint due to the scale of infrastructure.

During operation the assessment found that there is the potential for significant positive (moderate) effects against a number of SEA objectives as a result of this scheme due to the scale of new infrastructure required. This includes:

- Moderate positive effects for SEA Objective 2 in relation to tourism, recreation and amenity facilities.
- Moderate positive effects for SEA Objective 5 as the scheme is anticipated to provide opportunities for biodiversity enhancement and net gain.
- Moderate positive effects for SEA Objective 6 as the scheme presents opportunities for landscape enhancements and improvements. Specific mitigation measures and enhancements will be developed in the detailed design stages.
- Moderate positive effects for SEA Objective 8 as the scheme is upgrading transfer and storage capacity, resulting in positive effects on the resilience of Affinity Water's assets to climate change.

AMP14 (2055-60)

Two supply-side schemes are proposed for delivery during AMP14 under this programme. The first is a strategic scheme, **AFF-RTR-WRZ1-4010: Abingdon Reservoir to Harefield Transfer (50MI)**, which is closely linked to **AFF-RTR-WRZ4-4011** delivered in AMP12.

AFF-RTR-WRZ1-4010: Abingdon Reservoir to Harefield Transfer (50MI) utilises the same infrastructure as **AFF-RTR-WRZ4-4011** up to point near Iver 2 WTW. It would then extend the mains northward to an upgraded Harefield Reservoir and Harefield Treatment Works. The detailed assessment of this scheme was carried out on the basis that this scheme could include the delivery of the South East Strategic Reservoir (SESR). However, the SESR would already be established at this point given the earlier delivery of **AFF-RTR-WRZ4-4011**. While there is still the potential for negative effects as a result of the delivery of the pipeline and expanded Harefield reservoir it is considered that there is suitable mitigation available to ensure that residual effects are minor. It is also considered that there is unlikely to be any significant negative effects during operation.

The second supply-side scheme to be delivered in AMP14 during the same year is **AFF-EGW-WRZ7-0908: Tappington South - Licence Variation**. This scheme involves the re-commissioning of the

currently disused borehole at Tappington Source to provide resilience for the licence group. The scheme involves minimal new infrastructure and was not identified as having the potential for a significant effect through the SEA, HRA or the WFD assessment.

AMP16 (2065-70)

Only one supply-side scheme is proposed during AMP14. **AFF-CTR-WRZ3-1099: Boxted to Chaul End** involves a transfer of 40MI/d of treated water by a new main from Boxted Pump Station to Chaul End Reservoir via Friars Wash. The scheme includes a 40MI capacity upgrade of Chaul End Reservoir amongst other new infrastructure.

Key issues identified during the construction phase include potential impacts on landscape and biodiversity. A small proportion (approx 500m) of the pipeline route falls within the Chilterns AONB. The rest of the pipeline predominantly falls within rural areas and follows existing infrastructure, such as roads. The construction of the pipeline is identified as having the potential for a minor negative effect in the short term and a residual neutral effect during operation once buried. The upgrade of the Chaul End Service Reservoir is likely to have moderate negative effects on landscape during construction and it should be noted that the Chilterns AONB is around 550m from the reservoir. Once mitigation is taken into account it is unlikely that there will be any significant negative effects during operation, particularly given that the Chaul Reservoir lies in close proximity to the M1 and is separated from the AONB by new residential development. A new pump house may be required and other minor structures but these will be installed at a pre-existing pump station and will therefore not result in significantly visible new infrastructure.

Mitigation measures should include the retention of hedgerows, trees, fields, walls wherever possible and the re-instatement of soil/ land following construction of the pipeline. Use construction methods and barriers/hoardings that are sympathetic to the aesthetics of the surrounding landscape and historic environment. The delivery of screening/ planting should ensure that the residual effects during operation are reduced. More detailed mitigation measures should be explored at the detailed design stage.

The construction of the new pipeline route may result in the loss of priority habitats (in particular deciduous woodland) near to the Chaul End Reservoir. The assessment recommends that the pipeline is re-routed at the detailed design stage to avoid the priority habitat near to Chaul End Reservoir. There is also the potential for disturbance to species during the construction of the pipeline route; however, good practice construction methods should ensure that there are no significant negative effects.

AMP17 (2070-75)

Two supply-side schemes are proposed during AMP16. The first of these is **AFF-RTR-WRZ1-1066: Grand Union Canal (GUC - Berkhamstead/Hemel Hempstead)** and is scheduled to be delivered in 2070. This scheme proposes the cascade of water from the Severn Trent Minworth Sewerage Treatment Plant via the Grand Union Canal for abstraction at Hemel Hempstead. From here raw water would be transferred to a new Boxted Treatment Works for treatment and ultimately stored in an expanded Boxted Reservoir.

The assessment found that there is the potential for a moderate negative effect for SEA objectives 10 (WFD status) and 11 (surface/ ground water levels and flows). This was informed by the WFD assessment for the rdWRMP19, which identifies that the abstraction has the potential for impacts during operation on water levels/ flows and quality in the Tame (R Rea to R Blythe and from R Blythe to River Anker) surface water body. It suggests that this needs to be confirmed through further hydrogeological survey work. Given the delivery date of this scheme in 2070, there would be sufficient time to undertake further investigative work and detailed assessments to determine the likelihood and significance of effects along with suitable mitigation measures. Mitigation could include a hands-off flow condition to prevent abstraction at low flows below a certain level. As a result it is recommended that the water levels in the Tame (R Rea to R Blythe and from R Blythe to River Anker) surface water body are monitored.

The scheme proposes new infrastructure that is in close proximity to the Chilterns AONB. Potential for a moderate negative effect on the SEA objective relating to the landscape during construction. The assessment recommends that any new visible infrastructure should be designed sympathetically to fit in with the surrounding landscape, and/or screened as appropriate by landscaping and planting. Residual minor negative effect identified during operation primarily as a result of the expanded Boxted Reservoir.

The second scheme to be delivered in AMP17 in 2071 is **AFF-RTR-WRZ7-0301: Barham Import Increase (of 2 MI/d) to 4 MI/d**. An agreement between Affinity Water and South East Water exists for the import of 2 MI/d via the Barham Interconnection Point. This scheme proposes an increase of this import by 2 MI/d to a total of 4 MI/d for transfer to Chalksole Reservoir. This scheme will require a 2 MI upgrade of Chalksole Service Reservoir.

The Chalksole Reservoir is situated within the Kent Downs AONB and is surrounded by areas of Priority Habitat (deciduous woodland) that is also listed as Ancient and Semi-Natural Woodland. Potential for moderate negative effects on SEA objectives relating to biodiversity and the landscape during construction; however, it is acknowledged that there is uncertainty as the precise direction and area of land lost to the reservoir expansion is not known at this stage. The assessment notes that there are a number of areas around the existing reservoir where there are no designated habitats. It is therefore considered that there is high likelihood that the upgrade of the reservoir can avoid the important habitats and this should be explored as a first step at the detailed design stage. Further consultation with NE will be necessary as well as more detailed ecological surveys.

The assessment recommends that any new structures (such as the above ground concrete tank structure associated with the reservoir upgrade) should be designed sympathetically to fit in with the surrounding landscape, and/or screened as appropriate by landscaping and planting. More detailed mitigation measures should be set out at the detailed design stage.

5.4.2.2 Cumulative effects

Overall the cumulative effects assessment provided in **Appendix VI** has found that there is a low risk arising during construction of cumulative adverse effects regarding the SEA topic of population and human health. Extended construction related mitigation such as detailed routing, traffic planning and management and limitation of works within peak periods/ times will minimise the potential cumulative effects identified.

Regarding the SEA water topic, the assessment has identified a low risk of cumulative adverse effects as a result of schemes interacting with the potential to affect the Lower Thames Gravels Groundwater Body, the Thames (Cookham to Egham) Surface Water Body and the Colne (from confluence with Chess to River Thames) Surface Water Body; where mitigation, including CoPC and best practice for design, construction and operations is recommended.

The assessment has also identified a medium risk of cumulative adverse effects as a result of schemes interacting with the potential to affect the Upper Bedford Ouse Woburn Sands Groundwater Body. The WFD assessment identifies that further hydrogeological assessment to consider linkage between deep Lower Greensand aquifer and Upper Bedford Ouse Woburn Sands is required. It is also recommended that water levels/flows in the Upper Bedford Ouse Woburn Sands Groundwater Body are monitored and mitigation could include a hands-off flow condition to prevent abstraction if water levels/ flows drop below a certain level.

The assessment has also identified the potential for positive cumulative effects arising as a result of schemes (AFF-RTR-WRZ1-4010 and AFF-RTR-WRZ4-4011) interacting to improve water levels and flow rates, improve habitats and improve low flows and chemistry within the Thames (Evenlode to Thame, Wallingford to Caversham, and Reading to Cookham) Surface Water Bodies.

Overall the assessment has also found that there are low risks arising (predominantly through construction phases), of cumulative adverse effects regarding the SEA topics relating to biodiversity and landscape and visual amenity. Sensitive receptors found to be at low risk are the Kent Downs AONB, Chilterns AONB, North Wessex Downs AONB, South West London Waterbodies Ramsar and SPA.

The identified cumulative effects in relation to the AONBs are likely to be short-term and temporary associated with traffic and access disruption - including disruption to public rights of way, noise and

disturbance (potentially affecting tranquillity and landscape character in the short term). Extended construction related mitigation such as detailed routing, traffic planning and management and limitation of works within peak periods/ times are considered likely to minimise the potential cumulative effects identified. Any new visible infrastructure should be sensitively designed and adhere to the aims and policies of the relevant AONB Management Plan.

The HRA for the rdWRMP19 recommended a number of mitigation measures in relation to the schemes AFF-RTR-WRZ1-4010 (2059) and AFF-RTR-WRZ4-4011 (2047) which will need to be taken into consideration during construction and operation to minimise the risks associated with the European designated sites (South West London Waterbodies Ramsar and SPA). This mitigation includes an explicit commitment to ensure that the programming and construction processes for the schemes take into account the proximity of the SPA and that construction works on the short section of pipeline adjacent to the SPA are programmed to avoid the winter (October to March) period entirely or are accompanied by an impact assessment including noise modelling and mitigation in line with British Standard BS5228 as required in order to ensure that noise levels can be maintained at an acceptable level.

The WRSE (updated 2018) study into potential cumulative effects between water company WRMPs in South East England identified five schemes proposed under this programme that could interact with schemes proposed in other WRMPs to have a cumulative effect.

This includes four schemes located within the Southeast Region (WRZ 7 - Dour) which are identified as having the potential to have cumulative effects on the Kent Downs AONB as a result of interactions with options being considered through the emerging WRMP19 for Southern Water (BS_Win, IZT_Sel, and BR_Lug):

- AFF-RTR-WRZ7-0909 (Barham Continuation (After 2019/20))
- AFF-RTR-WRZ7-0301 (Barham Import Increase (of 2Ml/d) to 4Ml/d)
- AFF-EGW-WRZ7-0908 (Tappington South Licence Variation)
- AFF-EGW-WRZ7-0629 (Lye Oak Licence Variation)

Three of the schemes AFF-RTR-WRZ7-0909, AFF-EGW-WRZ7-0908, and AFF-EGW-WRZ7-0629 involve no new infrastructure so will not interact with the other Affinity Water rdWRMP19 schemes or the Southern Water schemes to have cumulative effects on the AONB. AFF-RTR-WRZ7-0301 proposes a small upgrade of the Chalksole Service Reservoir. Given the scale of the scheme and potential mitigation available, including screening/ planting, it is considered unlikely that there will be any significant cumulative effects with options being proposed through Southern Water's WRMP19 on the AONB. Any schemes that propose new infrastructure should ensure that it is sensitively designed and is in conformity with the Kent Downs AONB Management and Local Plans.

It is noted that the WRSE work identifies that a Southern Water option BS_Win is within 5km of option AFF-RTR-WRZ7-0301 so there is the potential for wider construction related impacts. As previously mentioned, AFF-RTR-WRZ7-0301 does not propose any significant new infrastructure and as such it is considered unlikely that there will be any cumulative effects during construction.

AFF-RES-WRZ4-0832 (Brent Reservoir) is identified in the WRSE study as having the potential for cumulative effects on the Thames (wider catchment) as a result of interactions with options being considered through the emerging WRMP19 for Thames Water. The WFD assessment for Affinity Water's rdWRMP19 found that AFF-RES-WRZ4-0832 would interact with the Lower Brent surface water body and would have no measurable or significant impact on the surface water body in terms of changes in flow velocity and volume from abstraction or any changes to hydromorphology during operation.

The other schemes proposed within this programme and identified through the WRSE study as having the potential for a cumulative effect in regards to the SEA topic water, are AFF-EGW-WRZ7-0629 (Lye Oak (LYEO) Licence Variation) and AFF-EGW-WRZ7-0908 (Tappington South (TAPS) Licence Variation) in WRZ 7. The study identified that these two schemes could interact with Southern Water option GWA_Fle (Flemings and Woodnesborough WSW licence variation) to have a cumulative effect on the East Kent Chalk - Stour groundwater body.

The WFD assessment concluded that AFF-EGW-WRZ7-0629 (LYEO Licence Variation) would not pose a significant risk to deterioration and that any impacts would be localised or temporary and not affect the overall status of the groundwater body. The AFF-EGW-WRZ7-0908 scheme involves TAPS, an existing (but disused) groundwater source within an existing licence group. There is a sequence of boreholes connected by an existing raw water main to the treatment works; DENT; TAPN; and RAKN. TAPS is not within this sequence currently and the option is to re-commission the borehole to provide resilience for the licence group (the group output is limited by licence/ treatment works). This scheme was scoped out of the WFD assessment as there would be no overall increase in abstracted volumes. As a result of the findings of the WFD assessment, it is considered that there is a low risk of cumulative effects arising as a result of interactions with Southern Water option GWA_Fle (Flemings and Woodnesborough WSW licence variation) on the East Kent Chalk - Stour groundwater body.

5.4.3 SEA of Aspirational Adaptive Run

This run contains optimistic levels of demand management savings and the expected supply-side future; however, it looks towards long-term 'stretch' targets. These targets are a reduction in PCC to 110 l/p/d and a 50% reduction in leakage by 2050. The supply-side schemes proposed under this programme are set out in the table below along with their delivery dates.

Table 5.6: Aspirational Adaptive Run supply-side schemes

Supply scheme	Delivery date	AMP
AFF-RTR-WRZ7-0639 : Deal Continuation After 2020	2020	7
AFF-RTR-WRZ7-0909 : Barham Continuation (After 2019/20)	2020	7
AFF-EGW-WRZ7-0629 : Lye Oak Licence Variation	2021	7
AFF-CTR-WRZ4-4001 : Egham to Iver	2022	7
AFF-RNC-WRZ7-0900 : Dover Constraint Removal	2022	7
AFF-NGW-WRZ3-1068 : Runley Wood (AMP7 LGS Borehole)	2046	12
AFF-EGW-WRZ2-0090 : Stonecross Source Optimisation	2051	13
AFF-NGW-WRZ3-1053 : Kings Walden	2051	13
AFF-RES-WRZ4-0832 : Brent Reservoir	2052	13
AFF-NGW-WRZ4-0624 : Canal and Rivers Trust and GSK Slough Boreholes	2055	14
AFF-CTR-WRZ3-4005 : Arkley North	2056	14
AFF-RTR-WRZ4-4011 : Abingdon to Iver 2 (50MI/d)	2056	14
AFF-TPO-WRZ4-0412 : Hillingdon Hospital boreholes	2067	16
AFF-RTR-WRZ1-4010 : Abingdon Reservoir to Harefield Transfer (50MI)	2068	16
AFF-CTR-WRZ3-0028 : Iver Arkley Transfer Upgrade	2074	17
AFF-EGW-WRZ7-0908 : Tappington South - Licence Variation	2074	17

5.4.3.1 Assessment findings

A summary of the key findings for the supply-side schemes under this programme is provided below in **Table 5.7**.

Table 5.7: Aspirational Adaptive Run summary SEA findings

Supply scheme	Delivery date	AMP	SEA Objectives and assessment questions																															
			1			2			3			4		5					6		7	8		9	10				11	12	13		14	
			1a	1b	1c	2a	2b	2c	3a	3b	4a	4b	5a	5b	5c	5d	5e	6a	6b	7a	8a	8b	9a	10a	10b	10c	10d	11a	12a	13a	13b	14a		
			C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O		
AFF-RTR-WRZ7-0639 : Deal Continuation After 2020	2020	7	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
AFF-RTR-WRZ7-0909 : Barham Continuation (After 2019/20)	2020	7	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
AFF-EGW-WRZ7-0629 : Lye Oak Licence Variation	2021	7	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
AFF-CTR-WRZ4-4001 : Egham to Iwer	2022	7	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
AFF-RNC-WRZ7-0900 : Dover Constraint Removal	2022	7	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
AFF-NGW-WRZ3-1068 : Runley Wood (AMP7 LGS Borehole)	2046	12	0	1	0	1	0	0	0	?	-1	0	?	0	0	0	0	0	-1	-1	0	0	?	?	0	0	0	0	0	-2	0	0	0	
AFF-EGW-WRZ2-0090 : Stonecross Source Optimisation	2051	13	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	-1	?	0	?	?	0	0	0	-1	0	0	-1	0	0	0	0	
AFF-NGW-WRZ3-1053 : Kings Walden	2051	13	0	1	0	1	0	0	?	0	0	0	0	0	0	0	0	-1	-1	0	0	?	0	0	0	-2	0	0	-2	0	0	0	0	
AFF-RES-WRZ4-0832 : Brent Reservoir	2052	13	0	1	0	1	0	0	0	?	-1	0	-1	0	-1	0	-2	-1	-1	0	0	-1	0	-1	-1	0	0	0	-1	0	-1	0	0	
AFF-NGW-WRZ4-0624 : Canal and Rivers Trust and GSK Slough Boreholes	2055	14	0	1	0	1	0	0	0	?	-1	0	-1	0	-1	0	0	0	-1	0	0	?	0	0	0	-1	-1	0	-1	-2	0	0	0	
AFF-CTR-WRZ3- 4005 : Arkley North	2056	14	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	?	0	0	?	?	-1	0	-1	-1	0	0	0	0	0	0	
AFF-RTR-WRZ4- 4011 : Abingdon to Iwer 2 (50M/d)	2056	14	0	2	0	2	0	2	0	2	0	-1	-2	1	-2	-1	-1	0	-3	0	-1	0	-2	-1	-2	-1	?	?	-2	-1	?	2	-3	-2
AFF-TPQ-WRZ4-0412 : Hillingdon Hospital boreholes	2067	16	0	1	0	1	0	0	0	0	0	0	0	-1	0	-1	0	0	0	0	0	0	?	?	0	0	?	?	0	0	0	0	0	
AFF-RTR-WRZ1- 4010 : Abingdon Reservoir to Harefield Transfer (50M/d)	2068	16	0	2	0	2	0	2	0	2	0	-1	-2	-1	-1	0	-3	0	-1	0	-2	-1	-2	-1	?	?	-2	-1	?	2	-3	-2	0	
AFF-CTR-WRZ3-0028 : Iwer Arkley Transfer Upgrade	2074	17	0	1	0	1	0	0	0	0	-1	0	-2	0	-1	0	-2	0	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	-2	0
AFF-EGW-WRZ7-0908 : Tappington South - Licence Variation	2074	17	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

AMP7 (2020-25)

The five supply-side schemes to be delivered within the first five years (2020-25) of the plan period during AMP7 all propose minimal new infrastructure. As a result, they are not identified as having the potential for a significant negative effect either during construction or operation through the SEA, HRA or the WFD assessment.

AFF-RTR-WRZ7-0639: Deal Continuation After 2020 and **AFF-RTR-WRZ7-0909: Barham Continuation (After 2019/20)** propose the continuation of current agreements with Southern Water and South East Water respectively for the import of water. No new infrastructure is required for either of these schemes and no negative effects identified through the assessment.

AFF-EGW-WRZ7-0629: Lye Oak Licence Variation involves a negotiation to increase the abstraction license at Lye Oak. The increase in abstraction would be by 0.14MI/d consistent with the volume of the “returned” water (around 4% of the abstraction). The assessment found that there is the potential for minor negative effects during operation against SEA objectives relating to East Kent Chalk Stour groundwater levels given the increased abstraction; however, this is likely to be local and minor given the small increase. As a result of this there is also some uncertainty identified against the SEA objective relating to biodiversity as a result of the potential for indirect effects and close proximity of the Lydden and Swingfield Woods SSSI. However, it is again considered that given the small increase in abstraction there is unlikely to be any significant negative effects. Mitigation could include a hands-off flow condition to prevent abstraction at low flows below a certain level. As a result it is recommended that the water level in the East Kent Chalk Stour groundwater body and condition status of the Lydden and Swingfield Woods SSSI are monitored.

AFF-RNC-WRZ7-0900: Dover Constraint Removal involves the removal of network constraints by construction of a new main from Primrose Treatment Works to The Cricketer's Public House with connection into the existing network; this will allow increased abstraction from the groundwater sources and transfer to Folkestone. The scheme involves minimal new infrastructure with a new 1.19km main and 1 x 1 m³ Surge Vessel. Minor negative effects are identified during construction against SEA objectives relating to recreation/ tourism, road infrastructure, biodiversity and landscape primarily as a result of the delivery of the new pipeline. Impacts will be temporary, local and minor and good practice construction methods should ensure that there are no significant negative effects.

AFF-CTR-WRZ4-4001: Egham to Iwer involves the installation of a new booster station on an existing site, which will allow 17 MI/d to be pushed through the existing main. This will allow transfer of 17 MI/d from Egham to Harefield, which will allow use of the existing surplus within the Wey community (WRZ4). The scheme involves minimal new infrastructure and the assessment found that there would be a residual neutral effect against the majority of SEA objectives during construction and operation. Standard construction practices should ensure that there are no significant impacts during the construction phase.

AMP12 (2045-50)

Under this programme no further supply-side options would be delivered until 2046 in AMP12. The only scheme proposed during this period is **AFF-NGW-WRZ3-1068: Runley Wood (AMP7 LGS Borehole)** - a scheme to license a new borehole in the Lower Greensand aquifer within the existing Runley Wood site boundary to allow an increased abstraction at this site. The assessment found that there is the potential for a moderate negative effect for SEA objectives 10 (WFD status) and 11 (surface/ ground water levels and flows). This was informed by the WFD assessment for the rdWRMP19, which identifies that the groundwater abstraction may influence local water balance in Woburn Sands groundwater body depending on extent of confined Lower Greensand (LGS) abstraction influence. It suggests that this needs to be confirmed through further hydrogeological survey work. There is also the potential to affect groundwater body input to the River Flit which could have impacts on water levels/ flow and quality. The WFD assessment recommends that further information and assessment required. Given the delivery date of this scheme in 2035, there would be sufficient time to undertake further investigative work and detailed assessments to determine the likelihood and significance of effects along with suitable mitigation measures. Mitigation could include a hands-off flow condition to prevent abstraction at low flows below a certain level. As a result it is recommended that the water level in the Woburn Sands groundwater body is monitored.

As a result of the above, the assessment also identifies that there is some uncertainty in terms of indirect effects on biodiversity (SEA objective 5) reliant on the River Flit during operation although it is unlikely that this would be of significance. The assessment also identified that there is also the potential for a negative effect on SEA objective 5 (biodiversity) during construction. The scheme requires the delivery of a short 580m pipeline to connect the borehole/ LGS WTW to the Chaul End Reservoir and this crosses over some priority habitat (deciduous woodland). Given the location of the scheme it is unlikely that the route of the pipeline could be altered to avoid the habitat, given that the borehole and reservoir are separated by the M1 and the priority habitats run along either side of the motorway. Pipe jacking/ directional drilling could be used to avoid any loss of the habitat but the feasibility of this is uncertain at this stage and should be explored further at the detailed design stage.

AMP13 (2050-55)

Three supply-side schemes are proposed for delivery during AMP11 under this programme. As for **AFF-NGW-WRZ3-1068: Runley Wood (AMP7 LGS Borehole)** in AMP12, similar issues are also identified through the assessment for **AFF-NGW-WRZ3-1053: Kings Walden**. This scheme proposes a Lower Greensand borehole to be drilled on the existing site at Kings Walden for an output of 3MI/d. The existing site already has a Chalk groundwater source. This water could then be used for blending with the chalk source on site that suffers from high nitrates.

The assessment found that there is the potential for a moderate negative effect for SEA objectives 10 (WFD status) and 11 (surface/ ground water levels and flows). This was informed by the WFD assessment for the rdWRMP19, which identifies that the groundwater abstraction may influence local water balance in Woburn Sands groundwater body depending on extent of confined Lower Greensand (LGS) abstraction influence. However, the WFD assessment notes that the LGS aquifer becomes unconfined more than 13 km north of the abstraction point, therefore any impact would be naturally mitigated due to the distance. It suggests that this needs to be confirmed through further hydrogeological survey work. There is also the potential to affect groundwater body input to the River Ivel which could have impacts on water levels/ flow and quality at a local scale.

The WFD assessment recommends that further information and assessment required. Given the delivery date of this scheme in 2040, there would be sufficient time to undertake further investigative work and detailed assessments to determine the likelihood and significance of effects along with suitable mitigation measures. Mitigation could include a hands-off flow condition to prevent abstraction at low flows below a certain level. As a result it is recommended that the water level in the Woburn Sands groundwater body is monitored.

As a result of the above, the assessment also identifies that there is some uncertainty in terms of indirect effects on biodiversity (SEA objective 5) reliant on the River Ivel during operation although it is unlikely that this would be of significance. The mitigation identified above would reduce the potential for any residual negative effects in the medium to long-term.

AFF-EGW-WRZ2-0090: Stonecross Source Optimisation involves upgrading the borehole pumps at the existing Stonecross chalk groundwater source, as well as treatment works, and a network modification to close the 0.41 MI/d gap between DO and licence. The scheme would result in minimal new infrastructure and the assessment does not identify the potential for any residual moderate or major negative effects during construction or operation.

The assessment identifies that there is the potential for minor negative effects in the medium to long-term during operation as the increased abstraction at peak times may have some potential impact on water level in the aquifer and impact base flow in the linked surface water body (Ver River). The WFD assessment notes that these impacts are likely to be local, minor and temporary. The assessment also acknowledges that the issue above could have indirect effects on biodiversity. Mitigation could include a hands-off flow condition to prevent abstraction at low flows below a certain level. This should be given further consideration at the detailed design stage.

AFF-RES-WRZ4-0832: Brent Reservoir proposes the import of water from the Canal & River Trust reservoir at Brent. The water would be transmitted via the River Brent and the Grand Union Canal to the existing Iwer Water Treatment Works for abstraction and subsequent treatment at a new Iwer 2 WTW. The option includes upgraded storage at a new Harrow Service Reservoir within WRZ4.

The assessment identified that during the construction phase there is the potential for negative effects on SEA objectives 6 (landscape) and 13 (historic environment). The scheme includes a new Harrow service reservoir at Harrow on the Hill, which is an important local area of open/ green space surrounded by the existing built area that provides areas for recreation and contributes to the character of the landscape/ townscape. The new reservoir is also situated in close proximity to the Harrow Park Registered Park and Garden. Potential for moderate negative effects during construction against SEA objectives relating to the landscape and historic environment. The assessment recommends the retention of hedgerows, trees, walls wherever possible and the re-instatement of soil/ land following construction of the pipeline. It also proposes the use of construction methods and barriers/ hoardings that are sympathetic to the aesthetics of the surrounding landscape. Where possible any opportunities to merge the reservoir embankment into the landscape should be explored.

During operation **AFF-RES-WRZ4-0832: Brent Reservoir** proposes the release of water from the reservoir, which is also a SSSI. The Brent Reservoir SSSI is currently in a favourable condition and is designated for breeding wetland birds, in particular for significant numbers of nesting great crested grebe, as well as wetland plant communities. There is uncertainty at this stage with regard to the extent and frequency of drawdown in the reservoir as a result of this proposed scheme. The Great Crested Grebe nest in reed beds and the Passerines (bullfinch, greenfinch, jay, willow warbler and wren) nest in willow woodland broadly between March and July so higher/ lower water levels in these periods could affect them. The wintering birds (Pochard, Gadwall, Snipe, Jack snipe and Smew) could also be affected as again; changing water levels could affect the amount of terrestrial habitat surrounding the waterbody that could be available for them to rest on when out of the water. The wetland plant species are sensitive to changes in water levels. It will be important to prevent the water levels from fluctuating significantly and frequently as this could displace plants as they move up/ or down in the inundation zone.

There are ongoing discussions between Affinity Water and the Canal & River Trust who operate the reservoir. More detailed hydrological investigations need to be carried out in order to determine the extent and frequency of drawdown as a result of this scheme and how the hydrological conditions affect the wetland habitats and birds they support. The assessment proposes that the water levels in the Brent Reservoir are monitored to inform the need and use of hands-off flow conditions to restrict the release of water when levels are low. Furthermore, the release of water could also be restricted during the breeding/ nesting seasons (broadly March to July). The condition status of the Brent Reservoir SSSI should also be monitored.

AMP14 (2055-60)

Three supply-side schemes are proposed for delivery during AMP12 under this programme. The first of these, **AFF-NGW-WRZ4-0624: Canal & River Trust and GSK Slough Boreholes** will be delivered in 2055. The scheme proposes obtaining supplies from existing Lower Greensand boreholes that are currently owned by third parties in the Slough area. The Lower Greensand water is to be pumped via a new pipeline along the Grand Union Canal towpath for treatment at a new Iver 2 WTW location (the existing Iver WTW is at full capacity). A new pipeline will then take the water to existing Iver for onward transfer to an upgraded Harrow Service Reservoir for use in WRZ4 (or WRZ2).

The assessment identifies the potential for a moderate negative effect against SEA objectives relating to surface and groundwater body status and flows. The WFD assessment notes that the GSK abstraction is/ was discharged to the Salthill stream following its use as non-evaporative cooling. As a result the WFD assessment found that there is a potential for a reduction in water returned to the surface water body that may lead to deterioration of status and flows. The proposed scheme may involve diverting this discharge to Affinity Water for consumptive use. The WFD assessment recommends that further information and assessment required. The discharge volume needs to be quantified and further WFD assessment undertaken to determine if could impact the status of the Salthill Stream surface water body. Given that the delivery date of this scheme is 2044 there is sufficient time to investigate this issue further.

The final two supply-side schemes to be delivered in AMP14 in 2056 include **AFF-RTR-WRZ4-4011: Abingdon to Iver 2 (50MI/d)** involves an increased abstraction from the River Thames at Sunnymeads, onwards transfer by a new main for treatment at Iver 2 WTW. Water will be discharged from a new South East Strategic Reservoir (within the Thames Water Supply Area) for abstraction

downstream from the River Thames at Sunnymead. The increased abstraction will provide an additional 50 Ml/d during both peak and average conditions for use within WRZ4.

During construction the assessment found that there is the potential for significant negative (moderate and major) effects against a number of SEA objectives as a result of this scheme due to the scale of new infrastructure required. This includes:

- Major negative effects for SEA objectives relating to material consumption and carbon footprint due to the scale of infrastructure.
- Moderate negative effects for SEA Objective 3 due to temporary disruption to local and strategic transport infrastructure, including public rights of way and major roads.
- Moderate negative effects also anticipated for SEA Objective 7 relating to Hillingdon AQMA and Marcham AQMA given the level of traffic anticipated during construction.
- Moderate negative effects for SEA Objective 5 due to temporary and permanent disruption to biodiversity, including internationally and nationally designated sites and other important habitats and species.
- Major negative effects for SEA Objective 6 given the construction of Abingdon reservoir is likely to have significant effects on the landscape. This includes impact on the setting of the North Wessex Downs AONB, and extensive disruption to views, visual amenity and landscape character.
- Major negative effects for SEA Objective 13 as a result of the heritage assets located within close proximity to the new reservoir and pipeline (including archaeological assets).

During operation the assessment found that there is the potential for significant negative (moderate and major) effects against a number of SEA objectives as a result of this scheme due to the scale of new infrastructure required. This includes:

- Moderate negative effects for SEA Objective 6 given that the new reservoir ancillary infrastructure would be a prominent new feature in the landscape. Notably, three towers will be seen against the visual context of the North Wessex Downs AONB to the south and east.
- Major negative effects for SEA Objective 8 relating to carbon footprint due to the scale of infrastructure.

During operation the assessment found that there is the potential for significant positive (moderate) effects against a number of SEA objectives as a result of this scheme due to the scale of new infrastructure required. This includes:

- Moderate positive effects for SEA Objective 2 in relation to tourism, recreation and amenity facilities.
- Moderate positive effects for SEA Objective 5 as the scheme is anticipated to provide opportunities for biodiversity enhancement and net gain.
- Moderate positive effects for SEA Objective 6 as the scheme presents opportunities for landscape enhancements and improvements. Specific mitigation measures and enhancements will be developed in the detailed design stages.

Moderate positive effects for SEA Objective 8 as the scheme is upgrading transfer and storage capacity, resulting in positive effects on the resilience of Affinity Water's assets to climate change.

AFF-CTR-WRZ3-4005: Arkley North, will be delivered in 2056. This scheme allows for the bypass of Arkley 2 Reservoir and seeks to improve the interconnectivity between reservoirs. It involves minimal new infrastructure (50m of new main) and is not identified in the SEA, HRA or WFD assessment as having the potential for a significant negative effect during construction or operation. The potential for minor negative effects are identified during construction of the new pipeline but it is considered that there is suitable mitigation available through standard construction practices to ensure that there are no residual significant negative effects.

AMP16 (2065-70)

Two supply-side schemes are proposed for delivery during AMP16 under this programme. The first is a strategic scheme, **AFF-RTR-WRZ1-4010: Abingdon Reservoir to Harefield Transfer (50MI)**, which is closely linked to **AFF-RTR-WRZ4-4011** delivered in AMP14.

AFF-RTR-WRZ1-4010: Abingdon Reservoir to Harefield Transfer (50MI) utilises the same infrastructure as **AFF-RTR-WRZ4-4011** up to point near Iver 2 WTW. It would then extend the mains northward to an upgraded Harefield Reservoir and Harefield Treatment Works. The detailed assessment of this scheme was carried out on the basis that this scheme could include the delivery of the South East Strategic Reservoir (SESR). However, the SESR would already be established at this point given the earlier delivery of **AFF-RTR-WRZ4-4011**. While there is still the potential for negative effects as a result of the delivery of the pipeline and expanded Harefield reservoir it is considered that there is suitable mitigation available to ensure that residual effects are minor. It is also considered that there is unlikely to be any significant negative effects during operation.

The second supply-side scheme to be delivered in AMP16 in 2067 is **AFF-TPO-WRZ4-0412: Hillingdon Hospital boreholes**. This scheme seeks to purchase or lease and then transfer any potential spare capacity from three boreholes owned by Hillingdon Hospital. Two boreholes (B & A) are in use, while borehole C has been out of use for years owing to high iron levels (water quality). According to the Environment Agency website, the licence 28/39/28/0513 (HILLINGDON HOSPITAL NHS TRUST) is for 0.55 MI/d at average and 1.00 MI/d at peak.

The assessment does not identify any moderate or major negative effects in relation to this scheme during construction or operation. The potential for minor negative effects are identified during construction of the new pipeline and WTW but it is considered that there is suitable mitigation available through standard construction practices to ensure that there are no residual significant negative effects.

AMP17 (2070-75)

Two supply-side schemes are proposed for delivery during AMP17 under this programme and both in 2074. The first of these is not proposed under any other reasonable alternative programme and this is **AFF-CTR-WRZ3-0028: Iver Arkley Transfer Upgrade**. This scheme will allow the transfer of 15MI/d from Iver 2 Treatment Works to Bulls Green Reservoir via Ickenham Pump Station and North Mymms Pump Station.

The assessment identifies the potential for moderate negative effects during the construction phase against a number of SEA objectives as a result of the new infrastructure, which includes around 69km of new pipeline and an upgraded Bulls Green Service Reservoir. The majority of these moderate negative effects are for SEA Objectives relating to road infrastructure, material consumption and carbon footprint. A moderate negative effect is identified against biodiversity during construction as the pipeline passes through some priority habitats. The assessment recommends that the pipeline should be re-routed at the detailed design stage to avoid the loss of priority habitats. It also identifies the potential for disturbance to some SSSIs given the proximity of the pipeline and recommends that during the detailed design stage the pipeline should be rerouted to avoid coming within 500m of a SSSI that has interest features sensitive to emissions of dust during earthworks. Otherwise good practice construction methods should reduce the likelihood of impacts. Careful design and construction of the pipeline, informed by further geotechnical and hydrogeological investigations, would enable it to be installed at a suitable depth and in a suitable manner (including return of any dewatering volumes immediately back to ground) that water levels and quality at the SSSIs or other important habitats would not be significantly affected. This would need to be developed further during detailed scheme design.

AFF-EGW-WRZ7-0908: Tappington South - Licence Variation. This scheme involves the re-commissioning of the currently disused borehole at Tappington Source to provide resilience for the licence group. The scheme involves minimal new infrastructure and was not identified as having the potential for a significant effect through the SEA, HRA or the WFD assessment.

5.4.3.2 Cumulative effects

Overall the cumulative effects assessment in **Appendix VI** has found that there is a low risk arising during construction of cumulative adverse effects regarding the SEA topic of population and human health. Extended construction related mitigation such as detailed routing, traffic planning and management and limitation of works within peak periods/ times will minimize the potential cumulative effects identified.

Regarding the SEA water topic, the assessment has identified a low risk of cumulative adverse effects as a result of schemes interacting with the potential to affect the Lower Thames Gravels Groundwater Body, the Thames (Cookham to Egham) Surface Water Body, the Colne Brook Surface Water Body, and the Colne (from confluence with Chess to River Thames) Surface Water Body; where mitigation, including CoPC and best practice for design, construction and operations is recommended.

The assessment has also identified a medium risk of cumulative adverse effects as a result of schemes interacting with the potential to affect the Upper Bedford Ouse Woburn Sands Groundwater Body. The WFD assessment identifies that further hydrogeological assessment to consider linkage between deep Lower Greensand aquifer and Upper Bedford Ouse Woburn Sands is required. It is also recommended that water levels/flows in the Upper Bedford Ouse Woburn Sands Groundwater Body are monitored and mitigation could include a hands-off flow condition to prevent abstraction if water levels/ flows drop below a certain level.

The assessment has also identified the potential for positive effects arising as a result of schemes (AFF-RTR-WRZ1-4010 and AFF-RTR-WRZ4-4011) interacting to improve water levels and flow rates, improve habitats and improve low flows and chemistry within the Thames (Evenlode to Thame, Wallingford to Caversham, and Reading to Cookham) Surface Water Bodies.

Overall the assessment has also found that there are low risks arising (predominantly through construction phases), of cumulative adverse effects regarding the SEA topics relating to biodiversity and landscape and visual amenity. Sensitive receptors found to be at low risk are the Kent Downs AONB, Chilterns AONB, North Wessex Downs AONB, South West London Waterbodies Ramsar and SPA and Ruislip Woods SSSI.

The identified effects in relation to the AONBs are likely to be short-term and temporary associated with traffic and access disruption - including disruption to public rights of way, noise and disturbance (potentially affecting tranquillity and landscape character in the short term). Extended construction related mitigation such as detailed routing, traffic planning and management and limitation of works within peak periods/ times are considered likely to minimise the potential cumulative effects identified. Any new visible infrastructure should be sensitively designed and adhere to the aims and policies of the relevant AONB Management Plan.

The HRA for the rdWRMP19 recommended a number of mitigation measures in relation to the schemes AFF-RTR-WRZ1-4010 (2068) and AFF-RTR-WRZ4-4011 (2056) which will need to be taken into consideration during construction and operation to minimise the risks associated with the European designated sites (South West London Waterbodies Ramsar and SPA. This mitigation includes an explicit commitment to ensure that the programming and construction processes for the schemes take into account the proximity of the SPA and that construction works on the short section of pipeline adjacent to the SPA are programmed to avoid the winter (October to March) period entirely or are accompanied by an impact assessment including noise modelling and mitigation in line with British Standard BS5228 as required in order to ensure that noise levels can be maintained at an acceptable level.

Mitigation measures are also outlined to reduce potential cumulative effects associated with infrastructure development within the vicinity of Ruislip Woods SSSI which includes; avoiding coming within 500m of the interest features of the site (which are sensitive to emissions of dust during earthworks), and careful design and construction of the pipelines, informed by further geotechnical and hydrogeological investigation.

The WRSE (updated 2018) study into potential cumulative effects between water company WRMPs in South East England identified five schemes proposed under this programme that could interact with schemes proposed in other WRMPs to have a cumulative effect.

This includes four schemes located within the Southeast Region (WRZ 7 - Dour) which are identified as having the potential to have cumulative effects on the Kent Downs AONB as a result of interactions with options being considered through the emerging WRMP19 for Southern Water (BS_Win, IZT_Sel, and BR_Lug):

- AFF-RTR-WRZ7-0909 (Barham Continuation (After 2019/20))
- AFF-RTR-WRZ7-0301 (Barham Import Increase (of 2Ml/d) to 4Ml/d)
- AFF-EGW-WRZ7-0908 (Tappington South Licence Variation)
- AFF-EGW-WRZ7-0629 (Lye Oak Licence Variation)

Three of the schemes AFF-RTR-WRZ7-0909, AFF-EGW-WRZ7-0908, and AFF-EGW-WRZ7-0629 involve no new infrastructure so will not interact with the other Affinity Water rdWRMP19 schemes or the Southern Water schemes to have cumulative effects on the AONB. AFF-RTR-WRZ7-0301 proposes a small upgrade of the Chalksole Service Reservoir. Given the scale of the scheme and potential mitigation available, including screening/ planting, it is considered unlikely that there will be any significant cumulative effects with options being proposed through Southern Water's WRMP19 on the AONB. Any schemes that propose new infrastructure should ensure that it is sensitively designed and is in conformity with the Kent Downs AONB Management and Local Plans.

It is noted that the WRSE work identifies that a Southern Water option BS_Win is within 5km of option AFF-RTR-WRZ7-0301 so there is the potential for wider construction related impacts. As previously mentioned, AFF-RTR-WRZ7-0301 does not propose any significant new infrastructure and as such it is considered unlikely that there will be any cumulative effects during construction.

AFF-RES-WRZ4-0832 (Brent Reservoir) and AFF-RES-WR5-0809 (Birds Green Reservoir) are identified in the WRSE study as having the potential for cumulative effects on the Thames (wider catchment) as a result of interactions with options being considered through the emerging WRMP19 for Thames Water. The WFD assessment for Affinity Water's rdWRMP19 found that AFF-RES-WRZ4-0832 would interact with the Lower Brent surface water body and would have no measurable or significant impact on the surface water body in terms of changes in flow velocity and volume from abstraction or any changes to hydromorphology during operation.

The WFD assessment found that AFF-RES-WR5-0809 has the potential to result in the deterioration in the status of the Lower and Upper Roding surface water bodies during operation. As a result, there is the potential for cumulative effects on the Thames (wider catchment). The WFD assessment recommends that further assessments and discussions with the EA are required to explore the need for and potential of compensatory flows. It is important to note that the delivery date for this scheme under this programme is 2078; it is therefore considered that there is ample time to undertake further investigations (including a more detailed WFD assessment) and identify specific mitigation measures to reduce the likelihood and significance of any residual cumulative effects.

The other schemes proposed within this programme and identified through the WRSE study as having the potential for a cumulative effect are AFF-EGW-WRZ7-0629 (Lye Oak (LYEO) Licence Variation) and AFF-EGW-WRZ7-0908 (Tappington South (TAPS) Licence Variation) in WRZ 7. The study identified that these two schemes could interact with Southern Water option GWA_Fle (Flemings and Woodnesborough WSW licence variation) to have a cumulative effect on the East Kent Chalk - Stour groundwater body.

The WFD assessment concluded that AFF-EGW-WRZ7-0629 (LYEO Licence Variation) would not pose a significant risk to deterioration and that any impacts would be localised or temporary and not affect the overall status of the groundwater body. The AFF-EGW-WRZ7-0908 scheme involves TAPS, an existing (but disused) groundwater source within an existing licence group. There is a sequence of boreholes connected by an existing raw water main to the treatment works; DENT; TAPN; and RAKN. TAPS is not within this sequence currently and the option is to re-commission the borehole to provide resilience for the licence group (the group output is limited by licence/ treatment works). This scheme was scoped out of the WFD assessment as there would be no overall increase in abstracted volumes. As a result of the findings of the WFD assessment, it is considered that there is a low risk of cumulative effects arising as a result of interactions with Southern Water option GWA_Fle (Flemings and Woodnesborough WSW licence variation) on the East Kent Chalk - Stour groundwater body.

5.4.4 SEA of Expected Future Adaptive Run

This run is Affinity Water's central, expected future. This contains the levels of demand management option savings that Affinity Water would expect to see, as well as an expected supply-side future, i.e. no restrictions. The supply-side schemes proposed under this programme are set out in the table below along with their delivery dates.

Table 5.8: Expected Future Adaptive Run supply-side schemes

Supply scheme	Delivery date	AMP
AFF-RTR-WRZ7-0639 : Deal Continuation After 2020	2020	7
AFF-RTR-WRZ7-0909 : Barham Continuation (After 2019/20)	2020	7
AFF-EGW-WRZ7-0629 : Lye Oak Licence Variation	2021	7
AFF-RNC-WRZ7-0900 : Dover Constraint Removal	2022	7
AFF-CTR-WRZ4-4001 : Egham to Iver	2022	7
AFF-NGW-WRZ3-1068 : Runley Wood (AMP7 LGS Borehole)	2025	8
AFF-NGW-WRZ3-1053 : Kings Walden	2030	9
AFF-RES-WRZ4-0832 : Brent Reservoir	2034	9
AFF-NGW-WRZ4-0624 : Canal and Rivers Trust and GSK Slough Boreholes	2039	10
AFF-CTR-WRZ3-4005 : Arkley North	2041	11
AFF-RTR-WRZ4-4011 : Abingdon to Iver 2 (50MI/d)	2041	11
AFF-EGW-WRZ7-0908 : Tappington South - Licence Variation	2044	11
AFF-EGW-WRZ2-0090 : Stonecross Source Optimisation	2052	13
AFF-RTR-WRZ1-4010 : Abingdon Reservoir to Harefield Transfer (50MI)	2053	13
AFF-RTR-WRZ7-0301 : Barham Import Increase (of 2MI/d) to 4 MI/d	2057	14
AFF-TPO-WRZ4-0412 : Hillingdon Hospital boreholes	2064	15
AFF-CTR-WRZ3-1099 : Boxted to Chaul End	2065	15
AFF-RTR-WRZ1-1066 : Grand Union Canal (GUC - Berkhamstead/Hemel Hempstead)	2065	16
AFF-RNC-WRZ7-0626 : Broome Network Improvement	2066	16
AFF-TPO-WRZ6-1083 : Surrey University (Guildford Site)	2076	18
AFF-RTR-WRZ6-0752 : Ladymead Optimisation	2077	18
AFF-RES-WRZ5-0809 : Birds Green Reservoir	2078	18
AFF-EGW-WRZ6-0173 : Clandon Source Optimisation	2079	18

5.4.4.1 Assessment findings

A summary of the key findings for the supply-side schemes under this programme is provided below in **Table 5.9**.

AMP7 (2020-25)

The five supply-side schemes to be delivered within the first five years (2020-25) of the plan period during AMP7 all propose minimal new infrastructure. As a result, they are not identified as having the potential for a significant negative effect either during construction or operation through the SEA, HRA or the WFD assessment.

AFF-RTR-WRZ7-0639: Deal Continuation After 2020 and **AFF-RTR-WRZ7-0909: Barham Continuation (After 2019/20)** propose the continuation of current agreements with Southern Water and South East Water respectively for the import of water. No new infrastructure is required for either of these schemes and no negative effects identified through the assessment.

AFF-EGW-WRZ7-0629: Lye Oak Licence Variation involves a negotiation to increase the abstraction license at Lye Oak. The increase in abstraction would be by 0.14MI/d consistent with the volume of the “returned” water (around 4% of the abstraction). The assessment found that there is the potential for minor negative effects during operation against SEA objectives relating to East Kent Chalk Stour groundwater levels given the increased abstraction; however, this is likely to be local and minor given the small increase. As a result of this there is also some uncertainty identified against the SEA objective relating to biodiversity as a result of the potential for indirect effects and close proximity of the Lydden and Swingfield Woods SSSI. However, it is again considered that given the small increase in abstraction there is unlikely to be any significant negative effects. Mitigation could include a hands-off flow condition to prevent abstraction at low flows below a certain level. As a result it is recommended that the water level in the East Kent Chalk Stour groundwater body and condition status of the Lydden and Swingfield Woods SSSI are monitored.

AFF-RNC-WRZ7-0900: Dover Constraint Removal involves the removal of network constraints by construction of a new main from Primrose Treatment Works to The Cricketer's Public House with connection into the existing network; this will allow increased abstraction from the groundwater sources and transfer to Folkestone. The scheme involves minimal new infrastructure with a new 1.19km main and 1 x 1 m3 Surge Vessel. Minor negative effects are identified during construction against SEA objectives relating to recreation/ tourism, road infrastructure, biodiversity and landscape primarily as a result of the delivery of the new pipeline. Impacts will be temporary, local and minor and good practice construction methods should ensure that there are no significant negative effects.

AFF-CTR-WRZ4-4001: Egham to Iwer involves the installation of a new booster station on an existing site, which will allow 17 MI/d to be pushed through the existing main. This will allow transfer of 17 MI/d from Egham to Harefield, which will allow use of the existing surplus within the Wey community (WRZ4). The scheme involves minimal new infrastructure and the assessment found that there would be a residual neutral effect against the majority of SEA objectives during construction and operation. Standard construction practices should ensure that there are no significant impacts during the construction phase.

AMP8 (2025-30)

The only scheme proposed during AMP8 in 2025 is **AFF-NGW-WRZ3-1068: Runley Wood (AMP7 LGS Borehole)** - a scheme to license a new borehole in the Lower Greensand aquifer within the existing Runley Wood site boundary to allow an increased abstraction at this site. The assessment found that there is the potential for a moderate negative effect for SEA objectives 10 (WFD status) and 11 (surface/ ground water levels and flows). This was informed by the WFD assessment for the rdWRMP19, which identifies that the groundwater abstraction may influence local water balance in Woburn Sands groundwater body depending on extent of confined Lower Greensand (LGS) abstraction influence. It suggests that this needs to be confirmed through further hydrogeological survey work. There is also the potential to affect groundwater body input to the River Flit which could have impacts on water levels/ flow and quality. The WFD assessment recommends that further information and assessment required. Given the delivery date of this scheme in 2035, there would be sufficient time to undertake further investigative work and detailed assessments to determine the likelihood and significance of effects along with suitable mitigation measures. Mitigation could include a hands-off flow condition to prevent abstraction at low flows below a certain level. As a result it is recommended that the water level in the Woburn Sands groundwater body is monitored.

As a result of the above, the assessment also identifies that there is some uncertainty in terms of indirect effects on biodiversity (SEA objective 5) reliant on the River Flit during operation although it is

unlikely that this would be of significance. The assessment also identified that there is also the potential for a negative effect on SEA objective 5 (biodiversity) during construction. The scheme requires the delivery of a short 580m pipeline to connect the borehole/ LGS WTW to the Chaul End Reservoir and this crosses over some priority habitat (deciduous woodland). Given the location of the scheme it is unlikely that the route of the pipeline could be altered to avoid the habitat, given that the borehole and reservoir are separated by the M1 and the priority habitats run along either side of the motorway. Pipe jacking/ directional drilling could be used to avoid any loss of the habitat but the feasibility of this is uncertain at this stage and should be explored further at the detailed design stage.

AMP9 (2030-35)

Two supply-side schemes are proposed for delivery during AMP9 under this programme. As for **AFF-NGW-WRZ3-1068: Runley Wood (AMP7 LGS Borehole)** in AMP8, similar issues are also identified through the assessment for **AFF-NGW-WRZ3-1053: Kings Walden** scheduled for delivery in 2030. This scheme proposes a Lower Greensand borehole to be drilled on the existing site at Kings Walden for an output of 3MI/d. The existing site already has a Chalk groundwater source. This water could then be used for blending with the chalk source on site that suffers from high nitrates.

The assessment found that there is the potential for a moderate negative effect for SEA objectives 10 (WFD status) and 11 (surface/ ground water levels and flows). This was informed by the WFD assessment for the rdWRMP19, which identifies that the groundwater abstraction may influence local water balance in Woburn Sands groundwater body depending on extent of confined Lower Greensand (LGS) abstraction influence. However, the WFD assessment notes that the LGS aquifer becomes unconfined more than 13 km north of the abstraction point, therefore any impact would be naturally mitigated due to the distance. It suggests that this needs to be confirmed through further hydrogeological survey work. There is also the potential to affect groundwater body input to the River Ivel which could have impacts on water levels/ flow and quality at a local scale.

The WFD assessment recommends that further information and assessment required. Given the delivery date of this scheme in 2040, there would be sufficient time to undertake further investigative work and detailed assessments to determine the likelihood and significance of effects along with suitable mitigation measures. Mitigation could include a hands-off flow condition to prevent abstraction at low flows below a certain level. As a result it is recommended that the water level in the Woburn Sands groundwater body is monitored.

As a result of the above, the assessment also identifies that there is some uncertainty in terms of indirect effects on biodiversity (SEA objective 5) reliant on the River Ivel during operation although it is unlikely that this would be of significance. The mitigation identified above would reduce the potential for any residual negative effects in the medium to long-term.

The second supply-side to be delivered during AMP9 in 2034 is **AFF-RES-WRZ4-0832: Brent Reservoir**, which proposes the import of water from the Canal & River Trust reservoir at Brent. The water would be transmitted via the River Brent and the Grand Union Canal to the existing Iwer Water Treatment Works for abstraction and subsequent treatment at a new Iwer 2 WTW. The option includes upgraded storage at a new Harrow Service Reservoir within WRZ4.

The assessment identified that during the construction phase there is the potential for negative effects on SEA objectives 6 (landscape) and 13 (historic environment). The scheme includes a new Harrow service reservoir at Harrow on the Hill, which is an important local area of open/ green space surrounded by the existing built area that provides areas for recreation and contributes to the character of the landscape/ townscape. The new reservoir is also situated in close proximity to the Harrow Park Registered Park and Garden. Potential for moderate negative effects during construction against SEA objectives relating to the landscape and historic environment. The assessment recommends the retention of hedgerows, trees, walls wherever possible and the re-instatement of soil/ land following construction of the pipeline. It also proposes the use of construction methods and barriers/ hoardings that are sympathetic to the aesthetics of the surrounding landscape. Where possible any opportunities to merge the reservoir embankment into the landscape should be explored.

During operation **AFF-RES-WRZ4-0832: Brent Reservoir** proposes the release of water from the reservoir, which is also a SSSI. The Brent Reservoir SSSI is currently in a favourable condition and is designated for breeding wetland birds, in particular for significant numbers of nesting great crested

grebe, as well as wetland plant communities. There is uncertainty at this stage with regard to the extent and frequency of drawdown in the reservoir as a result of this proposed scheme. The Great Crested Grebe nest in reed beds and the Passerines (bullfinch, greenfinch, jay, willow warbler and wren) nest in willow woodland broadly between March and July so higher/ lower water levels in these periods could affect them. The wintering birds (Pochard, Gadwall, Snipe, Jack snipe and Smew) could also be affected as again; changing water levels could affect the amount of terrestrial habitat surrounding the waterbody that could be available for them to rest on when out of the water. The wetland plant species are sensitive to changes in water levels. It will be important to prevent the water levels from fluctuating significantly and frequently as this could displace plants as they move up/ or down in the inundation zone.

There are ongoing discussions between Affinity Water and the Canal & River Trust who operate the reservoir. More detailed hydrological investigations need to be carried out in order to determine the extent and frequency of drawdown as a result of this scheme and how the hydrological conditions affect the wetland habitats and birds they support. The assessment proposes that the water levels in the Brent Reservoir are monitored to inform the need and use of hands-off flow conditions to restrict the release of water when levels are low. Furthermore, the release of water could also be restricted during the breeding/ nesting seasons (broadly March to July). The condition status of the Brent Reservoir SSSI should also be monitored.

AMP10 (2035-40)

Only one supply-side scheme is proposed during AMP10 in 2039. **AFF-NGW-WRZ4-0624: Canal & River Trust and GSK Slough Boreholes** proposes obtaining supplies from existing Lower Greensand boreholes that are currently owned by third parties in the Slough area. The Lower Greensand water is to be pumped via a new pipeline along the Grand Union Canal towpath for treatment at a new Iver 2 WTW location (the existing Iver WTW is at full capacity). A new pipeline will then take the water to existing Iver for onward transfer to an upgraded Harrow Service Reservoir for use in WRZ4 (or WRZ2).

The assessment identifies the potential for a moderate negative effect against SEA objectives relating to surface and groundwater body status and flows. The WFD assessment notes that the GSK abstraction is/ was discharged to the Salthill stream following its use as non-evaporative cooling. As a result the WFD assessment found that there is a potential for a reduction in water returned to the surface water body that may lead to deterioration of status and flows. The proposed scheme may involve diverting this discharge to Affinity Water for consumptive use. The WFD assessment recommends that further information and assessment required. The discharge volume needs to be quantified and further WFD assessment undertaken to determine if could impact the status of the Salthill Stream surface water body. Given that the delivery date of this scheme is 2044 there is sufficient time to investigate this issue further.

AMP11 (2040-45)

Three supply-side schemes are proposed for delivery during AMP11 under this programme.

AFF-CTR-WRZ3-4005: Arkley North will be delivered in 2046 and allows for the bypass of Arkley 2 Reservoir and seeks to improve the interconnectivity between reservoirs. It involves minimal new infrastructure (50m of new main) and is not identified in the SEA, HRA or WFD assessment as having the potential for a significant negative effect during construction or operation. The potential for minor negative effects are identified during construction of the new pipeline but it is considered that there is suitable mitigation available through standard construction practices to ensure that there are no residual significant negative effects.

Also being delivered in 2046 is **AFF-RTR-WRZ4-4011: Abingdon to Iver 2 (50MI/d)**, which involves an increased abstraction from the River Thames at Sunnymeads, onwards transfer by a new main for treatment at Iver 2 WTW. Water will be discharged from a new South East Strategic Reservoir (within the Thames Water Supply Area) for abstraction downstream from the River Thames at Sunnymead. The increased abstraction will provide an additional 50 MI/d during both peak and average conditions for use within WRZ4.

During construction the assessment found that there is the potential for significant negative (moderate and major) effects against a number of SEA objectives as a result of this scheme due to the scale of new infrastructure required. This includes:

- Major negative effects for SEA objectives relating to material consumption and carbon footprint due to the scale of infrastructure.
- Moderate negative effects for SEA Objective 3 due to temporary disruption to local and strategic transport infrastructure, including public rights of way and major roads.
- Moderate negative effects also anticipated for SEA Objective 7 relating to Hillingdon AQMA and Marcham AQMA given the level of traffic anticipated during construction.
- Moderate negative effects for SEA Objective 5 due to temporary and permanent disruption to biodiversity, including internationally and nationally designated sites and other important habitats and species.
- Major negative effects for SEA Objective 6 given the construction of Abingdon reservoir is likely to have significant effects on the landscape. This includes impact on the setting of the North Wessex Downs AONB, and extensive disruption to views, visual amenity and landscape character.
- Major negative effects for SEA Objective 13 as a result of the heritage assets located within close proximity to the new reservoir and pipeline (including archaeological assets).

During operation the assessment found that there is the potential for significant negative (moderate and major) effects against a number of SEA objectives as a result of this scheme due to the scale of new infrastructure required. This includes:

- Moderate negative effects for SEA Objective 6 given that the new reservoir ancillary infrastructure would be a prominent new feature in the landscape. Notably, three towers will be seen against the visual context of the North Wessex Downs AONB to the south and east.
- Major negative effects for SEA Objective 8 relating to carbon footprint due to the scale of infrastructure.

During operation the assessment found that there is the potential for significant positive (moderate) effects against a number of SEA objectives as a result of this scheme due to the scale of new infrastructure required. This includes:

- Moderate positive effects for SEA Objective 2 in relation to tourism, recreation and amenity facilities.
- Moderate positive effects for SEA Objective 5 as the scheme is anticipated to provide opportunities for biodiversity enhancement and net gain.
- Moderate positive effects for SEA Objective 6 as the scheme presents opportunities for landscape enhancements and improvements. Specific mitigation measures and enhancements will be developed in the detailed design stages.
- Moderate positive effects for SEA Objective 8 as the scheme is upgrading transfer and storage capacity, resulting in positive effects on the resilience of Affinity Water's assets to climate change.

The final supply-side scheme to be delivered in AMP11 in 2044 is **AFF-EGW-WRZ7-0908:**

Tappington South - Licence Variation. This scheme involves the re-commissioning of the currently disused borehole at Tappington Source to provide resilience for the licence group. The scheme involves minimal new infrastructure and was not identified as having the potential for a significant effect through the SEA, HRA or the WFD assessment.

AMP13 (2050-55)

Two supply-side schemes are proposed in AMP13. The first of these is **AFF-EGW-WRZ2-0090: Stonecross Source Optimisation** to be delivered in 2052. The scheme involves upgrading the borehole pumps at the existing Stonecross chalk groundwater source, as well as treatment works, and a network modification to close the 0.41 Ml/d gap between DO and licence. The scheme would result in minimal new infrastructure and the assessment does not identify the potential for any residual moderate or major negative effects during construction or operation.

The assessment identifies that there is the potential for minor negative effects in the medium to long-term during operation as the increased abstraction at peak times may have some potential impact on water level in the aquifer and impact base flow in the linked surface water body (Ver River). The WFD assessment notes that these impacts are likely to be local, minor and temporary. The assessment also acknowledges that the issue above could have indirect effects on biodiversity. Mitigation could include a hands-off flow condition to prevent abstraction at low flows below a certain level. This should be given further consideration at the detailed design stage.

The second supply-side scheme to be delivered in AMP 13 is **AFF-RTR-WRZ1-4010: Abingdon Reservoir to Harefield Transfer (50MI)**, which is closely linked to **AFF-RTR-WRZ4-4011** delivered in AMP11.

AFF-RTR-WRZ1-4010: Abingdon Reservoir to Harefield Transfer (50MI) utilises the same infrastructure as **AFF-RTR-WRZ4-4011** up to point near Iver 2 WTW. It would then extend the mains northward to an upgraded Harefield Reservoir and Harefield Treatment Works. The detailed assessment of this scheme was carried out on the basis that this scheme could include the delivery of the South East Strategic Reservoir (SESR). However, the SESR would already be established at this point given the earlier delivery of **AFF-RTR-WRZ4-4011**. While there is still the potential for negative effects as a result of the delivery of the pipeline and expanded Harefield reservoir it is considered that there is suitable mitigation available to ensure that residual effects are minor. It is also considered that there is unlikely to be any significant negative effects during operation.

AMP14 (2055-60)

The only scheme to be delivered in AMP14 in 2057 is **AFF-RTR-WRZ7-0301: Barham Import Increase (of 2MI/d) to 4 MI/d**. An agreement between Affinity Water and South East Water exists for the import of 2 MI/d via the Barham Interconnection Point. This scheme proposes an increase of this import by 2 MI/d to a total of 4 MI/d for transfer to Chalksole Reservoir. This scheme will require a 2 MI upgrade of Chalksole Service Reservoir.

The Chalksole Reservoir is situated within the Kent Downs AONB and is surrounded by areas of Priority Habitat (deciduous woodland) that is also listed as Ancient and Semi-Natural Woodland. Potential for moderate negative effects on SEA objectives relating to biodiversity and the landscape during construction; however, it is acknowledged that there is uncertainty as the precise direction and area of land lost to the reservoir expansion is not known at this stage. The assessment notes that there are a number of areas around the existing reservoir where there are no designated habitats. It is therefore considered that there is high likelihood that the upgrade of the reservoir can avoid the important habitats and this should be explored as a first step at the detailed design stage. Further consultation with NE will be necessary as well as more detailed ecological surveys.

The assessment recommends that any new structures (such as the above ground concrete tank structure associated with the reservoir upgrade) should be designed sympathetically to fit in with the surrounding landscape, and/or screened as appropriate by landscaping and planting. More detailed mitigation measures should be set out at the detailed design stage.

AMP15 (2060-65)

Two supply-side schemes are proposed during AMP15. The first to be delivered in 2064 is **AFF-TPO-WRZ4-0412: Hillingdon Hospital boreholes**. This scheme seeks to purchase or lease and then transfer any potential spare capacity from three boreholes owned by Hillingdon Hospital. Two boreholes (B & A) are in use, while borehole C has been out of use for years owing to high iron levels (water quality). According to the Environment Agency website, the licence 28/39/28/0513 (HILLINGDON HOSPITAL NHS TRUST) is for 0.55 MI/d at average and 1.00 MI/d at peak.

The assessment does not identify any moderate or major negative effects in relation to this scheme during construction or operation. The potential for minor negative effects are identified during construction of the new pipeline and WTW but it is considered that there is suitable mitigation available through standard construction practices to ensure that there are no residual significant negative effects.

The second supply-side scheme to be delivered in 2065 is **AFF-CTR-WRZ3-1099: Boxted to Chaul End**, which involves a transfer of 40MI/d of treated water by a new main from Boxted Pump Station to

Chaul End Reservoir via Friars Wash. The scheme includes a 40MI capacity upgrade of Chaul End Reservoir amongst other new infrastructure.

Key issues identified during the construction phase include potential impacts on landscape and biodiversity. A small proportion (approx 500m) of the pipeline route falls within the Chilterns AONB. The rest of the pipeline predominantly falls within rural areas and follows existing infrastructure, such as roads. The construction of the pipeline is identified as having the potential for a minor negative effect in the short term and a residual neutral effect during operation once buried. The upgrade of the Chaul End Service Reservoir is likely to have moderate negative effects on landscape during construction and it should be noted that the Chilterns AONB is around 550m from the reservoir. Once mitigation is taken into account it is unlikely that there will be any significant negative effects during operation, particularly given that the Chaul Reservoir lies in close proximity to the M1 and is separated from the AONB by new residential development. A new pump house may be required and other minor structures but these will be installed at a pre-existing pump station and will therefore not result in significantly visible new infrastructure.

Mitigation measures should include the retention of hedgerows, trees, fields, walls wherever possible and the re-instatement of soil/ land following construction of the pipeline. Use construction methods and barriers/hoardings that are sympathetic to the aesthetics of the surrounding landscape and historic environment. The delivery of screening/ planting should ensure that the residual effects during operation are reduced. More detailed mitigation measures should be explored at the detailed design stage.

The construction of the new pipeline route may result in the loss of Priority Habitats (in particular deciduous woodland) near to the Chaul End Reservoir. The assessment recommends that the pipeline is re-routed at the detailed design stage to avoid the Priority Habitat near to Chaul End Reservoir. There is also the potential for disturbance to species during the construction of the pipeline route; however, good practice construction methods should ensure that there are no significant negative effects.

AMP16 (2065-70)

Two supply-side schemes are proposed during AMP16. The first to be delivered in 2065 is **AFF-RTR-WRZ1-1066: Grand Union Canal (GUC - Berkhamstead/Hemel Hempstead)** and is scheduled to be delivered in 2070. This scheme proposes the cascade of water from the Severn Trent Minworth Sewerage Treatment Plant via the Grand Union Canal for abstraction at Hemel Hempstead. From here raw water would be transferred to a new Boxted Treatment Works for treatment and ultimately stored in an expanded Boxted Reservoir.

The assessment found that there is the potential for a moderate negative effect for SEA objectives 10 (WFD status) and 11 (surface/ ground water levels and flows). This was informed by the WFD assessment for the rdWRMP19, which identifies that the abstraction has the potential for impacts during operation on water levels/ flows and quality in the Tame (R Rea to R Blythe and from R Blythe to River Anker) surface water body. It suggests that this needs to be confirmed through further hydrogeological survey work. Given the delivery date of this scheme in 2070, there would be sufficient time to undertake further investigative work and detailed assessments to determine the likelihood and significance of effects along with suitable mitigation measures. Mitigation could include a hands-off flow condition to prevent abstraction at low flows below a certain level. As a result it is recommended that the water levels in the Tame (R Rea to R Blythe and from R Blythe to River Anker) surface water body are monitored.

The scheme proposes new infrastructure that is in close proximity to the Chilterns AONB. Potential for a moderate negative effect on the SEA objective relating to landscape during construction phase. The assessment recommends that any new visible infrastructure should be designed sympathetically to fit in with the surrounding landscape, and/or screened as appropriate by landscaping and planting. Residual minor negative effect identified during operation primarily as a result of the expanded Boxted Reservoir.

The second supply-side scheme to be delivered in AMP16 in 2066 is **AFF-RNC-WRZ7-0626: Broome Network Improvement**. The scheme is designed to remove a network constraint on the Barham South East Water Import Main and a demand constraint, by transferring the existing Broome Borehole Source to Denton rather than via the Barham Import Main (WRZ7).

The assessment does not identify any moderate or major negative effects in relation to this scheme during construction or operation. The potential for minor negative effects are identified during construction of the new pipeline and upgrading of the WTW but it is considered that there is suitable mitigation available through standard construction practices to ensure that there are no residual significant negative effects.

It should be noted that this scheme falls entirely within the Kent Downs AONB. Construction of the new pipeline could have a minor negative effect on the landscape in the short-term, but this will be temporary and once it is buried there will be a residual neutral effect during operation. At this stage there is some uncertainty about the scale of the new building for treatment but it is assumed that it will not be significant and be located within the existing treatment site. Once mitigation has been taken into account, including planting/ screening it is predicted that the significance of residual effects can be reduced. Despite the small scale of development, it is considered that there is the potential for a minor negative effect during operation, in recognition of the AONB.

AMP18 (2075-80)

Under this programme no further supply-side options would then be delivered until AMP18, during which four new schemes are proposed.

The first to be delivered in 2076 is **AFF-TPO-WRZ6-1083: Surrey University (Guildford Site)**, which is a third party scheme to obtain a supply from the Surrey University site in Guildford. The option requires further discussions with Surrey University to lease the use of the borehole, a licence application to the Environment Agency, and pipework to take the water into the existing Affinity Water network; the site is just outside WRZ6.

The assessment does not identify any moderate or major negative effects in relation to this scheme during construction or operation for the majority of SEA objectives. The potential for minor negative effects are identified during construction of new or upgraded infrastructure but it is considered that there is suitable mitigation available through standard construction practices to ensure that there are no residual significant negative effects. A moderate negative effect is predicted against biodiversity as the pipeline currently passes through priority habitat (deciduous woodland). The assessment recommends that the pipeline should be re-routed at the detailed design stage to avoid the loss of any priority habitat.

The next supply-side scheme to be delivered in 2077 is **AFF-RTR-WRZ6-0752: Ladymead Optimisation**. This scheme is an import of 2.7 Ml/d of treated water from Thames Water via Ladymead Interconnection Point for transfer to Park Barn Drive Reservoir. The increase will provide an additional 2.7 Ml/d during both peak and average conditions for use within WRZ6.

The assessment does not identify any moderate or major negative effects in relation to this scheme during construction or operation. The potential for minor negative effects are identified during construction of the new pipeline and upgrading of the WTW but it is considered that there is suitable mitigation available through standard construction practices to ensure that there are no residual significant negative effects. The assessment identifies some uncertainty over the area as the precise area required for the reservoir expansion is not known at this stage and there is priority habitat to the north, west and south of the site. The detailed design stage should ensure that priority habitats are avoided as part of the reservoir expansion.

The next supply-side scheme to be delivered in 2078 is **AFF-RES-WRZ5-0809: Birds Green Reservoir**. The scheme includes a river intake and pumping station at Marden Ash (River Roding), a new fully bunded bankside storage reservoir located at Birds Green, an onsite WTW and pumping station, and a treated water pipeline to Rye Hill service reservoir.

During construction the assessment identifies that there is the potential for moderate negative effects against SEA objectives relating to material consumption, landscape and carbon footprint primarily as a result of the scale of new infrastructure required. There is also a moderate negative effect identified during construction in relation to agricultural land, given the presence of best and most versatile agricultural land.

During operation moderate negative effects are identified for SEA objectives relating to carbon footprint, WFD status and surface and groundwater levels/ flows. The assessment identifies that

there is the potential for the scheme to reduce water flow and levels as well as quality in the Lower Roding (Cripsey Brook to Loughton) Surface Water Body during operation. This is informed by the WFD assessment which recommends that further assessments and discussions with the EA are required. The SEA suggests that the water levels and flows in the Lower Roding (Cripsey Brook to Loughton) should be monitored and hands-off flow conditions used when water levels and flows are low. Another issue identified during operation is that the new Birds Green Reservoir will lead to the loss of Best and Most versatile agricultural land.

Additional benefits/ moderate positive effects were identified during operation as once established the raw water reservoir provides new opportunities for recreation as well as opportunities for biodiversity net gain.

The final supply-side scheme to be delivered in AMP18 in 2079 is **AFF-EGW-WRZ6-0173: Clandon Source Optimisation**. This scheme seeks to optimise the Clandon source by changing the software to allow water level based control of the pump speed, which should allow an increase in DO. The assessment found that this scheme is not likely to have significant negative effects during construction or operation given that it involves a change in software.

5.4.4.2 Cumulative effects

Overall the cumulative effects assessment in **Appendix VI** has found that there is a low risk arising during construction of cumulative adverse effects regarding the SEA topic of population and human health. Extended construction related mitigation such as detailed routing, traffic planning and management and limitation of works within peak periods/ times will minimize the potential cumulative effects identified.

Regarding the SEA water topic, the assessment has identified a low risk of cumulative adverse effects as a result of schemes interacting with the potential to affect the Lower Thames Gravels Groundwater Body, the Thames (Cookham to Egham) Surface Water Body, and the Colne (from confluence with Chess to River Thames) Surface Water Body; where mitigation, including CoPC and best practice for design, construction and operations is recommended.

The assessment has also identified a medium risk of cumulative adverse effects as a result of schemes interacting with the potential to affect the Upper Bedford Ouse Woburn Sands Groundwater Body. The WFD assessment identifies that further hydrogeological assessment to consider linkage between deep Lower Greensand aquifer and Upper Bedford Ouse Woburn Sands is required. It is also recommended that water levels/flows in the Upper Bedford Ouse Woburn Sands Groundwater Body are monitored and mitigation could include a hands-off flow condition to prevent abstraction if water levels/ flows drop below a certain level.

The assessment has also identified the potential for positive effects arising as a result of schemes (AFF-RTR-WRZ1-4010 and AFF-RTR-WRZ4-4011) interacting to improve water levels and flow rates, improve habitats and improve low flows and chemistry within the Thames (Evenlode to Thame, Wallingford to Caversham, and Reading to Cookham) Surface Water Bodies.

Overall the assessment has also found that there are low risks arising (predominantly through construction phases), of cumulative adverse effects regarding the SEA topics relating to biodiversity and landscape and visual amenity. Sensitive receptors found to be at low risk are the Kent Downs AONB, Chilterns AONB, Surrey Hills AONB, North Wessex Downs AONB, South West London Waterbodies Ramsar and SPA.

The identified effects in relation to the AONBs are likely to be short-term and temporary associated with traffic and access disruption - including disruption to public rights of way, noise and disturbance (potentially affecting tranquillity and landscape character in the short term). Extended construction related mitigation such as detailed routing, traffic planning and management and limitation of works within peak periods/ times are considered likely to minimise the potential cumulative effects identified. Any new visible infrastructure should be sensitively designed and adhere to the aims and policies of the relevant AONB Management Plan.

The HRA for the rdWRMP19 recommended a number of mitigation measures in relation to the schemes AFF-RTR-WRZ1-4010 (2053) and AFF-RTR-WRZ4-4011 (2041) which will need to be taken into consideration during construction and operation to minimise the risks associated with the

European designated sites (South West London Waterbodies Ramsar and SPA). This mitigation includes an explicit commitment to ensure that the programming and construction processes for the schemes take into account the proximity of the SPA and that construction works on the short section of pipeline adjacent to the SPA are programmed to avoid the winter (October to March) period entirely or are accompanied by an impact assessment including noise modelling and mitigation in line with British Standard BS5228 as required in order to ensure that noise levels can be maintained at an acceptable level.

The WRSE (updated 2018) study of potential cumulative effects between water company WRMPs in South East England identified seven schemes proposed under this programme that could interact with schemes proposed in other WRMPs to have a cumulative effect.

This includes five schemes located within the Southeast Region (WRZ 7 - Dour) which are identified as having the potential to have cumulative effects on the Kent Downs AONB as a result of interactions with options being considered through the emerging WRMP19 for Southern Water (BS_Win, IZT_Sel, and BR_Lug):

- AFF-RNC-WRZ7-0626 (Broome Network Improvement)
- AFF-RTR-WRZ7-0909 (Barham Continuation (After 2019/20))
- AFF-RTR-WRZ7-0301 (Barham Import Increase (of 2Ml/d) to 4Ml/d)
- AFF-EGW-WRZ7-0908 (Tappington South Licence Variation)
- AFF-EGW-WRZ7-0629 (Lye Oak Licence Variation)

Three of the schemes (AFF-RTR-WRZ7-0909, AFF-EGW-WRZ7-0908 and AFF-EGW-WRZ7-0629) involve no new infrastructure so will not interact with the other Affinity Water rdWRMP19 schemes or the Southern Water schemes to have cumulative effects on the AONB. AFF-RNC-WRZ7-0626 proposes minimal new infrastructure and the risk of cumulative effects on the AONB is therefore low.

AFF-RTR-WRZ7-0301 proposes a small upgrade of the Chalksole Service Reservoir. Given the scale of the scheme and potential mitigation available, including screening/ planting, it is considered unlikely that there will be any significant cumulative effects with options being proposed through Southern Water's WRMP19 on the AONB. Any schemes that propose new infrastructure should ensure that it is sensitively designed and is in conformity with the Kent Downs AONB Management and Local Plans.

It is noted that the WRSE work identifies that a Southern Water option BS_Win is within 5km of option AFF-RTR-WRZ7-0301 and AFF-RNC-WRZ7-0626 so there is the potential for wider construction related impacts. As previously mentioned, AFF-RNC-WRZ7-0626 involves minimal new infrastructure and has a delivery date of 2066. AFF-RTR-WRZ7-0301 does not propose any significant new infrastructure and has a delivery date of 2057. Taking the scale of infrastructure proposed and the delivery dates it is considered unlikely that there will be any cumulative effects during construction.

The WRSE work identifies that there is the potential for cumulative effects on two water bodies as a result of interactions with schemes being considered in the WRMPs19 for Thames Water and Southern Water.

AFF-RES-WRZ4-0832 (Brent Reservoir) and AFF-RES-WR5-0809 (Birds Green Reservoir) are identified in the WRSE study as having the potential for cumulative effects on the Thames (wider catchment) as a result of interactions with options being considered through the emerging WRMP19 for Thames Water. The WFD assessment for Affinity Water's rdWRMP19 found that AFF-RES-WRZ4-0832 would interact with the Lower Brent surface water body and would have no measurable or significant impact on the surface water body in terms of changes in flow velocity and volume from abstraction or any changes to hydromorphology during operation.

The WFD assessment found that AFF-RES-WR5-0809 has the potential to result in the deterioration in the status of the Lower and Upper Roding surface water bodies during operation. As a result, there is the potential for cumulative effects on the Thames (wider catchment). The WFD assessment recommends that further assessments and discussions with the EA are required to explore the need for and potential of compensatory flows. It is important to note that the delivery date for this scheme under this programme is 2078; it is therefore considered that there is ample time to undertake further

investigations (including a more detailed WFD assessment) and identify specific mitigation measures to reduce the likelihood and significance of any residual cumulative effects.

The other schemes proposed within Affinity Water's rdWRMP19 and identified through the WRSE study as having the potential for a cumulative effect are AFF-EGW-WRZ7-0629 (Lye Oak (LYEO) Licence Variation) and AFF-EGW-WRZ7-0908 (Tappington South (TAPS) Licence Variation) in WRZ 7. The study identified that these two schemes could interact with Southern Water option GWA_Fle (Flemings and Woodnesborough WSW licence variation) to have a cumulative effect on the East Kent Chalk - Stour groundwater body.

The WFD assessment concluded that AFF-EGW-WRZ7-0629 (LYEO Licence Variation) would not pose a significant risk to deterioration and that any impacts would be localised or temporary and not affect the overall status of the groundwater body. The AFF-EGW-WRZ7-0908 scheme involves TAPS, an existing (but disused) groundwater source within an existing licence group. There is a sequence of boreholes connected by an existing raw water main to the treatment works; DENT; TAPN; and RAKN. TAPS is not within this sequence currently and the option is to re-commission the borehole to provide resilience for the licence group (the group output is limited by licence/ treatment works). This scheme was scoped out of the WFD assessment as there would be no overall increase in abstracted volumes. As a result of the findings of the WFD assessment, it is considered that there is a low risk of cumulative effects arising as a result of interactions with Southern Water option GWA_Fle (Flemings and Woodnesborough WSW licence variation) on the East Kent Chalk - Stour groundwater body.

5.4.5 SEA of Demand-side Challenging Future Adaptive Run

This run looks to simulate a challenging demand-side future by using lower levels of demand management savings. All of the supply-side options are available, including strategic options (Options with +50MI/d benefit). The supply-side schemes proposed under this programme are set out in the table below along with their delivery dates.

Table 5.10: Demand-side Challenging Future Adaptive Run supply-side schemes

Supply scheme	Delivery date	AMP
AFF-RTR-WRZ7-0639 : Deal Continuation After 2020	2020	7
AFF-RTR-WRZ7-0909 : Barham Continuation (After 2019/20)	2020	7
AFF-EGW-WRZ7-0629 : Lye Oak Licence Variation	2021	7
AFF-CTR-WRZ4-4001 : Egham to Iver	2022	7
AFF-RNC-WRZ7-0900 : Dover Constraint Removal	2022	7
AFF-NGW-WRZ3-1068 : Runley Wood (AMP7 LGS Borehole)	2026	8
AFF-NGW-WRZ3-1053 : Kings Walden	2031	9
AFF-RES-WRZ4-0832 : Brent Reservoir	2032	9
AFF-CTR-WRZ3-4005 : Arkley North	2035	9
AFF-NGW-WRZ4-0624 : Canal and Rivers Trust and GSK Slough Boreholes	2035	10
AFF-RTR-WRZ4-4011 : Abingdon to Iver 2 (50MI/d)	2037	10
AFF-EGW-WRZ7-0908 : Tappington South - Licence Variation	2041	11
AFF-EGW-WRZ2-0090 : Stonecross Source Optimisation	2050	13
AFF-TPO-WRZ4-0412 : Hillingdon Hospital boreholes	2050	13
AFF-RTR-WRZ3-4016 : Minworth Strategic Transfer (100 MI/d)	2051	13
AFF-RTR-WRZ7-0301 : Barham Import Increase (of 2MI/d) to 4 MI/d	2053	13
AFF-RNC-WRZ7-0626 : Broome Network Improvement	2063	15
AFF-TPO-WRZ6-1083 : Surrey University (Guildford Site)	2071	17
AFF-ASR-WRZ6-0174 : Egham ASR	2072	17
AFF-RTR-WRZ1-4010 : Abingdon Reservoir to Harefield Transfer (50MI)	2073	17
AFF-RTR-WRZ7-0842 : Aldington to Saltwood Import Increase by 3MI/d	2076	18

5.4.5.1 Assessment findings

A summary of the key findings for the supply-side schemes under this programme is provided below in **Table 5.11**.

Table 5.11: Demand-side Challenging Future Adaptive Run summary SEA findings

[illegible]

AMP7 (2020-25)

The five supply-side schemes to be delivered within the first five years (2020-25) of the plan period during AMP7 all propose minimal new infrastructure. As a result, they are not identified as having the potential for a significant negative effect either during construction or operation through the SEA, HRA or the WFD assessment.

AFF-RTR-WRZ7-0639: Deal Continuation After 2020 and **AFF-RTR-WRZ7-0909: Barham Continuation (After 2019/20)** propose the continuation of current agreements with Southern Water and South East Water respectively for the import of water. No new infrastructure is required for either of these schemes and no negative effects identified through the assessment.

AFF-EGW-WRZ7-0629: Lye Oak Licence Variation involves a negotiation to increase the abstraction license at Lye Oak. The increase in abstraction would be by 0.14Ml/d consistent with the volume of the “returned” water (around 4% of the abstraction). The assessment found that there is the potential for minor negative effects during operation against SEA objectives relating to East Kent Chalk Stour groundwater levels given the increased abstraction; however, this is likely to be local and minor given the small increase. As a result of this there is also some uncertainty identified against the SEA objective relating to biodiversity as a result of the potential for indirect effects and close proximity of the Lydden and Swingfield Woods SSSI. However, it is again considered that given the small increase in abstraction there is unlikely to be any significant negative effects. Mitigation could include a hands-off flow condition to prevent abstraction at low flows below a certain level. As a result it is recommended that the water level in the East Kent Chalk Stour groundwater body and condition status of the Lydden and Swingfield Woods SSSI are monitored.

AFF-RNC-WRZ7-0900: Dover Constraint Removal involves the removal of network constraints by construction of a new main from Primrose Treatment Works to The Cricketer's Public House with connection into the existing network; this will allow increased abstraction from the groundwater sources and transfer to Folkestone. The scheme involves minimal new infrastructure with a new 1.19km main and 1 x 1 m3 Surge Vessel. Minor negative effects are identified during construction against SEA objectives relating to recreation/ tourism, road infrastructure, biodiversity and landscape primarily as a result of the delivery of the new pipeline. Impacts will be temporary, local and minor and good practice construction methods should ensure that there are no significant negative effects.

AFF-CTR-WRZ4-4001: Egham to Iwer involves the installation of a new booster station on an existing site, which will allow 17 Ml/d to be pushed through the existing main. This will allow transfer of 17 Ml/d from Egham to Harefield, which will allow use of the existing surplus within the Wey community (WRZ4). The scheme involves minimal new infrastructure and the assessment found that there would be a residual neutral effect against the majority of SEA objectives during construction and operation. Standard construction practices should ensure that there are no significant impacts during the construction phase.

AMP8 (2025-30)

The only scheme proposed during AMP8 in 2026 is **AFF-NGW-WRZ3-1068: Runley Wood (AMP7 LGS Borehole)** - a scheme to license a new borehole in the Lower Greensand aquifer within the existing Runley Wood site boundary to allow an increased abstraction at this site. The assessment found that there is the potential for a moderate negative effect for SEA objectives 10 (WFD status) and 11 (surface/ ground water levels and flows). This was informed by the WFD assessment for the rdWRMP19, which identifies that the groundwater abstraction may influence local water balance in Woburn Sands groundwater body depending on extent of confined Lower Greensand (LGS) abstraction influence. It suggests that this needs to be confirmed through further hydrogeological survey work. There is also the potential to affect groundwater body input to the River Flit which could have impacts on water levels/ flow and quality. The WFD assessment recommends that further information and assessment required. Given the delivery date of this scheme in 2035, there would be sufficient time to undertake further investigative work and detailed assessments to determine the likelihood and significance of effects along with suitable mitigation measures. Mitigation could include a hands-off flow condition to prevent abstraction at low flows below a certain level. As a result it is recommended that the water level in the Woburn Sands groundwater body is monitored.

As a result of the above, the assessment also identifies that there is some uncertainty in terms of indirect effects on biodiversity (SEA objective 5) reliant on the River Flit during operation although it is

unlikely that this would be of significance. The assessment also identified that there is also the potential for a negative effect on SEA objective 5 (biodiversity) during construction. The scheme requires the delivery of a short 580m pipeline to connect the borehole/ LGS WTW to the Chaul End Reservoir and this crosses over some priority habitat (deciduous woodland). Given the location of the scheme it is unlikely that the route of the pipeline could be altered to avoid the habitat, given that the borehole and reservoir are separated by the M1 and the priority habitats run along either side of the motorway. Pipe jacking/ directional drilling could be used to avoid any loss of the habitat but the feasibility of this is uncertain at this stage and should be explored further at the detailed design stage.

AMP9 (2030-35)

Three supply-side schemes are proposed for delivery during AMP9 under this programme. As for **AFF-NGW-WRZ3-1068: Runley Wood (AMP7 LGS Borehole)** in AMP8, similar issues are also identified through the assessment for **AFF-NGW-WRZ3-1053: Kings Walden** scheduled for delivery in 2031. This scheme proposes a Lower Greensand borehole to be drilled on the existing site at Kings Walden for an output of 3Ml/d. The existing site already has a Chalk groundwater source. This water could then be used for blending with the chalk source on site that suffers from high nitrates.

The assessment found that there is the potential for a moderate negative effect for SEA objectives 10 (WFD status) and 11 (surface/ ground water levels and flows). This was informed by the WFD assessment for the rdWRMP19, which identifies that the groundwater abstraction may influence local water balance in Woburn Sands groundwater body depending on extent of confined Lower Greensand (LGS) abstraction influence. However, the WFD assessment notes that the LGS aquifer becomes unconfined more than 13 km north of the abstraction point, therefore any impact would be naturally mitigated due to the distance. It suggests that this needs to be confirmed through further hydrogeological survey work. There is also the potential to affect groundwater body input to the River Ivel which could have impacts on water levels/ flow and quality at a local scale.

The WFD assessment recommends that further information and assessment required. Given the delivery date of this scheme in 2040, there would be sufficient time to undertake further investigative work and detailed assessments to determine the likelihood and significance of effects along with suitable mitigation measures. Mitigation could include a hands-off flow condition to prevent abstraction at low flows below a certain level. As a result it is recommended that the water level in the Woburn Sands groundwater body is monitored.

As a result of the above, the assessment also identifies that there is some uncertainty in terms of indirect effects on biodiversity (SEA objective 5) reliant on the River Ivel during operation although it is unlikely that this would be of significance. The mitigation identified above would reduce the potential for any residual negative effects in the medium to long-term.

The second supply-side to be delivered during AMP9 in 2032 is **AFF-RES-WRZ4-0832: Brent Reservoir**, which proposes the import of water from the Canal & River Trust reservoir at Brent. The water would be transmitted via the River Brent and the Grand Union Canal to the existing Iver Water Treatment Works for abstraction and subsequent treatment at a new Iver 2 WTW. The option includes upgraded storage at a new Harrow Service Reservoir within WRZ4.

The assessment identified that during the construction phase there is the potential for negative effects on SEA objectives 6 (landscape) and 13 (historic environment). The scheme includes a new Harrow service reservoir at Harrow on the Hill, which is an important local area of open/ green space surrounded by the existing built area that provides areas for recreation and contributes to the character of the landscape/ townscape. The new reservoir is also situated in close proximity to the Harrow Park Registered Park and Garden. Potential for moderate negative effects during construction against SEA objectives relating to the landscape and historic environment. The assessment recommends the retention of hedgerows, trees, walls wherever possible and the re-instatement of soil/ land following construction of the pipeline. It also proposes the use of construction methods and barriers/ hoardings that are sympathetic to the aesthetics of the surrounding landscape. Where possible any opportunities to merge the reservoir embankment into the landscape should be explored.

During operation **AFF-RES-WRZ4-0832: Brent Reservoir** proposes the release of water from the reservoir, which is also a SSSI. The Brent Reservoir SSSI is currently in a favourable condition and is designated for breeding wetland birds, in particular for significant numbers of nesting great crested

grebe, as well as wetland plant communities. There is uncertainty at this stage with regard to the extent and frequency of drawdown in the reservoir as a result of this proposed scheme. The Great Crested Grebe nest in reed beds and the Passerines (bullfinch, greenfinch, jay, willow warbler and wren) nest in willow woodland broadly between March and July so higher/ lower water levels in these periods could affect them. The wintering birds (Pochard, Gadwall, Snipe, Jack snipe and Smew) could also be affected as again; changing water levels could affect the amount of terrestrial habitat surrounding the waterbody that could be available for them to rest on when out of the water. The wetland plant species are sensitive to changes in water levels. It will be important to prevent the water levels from fluctuating significantly and frequently as this could displace plants as they move up/ or down in the inundation zone.

There are ongoing discussions between Affinity Water and the Canal & River Trust who operate the reservoir. More detailed hydrological investigations need to be carried out in order to determine the extent and frequency of drawdown as a result of this scheme and how the hydrological conditions affect the wetland habitats and birds they support. The assessment proposes that the water levels in the Brent Reservoir are monitored to inform the need and use of hands-off flow conditions to restrict the release of water when levels are low. Furthermore, the release of water could also be restricted during the breeding/ nesting seasons (broadly March to July). The condition status of the Brent Reservoir SSSI should also be monitored.

The final supply-side scheme to be delivered in 2035 is **AFF-CTR-WRZ3-4005: Arkley North**. The scheme allows for the bypass of Arkley 2 Reservoir and seeks to improve the interconnectivity between reservoirs. It involves minimal new infrastructure (50m of new main) and is not identified in the SEA, HRA or WFD assessment as having the potential for a significant negative effect during construction or operation. The potential for minor negative effects are identified during construction of the new pipeline but it is considered that there is suitable mitigation available through standard construction practices to ensure that there are no residual significant negative effects.

AMP10 (2035-40)

Two supply-side scheme are proposed during AMP10. The first of these to be delivered in 2035 is **AFF-NGW-WRZ4-0624: Canal and Rivers Trust and GSK Slough Boreholes**. The scheme proposes obtaining supplies from existing Lower Greensand boreholes that are currently owned by third parties in the Slough area. The Lower Greensand water is to be pumped via a new pipeline along the Grand Union Canal towpath for treatment at a new Iwer 2 WTW location (the existing Iwer WTW is at full capacity). A new pipeline will then take the water to existing Iwer for onward transfer to an upgraded Harrow Service Reservoir for use in WRZ4 (or WRZ2).

The assessment identifies the potential for a moderate negative effect against SEA objectives relating to surface and groundwater body status and flows. The WFD assessment notes that the GSK abstraction is/ was discharged to the Salthill stream following its use as non-evaporative cooling. As a result the WFD assessment found that there is a potential for a reduction in water returned to the surface water body that may lead to deterioration of status and flows. The proposed scheme may involve diverting this discharge to Affinity Water for consumptive use. The WFD assessment recommends that further information and assessment required. The discharge volume needs to be quantified and further WFD assessment undertaken to determine if could impact the status of the Salthill Stream surface water body. Given that the delivery date of this scheme is 2044 there is sufficient time to investigate this issue further.

The second and final scheme to be delivered in AMP10 in 2037 is **AFF-RTR-WRZ4-4011: Abingdon to Iwer 2 (50MI/d)**. This scheme involves an increased abstraction from the River Thames at Sunnymeads, onwards transfer by a new main for treatment at Iwer 2 WTW. Water will be discharged from a new South East Strategic Reservoir (within the Thames Water Supply Area) for abstraction downstream from the River Thames at Sunnymead. The increased abstraction will provide an additional 50 MI/d during both peak and average conditions for use within WRZ4.

During construction the assessment found that there is the potential for significant negative (moderate and major) effects against a number of SEA objectives as a result of this scheme due to the scale of new infrastructure required. This includes:

- Major negative effects for SEA objectives relating to material consumption and carbon footprint due to the scale of infrastructure.

- Moderate negative effects for SEA Objective 3 due to temporary disruption to local and strategic transport infrastructure, including public rights of way and major roads.
- Moderate negative effects also anticipated for SEA Objective 7 relating to Hillingdon AQMA and Marcham AQMA given the level of traffic anticipated during construction.
- Moderate negative effects for SEA Objective 5 due to temporary and permanent disruption to biodiversity, including internationally and nationally designated sites and other important habitats and species.
- Major negative effects for SEA Objective 6 given the construction of Abingdon reservoir is likely to have significant effects on the landscape. This includes impact on the setting of the North Wessex Downs AONB, and extensive disruption to views, visual amenity and landscape character.
- Major negative effects for SEA Objective 13 as a result of the heritage assets located within close proximity to the new reservoir and pipeline (including archaeological assets).

During operation the assessment found that there is the potential for significant negative (moderate and major) effects against a number of SEA objectives as a result of this scheme due to the scale of new infrastructure required. This includes:

- Moderate negative effects for SEA Objective 6 given that the new reservoir ancillary infrastructure would be a prominent new feature in the landscape. Notably, three towers will be seen against the visual context of the North Wessex Downs AONB to the south and east.
- Major negative effects for SEA Objective 8 relating to carbon footprint due to the scale of infrastructure.

During operation the assessment found that there is the potential for significant positive (moderate) effects against a number of SEA objectives as a result of this scheme due to the scale of new infrastructure required. This includes:

- Moderate positive effects for SEA Objective 2 in relation to tourism, recreation and amenity facilities.
- Moderate positive effects for SEA Objective 5 as the scheme is anticipated to provide opportunities for biodiversity enhancement and net gain.
- Moderate positive effects for SEA Objective 6 as the scheme presents opportunities for landscape enhancements and improvements. Specific mitigation measures and enhancements will be developed in the detailed design stages.
- Moderate positive effects for SEA Objective 8 as the scheme is upgrading transfer and storage capacity, resulting in positive effects on the resilience of Affinity Water's assets to climate change.

AMP11 (2040-45)

Only one supply-side scheme is proposed for delivery during AMP11 under this programme. **AFF-EGW-WRZ7-0908: Tappington South - Licence Variation** is scheduled for delivery in 2041. This scheme involves the re-commissioning of the currently disused borehole at Tappington Source to provide resilience for the licence group. The scheme involves minimal new infrastructure and was not identified as having the potential for a significant effect through the SEA, HRA or the WFD assessment.

AMP13 (2050-55)

Four supply-side schemes are proposed for delivery in AMP13. Two of these schemes are to be delivered in 2050. **AFF-EGW-WRZ2-0090: Stonecross Source Optimisation** to be delivered in 2050. The scheme involves upgrading the borehole pumps at the existing Stonecross chalk groundwater source, as well as treatment works, and a network modification to close the 0.41 Ml/d gap between DO and licence. The scheme would result in minimal new infrastructure and the assessment does not identify the potential for any residual moderate or major negative effects during construction or operation.

The assessment identifies that there is the potential for minor negative effects in the medium to long-term during operation as the increased abstraction at peak times may have some potential impact on water level in the aquifer and impact base flow in the linked surface water body (Ver River). The WFD assessment notes that these impacts are likely to be local, minor and temporary. The assessment also acknowledges that the issue above could have indirect effects on biodiversity. Mitigation could include a hands-off flow condition to prevent abstraction at low flows below a certain level. This should be given further consideration at the detailed design stage.

AFF-TPO-WRZ4-0412: Hillingdon Hospital boreholes seeks to purchase or lease and then transfer any potential spare capacity from three boreholes owned by Hillingdon Hospital. Two boreholes (B & A) are in use, while borehole C has been out of use for years owing to high iron levels (water quality). According to the Environment Agency website, the licence 28/39/28/0513 (HILLINGDON HOSPITAL NHS TRUST) is for 0.55 Ml/d at average and 1.00 Ml/d at peak.

The assessment does not identify any moderate or major negative effects in relation to this scheme during construction or operation. The potential for minor negative effects are identified during construction of the new pipeline and WTW but it is considered that there is suitable mitigation available through standard construction practices to ensure that there are no residual significant negative effects.

The third supply scheme delivered under this programme during AMP13 in 2051 is **AFF-RTR-WRZ3-4016: Minworth Strategic Transfer (100 Ml/d)**. This scheme involves the transfer of 100Ml/d of raw water by a new main from Minworth Sewage Treatment Works (a Severn Trent asset) to a new Sundon Treatment Works. The scheme will require a new 130km long 800mm diameter main from Minworth STW to a new WTW at Sundon.

During construction the assessment identifies that there is the potential for major negative effects against SEA objectives relating to material consumption, landscape, carbon footprint and road infrastructure primarily as a result of the scale of new infrastructure required. With regard to landscape, this scheme requires the construction of new water treatment works and approx 3.3km of new main within the Chilterns AONB. The assessment also identifies potential issues for biodiversity, the historic environment and local water quality during construction. These primarily arise as a result of the proximity of the new pipeline to waterbodies as well as designated biodiversity and heritage assets. It is considered that there are suitable mitigation measures available to ensure that residual negative effects are not significant. The assessment recommends that the pipeline is re-routed where possible to avoid designated biodiversity and heritage assets.

During operation the assessment found that there is unlikely to be significant negative effects against the majority of SEA objectives. Although it is noted that significant negative effects are identified in terms of the carbon footprint of the company.

The assessment recognises that the new WTW falls within the Chilterns AONB and recommends that mitigation measures should include the retention of hedgerows, trees, fields, walls wherever possible and the re-instatement of soil/ land following construction of the pipeline. Use construction methods and barriers/hoardings that are sympathetic to the aesthetics of the surrounding landscape and historic environment. The delivery of screening/ planting should ensure that the residual effects during operation on the landscape and historic environment are reduced. More detailed mitigation measures should be explored at the detailed design stage.

The final scheme to be delivered in AMP13 in 2053 is **AFF-RTR-WRZ7-0301: Barham Import Increase (of 2Ml/d) to 4 Ml/d**. An agreement between Affinity Water and South East Water exists for the import of 2 Ml/d via the Barham Interconnection Point. This scheme proposes an increase of this import by 2 Ml/d to a total of 4 Ml/d for transfer to Chalksole Reservoir. This scheme will require a 2 Ml upgrade of Chalksole Service Reservoir.

The Chalksole Reservoir is situated within the Kent Downs AONB and is surrounded by areas of Priority Habitat (deciduous woodland) that is also listed as Ancient and Semi-Natural Woodland. Potential for moderate negative effects on SEA objectives relating to biodiversity and the landscape during construction; however, it is acknowledged that there is uncertainty as the precise direction and area of land lost to the reservoir expansion is not known at this stage. The assessment notes that there are a number of areas around the existing reservoir where there are no designated habitats. It is therefore considered that there is high likelihood that the upgrade of the reservoir can avoid the

important habitats and this should be explored as a first step at the detailed design stage. Further consultation with NE will be necessary as well as more detailed ecological surveys.

The assessment recommends that any new structures (such as the above ground concrete tank structure associated with the reservoir upgrade) should be designed sympathetically to fit in with the surrounding landscape, and/or screened as appropriate by landscaping and planting. More detailed mitigation measures should be set out at the detailed design stage.

AMP15 (2060-65)

Only one supply-side scheme is proposed for delivery during AMP15 in 2063. **AFF-RNC-WRZ7-0626: Broome Network Improvement** is designed to remove a network constraint on the Barham South East Water Import Main and a demand constraint, by transferring the existing Broome Borehole Source to Denton rather than via the Barham Import Main (WRZ7).

The assessment does not identify any moderate or major negative effects in relation to this scheme during construction or operation. The potential for minor negative effects are identified during construction of the new pipeline and upgrading of the WTW but it is considered that there is suitable mitigation available through standard construction practices to ensure that there are no residual significant negative effects.

It should be noted that this scheme falls entirely within the Kent Downs AONB. Construction of the new pipeline could have a minor negative effect on the landscape in the short-term, but this will be temporary and once it is buried there will be a residual neutral effect during operation. At this stage there is some uncertainty about the scale of the new building for treatment but it is assumed that it will not be significant and be located within the existing treatment site. Once mitigation has been taken into account, including planting/ screening it is predicted that the significance of residual effects can be reduced. Despite the small scale of development, it is considered that there is the potential for a minor negative effect during operation, in recognition of the AONB.

AMP17 (2070-75)

Three supply-side schemes are proposed during AMP16. The first is to be delivered in 2071 is **AFF-TPO-WRZ6-1083: Surrey University (Guildford Site)**, which is a third party scheme to obtain a supply from the Surrey University site in Guildford. The option requires further discussions with Surrey University to lease the use of the borehole, a licence application to the Environment Agency, and pipework to take the water into the existing Affinity Water network; the site is just outside WRZ6.

The assessment does not identify any moderate or major negative effects in relation to this scheme during construction or operation for the majority of SEA objectives. The potential for minor negative effects are identified during construction of new or upgraded infrastructure but it is considered that there is suitable mitigation available through standard construction practices to ensure that there are no residual significant negative effects. A moderate negative effect is predicted against biodiversity as the pipeline currently passes through priority habitat (deciduous woodland). The assessment recommends that the pipeline should be re-routed at the detailed design stage to avoid the loss of any priority habitat.

The second scheme to be delivered in AMP17 in 2072 is **AFF-ASR-WRZ6-0174: Egham ASR**. This is a speculative scheme to inject winter excess water into the confined chalk or Lower Greensand (LGS) for use in the summer peak demand period. The source of water is likely to be treated surface water (e.g. from the existing Egham or Chertsey sources). Exploration boreholes (LGS and Chalk) and testing will be required, at which point the option is likely to evolve based on the new data (groundwater levels and water quality); for example, it is possible that based on the new information a conventional groundwater abstraction (average and peak benefit) may be possible, albeit with a suitable level of treatment.

The assessment does not identify any moderate or major negative effects in relation to this scheme during construction or operation. The potential for minor negative effects are identified during construction of new or upgraded infrastructure but it is considered that there is suitable mitigation available through standard construction practices to ensure that there are no residual significant negative effects. The new pipeline passes in close proximity to a number of designated biodiversity

and heritage assets but there is suitable mitigation available to ensure that there are no significant residual negative effects.

The final supply-side scheme to be delivered in AMP17 in 2073 is **AFF-RTR-WRZ1-4010: Abingdon Reservoir to Harefield Transfer (50MI)**, which is closely linked to **AFF-RTR-WRZ4-4011** delivered in AMP10.

AFF-RTR-WRZ1-4010: Abingdon Reservoir to Harefield Transfer (50MI) utilises the same infrastructure as **AFF-RTR-WRZ4-4011** up to point near Iver 2 WTW. It would then extend the mains northward to an upgraded Harefield Reservoir and Harefield Treatment Works. The detailed assessment of this scheme was carried out on the basis that this scheme could include the delivery of the South East Strategic Reservoir (SESR). However, the SESR would already be established at this point given the earlier delivery of **AFF-RTR-WRZ4-4011**. While there is still the potential for negative effects as a result of the delivery of the pipeline and expanded Harefield reservoir it is considered that there is suitable mitigation available to ensure that residual effects are minor. It is also considered that there is unlikely to be any significant negative effects during operation.

AMP18 (2075-80)

One supply-side scheme is proposed for delivery during AMP18. **AFF-RTR-WRZ7-0842: Aldington to Saltwood Import Increase by 3MI** is scheduled for delivery in 2076. This scheme is an import of water from South East Water to WRZ7 via an interconnection point at Aldington for transfer to Saltwood Reservoir. This scheme requires a 3MI capacity upgrade of Saltwood Reservoir, a new 12.2 km 200 mm Diameter Main from the interconnection point to Saltwood Reservoir and a new pump station at the interconnection point (3 x 22 kW Booster Pumps).

The assessment does not identify any moderate or major negative effects in relation to this scheme during construction or operation for the majority of SEA objectives. Moderate negative effects identified during construction for SEA objectives relating to carbon footprint, the landscape, historic environment and agricultural land. In terms of the landscape, approximately 2.5km of the pipeline and the expanded reservoir fall within the Kent Downs AONB. The new pump house falls just outside the AONB and the expansion of the Saltwood service reservoir would fall within the AONB, as a result the potential for negative effects during construction is predicted to be moderate. The new pipeline passes within 5m of a Scheduled Monument and within 20m of a Listed Building. There is therefore potential for a moderate negative effect during the construction phase due to the proximity of the designated heritage assets.

The assessment recommends that mitigation measures should include the retention of hedgerows, trees, fields, and walls wherever possible and the re-instatement of soil/ land following construction of the pipeline. Use construction methods that are sympathetic to the aesthetics of the surrounding landscape and historic environment. The delivery of screening/planting should ensure that the residual effects during operation are reduced. The new pump house building should also be designed sympathetically to fit in with the surrounding landscape/ historic environment and screening used where appropriate. More detailed mitigation measures should be set out at the detailed design stage.

During operation the assessment found that there is unlikely to be any significant negative effects once mitigation is taken into account. Key issues during operation relate to medium to long-term effects on the landscape and historic environment (mitigation referred to above) as well as potential issues in relation to water quality through the creation of new preferential pathways into the aquifer due to below ground workings and construction of mains. The WFD assessment concluded that best practice design, construction and operation should ensure that impacts are minor, localised and temporary.

5.4.5.2 Cumulative effects

Overall the cumulative effects assessment in **Appendix VI** has found that there is a low risk arising during construction of cumulative adverse effects regarding the SEA topic of population and human health. Extended construction related mitigation such as detailed routing, traffic planning and management and limitation of works within peak periods/ times will minimize the potential cumulative effects identified.

Regarding the SEA water topic, the assessment has identified a low risk of cumulative adverse effects as a result of schemes interacting with the potential to affect the Lower Thames Gravels Groundwater Body, the Thames (Cookham to Egham) Surface Water Body, the Mid-Chilterns Chalk Groundwater Body, and the Colne (from confluence with Chess to River Thames) Surface Water Body; where mitigation, including CoPC and best practice for design, construction and operations is recommended.

The assessment has also identified a medium risk of cumulative adverse effects as a result of schemes interacting with the potential to affect the Upper Bedford Ouse Woburn Sands Groundwater Body. The WFD assessment identifies that further hydrogeological assessment to consider linkage between deep Lower Greensand aquifer and Upper Bedford Ouse Woburn Sands is required. It is also recommended that water levels/flows in the Upper Bedford Ouse Woburn Sands Groundwater Body are monitored and mitigation could include a hands-off flow condition to prevent abstraction if water levels/ flows drop below a certain level.

The assessment has also identified the potential for positive effects arising as a result of schemes (AFF-RTR-WRZ1-4010 and AFF-RTR-WRZ4-4011) interacting to improve water levels and flow rates, improve habitats and improve low flows and chemistry within the Thames (Evenlode to Thame, Wallingford to Caversham, and Reading to Cookham) Surface Water Bodies.

Overall the assessment has also found that there are low risks arising (predominantly through construction phases), of cumulative adverse effects regarding the SEA topics relating to biodiversity and landscape and visual amenity. Sensitive receptors found to be at low risk are the Kent Downs AONB, Chilterns AONB, North Wessex Downs AONB and South West London Waterbodies Ramsar and SPA.

The identified effects in relation to the AONBs are likely to be short-term and temporary associated with traffic and access disruption - including disruption to public rights of way, noise and disturbance (potentially affecting tranquillity and landscape character in the short term). Extended construction related mitigation such as detailed routing, traffic planning and management and limitation of works within peak periods/ times are considered likely to minimise the potential cumulative effects identified. Any new visible infrastructure should be sensitively designed and adhere to the aims and policies of the relevant AONB Management Plan.

The HRA for the rdWRMP19 recommended a number of mitigation measures in relation to the schemes AFF-RTR-WRZ1-4010 (2073) and AFF-RTR-WRZ4-4011 (2037) which will need to be taken into consideration during construction and operation to minimise the risks associated with the European designated sites (South West London Waterbodies Ramsar and SPA). This mitigation includes an explicit commitment to ensure that the programming and construction processes for the schemes take into account the proximity of the SPA and that construction works on the short section of pipeline adjacent to the SPA are programmed to avoid the winter (October to March) period entirely or are accompanied by an impact assessment including noise modelling and mitigation in line with British Standard BS5228 as required in order to ensure that noise levels can be maintained at an acceptable level.

The WRSE (updated 2018) study of potential cumulative effects between water company WRMPs in South East England identified seven schemes proposed under this programme that could interact with schemes proposed in other WRMPs to have a cumulative effect.

This includes six schemes located within the Southeast Region (WRZ 7 - Dour) which are identified as having the potential to have cumulative effects on the Kent Downs AONB as a result of interactions with options being considered through the emerging WRMP19 for Southern Water (BS_Win, IZT_Sel, and BR_Lug):

- AFF-RNC-WRZ7-0626 (Broome Network Improvement)
- AFF-RTR-WRZ7-0909 (Barham Continuation (After 2019/20))
- AFF-RTR-WRZ7-0301 (Barham Import Increase (of 2Ml/d) to 4Ml/d)
- AFF-EGW-WRZ7-0908 (Tappington South Licence Variation)
- AFF-EGW-WRZ7-0629 (Lye Oak Licence Variation)
- AFF-RTR-WRZ7-0842 (Aldington to Saltwood Import Increase by 3Mld)

Three of the schemes (AFF-RTR-WRZ7-0909, AFF-EGW-WRZ7-0908 and AFF-EGW-WRZ7-0629) involve no new infrastructure so will not interact with the other Affinity Water rdWRMP19 schemes or the Southern Water schemes to have cumulative effects on the AONB. AFF-RNC-WRZ7-0626 proposes minimal new infrastructure and the risk of cumulative effects on the AONB is therefore low.

AFF-RTR-WRZ7-0301 proposes a small upgrade of the Chalksole Service Reservoir and AFF-RTR-WRZ7-0842 proposes a small upgrade of the Saltwood Reservoir along with a new mains and pump station at the interconnection point. Given the scale of the schemes and potential mitigation available, including screening/ planting, it is considered unlikely that there will be any significant cumulative effects with options being proposed through Southern Water's WRMP19 on the AONB. Any schemes that propose new infrastructure should ensure that it is sensitively designed and is in conformity with the Kent Downs AONB Management and Local Plans.

It is noted that the WRSE work identifies that a Southern Water option BS_Win is within 5km of option AFF-RTR-WRZ7-0301 and AFF-RNC-WRZ7-0626 so there is the potential for wider construction related impacts. As previously mentioned, AFF-RNC-WRZ7-0626 involves minimal new infrastructure and has a delivery date of 2063. AFF-RTR-WRZ7-0301 does not propose any significant new infrastructure and has a delivery date of 2053. Taking the scale of infrastructure proposed and the delivery dates it is considered unlikely that there will be any cumulative effects during construction.

AFF-RES-WRZ4-0832 (Brent Reservoir) is identified in the WRSE study as having the potential for cumulative effects on the Thames (wider catchment) as a result of interactions with options being considered through the emerging WRMP19 for Thames Water. The preliminary WFD assessment for Affinity Water's rdWRMP19 found that AFF-RES-WRZ4-0832 would interact with the Lower Brent surface water body and would have no measurable or significant impact on the surface water body in terms of changes in flow velocity and volume from abstraction or any changes to hydromorphology during operation.

The other schemes proposed within this programme and identified through the WRSE study as having the potential for a cumulative effect are AFF-EGW-WRZ7-0629 (Lye Oak (LYEO) Licence Variation) and AFF-EGW-WRZ7-0908 (Tappington South (TAPS) Licence Variation) in WRZ 7. The study identified that these two schemes could interact with Southern Water option GWA_Fle (Flemings and Woodnesborough WSW licence variation) to have a cumulative effect on the East Kent Chalk - Stour groundwater body.

The WFD assessment concluded that AFF-EGW-WRZ7-0629 (LYEO Licence Variation) would not pose a significant risk to deterioration and that any impacts would be localised or temporary and not affect the overall status of the groundwater body. The AFF-EGW-WRZ7-0908 scheme involves TAPS, an existing (but disused) groundwater source within an existing licence group. There is a sequence of boreholes connected by an existing raw water main to the treatment works; DENT; TAPN; and RAKN. TAPS is not within this sequence currently and the option is to re-commission the borehole to provide resilience for the licence group (the group output is limited by licence/ treatment works). This scheme was scoped out of the WFD assessment as there would be no overall increase in abstracted volumes. As a result of the findings of the WFD assessment, it is considered that there is a low risk of cumulative effects arising as a result of interactions with Southern Water option GWA_Fle (Flemings and Woodnesborough WSW licence variation) on the East Kent Chalk - Stour groundwater body.

5.4.6 SEA of AD_2

This run contains expected levels of demand management savings, and also will not allow any strategic options (Options with +50MI/d benefit) to be selected. This model run has an otherwise expected supply-side future. This would help to simulate what options would be required if Affinity Water were unable to progress with a strategic option. It should be noted that the model could not balance supply and demand with no strategic options selected under this scenario. As a result, Affinity Water allowed the selection of AFF-RTR-WRZ3-4016: Minworth Strategic Transfer (100 MI/d) based on the findings of the SEA, WFD and HRA as it was not identified as having any significant negative effects during operation (apart from the carbon related SEA objective).

Table 5.12: AD_2 supply-side schemes

Supply scheme	Delivery date	AMP
AFF-RTR-WRZ7-0639 : Deal Continuation After 2020	2020	7
AFF-RTR-WRZ7-0909 : Barham Continuation (After 2019/20)	2020	7
AFF-EGW-WRZ7-0629 : Lye Oak Licence Variation	2021	7
AFF-CTR-WRZ4-4001 : Egham to Iver	2022	7
AFF-RNC-WRZ7-0900 : Dover Constraint Removal	2022	7
AFF-NGW-WRZ3-1068 : Runley Wood (AMP7 LGS Borehole)	2025	8
AFF-NGW-WRZ3-1053 : Kings Walden	2030	9
AFF-RES-WRZ4-0832 : Brent Reservoir	2031	9
AFF-NGW-WRZ4-0624 : Canal and Rivers Trust and GSK Slough Boreholes	2040	11
AFF-TPO-WRZ4-0412 : Hillingdon Hospital boreholes	2041	11
AFF-RTR-WRZ3-4016 : Minworth Strategic Transfer (100 MI/d)	2042	11
AFF-EGW-WRZ7-0908 : Tappington South - Licence Variation	2044	11
AFF-RNC-WRZ7-0626 : Broome Network Improvement	2057	14
AFF-RTR-WRZ7-0301 : Barham Import Increase (of 2MI/d) to 4 MI/d	2068	16
AFF-EGW-WRZ2-0090 : Stonecross Source Optimisation	2071	17
AFF-RES-WRZ5-0809 : Birds Green Reservoir	2072	17
AFF-TPO-WRZ6-1083 : Surrey University (Guildford Site)	2074	17
AFF-EFF-WRZ3-0180 : Stevenage STW - Effluent Reuse	2075	18
AFF-EGW-WRZ6-0173 : Clandon Source Optimisation	2076	18
AFF-RTR-WRZ6-0752 : Ladymead Optimisation	2076	18
AFF-RES-WRZ3-0814 : Honeywick Rye Reservoir	2077	18

5.4.6.1 Assessment findings

A summary of the key findings for the supply-side schemes under this programme is provided below in **Table 5.13**.

Table 5.13: AD_2 summary SEA findings

Supply scheme	Delivery date	AMP	SEA Objectives and assessment questions																																		
			1			2			3			4			5					6			7	8		9		10				11	12	13		14	
			1a	1b	1c	2a	2b	2c	3a	3b	4a	4b	5a	5b	5c	5d	5e	6a	6b	7a	8a	8b	9a	10a	10b	10c	10d	11a	12a	13a	13b	14a					
AFF-RTR-WRZ7-0639 : Deal Continuation After 2020	2020	7	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
AFF-RTR-WRZ7-0909 : Barham Continuation (After 2019/20)	2020	7	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
AFF-EGW-WRZ7-0629 : Lye Oak Licence Variation	2021	7	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
AFF-CTR-WRZ4-4001 : Egham to Iwer	2022	7	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
AFF-RNC-WRZ7-0900 : Dover Constraint Removal	2022	7	0	1	0	1	0	0	0	0	0	-1	0	-1	0	-1	0	-1	0	0	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
AFF-NGW-WRZ3-1068 : Runley Wood (AMP7 LGS Borehole)	2025	8	0	1	0	1	0	0	0	0	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
AFF-NGW-WRZ3-1053 : Kings Walden	2030	9	0	1	0	1	0	0	0	0	0	0	0	0	0	0	-1	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
AFF-RES-WRZ4-0832 : Brent Reservoir	2031	9	0	1	0	1	0	0	0	0	-1	0	-1	0	-2	0	-1	0	-2	0	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
AFF-NGW-WRZ4-0624 : Canal and Rivers Trust and GSK Slough Boreholes	2040	11	0	1	0	1	0	0	0	0	-1	0	-1	0	-1	0	-1	0	0	0	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
AFF-TPO-WRZ4-0412 : Hillingdon Hospital boreholes	2041	11	0	1	0	1	0	0	0	0	-1	0	-1	0	-1	0	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
AFF-CTR-WRZ3- 4016 : Minworth Strategic Transfer (100M/d)	2042	11	0	3	0	3	0	0	0	0	-1	0	-3	0	-1	0	-3	0	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
AFF-EGW-WRZ7-0908 : Tappington South - Licence Variation	2044	11	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
AFF-RNC-WRZ7-0626 : Broome Network Improvement	2057	14	0	1	0	1	0	0	0	0	-1	0	-1	0	-1	0	-1	0	0	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-1	0
AFF-RTR-WRZ7-0301 : Barham Import Increase (of 2M/d) to 4 M/d	2068	16	0	1	0	1	0	0	0	0	0	0	0	0	0	0	-2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-1	0
AFF-EGW-WRZ2-0090 : Stonecross Source Optimisation	2071	17	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
AFF-RES-WRZ5-0809 : Birds Green Reservoir	2072	17	0	1	0	1	0	0	0	0	-1	0	-1	0	-2	0	-1	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
AFF-TPO-WRZ6-1083 : Surrey University (Guildford Site)	2074	17	0	1	0	1	0	0	0	0	-1	0	-1	0	-1	0	-1	0	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
AFF-EFF-WRZ3-0180 : Stevenage STW - Effluent Reuse	2075	18	0	1	0	1	0	0	0	0	0	0	0	0	0	0	-1	0	0	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
AFF-RTR-WRZ6-0752 : Ladymead Optimisation	2076	18	0	1	0	1	0	0	0	0	-1	0	-1	0	-1	0	-1	0	0	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
AFF-EGW-WRZ6-0173 : Clandon Source Optimisation	2076	18	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
AFF-RES-WRZ3-0814 : Honeywick Rye Reservoir	2077	18	0	1	0	1	0	0	0	0	-1	0	-1	0	-1	0	-1	0	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

AMP7 (2020-25)

The five supply-side schemes to be delivered within the first five years (2020-25) of the plan period during AMP7 all propose minimal new infrastructure. As a result, they are not identified as having the potential for a significant negative effect either during construction or operation through the SEA, HRA or the WFD assessment.

AFF-RTR-WRZ7-0639: Deal Continuation After 2020 and **AFF-RTR-WRZ7-0909: Barham Continuation (After 2019/20)** propose the continuation of current agreements with Southern Water and South East Water respectively for the import of water. No new infrastructure is required for either of these schemes and no negative effects identified through the assessment.

AFF-EGW-WRZ7-0629: Lye Oak Licence Variation involves a negotiation to increase the abstraction license at Lye Oak. The increase in abstraction would be by 0.14Ml/d consistent with the volume of the “returned” water (around 4% of the abstraction). The assessment found that there is the potential for minor negative effects during operation against SEA objectives relating to East Kent Chalk Stour groundwater levels given the increased abstraction; however, this is likely to be local and minor given the small increase. As a result of this there is also some uncertainty identified against the SEA objective relating to biodiversity as a result of the potential for indirect effects and close proximity of the Lydden and Swingfield Woods SSSI. However, it is again considered that given the small increase in abstraction there is unlikely to be any significant negative effects. Mitigation could include a hands-off flow condition to prevent abstraction at low flows below a certain level. As a result it is recommended that the water level in the East Kent Chalk Stour groundwater body and condition status of the Lydden and Swingfield Woods SSSI are monitored.

AFF-RNC-WRZ7-0900: Dover Constraint Removal involves the removal of network constraints by construction of a new main from Primrose Treatment Works to The Cricketer's Public House with connection into the existing network; this will allow increased abstraction from the groundwater sources and transfer to Folkestone. The scheme involves minimal new infrastructure with a new 1.19km main and 1 x 1 m3 Surge Vessel. Minor negative effects are identified during construction against SEA objectives relating to recreation/ tourism, road infrastructure, biodiversity and landscape primarily as a result of the delivery of the new pipeline. Impacts will be temporary, local and minor and good practice construction methods should ensure that there are no significant negative effects.

AFF-CTR-WRZ4-4001: Egham to Iver involves the installation of a new booster station on an existing site, which will allow 17 Ml/d to be pushed through the existing main. This will allow transfer of 17 Ml/d from Egham to Harefield, which will allow use of the existing surplus within the Wey community (WRZ4). The scheme involves minimal new infrastructure and the assessment found that there would be a residual neutral effect against the majority of SEA objectives during construction and operation. Standard construction practices should ensure that there are no significant impacts during the construction phase.

AMP8 (2025-30)

The only scheme proposed during AMP8 in 2025 is **AFF-NGW-WRZ3-1068: Runley Wood (AMP7 LGS Borehole)** - a scheme to license a new borehole in the Lower Greensand aquifer within the existing Runley Wood site boundary to allow an increased abstraction at this site. The assessment found that there is the potential for a moderate negative effect for SEA objectives 10 (WFD status) and 11 (surface/ ground water levels and flows). This was informed by the WFD assessment for the rdWRMP19, which identifies that the groundwater abstraction may influence local water balance in Woburn Sands groundwater body depending on extent of confined Lower Greensand (LGS) abstraction influence. It suggests that this needs to be confirmed through further hydrogeological survey work. There is also the potential to affect groundwater body input to the River Flit which could have impacts on water levels/ flow and quality. The WFD assessment recommends that further information and assessment required. Given the delivery date of this scheme in 2035, there would be sufficient time to undertake further investigative work and detailed assessments to determine the likelihood and significance of effects along with suitable mitigation measures. Mitigation could include a hands-off flow condition to prevent abstraction at low flows below a certain level. As a result it is recommended that the water level in the Woburn Sands groundwater body is monitored.

As a result of the above, the assessment also identifies that there is some uncertainty in terms of indirect effects on biodiversity (SEA objective 5) reliant on the River Flit during operation although it is

unlikely that this would be of significance. The assessment also identified that there is also the potential for a negative effect on SEA objective 5 (biodiversity) during construction. The scheme requires the delivery of a short 580m pipeline to connect the borehole/ LGS WTW to the Chaul End Reservoir and this crosses over some priority habitat (deciduous woodland). Given the location of the scheme it is unlikely that the route of the pipeline could be altered to avoid the habitat, given that the borehole and reservoir are separated by the M1 and the priority habitats run along either side of the motorway. Pipe jacking/ directional drilling could be used to avoid any loss of the habitat but the feasibility of this is uncertain at this stage and should be explored further at the detailed design stage.

AMP9 (2030-35)

Two supply-side schemes are proposed for delivery during AMP9 under this programme. As for **AFF-NGW-WRZ3-1068: Runley Wood (AMP7 LGS Borehole)** in AMP8, similar issues are also identified through the assessment for **AFF-NGW-WRZ3-1053: Kings Walden** scheduled for delivery in 2030. This scheme proposes a Lower Greensand borehole to be drilled on the existing site at Kings Walden for an output of 3MI/d. The existing site already has a Chalk groundwater source. This water could then be used for blending with the chalk source on site that suffers from high nitrates.

The assessment found that there is the potential for a moderate negative effect for SEA objectives 10 (WFD status) and 11 (surface/ ground water levels and flows). This was informed by the WFD assessment for the rdWRMP19, which identifies that the groundwater abstraction may influence local water balance in Woburn Sands groundwater body depending on extent of confined Lower Greensand (LGS) abstraction influence. However, the WFD assessment notes that the LGS aquifer becomes unconfined more than 13 km north of the abstraction point, therefore any impact would be naturally mitigated due to the distance. It suggests that this needs to be confirmed through further hydrogeological survey work. There is also the potential to affect groundwater body input to the River Ivel which could have impacts on water levels/ flow and quality at a local scale.

The WFD assessment recommends that further information and assessment required. Given the delivery date of this scheme in 2040, there would be sufficient time to undertake further investigative work and detailed assessments to determine the likelihood and significance of effects along with suitable mitigation measures. Mitigation could include a hands-off flow condition to prevent abstraction at low flows below a certain level. As a result it is recommended that the water level in the Woburn Sands groundwater body is monitored.

As a result of the above, the assessment also identifies that there is some uncertainty in terms of indirect effects on biodiversity (SEA objective 5) reliant on the River Ivel during operation although it is unlikely that this would be of significance. The mitigation identified above would reduce the potential for any residual negative effects in the medium to long-term.

The second supply-side to be delivered during AMP9 in 2031 is **AFF-RES-WRZ4-0832: Brent Reservoir**, which proposes the import of water from the Canal & River Trust reservoir at Brent. The water would be transmitted via the River Brent and the Grand Union Canal to the existing Iwer Water Treatment Works for abstraction and subsequent treatment at a new Iwer 2 WTW. The option includes upgraded storage at a new Harrow Service Reservoir within WRZ4.

The assessment identified that during the construction phase there is the potential for negative effects on SEA objectives 6 (landscape) and 13 (historic environment). The scheme includes a new Harrow service reservoir at Harrow on the Hill, which is an important local area of open/ green space surrounded by the existing built area that provides areas for recreation and contributes to the character of the landscape/ townscape. The new reservoir is also situated in close proximity to the Harrow Park Registered Park and Garden. Potential for moderate negative effects during construction against SEA objectives relating to the landscape and historic environment. The assessment recommends the retention of hedgerows, trees, walls wherever possible and the re-instatement of soil/ land following construction of the pipeline. It also proposes the use of construction methods and barriers/ hoardings that are sympathetic to the aesthetics of the surrounding landscape. Where possible any opportunities to merge the reservoir embankment into the landscape should be explored.

During operation **AFF-RES-WRZ4-0832: Brent Reservoir** proposes the release of water from the reservoir, which is also a SSSI. The Brent Reservoir SSSI is currently in a favourable condition and is designated for breeding wetland birds, in particular for significant numbers of nesting great crested

grebe, as well as wetland plant communities. There is uncertainty at this stage with regard to the extent and frequency of drawdown in the reservoir as a result of this proposed scheme. The Great Crested Grebe nest in reed beds and the Passerines (bullfinch, greenfinch, jay, willow warbler and wren) nest in willow woodland broadly between March and July so higher/ lower water levels in these periods could affect them. The wintering birds (Pochard, Gadwall, Snipe, Jack snipe and Smew) could also be affected as again; changing water levels could affect the amount of terrestrial habitat surrounding the waterbody that could be available for them to rest on when out of the water. The wetland plant species are sensitive to changes in water levels. It will be important to prevent the water levels from fluctuating significantly and frequently as this could displace plants as they move up/ or down in the inundation zone.

There are ongoing discussions between Affinity Water and the Canal & River Trust who operate the reservoir. More detailed hydrological investigations need to be carried out in order to determine the extent and frequency of drawdown as a result of this scheme and how the hydrological conditions affect the wetland habitats and birds they support. The assessment proposes that the water levels in the Brent Reservoir are monitored to inform the need and use of hands-off flow conditions to restrict the release of water when levels are low. Furthermore, the release of water could also be restricted during the breeding/ nesting seasons (broadly March to July). The condition status of the Brent Reservoir SSSI should also be monitored.

AMP11 (2040-45)

Four supply-side schemes are proposed during AMP11 under this programme. The first scheme scheduled to be delivered in 2040 is **AFF-NGW-WRZ4-0624: Canal & River Trust and GSK Slough Boreholes**, which proposes obtaining supplies from existing Lower Greensand boreholes that are currently owned by third parties in the Slough area. The Lower Greensand water is to be pumped via a new pipeline along the Grand Union Canal towpath for treatment at a new Iver 2 WTW location (the existing Iver WTW is at full capacity). A new pipeline will then take the water to existing Iver for onward transfer to an upgraded Harrow Service Reservoir for use in WRZ4 (or WRZ2).

The assessment identifies the potential for a moderate negative effect against SEA objectives relating to surface and groundwater body status and flows. The WFD assessment notes that the GSK abstraction is/ was discharged to the Salthill stream following its use as non-evaporative cooling. As a result the WFD assessment found that there is a potential for a reduction in water returned to the surface water body that may lead to deterioration of status and flows. The proposed scheme may involve diverting this discharge to Affinity Water for consumptive use. The WFD assessment recommends that further information and assessment required. The discharge volume needs to be quantified and further WFD assessment undertaken to determine if could impact the status of the Salthill Stream surface water body. Given that the delivery date of this scheme is 2044 there is sufficient time to investigate this issue further.

The second supply-side scheme to be delivered in 2041 is **AFF-TPO-WRZ4-0412: Hillingdon Hospital boreholes**. This scheme seeks to purchase or lease and then transfer any potential spare capacity from three boreholes owned by Hillingdon Hospital. Two boreholes (B & A) are in use, while borehole C has been out of use for years owing to high iron levels (water quality). According to the Environment Agency website, the licence 28/39/28/0513 (HILLINGDON HOSPITAL NHS TRUST) is for 0.55 Ml/d at average and 1.00 Ml/d at peak.

The assessment does not identify any moderate or major negative effects in relation to this scheme during construction or operation. The potential for minor negative effects are identified during construction of the new pipeline and WTW but it is considered that there is suitable mitigation available through standard construction practices to ensure that there are no residual significant negative effects.

The third supply scheme delivered under this programme during AMP11 in 2042 is **AFF-RTR-WRZ3-4016: Minworth Strategic Transfer (100 Ml/d)**. This scheme involves the transfer of 100Ml/d of raw water by a new main from Minworth Sewage Treatment Works (a Severn Trent asset) to a new Sundon Treatment Works. The scheme will require a new 130km long 800mm diameter main from Minworth STW to a new WTW at Sundon.

During construction the assessment identifies that there is the potential for major negative effects against SEA objectives relating to material consumption, landscape, carbon footprint and road

infrastructure primarily as a result of the scale of new infrastructure required. With regard to landscape, this scheme requires the construction of new water treatment works and approx 3.3km of new main within the Chilterns AONB. The assessment also identifies potential issues for biodiversity, the historic environment and local water quality during construction. These primarily arise as a result of the proximity of the new pipeline to waterbodies as well as designated biodiversity and heritage assets. It is considered that there are suitable mitigation measures available to ensure that residual negative effects are not significant. The assessment recommends that the pipeline is re-routed where possible to avoid designated biodiversity and heritage assets.

During operation the assessment found that there is unlikely to be significant negative effects against the majority of SEA objectives. Although it is noted that significant negative effects are identified in terms of the carbon footprint of the company.

The assessment recognises that the new WTW falls within the Chilterns AONB and recommends that mitigation measures should include the retention of hedgerows, trees, fields, walls wherever possible and the re-instatement of soil/ land following construction of the pipeline. Use construction methods and barriers/hoardings that are sympathetic to the aesthetics of the surrounding landscape and historic environment. The delivery of screening/ planting should ensure that the residual effects during operation on the landscape and historic environment are reduced. More detailed mitigation measures should be explored at the detailed design stage.

The final supply-side scheme to be delivered in AMP11 in 2044 is **AFF-EGW-WRZ7-0908: Tappington South - Licence Variation**. This scheme involves the re-commissioning of the currently disused borehole at Tappington Source to provide resilience for the licence group. The scheme involves minimal new infrastructure and was not identified as having the potential for a significant effect through the SEA, HRA or the WFD assessment.

AMP14 (2055-60)

The only scheme to be delivered in AMP14 in 2057 is **AFF-RNC-WRZ7-0626: Broome Network Improvement**. The scheme is designed to remove a network constraint on the Barham South East Water Import Main and a demand constraint, by transferring the existing Broome Borehole Source to Denton rather than via the Barham Import Main (WRZ7).

The assessment does not identify any moderate or major negative effects in relation to this scheme during construction or operation. The potential for minor negative effects are identified during construction of the new pipeline and upgrading of the WTW but it is considered that there is suitable mitigation available through standard construction practices to ensure that there are no residual significant negative effects.

It should be noted that this scheme falls entirely within the Kent Downs AONB. Construction of the new pipeline could have a minor negative effect on the landscape in the short-term, but this will be temporary and once it is buried there will be a residual neutral effect during operation. At this stage there is some uncertainty about the scale of the new building for treatment but it is assumed that it will not be significant and be located within the existing treatment site. Once mitigation has been taken into account, including planting/ screening it is predicted that the significance of residual effects can be reduced. Despite the small scale of development, it is considered that there is the potential for a minor negative effect during operation, in recognition of the AONB.

AMP16 (2065-70)

The only scheme to be delivered in AMP16 in 2068 is **AFF-RTR-WRZ7-0301: Barham Import Increase (of 2 MI/d) to 4 MI/d**. An agreement between Affinity Water and South East Water exists for the import of 2 MI/d via the Barham Interconnection Point. This scheme proposes an increase of this import by 2 MI/d to a total of 4 MI/d for transfer to Chalksole Reservoir. This scheme will require a 2 MI upgrade of Chalksole Service Reservoir.

The Chalksole Reservoir is situated within the Kent Downs AONB and is surrounded by areas of Priority Habitat (deciduous woodland) that is also listed as Ancient and Semi-Natural Woodland. Potential for moderate negative effects on SEA objectives relating to biodiversity and the landscape during construction; however, it is acknowledged that there is uncertainty as the precise direction and area of land lost to the reservoir expansion is not known at this stage. The assessment notes that

there are a number of areas around the existing reservoir where there are no designated habitats. It is therefore considered that there is high likelihood that the upgrade of the reservoir can avoid the important habitats and this should be explored as a first step at the detailed design stage. Further consultation with NE will be necessary as well as more detailed ecological surveys.

The assessment recommends that any new structures (such as the above ground concrete tank structure associated with the reservoir upgrade) should be designed sympathetically to fit in with the surrounding landscape, and/or screened as appropriate by landscaping and planting. More detailed mitigation measures should be set out at the detailed design stage.

AMP17 (2070-75)

Three supply-side schemes are proposed during AMP17 under this programme. The first of these is **AFF-EGW-WR22-0090: Stonecross Source Optimisation** to be delivered in 2071. The scheme involves upgrading the borehole pumps at the existing Stonecross chalk groundwater source, as well as treatment works, and a network modification to close the 0.41 Ml/d gap between DO and licence. The scheme would result in minimal new infrastructure and the assessment does not identify the potential for any residual moderate or major negative effects during construction or operation.

The assessment identifies that there is the potential for minor negative effects in the medium to long-term during operation as the increased abstraction at peak times may have some potential impact on water level in the aquifer and impact base flow in the linked surface water body (Ver River). The WFD assessment notes that these impacts are likely to be local, minor and temporary. The assessment also acknowledges that the issue above could have indirect effects on biodiversity. Mitigation could include a hands-off flow condition to prevent abstraction at low flows below a certain level. This should be given further consideration at the detailed design stage.

The next supply-side scheme to be delivered in 2074 is **AFF-RES-WR25-0809: Birds Green Reservoir**. The scheme includes a river intake and pumping station at Marden Ash (River Roding), a new fully bunded bankside storage reservoir located at Birds Green, an onsite WTW and pumping station, and a treated water pipeline to Rye Hill service reservoir.

During construction the assessment identifies that there is the potential for moderate negative effects against SEA objectives relating to material consumption, landscape and carbon footprint primarily as a result of the scale of new infrastructure required. There is also a moderate negative effect identified during construction in relation to agricultural land, given the presence of best and most versatile agricultural land.

During operation moderate negative effects are identified for SEA objectives relating to carbon footprint, WFD status and surface and groundwater levels/ flows. The assessment identifies that there is the potential for the scheme to reduce water flow and levels as well as quality in the Lower Roding (Cripsey Brook to Loughton) Surface Water Body during operation. This is informed by the WFD assessment which recommends that further assessments and discussions with the EA are required. The SEA suggests that the water levels and flows in the Lower Roding (Cripsey Brook to Loughton) should be monitored and hands-off flow conditions used when water levels and flows are low. Another issue identified during operation is that the new Birds Green Reservoir will lead to the loss of Best and Most versatile agricultural land.

Additional benefits/ moderate positive effects were identified during operation as once established the raw water reservoir provides new opportunities for recreation as well as opportunities for biodiversity net gain.

The final supply-side scheme to be delivered during AMP17 in 2074 is **AFF-TPO-WR26-1083: Surrey University (Guildford Site)**, which is a third party scheme to obtain a supply from the Surrey University site in Guildford. The option requires further discussions with Surrey University to lease the use of the borehole, a licence application to the Environment Agency, and pipework to take the water into the existing Affinity Water network; the site is just outside WR26.

The assessment does not identify any moderate or major negative effects in relation to this scheme during construction or operation for the majority of SEA objectives. The potential for minor negative effects are identified during construction of new or upgraded infrastructure but it is considered that there is suitable mitigation available through standard construction practices to ensure that there are

no residual significant negative effects. A moderate negative effect is predicted against biodiversity as the pipeline currently passes through priority habitat (deciduous woodland). The assessment recommends that the pipeline should be re-routed at the detailed design stage to avoid the loss of any priority habitat.

AMP18 (2075-80)

Four supply-side schemes are proposed during AMP18 under this programme. The first to be delivered in 2075 is **AFF-EFF-WRZ3-0180: Stevenage STW - Effluent Reuse**. This scheme is for the provision of a new STW local to Stevenage in order to provide tertiary treated effluent that can be used to restore flows in the River Middle Beane, via Stevenage Brook.

The assessment found that the scheme is not likely to have any significant negative effects during construction. There is the potential for localised minor negative effects in the short-term as a result of the construction of the STW but this is unlikely to be significant once mitigation is taken into account.

During operation the assessment found that there is the potential for a moderate negative effect against the SEA objective that relates to WFD status. The WFD assessment identified that the discharge of treated water into surface water channel could lead to increase in nutrients which could be mobilised to the hydraulically connected groundwater body. Conversely the assessment also identified potential benefits and moderate positive effects for WFD status and surface and groundwater levels/ flows as the scheme would increase river flows in river Beane via discharge of treated effluent in Stevenage Brook. Chalk is unconfined at that location so there is a hydraulic connection and this would potentially increase recharge into the aquifer. WFD assessment states further information and investigation required to confirm the likelihood for negative and positive effects and inform the identification of mitigation measures if necessary.

The second supply-side scheme to be delivered in AMP18 in 2076 is **AFF-EGW-WRZ6-0173: Clandon Source Optimisation**. This scheme seeks to optimise the Clandon source by changing the software to allow water level based control of the pump speed, which should allow an increase in DO. The assessment found that this scheme is not likely to have significant negative effects during construction or operation given that it involves a change in software.

The next supply-side scheme to be delivered in 2076 is **AFF-RTR-WRZ6-0752: Ladymead Optimisation**. This scheme is an import of 2.7 MI/d of treated water from Thames Water via Ladymead Interconnection Point for transfer to Park Barn Drive Reservoir. The increase will provide an additional 2.7 MI/d during both peak and average conditions for use within WRZ6.

The assessment does not identify any moderate or major negative effects in relation to this scheme during construction or operation. The potential for minor negative effects are identified during construction of the new pipeline and upgrading of the WTW but it is considered that there is suitable mitigation available through standard construction practices to ensure that there are no residual significant negative effects. The assessment identifies some uncertainty over the precise area required for the reservoir expansion is not known at this stage and there is priority habitat to the north, west and south of the site. The detailed design stage should ensure that priority habitats are avoided as part of the reservoir expansion.

The final supply-side scheme to be delivered in AMP18 in 2077 is **AFF-RES-WRZ3-0814: Honeywick Rye Reservoir**. This is an augmentation scheme proposed to help offset the Runley Wood and Periwinkle Lane 10 MI/d sustainability reductions (AMP7). The scheme involves abstracting water from the River Ouzel, storing it at a new fully bunded raw water reservoir at Honeywick Rye, and discharging flow to the Upper Lee River.

During construction the assessment found that there is the potential for a moderate negative effect against SEA objectives that relate to carbon footprint and the landscape primarily as a result of the delivery of the new infrastructure.

During operation the assessment found that there is the potential for moderate negative effects against SEA objectives that relate to carbon footprint as well as WFD status and surface and groundwater levels/ flows. The WFD assessment found that during operation the scheme has the potential to impact flow velocity and volume, hydromorphology and therefore water quality of the

Ouzel (US Clipstone Brook) surface water body. The WFD assessment recommends that the timing of the abstraction needs to be confirmed and that further investigation and assessment is required.

Conversely the assessment also notes that there is the potential for benefits/ positive effects. The WFD assessment found that there is also the potential for this scheme to have benefits for the Lee (from Luton to Luton Hoo Lakes) surface water body and the Upper Bedford Ouse Chalk Groundwater body as a result of increased treated discharge into the Upper Lee catchment. This will help to improve water levels and flow rates. This will help to improve water levels and flow rates.

The assessment also identified the potential for moderate positive effects in the medium to long-term during operation once the new raw water reservoir is established. It has the potential to provide new opportunities for recreation as well as biodiversity net gain by providing new habitat for waders and waterfowl as well as other species.

5.4.6.2 Cumulative effects

Overall the cumulative effects assessment in **Appendix VI** has found that there is a low risk arising during construction of cumulative adverse effects regarding the SEA topic of population and human health. Extended construction related mitigation such as detailed routing, traffic planning and management and limitation of works within peak periods/ times will minimize the potential cumulative effects identified.

Regarding the SEA water topic, the assessment has identified a medium risk of cumulative adverse effects as a result of schemes interacting with the potential to affect the Upper Bedford Ouse Woburn Sands Groundwater Body. The WFD assessment identifies that further hydrogeological assessment to consider linkage between deep Lower Greensand aquifer and Upper Bedford Ouse Woburn Sands is required. It is also recommended that water levels/flows in the Upper Bedford Ouse Woburn Sands Groundwater Body are monitored and mitigation could include a hands-off flow condition to prevent abstraction if water levels/ flows drop below a certain level.

Overall the assessment has also found that there are low risks arising (predominantly through construction phases), of cumulative adverse effects regarding the SEA topics relating to biodiversity and landscape and visual amenity. Sensitive receptors found to be at low risk are the Kent Downs AONB, Chilterns AONB, Surrey Hills AONB, and South West London Waterbodies Ramsar and SPA.

The identified effects in relation to the AONBs are likely to be short-term and temporary associated with traffic and access disruption - including disruption to public rights of way, noise and disturbance (potentially affecting tranquillity and landscape character in the short term). Extended construction related mitigation such as detailed routing, traffic planning and management and limitation of works within peak periods/ times are considered likely to minimise the potential cumulative effects identified. Any new visible infrastructure should be sensitively designed and adhere to the aims and policies of the relevant AONB Management Plan.

The HRA for the rdWRMP19 found that the schemes with the potential to cumulatively affect the South West London Waterbodies Ramsar and SPA are not likely to have significant effects on the European designated sites as there are no identified impact pathways.

The WRSE (updated 2018) study of potential cumulative effects between water company WRMPs in South East England identified seven schemes proposed under this programme that could interact with schemes proposed in other WRMPs to have a cumulative effect.

This includes five schemes located within the Southeast Region (WRZ 7 - Dour) which are identified as having the potential to have cumulative effects on the Kent Downs AONB as a result of interactions with options being considered through the emerging WRMP19 for Southern Water (BS_Win, IZT_Sel, and BR_Lug):

- AFF-RNC-WRZ7-0626 (Broome Network Improvement)
- AFF-RTR-WRZ7-0909 (Barham Continuation (After 2019/20))
- AFF-RTR-WRZ7-0301 (Barham Import Increase (of 2MI/d) to 4MI/d)
- AFF-EGW-WRZ7-0908 (Tappington South Licence Variation)

- AFF-EGW-WRZ7-0629 (Lye Oak Licence Variation)

Three of the schemes (AFF-RTR-WRZ7-0909, AFF-EGW-WRZ7-0908 and AFF-EGW-WRZ7-0629) involve no new infrastructure so will not interact with the other Affinity Water rdWRMP19 schemes or the Southern Water schemes to have cumulative effects on the AONB. AFF-RNC-WRZ7-0626 proposes minimal new infrastructure and the risk of cumulative effects on the AONB is therefore low.

AFF-RTR-WRZ7-0301 proposes a small upgrade of the Chalksole Service Reservoir. Given the scale of the scheme and potential mitigation available, including screening/ planting, it is considered unlikely that there will be any significant cumulative effects with options being proposed through Southern Water's WRMP19 on the AONB. Any schemes that propose new infrastructure should ensure that it is sensitively designed and is in conformity with the Kent Downs AONB Management and Local Plans.

It is noted that the WRSE work identifies that a Southern Water option BS_Win is within 5km of option AFF-RTR-WRZ7-0301 and AFF-RNC-WRZ7-0626 so there is the potential for wider construction related impacts. As previously mentioned, AFF-RNC-WRZ7-0626 involves minimal new infrastructure and has a delivery date of 2066. AFF-RTR-WRZ7-0301 does not propose any significant new infrastructure and has a delivery date of 2057. Taking the scale of infrastructure proposed and the delivery dates it is considered unlikely that there will be any cumulative effects during construction.

The WRSE work identifies that there is the potential for cumulative effects on two water bodies as a result of interactions with schemes being considered in the WRMPs19 for Thames Water and Southern Water.

AFF-RES-WRZ4-0832 (Brent Reservoir) and AFF-RES-WR5-0809 (Birds Green Reservoir) are identified in the WRSE study as having the potential for cumulative effects on the Thames (wider catchment) as a result of interactions with options being considered through the emerging WRMP19 for Thames Water. The WFD assessment for Affinity Water's rdWRMP19 found that AFF-RES-WRZ4-0832 would interact with the Lower Brent surface water body and would have no measurable or significant impact on the surface water body in terms of changes in flow velocity and volume from abstraction or any changes to hydromorphology during operation.

The WFD assessment found that AFF-RES-WR5-0809 has the potential to result in the deterioration in the status of the Lower and Upper Roding surface water bodies during operation. As a result, there is the potential for cumulative effects on the Thames (wider catchment). The WFD assessment recommends that further assessments and discussions with the EA are required to explore the need for and potential of compensatory flows. It is important to note that the delivery date for this scheme under this programme is 2072; it is therefore considered that there is ample time to undertake further investigations (including a more detailed WFD assessment) and identify specific mitigation measures to reduce the likelihood and significance of any residual cumulative effects.

The other schemes proposed within this programme and identified through the WRSE study as having the potential for a cumulative effect are AFF-EGW-WRZ7-0629 (Lye Oak (LYEO) Licence Variation) and AFF-EGW-WRZ7-0908 (Tappington South (TAPS) Licence Variation) in WRZ 7. The study identified that these two schemes could interact with Southern Water option GWA_Fle (Flemings and Woodnesborough WSW licence variation) to have a cumulative effect on the East Kent Chalk - Stour groundwater body.

The WFD assessment concluded that AFF-EGW-WRZ7-0629 (LYEO Licence Variation) would not pose a significant risk to deterioration and that any impacts would be localised or temporary and not affect the overall status of the groundwater body. The AFF-EGW-WRZ7-0908 scheme involves TAPS, an existing (but disused) groundwater source within an existing licence group. There is a sequence of boreholes connected by an existing raw water main to the treatment works; DENT; TAPN; and RAKN. TAPS is not within this sequence currently and the option is to re-commission the borehole to provide resilience for the licence group (the group output is limited by licence/ treatment works). This scheme was scoped out of the WFD assessment as there would be no overall increase in abstracted volumes. As a result of the findings of the WFD assessment, it is considered that there is a low risk of cumulative effects arising as a result of interactions with Southern Water option GWA_Fle (Flemings and Woodnesborough WSW licence variation) on the East Kent Chalk - Stour groundwater body.

5.4.7 SEA of AD_3

This run contains low levels of demand management savings, and also will not allow any strategic options (Options with +50MI/d benefit) to be selected. This would help to simulate what options would be required if Affinity Water were unable to progress with a strategic option. The supply-side schemes proposed under this programme are set out in the table below along with their delivery dates.

Table 5.14: AD_3 supply-side schemes

Supply scheme	Delivery date	AMP
AFF-RTR-WRZ7-0639 : Deal Continuation After 2020	2020	7
AFF-RTR-WRZ7-0909 : Barham Continuation (After 2019/20)	2020	7
AFF-EGW-WRZ7-0629 : Lye Oak Licence Variation	2021	7
AFF-CTR-WRZ4-4001 : Egham to Iver	2022	7
AFF-RNC-WRZ7-0900 : Dover Constraint Removal	2022	7
AFF-NGW-WRZ3-1068 : Runley Wood (AMP7 LGS Borehole)	2025	8
AFF-NGW-WRZ3-1053 : Kings Walden	2030	9
AFF-RES-WRZ4-0832 : Brent Reservoir	2031	9
AFF-NGW-WRZ4-0624 : Canal and Rivers Trust and GSK Slough Boreholes	2040	11
AFF-TPO-WRZ4-0412 : Hillingdon Hospital boreholes	2041	11
AFF-RTR-WRZ3-4016 : Minworth Strategic Transfer (100 MI/d)	2042	11
AFF-EGW-WRZ7-0908 : Tappington South - Licence Variation	2044	11
AFF-RNC-WRZ7-0626 : Broome Network Improvement	2057	14
AFF-RTR-WRZ7-0301 : Barham Import Increase (of 2MI/d) to 4 MI/d	2068	16
AFF-EGW-WRZ2-0090 : Stonecross Source Optimisation	2071	17
AFF-RES-WRZ5-0809 : Birds Green Reservoir	2072	17
AFF-ASR-WRZ6-0174 : Egham ASR	2074	17
AFF-TPO-WRZ6-1083 : Surrey University (Guildford Site)	2074	17
AFF-EFF-WRZ3-0180 : Stevenage STW - Effluent Reuse	2075	18
AFF-EGW-WRZ6-0173 : Clandon Source Optimisation	2076	18
AFF-RTR-WRZ6-0752 : Ladymead Optimisation	2076	18
AFF-RES-WRZ3-0814 : Honeywick Rye Reservoir	2077	18
AFF-NGW-WRZ6-0005 : Horsley source recommissioning	2079	18

5.4.7.1 Assessment findings

A summary of the key findings for the supply-side schemes under this programme is provided below in **Table 5.15**.

Table 5.15: AD_3 summary SEA findings

Supply scheme	Delivery date	AMP	SEA Objectives and assessment questions																																				
			1			2			3			4			5					6			7		8		9		10			11		12		13		14	
			1a	1b	1c	2a	2b	2c	3a	3b	4a	4b	5a	5b	5c	5d	5e	6a	6b	7a	8a	8b	9a	10a	10b	10c	10d	11a	12a	13a	13b	14a							
AFF-RTR-WRZ7-0639 : Deal Continuation After 2020	2020	7	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
AFF-RTR-WRZ7-0909 : Barham Continuation (After 2019/20)	2020	7	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
AFF-EGW-WRZ7-0629 : Lye Oak Licence Variation	2021	7	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
AFF-CTR-WRZ4-4001 : Egham to Iwer	2022	7	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
AFF-RNC-WRZ7-0900 : Dover Constraint Removal	2022	7	0	1	0	1	0	1	0	0	0	0	0	-1	0	-1	-1	-1	-1	0	0	-1	0	0	0	0	0	0	0	0	0	0	0	0					
AFF-NGW-WRZ3-1068 : Runley Wood (AMP7 LGS Borehole)	2025	8	0	1	0	1	0	1	0	0	0	0	0	-1	-1	0	0	0	0	0	0	-1	0	0	0	0	0	0	0	0	0	0	0	0					
AFF-NGW-WRZ3-1053 : Kings Walden	2030	9	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	-1	0	0	0	0	0	0	0	0	0	0	0	0					
AFF-RES-WRZ4-0832 : Brent Reservoir	2031	9	0	1	0	1	0	1	0	0	0	-1	0	-1	0	-1	-1	0	-2	0	-1	0	0	0	0	0	0	0	0	0	0	0	0	0					
AFF-NGW-WRZ4-0624 : Canal and Rivers Trust and GSK Slough Boreholes	2040	11	0	1	0	1	0	1	0	0	0	-1	0	-1	0	0	0	0	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
AFF-TPO-WRZ4-0412 : Hillingdon Hospital boreholes	2041	11	0	1	0	1	0	1	0	0	0	0	-1	-1	-1	-1	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
AFF-CTR-WRZ3- 4016 : Minworth Strategic Transition (100M/d)	2042	11	0	3	0	3	0	3	0	0	0	-1	0	-3	0	-1	0	-3	-1	0	0	-2	0	0	0	0	0	0	0	0	0	0	0	0					
AFF-EGW-WRZ7-0908 : Tappington South - Licence Variation	2044	11	0	1	0	1	0	1	0	0	0	0	0	-1	0	0	0	0	0	0	0	-1	0	0	0	0	0	0	0	0	0	0	0	0					
AFF-RNC-WRZ7-0626 : Broome Network Improvement	2057	14	0	1	0	1	0	1	0	0	0	0	-1	0	-1	-1	-1	-1	0	0	0	-1	0	0	0	0	0	0	0	0	0	0	0	0					
AFF-RTR-WRZ7-0301 : Barham Import Increase (of 2M/d) to 4 M/d	2068	16	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
AFF-EGW-WRZ2-0090 : Stonecross Source Optimisation	2071	17	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
AFF-RES-WRZ5-0809 : Birds Green Reservoir	2072	17	0	1	0	1	0	1	0	0	0	-1	0	-1	0	-1	-2	-1	-1	0	0	-1	0	0	0	0	0	0	0	0	0	0	0	0					
AFF-TPO-WRZ6-1083 : Surrey University (Guildford Site)	2074	17	0	1	0	1	0	1	0	0	0	0	-1	0	-1	0	-1	-1	0	0	-2	0	0	0	0	0	0	0	0	0	0	0	0	0					
AFF-ASR-WRZ6-0174 : Egham ASR	2074	17	0	1	0	1	0	1	0	0	0	-1	0	-1	0	-1	-1	0	0	0	0	-1	0	0	0	0	0	0	0	0	0	0	0	0					
AFF-EFF-WRZ3-0180 : Stevenage STW - Effluent Reuse	2075	18	0	1	0	1	0	1	0	0	0	0	0	0	-1	0	-1	0	-1	0	0	-1	0	0	0	0	0	0	0	0	0	0	0	0					
AFF-RTR-WRZ6-0752 : Ladymead Optimisation	2076	18	0	1	0	1	0	1	0	0	0	0	-1	0	-1	0	-1	0	0	0	0	-1	0	0	0	0	0	0	0	0	0	0	0	0					
AFF-EGW-WRZ6-0173 : Clandon Source Optimisation	2076	18	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
AFF-RES-WRZ3-0814 : Honeywick Rye Reservoir	2077	18	0	1	0	1	0	1	0	0	0	-1	0	-1	0	-1	-1	0	0	0	0	-1	0	0	0	0	0	0	0	0	0	0	0	0					
AFF-NGW-WRZ6-0005 : Horsley source recommissioning	2079	18	0	1	0	1	0	1	0	0	0	0	0	0	0	0	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					

AMP7 (2020-25)

The five supply-side schemes to be delivered within the first five years (2020-25) of the plan period during AMP7 all propose minimal new infrastructure. As a result, they are not identified as having the potential for a significant negative effect either during construction or operation through the SEA, HRA or the WFD assessment.

AFF-RTR-WRZ7-0639: Deal Continuation After 2020 and **AFF-RTR-WRZ7-0909: Barham Continuation (After 2019/20)** propose the continuation of current agreements with Southern Water and South East Water respectively for the import of water. No new infrastructure is required for either of these schemes and no negative effects identified through the assessment.

AFF-EGW-WRZ7-0629: Lye Oak Licence Variation involves a negotiation to increase the abstraction license at Lye Oak. The increase in abstraction would be by 0.14Ml/d consistent with the volume of the “returned” water (around 4% of the abstraction). The assessment found that there is the potential for minor negative effects during operation against SEA objectives relating to East Kent Chalk Stour groundwater levels given the increased abstraction; however, this is likely to be local and minor given the small increase. As a result of this there is also some uncertainty identified against the SEA objective relating to biodiversity as a result of the potential for indirect effects and close proximity of the Lydden and Swingfield Woods SSSI. However, it is again considered that given the small increase in abstraction there is unlikely to be any significant negative effects. Mitigation could include a hands-off flow condition to prevent abstraction at low flows below a certain level. As a result it is recommended that the water level in the East Kent Chalk Stour groundwater body and condition status of the Lydden and Swingfield Woods SSSI are monitored.

AFF-RNC-WRZ7-0900: Dover Constraint Removal involves the removal of network constraints by construction of a new main from Primrose Treatment Works to The Cricketer's Public House with connection into the existing network; this will allow increased abstraction from the groundwater sources and transfer to Folkestone. The scheme involves minimal new infrastructure with a new 1.19km main and 1 x 1 m3 Surge Vessel. Minor negative effects are identified during construction against SEA objectives relating to recreation/ tourism, road infrastructure, biodiversity and landscape primarily as a result of the delivery of the new pipeline. Impacts will be temporary, local and minor and good practice construction methods should ensure that there are no significant negative effects.

AFF-CTR-WRZ4-4001: Egham to Iwer involves the installation of a new booster station on an existing site, which will allow 17 Ml/d to be pushed through the existing main. This will allow transfer of 17 Ml/d from Egham to Harefield, which will allow use of the existing surplus within the Wey community (WRZ4). The scheme involves minimal new infrastructure and the assessment found that there would be a residual neutral effect against the majority of SEA objectives during construction and operation. Standard construction practices should ensure that there are no significant impacts during the construction phase.

AMP8 (2025-30)

The only scheme proposed during AMP8 in 2025 is **AFF-NGW-WRZ3-1068: Runley Wood (AMP7 LGS Borehole)** - a scheme to license a new borehole in the Lower Greensand aquifer within the existing Runley Wood site boundary to allow an increased abstraction at this site. The assessment found that there is the potential for a moderate negative effect for SEA objectives 10 (WFD status) and 11 (surface/ ground water levels and flows). This was informed by the WFD assessment for the rdWRMP19, which identifies that the groundwater abstraction may influence local water balance in Woburn Sands groundwater body depending on extent of confined Lower Greensand (LGS) abstraction influence. It suggests that this needs to be confirmed through further hydrogeological survey work. There is also the potential to affect groundwater body input to the River Flit which could have impacts on water levels/ flow and quality. The WFD assessment recommends that further information and assessment required. Given the delivery date of this scheme in 2035, there would be sufficient time to undertake further investigative work and detailed assessments to determine the likelihood and significance of effects along with suitable mitigation measures. Mitigation could include a hands-off flow condition to prevent abstraction at low flows below a certain level. As a result it is recommended that the water level in the Woburn Sands groundwater body is monitored.

As a result of the above, the assessment also identifies that there is some uncertainty in terms of indirect effects on biodiversity (SEA objective 5) reliant on the River Flit during operation although it is

unlikely that this would be of significance. The assessment also identified that there is also the potential for a negative effect on SEA objective 5 (biodiversity) during construction. The scheme requires the delivery of a short 580m pipeline to connect the borehole/ LGS WTW to the Chaul End Reservoir and this crosses over some priority habitat (deciduous woodland). Given the location of the scheme it is unlikely that the route of the pipeline could be altered to avoid the habitat, given that the borehole and reservoir are separated by the M1 and the priority habitats run along either side of the motorway. Pipe jacking/ directional drilling could be used to avoid any loss of the habitat but the feasibility of this is uncertain at this stage and should be explored further at the detailed design stage.

AMP9 (2030-35)

Two supply-side schemes are proposed for delivery during AMP9 under this programme. As for **AFF-NGW-WRZ3-1068: Runley Wood (AMP7 LGS Borehole)** in AMP8, similar issues are also identified through the assessment for **AFF-NGW-WRZ3-1053: Kings Walden** scheduled for delivery in 2030. This scheme proposes a Lower Greensand borehole to be drilled on the existing site at Kings Walden for an output of 3MI/d. The existing site already has a Chalk groundwater source. This water could then be used for blending with the chalk source on site that suffers from high nitrates.

The assessment found that there is the potential for a moderate negative effect for SEA objectives 10 (WFD status) and 11 (surface/ ground water levels and flows). This was informed by the WFD assessment for the rdWRMP19, which identifies that the groundwater abstraction may influence local water balance in Woburn Sands groundwater body depending on extent of confined Lower Greensand (LGS) abstraction influence. However, the WFD assessment notes that the LGS aquifer becomes unconfined more than 13 km north of the abstraction point, therefore any impact would be naturally mitigated due to the distance. It suggests that this needs to be confirmed through further hydrogeological survey work. There is also the potential to affect groundwater body input to the River Ivel which could have impacts on water levels/ flow and quality at a local scale.

The WFD assessment recommends that further information and assessment required. Given the delivery date of this scheme in 2040, there would be sufficient time to undertake further investigative work and detailed assessments to determine the likelihood and significance of effects along with suitable mitigation measures. Mitigation could include a hands-off flow condition to prevent abstraction at low flows below a certain level. As a result it is recommended that the water level in the Woburn Sands groundwater body is monitored.

As a result of the above, the assessment also identifies that there is some uncertainty in terms of indirect effects on biodiversity (SEA objective 5) reliant on the River Ivel during operation although it is unlikely that this would be of significance. The mitigation identified above would reduce the potential for any residual negative effects in the medium to long-term.

The second supply-side to be delivered during AMP9 in 2031 is **AFF-RES-WRZ4-0832: Brent Reservoir**, which proposes the import of water from the Canal & River Trust reservoir at Brent. The water would be transmitted via the River Brent and the Grand Union Canal to the existing Iwer Water Treatment Works for abstraction and subsequent treatment at a new Iwer 2 WTW. The option includes upgraded storage at a new Harrow Service Reservoir within WRZ4.

The assessment identified that during the construction phase there is the potential for negative effects on SEA objectives 6 (landscape) and 13 (historic environment). The scheme includes a new Harrow service reservoir at Harrow on the Hill, which is an important local area of open/ green space surrounded by the existing built area that provides areas for recreation and contributes to the character of the landscape/ townscape. The new reservoir is also situated in close proximity to the Harrow Park Registered Park and Garden. Potential for moderate negative effects during construction against SEA objectives relating to the landscape and historic environment. The assessment recommends the retention of hedgerows, trees, walls wherever possible and the re-instatement of soil/ land following construction of the pipeline. It also proposes the use of construction methods and barriers/ hoardings that are sympathetic to the aesthetics of the surrounding landscape. Where possible any opportunities to merge the reservoir embankment into the landscape should be explored.

During operation **AFF-RES-WRZ4-0832: Brent Reservoir** proposes the release of water from the reservoir, which is also a SSSI. The Brent Reservoir SSSI is currently in a favourable condition and is designated for breeding wetland birds, in particular for significant numbers of nesting great crested

grebe, as well as wetland plant communities. There is uncertainty at this stage with regard to the extent and frequency of drawdown in the reservoir as a result of this proposed scheme. The Great Crested Grebe nest in reed beds and the Passerines (bullfinch, greenfinch, jay, willow warbler and wren) nest in willow woodland broadly between March and July so higher/ lower water levels in these periods could affect them. The wintering birds (Pochard, Gadwall, Snipe, Jack snipe and Smew) could also be affected as again; changing water levels could affect the amount of terrestrial habitat surrounding the waterbody that could be available for them to rest on when out of the water. The wetland plant species are sensitive to changes in water levels. It will be important to prevent the water levels from fluctuating significantly and frequently as this could displace plants as they move up/ or down in the inundation zone.

There are ongoing discussions between Affinity Water and the Canal & River Trust who operate the reservoir. More detailed hydrological investigations need to be carried out in order to determine the extent and frequency of drawdown as a result of this scheme and how the hydrological conditions affect the wetland habitats and birds they support. The assessment proposes that the water levels in the Brent Reservoir are monitored to inform the need and use of hands-off flow conditions to restrict the release of water when levels are low. Furthermore, the release of water could also be restricted during the breeding/ nesting seasons (broadly March to July). The condition status of the Brent Reservoir SSSI should also be monitored.

AMP11 (2040-45)

Four supply-side schemes are proposed during AMP11 under this programme. The first scheme scheduled to be delivered in 2040 is **AFF-NGW-WRZ4-0624: Canal & River Trust and GSK Slough Boreholes**, which proposes obtaining supplies from existing Lower Greensand boreholes that are currently owned by third parties in the Slough area. The Lower Greensand water is to be pumped via a new pipeline along the Grand Union Canal towpath for treatment at a new Iver 2 WTW location (the existing Iver WTW is at full capacity). A new pipeline will then take the water to existing Iver for onward transfer to an upgraded Harrow Service Reservoir for use in WRZ4 (or WRZ2).

The assessment identifies the potential for a moderate negative effect against SEA objectives relating to surface and groundwater body status and flows. The WFD assessment notes that the GSK abstraction is/ was discharged to the Salthill stream following its use as non-evaporative cooling. As a result the WFD assessment found that there is a potential for a reduction in water returned to the surface water body that may lead to deterioration of status and flows. The proposed scheme may involve diverting this discharge to Affinity Water for consumptive use. The WFD assessment recommends that further information and assessment required. The discharge volume needs to be quantified and further WFD assessment undertaken to determine if could impact the status of the Salthill Stream surface water body. Given that the delivery date of this scheme is 2044 there is sufficient time to investigate this issue further.

The second supply-side scheme to be delivered in 2041 is **AFF-TPO-WRZ4-0412: Hillingdon Hospital boreholes**. This scheme seeks to purchase or lease and then transfer any potential spare capacity from three boreholes owned by Hillingdon Hospital. Two boreholes (B & A) are in use, while borehole C has been out of use for years owing to high iron levels (water quality). According to the Environment Agency website, the licence 28/39/28/0513 (HILLINGDON HOSPITAL NHS TRUST) is for 0.55 Ml/d at average and 1.00 Ml/d at peak.

The assessment does not identify any moderate or major negative effects in relation to this scheme during construction or operation. The potential for minor negative effects are identified during construction of the new pipeline and WTW but it is considered that there is suitable mitigation available through standard construction practices to ensure that there are no residual significant negative effects.

The third supply scheme delivered under this programme during AMP11 in 2042 is **AFF-RTR-WRZ3-4016: Minworth Strategic Transfer (100 Ml/d)**. This scheme involves the transfer of 100Ml/d of raw water by a new main from Minworth Sewage Treatment Works (a Severn Trent asset) to a new Sundon Treatment Works. The scheme will require a new 130km long 800mm diameter main from Minworth STW to a new WTW at Sundon.

During construction the assessment identifies that there is the potential for major negative effects against SEA objectives relating to material consumption, landscape, carbon footprint and road

infrastructure primarily as a result of the scale of new infrastructure required. With regard to landscape, this scheme requires the construction of new water treatment works and approx 3.3km of new main within the Chilterns AONB. The assessment also identifies potential issues for biodiversity, the historic environment and local water quality during construction. These primarily arise as a result of the proximity of the new pipeline to waterbodies as well as designated biodiversity and heritage assets. It is considered that there are suitable mitigation measures available to ensure that residual negative effects are not significant. The assessment recommends that the pipeline is re-routed where possible to avoid designated biodiversity and heritage assets.

During operation the assessment found that there is unlikely to be significant negative effects against the majority of SEA objectives. Although it is noted that significant negative effects are identified in terms of the carbon footprint of the company.

The assessment recognises that the new WTW falls within the Chilterns AONB and recommends that mitigation measures should include the retention of hedgerows, trees, fields, walls wherever possible and the re-instatement of soil/ land following construction of the pipeline. Use construction methods and barriers/hoardings that are sympathetic to the aesthetics of the surrounding landscape and historic environment. The delivery of screening/ planting should ensure that the residual effects during operation on the landscape and historic environment are reduced. More detailed mitigation measures should be explored at the detailed design stage.

The final supply-side scheme to be delivered in AMP11 in 2044 is **AFF-EGW-WRZ7-0908: Tappington South - Licence Variation**. This scheme involves the re-commissioning of the currently disused borehole at Tappington Source to provide resilience for the licence group. The scheme involves minimal new infrastructure and was not identified as having the potential for a significant effect through the SEA, HRA or the WFD assessment.

AMP14 (2055-60)

The only scheme to be delivered in AMP14 in 2057 is **AFF-RNC-WRZ7-0626: Broome Network Improvement**. The scheme is designed to remove a network constraint on the Barham South East Water Import Main and a demand constraint, by transferring the existing Broome Borehole Source to Denton rather than via the Barham Import Main (WRZ7).

The assessment does not identify any moderate or major negative effects in relation to this scheme during construction or operation. The potential for minor negative effects are identified during construction of the new pipeline and upgrading of the WTW but it is considered that there is suitable mitigation available through standard construction practices to ensure that there are no residual significant negative effects.

It should be noted that this scheme falls entirely within the Kent Downs AONB. Construction of the new pipeline could have a minor negative effect on the landscape in the short-term, but this will be temporary and once it is buried there will be a residual neutral effect during operation. At this stage there is some uncertainty about the scale of the new building for treatment but it is assumed that it will not be significant and be located within the existing treatment site. Once mitigation has been taken into account, including planting/ screening it is predicted that the significance of residual effects can be reduced. Despite the small scale of development, it is considered that there is the potential for a minor negative effect during operation, in recognition of the AONB.

AMP16 (2065-70)

The only scheme to be delivered in AMP16 in 2068 is **AFF-RTR-WRZ7-0301: Barham Import Increase (of 2 MI/d) to 4 MI/d**. An agreement between Affinity Water and South East Water exists for the import of 2 MI/d via the Barham Interconnection Point. This scheme proposes an increase of this import by 2 MI/d to a total of 4 MI/d for transfer to Chalksole Reservoir. This scheme will require a 2 MI upgrade of Chalksole Service Reservoir.

The Chalksole Reservoir is situated within the Kent Downs AONB and is surrounded by areas of Priority Habitat (deciduous woodland) that is also listed as Ancient and Semi-Natural Woodland. Potential for moderate negative effects on SEA objectives relating to biodiversity and the landscape during construction; however, it is acknowledged that there is uncertainty as the precise direction and area of land lost to the reservoir expansion is not known at this stage. The assessment notes that

there are a number of areas around the existing reservoir where there are no designated habitats. It is therefore considered that there is high likelihood that the upgrade of the reservoir can avoid the important habitats and this should be explored as a first step at the detailed design stage. Further consultation with NE will be necessary as well as more detailed ecological surveys.

The assessment recommends that any new structures (such as the above ground concrete tank structure associated with the reservoir upgrade) should be designed sympathetically to fit in with the surrounding landscape, and/or screened as appropriate by landscaping and planting. More detailed mitigation measures should be set out at the detailed design stage.

AMP17 (2070-75)

Four supply-side schemes are proposed during AMP17 under this programme. The first of these is **AFF-EGW-WR22-0090: Stonecross Source Optimisation** to be delivered in 2071. The scheme involves upgrading the borehole pumps at the existing Stonecross chalk groundwater source, as well as treatment works, and a network modification to close the 0.41 Ml/d gap between DO and licence. The scheme would result in minimal new infrastructure and the assessment does not identify the potential for any residual moderate or major negative effects during construction or operation.

The assessment identifies that there is the potential for minor negative effects in the medium to long-term during operation as the increased abstraction at peak times may have some potential impact on water level in the aquifer and impact base flow in the linked surface water body (Ver River). The WFD assessment notes that these impacts are likely to be local, minor and temporary. The assessment also acknowledges that the issue above could have indirect effects on biodiversity. Mitigation could include a hands-off flow condition to prevent abstraction at low flows below a certain level. This should be given further consideration at the detailed design stage.

The next supply-side scheme to be delivered in 2072 is **AFF-RES-WR25-0809: Birds Green Reservoir**. The scheme includes a river intake and pumping station at Marden Ash (River Roding), a new fully bunded bankside storage reservoir located at Birds Green, an onsite WTW and pumping station, and a treated water pipeline to Rye Hill service reservoir.

During construction the assessment identifies that there is the potential for moderate negative effects against SEA objectives relating to material consumption, landscape and carbon footprint primarily as a result of the scale of new infrastructure required. There is also a moderate negative effect identified during construction in relation to agricultural land, given the presence of best and most versatile agricultural land.

During operation moderate negative effects are identified for SEA objectives relating to carbon footprint, WFD status and surface and groundwater levels/ flows. The assessment identifies that there is the potential for the scheme to reduce water flow and levels as well as quality in the Lower Roding (Cripsey Brook to Loughton) Surface Water Body during operation. This is informed by the WFD assessment which recommends that further assessments and discussions with the EA are required. The SEA suggests that the water levels and flows in the Lower Roding (Cripsey Brook to Loughton) should be monitored and hands-off flow conditions used when water levels and flows are low. Another issue identified during operation is that the new Birds Green Reservoir will lead to the loss of Best and Most versatile agricultural land.

Additional benefits/ moderate positive effects were identified during operation as once established the raw water reservoir provides new opportunities for recreation as well as opportunities for biodiversity net gain.

The third scheme to be delivered during AMP17 in 2074 is **AFF-ASR-WR26-0174: Egham ASR**. This is a speculative scheme to inject winter excess water into the confined chalk or Lower Greensand (LGS) for use in the summer peak demand period. The source of water is likely to be treated surface water (e.g. from the existing Egham or Chertsey sources). Exploration boreholes (LGS and Chalk) and testing will be required, at which point the option is likely to evolve based on the new data (groundwater levels and water quality); for example, it is possible that based on the new information a conventional groundwater abstraction (average and peak benefit) may be possible, albeit with a suitable level of treatment.

The assessment does not identify any moderate or major negative effects in relation to this scheme during construction or operation. The potential for minor negative effects are identified during construction of new or upgraded infrastructure but it is considered that there is suitable mitigation available through standard construction practices to ensure that there are no residual significant negative effects. The new pipeline passes in close proximity to a number of designated biodiversity and heritage assets but there is suitable mitigation available to ensure that there are no significant residual negative effects.

The final supply-side scheme to be delivered during AMP17 in 2074 is **AFF-TPO-WRZ6-1083: Surrey University (Guildford Site)**, which is a third party scheme to obtain a supply from the Surrey University site in Guildford. The option requires further discussions with Surrey University to lease the use of the borehole, a licence application to the Environment Agency, and pipework to take the water into the existing Affinity Water network; the site is just outside WRZ6.

The assessment does not identify any moderate or major negative effects in relation to this scheme during construction or operation for the majority of SEA objectives. The potential for minor negative effects are identified during construction of new or upgraded infrastructure but it is considered that there is suitable mitigation available through standard construction practices to ensure that there are no residual significant negative effects. A moderate negative effect is predicted against biodiversity as the pipeline currently passes through priority habitat (deciduous woodland). The assessment recommends that the pipeline should be re-routed at the detailed design stage to avoid the loss of any priority habitat.

AMP18 (2075-80)

Five supply-side schemes are proposed during AMP18 under this programme. The first to be delivered in 2075 is **AFF-EFF-WRZ3-0180: Stevenage STW - Effluent Reuse**. This scheme is for the provision of a new STW local to Stevenage in order to provide tertiary treated effluent that can be used to restore flows in the River Middle Beane, via Stevenage Brook.

The assessment found that the scheme is not likely to have any significant negative effects during construction. There is the potential for localised minor negative effects in the short-term as a result of the construction of the STW but this is unlikely to be significant once mitigation is taken into account.

During operation the assessment found that there is the potential for a moderate negative effect against the SEA objective that relates to WFD status. The WFD assessment identified that the discharge of treated water into surface water channel could lead to increase in nutrients which could be mobilised to the hydraulically connected groundwater body. Conversely the assessment also identified potential benefits and moderate positive effects for WFD status and surface and groundwater levels/ flows as the scheme would increase river flows in river Beane via discharge of treated effluent in Stevenage Brook. Chalk is unconfined at that location so there is a hydraulic connection and this would potentially increase recharge into the aquifer. WFD assessment states further information and investigation required to confirm the likelihood for negative and positive effects and inform the identification of mitigation measures if necessary.

The second supply-side scheme to be delivered in AMP18 in 2076 is **AFF-EGW-WRZ6-0173: Clandon Source Optimisation**. This scheme seeks to optimise the Clandon source by changing the software to allow water level based control of the pump speed, which should allow an increase in DO. The assessment found that this scheme is not likely to have significant negative effects during construction or operation given that it involves a change in software.

The next supply-side scheme to be delivered in 2076 is **AFF-RTR-WRZ6-0752: Ladymead Optimisation**. This scheme is an import of 2.7 Ml/d of treated water from Thames Water via Ladymead Interconnection Point for transfer to Park Barn Drive Reservoir. The increase will provide an additional 2.7 Ml/d during both peak and average conditions for use within WRZ6.

The assessment does not identify any moderate or major negative effects in relation to this scheme during construction or operation. The potential for minor negative effects are identified during construction of the new pipeline and upgrading of the WTW but it is considered that there is suitable mitigation available through standard construction practices to ensure that there are no residual significant negative effects. The assessment identifies some uncertainty over the area required for the reservoir expansion is not known at this stage and there is priority habitat to the north,

west and south of the site. The detailed design stage should ensure that priority habitats are avoided as part of the reservoir expansion.

The fourth supply-side scheme to be delivered in AMP18 in 2077 is **AFF-RES-WRZ3-0814: Honeywick Rye Reservoir**. This is an augmentation scheme proposed to help offset the Runley Wood and Periwinkle Lane 10 MI/d sustainability reductions (AMP7). The scheme involves abstracting water from the River Ouzel, storing it at a new fully bunded raw water reservoir at Honeywick Rye, and discharging flow to the Upper Lee River.

During construction the assessment found that there is the potential for a moderate negative effect against SEA objectives that relate to carbon footprint and the landscape primarily as a result of the delivery of the new infrastructure.

During operation the assessment found that there is the potential for moderate negative effects against SEA objectives that relate to carbon footprint as well as WFD status and surface and groundwater levels/ flows. The WFD assessment found that during operation the scheme has the potential to impact flow velocity and volume, hydromorphology and therefore water quality of the Ouzel (US Clipstone Brook) surface water body. The WFD assessment recommends that the timing of the abstraction needs to be confirmed and that further investigation and assessment is required.

Conversely the assessment also notes that there is the potential for benefits/ positive effects. The WFD assessment found that there is also the potential for this scheme to have benefits for the Lee (from Luton to Luton Hoo Lakes) surface water body and the Upper Bedford Ouse Chalk Groundwater body as a result of increased treated discharge into the Upper Lee catchment. This will help to improve water levels and flow rates. This will help to improve water levels and flow rates.

The assessment also identified the potential for moderate positive effects in the medium to long-term during operation once the new raw water reservoir is established. It has the potential to provide new opportunities for recreation as well as biodiversity net gain by providing new habitat for waders and waterfowl as well as other species.

The final supply-side scheme to be delivered during AMP18 in 2079 is **AFF-NGW-WRZ6-0005: Horsley source recommissioning**. The Horsley abstraction well was last pumped in 1997. There were water quality issues (coliforms and nitrates) that the available treatment (marginal chlorination) could not solve. This scheme is to investigate the groundwater source to confirm yields and to upgrade treatment as necessary; although the licence is for 0.69 MI/d (average) and 1.14 MI/d (peak) the most likely yield is believed to be 0.38 MI/d at average and 0.62 MI/d peak owing to an adit related constraint.

This is a small scale scheme with minimal new infrastructure; as a result the assessment found that there would not be any significant negative effects during construction or operation against any SEA objectives.

5.4.7.2 Cumulative effects

Overall the cumulative effects assessment in **Appendix VI** has found that there is a low risk arising during construction of cumulative adverse effects regarding the SEA topic of population and human health. Extended construction related mitigation such as detailed routing, traffic planning and management and limitation of works within peak periods/ times will minimize the potential cumulative effects identified.

Regarding the SEA water topic, the assessment has identified a low risk of cumulative adverse effects as a result of schemes interacting with the potential to affect the Mid-Chilterns Chalk Groundwater Body; where mitigation, including CoPC and best practice for design, construction and operations is recommended.

The assessment has also identified a medium risk of cumulative adverse effects as a result of schemes interacting with the potential to affect the Upper Bedford Ouse Woburn Sands Groundwater Body. The WFD assessment identifies that further hydrogeological assessment to consider linkage between deep Lower Greensand aquifer and Upper Bedford Ouse Woburn Sands is required. It is also recommended that water levels/flows in the Upper Bedford Ouse Woburn Sands Groundwater

Body are monitored and mitigation could include a hands-off flow condition to prevent abstraction if water levels/ flows drop below a certain level.

Overall the assessment has also found that there are low risks arising (predominantly through construction phases), of cumulative adverse effects regarding the SEA topics relating to biodiversity and landscape and visual amenity. Sensitive receptors found to be at low risk are the Kent Downs AONB, Chilterns AONB, Surrey Hills AONB, and South West London Waterbodies Ramsar and SPA.

The identified effects in relation to the AONBs are likely to be short-term and temporary associated with traffic and access disruption - including disruption to public rights of way, noise and disturbance (potentially affecting tranquillity and landscape character in the short term). Extended construction related mitigation such as detailed routing, traffic planning and management and limitation of works within peak periods/ times are considered likely to minimise the potential cumulative effects identified. Any new visible infrastructure should be sensitively designed and adhere to the aims and policies of the relevant AONB Management Plan.

The HRA for the rdWRMP19 found that the schemes with the potential to cumulatively affect the South West London Waterbodies Ramsar and SPA are not likely to have significant effects on the European designated sites as there are no identified impact pathways.

The WRSE (updated 2018) study of potential cumulative effects between water company WRMPs in South East England identified eight schemes proposed under this programme that could interact with schemes proposed in other WRMPs to have a cumulative effect.

This includes five schemes located within the Southeast Region (WRZ 7 - Dour) which are identified as having the potential to have cumulative effects on the Kent Downs AONB as a result of interactions with options being considered through the emerging WRMP19 for Southern Water (BS_Win, IZT_Sel, and BR_Lug):

- AFF-RNC-WRZ7-0626 (Broome Network Improvement)
- AFF-RTR-WRZ7-0909 (Barham Continuation (After 2019/20))
- AFF-RTR-WRZ7-0301 (Barham Import Increase (of 2Ml/d) to 4Ml/d)
- AFF-EGW-WRZ7-0908 (Tappington South Licence Variation)
- AFF-EGW-WRZ7-0629 (Lye Oak Licence Variation)

Three of the schemes (AFF-RTR-WRZ7-0909, AFF-EGW-WRZ7-0908 and AFF-EGW-WRZ7-0629) involve no new infrastructure so will not interact with the other Affinity Water rdWRMP19 schemes or the Southern Water schemes to have cumulative effects on the AONB. AFF-RNC-WRZ7-0626 proposes minimal new infrastructure and the risk of cumulative effects on the AONB is therefore low.

AFF-RTR-WRZ7-0301 proposes a small upgrade of the Chalksole Service Reservoir. Given the scale of the scheme and potential mitigation available, including screening/ planting, it is considered unlikely that there will be any significant cumulative effects with options being proposed through Southern Water's WRMP19 on the AONB. Any schemes that propose new infrastructure should ensure that it is sensitively designed and is in conformity with the Kent Downs AONB Management and Local Plans.

It is noted that the WRSE work identifies that a Southern Water option BS_Win is within 5km of option AFF-RTR-WRZ7-0301 and AFF-RNC-WRZ7-0626 so there is the potential for wider construction related impacts. As previously mentioned, AFF-RNC-WRZ7-0626 involves minimal new infrastructure and has a delivery date of 2066. AFF-RTR-WRZ7-0301 does not propose any significant new infrastructure and has a delivery date of 2057. Taking the scale of infrastructure proposed and the delivery dates it is considered unlikely that there will be any cumulative effects during construction.

The WRSE work identifies that there is the potential for cumulative effects on three water bodies as a result of interactions with schemes being considered in the WRMPs19 for Thames Water, Southern Water and SES Water.

AFF-RES-WRZ4-0832 (Brent Reservoir) and AFF-RES-WR5-0809 (Birds Green Reservoir) are identified in the WRSE study as having the potential for cumulative effects on the Thames (wider catchment) as a result of interactions with options being considered through the emerging WRMP19 for Thames Water. The WFD assessment for Affinity Water's rdWRMP19 found that AFF-RES-WRZ4-

0832 would interact with the Lower Brent surface water body and would have no measurable or significant impact on the surface water body in terms of changes in flow velocity and volume from abstraction or any changes to hydromorphology during operation.

The WFD assessment found that AFF-RES-WR5-0809 has the potential to result in the deterioration in the status of the Lower and Upper Roding surface water bodies during operation. As a result, there is the potential for cumulative effects on the Thames (wider catchment). The WFD assessment recommends that further assessments and discussions with the EA are required to explore the need for and potential of compensatory flows. It is important to note that the delivery date for this scheme under this programme is 2072; it is therefore considered that there is ample time to undertake further investigations (including a more detailed WFD assessment) and identify specific mitigation measures to reduce the likelihood and significance of any residual cumulative effects.

The other schemes proposed within this programme and identified through the WRSE study as having the potential for a cumulative effect are AFF-EGW-WRZ7-0629 (Lye Oak (LYEO) Licence Variation) and AFF-EGW-WRZ7-0908 (Tappington South (TAPS) Licence Variation) in WRZ 7. The study identified that these two schemes could interact with Southern Water option GWA_Fle (Flemings and Woodnesborough WSW licence variation) to have a cumulative effect on the East Kent Chalk - Stour groundwater body.

The WFD assessment concluded that AFF-EGW-WRZ7-0629 (LYEO Licence Variation) would not pose a significant risk to deterioration and that any impacts would be localised or temporary and not affect the overall status of the groundwater body. The AFF-EGW-WRZ7-0908 scheme involves TAPS, an existing (but disused) groundwater source within an existing licence group. There is a sequence of boreholes connected by an existing raw water main to the treatment works; DENT; TAPN; and RAKN. TAPS is not within this sequence currently and the option is to re-commission the borehole to provide resilience for the licence group (the group output is limited by licence/ treatment works). This scheme was scoped out of the WFD assessment as there would be no overall increase in abstracted volumes. As a result of the findings of the WFD assessment, it is considered that there is a low risk of cumulative effects arising as a result of interactions with Southern Water option GWA_Fle (Flemings and Woodnesborough WSW licence variation) on the East Kent Chalk - Stour groundwater body.

AFF-NGW-WRZ6-0005 is also identified in the WRSE study as having the potential for cumulative effects on the Effingham Tertiaries Groundwater Body as a result of interactions with options being considered through the emerging WRMP19 for SES Water, however hydrogeological conditions indicate that the options between the two water companies are unlikely to interact and the study identifies that no further assessment is required unless site specific hydrogeological information indicates otherwise.

5.4.8 SEA of Supply-side Challenging Future Adaptive Run

This run includes expected levels of demand management savings, but is challenging on the supply-side as it looks to simulate greater levels of Sustainability Reductions to determine potential solutions, and the yields of some schemes flagged by the WFD assessment for the rdWRMP19 have been halved to understand the impact this would have. The supply-side schemes proposed under this programme are set out in the table below along with their delivery dates.

Table 5.16: Supply-side Challenging Future Adaptive Run supply-side schemes

Supply scheme	Delivery date	AMP
AFF-RTR-WRZ7-0639 : Deal Continuation After 2020	2020	7
AFF-RTR-WRZ7-0909 : Barham Continuation (After 2019/20)	2020	7
AFF-EGW-WRZ7-0629 : Lye Oak Licence Variation	2021	7
AFF-CTR-WRZ4-4001 : Egham to Iver	2022	7
AFF-RNC-WRZ7-0900 : Dover Constraint Removal	2022	7
AFF-NGW-WRZ3-1068 : Runley Wood (AMP7 LGS Borehole)	2024	7
AFF-NGW-WRZ4-0624 : Canal and Rivers Trust and GSK Slough Boreholes	2026	8
AFF-NGW-WRZ3-1053 : Kings Walden	2029	8
AFF-EGW-WRZ2-0090 : Stonecross Source Optimisation	2039	10
AFF-CTR-WRZ3-4005 : Arkley North	2034	9
AFF-RTR-WRZ4-4011 : Abingdon to Iver 2 (50MI/d)	2037	10
AFF-EGW-WRZ7-0908 : Tappington South - Licence Variation	2049	12
AFF-RTR-WRZ1-4010 : Abingdon Reservoir to Harefield Transfer (50MI)	2051	13
AFF-RTR-WRZ7-0301 : Barham Import Increase (of 2MI/d) to 4 MI/d	2061	15
AFF-CTR-WRZ3-1099 : Boxted to Chaul End	2062	15
AFF-TPO-WRZ4-0412 : Hillingdon Hospital boreholes	2065	16
AFF-RTR-WRZ1-1066 : Grand Union Canal (GUC - Berkhamstead/Hemel Hempstead)	2062	15
AFF-RNC-WRZ7-0626 : Broome Network Improvement	2070	17
AFF-RTR-WRZ6-0752 : Ladymead Optimisation	2076	18
AFF-TPO-WRZ6-1083 : Surrey University (Guildford Site)	2076	18
AFF-ASR-WRZ6-0174 : Egham ASR	2077	18
AFF-RES-WRZ5-0809 : Birds Green Reservoir	2078	18

5.4.8.1 Assessment findings

A summary of the key findings for the supply-side schemes under this programme is provided below in **Table 5.17**.

Table 5.17: Supply-side Challenging Future Adaptive Run summary SEA findings

Supply scheme	Delivery date	AMP	SEA Objectives and assessment questions																														
			1			2			3			4		5					6		7	8		9	10				11	12	13		14
			1a	1b	1c	2a	2b	2c	3a	3b	4a	4b	5a	5b	5c	5d	5e	6a	6b	7a	8a	8b	9a	10a	10b	10c	10d	11a	12a	13a	13b	14a	
AFF-RTR-W RZ7-0639 : Deal Continuation After 2020	2020	7	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
AFF-RTR-W RZ7-0909 : Barham Continuation (After 2019/20)	2020	7	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
AFF-EGW -W RZ7-0629 : Lye Oak Licence Variation	2021	7	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
AFF-CTR-WRZ4-4001 : Egham to Iwer	2022	7	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
AFF-RVC-WRZ7-0900 : Dover Constraint Removal	2022	7	0	1	0	1	0	0	0	0	0	-1	-1	0	-1	0	-1	0	-1	0	-1	0	-1	0	0	0	0	0	0	0	0		
AFF-NGW -W RZ3-1068 : Runley Wood (AMP7 LGS Borehole)	2024	7	0	1	0	1	0	0	0	0	-1	0	0	0	-1	0	0	0	0	0	0	0	0	0	0	-1	0	0	0	0	0		
AFF-NGW -W RZ4-0624 : Canal and Rivers Trust and GSK Slough Boreholes	2026	8	0	1	0	1	0	0	0	0	-1	-1	0	-1	0	0	-1	0	0	-1	0	-1	0	0	0	-1	-1	0	0	0	0		
AFF-NGW -W RZ3-1053 : Kings Walden	2029	8	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
AFF-CTR-WRZ3-4005 : Arkeley North	2034	9	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
AFF-RTR-W RZ4-4011 : Abingdon to Iwer 2 (50M/d)	2037	10	0	2	0	2	0	0	0	-1	-2	-1	-1	0	0	-1	0	-2	-1	-2	-1	0	0	0	0	0	0	0	0	0	0		
AFF-EGW -W RZ2-0900 : Stonecross Source Optimisation	2039	10	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
AFF-EGW -W RZ7-0908 : Tappindon South - Licence Variation	2049	12	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
AFF-RTR-W RZ1-4010 : Abingdon Reservoir to Harefield Transfer (50M/d)	2051	13	0	2	0	2	0	0	0	-1	-2	-1	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
AFF-RTR-W RZ7-0301 : Barham Import Increase (of 2M/d) to 4 M/d	2061	15	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
AFF-CTR-WRZ3-1099 : Botted to Chaul End	2062	15	0	1	0	1	0	0	0	-1	0	-1	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
AFF-RTR-W RZ1-1066 : Grand Union Canal (GUC - Berkhamstead/Hemel Hempstead)	2062	15	0	2	0	2	0	0	0	0	0	-1	0	0	-2	0	-1	0	0	-1	0	0	0	0	0	0	0	0	0	0	0		
AFF-TPQ-WRZ4-0412 : Hillingdon Hospital boreholes	2065	16	0	1	0	1	0	0	0	0	-1	0	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
AFF-RVC-WRZ7-0626 : Broome Network Improvement	2070	17	0	1	0	1	0	0	0	0	0	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
AFF-RTR-W RZ6-0752 : Ladymead Optimisation	2076	18	0	1	0	1	0	0	0	0	0	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
AFF-TPQ-WRZ6-1083 : Surrey University (Guildford Site)	2076	18	0	1	0	1	0	0	0	0	-1	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
AFF-ASR-W RZ6-0174 : Egham ASR	2077	18	0	1	0	1	0	0	0	-1	0	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
AFF-RES-W RZ5-0809 : Birds Green Reservoir	2078	18	0	1	0	1	0	0	0	0	-1	0	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		

AMP7 (2020-25)

Six supply-side schemes are proposed for delivery during AMP7 under this programme. The first five supply-side schemes to be delivered in AMP7 all propose minimal new infrastructure. As a result, they are not identified as having the potential for a significant negative effect either during construction or operation through the SEA, HRA or the WFD assessment.

AFF-RTR-WRZ7-0639: Deal Continuation After 2020 and **AFF-RTR-WRZ7-0909: Barham Continuation (After 2019/20)** propose the continuation of current agreements with Southern Water and South East Water respectively for the import of water. No new infrastructure is required for either of these schemes and no negative effects identified through the assessment.

AFF-EGW-WRZ7-0629: Lye Oak Licence Variation involves a negotiation to increase the abstraction license at Lye Oak. The increase in abstraction would be by 0.14Ml/d consistent with the volume of the “returned” water (around 4% of the abstraction). The assessment found that there is the potential for minor negative effects during operation against SEA objectives relating to East Kent Chalk Stour groundwater levels given the increased abstraction; however, this is likely to be local and minor given the small increase. As a result of this there is also some uncertainty identified against the SEA objective relating to biodiversity as a result of the potential for indirect effects and close proximity of the Lydden and Swingfield Woods SSSI. However, it is again considered that given the small increase in abstraction there is unlikely to be any significant negative effects. Mitigation could include a hands-off flow condition to prevent abstraction at low flows below a certain level. As a result it is recommended that the water level in the East Kent Chalk Stour groundwater body and condition status of the Lydden and Swingfield Woods SSSI are monitored.

AFF-RNC-WRZ7-0900: Dover Constraint Removal involves the removal of network constraints by construction of a new main from Primrose Treatment Works to The Cricketer's Public House with connection into the existing network; this will allow increased abstraction from the groundwater sources and transfer to Folkestone. The scheme involves minimal new infrastructure with a new 1.19km main and 1 x 1 m³ Surge Vessel. Minor negative effects are identified during construction against SEA objectives relating to recreation/ tourism, road infrastructure, biodiversity and landscape primarily as a result of the delivery of the new pipeline. Impacts will be temporary, local and minor and good practice construction methods should ensure that there are no significant negative effects.

AFF-CTR-WRZ4-4001: Egham to Iwer involves the installation of a new booster station on an existing site, which will allow 17 Ml/d to be pushed through the existing main. This will allow transfer of 17 Ml/d from Egham to Harefield, which will allow use of the existing surplus within the Wey community (WRZ4). The scheme involves minimal new infrastructure and the assessment found that there would be a residual neutral effect against the majority of SEA objectives during construction and operation. Standard construction practices should ensure that there are no significant impacts during the construction phase.

The final supply-side scheme to be delivered in AMP7 in 2024 is **AFF-NGW-WRZ3-1068: Runley Wood (AMP7 LGS Borehole)** - a scheme to license a new borehole in the Lower Greensand aquifer within the existing Runley Wood site boundary to allow an increased abstraction at this site. The assessment found that there is the potential for a moderate negative effect for SEA objectives 10 (WFD status) and 11 (surface/ ground water levels and flows). This was informed by the WFD assessment for the rdWRMP19, which identifies that the groundwater abstraction may influence local water balance in Woburn Sands groundwater body depending on extent of confined Lower Greensand (LGS) abstraction influence. It suggests that this needs to be confirmed through further hydrogeological survey work. There is also the potential to affect groundwater body input to the River Flit which could have impacts on water levels/ flow and quality. The WFD assessment recommends that further information and assessment required. Given the delivery date of this scheme in 2035, there would be sufficient time to undertake further investigative work and detailed assessments to determine the likelihood and significance of effects along with suitable mitigation measures. Mitigation could include a hands-off flow condition to prevent abstraction at low flows below a certain level. As a result it is recommended that the water level in the Woburn Sands groundwater body is monitored.

As a result of the above, the assessment also identifies that there is some uncertainty in terms of indirect effects on biodiversity (SEA objective 5) reliant on the River Flit during operation although it is unlikely that this would be of significance. The assessment also identified that there is also the

potential for a negative effect on SEA objective 5 (biodiversity) during construction. The scheme requires the delivery of a short 580m pipeline to connect the borehole/ LGS WTW to the Chaul End Reservoir and this crosses over some priority habitat (deciduous woodland). Given the location of the scheme it is unlikely that the route of the pipeline could be altered to avoid the habitat, given that the borehole and reservoir are separated by the M1 and the priority habitats run along either side of the motorway. Pipe jacking/ directional drilling could be used to avoid any loss of the habitat but the feasibility of this is uncertain at this stage and should be explored further at the detailed design stage.

It should be noted that for the purposes of this programme the yield of this scheme was cut by 50% to help mitigate the risks flagged through the SEA and WFD assessment. It is likely that this would help to reduce the significance of the residual negative effects identified above during operation.

AMP8 (2025-30)

Two supply-side schemes are proposed for delivery during AMP9 under this programme. **AFF-NGW-WRZ4-0624: Canal & River Trust and GSK Slough Boreholes** would be delivered first in 2026 and it proposes obtaining supplies from existing Lower Greensand boreholes that are currently owned by third parties in the Slough area. The Lower Greensand water is to be pumped via a new pipeline along the Grand Union Canal towpath for treatment at a new Iwer 2 WTW location (the existing Iwer WTW is at full capacity). A new pipeline will then take the water to existing Iwer for onward transfer to an upgraded Harrow Service Reservoir for use in WRZ4 (or WRZ2).

The assessment identifies the potential for a moderate negative effect against SEA objectives relating to surface and groundwater body status and flows. The WFD assessment notes that the GSK abstraction is/ was discharged to the Salthill stream following its use as non-evaporative cooling. As a result the WFD assessment found that there is a potential for a reduction in water returned to the surface water body that may lead to deterioration of status and flows. The proposed scheme may involve diverting this discharge to Affinity Water for consumptive use. The WFD assessment recommends that further information and assessment required. The discharge volume needs to be quantified and further WFD assessment undertaken to determine if could impact the status of the Salthill Stream surface water body. Given that the delivery date of this scheme is 2044 there is sufficient time to investigate this issue further.

It should be noted that for the purposes of this programme the yield of this scheme was cut by 50% to help mitigate the risks flagged through the SEA and WFD assessment. It is likely that this would help to reduce the significance of the residual negative effects identified above during operation.

As for **AFF-NGW-WRZ3-1068: Runley Wood (AMP7 LGS Borehole)** in AMP7, similar issues are also identified through the assessment for **AFF-NGW-WRZ3-1053: Kings Walden** scheduled for delivery in 2029. This scheme proposes a Lower Greensand borehole to be drilled on the existing site at Kings Walden for an output of 3Ml/d. The existing site already has a Chalk groundwater source. This water could then be used for blending with the chalk source on site that suffers from high nitrates.

The assessment found that there is the potential for a moderate negative effect for SEA objectives 10 (WFD status) and 11 (surface/ ground water levels and flows). This was informed by the WFD assessment for the rdWRMP19, which identifies that the groundwater abstraction may influence local water balance in Woburn Sands groundwater body depending on extent of confined Lower Greensand (LGS) abstraction influence. However, the WFD assessment notes that the LGS aquifer becomes unconfined more than 13 km north of the abstraction point, therefore any impact would be naturally mitigated due to the distance. It suggests that this needs to be confirmed through further hydrogeological survey work. There is also the potential to affect groundwater body input to the River Ivel which could have impacts on water levels/ flow and quality at a local scale.

The WFD assessment recommends that further information and assessment required. Given the delivery date of this scheme in 2040, there would be sufficient time to undertake further investigative work and detailed assessments to determine the likelihood and significance of effects along with suitable mitigation measures. Mitigation could include a hands-off flow condition to prevent abstraction at low flows below a certain level. As a result it is recommended that the water level in the Woburn Sands groundwater body is monitored.

As a result of the above, the assessment also identifies that there is some uncertainty in terms of indirect effects on biodiversity (SEA objective 5) reliant on the River Ivel during operation although it is unlikely that this would be of significance. The mitigation identified above would reduce the potential for any residual negative effects in the medium to long-term.

It should be noted that for the purposes of this programme the yield of this scheme was cut by 50% to help mitigate the risks flagged through the SEA and WFD assessment. It is likely that this would help to reduce the significance of the residual negative effects identified above during operation.

AMP10 (2035-40)

Three supply-side schemes are proposed for delivery during AMP10 under this programme. The first, in 2034 is **AFF-CTR-WRZ3-4005: Arkley North**, which allows for the bypass of Arkley 2 Reservoir and seeks to improve the interconnectivity between reservoirs. It involves minimal new infrastructure (50m of new main) and is not identified in the SEA, HRA or WFD assessment as having the potential for a significant negative effect during construction or operation. The potential for minor negative effects are identified during construction of the new pipeline but it is considered that there is suitable mitigation available through standard construction practices to ensure that there are no residual significant negative effects.

Also being delivered in 2037 is **AFF-RTR-WRZ4-4011: Abingdon to Iwer 2 (50MI/d)**, a strategic scheme that involves an increased abstraction from the River Thames at Sunnymeads, onwards transfer by a new main for treatment at Iwer 2 WTW. Water will be discharged from a new South East Strategic Reservoir (within the Thames Water Supply Area) for abstraction downstream from the River Thames at Sunnymead. The increased abstraction will provide an additional 50 MI/d during both peak and average conditions for use within WRZ4.

During construction the assessment found that there is the potential for significant negative (moderate and major) effects against a number of SEA objectives as a result of this scheme due to the scale of new infrastructure required. This includes:

- Major negative effects for SEA objectives relating to material consumption and carbon footprint due to the scale of infrastructure.
- Moderate negative effects for SEA Objective 3 due to temporary disruption to local and strategic transport infrastructure, including public rights of way and major roads.
- Moderate negative effects also anticipated for SEA Objective 7 relating to Hillingdon AQMA and Marcham AQMA given the level of traffic anticipated during construction.
- Moderate negative effects for SEA Objective 5 due to temporary and permanent disruption to biodiversity, including internationally and nationally designated sites and other important habitats and species.
- Major negative effects for SEA Objective 6 given the construction of Abingdon reservoir is likely to have significant effects on the landscape. This includes impact on the setting of the North Wessex Downs AONB, and extensive disruption to views, visual amenity and landscape character.
- Major negative effects for SEA Objective 13 as a result of the heritage assets located within close proximity to the new reservoir and pipeline (including archaeological assets).

During operation the assessment found that there is the potential for significant negative (moderate and major) effects against a number of SEA objectives as a result of this scheme due to the scale of new infrastructure required. This includes:

- Moderate negative effects for SEA Objective 6 given that the new reservoir ancillary infrastructure would be a prominent new feature in the landscape. Notably, three towers will be seen against the visual context of the North Wessex Downs AONB to the south and east.
- Major negative effects for SEA Objective 8 relating to carbon footprint due to the scale of infrastructure.

During operation the assessment found that there is the potential for significant positive (moderate) effects against a number of SEA objectives as a result of this scheme due to the scale of new infrastructure required. This includes:

- Moderate positive effects for SEA Objective 2 in relation to tourism, recreation and amenity facilities.
- Moderate positive effects for SEA Objective 5 as the scheme is anticipated to provide opportunities for biodiversity enhancement and net gain.
- Moderate positive effects for SEA Objective 6 as the scheme presents opportunities for landscape enhancements and improvements. Specific mitigation measures and enhancements will be developed in the detailed design stages.
- Moderate positive effects for SEA Objective 8 as the scheme is upgrading transfer and storage capacity, resulting in positive effects on the resilience of Affinity Water's assets to climate change.

The final scheme to be delivered in AMP10 in 2039 is **AFF-EGW-WRZ2-0090: Stonecross Source Optimisation** to be delivered in 2052. The scheme involves upgrading the borehole pumps at the existing Stonecross chalk groundwater source, as well as treatment works, and a network modification to close the 0.41 Ml/d gap between DO and licence. The scheme would result in minimal new infrastructure and the assessment does not identify the potential for any residual moderate or major negative effects during construction or operation.

The assessment identifies that there is the potential for minor negative effects in the medium to long-term during operation as the increased abstraction at peak times may have some potential impact on water level in the aquifer and impact base flow in the linked surface water body (Ver River). The WFD assessment notes that these impacts are likely to be local, minor and temporary. The assessment also acknowledges that the issue above could have indirect effects on biodiversity. Mitigation could include a hands-off flow condition to prevent abstraction at low flows below a certain level. This should be given further consideration at the detailed design stage.

AMP11 (2040-45)

There are no schemes planned for delivery in this AMP

AMP12 (2045-50)

The only scheme to be delivered in AMP10 in 2049 is **AFF-EGW-WRZ7-0908: Tappington South - Licence Variation**. This scheme involves the re-commissioning of the currently disused borehole at Tappington Source to provide resilience for the licence group. The scheme involves minimal new infrastructure and was not identified as having the potential for a significant effect through the SEA, HRA or the WFD assessment.

AMP13 (2050-55)

The only scheme to be delivered in AMP13 in 2051 is **AFF-RTR-WRZ1-4010: Abingdon Reservoir to Harefield Transfer (50MI)**, which is closely linked to **AFF-RTR-WRZ4-4011** delivered in AMP10.

AFF-RTR-WRZ1-4010: Abingdon Reservoir to Harefield Transfer (50MI) utilises the same infrastructure as **AFF-RTR-WRZ4-4011** up to point near Iver 2 WTW. It would then extend the mains northward to an upgraded Harefield Reservoir and Harefield Treatment Works. The detailed assessment of this scheme was carried out on the basis that this scheme could include the delivery of the South East Strategic Reservoir (SESR). However, the SESR would already be established at this point given the earlier delivery of **AFF-RTR-WRZ4-4011**. While there is still the potential for negative effects as a result of the delivery of the pipeline and expanded Harefield reservoir it is considered that there is suitable mitigation available to ensure that residual effects are minor. It is also considered that there is unlikely to be any significant negative effects during operation.

AMP15 (2060-65)

Three supply-side schemes are proposed during AMP15. The first to be delivered in 2061 is **AFF-RTR-WRZ7-0301: Barham Import Increase (of 2MI/d) to 4 MI/d**. An agreement between Affinity Water and South East Water exists for the import of 2 MI/d via the Barham Interconnection Point. This scheme proposes an increase of this import by 2 MI/d to a total of 4 MI/d for transfer to Chalksole Reservoir. This scheme will require a 2 MI upgrade of Chalksole Service Reservoir.

The Chalksole Reservoir is situated within the Kent Downs AONB and is surrounded by areas of Priority Habitat (deciduous woodland) that is also listed as Ancient and Semi-Natural Woodland. Potential for moderate negative effects on SEA objectives relating to biodiversity and the landscape during construction; however, it is acknowledged that there is uncertainty as the precise direction and area of land lost to the reservoir expansion is not known at this stage. The assessment notes that there are a number of areas around the existing reservoir where there are no designated habitats. It is therefore considered that there is high likelihood that the upgrade of the reservoir can avoid the important habitats and this should be explored as a first step at the detailed design stage. Further consultation with NE will be necessary as well as more detailed ecological surveys.

The assessment recommends that any new structures (such as the above ground concrete tank structure associated with the reservoir upgrade) should be designed sympathetically to fit in with the surrounding landscape, and/or screened as appropriate by landscaping and planting. More detailed mitigation measures should be set out at the detailed design stage.

The second and third supply-side schemes that are expected are both to be delivered in 2062. The second is **AFF-CTR-WRZ3-1099: Boxted to Chaul End**, which involves a transfer of 40MI/d of treated water by a new main from Boxted Pump Station to Chaul End Reservoir via Friars Wash. The scheme includes a 40MI capacity upgrade of Chaul End Reservoir amongst other new infrastructure.

Key issues identified during the construction phase include potential impacts on landscape and biodiversity. A small proportion (approx 500m) of the pipeline route falls within the Chilterns AONB. The rest of the pipeline predominantly falls within rural areas and follows existing infrastructure, such as roads. The construction of the pipeline is identified as having the potential for a minor negative effect in the short term and a residual neutral effect during operation once buried. The upgrade of the Chaul End Service Reservoir is likely to have moderate negative effects on landscape during construction and it should be noted that the Chilterns AONB is around 550m from the reservoir. Once mitigation is taken into account it is unlikely that there will be any significant negative effects during operation, particularly given that the Chaul Reservoir lies in close proximity to the M1 and is separated from the AONB by new residential development. A new pump house may be required and other minor structures but these will be installed at a pre-existing pump station and will therefore not result in significantly visible new infrastructure.

Mitigation measures should include the retention of hedgerows, trees, fields, walls wherever possible and the re-instatement of soil/ land following construction of the pipeline. Use construction methods and barriers/hoardings that are sympathetic to the aesthetics of the surrounding landscape and historic environment. The delivery of screening/ planting should ensure that the residual effects during operation are reduced. More detailed mitigation measures should be explored at the detailed design stage.

The construction of the new pipeline route may result in the loss of Priority Habitats (in particular deciduous woodland) near to the Chaul End Reservoir. The assessment recommends that the pipeline is re-routed at the detailed design stage to avoid the Priority Habitat near to Chaul End Reservoir. There is also the potential for disturbance to species during the construction of the pipeline route; however, good practice construction methods should ensure that there are no significant negative effects.

The third to be delivered in 2062 is **AFF-RTR-WRZ1-1066: Grand Union Canal (GUC - Berkhamstead/Hemel Hempstead)** and is scheduled to be delivered in 2070. This scheme proposes the cascade of water from the Severn Trent Minworth Sewerage Treatment Plant via the Grand Union Canal for abstraction at Hemel Hempstead. From here raw water would be transferred to a new Boxted Treatment Works for treatment and ultimately stored in an expanded Boxted Reservoir.

The assessment found that there is the potential for a moderate negative effect for SEA objectives 10 (WFD status) and 11 (surface/ ground water levels and flows). This was informed by the WFD assessment for the rdWRMP19, which identifies that the abstraction has the potential for impacts during operation on water levels/ flows and quality in the Tame (R Rea to R Blythe and from R Blythe to River Anker) surface water body. It suggests that this needs to be confirmed through further hydrogeological survey work. Given the delivery date of this scheme in 2070, there would be sufficient time to undertake further investigative work and detailed assessments to determine the likelihood and significance of effects along with suitable mitigation measures. Mitigation could include

a hands-off flow condition to prevent abstraction at low flows below a certain level. As a result it is recommended that the water levels in the Tame (R Rea to R Blythe and from R Blythe to River Anker) surface water body are monitored.

The scheme proposes new infrastructure that is in close proximity to the Chilterns AONB. Potential for a moderate negative effect on the SEA objective relating to landscape during construction phase. The assessment recommends that any new visible infrastructure should be designed sympathetically to fit in with the surrounding landscape, and/or screened as appropriate by landscaping and planting. Residual minor negative effect identified during operation primarily as a result of the expanded Boxted Reservoir.

AMP16 (2065-70)

Only one supply side scheme is proposed during AMP16, the **AFF-TPO-WRZ4-0412: Hillingdon Hospital boreholes**. This scheme seeks to purchase or lease and then transfer any potential spare capacity from three boreholes owned by Hillingdon Hospital. Two boreholes (B & A) are in use, while borehole C has been out of use for years owing to high iron levels (water quality). According to the Environment Agency website, the licence 28/39/28/0513 (HILLINGDON HOSPITAL NHS TRUST) is for 0.55 Ml/d at average and 1.00 Ml/d at peak.

The assessment does not identify any moderate or major negative effects in relation to this scheme during construction or operation. The potential for minor negative effects are identified during construction of the new pipeline and WTW but it is considered that there is suitable mitigation available through standard construction practices to ensure that there are no residual significant negative effects.

AMP17 (2070-75)

The only scheme to be delivered in AMP17 in 2070 is **AFF-RNC-WRZ7-0626: Broome Network Improvement**. The scheme is designed to remove a network constraint on the Barham South East Water Import Main and a demand constraint, by transferring the existing Broome Borehole Source to Denton rather than via the Barham Import Main (WRZ7).

The assessment does not identify any moderate or major negative effects in relation to this scheme during construction or operation. The potential for minor negative effects are identified during construction of the new pipeline and upgrading of the WTW but it is considered that there is suitable mitigation available through standard construction practices to ensure that there are no residual significant negative effects.

It should be noted that this scheme falls entirely within the Kent Downs AONB. Construction of the new pipeline could have a minor negative effect on the landscape in the short-term, but this will be temporary and once it is buried there will be a residual neutral effect during operation. At this stage there is some uncertainty about the scale of the new building for treatment but it is assumed that it will not be significant and be located within the existing treatment site. Once mitigation has been taken into account, including planting/ screening it is predicted that the significance of residual effects can be reduced. Despite the small scale of development, it is considered that there is the potential for a minor negative effect during operation, in recognition of the AONB.

AMP18 (2075-80)

Four new supply-side schemes are proposed during AMP16. The first two of these schemes will be delivered in 2076. **AFF-RTR-WRZ6-0752: Ladymead Optimisation** is an import of 2.7 Ml/d of treated water from Thames Water via Ladymead Interconnection Point for transfer to Park Barn Drive Reservoir. The increase will provide an additional 2.7 Ml/d during both peak and average conditions for use within WRZ6.

The assessment does not identify any moderate or major negative effects in relation to this scheme during construction or operation. The potential for minor negative effects are identified during construction of the new pipeline and upgrading of the WTW but it is considered that there is suitable mitigation available through standard construction practices to ensure that there are no residual significant negative effects. The assessment identifies some uncertainty over the as the precise area required for the reservoir expansion is not known at this stage and there is priority habitat to the north,

west and south of the site. The detailed design stage should ensure that priority habitats are avoided as part of the reservoir expansion.

The other scheme to be delivered in 2076 is **AFF-TPO-WRZ6-1083: Surrey University (Guildford Site)**, which is a third party scheme to obtain a supply from the Surrey University site in Guildford. The option requires further discussions with Surrey University to lease the use of the borehole, a licence application to the Environment Agency, and pipework to take the water into the existing Affinity Water network; the site is just outside WRZ6.

The assessment does not identify any moderate or major negative effects in relation to this scheme during construction or operation for the majority of SEA objectives. The potential for minor negative effects are identified during construction of new or upgraded infrastructure but it is considered that there is suitable mitigation available through standard construction practices to ensure that there are no residual significant negative effects. A moderate negative effect is predicted against biodiversity as the pipeline currently passes through priority habitat (deciduous woodland). The assessment recommends that the pipeline should be re-routed at the detailed design stage to avoid the loss of any priority habitat.

The next scheme to be delivered during AMP18 in 2077 is **AFF-CTR-WRZ4-4001: Egham to Iwer**. The scheme involves the installation of a new booster station on an existing site, which will allow 17 Ml/d to be pushed through the existing main. This will allow transfer of 17 Ml/d from Egham to Harefield, which will allow use of the existing surplus within the Wey community (WRZ4). The scheme involves minimal new infrastructure and the assessment found that there would be a residual neutral effect against the majority of SEA objectives during construction and operation. Standard construction practices should ensure that there are no significant impacts during the construction phase.

The final supply-side scheme to be delivered in 2078 is **AFF-RES-WRZ5-0809: Birds Green Reservoir**. The scheme includes a river intake and pumping station at Marden Ash (River Roding), a new fully bunded bankside storage reservoir located at Birds Green, an onsite WTW and pumping station, and a treated water pipeline to Rye Hill service reservoir.

During construction the assessment identifies that there is the potential for moderate negative effects against SEA objectives relating to material consumption, landscape and carbon footprint primarily as a result of the scale of new infrastructure required. There is also a moderate negative effect identified during construction in relation to agricultural land, given the presence of best and most versatile agricultural land.

During operation moderate negative effects are identified for SEA objectives relating to carbon footprint, WFD status and surface and groundwater levels/ flows. The assessment identifies that there is the potential for the scheme to reduce water flow and levels as well as quality in the Lower Roding (Cripsey Brook to Loughton) Surface Water Body during operation. This is informed by the WFD assessment which recommends that further assessments and discussions with the EA are required. The SEA suggests that the water levels and flows in the Lower Roding (Cripsey Brook to Loughton) should be monitored and hands-off flow conditions used when water levels and flows are low. Another issue identified during operation is that the new Birds Green Reservoir will lead to the loss of Best and Most versatile agricultural land.

Additional benefits/ moderate positive effects were identified during operation as once established the raw water reservoir provides new opportunities for recreation as well as opportunities for biodiversity net gain.

It should be noted that for the purposes of this programme the yield of this scheme was cut by 50% to help mitigate the risks flagged through the SEA and WFD assessment. It is likely that this would help to reduce the significance of the residual negative effects identified above during operation.

5.4.8.2 Cumulative effects

Overall the cumulative effects assessment in **Appendix VI** has found that there is a low risk arising during construction of cumulative adverse effects regarding the SEA topic of population and human health. Extended construction related mitigation such as detailed routing, traffic planning and

management and limitation of works within peak periods/ times will minimize the potential cumulative effects identified.

Regarding the SEA water topic, the assessment has identified a low risk of cumulative adverse effects as a result of schemes interacting with the potential to affect the Lower Thames Gravels Groundwater Body, the Thames (Cookham to Egham) Surface Water Body, the Mid-Chilterns Chalk Groundwater Body, and the Colne (from confluence with Chess to River Thames) Surface Water Body; where mitigation, including CoPC and best practice for design, construction and operations is recommended.

The assessment has also identified a medium risk of cumulative adverse effects as a result of schemes interacting with the potential to affect the Upper Bedford Ouse Woburn Sands Groundwater Body. The WFD assessment identifies that further hydrogeological assessment to consider linkage between deep Lower Greensand aquifer and Upper Bedford Ouse Woburn Sands is required. It is also recommended that water levels/flows in the Upper Bedford Ouse Woburn Sands Groundwater Body are monitored and mitigation could include a hands-off flow condition to prevent abstraction if water levels/ flows drop below a certain level.

It should be noted that for the purposes of this programme the yield of schemes identified as having the potential for an adverse impact through the WFD assessment were cut by 50%. It is likely that this would help to reduce the significance of the residual risk of cumulative negative effects identified above during operation. However, this is uncertain at this stage.

The assessment has also identified the potential for positive effects arising as a result of schemes (AFF-RTR-WRZ1-4010 and AFF-RTR-WRZ4-4011) interacting to improve water levels and flow rates, improve habitats and improve low flows and chemistry within the Thames (Evenlode to Thame, Wallingford to Caversham, and Reading to Cookham) Surface Water Bodies.

Overall the assessment has also found that there are low risks arising (predominantly through construction phases), of cumulative adverse effects regarding the SEA topics relating to biodiversity and landscape and visual amenity. Sensitive receptors found to be at low risk are the Kent Downs AONB, Chilterns AONB, Surrey Hills AONB, North Wessex Downs AONB and South West London Waterbodies Ramsar and SPA.

The identified effects in relation to the AONBs are likely to be short-term and temporary associated with traffic and access disruption - including disruption to public rights of way, noise and disturbance (potentially affecting tranquillity and landscape character in the short term). Extended construction related mitigation such as detailed routing, traffic planning and management and limitation of works within peak periods/ times are considered likely to minimise the potential cumulative effects identified. Any new visible infrastructure should be sensitively designed and adhere to the aims and policies of the relevant AONB Management Plan.

The HRA for the rdWRMP19 recommended a number of mitigation measures in relation to the schemes AFF-RTR-WRZ1-4010 (2054) and AFF-RTR-WRZ4-4011 (2041) which will need to be taken into consideration during construction and operation to minimise the risks associated with the European designated sites (South West London Waterbodies Ramsar and SPA). This mitigation includes an explicit commitment to ensure that the programming and construction processes for the schemes take into account the proximity of the SPA and that construction works on the short section of pipeline adjacent to the SPA are programmed to avoid the winter (October to March) period entirely or are accompanied by an impact assessment including noise modelling and mitigation in line with British Standard BS5228 as required in order to ensure that noise levels can be maintained at an acceptable level.

The WRSE (updated 2018) study of potential cumulative effects between water company WRMPs in South East England identified six schemes proposed under this programme that could interact with schemes proposed in other WRMPs to have a cumulative effect.

This includes five schemes located within the Southeast Region (WRZ 7 - Dour) which are identified as having the potential to have cumulative effects on the Kent Downs AONB as a result of interactions with options being considered through the emerging WRMP19 for Southern Water (BS_Win, IZT_Sel, and BR_Lug):

- AFF-RNC-WRZ7-0626 (Broome Network Improvement)
- AFF-RTR-WRZ7-0909 (Barham Continuation (After 2019/20))
- AFF-RTR-WRZ7-0301 (Barham Import Increase (of 2MI/d) to 4MI/d)
- AFF-EGW-WRZ7-0908 (Tappington South Licence Variation)
- AFF-EGW-WRZ7-0629 (Lye Oak Licence Variation)

Three of the schemes (AFF-RTR-WRZ7-0909, AFF-EGW-WRZ7-0908 and AFF-EGW-WRZ7-0629) involve no new infrastructure so will not interact with the other Affinity Water rdWRMP19 schemes or the Southern Water schemes to have cumulative effects on the AONB. AFF-RNC-WRZ7-0626 proposes minimal new infrastructure and the risk of cumulative effects on the AONB is therefore low.

AFF-RTR-WRZ7-0301 proposes a small upgrade of the Chalksole Service Reservoir. Given the scale of the scheme and potential mitigation available, including screening/ planting, it is considered unlikely that there will be any significant cumulative effects with options being proposed through Southern Water's WRMP19 on the AONB. Any schemes that propose new infrastructure should ensure that it is sensitively designed and is in conformity with the Kent Downs AONB Management and Local Plans.

It is noted that the WRSE work identifies that a Southern Water option BS_Win is within 5km of option AFF-RTR-WRZ7-0301 and AFF-RNC-WRZ7-0626 so there is the potential for wider construction related impacts. As previously mentioned, AFF-RNC-WRZ7-0626 involves minimal new infrastructure and has a delivery date of 2066. AFF-RTR-WRZ7-0301 does not propose any significant new infrastructure and has a delivery date of 2057. Taking the scale of infrastructure proposed and the delivery dates it is considered unlikely that there will be any cumulative effects during construction.

The WRSE work identifies AFF-RES-WR5-0809 (Birds Green Reservoir) as having the potential for cumulative effects on the Thames (wider catchment) as a result of interactions with options being considered through the emerging WRMP19 for Thames Water. The WFD assessment found that AFF-RES-WR5-0809 has the potential to result in the deterioration in the status of the Lower and Upper Roding surface water bodies during operation. As a result, there is the potential for cumulative effects on the Thames (wider catchment). The WFD assessment recommends that further assessments and discussions with the EA are required to explore the need for and potential of compensatory flows. It is important to note that the delivery date for this scheme under this programme is 2078; it is therefore considered that there is ample time to undertake further investigations (including a more detailed WFD assessment) and identify specific mitigation measures to reduce the likelihood and significance of any residual cumulative effects.

The other schemes proposed within this programme and identified through the WRSE study as having the potential for a cumulative effect are AFF-EGW-WRZ7-0629 (Lye Oak (LYEO) Licence Variation) and AFF-EGW-WRZ7-0908 (Tappington South (TAPS) Licence Variation) in WRZ 7. The study identified that these two schemes could interact with Southern Water option GWA_Fle (Flemings and Woodnesborough WSW licence variation) to have a cumulative effect on the East Kent Chalk - Stour groundwater body.

The WFD assessment concluded that AFF-EGW-WRZ7-0629 (LYEO Licence Variation) would not pose a significant risk to deterioration and that any impacts would be localised or temporary and not affect the overall status of the groundwater body. The AFF-EGW-WRZ7-0908 scheme involves TAPS, an existing (but disused) groundwater source within an existing licence group. There is a sequence of boreholes connected by an existing raw water main to the treatment works; DENT; TAPN; and RAKN. TAPS is not within this sequence currently and the option is to re-commission the borehole to provide resilience for the licence group (the group output is limited by licence/ treatment works). This scheme was scoped out of the WFD assessment as there would be no overall increase in abstracted volumes. As a result of the findings of the WFD assessment, it is considered that there is a low risk of cumulative effects arising as a result of interactions with Southern Water option GWA_Fle (Flemings and Woodnesborough WSW licence variation) on the East Kent Chalk - Stour groundwater body.

5.4.9 SEA of Optimistic Adaptive Run

This run is an adaptation of the **Aspirational Adaptive Run** which looks to bring the 50% reduction leakage target forward to 2044/45. The supply-side schemes proposed under this programme are set out in the table below along with their delivery dates.

Table 5.18: Optimistic Adaptive Run supply-side schemes

Supply scheme	Delivery date	AMP
AFF-RTR-WRZ7-0639 : Deal Continuation After 2020	2020	7
AFF-RTR-WRZ7-0909 : Barham Continuation (After 2019/20)	2020	7
AFF-EGW-WRZ7-0629 : Lye Oak Licence Variation	2021	7
AFF-CTR-WRZ4-4001 : Egham to Iver	2022	7
AFF-RNC-WRZ7-0900 : Dover Constraint Removal	2022	7
AFF-NGW-WRZ3-1068 : Runley Wood (AMP7 LGS Borehole)	2037	10
AFF-NGW-WRZ3-1053 : Kings Walden	2042	11
AFF-NGW-WRZ4-0624 : Canal and Rivers Trust and GSK Slough Boreholes	2043	11
AFF-CTR-WRZ3-4005 : Arkley North	2045	12
AFF-RTR-WRZ4-4011 : Abingdon to Iver 2 (50MI/d)	2045	12
AFF-RTR-WRZ1-4010 : Abingdon Reservoir to Harefield Transfer (50MI)	2057	14
AFF-EGW-WRZ7-0908 : Tappington South - Licence Variation	2057	14
AFF-CTR-WRZ3-1099 : Boxted to Chaul End	2065	16
AFF-RNC-WRZ7-0626 : Broome Network Improvement	2069	16
AFF-EGW-WRZ6-0173 : Clandon Source Optimisation	2079	18
AFF-TPO-WRZ6-1083 : Surrey University (Guildford Site)	2079	18

5.4.9.1 Assessment findings

A summary of the key findings for the supply-side schemes under this programme is provided below in **Table 5.19**.

Table 5.19: Optimistic Adaptive Run summary SEA findings

[illegible]

AMP7 (2020-25)

The five supply-side schemes to be delivered within the first five years (2020-25) of the plan period during AMP7 all propose minimal new infrastructure. As a result, they are not identified as having the potential for a significant negative effect either during construction or operation through the SEA, HRA or the WFD assessment.

AFF-RTR-WRZ7-0639: Deal Continuation After 2020 and **AFF-RTR-WRZ7-0909: Barham Continuation (After 2019/20)** propose the continuation of current agreements with Southern Water and South East Water respectively for the import of water. No new infrastructure is required for either of these schemes and no negative effects identified through the assessment.

AFF-EGW-WRZ7-0629: Lye Oak Licence Variation involves a negotiation to increase the abstraction license at Lye Oak. The increase in abstraction would be by 0.14Ml/d consistent with the volume of the “returned” water (around 4% of the abstraction). The assessment found that there is the potential for minor negative effects during operation against SEA objectives relating to East Kent Chalk Stour groundwater levels given the increased abstraction; however, this is likely to be local and minor given the small increase. As a result of this there is also some uncertainty identified against the SEA objective relating to biodiversity as a result of the potential for indirect effects and close proximity of the Lydden and Swingfield Woods SSSI. However, it is again considered that given the small increase in abstraction there is unlikely to be any significant negative effects. Mitigation could include a hands-off flow condition to prevent abstraction at low flows below a certain level. As a result it is recommended that the water level in the East Kent Chalk Stour groundwater body and condition status of the Lydden and Swingfield Woods SSSI are monitored.

AFF-RNC-WRZ7-0900: Dover Constraint Removal involves the removal of network constraints by construction of a new main from Primrose Treatment Works to The Cricketer's Public House with connection into the existing network; this will allow increased abstraction from the groundwater sources and transfer to Folkestone. The scheme involves minimal new infrastructure with a new 1.19km main and 1 x 1 m³ Surge Vessel. Minor negative effects are identified during construction against SEA objectives relating to recreation/ tourism, road infrastructure, biodiversity and landscape primarily as a result of the delivery of the new pipeline. Impacts will be temporary, local and minor and good practice construction methods should ensure that there are no significant negative effects.

AFF-CTR-WRZ4-4001: Egham to Iver involves the installation of a new booster station on an existing site, which will allow 17 Ml/d to be pushed through the existing main. This will allow transfer of 17 Ml/d from Egham to Harefield, which will allow use of the existing surplus within the Wey community (WRZ4). The scheme involves minimal new infrastructure and the assessment found that there would be a residual neutral effect against the majority of SEA objectives during construction and operation. Standard construction practices should ensure that there are no significant impacts during the construction phase.

AMP10 (2035-40)

Under this programme no supply-side schemes would then be delivered until AMP10. The only scheme proposed during AMP10 in 2037 is **AFF-NGW-WRZ3-1068: Runley Wood (AMP7 LGS Borehole)** - a scheme to license a new borehole in the Lower Greensand aquifer within the existing Runley Wood site boundary to allow an increased abstraction at this site. The assessment found that there is the potential for a moderate negative effect for SEA objectives 10 (WFD status) and 11 (surface/ ground water levels and flows). This was informed by the WFD assessment for the rdWRMP19, which identifies that the groundwater abstraction may influence local water balance in Woburn Sands groundwater body depending on extent of confined Lower Greensand (LGS) abstraction influence. It suggests that this needs to be confirmed through further hydrogeological survey work. There is also the potential to affect groundwater body input to the River Flit which could have impacts on water levels/ flow and quality. The WFD assessment recommends that further information and assessment required. Given the delivery date of this scheme in 2035, there would be sufficient time to undertake further investigative work and detailed assessments to determine the likelihood and significance of effects along with suitable mitigation measures. Mitigation could include a hands-off flow condition to prevent abstraction at low flows below a certain level. As a result it is recommended that the water level in the Woburn Sands groundwater body is monitored.

As a result of the above, the assessment also identifies that there is some uncertainty in terms of indirect effects on biodiversity (SEA objective 5) reliant on the River Flit during operation although it is unlikely that this would be of significance. The assessment also identified that there is also the potential for a negative effect on SEA objective 5 (biodiversity) during construction. The scheme requires the delivery of a short 580m pipeline to connect the borehole/ LGS WTW to the Chaul End Reservoir and this crosses over some priority habitat (deciduous woodland). Given the location of the scheme it is unlikely that the route of the pipeline could be altered to avoid the habitat, given that the borehole and reservoir are separated by the M1 and the priority habitats run along either side of the motorway. Pipe jacking/ directional drilling could be used to avoid any loss of the habitat but the feasibility of this is uncertain at this stage and should be explored further at the detailed design stage.

AMP11 (2040-45)

Two supply-side schemes are proposed for delivery during AMP9 under this programme. As for **AFF-NGW-WRZ3-1068: Runley Wood (AMP7 LGS Borehole)** in AMP10, similar issues are also identified through the assessment for **AFF-NGW-WRZ3-1053: Kings Walden** scheduled for delivery in 2042. This scheme proposes a Lower Greensand borehole to be drilled on the existing site at Kings Walden for an output of 3MI/d. The existing site already has a Chalk groundwater source. This water could then be used for blending with the chalk source on site that suffers from high nitrates.

The assessment found that there is the potential for a moderate negative effect for SEA objectives 10 (WFD status) and 11 (surface/ ground water levels and flows). This was informed by the WFD assessment for the rdWRMP19, which identifies that the groundwater abstraction may influence local water balance in Woburn Sands groundwater body depending on extent of confined Lower Greensand (LGS) abstraction influence. However, the WFD assessment notes that the LGS aquifer becomes unconfined more than 13 km north of the abstraction point, therefore any impact would be naturally mitigated due to the distance. It suggests that this needs to be confirmed through further hydrogeological survey work. There is also the potential to affect groundwater body input to the River Ivel which could have impacts on water levels/ flow and quality at a local scale.

The WFD assessment recommends that further information and assessment required. Given the delivery date of this scheme in 2040, there would be sufficient time to undertake further investigative work and detailed assessments to determine the likelihood and significance of effects along with suitable mitigation measures. Mitigation could include a hands-off flow condition to prevent abstraction at low flows below a certain level. As a result it is recommended that the water level in the Woburn Sands groundwater body is monitored.

As a result of the above, the assessment also identifies that there is some uncertainty in terms of indirect effects on biodiversity (SEA objective 5) reliant on the River Ivel during operation although it is unlikely that this would be of significance. The mitigation identified above would reduce the potential for any residual negative effects in the medium to long-term.

The second supply-side to be delivered during AMP11 in 2043 is **AFF-NGW-WRZ4-0624: Canal & River Trust and GSK Slough Boreholes**, which proposes obtaining supplies from existing Lower Greensand boreholes that are currently owned by third parties in the Slough area. The Lower Greensand water is to be pumped via a new pipeline along the Grand Union Canal towpath for treatment at a new Iwer 2 WTW location (the existing Iwer WTW is at full capacity). A new pipeline will then take the water to existing Iwer for onward transfer to an upgraded Harrow Service Reservoir for use in WRZ4 (or WRZ2).

The assessment identifies the potential for a moderate negative effect against SEA objectives relating to surface and groundwater body status and flows. The WFD assessment notes that the GSK abstraction is/ was discharged to the Salthill stream following its use as non-evaporative cooling. As a result the WFD assessment found that there is a potential for a reduction in water returned to the surface water body that may lead to deterioration of status and flows. The proposed scheme may involve diverting this discharge to Affinity Water for consumptive use. The WFD assessment recommends that further information and assessment required. The discharge volume needs to be quantified and further WFD assessment undertaken to determine if could impact the status of the Salthill Stream surface water body. Given that the delivery date of this scheme is 2044 there is sufficient time to investigate this issue further.

AMP12 (2045-50)

Two supply-side schemes are proposed for delivery during AMP12 in 2045 under this programme.

AFF-CTR-WRZ3-4005: Arkley North allows for the bypass of Arkley 2 Reservoir and seeks to improve the interconnectivity between reservoirs. It involves minimal new infrastructure (50m of new main) and is not identified in the SEA, HRA or WFD assessment as having the potential for a significant negative effect during construction or operation. The potential for minor negative effects are identified during construction of the new pipeline but it is considered that there is suitable mitigation available through standard construction practices to ensure that there are no residual significant negative effects.

Also being delivered in 2045 is **AFF-RTR-WRZ4-4011: Abingdon to Iwer 2 (50MI/d)**, a strategic scheme that involves an increased abstraction from the River Thames at Sunnymeads, onwards transfer by a new main for treatment at Iwer 2 WTW. Water will be discharged from a new South East Strategic Reservoir (within the Thames Water Supply Area) for abstraction downstream from the River Thames at Sunnymead. The increased abstraction will provide an additional 50 MI/d during both peak and average conditions for use within WRZ4.

During construction the assessment found that there is the potential for significant negative (moderate and major) effects against a number of SEA objectives as a result of this scheme due to the scale of new infrastructure required. This includes:

- Major negative effects for SEA objectives relating to material consumption and carbon footprint due to the scale of infrastructure.
- Moderate negative effects for SEA Objective 3 due to temporary disruption to local and strategic transport infrastructure, including public rights of way and major roads.
- Moderate negative effects also anticipated for SEA Objective 7 relating to Hillingdon AQMA and Marcham AQMA given the level of traffic anticipated during construction.
- Moderate negative effects for SEA Objective 5 due to temporary and permanent disruption to biodiversity, including internationally and nationally designated sites and other important habitats and species.
- Major negative effects for SEA Objective 6 given the construction of Abingdon reservoir is likely to have significant effects on the landscape. This includes impact on the setting of the North Wessex Downs AONB, and extensive disruption to views, visual amenity and landscape character.
- Major negative effects for SEA Objective 13 as a result of the heritage assets located within close proximity to the new reservoir and pipeline (including archaeological assets).

During operation the assessment found that there is the potential for significant negative (moderate and major) effects against a number of SEA objectives as a result of this scheme due to the scale of new infrastructure required. This includes:

- Moderate negative effects for SEA Objective 6 given that the new reservoir ancillary infrastructure would be a prominent new feature in the landscape. Notably, three towers will be seen against the visual context of the North Wessex Downs AONB to the south and east.
- Major negative effects for SEA Objective 8 relating to carbon footprint due to the scale of infrastructure.

During operation the assessment found that there is the potential for significant positive (moderate) effects against a number of SEA objectives as a result of this scheme due to the scale of new infrastructure required. This includes:

- Moderate positive effects for SEA Objective 2 in relation to tourism, recreation and amenity facilities.
- Moderate positive effects for SEA Objective 5 as the scheme is anticipated to provide opportunities for biodiversity enhancement and net gain.

- Moderate positive effects for SEA Objective 6 as the scheme presents opportunities for landscape enhancements and improvements. Specific mitigation measures and enhancements will be developed in the detailed design stages.
- Moderate positive effects for SEA Objective 8 as the scheme is upgrading transfer and storage capacity, resulting in positive effects on the resilience of Affinity Water's assets to climate change.

AMP14 (2055-60)

Two supply-side schemes are proposed for delivery during AMP12 in 2057 under this programme.

AFF-RTR-WRZ1-4010: Abingdon Reservoir to Harefield Transfer (50MI), which is closely linked to **AFF-RTR-WRZ4-4011** delivered in AMP11.

AFF-RTR-WRZ1-4010: Abingdon Reservoir to Harefield Transfer (50MI) utilises the same infrastructure as **AFF-RTR-WRZ4-4011** up to point near Iver 2 WTW. It would then extend the mains northward to an upgraded Harefield Reservoir and Harefield Treatment Works. The detailed assessment of this scheme was carried out on the basis that this scheme could include the delivery of the South East Strategic Reservoir (SESR). However, the SESR would already be established at this point given the earlier delivery of **AFF-RTR-WRZ4-4011**. While there is still the potential for negative effects as a result of the delivery of the pipeline and expanded Harefield reservoir it is considered that there is suitable mitigation available to ensure that residual effects are minor. It is also considered that there is unlikely to be any significant negative effects during operation.

The final supply-side scheme to be delivered in AMP14 is **AFF-EGW-WRZ7-0908: Tappington South - Licence Variation**. This scheme involves the re-commissioning of the currently disused borehole at Tappington Source to provide resilience for the licence group. The scheme involves minimal new infrastructure and was not identified as having the potential for a significant effect through the SEA, HRA or the WFD assessment.

AMP16 (2065-70)

Two supply-side schemes are proposed during AMP16. The first to be delivered in 2065 is **AFF-CTR-WRZ3-1099: Boxted to Chaul End**, which involves a transfer of 40MI/d of treated water by a new main from Boxted Pump Station to Chaul End Reservoir via Friars Wash. The scheme includes a 40MI capacity upgrade of Chaul End Reservoir amongst other new infrastructure.

Key issues identified during the construction phase include potential impacts on landscape and biodiversity. A small proportion (approx 500m) of the pipeline route falls within the Chilterns AONB. The rest of the pipeline predominantly falls within rural areas and follows existing infrastructure, such as roads. The construction of the pipeline is identified as having the potential for a minor negative effect in the short term and a residual neutral effect during operation once buried. The upgrade of the Chaul End Service Reservoir is likely to have moderate negative effects on landscape during construction and it should be noted that the Chilterns AONB is around 550m from the reservoir. Once mitigation is taken into account it is unlikely that there will be any significant negative effects during operation, particularly given that the Chaul Reservoir lies in close proximity to the M1 and is separated from the AONB by new residential development. A new pump house may be required and other minor structures but these will be installed at a pre-existing pump station and will therefore not result in significantly visible new infrastructure.

Mitigation measures should include the retention of hedgerows, trees, fields, walls wherever possible and the re-instatement of soil/ land following construction of the pipeline. Use construction methods and barriers/hoardings that are sympathetic to the aesthetics of the surrounding landscape and historic environment. The delivery of screening/ planting should ensure that the residual effects during operation are reduced. More detailed mitigation measures should be explored at the detailed design stage.

The construction of the new pipeline route may result in the loss of Priority Habitats (in particular deciduous woodland) near to the Chaul End Reservoir. The assessment recommends that the pipeline is re-routed at the detailed design stage to avoid the Priority Habitat near to Chaul End Reservoir. There is also the potential for disturbance to species during the construction of the pipeline route; however, good practice construction methods should ensure that there are no significant negative effects.

AMP16 (2065-70)

Two supply-side schemes are proposed during AMP16. The first to be delivered in 2065 is **AFF-RTR-WRZ1-1066: Grand Union Canal (GUC - Berkhamstead/Hemel Hempstead)** and is scheduled to be delivered in 2070. This scheme proposes the cascade of water from the Severn Trent Minworth Sewerage Treatment Plant via the Grand Union Canal for abstraction at Hemel Hempstead. From here raw water would be transferred to a new Boxted Treatment Works for treatment and ultimately stored in an expanded Boxted Reservoir.

The assessment found that there is the potential for a moderate negative effect for SEA objectives 10 (WFD status) and 11 (surface/ ground water levels and flows). This was informed by the WFD assessment for the rdWRMP19, which identifies that the abstraction has the potential for impacts during operation on water levels/ flows and quality in the Tame (R Rea to R Blythe and from R Blythe to River Anker) surface water body. It suggests that this needs to be confirmed through further hydrogeological survey work. Given the delivery date of this scheme in 2065, there would be sufficient time to undertake further investigative work and detailed assessments to determine the likelihood and significance of effects along with suitable mitigation measures. Mitigation could include a hands-off flow condition to prevent abstraction at low flows below a certain level. As a result it is recommended that the water levels in the Tame (R Rea to R Blythe and from R Blythe to River Anker) surface water body are monitored.

The scheme proposes new infrastructure that is in close proximity to the Chilterns AONB. Potential for a moderate negative effect on the SEA objective relating to landscape during construction phase. The assessment recommends that any new visible infrastructure should be designed sympathetically to fit in with the surrounding landscape, and/or screened as appropriate by landscaping and planting. Residual minor negative effect identified during operation primarily as a result of the expanded Boxted Reservoir.

The second supply-side scheme to be delivered in AMP16 in 2069 is **AFF-RNC-WRZ7-0626: Broome Network Improvement**. The scheme is designed to remove a network constraint on the Barham South East Water Import Main and a demand constraint, by transferring the existing Broome Borehole Source to Denton rather than via the Barham Import Main (WRZ7).

The assessment does not identify any moderate or major negative effects in relation to this scheme during construction or operation. The potential for minor negative effects are identified during construction of the new pipeline and upgrading of the WTW but it is considered that there is suitable mitigation available through standard construction practices to ensure that there are no residual significant negative effects.

It should be noted that this scheme falls entirely within the Kent Downs AONB. Construction of the new pipeline could have a minor negative effect on the landscape in the short-term, but this will be temporary and once it is buried there will be a residual neutral effect during operation. At this stage there is some uncertainty about the scale of the new building for treatment but it is assumed that it will not be significant and be located within the existing treatment site. Once mitigation has been taken into account, including planting/ screening it is predicted that the significance of residual effects can be reduced. Despite the small scale of development, it is considered that there is the potential for a minor negative effect during operation, in recognition of the AONB.

AMP18 (2075-80)

Under this programme no further supply-side options would then be delivered until AMP18, during which two new schemes are proposed. The first to be delivered in 2079 is **AFF-EGW-WRZ6-0173: Clandon Source Optimisation**. This scheme seeks to optimise the Clandon source by changing the software to allow water level based control of the pump speed, which should allow an increase in DO. The assessment found that this scheme is not likely to have significant negative effects during construction or operation given that it involves a change in software.

The second and final scheme to be delivered in 2079 is **AFF-TPO-WRZ6-1083: Surrey University (Guildford Site)**, which is a third party scheme to obtain a supply from the Surrey University site in Guildford. The option requires further discussions with Surrey University to lease the use of the borehole, a licence application to the Environment Agency, and pipework to take the water into the existing Affinity Water network; the site is just outside WRZ6.

The assessment does not identify any moderate or major negative effects in relation to this scheme during construction or operation for the majority of SEA objectives. The potential for minor negative effects are identified during construction of new or upgraded infrastructure but it is considered that there is suitable mitigation available through standard construction practices to ensure that there are no residual significant negative effects. A moderate negative effect is predicted against biodiversity as the pipeline currently passes through priority habitat (deciduous woodland). The assessment recommends that the pipeline should be re-routed at the detailed design stage to avoid the loss of any priority habitat.

5.4.9.2 Cumulative effects

Overall the cumulative effects assessment in **Appendix VI** has found that there is a low risk arising during construction of cumulative adverse effects regarding the SEA topic of population and human health. Extended construction related mitigation such as detailed routing, traffic planning and management and limitation of works within peak periods/ times will minimize the potential cumulative effects identified.

Regarding the SEA water topic, the assessment has identified a low risk of cumulative adverse effects as a result of schemes interacting with the potential to affect the Lower Thames Gravels Groundwater Body, the Thames (Cookham to Egham) Surface Water Body, and the Colne (from confluence with Chess to River Thames) Surface Water Body; where mitigation, including CoPC and best practice for design, construction and operations is recommended.

The assessment has also identified a medium risk of cumulative adverse effects as a result of schemes interacting with the potential to affect the Upper Bedford Ouse Woburn Sands Groundwater Body. The WFD assessment identifies that further hydrogeological assessment to consider linkage between deep Lower Greensand aquifer and Upper Bedford Ouse Woburn Sands is required. It is also recommended that water levels/flows in the Upper Bedford Ouse Woburn Sands Groundwater Body are monitored and mitigation could include a hands-off flow condition to prevent abstraction if water levels/ flows drop below a certain level.

The assessment has also identified the potential for positive effects arising as a result of schemes (AFF-RTR-WRZ1-4010 and AFF-RTR-WRZ4-4011) interacting to improve water levels and flow rates, improve habitats and improve low flows and chemistry within the Thames (Evenlode to Thame, Wallingford to Caversham, and Reading to Cookham) Surface Water Bodies.

Overall the assessment has also found that there are low risks arising (predominantly through construction phases), of cumulative adverse effects regarding the SEA topics relating to biodiversity and landscape and visual amenity. Sensitive receptors found to be at low risk are the Kent Downs AONB, Chilterns AONB, Surrey Hills AONB, North Wessex Downs AONB and South West London Waterbodies Ramsar and SPA.

The identified effects in relation to the AONBs are likely to be short-term and temporary associated with traffic and access disruption - including disruption to public rights of way, noise and disturbance (potentially affecting tranquillity and landscape character in the short term). Extended construction related mitigation such as detailed routing, traffic planning and management and limitation of works within peak periods/ times are considered likely to minimise the potential cumulative effects identified. Any new visible infrastructure should be sensitively designed and adhere to the aims and policies of the relevant AONB Management Plan.

The HRA for the rdWRMP19 recommended a number of mitigation measures in relation to the schemes AFF-RTR-WRZ1-4010 (2073) and AFF-RTR-WRZ4-4011 (2037) which will need to be taken into consideration during construction and operation to minimise the risks associated with the European designated sites (South West London Waterbodies Ramsar and SPA). This mitigation includes an explicit commitment to ensure that the programming and construction processes for the schemes take into account the proximity of the SPA and that construction works on the short section of pipeline adjacent to the SPA are programmed to avoid the winter (October to March) period entirely or are accompanied by an impact assessment including noise modelling and mitigation in line with British Standard BS5228 as required in order to ensure that noise levels can be maintained at an acceptable level.

The WRSE (updated 2018) study of potential cumulative effects between water company WRMPs in South East England identified four schemes proposed under this programme that could interact with schemes proposed in other WRMPs to have a cumulative effect.

The four schemes are located within the Southeast Region (WRZ 7 - Dour) and are identified as having the potential to have cumulative effects on the Kent Downs AONB as a result of interactions with options being considered through the emerging WRMP19 for Southern Water (BS_Win, IZT_Sel, and BR_Lug):

- AFF-RNC-WRZ7-0626 (Broome Network Improvement)
- AFF-RTR-WRZ7-0909 (Barham Continuation (After 2019/20))
- AFF-EGW-WRZ7-0908 (Tappington South Licence Variation)
- AFF-EGW-WRZ7-0629 (Lye Oak Licence Variation)

Three of the schemes (AFF-RTR-WRZ7-0909, AFF-EGW-WRZ7-0908 and AFF-EGW-WRZ7-0629) involve no new infrastructure so will not interact with the other Affinity Water rdWRMP19 schemes or the Southern Water schemes to have cumulative effects on the AONB. AFF-RNC-WRZ7-0626 proposes minimal new infrastructure and it is considered unlikely that there will be any significant cumulative effects with options being proposed through Southern Water's WRMP19 on the AONB. Any schemes that propose new infrastructure should ensure that it is sensitively designed and is in conformity with the Kent Downs AONB Management and Local Plans.

It is noted that the WRSE work identifies that a Southern Water option BS_Win is within 5km of option AFF-RNC-WRZ7-0626 so there is the potential for wider construction related impacts. As previously mentioned, AFF-RNC-WRZ7-0626 involves minimal new infrastructure and it is considered unlikely that there will be any cumulative effects during construction.

Two of the schemes are also identified through the WRSE study as having the potential for a cumulative effect; AFF-EGW-WRZ7-0629 (Lye Oak (LYEO) Licence Variation) and AFF-EGW-WRZ7-0908 (Tappington South (TAPS) Licence Variation) in WRZ 7. The study identified that these two schemes could interact with Southern Water option GWA_Fle (Flemings and Woodnesborough WSW licence variation) to have a cumulative effect on the East Kent Chalk - Stour groundwater body.

The WFD assessment concluded that AFF-EGW-WRZ7-0629 (LYEO Licence Variation) would not pose a significant risk to deterioration and that any impacts would be localised or temporary and not affect the overall status of the groundwater body. The AFF-EGW-WRZ7-0908 scheme involves TAPS, an existing (but disused) groundwater source within an existing licence group. There is a sequence of boreholes connected by an existing raw water main to the treatment works; DENT; TAPN; and RAKN. TAPS is not within this sequence currently and the option is to re-commission the borehole to provide resilience for the licence group (the group output is limited by licence/ treatment works). This scheme was scoped out of the WFD assessment as there would be no overall increase in abstracted volumes. As a result of the findings of the WFD assessment, it is considered that there is a low risk of cumulative effects arising as a result of interactions with Southern Water option GWA_Fle (Flemings and Woodnesborough WSW licence variation) on the East Kent Chalk - Stour groundwater body.

5.4.10 SEA of Environmental Adaptive Run

This run is an adaptation of the **Expected Future Adaptive Run** and focuses on minimising environmental effects taking account of the findings of the SEA. Options which are identified in the SEA (see Section 4) as having the potential for a moderate (-2) or major negative (-3) effect during operation are not selected for this run.²⁴ This run includes expected levels of demand management savings.

Table 5.20: Environmental Adaptive Run supply-side schemes

Supply scheme	Delivery date	AMP
AFF-RTR-WRZ7-0639 : Deal Continuation After 2020	2020	7
AFF-RTR-WRZ7-0909 : Barham Continuation (After 2019/20)	2020	7
AFF-EGW-WRZ7-0629 : Lye Oak Licence Variation	2021	7
AFF-CTR-WRZ4-4001 : Egham to Iver	2022	7
AFF-RNC-WRZ7-0900 : Dover Constraint Removal	2022	7
AFF-RTR-WRZ3-4016 : Minworth Strategic Transfer (100 MI/d)	2034	9
AFF-EGW-WRZ7-0908 : Tappington South - Licence Variation	2048	12
AFF-TPO-WRZ4-0412 : Hillingdon Hospital boreholes	2058	14
AFF-RNC-WRZ7-0626 : Broome Network Improvement	2058	14
AFF-EGW-WRZ2-0090 : Stonecross Source Optimisation	2069	16
AFF-RTR-WRZ7-0842 : Aldington to Saltwood Import Increase by 3MI/d	2072	17
AFF-EGW-WRZ6-0173 : Clandon Source Optimisation	2076	18
AFF-TPO-WRZ6-1083 : Surrey University (Guildford Site)	2076	18

5.4.10.1 Assessment findings

A summary of the key findings for the supply-side schemes under this programme is provided below in **Table 5.21**.

²⁴ In line with extant SEA guidance for WRMPs, schemes identified as having a moderate (-2) or major (-3) major negative effect during operation against SEA Objective 8 (Carbon Footprint) were not excluded as part of this run to avoid double counting. Carbon impacts and costs are already monetised through the programme appraisal stage.

Table 5.21: Environmental Adaptive Run summary SEA findings

Supply scheme	Delivery date	AMP	SEA Objectives and assessment questions																													
			1			2			3		4		5					6		7	8		9	10				11	12	13		14
			1a	1b	1c	2a	2b	2c	3a	3b	4a	4b	5a	5b	5c	5d	5e	6a	6b	7a	8a	8b	9a	10a	10b	10c	10d	11a	12a	13a	13b	14a
			C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O
AFF-RTR-WRZ7-0639 : Deal Continuation After 2020	2020	7	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AFF-RTR-WRZ7-0909 : Barham Continuation (After 2019/20)	2020	7	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AFF-EGW-WRZ7-0629 : Lye Oak Licence Variation	2021	7	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AFF-CTR-WRZ4-4001 : Egham to Iwer	2022	7	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AFF-RNC-WRZ7-0900 : Dover Constraint Removal	2022	7	0	1	0	1	0	1	0	0	0	0	-1	0	-1	0	-1	0	-1	0	0	0	0	0	0	0	0	0	0	0	0	0
AFF-CTR-WRZ3- 4016 : Minworth Strategic Transfer (100M/d)	2034	9	0	3	0	3	0	3	0	0	0	-1	0	-3	0	-1	0	-3	0	-1	0	-1	0	0	0	0	0	0	0	0	0	0
AFF-EGW-WRZ7-0908 : Tappington South - Licence Variation	2048	12	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AFF-TPO-WRZ4-0412 : Hillingdon Hospital boreholes	2058	14	0	1	0	1	0	1	0	0	0	0	-1	0	-1	0	-1	0	-1	0	0	0	0	0	0	0	0	0	0	0	0	0
AFF-RNC-WRZ7-0626 : Broome Network Improvement	2058	14	0	1	0	1	0	1	0	0	0	0	0	-1	0	-1	0	-1	0	-1	0	0	0	0	0	0	0	0	0	0	-1	0
AFF-EGW-WRZ2-0090 : Stonecross Source Optimisation	2069	16	0	1	0	1	0	1	0	0	0	0	-1	0	-1	0	-1	0	-1	0	0	0	0	0	0	0	0	0	0	0	0	0
AFF-RTR-WRZ7-0842 : Aldington to Saltwood Import Increase by 3M/d	2072	17	0	1	0	1	0	1	0	0	0	-1	0	-1	0	-1	0	-1	0	0	0	0	0	-1	0	-1	0	0	0	-2	0	0
AFF-TPO-WRZ6-1083 : Surrey University (Guildford Site)	2076	18	0	1	0	1	0	1	0	0	0	0	-1	0	-1	0	-1	0	-1	0	-2	0	0	0	0	0	0	0	0	0	0	0
AFF-EGW-WRZ6-0173 : Clandon Source Optimisation	2076	18	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

AMP7 (2020-25)

The five supply-side schemes to be delivered within the first five years (2020-25) of the plan period during AMP7 all propose minimal new infrastructure. As a result, they are not identified as having the potential for a significant negative effect either during construction or operation through the SEA, HRA or the WFD assessment.

AFF-RTR-WRZ7-0639: Deal Continuation After 2020 and **AFF-RTR-WRZ7-0909: Barham Continuation (After 2019/20)** propose the continuation of current agreements with Southern Water and South East Water respectively for the import of water. No new infrastructure is required for either of these schemes and no negative effects identified through the assessment.

AFF-EGW-WRZ7-0629: Lye Oak Licence Variation involves a negotiation to increase the abstraction license at Lye Oak. The increase in abstraction would be by 0.14MI/d consistent with the volume of the “returned” water (around 4% of the abstraction). The assessment found that there is the potential for minor negative effects during operation against SEA objectives relating to East Kent Chalk Stour groundwater levels given the increased abstraction; however, this is likely to be local and minor given the small increase. As a result of this there is also some uncertainty identified against the SEA objective relating to biodiversity as a result of the potential for indirect effects and close proximity of the Lydden and Swingfield Woods SSSI. However, it is again considered that given the small increase in abstraction there is unlikely to be any significant negative effects. Mitigation could include a hands-off flow condition to prevent abstraction at low flows below a certain level. As a result it is recommended that the water level in the East Kent Chalk Stour groundwater body and condition status of the Lydden and Swingfield Woods SSSI are monitored.

AFF-RNC-WRZ7-0900: Dover Constraint Removal involves the removal of network constraints by construction of a new main from Primrose Treatment Works to The Cricketer's Public House with connection into the existing network; this will allow increased abstraction from the groundwater sources and transfer to Folkestone. The scheme involves minimal new infrastructure with a new 1.19km main and 1 x 1 m3 Surge Vessel. Minor negative effects are identified during construction against SEA objectives relating to recreation/ tourism, road infrastructure, biodiversity and landscape primarily as a result of the delivery of the new pipeline. Impacts will be temporary, local and minor and good practice construction methods should ensure that there are no significant negative effects.

AFF-CTR-WRZ4-4001: Egham to Iwer involves the installation of a new booster station on an existing site, which will allow 17 MI/d to be pushed through the existing main. This will allow transfer of 17 MI/d from Egham to Harefield, which will allow use of the existing surplus within the Wey community (WRZ4). The scheme involves minimal new infrastructure and the assessment found that there would be a residual neutral effect against the majority of SEA objectives during construction and operation. Standard construction practices should ensure that there are no significant impacts during the construction phase.

AMP9 (2030-35)

The only supply-side scheme delivered under this programme during AMP9 in 2034 is **AFF-RTR-WRZ3-4016: Minworth Strategic Transfer (100 MI/d)**. This scheme involves the transfer of 100MI/d of raw water by a new main from Minworth Sewage Treatment Works (a Severn Trent asset) to a new Sundon Treatment Works. The scheme will require a new 130km long 800mm diameter main from Minworth STW to a new WTW at Sundon.

During construction the assessment identifies that there is the potential for major negative effects against SEA objectives relating to material consumption, landscape, carbon footprint and road infrastructure primarily as a result of the scale of new infrastructure required. With regard to landscape, this scheme requires the construction of new water treatment works and approx 3.3km of new main within the Chilterns AONB. The assessment also identifies potential issues for biodiversity, the historic environment and local water quality during construction. These primarily arise as a result of the proximity of the new pipeline to waterbodies as well as designated biodiversity and heritage assets. It is considered that there are suitable mitigation measures available to ensure that residual negative effects are not significant. The assessment recommends that the pipeline is re-routed where possible to avoid designated biodiversity and heritage assets.

During operation the assessment found that there is unlikely to be significant negative effects against the majority of SEA objectives. Although it is noted that significant negative effects are identified in terms of the carbon footprint of the company.

The assessment recognises that the new WTW falls within the Chilterns AONB and recommends that mitigation measures should include the retention of hedgerows, trees, fields, walls wherever possible and the re-instatement of soil/ land following construction of the pipeline. Use construction methods and barriers/hoardings that are sympathetic to the aesthetics of the surrounding landscape and historic environment. The delivery of screening/ planting should ensure that the residual effects during operation on the landscape and historic environment are reduced. More detailed mitigation measures should be explored at the detailed design stage.

AMP12 (2045-50)

Only one supply-side scheme is proposed for delivery during AMP11 under this programme. **AFF-EGW-WRZ7-0908: Tappington South - Licence Variation** is scheduled for delivery in 2048. This scheme involves the re-commissioning of the currently disused borehole at Tappington Source to provide resilience for the licence group. The scheme involves minimal new infrastructure and was not identified as having the potential for a significant effect through the SEA, HRA or the WFD assessment.

AMP14 (2055-60)

Two supply-side schemes are proposed for delivery in 2058 under this programme in AMP14. **AFF-TPO-WRZ4-0412: Hillingdon Hospital boreholes** seeks to purchase or lease and then transfer any potential spare capacity from three boreholes owned by Hillingdon Hospital. Two boreholes (B & A) are in use, while borehole C has been out of use for years owing to high iron levels (water quality). According to the Environment Agency website, the licence 28/39/28/0513 (HILLINGDON HOSPITAL NHS TRUST) is for 0.55 MI/d at average and 1.00 MI/d at peak.

The assessment does not identify any moderate or major negative effects in relation to this scheme during construction or operation. The potential for minor negative effects are identified during construction of the new pipeline and WTW but it is considered that there is suitable mitigation available through standard construction practices to ensure that there are no residual significant negative effects.

AFF-RNC-WRZ7-0626: Broome Network Improvement is designed to remove a network constraint on the Barham South East Water Import Main and a demand constraint, by transferring the existing Broome Borehole Source to Denton rather than via the Barham Import Main (WRZ7).

The assessment does not identify any moderate or major negative effects in relation to this scheme during construction or operation. The potential for minor negative effects are identified during construction of the new pipeline and upgrading of the WTW but it is considered that there is suitable mitigation available through standard construction practices to ensure that there are no residual significant negative effects.

It should be noted that this scheme falls entirely within the Kent Downs AONB. Construction of the new pipeline could have a minor negative effect on the landscape in the short-term, but this will be temporary and once it is buried there will be a residual neutral effect during operation. At this stage there is some uncertainty about the scale of the new building for treatment but it is assumed that it will not be significant and be located within the existing treatment site. Once mitigation has been taken into account, including planting/ screening it is predicted that the significance of residual effects can be reduced. Despite the small scale of development, it is considered that there is the potential for a minor negative effect during operation, in recognition of the AONB.

AMP16 (2065-70)

Only one supply-side scheme is proposed for delivery during AMP16 under this programme. **AFF-EGW-WRZ2-0090: Stonecross Source Optimisation** to be delivered in 2050. The scheme involves upgrading the borehole pumps at the existing Stonecross chalk groundwater source, as well as treatment works, and a network modification to close the 0.41 MI/d gap between DO and licence. The scheme would result in minimal new infrastructure and the assessment does not identify the potential for any residual moderate or major negative effects during construction or operation.

The assessment identifies that there is the potential for minor negative effects in the medium to long-term during operation as the increased abstraction at peak times may have some potential impact on water level in the aquifer and impact base flow in the linked surface water body (Ver River). The WFD assessment notes that these impacts are likely to be local, minor and temporary. The assessment also acknowledges that the issue above could have indirect effects on biodiversity. Mitigation could include a hands-off flow condition to prevent abstraction at low flows below a certain level. This should be given further consideration at the detailed design stage.

AMP17 (2070-75)

One supply-side scheme is proposed for delivery during AMP17. **AFF-RTR-WRZ7-0842: Aldington to Saltwood Import Increase by 3Mld** is scheduled for delivery in 2076. This scheme is an import of water from South East Water to WRZ7 via an interconnection point at Aldington for transfer to Saltwood Reservoir. This scheme requires a 3MI capacity upgrade of Saltwood Reservoir, a new 12.2 km 200 mm Diameter Main from the interconnection point to Saltwood Reservoir and a new pump station at the interconnection point (3 x 22 kW Booster Pumps).

The assessment does not identify any moderate or major negative effects in relation to this scheme during construction or operation for the majority of SEA objectives. Moderate negative effects identified during construction for SEA objectives relating to carbon footprint, the landscape, historic environment and agricultural land. In terms of the landscape, approximately 2.5km of the pipeline and the expanded reservoir fall within the Kent Downs AONB. The new pump house falls just outside the AONB and the expansion of the Saltwood service reservoir would fall within the AONB, as a result the potential for negative effects during construction is predicted to be moderate. The new pipeline passes within 5m of a Scheduled Monument and within 20m of a Listed Building. There is therefore potential for a moderate negative effect during the construction phase due to the proximity of the designated heritage assets.

The assessment recommends that mitigation measures should include the retention of hedgerows, trees, fields, and walls wherever possible and the re-instatement of soil/ land following construction of the pipeline. Use construction methods that are sympathetic to the aesthetics of the surrounding landscape and historic environment. The delivery of screening/planting should ensure that the residual effects during operation are reduced. The new pump house building should also be designed sympathetically to fit in with the surrounding landscape/ historic environment and screening used where appropriate. More detailed mitigation measures should be set out at the detailed design stage.

During operation the assessment found that there is unlikely to be any significant negative effects once mitigation is taken into account. Key issues during operation relate to medium to long-term effects on the landscape and historic environment (mitigation referred to above) as well as potential issues in relation to water quality through the creation of new preferential pathways into the aquifer due to below ground workings and construction of mains. The WFD assessment concluded that best practice design, construction and operation should ensure that impacts are minor, localised and temporary.

AMP18 (2075-80)

Two supply-side schemes are proposed under this programme during AMP18 in 2076. The first is **AFF-TPO-WRZ6-1083: Surrey University (Guildford Site)**, which is a third party scheme to obtain a supply from the Surrey University site in Guildford. The option requires further discussions with Surrey University to lease the use of the borehole, a licence application to the Environment Agency, and pipework to take the water into the existing Affinity Water network; the site is just outside WRZ6.

The assessment does not identify any moderate or major negative effects in relation to this scheme during construction or operation for the majority of SEA objectives. The potential for minor negative effects are identified during construction of new or upgraded infrastructure but it is considered that there is suitable mitigation available through standard construction practices to ensure that there are no residual significant negative effects. A moderate negative effect is predicted against biodiversity as the pipeline currently passes through priority habitat (deciduous woodland). The assessment recommends that the pipeline should be re-routed at the detailed design stage to avoid the loss of any priority habitat.

The final supply-side scheme to be delivered in AMP18 is **AFF-EGW-WRZ6-0173: Clandon Source Optimisation**. This scheme seeks to optimise the Clandon source by changing the software to allow water level based control of the pump speed, which should allow an increase in DO. The assessment found that this scheme is not likely to have significant negative effects during construction or operation given that it involves a change in software.

5.4.10.2 Cumulative effects

Overall the cumulative effects assessment in **Appendix VI** has also found that there are low risks arising (predominantly through construction phases), of cumulative adverse effects regarding the SEA topic relating to landscape and visual amenity. Sensitive receptors found to be at low risk are the Kent Downs AONB and Surrey Hills AONB.

The identified effects in relation to the AONBs are likely to be short-term and temporary associated with traffic and access disruption - including disruption to public rights of way, noise and disturbance (potentially affecting tranquillity and landscape character in the short term). Extended construction related mitigation such as detailed routing, traffic planning and management and limitation of works within peak periods/ times are considered likely to minimise the potential cumulative effects identified. Any new visible infrastructure should be sensitively designed and adhere to the aims and policies of the relevant AONB Management Plan.

The WRSE (updated 2018) study of potential cumulative effects between water company WRMPs in South East England identified five schemes proposed under this programme that could interact with schemes proposed in other WRMPs to have a cumulative effect.

All of the schemes are located within the Southeast Region (WRZ 7 - Dour) and are identified as having the potential to have cumulative effects on the Kent Downs AONB as a result of interactions with options being considered through the emerging WRMP19 for Southern Water (BS_Win, IZT_Sel, and BR_Lug):

- AFF-RNC-WRZ7-0626 (Broome Network Improvement)
- AFF-RTR-WRZ7-0909 (Barham Continuation (After 2019/20))
- AFF-RTR-WRZ7-0842 (Aldington to Saltwood Import Increase by 3Mld)
- AFF-EGW-WRZ7-0908 (Tappington South Licence Variation)
- AFF-EGW-WRZ7-0629 (Lye Oak Licence Variation)

Three of the schemes (AFF-RTR-WRZ7-0909, AFF-EGW-WRZ7-0908 and AFF-EGW-WRZ7-0629) involve no new infrastructure so will not interact with the other Affinity Water rdWRMP19 schemes or the Southern Water schemes to have cumulative effects on the AONB. AFF-RNC-WRZ7-0626 proposes minimal new infrastructure and the risk of cumulative effects on the AONB is therefore low.

AFF-RTR-WRZ7-0842 proposes a small upgrade of the Saltwood Reservoir along with a new mains and pump station at the interconnection point. Given the scale of the scheme and potential mitigation available, including screening/ planting, it is considered unlikely that there will be any significant cumulative effects with options being proposed through Southern Water's WRMP19 on the AONB. Any schemes that propose new infrastructure should ensure that it is sensitively designed and is in conformity with the Kent Downs AONB Management and Local Plans.

It is noted that the WRSE work identifies that a Southern Water option BS_Win is within 5km of option AFF-RNC-WRZ7-0626 so there is the potential for wider construction related impacts. As previously mentioned, AFF-RNC-WRZ7-0626 involves minimal new infrastructure and it is considered unlikely that there will be any cumulative effects during construction.

Also, the schemes proposed within this programme and identified through the WRSE study as having the potential for a cumulative effect are AFF-EGW-WRZ7-0629 (Lye Oak (LYEO) Licence Variation) and AFF-EGW-WRZ7-0908 (Tappington South (TAPS) Licence Variation) in WRZ 7. The study identified that these two schemes could interact with Southern Water option GWA_Fle (Flemings and Woodnesborough WSW licence variation) to have a cumulative effect on the East Kent Chalk - Stour groundwater body.

The WFD assessment concluded that AFF-EGW-WRZ7-0629 (LYEO Licence Variation) would not pose a significant risk to deterioration and that any impacts would be localised or temporary and not affect the overall status of the groundwater body. The AFF-EGW-WRZ7-0908 scheme involves TAPS, an existing (but disused) groundwater source within an existing licence group. There is a sequence of boreholes connected by an existing raw water main to the treatment works; DENT; TAPN; and RAKN. TAPS is not within this sequence currently and the option is to re-commission the borehole to provide resilience for the licence group (the group output is limited by licence/ treatment works). This scheme was scoped out of the WFD assessment as there would be no overall increase in abstracted volumes. As a result of the findings of the WFD assessment, it is considered that there is a low risk of cumulative effects arising as a result of interactions with Southern Water option GWA_Fle (Flemings and Woodnesborough WSW licence variation) on the East Kent Chalk - Stour groundwater body.

5.4.11 Assessment conclusions for reasonable alternative programmes

An assessment of each of the reasonable alternative programmes has been carried out to the same level of detail against the SEA objectives. The programmes are all based on different model conditions, which include varying levels of demand management savings (optimistic, expected and lower) as well as the number of supply-side schemes available for selection. As a result, there are differences between the programmes in terms of the overall number of supply-side schemes selected as well as differences between the individual schemes selected.

The programmes that are based on expected or lower demand management savings, or where strategic supply-side schemes (with +50MI/d benefit) are removed from consideration tend to result in a greater number of supply-side schemes being selected for delivery. This includes the Expected Future (23 supply-side schemes), Demand-side Challenging (21 supply-side schemes), AD_2 (20 supply-side schemes), AD_3 (23 supply-side schemes) and Supply-side Challenging (22 supply-side schemes). The Environmental Adaptive Run includes the fewest supply-side schemes at 13 as a number of schemes could not be selected based on the criteria adopted for this run (i.e. excluding options with the potential for a moderate or major adverse effect during operation as identified by the SEA).

All of the programmes propose the delivery of the same five supply-side schemes in the first five years of the plan period in AMP7 and with the same delivery date:

- AFF-RTR-WRZ7-0639: Deal Continuation After 2020 (Delivery in 2020)
- AFF-RTR-WRZ7-0909: Barham Continuation (After 2019/20) (Delivery in 2020)
- AFF-EGW-WRZ7-0629: Lye Oak Licence Variation (Delivery in 2021)
- AFF-CTR-WRZ4-4001: Egham to Iver (Delivery in 2022)
- AFF-RNC-WRZ7-0900: Dover Constraint Removal (Delivery in 2022)

All these schemes propose minimal new infrastructure and as a result, they are not identified as having the potential for a significant negative effect either during construction or operation through the SEA, HRA or the WFD assessment.

All of the programmes except for the Environmental Adaptive Run include the delivery of AFF-NGW-WRZ3-1068: Runley Wood (AMP7 LGS Borehole) and AFF-NGW-WRZ3-1053: Kings Walden. Both of these schemes are identified through the assessment as having the potential for a moderate negative effect on SEA objectives relating to WFD status and surface and groundwater levels/ flows. This was informed by the WFD assessment for the rdWRMP19, which identifies that the groundwater abstractions may influence local water balance in Woburn Sands groundwater body depending on extent of confined Lower Greensand (LGS) abstraction influence.

All of the programmes select the delivery of AFF-NGW-WRZ3-1068: Runley Wood (AMP7 LGS Borehole) first and then AFF-NGW-WRZ3-1053: Kings Walden shortly after in the following AMP. The Supply-side Challenging Future Adaptive programme proposes the earliest delivery of AFF-NGW-WRZ3-1068: Runley Wood (AMP7 LGS Borehole) in AMP7. Four programmes propose it for delivery in AMP8 (Expected Future, Demand-side challenging, AD_2 and AD_3), two in AMP10 (AD_1 and Optimistic) and one in AMP12 (Aspirational). The early delivery of the schemes through the Supply-side Challenging Future Adaptive programme restricts the amount of time available for further investigative work and assessment.

The assessment found that there is the potential for a moderate negative effect against SEA objectives relating to WFD status and surface and groundwater levels/ flows for AFF-NGW-WRZ4-0624: Canal & River Trust and GSK Slough Boreholes. All of the programmes except the Environmental Adaptive Run include the delivery of AFF-NGW-WRZ4-0624: Canal & River Trust and GSK Slough Boreholes. The earliest delivery is proposed through the Supply-side Challenging programme in AMP8. Two programmes propose it for delivery in AMP10 (Expected Future and Demand-side challenging), four in AMP11 (AD_1, AD_2, AD_3 and Optimistic) and one in AMP14 (Aspirational).

The assessment identified potential issues and uncertainties in relation to AFF-RES-WRZ4-0832: Brent Reservoir. During operation the scheme proposes the release of water from the Brent

Reservoir, which is also a SSSI. More detailed hydrological investigations need to be carried out in order to determine the extent and frequency of drawdown as a result of this scheme and how the hydrological conditions affect the wetland habitats and birds they support. Six of the programmes include AFF-RES-WRZ4-0832: Brent Reservoir, with four proposing it for delivery in AMP9 (Expected Future, Demand-side challenging, AD_2 and AD_3), one in AMP11 (AD_1) and in AMP13 (Aspirational). The three remaining programmes (Supply-side challenging, Optimistic and Environmental) do not include this scheme. Given that the earliest this scheme is proposed for delivery is AMP9, it is considered that there is sufficient time to investigate this issue further.

Four programmes (Expected Future, AD_2, AD_3 and Supply-side Challenging) include the delivery of AFF-RES-WRZ5-0809: Birds Green Reservoir, which is also identified through the assessment as having the potential for a moderate negative effect against SEA objectives relating to WFD status and surface and groundwater levels/ flows. The assessment also identifies the potential for moderate positive effects during operation as once established the raw water reservoir will provide new opportunities for recreation as well as opportunities for biodiversity net gain. The four programmes all propose the delivery of this scheme late in the planning horizon in either AMP17 or 18, as a result it is considered that there is sufficient time to investigate this issue further and identify more detailed mitigation measures if necessary.

It is important to note that the Environmental Adaptive Run does not include any of the schemes identified above as potentially having issues relating to WFD status and surface and groundwater levels/ flows. Furthermore, the Supply-side Challenging Future Adaptive Run cut the yield of these schemes by 50% to help mitigate the risks flagged through assessment as well as help to explore potential alternatives. It is likely that reducing their yield would help to reduce the significance of/ potential risk of residual negative effects identified during operation but this is uncertain at this stage.

The assessment also identifies potential issues during operation in terms of WFD status and surface and groundwater levels/flows for AFF-EFF-WRZ3-0180: Stevenage STW - Effluent Reuse and AFF-RES-WRZ3-0814: Honeywick Rye Reservoir. The assessment also found that there are potential benefits associated with the delivery of a new raw water reservoir in relation to recreation and biodiversity net gain. Only programmes AD_2 and AD_3 include these schemes as a result of restricting the selection of any strategic supply-side schemes. They are both proposed for delivery at the end of the planning horizon in AMP18.

The model parameters associated with programmes AD_2, AD_3 and the Environmental Adaptive Run mean that they generally do not include any strategic supply-side schemes. The only exception to this is the inclusion of AFF-RTR-WRZ3-4016: Minworth Strategic Transfer (100 MI/d) within programmes AD_3 and the Environmental Adaptive Run. The Minworth scheme is not identified through the SEA as being likely to have significant negative effects during operation²⁵ and no significant issues are highlighted through the HRA or WFD assessment.

AD_2, AD_3 and the Environmental Adaptive Run do not include any schemes related to the delivery of the South East Strategic Reservoir. The other programmes all include two schemes that are linked to the delivery of the SESR. AFF-RTR-WRZ4-4011: Abingdon to Iwer 2 (50MI/d) is proposed for delivery first under all the programmes and is then followed by AFF-RTR-WRZ1-4010: Abingdon Reservoir to Harefield Transfer (50MI) at a later date. The Demand-side Challenging programme proposes the earliest delivery of AFF-RTR-WRZ4-4011: Abingdon to Iwer 2 (50MI/d) in AMP10 followed by Supply-side Challenging and Expected Future in AMP11, Optimistic and AD_1 in AMP12 and Aspirational in AMP14. The assessment has highlighted for a number of significant negative as well as positive effects as a result of these schemes.

All of the programmes propose a variety of demand management measures throughout the planning horizon and the assessment found that these will generally perform positively or have a residual neutral effect against the majority of SEA objectives. Some of the leakage options would require construction works to repair or replace pipes and this could have local, temporary and short term minor negative effects; however, these are not likely to be significant.

²⁵ Except relating to SEA Objective 8 which deals with carbon.

5.5 Outline reasons for the selection and rejection of reasonable alternative programmes

5.5.1 Outline reasons for the selection of the preferred programme and adaptive futures

As described in Section 5.2, Affinity Water has progressed with an adaptive modelling approach to help inform decision-making on the preferred programme and manage future uncertainties given the long planning horizon of the WRMP. This includes recognition of points in time whereby they would have to make a decision based on the realisation of benefits from demand-side and leakage measures. This decision-making point could take them down one of a number of adaptive futures.

At this stage, taking account of a wide range of factors, including the findings of the SEA (and associated HRA and WFD assessment), the Expected Future Run is selected by Affinity Water as the preferred programme and is based on expected demand management savings and leakage targets. It contains a suitable range of supply-side schemes throughout the planning horizon to minimise risk and enhance the resilience of the plan.

While it is recognised that the SEA and associated WFD assessment have highlighted a number of potential issues for schemes that are proposed under this programme, it is considered that there is sufficient time before they are implemented to allow for further investigation, assessment and consultation to be carried out in relation to the identified issues. This will establish the likelihood and significance of impacts as well as any detailed mitigation measures that are necessary. All but one of the schemes flagged by WFD are to be delivered in AMP8 or later. The one scheme that has been flagged through this assessment which is scheduled for AMP7 delivery is in the last year of the AMP, and has been recognised by the PR19 business planning process as a key area for investigation. We have already undergone works to investigate and study this particular area and have ongoing discussions with the local EA teams on this topic. To ensure we have all future eventualities covered however, our Challenging Supply-Side Future simulates what would happen if the volumes from this scheme were not able to be materialised as part of an adaptive future.

Alongside the Expected Future Run the following reasonable alternatives have also been progressed as possible adaptive futures under the rdWRMP19:

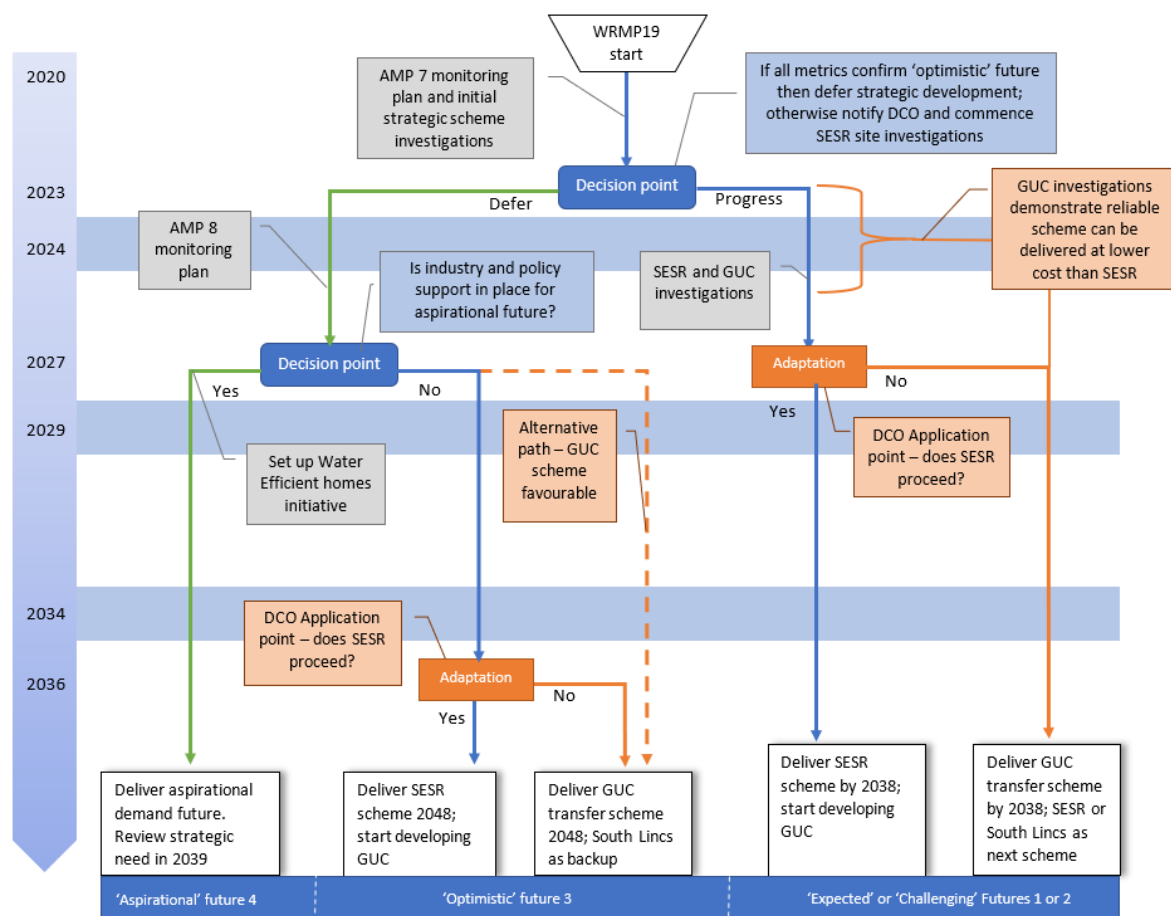
- Aspirational Future;
- Demand-side Challenging Future;
- Supply-side Challenging Future; and
- Optimistic Future.

As noted above, given the adaptive planning approach there are points in the future (**Figure 5.3**) where a decision will be made, based on the evidence available, to determine if it would be more appropriate to progress down the Challenging (supply-side or demand) Future, Optimistic Future or Aspirational Future programmes. Affinity Water's adaptive approach will dictate which of these programmes is progressed as a result of meeting the leakage and/ or demand-side targets set (or conversely not meeting these targets). The four adaptive programmes to our Expected Future are necessary to highlight the different pathways our future could materialise depending upon the realisation of demand management benefits and leakage reduction. They show that if the benefits of these measures are not realised, we will need to bring forward the delivery of specific supply-side schemes to compensate in order to maintain supply to our customers. Conversely, they also show the effect on the same supply-side schemes should we achieve optimistic levels of demand management savings and leakage reduction, which results in these schemes being pushed further into the future.

Figure 5.3 shows each of these four adaptive futures in relation to a WRMP19 start point. For the majority of AMP7, the plan will continue along one pathway until 2023 whereby Affinity Water will meet a decision point. For the previous years, the demand management and leakage results will have been tracked so once Affinity Water meet this decision point it can then be determined if these demand-side measures are on track or not in delivering demand savings. If the proposed demand management and leakage schemes deliver their expected benefits (central/ expected estimate) as

opposed to the more optimistic forecast benefits, Affinity Water will progress down the Expected Future which involves developing a strategic source for delivery in 2041. This is represented by the right hand 'flow' direction from the first decision point in **Figure 5.3**.

Figure 5.3: Flow diagram illustrating adaptive futures



Under the Adaptive Run process, there is the ability to switch between strategic sources depending upon the success of the DCO application. There is also an ability to bring forward the construction of either strategic source option on the grounds of Challenging Supply-Side, or Challenging Demand-Side Futures. These Challenging Futures take consideration of possibilities such as demand management options not performing at their expected levels, or reduced yield of supply options as flagged by the WFD assessment. All schemes flagged by WFD as potentially having adverse impacts on status and where further investigation is required had their yields cut by 50% under the Challenging Supply-Side Future to mitigate the flagged risks and highlight which alternative schemes would be implemented earlier and/ or introduced.

If, at the AMP7 decision point, Affinity Water finds they are on track with demand management or leakage targets, they can defer the construction of a strategic option and continue to monitor through AMP8. Another decision point would then be reached in 2027. If at this point Affinity Water finds the more ambitious, long term targets are not likely to be met, they have the ability to then construct a strategic option albeit a bit later than the expected and challenging futures.

Alternatively, if Affinity Water finds the demand management and leakage targets are being met at the 2027 decision point, they can continue down the Aspirational Future pathway with the view to reviewing the need for a strategic option in 2039.

5.5.2 Outline reasons for rejecting the remaining reasonable alternative programmes

The Environmental Adaptive Run, AD_1, AD_2 and AD_3 alternative programmes have all been rejected for the reasons set out below.

The Environmental Adaptive Run is a viable alternative programme which will not select options that the SEA has flagged as being potentially negative without mitigation. This is a reasonable alternative programme; however, on the grounds that there are not enough options under the conditions of this model run, additional levels of leakage reduction are selected to infill the gap left by the supply-side options excluded. This generates a programme with quite a high level of risk and dependency on meeting leakage reduction targets and does not consider that further investigation and more detailed mitigation at the detailed design stage could remove or further reduce the significance of negative effects identified through the SEA. By doing this, we generate a programme with a high level of risk associated with meeting extremely ambitious levels of leakage reduction. We do not deem this to be an acceptable level of risk and have such removed this from our process.

Similarly, AD_2 and AD_3 meet the plan objectives. The intention of these modelling runs was to understand what a programme of options would look like, should a strategic source option not be available. We recognise through our rdWRMP19 modelling that forecasted growth in the rdWRMP19 is so significant that Affinity Water consistently need between 100MI/d and 150MI/d of strategic imports into their supply region. Therefore, options which satisfy this need have a great deal of weight, so by undertaking AD_2 and AD_3 Affinity Water can understand the implications of not having one of these schemes available.

AD_2 and AD_3 were removed from the process because they were overly pessimistic. Our Challenging Future runs cover the eventualities of investigations flagging potential reasons to not progress with a particular strategic source, or events like DCO applications being unsuccessful, by allowing for an alternative strategic option to be selected rather than simply not selecting any strategic options. These runs were still useful to allow us to understand the weight of these options on our future ability to provide supply.

AD_1 was rejected because it was superseded by our Optimistic Future. Both runs had optimistic demand management futures involved; however, the long term targets (i.e. leakage reduced by 50% in 2044/45) exist in the Optimistic Future but not in AD_1. This was not a secondary or primary objective, so we were not able to rule AD_1 out of the process, but the run was not required further on the basis that the Optimistic Future does what AD_1 does, and goes further in line with long term targets raised by stakeholders as desirable.

6. Summary findings for the revised draft WRMP19

6.1 Introduction

This Chapter sets out key findings for the preferred programme (Expected Future) set out in the rdWRMP19 as well as any additional schemes that have a reasonable prospect of coming forward under one of the adaptive futures (Challenging Future, Optimistic Future and Aspirational Future).

6.2 The revised draft WRMP19

The proposed schemes in the rdWRMP19 under Dry Year Annual Average (DYAA) and Dry Year Critical Period (DCYP) are set out below in **Table 6.1**, organised according to WRZ. The supply and demand management schemes are expected to deliver enough additional water to meet predicted demand until 2079/80. **Figures 6.1 and 6.2** show the location and spatial extent of supply-side options proposed under rdWRMP19 DYCP, which includes all those supply-side options under the DYAA.

Table 6.1: Expected future programme

DYAA		DCYP	
Scheme	Delivery year	Scheme	Delivery year
WRZ1			
Supply			
AFF-RTR-WRZ1-4010 : Abingdon Reservoir to Harefield Transfer (50MI)	2053	AFF-RTR-WRZ1-4010 : Abingdon Reservoir to Harefield Transfer (50MI)	2053
AFF-RTR-WRZ1-1066 : Grand Union Canal (GUC - Berkhamstead/Hemel Hempstead)	2065	AFF-RTR-WRZ1-1066 : Grand Union Canal (GUC - Berkhamstead/Hemel Hempstead)	2065
Demand			
AFF-MET-WRZ1-0531 : Metering of Leftover Commercials	2020	AFF-MET-WRZ1-0531 : Metering of Leftover Commercials	2020
AFF-WEF-WRZ1-0567 : Community Water Efficiency Scheme	2020	AFF-WEF-WRZ1-0567 : Community Water Efficiency Scheme	2020
AFF-WEF-WRZ1-0901 : Comprehensive household water audit and retrofit	2020	AFF-WEF-WRZ1-0901 : Comprehensive household water audit and retrofit	220
AFF-WEF-WRZ1-0569 : Housing Associations - targeted programme	2020	AFF-WEF-WRZ1-0569 : Housing Associations - targeted programme	2020
AFF-WEF-WRZ1-1000 : Water Audits Retail - non process	2020	AFF-WEF-WRZ1-1000 : Water Audits Retail - non process	2020
AFF-MET-WRZ1-1010 : Street level PHC	2020	AFF-MET-WRZ1-1010 : Street level PHC	2020
AFF-WEF-WRZ1-1050 : Concerted action on Water efficiency	2020	AFF-WEF-WRZ1-1050 : Concerted action on Water efficiency	2020
AFF-MET-WRZ1-0904 : Compulsory Metering fixed network	2026	AFF-MET-WRZ1-0904 : Compulsory Metering fixed network	2026
AFF-LEA-WRZ1-ALC4	2030	AFF-LEA-WRZ1-ALC4	2030
AFF-LEA-WRZ1-1008 : OPTION 1008 POLICY 3: COMM PIPE RENEWAL	2063	AFF-LEA-WRZ1-1008 : OPTION 1008 POLICY 3: COMM PIPE RENEWAL	2063
AFF-LEA-WRZ1-1012 :	2076	AFF-LEA-WRZ1-1012 :	2076

DYAA		DCYP	
Scheme	Delivery year	Scheme	Delivery year
OPTION 1012 POLICY 2: MAINS & COMM PIPE RENEWAL - on selected DMAs		OPTION 1012 POLICY 2: MAINS & COMM PIPE RENEWAL - on selected DMAs	
WRZ2			
Supply			
		AFF-EGW-WRZ2-0090 : Stonecross Source Optimisation	2052
Demand			
AFF-MET-WRZ2-0531 : Metering of Leftover Commercials	2020	AFF-MET-WRZ2-0531 : Metering of Leftover Commercials	2020
AFF-WEF-WRZ2-0901 : Comprehensive household water audit and retrofit	2020	AFF-WEF-WRZ2-0901 : Comprehensive household water audit and retrofit	2020
AFF-WEF-WRZ2-0569 : Housing Associations - targeted programme	2020	AFF-WEF-WRZ2-0569 : Housing Associations - targeted programme	2020
AFF-MET-WRZ2-1010 : Street level PHC	2020	AFF-MET-WRZ2-1010 : Street level PHC	2020
AFF-LEA-WRZ2-0423 : Option 423 New PRVs	2020	AFF-LEA-WRZ2-0423 : Option 423 New PRVs	2020
AFF-WEF-WRZ2-1050 : Concerted action on Water efficiency	2020	AFF-WEF-WRZ2-1050 : Concerted action on Water efficiency	2020
AFF-WEF-WRZ2-0567 : Community Water Efficiency Scheme	2021	AFF-WEF-WRZ2-0567 : Community Water Efficiency Scheme	2021
AFF-MET-WRZ2-0904 : Compulsory Metering fixed network	2026	AFF-MET-WRZ2-0904 : Compulsory Metering fixed network	2026
AFF-LEA-WRZ2-ALC4	2035	AFF-LEA-WRZ2-ALC4	2035
AFF-WEF-WRZ2-1000 : Water Audits Retail - non process	2073	AFF-WEF-WRZ2-1000 : Water Audits Retail - non process	2073
AFF-LEA-WRZ2-1008 : OPTION 1008 POLICY 3: COMM PIPE RENEWAL	2074	AFF-LEA-WRZ2-1008 : OPTION 1008 POLICY 3: COMM PIPE RENEWAL	2074
AFF-LEA-WRZ2-1012 : OPTION 1012 POLICY 2: MAINS & COMM PIPE RENEWAL - on selected DMAs	2077	AFF-LEA-WRZ2-1012 : OPTION 1012 POLICY 2: MAINS & COMM PIPE RENEWAL - on selected DMAs	2077
WRZ3			
Supply			
AFF-NGW-WRZ3-1068 : Runley Wood (AMP7 LGS Borehole)	2025	AFF-NGW-WRZ3-1068 : Runley Wood (AMP7 LGS Borehole)	2025
AFF-NGW-WRZ3-1053 : Kings Walden	2030	AFF-NGW-WRZ3-1053 : Kings Walden	2030
AFF-CTR-WRZ3-4005 : Arkley North	2041	AFF-CTR-WRZ3-4005 : Arkley North	2041
AFF-CTR-WRZ3-1099 : Boxted to Chaul End	2065	AFF-CTR-WRZ3-1099 : Boxted to Chaul End	2065

DYAA		DCYP	
Scheme	Delivery year	Scheme	Delivery year
Demand			
AFF-MET-WRZ3-0531 : Metering of Leftover Commercials	2020	AFF-MET-WRZ3-0531 : Metering of Leftover Commercials	2020
AFF-WEF-WRZ3-0901 : Comprehensive household water audit and retrofit	2020	AFF-WEF-WRZ3-0901 : Comprehensive household water audit and retrofit	2020
AFF-WEF-WRZ3-0569 : Housing Associations - targeted programme	2020	AFF-WEF-WRZ3-0569 : Housing Associations - targeted programme	2020
AFF-WEF-WRZ3-1000 : Water Audits Retail - non process	2020	AFF-WEF-WRZ3-1000 : Water Audits Retail - non process	2020
AFF-MET-WRZ3-1010 : Street level PHC	2020	AFF-MET-WRZ3-1010 : Street level PHC	2020
AFF-WEF-WRZ3-1050 : Concerted action on Water efficiency	2020	AFF-WEF-WRZ3-1050 : Concerted action on Water efficiency	2020
AFF-LEA-WRZ3-ALC4	2020	AFF-LEA-WRZ3-ALC4	2020
AFF-WEF-WRZ3-0567 : Community Water Efficiency Scheme	2022	AFF-WEF-WRZ3-0567 : Community Water Efficiency Scheme	2022
AFF-MET-WRZ3-0904 : Compulsory Metering fixed network	2025	AFF-MET-WRZ3-0904 : Compulsory Metering fixed network	2025
AFF-REU-WRZ3-621 : Large user - surface water reuse (Luton Airport)	2031	AFF-REU-WRZ3-621 : Large user - surface water reuse (Luton Airport)	2031
AFF-REU-WRZ3-620 : Large user - rainwater harvesting (Luton Airport)	2033	AFF-REU-WRZ3-620 : Large user - rainwater harvesting (Luton Airport)	2033
AFF-LEA-WRZ3-1008 : OPTION 1008 POLICY 3: COMM PIPE RENEWAL	2071	AFF-LEA-WRZ3-1008 : OPTION 1008 POLICY 3: COMM PIPE RENEWAL	2071
WRZ4			
Supply			
AFF-CTR-WRZ4-4001 : Egham to Iver	2022	AFF-CTR-WRZ4-4001 : Egham to Iver	2022
AFF-RES-WRZ4-0832 : Brent Reservoir	2034	AFF-RES-WRZ4-0832 : Brent Reservoir	2034
AFF-NGW-WRZ4-0624 : Canal and Rivers Trust and GSK Slough Boreholes	2039	AFF-NGW-WRZ4-0624 : Canal and Rivers Trust and GSK Slough Boreholes	2039
AFF-RTR-WRZ4-4011 : Abingdon to Iver 2 (50MI/d)	2041	AFF-RTR-WRZ4-4011 : Abingdon to Iver 2 (50MI/d)	2041
AFF-TPO-WRZ4-0412 : Hillingdon Hospital boreholes	2064	AFF-TPO-WRZ4-0412 : Hillingdon Hospital boreholes	2064
Demand			
AFF-MET-WRZ4-0531 : Metering of Leftover Commercials	2020	AFF-MET-WRZ4-0531 : Metering of Leftover Commercials	2020
AFF-WEF-WRZ4-0901 :	2020	AFF-WEF-WRZ4-0901 :	2020

DYAA		DCYP	
Scheme	Delivery year	Scheme	Delivery year
Comprehensive household water audit and retrofit		Comprehensive household water audit and retrofit	
AFF-WEF-WRZ4-0569 : Housing Associations - targeted programme	2020	AFF-WEF-WRZ4-0569 : Housing Associations - targeted programme	2020
AFF-MET-WRZ4-1010 : Street level PHC	2020	AFF-MET-WRZ4-1010 : Street level PHC	2020
AFF-WEF-WRZ4-1050 : Concerted action on Water efficiency	2020	AFF-WEF-WRZ4-1050 : Concerted action on Water efficiency	2020
AFF-LEA-WRZ4-ALC4	2020	AFF-LEA-WRZ4-ALC4	2020
AFF-WEF-WRZ4-0567 : Community Water Efficiency Scheme	2023	AFF-WEF-WRZ4-0567 : Community Water Efficiency Scheme	2023
AFF-MET-WRZ4-0904 : Compulsory Metering fixed network	2029	AFF-MET-WRZ4-0904 : Compulsory Metering fixed network	2029
AFF-WEF-WRZ4-1000 : Water Audits Retail - non process	2073	AFF-WEF-WRZ4-1000 : Water Audits Retail - non process	2073
AFF-LEA-WRZ4-1012 : OPTION 1012 POLICY 2: MAINS & COMM PIPE RENEWAL - on selected DMAs	2076	AFF-LEA-WRZ4-1012 : OPTION 1012 POLICY 2: MAINS & COMM PIPE RENEWAL - on selected DMAs	2076

WRZ5			
Supply			
AFF-RES-WRZ5-0809 : Birds Green Reservoir	2078	AFF-RES-WRZ5-0809 : Birds Green Reservoir	2078
Demand			
AFF-MET-WRZ5-0531 : Metering of Leftover Commercials	2020	AFF-MET-WRZ5-0531 : Metering of Leftover Commercials	2020
AFF-WEF-WRZ5-0569 : Housing Associations - targeted programme	2020	AFF-WEF-WRZ5-0569 : Housing Associations - targeted programme	2020
AFF-WEF-WRZ5-1000 : Water Audits Retail - non process	2020	AFF-WEF-WRZ5-1000 : Water Audits Retail - non process	2020
AFF-MET-WRZ5-1010 : Street level PHC	2020	AFF-MET-WRZ5-1010 : Street level PHC	2020
AFF-WEF-WRZ5-1050 : Concerted action on Water efficiency	2020	AFF-WEF-WRZ5-1050 : Concerted action on Water efficiency	2020
AFF-LEA-WRZ5-ALC4	2020	AFF-LEA-WRZ5-ALC4	2020
AFF-WEF-WRZ5-0567 : Community Water Efficiency Scheme	2024	AFF-WEF-WRZ5-0567 : Community Water Efficiency Scheme	2024
AFF-MET-WRZ5-0904 : Compulsory Metering fixed network	2025	AFF-MET-WRZ5-0904 : Compulsory Metering fixed network	2025
AFF-REU-WRZ5-606 : Large user - rainwater harvesting (Stansted Airport)	2033	AFF-REU-WRZ5-606 : Large user - rainwater harvesting (Stansted Airport)	2033
AFF-WEF-WRZ5-0901 : Comprehensive household water audit and retrofit	2076	AFF-WEF-WRZ5-0901 : Comprehensive household water audit and retrofit	2076

DYAA		DCYP	
Scheme	Delivery year	Scheme	Delivery year
AFF-LEA-WRZ5-1008 : OPTION 1008 POLICY 3: COMM PIPE RENEWAL	2078	AFF-LEA-WRZ5-1008 : OPTION 1008 POLICY 3: COMM PIPE RENEWAL	2078
WRZ6			
Supply			
AFF-TPO-WRZ6-1083 : Surrey University (Guildford Site)	2076	AFF-TPO-WRZ6-1083 : Surrey University (Guildford Site)	2076
		AFF-RTR-WRZ6-0752 : Ladymead Optimisation	2077
AFF-EGW-WRZ6-0173 : Clandon Source Optimisation	2079	AFF-EGW-WRZ6-0173 : Clandon Source Optimisation	2079
Demand			
AFF-WEF-WRZ6-1050 : Concerted action on Water efficiency	2020	AFF-WEF-WRZ6-1050 : Concerted action on Water efficiency	2020
AFF-WEF-WRZ6-0569 : Housing Associations - targeted programme	2020	AFF-WEF-WRZ6-0569 : Housing Associations - targeted programme	2020
AFF-MET-WRZ6-1010 : Street level PHC	2022	AFF-MET-WRZ6-1010 : Street level PHC	2020
AFF-WEF-WRZ6-0567 : Community Water Efficiency Scheme	2025	AFF-WEF-WRZ6-0567 : Community Water Efficiency Scheme	2025
AFF-MET-WRZ6-0904 : Compulsory Metering fixed network	2031	AFF-MET-WRZ6-0904 : Compulsory Metering fixed network	2031
AFF-MET-WRZ6-0531 : Metering of Leftover Commercials	2041	AFF-MET-WRZ6-0531 : Metering of Leftover Commercials	2041
AFF-WEF-WRZ6-1000 : Water Audits Retail - non process	2075	AFF-WEF-WRZ6-1000 : Water Audits Retail - non process	2075
WRZ7			
Supply			
AFF-RTR-WRZ7-0639 : Deal Continuation After 2020	2020	AFF-RTR-WRZ7-0639 : Deal Continuation After 2020	2020
		AFF-RTR-WRZ7-0909 : Barham Continuation (After 2019/20)	2020
AFF-EGW-WRZ7-0629 : Lye Oak Licence Variation	2021	AFF-EGW-WRZ7-0629 : Lye Oak Licence Variation	2021
AFF-RNC-WRZ7-0900 : Dover Constraint Removal	2022	AFF-RNC-WRZ7-0900 : Dover Constraint Removal	2022
AFF-EGW-WRZ7-0908 : Tappington South - Licence Variation	2044	AFF-EGW-WRZ7-0908 : Tappington South - Licence Variation	2044
		AFF-RTR-WRZ7-0301 : Barham Import Increase (of 2MI/d) to 4 MI/d	2057
		AFF-RNC-WRZ7-0626 : Broome Network Improvement	2066
Demand			

DYAA		DCYP	
Scheme	Delivery year	Scheme	Delivery year
AFF-MET-WRZ7-0531 : Metering of Leftover Commercials	2020	AFF-MET-WRZ7-0531 : Metering of Leftover Commercials	2020
AFF-WEF-WRZ7-0901 : Comprehensive household water audit and retrofit	2020	AFF-WEF-WRZ7-0901 : Comprehensive household water audit and retrofit	2020
AFF-WEF-WRZ7-0569 : Housing Associations - targeted programme	2020	AFF-WEF-WRZ7-0569 : Housing Associations - targeted programme	2020
AFF-WEF-WRZ7-1050 : Concerted action on Water efficiency	2020	AFF-WEF-WRZ7-1050 : Concerted action on Water efficiency	2020
AFF-WEF-WRZ7-0567 : Community Water Efficiency Scheme	2026	AFF-WEF-WRZ7-0567 : Community Water Efficiency Scheme	2026
AFF-LEA-WRZ7-ALC4	2045	AFF-LEA-WRZ7-ALC4	2045
AFF-WEF-WRZ7-1000 : Water Audits Retail - non process	2075	AFF-WEF-WRZ7-1000 : Water Audits Retail - non process	2075
AFF-LEA-WRZ7-0955 : Option 955 reduction in DMA sizes Zone R07 only	2078	AFF-LEA-WRZ7-0955 : Option 955 reduction in DMA sizes Zone R07 only	2078

WRZ8			
Demand			
AFF-MET-WRZ8-0531 : Metering of Leftover Commercials	2020	AFF-MET-WRZ8-0531 : Metering of Leftover Commercials	2020
AFF-WEF-WRZ8-1050 : Concerted action on Water efficiency	2020	AFF-WEF-WRZ8-1050 : Concerted action on Water efficiency	2020
AFF-WEF-WRZ8-0567 : Community Water Efficiency Scheme	2027	AFF-WEF-WRZ8-0567 : Community Water Efficiency Scheme	2027

Figure 6.1: revised draft WRMP19 supply schemes (Central Region)

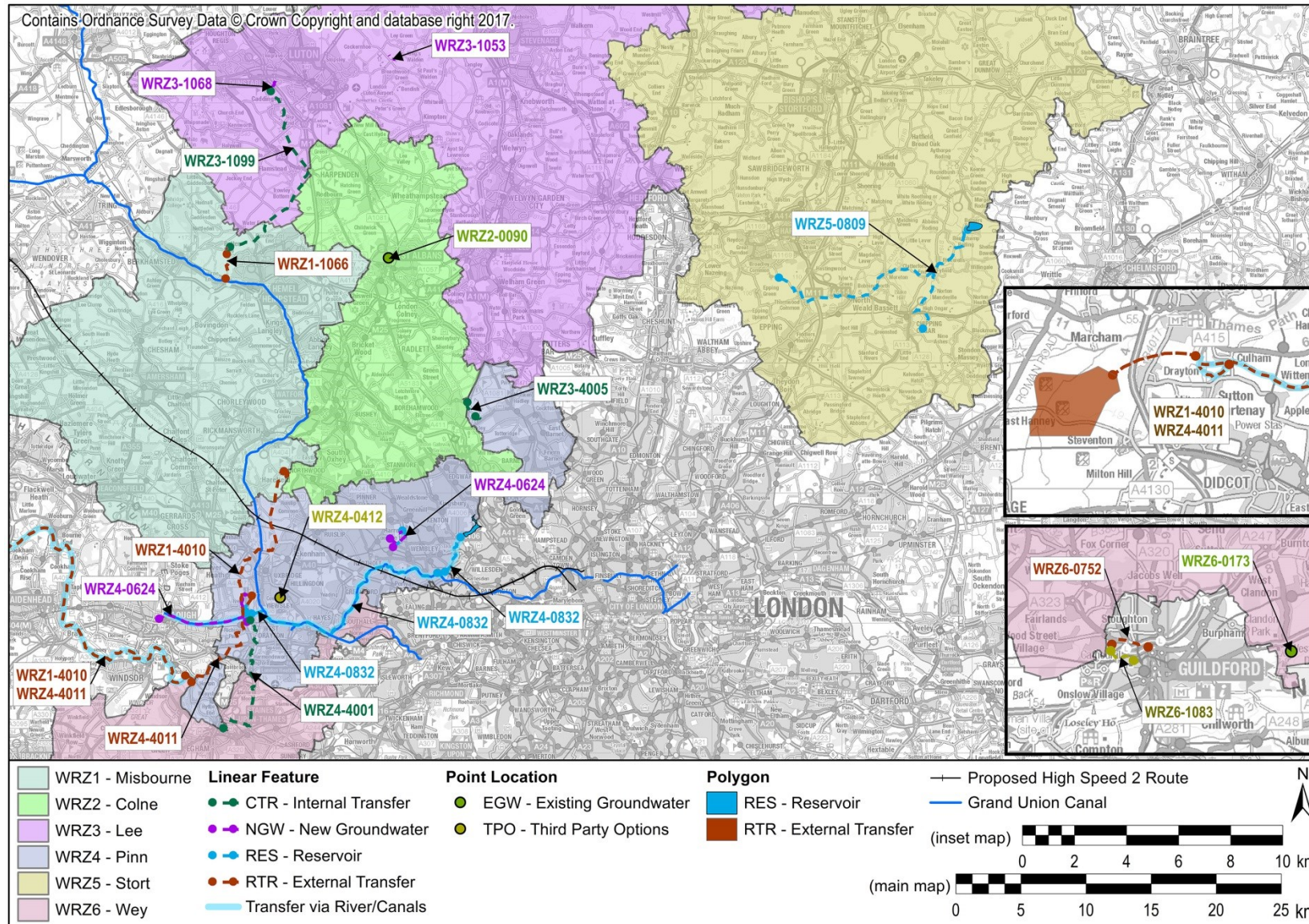
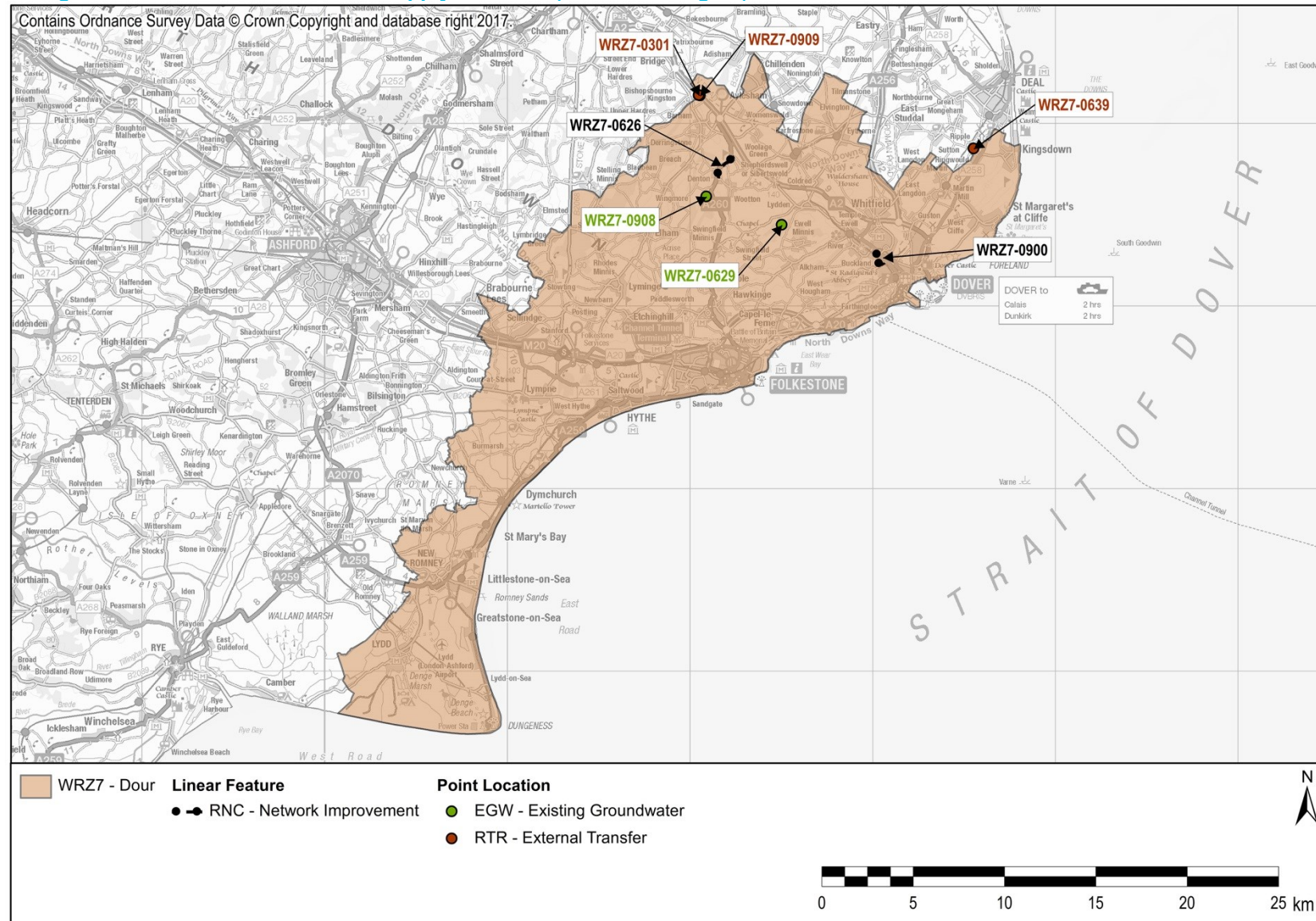


Figure 6.2: revised draft WRMP19 supply schemes (Southeast Region)



6.2.1 Adaptive futures

As explained in Chapter 5 of this report, Affinity Water has progressed with an adaptive modelling approach to help inform decision-making on the preferred programme and manage future uncertainties given the long planning horizon of the WRMP. This includes recognition of points in time whereby they would have to make a decision based on the realisation of benefits from demand-side and leakage measures. This decision-making point could take them down one of a number of adaptive futures (Challenging Future, Optimistic Future or Aspirational Future).

While the majority of the supply-side schemes are common between the adaptive futures with the only differences being delivery dates, the Aspirational and Challenging Futures contain supply-side schemes that are not proposed under the Expected Future, i.e. the rdWRMP19. These are:

- AFF-CTR-WRZ3-0028: Iver Arkley Transfer Upgrade
- AFF-ASR-WRZ6-0174: Egham ASR
- AFF-RTR-WRZ7-0842: Aldington to Saltwood Import Increase by 3Mld
- AFF-RTR-WRZ3-4016: Minworth Strategic Transfer (100 Ml/d)

While the Minworth Strategic Transfer does appear as a potential scheme under the Adaptive Future, Affinity Water consider that there is a greater potential for cost engineering a strategic version of the Grand Union Canal (GUC) transfer (AFF-RTR-WRZ1-1066) that is currently proposed under the rdWRMP19 (the Expected Future). Customers also significantly preferred the GUC transfer in comparison. The strategic version of the GUC transfer (AFF-RTR-WRZ1-4020: Grand Union Canal (Berkhamstead/ Hemel Hempstead) is Affinity Water's preferred alternative if the South East Strategic Reservoir (AFF-RTR-WRZ1-4010 and AFF-RTR-WRZ4-4011) was to not come forward. The Minworth Strategic Transfer would only be pursued if costs or delivery risks on the GUC transfer (AFF-RTR-WRZ1-1066) escalated beyond current expectations.

Taking the above into account, the following schemes have also been included for consideration within this Chapter as they have a reasonable prospect of coming forward under one of the adaptive futures:

- AFF-CTR-WRZ3-0028: Iver Arkley Transfer Upgrade;
- AFF-ASR-WRZ6-0174: Egham ASR;
- AFF-RTR-WRZ7-0842: Aldington to Saltwood Import Increase by 3Mld; and
- AFF-RTR-WRZ1-4020: Grand Union Canal (Berkhamstead/ Hemel Hempstead).

It should be noted that the precise delivery dates for these additional schemes are not known at this stage.

6.1 HRA findings

The HRA of the rdWRMP19 found that following a test of Likely Significant Effects with the exception of two Options (AFF-RTR-WRZ1-4010: Abingdon Reservoir to Harefield Transfer (50Ml) and AFF-RTR-WRZ4-4011: Abingdon to Iver 2 (50Ml/d)), it can be concluded that no Likely Significant Effects will result either alone or in combination with other options, projects or plans as a result of the construction or operation of the options included in the rdWRMP. Options AFF-RTR-WRZ1-4010: Abingdon Reservoir to Harefield Transfer (50Ml) and AFF-RTR-WRZ4-4011: Abingdon to Iver 2 (50Ml/d) were subject to Appropriate Assessment both alone and in combination.

Following Appropriate Assessment 'alone' which investigated impacts on the South West London Waterbodies SPA/ Ramsar site, recommendations were made for the inclusion of protective mitigation measures within the Plan to ensure that at the project level, no adverse effects on the integrity of this SPA/ Ramsar will result. These mitigation measures are as follows:

- It is recommended that the inclusion of this option within the WRMP is accompanied by an explicit commitment that the programming and construction processes for this scheme take into account the proximity of the SPA and Ramsar site. The WRMP should stipulate that construction

works on the short section of pipeline adjacent to the SPA will be programmed to avoid the winter (October to March) period entirely where possible. If this is not possible then at planning application a scheme-specific impact assessment including noise modelling will be undertaken and agreed with Natural England, to demonstrate that maximum noise levels will not exceed 70 dBA (L_{Amax}) at the SPA boundary during the October to March period. If necessary to achieve noise levels below 70dBA (L_{Amax}) mitigation will be implemented. British Standard BS5228 is a suitable source of mitigation measures which sets out tried and tested standard mitigation measures applicable in all situations. They include: using quieter techniques, use of cowling or damping to contain/ limit noise and use of close-board fencing (if required). The detailed assessment at the project level will also consider which components of the construction programme (if any) do not have any adverse effects so that these can be programmed for delivery (where feasible) during October to March.

- As a precaution, it is recommended that the inclusion of this option within the WRMP is accompanied by an explicit commitment to carefully design the pipeline, informed by geotechnical and hydrogeological investigations as necessary, to ensure that there is no requirement for dewatering of the excavation, or that any dewatering that is required is returned immediately to ground. These measures would enable the pipeline to be installed at a suitable depth and in a suitable manner that groundwater continuity to the gravel pits would not be disrupted and groundwater quality would be protected.

Affinity Water should work closely with Natural England and the SAC/ Ramsar site managers to agree the specific mitigation measures to be included in the project-specific HRA of both schemes to support applications for planning permission and environmental permits. The agreed mitigation measures will be expected to form part of planning conditions and/or conditions of relevant environmental permits, and their implementation managed through contractual obligations with supervision from an Environmental Clerk of Works appointed by Affinity Water.

Appropriate Assessment in combination investigated potential for disturbance effects on South West London Waterbodies SPA/ Ramsar site in combination with three Thames Water dWRMP schemes (Kempton WTW, Datchet groundwater scheme and South West London Pipelines (Chalk Streams). However, it concluded no adverse effects in combination on the integrity of the designated sites due to the recommended mitigation measures identified for both the Thames Water schemes and Affinity Water schemes.

The HRA also considered the potential for adverse effects upon Hackpen Hill SAC, Little Wittenham SAC, Cothill Fen SAC and Oxford Meadows SAC as a result of the South East Strategic Reservoir component of the Affinity Water Options AFF-RTR-WRZ1-4010: Abingdon Reservoir to Harefield Transfer (50MI) and AFF-RTR-WRZ4-4011: Abingdon to Iwer 2 (50MI/d) It was possible to conclude no adverse effects on the integrity of any European sites would result from the construction and operation of the reservoir.

The HRA concluded that, provided mitigation measures proposed in the HRA report to protect the South West London Waterbodies SPA/ Ramsar site are included in the rdWRMP19 as part of the development of Options AFF-RTR-WRZ1-4010: Abingdon Reservoir to Harefield Transfer (50MI) and AFF-RTR-WRZ4-4011: Abingdon to Iwer 2 (50MI/d) to ensure no adverse effects on the integrity of the South West London Waterbodies European sites, it can be concluded that the Affinity Water rdWRMP19 will not result in adverse effects on any European sites. Moreover, there are five alternative supply options that are not included in the rdWRMP but are included in Affinity Water's reasonable alternative Adaptive Plan model runs and which could come forward to make up for any supply shortfall in the unlikely event that the mitigation measures for these two options could not be implemented effectively and thus the options could not be delivered. All five of these alternative options have been assessed and deemed not to pose any likely significant effects on any European site. There is therefore a high degree of confidence that the rdWRMP19 can be delivered without an adverse effect on the integrity of South West London Waterbodies SPA or Ramsar site, or any other European site.

6.2 WFD assessment findings

The WFD assessment for the rdWRMP19 identified six schemes that have the potential for a risk of deterioration in status or potential, under Article 4.7 of the WFD. Six schemes were identified that may provide a potential improvement to status/ potential or may allow good status/ potential to be achieved. The options are identified in the table below.

Table 6.2: WFD assessment findings for rdWRMP19

rdWRMP19 scheme	Potential adverse impact	Potential benefit
AFF-NGW-WRZ3-1068: Runley Wood (AMP7 LGS Borehole) 2025	Yes	
AFF-NGW-WRZ3-1053: Kings Walden 2030	Yes	
AFF-RES-WRZ4-0832: Brent Reservoir 2034	Yes	Yes
AFF-RES-WRZ5-0809: Birds Green Reservoir 2078	Yes	
AFF-RTR-WRZ1-1066: Grand Union Canal (Berkhamstead/ Hemel Hempstead) 2065	Yes	Yes
AFF-RTR-WRZ1-4020: Grand Union Canal (Berkhamstead/ Hemel Hempstead) 2065	Yes	Yes
AFF-RTR-WRZ1-4010: Abingdon Reservoir to Harefield Transfer (50MI)		Yes
AFF-RTR-WRZ4-4011: Abingdon to Iver 2 (50MI/d)		Yes

The potential risks of deterioration in status or potential are expected to be mitigated by appropriate design and management of the options. For example, measures can be taken to minimise the risk of invasive species for surface water schemes at the point of abstraction and transfer; groundwater abstraction options could be operated at lower abstraction rates dependent on hydrogeological investigations to identify a sustainable yield; and specific abstraction licensing conditions to protect WFD water bodies will be developed in consultation with the Environment Agency.

Affinity Water's proposed strategy is to manage the identified WFD compliance risks through a robust adaptive approach that includes, if necessary, reducing abstraction from schemes, or not developing them at all. Should this prove necessary following completion of the further WFD investigations, any remaining supply deficit will be addressed by bringing forward implementation of strategic solutions that have been demonstrated to have no WFD compliance risks. Application of this adaptive strategy would be discussed in detail with the Environment Agency, but the rdWRMP demonstrates that there are viable alternatives available that can be implemented in time to address the supply deficit and with no WFD compliance risks.

Two options in the rdWRMP19 have the potential for cumulative effects when the streams combine in a downstream water body. These options are Runley Wood (AMP7 LGS Borehole) and Kings Walden, where there is the potential to impact baseflow to the rivers Flit and Henlow Brook respectively. The WFD assessment found that cumulative impacts are not anticipated to lead to a deterioration of status.

Other Protected Areas have been identified for two options, Runley Wood (AMP7 LGS Borehole) and Kings Walden, where Nitrate Vulnerable Zones are present in the potentially affected groundwater body. However, these options are not considered to significantly affect the designated areas.

6.3 SEA findings

6.3.1 Assessment of the rdWRMP schemes

A summary of the key findings for the supply and demand schemes proposed in the rdWRMP19 is provided below in **Table 6.3**. A narrative summary of the assessment findings for the demand management schemes is then provided next and followed by a summary narrative for the supply-side schemes and this is structured according to the Asset Management Period (AMP).

Table 6.3: rdWRMP19 summary SEA findings

Supply scheme	Delivery date	AMP	SEA Objectives and assessment questions																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						
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6.3.1.1 Demand management schemes

As illustrated in **Table 6.3** above there are no significant negative effects identified as a result of the proposed demand management schemes. Significant (moderate) positive effect for the metering options against assessment question 8a (Reduce/increase predicted carbon footprint?) through a medium term carbon saving associated with the reduced water requirement.

Some of the leakage options would require construction works to repair or replace pipes and this could have a short term minor negative effect on assessment questions relating to water supply (1a) and transport infrastructure (3a), as there could be temporary disruption of supply and disturbance through increased traffic on the road network during construction.

6.3.1.2 AMP7 (2020-25)

The five supply-side schemes to be delivered within the first five years (2020-25) of the plan period during AMP7 all propose minimal new infrastructure. As a result, they are not identified as having the potential for a significant negative effect either during construction or operation through the SEA, HRA or the WFD assessment.

AFF-RTR-WRZ7-0639: Deal Continuation After 2020 and **AFF-RTR-WRZ7-0909: Barham Continuation (After 2019/20)** these options involve the continuation of current agreements with Southern Water and South East Water respectively for the import of water. No new infrastructure is required for either of these schemes and no negative effects identified through the assessment.

AFF-EGW-WRZ7-0629: Lye Oak Licence Variation involves a negotiation to increase the abstraction license at Lye Oak. The increase in abstraction would be by 0.14MI/d consistent with the volume of the “returned” water (around 4% of the abstraction). The assessment found that there is the potential for minor negative effects during operation against SEA objectives relating to East Kent Chalk Stour groundwater levels given the increased abstraction; however, this is likely to be local and minor given the small increase. As a result of this there is also some uncertainty identified against the SEA objective relating to biodiversity as a result of the potential for indirect effects and close proximity of the Lydden and Swingfield Woods SSSI. However, it is again considered that given the small increase in abstraction there is unlikely to be any significant negative effects. Mitigation could include a hands-off flow condition to prevent abstraction at low flows below a certain level. As a result it is recommended that the water level in the East Kent Chalk Stour groundwater body and condition status of the Lydden and Swingfield Woods SSSI are monitored.

AFF-RNC-WRZ7-0900: Dover Constraint Removal involves the removal of network constraints by construction of a new main from Primrose Treatment Works to The Cricketer's Public House with connection into the existing network; this will allow increased abstraction from the groundwater sources and transfer to Folkestone. The scheme involves minimal new infrastructure with a new 1.19km main and 1 x 1 m³ Surge Vessel. Minor negative effects are identified during construction against SEA objectives relating to recreation/ tourism, road infrastructure, biodiversity and landscape primarily as a result of the delivery of the new pipeline. Impacts will be temporary, local and minor and good practice construction methods should ensure that there are no significant negative effects.

AFF-CTR-WRZ4-4001: Egham to Iwer involves the installation of a new booster station on an existing site, which will allow 17 MI/d to be pushed through the existing main. This will allow transfer of 17 MI/d from Egham to Harefield, which will allow use of the existing surplus within the Wey community (WRZ4). The scheme involves minimal new infrastructure and the assessment found that there would a residual neutral effect against the majority of SEA objectives during construction and operation. Standard construction practices should ensure that there are no significant impacts during the construction phase.

6.3.1.3 AMP8 (2025-30)

The only scheme proposed during AMP8 in 2025 is **AFF-NGW-WRZ3-1068: Runley Wood (AMP7 LGS Borehole)** - a scheme to license a new borehole in the Lower Greensand aquifer within the existing Runley Wood site boundary to allow an increased abstraction at this site. The assessment found that there is the potential for a moderate negative effect for SEA objectives 10 (WFD status) and 11 (surface/ ground water levels and flows). This was informed by the WFD assessment for the rdWRMP19, which identifies that the groundwater abstraction may influence local water balance in

Woburn Sands groundwater body depending on extent of confined Lower Greensand (LGS) abstraction influence. It suggests that this needs to be confirmed through further hydrogeological survey work. There is also the potential to affect groundwater body input to the River Flit which could have impacts on water levels/ flow and quality. The WFD assessment recommends that further information and assessment required. Given the delivery date of this scheme in 2035, there would be sufficient time to undertake further investigative work and detailed assessments to determine the likelihood and significance of effects along with suitable mitigation measures. Mitigation could include a hands-off flow condition to prevent abstraction at low flows below a certain level. As a result it is recommended that the water level in the Woburn Sands groundwater body is monitored.

As a result of the above, the assessment also identifies that there is some uncertainty in terms of indirect effects on biodiversity (SEA objective 5) reliant on the River Flit during operation although it is unlikely that this would be of significance. The assessment also identified that there is also the potential for a negative effect on SEA objective 5 (biodiversity) during construction. The scheme requires the delivery of a short 580m pipeline to connect the borehole/ LGS WTW to the Chaul End Reservoir and this crosses over some priority habitat (deciduous woodland). Given the location of the scheme it is unlikely that the route of the pipeline could be altered to avoid the habitat, given that the borehole and reservoir are separated by the M1 and the priority habitats run along either side of the motorway. Pipe jacking/ directional drilling could be used to avoid any loss of the habitat but the feasibility of this is uncertain at this stage and should be explored further at the detailed design stage.

6.3.1.4 AMP9 (2030-35)

Two supply-side schemes are proposed for delivery during AMP9 under this programme. As for **AFF-NGW-WRZ3-1068: Runley Wood (AMP7 LGS Borehole)** in AMP8, similar issues are also identified through the assessment for **AFF-NGW-WRZ3-1053: Kings Walden** scheduled for delivery in 2030. This scheme proposes a Lower Greensand borehole to be drilled on the existing site at Kings Walden for an output of 3MI/d. The existing site already has a Chalk groundwater source. This water could then be used for blending with the chalk source on site that suffers from high nitrates.

The assessment found that there is the potential for a moderate negative effect for SEA objectives 10 (WFD status) and 11 (surface/ ground water levels and flows). This was informed by the WFD assessment for the rdWRMP19, which identifies that the groundwater abstraction may influence local water balance in Woburn Sands groundwater body depending on extent of confined Lower Greensand (LGS) abstraction influence. However, the WFD assessment notes that the LGS aquifer becomes unconfined more than 13 km north of the abstraction point, therefore any impact would be naturally mitigated due to the distance. It suggests that this needs to be confirmed through further hydrogeological survey work. There is also the potential to affect groundwater body input to the River Ivel which could have impacts on water levels/ flow and quality at a local scale.

The WFD assessment recommends that further information and assessment required. Given the delivery date of this scheme in 2040, there would be sufficient time to undertake further investigative work and detailed assessments to determine the likelihood and significance of effects along with suitable mitigation measures. Mitigation could include a hands-off flow condition to prevent abstraction at low flows below a certain level. As a result it is recommended that the water level in the Woburn Sands groundwater body is monitored.

As a result of the above, the assessment also identifies that there is some uncertainty in terms of indirect effects on biodiversity (SEA objective 5) reliant on the River Ivel during operation although it is unlikely that this would be of significance. The mitigation identified above would reduce the potential for any residual negative effects in the medium to long-term.

The second supply-side to be delivered during AMP9 in 2034 is **AFF-RES-WRZ4-0832: Brent Reservoir**, which proposes the import of water from the Canal & River Trust reservoir at Brent. The water would be transmitted via the River Brent and the Grand Union Canal to the existing Iver Water Treatment Works for abstraction and subsequent treatment at a new Iver 2 WTW. The option includes upgraded storage at a new Harrow Service Reservoir within WRZ4.

The assessment identified that during the construction phase there is the potential for negative effects on SEA objectives 6 (landscape) and 13 (historic environment). The scheme includes a new Harrow service reservoir at Harrow on the Hill, which is an important local area of open/ green space surrounded by the existing built area that provides areas for recreation and contributes to the

character of the landscape/ townscape. The new reservoir is also situated in close proximity to the Harrow Park Registered Park and Garden. Potential for moderate negative effects during construction against SEA objectives relating to the landscape and historic environment. The assessment recommends the retention of hedgerows, trees, walls wherever possible and the re-instatement of soil/ land following construction of the pipeline. It also proposes the use of construction methods and barriers/ hoardings that are sympathetic to the aesthetics of the surrounding landscape. Where possible any opportunities to merge the reservoir embankment into the landscape should be explored.

During operation **AFF-RES-WRZ4-0832: Brent Reservoir** proposes the release of water from the reservoir, which is also a SSSI. The Brent Reservoir SSSI is currently in a favourable condition and is designated for breeding wetland birds, in particular for significant numbers of nesting great crested grebe, as well as wetland plant communities. There is uncertainty at this stage with regard to the extent and frequency of drawdown in the reservoir as a result of this proposed scheme. The Great Crested Grebe nest in reed beds and the Passerines (bullfinch, greenfinch, jay, willow warbler and wren) nest in willow woodland broadly between March and July so higher/ lower water levels in these periods could affect them. The wintering birds (Pochard, Gadwall, Snipe, Jack snipe and Smew) could also be affected as again; changing water levels could affect the amount of terrestrial habitat surrounding the waterbody that could be available for them to rest on when out of the water. The wetland plant species are sensitive to changes in water levels. It will be important to prevent the water levels from fluctuating significantly and frequently as this could displace plants as they move up/ or down in the inundation zone.

There are ongoing discussions between Affinity Water and the Canal & River Trust who operate the reservoir. More detailed hydrological investigations need to be carried out in order to determine the extent and frequency of drawdown as a result of this scheme and how the hydrological conditions affect the wetland habitats and birds they support. The assessment proposes that the water levels in the Brent Reservoir are monitored to inform the need and use of hands-off flow conditions to restrict the release of water when levels are low. Furthermore, the release of water could also be restricted during the breeding/ nesting seasons (broadly March to July). The condition status of the Brent Reservoir SSSI should also be monitored.

6.3.1.5 AMP10 (2035-40)

Only one supply-side scheme is proposed during AMP10 in 2039. **AFF-NGW-WRZ4-0624: Canal & River Trust and GSK Slough Boreholes** proposes obtaining supplies from existing Lower Greensand boreholes that are currently owned by third parties in the Slough area. The Lower Greensand water is to be pumped via a new pipeline along the Grand Union Canal towpath for treatment at a new Iver 2 WTW location (the existing Iver WTW is at full capacity). A new pipeline will then take the water to existing Iver for onward transfer to an upgraded Harrow Service Reservoir for use in WRZ4 (or WRZ2).

The assessment identifies the potential for a moderate negative effect against SEA objectives relating to surface and groundwater body status and flows. The WFD assessment notes that the GSK abstraction is/ was discharged to the Salthill stream following its use as non-evaporative cooling. As a result the WFD assessment found that there is a potential for a reduction in water returned to the surface water body that may lead to deterioration of status and flows. The proposed scheme may involve diverting this discharge to Affinity Water for consumptive use. The WFD assessment recommends that further information and assessment required. The discharge volume needs to be quantified and further WFD assessment undertaken to determine if could impact the status of the Salthill Stream surface water body. Given that the delivery date of this scheme is 2044 there is sufficient time to investigate this issue further.

6.3.1.6 AMP11 (2040-45)

Three supply-side schemes are proposed for delivery during AMP11 under this programme.

AFF-CTR-WRZ3-4005: Arkley North will be delivered in 2046 and allows for the bypass of Arkley 2 Reservoir and seeks to improve the interconnectivity between reservoirs. It involves minimal new infrastructure (50m of new main) and is not identified in the SEA, HRA or WFD assessment as having the potential for a significant negative effect during construction or operation. The potential for minor

negative effects are identified during construction of the new pipeline but it is considered that there is suitable mitigation available through standard construction practices to ensure that there are no residual significant negative effects.

Also being delivered in 2046 is **AFF-RTR-WRZ4-4011: Abingdon to Iwer 2 (50MI/d)**, which involves an increased abstraction from the River Thames at Sunnymeads, onwards transfer by a new main for treatment at Iwer 2 WTW. Water will be discharged from a new South East Strategic Reservoir (within the Thames Water Supply Area) for abstraction at Sunnymead. The increased abstraction will provide an additional 50 MI/d during both peak and average conditions for use within WRZ4.

During construction the assessment found that there is the potential for significant negative (moderate and major) effects against a number of SEA objectives as a result of this scheme due to the scale of new infrastructure required. This includes:

- Major negative effects for SEA objectives relating to material consumption and carbon footprint due to the scale of infrastructure.
- Moderate negative effects for SEA Objective 3 due to temporary disruption to local and strategic transport infrastructure, including public rights of way and major roads.
- Moderate negative effects also anticipated for SEA Objective 7 relating to Hillingdon AQMA and Marcham AQMA given the level of traffic anticipated during construction.
- Moderate negative effects for SEA Objective 5 due to temporary and permanent disruption to biodiversity, including internationally and nationally designated sites and other important habitats and species.
- Major negative effects for SEA Objective 6 given the construction of Abingdon reservoir is likely to have significant effects on the landscape. This includes impact on the setting of the North Wessex Downs AONB, and extensive disruption to views, visual amenity and landscape character.
- Major negative effects for SEA Objective 13 as a result of the heritage assets located within close proximity to the new reservoir and pipeline (including archaeological assets).

During operation the assessment found that there is the potential for significant negative (moderate and major) effects against a number of SEA objectives as a result of this scheme due to the scale of new infrastructure required. This includes:

- Moderate negative effects for SEA Objective 6 given that the new reservoir ancillary infrastructure would be a prominent new feature in the landscape. Notably, three towers will be seen against the visual context of the North Wessex Downs AONB to the south and east.
- Major negative effects for SEA Objective 8 relating to carbon footprint due to the scale of infrastructure.

During operation the assessment found that there is the potential for significant positive (moderate) effects against a number of SEA objectives as a result of this scheme due to the scale of new infrastructure required. This includes:

- Moderate positive effects for SEA Objective 2 in relation to tourism, recreation and amenity facilities.
- Moderate positive effects for SEA Objective 5 as the scheme is anticipated to provide opportunities for biodiversity enhancement and net gain.
- Moderate positive effects for SEA Objective 6 as the scheme presents opportunities for landscape enhancements and improvements. Specific mitigation measures and enhancements will be developed in the detailed design stages.
- Moderate positive effects for SEA Objective 8 as the scheme is upgrading transfer and storage capacity, resulting in positive effects on the resilience of Affinity Water's assets to climate change.

The final supply-side scheme to be delivered in AMP11 in 2044 is **AFF-EGW-WRZ7-0908: Tappington South - Licence Variation**. This scheme involves the re-commissioning of the currently disused borehole at Tappington Source to provide resilience for the licence group. The scheme

involves minimal new infrastructure and was not identified as having the potential for a significant effect through the SEA, HRA or the WFD assessment.

6.3.1.7 AMP13 (2050-55)

Two supply-side schemes are proposed in AMP13. The first of these is **AFF-EGW-WRZ2-0090: Stonecross Source Optimisation** to be delivered in 2052. The scheme involves upgrading the borehole pumps at the existing Stonecross chalk groundwater source, as well as treatment works, and a network modification to close the 0.41 Ml/d gap between DO and licence. The scheme would result in minimal new infrastructure and the assessment does not identify the potential for any residual moderate or major negative effects during construction or operation.

The assessment identifies that there is the potential for minor negative effects in the medium to long-term during operation as the increased abstraction at peak times may have some potential impact on water level in the aquifer and impact base flow in the linked surface water body (Ver River). The WFD assessment notes that these impacts are likely to be local, minor and temporary. The assessment also acknowledges that the issue above could have indirect effects on biodiversity. Mitigation could include a hands-off flow condition to prevent abstraction at low flows below a certain level. This should be given further consideration at the detailed design stage.

The second supply-side scheme to be delivered in AMP 13 is **AFF-RTR-WRZ1-4010: Abingdon Reservoir to Harefield Transfer (50MI)**, which is closely linked to **AFF-RTR-WRZ4-4011** delivered in AMP11.

AFF-RTR-WRZ1-4010: Abingdon Reservoir to Harefield Transfer (50MI) utilises the same infrastructure as **AFF-RTR-WRZ4-4011** up to point near Iver 2 WTW. It would then extend the mains northward to an upgraded Harefield Reservoir and Harefield Treatment Works. The detailed assessment of this scheme was carried out on the basis that this scheme could include the delivery of the South East Strategic Reservoir (SESR). However, the SESR would already be established at this point given the earlier delivery of **AFF-RTR-WRZ4-4011**. While there is still the potential for negative effects as a result of the delivery of the pipeline and expanded Harefield reservoir it is considered that there is suitable mitigation available to ensure that residual effects are minor. It is also considered that there is unlikely to be any significant negative effects during operation.

6.3.1.8 AMP14 (2055-60)

The only scheme to be delivered in AMP14 in 2057 is **AFF-RTR-WRZ7-0301: Barham Import Increase (of 2MI/d) to 4 MI/d**. An agreement between Affinity Water and South East Water exists for the import of 2 Ml/d via the Barham Interconnection Point. This scheme proposes an increase of this import by 2 Ml/d to a total of 4 Ml/d for transfer to Chalksole Reservoir. This scheme will require a 2 MI upgrade of Chalksole Service Reservoir.

The Chalksole Reservoir is situated within the Kent Downs AONB and is surrounded by areas of Priority Habitat (deciduous woodland) that is also listed as Ancient and Semi-Natural Woodland. Potential for moderate negative effects on SEA objectives relating to biodiversity and the landscape during construction; however, it is acknowledged that there is uncertainty as the precise direction and area of land lost to the reservoir expansion is not known at this stage. The assessment notes that there are a number of areas around the existing reservoir where there are no designated habitats. It is therefore considered that there is high likelihood that the upgrade of the reservoir can avoid the important habitats and this should be explored as a first step at the detailed design stage. Further consultation with NE will be necessary as well as more detailed ecological surveys.

The assessment recommends that any new structures (such as the above ground concrete tank structure associated with the reservoir upgrade) should be designed sympathetically to fit in with the surrounding landscape, and/or screened as appropriate by landscaping and planting. More detailed mitigation measures should be set out at the detailed design stage.

6.3.1.9 AMP15 (2060-65)

Two supply-side schemes are proposed during AMP15. The first to be delivered in 2064 is **AFF-TPO-WRZ4-0412: Hillingdon Hospital boreholes**. This scheme seeks to purchase or lease and then transfer any potential spare capacity from three boreholes owned by Hillingdon Hospital. Two

boreholes (B & A) are in use, while borehole C has been out of use for years owing to high iron levels (water quality). According to the Environment Agency website, the licence 28/39/28/0513 (HILLINGDON HOSPITAL NHS TRUST) is for 0.55 MI/d at average and 1.00 MI/d at peak.

The assessment does not identify any moderate or major negative effects in relation to this scheme during construction or operation. The potential for minor negative effects are identified during construction of the new pipeline and WTW but it is considered that there is suitable mitigation available through standard construction practices to ensure that there are no residual significant negative effects.

The second supply-side scheme to be delivered in 2065 is **AFF-CTR-WRZ3-1099: Boxted to Chaul End**, which involves a transfer of 40MI/d of treated water by a new main from Boxted Pump Station to Chaul End Reservoir via Friars Wash. The scheme includes a 40MI capacity upgrade of Chaul End Reservoir amongst other new infrastructure.

Key issues identified during the construction phase include potential impacts on landscape and biodiversity. A small proportion (approx 500m) of the pipeline route falls within the Chilterns AONB. The rest of the pipeline predominantly falls within rural areas and follows existing infrastructure, such as roads. The construction of the pipeline is identified as having the potential for a minor negative effect in the short term and a residual neutral effect during operation once buried. The upgrade of the Chaul End Service Reservoir is likely to have moderate negative effects on landscape during construction and it should be noted that the Chilterns AONB is around 550m from the reservoir. Once mitigation is taken into account it is unlikely that there will be any significant negative effects during operation, particularly given that the Chaul Reservoir lies in close proximity to the M1 and is separated from the AONB by new residential development. A new pump house may be required and other minor structures but these will be installed at a pre-existing pump station and will therefore not result in significantly visible new infrastructure.

Mitigation measures should include the retention of hedgerows, trees, fields, walls wherever possible and the re-instatement of soil/ land following construction of the pipeline. Use construction methods and barriers/hoardings that are sympathetic to the aesthetics of the surrounding landscape and historic environment. The delivery of screening/ planting should ensure that the residual effects during operation are reduced. More detailed mitigation measures should be explored at the detailed design stage.

The construction of the new pipeline route may result in the loss of Priority Habitats (in particular deciduous woodland) near to the Chaul End Reservoir. The assessment recommends that the pipeline is re-routed at the detailed design stage to avoid the Priority Habitat near to Chaul End Reservoir. There is also the potential for disturbance to species during the construction of the pipeline route; however, good practice construction methods should ensure that there are no significant negative effects.

6.3.1.10 AMP16 (2065-70)

Two supply-side schemes are proposed during AMP16. The first to be delivered in 2065 is **AFF-RTR-WRZ1-1066: Grand Union Canal (GUC - Berkhamstead/Hemel Hempstead)** and is scheduled to be delivered in 2070. This scheme proposes the cascade of water from the Severn Trent Minworth Sewerage Treatment Plant via the Grand Union Canal for abstraction at Hemel Hempstead. From here raw water would be transferred to a new Boxted Treatment Works for treatment and ultimately stored in an expanded Boxted Reservoir.

The assessment found that there is the potential for a moderate negative effect for SEA objectives 10 (WFD status) and 11 (surface/ ground water levels and flows). This was informed by the WFD assessment for the rdWRMP19, which identifies that the abstraction has the potential for impacts during operation on water levels/ flows and quality in the Tame (R Rea to R Blythe and from R Blythe to River Anker) surface water body. It suggests that this needs to be confirmed through further hydrogeological survey work. Given the delivery date of this scheme in 2065, there would be sufficient time to undertake further investigative work and detailed assessments to determine the likelihood and significance of effects along with suitable mitigation measures. Mitigation could include a hands-off flow condition to prevent abstraction at low flows below a certain level. As a result it is recommended that the water levels in the Tame (R Rea to R Blythe and from R Blythe to River Anker) surface water body are monitored.

The second supply-side scheme to be delivered in AMP16 in 2066 is **AFF-RNC-WRZ7-0626: Broome Network Improvement**. The scheme is designed to remove a network constraint on the Barham South East Water Import Main and a demand constraint, by transferring the existing Broome Borehole Source to Denton rather than via the Barham Import Main (WRZ7).

The assessment does not identify any moderate or major negative effects in relation to this scheme during construction or operation. The potential for minor negative effects are identified during construction of the new pipeline and upgrading of the WTW but it is considered that there is suitable mitigation available through standard construction practices to ensure that there are no residual significant negative effects.

It should be noted that this scheme falls entirely within the Kent Downs AONB. Construction of the new pipeline could have a minor negative effect on the landscape in the short-term, but this will be temporary and once it is buried there will be a residual neutral effect during operation. At this stage there is some uncertainty about the scale of the new building for treatment but it is assumed that it will not be significant and be located within the existing treatment site. Once mitigation has been taken into account, including planting/ screening it is predicted that the significance of residual effects can be reduced. Despite the small scale of development, it is considered that there is the potential for a minor negative effect during operation, in recognition of the AONB.

6.3.1.11 AMP18 (2075-80)

Under this programme no further supply-side options would then be delivered until AMP18, during which four new schemes are proposed.

The first to be delivered in 2076 is **AFF-TPO-WRZ6-1083: Surrey University (Guildford Site)**, which is a third party scheme to obtain a supply from the Surrey University site in Guildford. The option requires further discussions with Surrey University to lease the use of the borehole, a licence application to the Environment Agency, and pipework to take the water into the existing Affinity Water network; the site is just outside WRZ6.

The assessment does not identify any moderate or major negative effects in relation to this scheme during construction or operation for the majority of SEA objectives. The potential for minor negative effects are identified during construction of new or upgraded infrastructure but it is considered that there is suitable mitigation available through standard construction practices to ensure that there are no residual significant negative effects. A moderate negative effect is predicted against biodiversity as the pipeline currently passes through priority habitat (deciduous woodland). The assessment recommends that the pipeline should be re-routed at the detailed design stage to avoid the loss of any priority habitat.

The next supply-side scheme to be delivered in 2077 is **AFF-RTR-WRZ6-0752: Ladymead Optimisation**. This scheme is an import of 2.7 Ml/d of treated water from Thames Water via Ladymead Interconnection Point for transfer to Park Barn Drive Reservoir. The increase will provide an additional 2.7 Ml/d during both peak and average conditions for use within WRZ6.

The assessment does not identify any moderate or major negative effects in relation to this scheme during construction or operation. The potential for minor negative effects are identified during construction of the new pipeline and upgrading of the WTW but it is considered that there is suitable mitigation available through standard construction practices to ensure that there are no residual significant negative effects. The assessment identifies some uncertainty over the precise area required for the reservoir expansion is not known at this stage and there is priority habitat to the north, west and south of the site. The detailed design stage should ensure that priority habitats are avoided as part of the reservoir expansion.

The next supply-side scheme to be delivered in 2078 is **AFF-RES-WRZ5-0809: Birds Green Reservoir**. The scheme includes a river intake and pumping station at Marden Ash (River Roding), a new fully bunded bankside storage reservoir located at Birds Green, an onsite WTW and pumping station, and a treated water pipeline to Rye Hill service reservoir.

During construction the assessment identifies that there is the potential for moderate negative effects against SEA objectives relating to material consumption, landscape and carbon footprint primarily as a result of the scale of new infrastructure required. There is also a moderate negative effect identified

during construction in relation to agricultural land, given the presence of best and most versatile agricultural land.

During operation moderate negative effects are identified for SEA objectives relating to carbon footprint, WFD status and surface and groundwater levels/ flows. The assessment identifies that there is the potential for the scheme to reduce water flow and levels as well as quality in the Lower Roding (Cripsey Brook to Loughton) Surface Water Body during operation. This is informed by the WFD assessment which recommends that further assessments and discussions with the EA are required. The SEA suggests that the water levels and flows in the Lower Roding (Cripsey Brook to Loughton) should be monitored and hands-off flow conditions used when water levels and flows are low. Another issue identified during operation is that the new Birds Green Reservoir will lead to the loss of Best and Most versatile agricultural land.

Additional benefits/ moderate positive effects were identified during operation as once established the raw water reservoir provides new opportunities for recreation as well as opportunities for biodiversity net gain.

The final supply-side scheme to be delivered in AMP18 in 2079 is **AFF-EGW-WRZ6-0173: Clandon Source Optimisation**. This scheme seeks to optimise the Clandon source by changing the software to allow water level based control of the pump speed, which should allow an increase in DO. The assessment found that this scheme is not likely to have significant negative effects during construction or operation given that it involves a change in software.

6.3.2 Assessment of the adaptive future schemes

A summary of the key findings for the four additional supply-side schemes that could come forward under the adaptive futures is provided below in **Table 6.4**. A summary of the assessment findings for the demand management schemes is initially provided. A summary narrative for the supply-side schemes is then provided setting out the key issues identified and this is structured according to the AMP.

Table 6.4: Additional adaptive future scheme SEA findings

Schemes		SEA Objectives and assessment questions																																		
		1			2			3		4		5					6		7	8		9	10				11	12	13		14					
		1a	1b	1c	2a	2b	2c	3a	3b	4a	4b	5a	5b	5c	5d	5e	6a	6b	7a	8a	8b	9a	10a	10b	10c	10d	11a	12a	13a	13b	14a					
		C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O					
Supply-side																																				
AFF-CTR-WRZ3-0028 : Iver Arkley Transfer Upgrade		0	1	0	1	0	1	0	0	0	-1	0	-2	0	-1	0	-2	0	0	0	0	0	0	0	0	0	0	0	0	0	-1	0	0	-2	0	
AFF-ASR-WRZ6-0174 : Egham ASR		0	1	0	1	0	1	0	0	0	-1	-1	0	-1	0	-1	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
AFF-RTR-WRZ7-0842 : Aldington to Saltwood Import Increase by 3Mld		0	1	0	1	0	1	0	0	0	-1	-1	0	-1	0	-1	-1	0	0	0	0	-1	-1	0	0	0	0	0	0	0	-2	0	0	0	-2	0
AFF-RTR-WRZ1-4020 : Grand Union Canal (GUC - Berkhamstead/Hemel Hempstead ; 100 M/d)		0	3	0	3	0	3	0	0	0	0	-1	0	-1	0	-2	0	-1	-1	0	0	0	-1	-1	0	0	-1	-2	0	-2	0	0	-2	0	0	

AFF-CTR-WRZ3-0028: Iver Arkley Transfer Upgrade will allow the transfer of 15Ml/d from Iver 2 Treatment Works to Bulls Green Reservoir via Ickenham Pump Station and North Mymms Pump Station.

The assessment identifies the potential for moderate negative effects during the construction phase against a number of SEA objectives as a result of the new infrastructure, which includes around 69km of new pipeline and an upgraded Bulls Green Service Reservoir. The majority of these moderate negative effects are for SEA Objectives relating to road infrastructure, material consumption and carbon footprint. A moderate negative effect is identified against biodiversity during construction as the pipeline passes through some priority habitats. The assessment recommends that the pipeline should be re-routed at the detailed design stage to avoid the loss of priority habitats. It also identifies the potential for disturbance to some SSSIs given the proximity of the pipeline and recommends that during the detailed design stage the pipeline should be rerouted to avoid coming within 500m of a SSSI that has interest features sensitive to emissions of dust during earthworks. Otherwise good practice construction methods should reduce the likelihood of impacts. Careful design and construction of the pipeline, informed by further geotechnical and hydrogeological investigations, would enable it to be installed at a suitable depth and in a suitable manner (including return of any dewatering volumes immediately back to ground) that water levels and quality at the SSSIs or other important habitats would not be significantly affected. This would need to be developed further during detailed scheme design.

AFF-ASR-WRZ6-0174: Egham ASR is a speculative scheme to inject winter excess water into the confined chalk or Lower Greensand (LGS) for use in the summer peak demand period. The source of water is likely to be treated surface water (e.g. from the existing Egham or Chertsey sources). Exploration boreholes (LGS and Chalk) and testing will be required, at which point the option is likely to evolve based on the new data (groundwater levels and water quality); for example, it is possible that based on the new information a conventional groundwater abstraction (average and peak benefit) may be possible, albeit with a suitable level of treatment.

The assessment does not identify any moderate or major negative effects in relation to this scheme during construction or operation. The potential for minor negative effects are identified during construction of new or upgraded infrastructure but it is considered that there is suitable mitigation available through standard construction practices to ensure that there are no residual significant negative effects. The new pipeline passes in close proximity to a number of designated biodiversity and heritage assets but there is suitable mitigation available to ensure that there are no significant residual negative effects.

AFF-RTR-WRZ7-0842: Aldington to Saltwood Import Increase by 3Mld is an import of water from South East Water to WRZ7 via an interconnection point at Aldington for transfer to Saltwood Reservoir. This scheme requires a 3Ml capacity upgrade of Saltwood Reservoir, a new 12.2 km 200 mm Diameter Main from the interconnection point to Saltwood Reservoir and a new pump station at the interconnection point (3 x 22 kW Booster Pumps).

The assessment does not identify any moderate or major negative effects in relation to this scheme during construction or operation for the majority of SEA objectives. Moderate negative effects identified during construction for SEA objectives relating to carbon footprint, the landscape, historic environment and agricultural land. In terms of the landscape, approximately 2.5km of the pipeline and the expanded reservoir fall within the Kent Downs AONB. The new pump house falls just outside the AONB and the expansion of the Saltwood service reservoir would fall within the AONB, as a result the potential for negative effects during construction is predicted to be moderate. The new pipeline passes within 5m of a Scheduled Monument and within 20m of a Listed Building. There is therefore potential for a moderate negative effect during the construction phase due to the proximity of the designated heritage assets.

The assessment recommends that mitigation measures should include the retention of hedgerows, trees, fields, and walls wherever possible and the re-instatement of soil/ land following construction of the pipeline. Use construction methods that are sympathetic to the aesthetics of the surrounding landscape and historic environment. The delivery of screening/planting should ensure that the residual effects during operation are reduced. The new pump house building should also be designed sympathetically to fit in with the surrounding landscape/ historic environment and screening used

where appropriate. More detailed mitigation measures should be set out at the detailed design stage.

During operation the assessment found that there is unlikely to be any significant negative effects once mitigation is taken into account. Key issues during operation relate to medium to long-term effects on the landscape and historic environment (mitigation referred to above) as well as potential issues in relation to water quality through the creation of new preferential pathways into the aquifer due to below ground workings and construction of mains. The WFD assessment concluded that best practice design, construction and operation should ensure that impacts are minor, localised and temporary.

AFF-RTR-WRZ1-4020: (GUC – Berkhamsted/ Hemel Hempstead, 100 MI/d) is a strategic 100 MI/d version of **AFF-RTR-WRZ1-1066**, which is currently proposed under the Expected Future (i.e. the rdWRMP19). The two schemes include the same infrastructure except that AFF-RTR-WRZ1-4020 includes a larger capacity upgrade of the existing Boxted Service Reservoir. As for AFF-RTR-WRZ1-1066 it proposes the cascade of water from the Severn Trent Minworth Sewerage Treatment Plant via the Grand Union Canal for abstraction at Hemel Hempstead. From here raw water would be transferred to a new Boxted Treatment Works for treatment and ultimately stored in an expanded Boxted Reservoir.

The first of these is **AFF-RTR-WRZ1-1066: Grand Union Canal (GUC - Berkhamstead/Hemel Hempstead)** and is scheduled to be delivered in 2070. This scheme proposes the cascade of water from the Severn Trent Minworth Sewerage Treatment Plant via the Grand Union Canal for abstraction at Hemel Hempstead. From here raw water would be transferred to a new Boxted Treatment Works for treatment and ultimately stored in an expanded Boxted Reservoir.

The assessment found that there is the potential for a moderate negative effect for SEA objectives 10 (WFD status) and 11 (surface/ ground water levels and flows). This was informed by the WFD assessment for the rdWRMP19, which identifies that the abstraction has the potential for impacts during operation on water levels/ flows and quality in the Tame (R Rea to R Blythe and from R Blythe to River Anker) surface water body. It suggests that this needs to be confirmed through further hydrogeological survey work. Given the delivery date of this scheme in 2070, there would be sufficient time to undertake further investigative work and detailed assessments to determine the likelihood and significance of effects along with suitable mitigation measures. Mitigation could include a hands-off flow condition to prevent abstraction at low flows below a certain level. As a result it is recommended that the water levels in the Tame (R Rea to R Blythe and from R Blythe to River Anker) surface water body are monitored.

The scheme propose new infrastructure that is in close proximity to the Chilterns AONB. Potential for a moderate negative effect on the SEA objective relating to the landscape during construction. The assessment recommends that any new visible infrastructure should be designed sympathetically to fit in with the surrounding landscape, and/or screened as appropriate by landscaping and planting. Residual minor negative effect identified during operation primarily as a result of the expanded Boxted Reservoir.

6.3.3 Cumulative effects

6.3.3.1 Cumulative effects (Intra-plan) for the rdWRMP19 schemes

Overall the cumulative effects assessment in **Appendix VI** has found that there is a low risk arising during construction of cumulative adverse effects regarding the SEA topic of population and human health. Extended construction related mitigation such as detailed routing, traffic planning and management and limitation of works within peak periods/ times will minimize the potential cumulative effects identified.

Regarding the SEA water topic, the assessment has identified a low risk of cumulative adverse effects as a result of schemes interacting with the potential to affect the Lower Thames Gravels Groundwater Body, the Thames (Cookham to Egham) Surface Water Body, and the Colne (from confluence with Chess to River Thames) Surface Water Body; where mitigation, including CoPC and best practice for design, construction and operations is recommended.

The assessment has also identified a medium risk of cumulative adverse effects as a result of schemes interacting with the potential to affect the Upper Bedford Ouse Woburn Sands Groundwater Body. The WFD assessment identifies that further hydrogeological assessment to consider linkage between deep Lower Greensand aquifer and Upper Bedford Ouse Woburn Sands is required. It is also recommended that water levels/flows in the Upper Bedford Ouse Woburn Sands Groundwater Body are monitored and mitigation could include a hands-off flow condition to prevent abstraction if water levels/ flows drop below a certain level.

The assessment has also identified the potential for positive effects arising as a result of schemes (AFF-RTR-WRZ1-4010 and AFF-RTR-WRZ4-4011) interacting to improve water levels and flow rates, improve habitats and improve low flows and chemistry within the Thames (Evenlode to Thame, Wallingford to Caversham, and Reading to Cookham) Surface Water Bodies.

Overall the assessment has also found that there are low risks arising (predominantly through construction phases), of cumulative adverse effects regarding the SEA topics relating to biodiversity and landscape and visual amenity. Sensitive receptors found to be at low risk are the Kent Downs AONB, Chilterns AONB, Surrey Hills AONB, North Wessex Downs AONB, South West London Waterbodies Ramsar and SPA, and the Little Wittenham SAC and SSSI.

The identified effects in relation to the AONBs are likely to be short-term and temporary associated with traffic and access disruption - including disruption to public rights of way, noise and disturbance (potentially affecting tranquillity and landscape character in the short term). Extended construction related mitigation such as detailed routing, traffic planning and management and limitation of works within peak periods/ times are considered likely to minimise the potential cumulative effects identified. Any new visible infrastructure should be sensitively designed and adhere to the aims and policies of the relevant AONB Management Plan.

The HRA for the rdWRMP19 recommended a number of mitigation measures in relation to the schemes AFF-RTR-WRZ1-4010 (2053) and AFF-RTR-WRZ4-4011 (2041) which will need to be taken into consideration during construction and operation to minimise the risks associated with the European designated sites (South West London Waterbodies Ramsar and SPA). This mitigation includes an explicit commitment to ensure that the programming and construction processes for the schemes take into account the proximity of the SPA and that construction works on the short section of pipeline adjacent to the SPA are programmed to avoid the winter (October to March) period entirely or are accompanied by an impact assessment including noise modelling and mitigation in line with British Standard BS5228 as required in order to ensure that noise levels can be maintained at an acceptable level.

6.3.3.2 Cumulative effects (Intra-plan) for the adaptive future schemes

When considering the potential additional schemes under the adaptive future approach (AFF-CTR-WRZ3-0028, AFF-ASR-WRZ6-0174, AFF-RTR-WRZ7-0842 and AFF-RTR-WRZ1-4020), there are a number of additional potential cumulative adverse effects arising that are explored further below.

The strategic scheme AFF-RTR-WRZ1-4020: (GUC – Berkhamsted/ Hemel Hempstead, 100 MI/d) is a strategic 100 MI/d version of AFF-RTR-WRZ1-1066, which is currently proposed under the Expected Future (i.e. the rdWRMP19). The two schemes include the same infrastructure except that AFF-RTR-WRZ1-4020 includes a larger capacity upgrade of the existing Boxted Service Reservoir.

A delivery date for AFF-RTR-WRZ1-4020 is not known at this stage; however, it is recognised that there is the potential, in combination with scheme AFF-CTR-WRZ3-1099, for cumulative impacts during construction given their proximity (within 5km) should the scheme be delivered between 2062 and 2065. Overall it is considered that there is low risk of cumulative effects as if required, extended construction related mitigation such as detailed routing, traffic planning and management and limitation of works within peak periods/ times will minimise any residual effects.

Given that the scheme proposes minimal additional infrastructure (a larger capacity upgrade) than identified for rdWRMP19 scheme AFF-RTR-WRZ1-1066 the cumulative effects regarding the Chilterns AONB and SEA topic of landscape and visual amenity are considered likely to be similar and the same proposed mitigation measures will apply.

Scheme AFF-CTR-WRZ3-0028 has the potential to interact with a number of the other rdWRMP19 schemes. Although the delivery date is unknown at this stage, it is recognised that there is the potential (in combination with four of the rdWRMP19 schemes; AFF-RTR-WRZ1-4010, AFF-RES-WRZ4-0832, AFF-NGW-WRZ4-0624 and AFF-RTR-WRZ4-4011) for cumulative impacts during construction given their proximity (within 5km). Again if required, extended construction related mitigation such as detailed routing, traffic planning and management and limitation of works within peak periods/ times will minimise the potential cumulative effects identified.

In regards to the SEA topic relating to water, scheme AFF-CTR-WRZ3-0028 interacts with scheme AFF-NGW-WRZ4-0624 where there is the potential for cumulative impacts on the Colne Brook Surface Water Body during operation. Mitigation, including CoPC and best practice design, construction and operations is recommended to minimise the potential for any residual negative effects.

In terms of landscape, scheme AFF-CTR-WRZ3-0028 also interacts with six of the rdWRMP19 schemes; and the potential for cumulative impacts on the Chilterns AONB is identified. These effects are predominantly likely to be short-term and temporary associated with traffic and access disruption - including disruption to public rights of way, noise and disturbance (potentially affecting tranquillity and landscape character in the short term). Longer term impacts are likely to be minor and relate to visible new infrastructure affecting the AONB and its setting. Extended construction related mitigation such as detailed routing, traffic planning and management and limitation of works within peak periods/ times are considered likely to minimise the potential for negative cumulative effects during construction. Any new visible infrastructure should be sensitively designed and adhere to the aims and policies of the relevant AONB Management Plan.

Scheme AFF-CTR-WRZ3-0028 is also identified as having the potential for cumulative effects on biodiversity. Potential impacts are identified during construction in relation to Ruislip Woods SSSI and this could interact with rdWRMP19 scheme AFF-RTR-WRZ1-4010. Given the interest features of the SSSI (lowland acid grassland, woodland and invertebrate assemblage) impacts are most likely to occur as a result of emissions of dust and changes to water quality and levels during construction. During the detailed design stage the pipelines should be routed to avoid coming within 500m of the interest features sensitive to emissions of dust during earthworks. Otherwise, standard dust suppression measures should be introduced in line with the relevant British Standard. Careful design and construction of the pipeline, informed by further geotechnical and hydrogeological investigations, would enable it to be installed at a suitable depth and in a suitable manner (including return of any dewatering volumes immediately back to ground) that water levels and quality on the SSSI would not be significantly affected. This would need to be developed further during detailed scheme design.

Scheme AFF-ASR-WRZ6-0174 also has the potential to interact with other rdWRMP19 schemes. Although the delivery date is unknown at this stage, it is recognised that there is the potential (in combination with three of the rdWRMP19 schemes; AFF-RTR-WRZ1-4010, AFF-CTR-WRZ4-4001, and AFF-RTR-WRZ4-4011) for cumulative impacts during construction given their proximity (within 5km). Again if required, extended construction related mitigation such as detailed routing, traffic planning and management and limitation of works within peak periods/ times will minimise the potential cumulative effects identified.

In regards to the SEA topic relating to water, scheme AFF-ASR-WRZ6-0174 interacts with scheme AFF-EGW-WRZ2-0090 where there is the potential for cumulative impacts on the Mid-Chilterns Chalk Groundwater Body during operation. Mitigation, including CoPC and best practice design, construction and operations is recommended to minimise the potential for any residual negative effects.

Scheme AFF-RTR-WRZ7-0842 has the potential to interact with the other supply schemes proposed in the rdWRMP19 within WRZ7 on the Kent Downs AONB. These impacts are predominantly likely to be short-term and temporary associated with traffic and access disruption - including disruption to public rights of way, noise and disturbance (potentially affecting tranquillity and landscape character in the short term). Longer term impacts are likely to be minor and relate to visible new infrastructure affecting the AONB and its setting. Extended construction related mitigation such as detailed routing, traffic planning and management and limitation of works within peak periods/ times are considered likely to minimise the potential cumulative effects identified. Any new visible infrastructure should be sensitively designed and adhere to the aims and policies of the relevant AONB Management Plan.

6.3.4 Special Sites of Scientific Interest (SSSIs)

6.3.4.1 rdWRMP19 schemes

For the majority of schemes proposed in the rdWRMP19 the assessment found that there are no pathways for impacts to SSSIs, or that there is suitable mitigation available to ensure that there is a residual neutral effect during construction and/ or operation.

The assessment identified three schemes with the potential for a negative effect on a SSSI during construction and these are:

- AFF-RTR-WRZ4-4011: Abingdon to Iwer 2 (50MI/d) (Delivery in 2041)
- AFF-RTR-WRZ1-4010: Abingdon Reservoir to Harefield Transfer (50MI) (Delivery in 2053)
- AFF-RES-WRZ5-0809 : Birds Green Reservoir (Delivery in 2078)

AFF-RTR-WRZ1-4010: Abingdon Reservoir to Harefield Transfer (50MI) and AFF-RTR-WRZ4-4011: Abingdon to Iwer 2 (50MI/d) both rely on a new pipeline within the Affinity Water supply area that passes adjacent to the Wraysbury No.1 Gravel Pit SSSI. There is the potential for disturbance (dust emissions, noise and light) that could affect the interest features (wintering Gadwall).

There are standard dust suppression measures that could be introduced in line with the relevant British Standard. In terms of noise and light disturbance, depending on the noise levels generated during construction (which are unknown at this point) works may need to be timed to avoid the winter (October to March). This would usually be the preference for construction crews but is a matter to consider further during detailed design.

It is also noted that depending on the depth of the pipeline there is the potential for changes in hydrology at the SSSIs. In practice impacts of the pipeline can be avoided through careful design and construction, informed by geotechnical and hydrogeological investigations. These would enable the pipeline to be installed at a suitable depth and in a suitable manner that water levels and quality would be protected. This would need to be developed further during detailed scheme design.

The Environmental Report for Thames Water rdWRMP19 states that there are no designated nature conservation sites within the proposed South East Strategic Reservoir site. While there are SSSIs within 1km of the reservoir site the assessment found that it will not have any significant negative effects on any SSSIs during construction. The assessment of AFF-RTR-WRZ1-4010 and AFF-RTR-WRZ4-4010 through the SEA for Affinity Water's rdWRMP19 also concluded that there would be no significant effects on SSSIs during the construction of the South East Strategic Reservoir.

AFF-RES-WRZ5-0809: Birds Green Reservoir proposes the expansion of Rye Hill Reservoir, which is approximately 300m from Harlow Woods SSSI. The SSSI is broadly designated for its broadleaved mixed and yew woodland) and is currently in a favourable and unfavourable recovering condition. The citation for the SSSI suggests that site level management, such as coppicing, is one of the most important factors in maintaining a favourable condition status.

It is assumed that the expansion of the reservoir can be carried out within the existing Affinity Water site. As a result of this and given the interest features and condition status of the SSSI, it is considered that there will be no significant impacts during the construction of the expanded Rye Hill Reservoir. There are standard dust suppression measures that could be introduced in line with the relevant British Standard. Good practice construction methods should ensure that there are no impacts on water quality and levels during construction.

The assessment identified four schemes with the potential for a negative effect on a SSSI during operation and these are:

- AFF-RES-WRZ4-0832 : Brent Reservoir (Delivery in 2034)
- AFF-RTR-WRZ4-4011: Abingdon to Iwer 2 (50MI/d) (Delivery in 2041)
- AFF-RTR-WRZ1-4010: Abingdon Reservoir to Harefield Transfer (50MI) (Delivery in 2053)
- AFF-RES-WRZ5-0809: Birds Green Reservoir (Delivery in 2078)

During operation AFF-RES-WRZ4-0832: Brent Reservoir proposes the release of water from the reservoir, which is also a SSSI. The Brent Reservoir SSSI is currently in a favourable condition and is designated for breeding wetland birds, in particular for significant numbers of nesting great crested grebe, as well as wetland plant communities. There is uncertainty at this stage with regard to the extent and frequency of drawdown in the reservoir as a result of this proposed scheme. The Great Crested Grebe nest in reed beds and the Passerines (bullfinch, greenfinch, jay, willow warbler and wren) nest in willow woodland broadly between March and July so higher/ lower water levels in these periods could affect them. The wintering birds (Pochard, Gadwall, Snipe, Jack snipe and Smew) could also be affected as again; changing water levels could affect the amount of terrestrial habitat surrounding the waterbody that could be available for them to rest on when out of the water. The wetland plant species are sensitive to changes in water levels. It will be important to prevent the water levels from fluctuating significantly and frequently as this could displace plants as they move up/ or down in the inundation zone.

There are ongoing discussions between Affinity Water and the Canal & River Trust who operate the reservoir. More detailed hydrological investigations need to be carried out in order to determine the extent and frequency of drawdown as a result of this scheme and how the hydrological conditions affect the wetland habitats and birds they support. The assessment proposes that the water levels in the Brent Reservoir are monitored to inform the need and use of hands-off flow conditions to restrict the release of water when levels are low. Furthermore, the release of water could also be restricted during the breeding/ nesting seasons (broadly March to July). The condition status of the Brent Reservoir SSSI should also be monitored.

The SEA Environmental Report for the Thames Water rdWRMP19 identifies that the habitat types most at risk as a result of the South East Strategic Reservoir during operation are the weir pools in the River Thames due to the potential change in their level and flow regime. Overall, it is expected that the ecological status will remain the same with flows regulated and discharges subject to licencing from the Environment Agency. The provision of three drawdown towers will allow the draw off to be controlled to minimise any potential water quality issues and manage the quality of the water released. Further assessment of the water quality of the releases is required and therefore low certainty but it is expected that any water quality impacts relating to temperature or DO issues can be mitigated.

Furthermore, the Thames Water SEA states that discharge from the reservoir to the River Thames to regulate river flows will be subject to a discharge permit granted by the Environment Agency and is not expected to have an adverse impact on water quality or ecology, including the ecology of Culham Brake SSSI. The regulated reservoir releases could also provide a benefit to aquatic ecosystems during times of low flow. The assessment of AFF-RTR-WRZ1-4010 and AFF-RTR-WRZ4-4010 through the SEA for Affinity Water's rdWRMP19 are consistent with these conclusions.

The assessment identifies that AFF-RES-WRZ5-0809: Birds Green Reservoir has the potential for impacts on the flows and quality of the River Roding during operation. There are two SSSIs located downstream of the abstraction, Curtismill Green and Roding Valle. Curtismill Green SSSI is broadly designated for neutral grassland and broadleaved, mixed and yew woodland. Roding Valley SSSI is broadly designated for neutral grassland (lowland). Reduced water levels and quality in the River Roding could affect the interest features of the SSSIs but this is uncertain at this stage and further hydrological investigations required.

The assessment recommends that water levels in the Lower Roding/ River Roding are monitored to inform the use of hands-off flow conditions/ restrict abstraction of water at low flows. This will help to maintain suitable water levels to maintain the interest features of the two SSSIs downstream.

Given the delivery dates of the schemes identified above, it is considered that there is sufficient time for further investigation, assessment and consultation to inform the need for and identification of more detailed mitigation measures.

6.3.4.2 Adaptive Future schemes

The assessment identified that two of the additional schemes under the adaptive futures have the potential for a negative effect on a SSSI during construction and these are:

- AFF-CTR-WRZ3-0028: Iver Arkley Transfer Upgrade

- AFF-ASR-WRZ6-0174: Egham ASR

The new pipeline required for AFF-CTR-WRZ3-0028: Iver Arkley Transfer Upgrade; follows existing infrastructure where possible and this takes it in close proximity to a number of SSSIs, including Fray's Farm Meadows SSSI, Ruislip Woods SSSI, Water End Swallow Holes SSSI and Whippendell Wood SSSI and Bricket Wood Common SSSI. There is the potential during construction for disturbance to some of the interest features (see Appendix II, Annex B) as a result of emissions of dust as well as impacts on water quality/ and hydrology depending on the depth of the pipeline. Given the interest features of the SSSIs it is unlikely that noise and light pollution would be a particular issue.

AFF-ASR-WRZ6-0174: Egham ASR includes the delivery of a new pipeline that runs along a section of the A30 that passes within 100m of the Langham Pond SSSI. Interest features include assemblages of breeding birds. There is the potential for disturbance (dust emissions, noise and light) that could affect the interest features (assemblages of breeding birds). There is also the potential for impacts on water quality/ and hydrology depending on the depth of the pipeline and this could have indirect effects on the assemblages of breeding birds.

The impacts identified above as a result of disturbance (dust emissions, noise and light) during construction will be temporary and local. There are standard dust suppression measures that could be introduced in line with the relevant British Standard. Careful design and construction of the pipelines, informed by further geotechnical and hydrogeological investigations, would enable them to be installed at a suitable depth and in a suitable manner (including return of any dewatering volumes immediately back to ground) that water levels and quality at the SSSIs would not be significantly affected. This would need to be developed further during detailed scheme design.

In terms of noise and light disturbance, depending on the noise levels generated during construction (which are unknown at this point) works may need to be timed to avoid the winter (October to March) and avoid impacts on the interest features of the Wrybury No.1 Gravel Pit SSSI and Langham Pond SSSI. This would usually be the preference for construction crews but is a matter to consider further during detailed design.

Taken the mitigation outlined above into account, it is not considered likely that the schemes identified would have a significant negative effect on any SSSIs during construction.

The assessment did not identify the potential for any impacts on SSSIs during operation as a result of the additional schemes that might come forward under the adaptive futures.

6.3.5 Invasive and Non-Native Species (INNS)

Defra, Natural England, Environment Agency (EA) and water companies have identified transfer of raw water as a significant pathway for the spread of Invasive Non-Native Species (INNS). The published position statement on *'Managing the risk of spread of INNS through raw water transfers'* (January 2018) states: *"New schemes that create a hydrological connection between locations not already connected will be required to have mitigation measures which provide effective and total removal of INNS"*.

The SEA has concluded that all schemes that propose new or upgraded infrastructure have the potential to introduce or spread INNS during construction. However, it is considered that standard construction practices should ensure that the potential risk is low. INNS on site should be identified and removed in advance of any construction as per standard construction practice.

During operation, any schemes that would result in the transfer of raw water or lead to increased recreation have the potential to exacerbate the spread of INNS. The rdWRMP19 Supply Constrained Options Report (2019) states that where schemes are abstracting from a neighbouring catchment and transferring the water for storage in another reservoir before discharging to the environment or treatment will need additional works to evaluate the INNS risk.

There are three schemes proposed in the rdWRMP19 and potential adaptive futures with a potential risk for exacerbating the spread of INNS and these are

- AFF-RTR-WRZ1-1066: Grand Union Canal (GUC - Berkhamstead/Hemel Hempstead) (Delivery in 2065) - Abstraction from Grand Union Canal at Hemel Hempstead (Severn).

- AFF-RTR-WRZ1-4020: Grand Union Canal (GUC - Berkhamstead/Hemel Hempstead 100 MI/d)) - Abstraction from Grand Union Canal at Hemel Hempstead (Severn).
- AFF-RES-WRZ4-0832: Brent Reservoir (Delivery in 2034) - Transfer from the River Brent to the Grand Union Canal for treatment at Iwer WTWs.

AFF-NGW-WRZ4-0624: Canal & River Trust and GSK Slough Boreholes may need evaluation for the INNS risk if at detailed design stage there is a preference for the delivery of abstracted water to the Affinity Water network via the canals rather than a pipeline.

Given the delivery dates of these schemes there is sufficient time to undertake a more detailed INNS risk assessment and consider potential mitigation measures with the EA. However, it should be noted that the precise delivery date of AFF-RTR-WRZ1-4020 is not known at this stage as it would sit under one of the possible adaptive futures.

While it is recognised that there are several other raw water transfers considered through the SEA, these are abstracted from existing abstraction points, and on the basis Affinity Water consider their existing operations to pose no risk of transfer of INNS, the risk of importing INNS to the Affinity Water Catchment is considered negligible for these schemes.

6.3.6 Marine Conservation Zones (MCZs)

The SEA did not identify any schemes proposed within the rdWRMP19 or the potential adaptive futures as likely to have impacts on any MCZs. Given the nature (continuation of existing agreements or removal of constraints) and scale of the schemes proposed in WRZ7 they are not likely to have any impacts on the interest features of the Dover to Folkestone or Dover to Deal MCZs. None of the proposed schemes are likely to have any significant impacts on the interest features of the Thames Estuary (Recommended) MCZ based on the findings of the WFD assessment and the SEA for the Thames Water's rdWRMP19.

6.3.7 Environmental Net Gain

Environmental net gain is an approach to development that aims to leave the natural environment in a measurably better state than beforehand. It is identified as a policy principle in the Government's 25 year plan to improve the environment (published January 2018). There are also references to achieving net gains across the three overarching objectives for sustainable development (economic, social and environmental) along with achieving net gain in biodiversity in the updated National Planning Policy Framework (NPPF) published in July 2018 (and previously included in the 2012 NPPF). The Draft national Policy Statement for Water Resources Infrastructure published in November 2018 recognises that water resource infrastructure projects have the potential to deliver significant benefits and enhancements, resulting in environmental net gains.

The SEA incorporates these key policy principles within the SEA Framework and therefore has had regard to these national planning objectives in carrying out the assessment of the rdWRMP19. The assessment identified a number of opportunities for potential benefits as a result of schemes proposed in the rdWRMP19 and under the adaptive futures. This includes potential benefits identified through the WFD assessment for six schemes as well as the potential long-term positive effects for recreation and biodiversity as a result of schemes delivering a new raw water reservoir.

As they deliver their plan going forward, Affinity Water will seek opportunities to embed the principles of net gain across the three overarching objectives for sustainable development (economic, social and environmental) in line with the government's 25 Year Plan and the NPPF. This includes working closely with regulators, planners and stakeholders as they progress to the detailed design stage and detailed consideration of any required environmental mitigation measures.

7. Cumulative Effects of the revised draft WRMP19 with other Plans, Programmes and Projects

7.1 Introduction

This Chapter sets out potential inter-plan cumulative effects arising as a result of the rdWRMP19 interacting with other plans, programmes and projects, including other WRMPs. It also considers four additional schemes that may come forward under one of Affinity Water's adaptive futures.

The approach and method used for the cumulative effects assessment (CEA) of Affinity Water's rdWRMP19 is in line with the regional approach to CEA adopted by Water Resources South East (WRSE) group. A regional approach to CEA was explored by WRSE in response to some short comings in the SEAs of WRMPs produced in 2014 identified by consultees and also with the aim of supporting an improved approach for the next round of WRMPs (2019). The study published in early 2017 and updated in 2018, sets out a systematic procedure for identifying and evaluating the risk of cumulative effects.²⁶

7.2 Other Affinity Water Plans

7.2.1 Affinity Water's Drought Management Plan

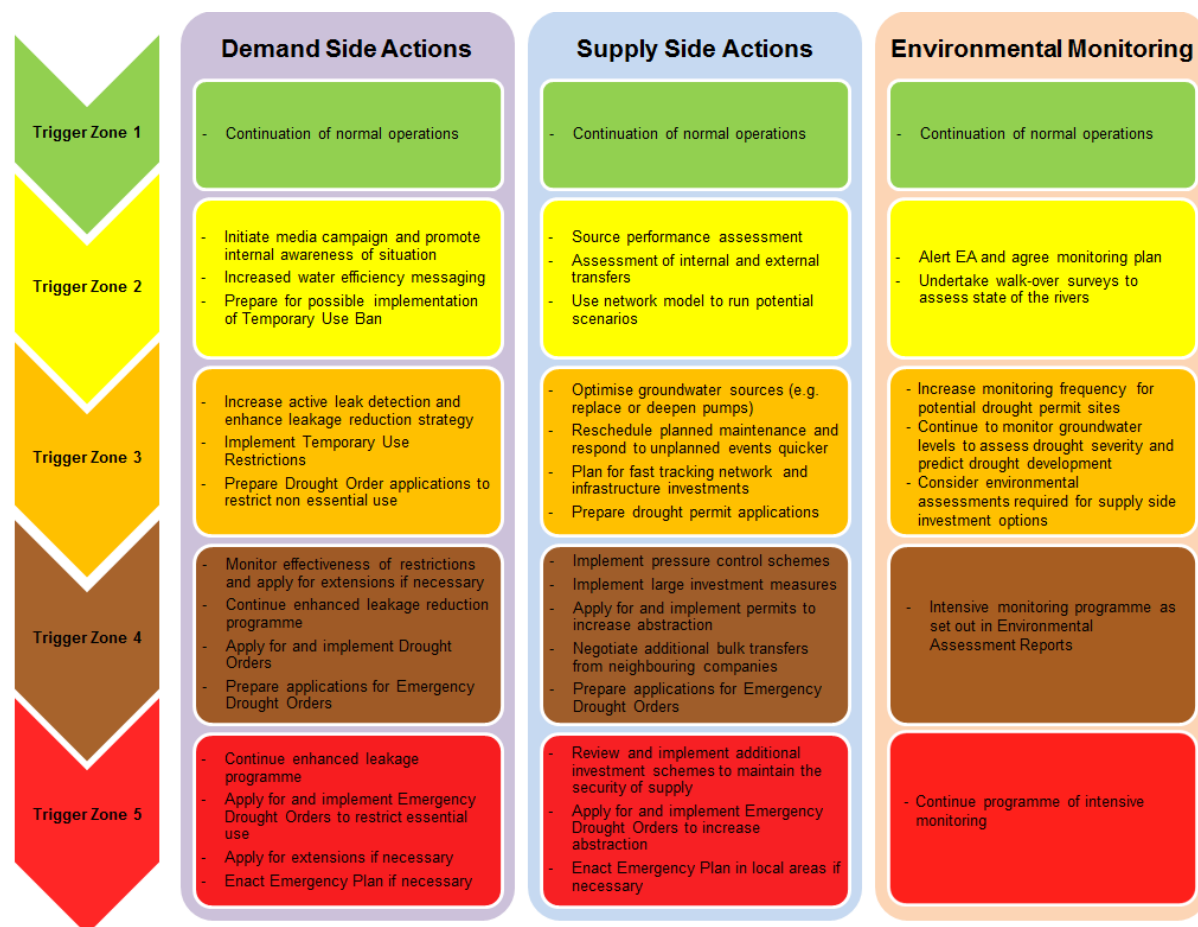
The Affinity Water draft Drought Management Plan (DMP) was published for public consultation from August to October 2017. Taking account of the representations received a revised draft DMP was submitted to the Secretary of State, and in July 2018 Affinity Water were given the go-ahead by Defra to publish the Plan as final, incorporating minor changes to ensure alignment with the WRMP19, as well as lessons learnt from the dry weather situation in 2017/ 2018.

To ensure a consistent approach to drought management, the draft DMP covers all eight WRZs across Affinity Water's three regions. The purpose of the DMP is to demonstrate how Affinity Water plans to monitor and manage future drought related events, reduce the demand for water and mobilise extra resources, whilst minimising recourse to drought orders and permits and ensuring security of supply. It is a tactical plan setting out the policy and steps we would take during a drought.

During a drought, the DMP proposes to manage the supply and demand balance using a two tiered approach, in which actions would be taken to reduce demands on water resources, as well as increasing the water available for use. The actions proposed through the DMP are set out in **Figure 6.1** below.

²⁶ WRSE (2017 updated in 2018) Environmental Information to inform Water Company SEAs - Cumulative Effects Assessment in WRMP SEAs.

Figure 6.1: Summary of the drought management actions



The DMP proposes a range of demand side actions that are non-site specific. It's possible that the enhanced leakage reduction strategy could have some interactions with schemes proposed through the rdWRMP19 but this is uncertain at this stage.

A number of the proposed supply side actions are also non-site specific, such as the optimisation of groundwater sources, so it is difficult to highlight any potential for cumulative effects. All of the drought permit options have been assessed through the SEA process (see **Chapter 4**). It was concluded that none are likely to result in any significant effects against the SEA Framework. The options are essentially groundwater options across a number of Affinity Water WRZs that involve increasing peak (and in the case of prolonged drought, average) abstraction above existing licensed volumes or drought related environmental (river flow or groundwater level) constraints. With that in mind they are most likely to interact with rdWRMP19 schemes through changes to the water levels and quality of surface and groundwater bodies. In this regard, the WFD assessment screened out all the drought permit options as they would be temporary in nature, and have already been assessed through modelling as having only small impacts compared to natural drought impacts.

Overall, it is considered that the potential risk for the rdWRMP19 and the DMP to have cumulative effects are low. Once the location of particular drought actions is known there may need to be some consideration as to how these could interact with ongoing or emerging rdWRMP19 schemes.

7.2.2 Affinity Water's Business Plan

The Business Plan sets out the investment Affinity Water intend to make to maintain and improve essential water and wastewater services, and achieve the targets agreed with Ofwat. The current Business Plan was submitted in September 2018. The rdWRMP19 will make sure that there is enough water to meet demands and therefore help the Business Plan to meet customer expectations.

At this stage, it is considered that the risk of cumulative effects as a result of these plans interacting is low as they will be implemented by Affinity Water.

7.3 Other WRMPs

WRSE carried out a study to identify potential cumulative effects arising as a result of interactions between schemes being proposed through emerging WRMPs within their area.²⁷ The study identified eight schemes proposed within Affinity Water's rdWRMP19 and one scheme within the adaptive futures that could interact with schemes proposed in other WRMPs to have a cumulative effect.

This includes six schemes located within the Southeast Region (WRZ 7 - Dour) which are identified as having the potential to have cumulative effects on the Kent Downs AONB as a result of interactions with options being considered through the emerging WRMP19 for Southern Water (BS_Win, IZT_Sel, and BR_Lug):

- AFF-RNC-WRZ7-0626 (Broome Network Improvement)
- AFF-RTR-WRZ7-0909 (Barham Continuation (After 2019/20))
- AFF-RTR-WRZ7-0301 (Barham Import Increase (of 2Ml/d) to 4Ml/d)
- AFF-EGW-WRZ7-0908 (Tappington South Licence Variation)
- AFF-EGW-WRZ7-0629 (Lye Oak Licence Variation)
- AFF-RTR-WRZ7-0842 (Aldington to Saltwood Import Increase by 3Ml/d)

Two of the schemes AFF-RTR-WRZ7-0909 and AFF-EGW-WRZ7-0908 involve no new infrastructure so will not interact with the other Affinity Water rdWRMP19 schemes or the Southern Water schemes to have cumulative effects on the AONB. A further two schemes AFF-RNC-WRZ7-0626 and AFF-EGW-WRZ7-0908 propose minimal new infrastructure and the risk of cumulative effects on the AONB is therefore low.

AFF-RTR-WRZ7-0301 proposes a small upgrade of the Chalksole Service Reservoir and AFF-RTR-WRZ7-0842 proposes a small upgrade of the Saltwood Reservoir along with new mains and pump station at the interconnection point. Given the scale of the schemes and potential mitigation available, including screening/ planting, it is considered unlikely that there will be any significant cumulative effects with options being proposed through Southern Water's WRMP19 on the AONB. Any schemes that propose new infrastructure should ensure that it is sensitively designed and is in conformity with the Kent Downs AONB Management and Local Plans.

It is noted that the WRSE work identifies that a Southern Water option BS_Win is within 5km of option AFF-RTR-WRZ7-0301 and AFF-RNC-WRZ7-0626 so there is the potential for wider construction related impacts. As previously mentioned, AFF-RNC-WRZ7-0626 involves minimal new infrastructure and has a delivery date of 2066. AFF-RTR-WRZ7-0301 does not propose any significant new infrastructure and has a delivery date of 2057. Taking the scale of infrastructure proposed and the delivery dates it is considered unlikely that there will be any cumulative effects during construction.

The WRSE work identifies that there is the potential for cumulative effects on two water bodies as a result of interactions with schemes being considered in the WRMPs19 for Thames Water and Southern Water.

AFF-RES-WRZ4-0832 (Brent Reservoir) and AFF-RES-WR5-0809 (Birds Green Reservoir) are identified in the WRSE study as having the potential for cumulative effects on the Thames (wider catchment) as a result of interactions with options being considered through the emerging WRMP19 for Thames Water. The WFD assessment for Affinity Water's rdWRMP19 found that AFF-RES-WRZ4-0832 would interact with the Lower Brent surface water body and would have no measurable or significant impact on the surface water body in terms of changes in flow velocity and volume from abstraction or any changes to hydromorphology during operation.

²⁷ WRSE (2017 and updated in 2018) Environmental information to inform Water Company SEAs – Identification of potential for cumulative effects between water companies for WRMP19 SEAs. Prepared by Ricardo.

The WFD assessment found that AFF-RES-WR5-0809 has the potential to result in the deterioration in the status of the Lower and Upper Roding surface water bodies during operation. As a result, there is the potential for cumulative effects on the Thames (wider catchment). The WFD assessment recommends that further assessments and discussions with the EA are required to explore the need for and potential of compensatory flows. It is important to note that the delivery date for this scheme under this programme is 2078; it is therefore considered that there is ample time to undertake further investigations (including a more detailed WFD assessment) and identify specific mitigation measures to reduce the likelihood and significance of any residual cumulative effects.

The other schemes proposed within Affinity Water's rdWRMP19 and identified through the WRSE study as having the potential for a cumulative effect are AFF-EGW-WRZ7-0629 (Lye Oak (LYEO) Licence Variation) and AFF-EGW-WRZ7-0908 (Tappington South (TAPS) Licence Variation) in WRZ 7. The study identified that these two schemes could interact with Southern Water option GWA_Fle (Flemings and Woodnesborough WSW licence variation) to have a cumulative effect on the East Kent Chalk - Stour groundwater body.

The WFD assessment concluded that AFF-EGW-WRZ7-0629 (LYEO Licence Variation) would not pose a significant risk to deterioration and that any impacts would be localised or temporary and not affect the overall status of the groundwater body. The AFF-EGW-WRZ7-0908 scheme involves TAPS, an existing (but disused) groundwater source within an existing licence group. There is a sequence of boreholes connected by an existing raw water main to the treatment works; DENT; TAPN; and RAKN. TAPS is not within this sequence currently and the option is to re-commission the borehole to provide resilience for the licence group (the group output is limited by licence/ treatment works). This scheme was scoped out of the WFD assessment as there would be no overall increase in abstracted volumes. As a result of the findings of the WFD assessment, it is considered that there is a low risk of cumulative effects arising as a result of interactions with Southern Water option GWA_Fle (Flemings and Woodnesborough WSW licence variation) on the East Kent Chalk - Stour groundwater body.

It is recognised that the Thames Water WRMP19 is continuing to evolve and as it does, it will be necessary to further re-visit the cumulative effects as part of the implementation of the WRMP and in subsequent future WRMPs prepared every five years. Despite this, it is considered likely that any changes will not lead to any adverse cumulative effects.

7.4 Other Drought Plans

Consideration was also given to the potential for cumulative effects to arise as a result of interactions with schemes proposed through the Drought Plans of neighbouring water companies. Drought options are temporary in nature, and generally have small impacts compared to the impacts of natural drought conditions.

The assessment of drought options proposed within Affinity Water's Drought Plan (2018) found that that none are likely to result in any significant effects against the SEA Framework (see Chapter 4). As noted earlier in this Chapter a number of the proposed supply side actions are non-site specific, such as the optimisation of groundwater sources, so it is difficult to highlight any potential for cumulative effects. The assessment concluded that the risk for the rdWRMP19 (including additional schemes under the adaptive futures) and the draft DMP to have cumulative effects is low.

It is also considered that the potential for the rdWRMP19 (including additional schemes under the adaptive futures) and other Drought Plan to interact and have negative cumulative effects is low. The demand management measures set out in the Drought Plan are likely to have a positive cumulative effect along with the demand management measures proposed through the rdWRMP19 - reducing the pressure on water resources during periods of prolonged dry weather when river flows and groundwater levels are well below normal.

The rdWRMP19 and Drought Plans will help to increase the resilience of the Affinity Water Supply system to withstand a severe drought with positive cumulative effects with those neighbouring water companies that are reliant on bulk water supply exports from Affinity Water during drought.

The cumulative effects assessments will need to be updated over time to reflect any changes to the Drought Plans.

7.5 Other plans and programmes

Other plans and programmes have already been considered to a certain extent during the scoping stage as part of the review of other plans and programmes (see **Chapter 3** and **Appendix II**). The UKWIR SEA guidance states that once preferred options have been identified through the WRMP process, specific potential impacts with other plans and programmes should be identified, particularly in the context of spatial and temporal proximity.

7.5.1 River Basin Management Plans

The Water Framework Directive (WFD) calls for management plans to be delivered for each river basin district (RBD). A RBD covers an entire river system, including river, lake, groundwater, estuarine and coastal water bodies. In England the Environment Agency is the competent authority for the WFD and it published the first river basin management plans (RBMPs) in December 2009. The 2009 plans outlined the measures needed to bring more waters to good status by 2015 and what needed to be investigated to test whether all waters could justifiably achieve this aim by 2021 or 2027.

The RBMPs, including the objectives and measures they contain, must be reviewed and updated every 6 years. The Environment Agency published updated RBMPs in 2015.

Affinity Water's central supply area falls within the Thames RBD, while the southeast supply area falls within the South East RBD and the east supply area falls within the Anglian RBD. The Thames, South East and Anglian RBMPs set out the current state of the environment as well as a range of measures to achieve environmental objectives in line with the WFD.

The key link between the rdWRMP19 and the RBMPs in terms of interactions and potential for cumulative effects relate to the achievement of environmental objectives in line with the WFD. A WFD assessment has been carried out for the rdWRMP19. All of the schemes proposed within the rdWRMP19 were assessed to identify the potential for schemes to (i) result in deterioration of water body status and (ii) prevent future target status.

The WFD assessment for the rdWRMP19 identified six schemes that have the potential for a risk of deterioration in status or potential, under Article 4.7 of the WFD. Six schemes were identified that may provide a potential improvement to status/ potential or may allow good status/ potential to be achieved. The options are identified in the table below.

Table 7.1: WFD assessment findings for rdWRMP19

rdWRMP19 scheme	Potential adverse impact	Potential benefit
AFF-NGW-WRZ3-1068: Runley Wood (AMP7 LGS Borehole) 2025	Yes	
AFF-NGW-WRZ3-1053: Kings Walden 2030	Yes	
AFF-RES-WRZ4-0832: Brent Reservoir 2034	Yes	Yes
AFF-RES-WRZ5-0809: Birds Green Reservoir 2078	Yes	
AFF-RTR-WRZ1-1066: Grand Union Canal (Berkhamstead/ Hemel Hempstead) 2065	Yes	Yes
AFF-RTR-WRZ1-4020: Grand Union Canal (Berkhamstead/ Hemel Hempstead) 2065	Yes	Yes
AFF-RTR-WRZ1-4010: Abingdon Reservoir to Harefield Transfer (50MI)		Yes
AFF-RTR-WRZ4-4011: Abingdon to Iver 2 (50MI/d)		Yes

The potential risks of deterioration in status or potential are expected to be mitigated by appropriate design and management of the options. For example, measures can be taken to minimise the risk of invasive species for surface water schemes at the point of abstraction and transfer; groundwater abstraction options will be based on hydrogeological investigations to identify a sustainable yield; and licensing conditions will be developed in consultation with the Environment Agency.

Affinity Water's proposed strategy is to manage risks through a robust adaptive approach that includes, if necessary, reducing abstraction from schemes, or not developing them at all. The remaining supply deficit will be addressed by bringing forward implementation of strategic solutions e.g. based on flow augmentation support from a South East Strategic Reservoir scheme.

Two options in the rdWRMP19 have the potential for cumulative effects when the streams combine in a downstream water body. These options are Runley Wood (AMP7 LGS Borehole) and Kings Walden, where there is the potential to impact baseflow to the rivers Flit and Henlow Brook respectively. The WFD assessment found that cumulative impacts are not anticipated to lead to a deterioration of status.

Other Protected Areas have been identified for two options, Runley Wood (AMP7 LGS Borehole) and Kings Walden, where Nitrate Vulnerable Zones are present in the potentially affected groundwater body. However, these options are not considered to significantly affect the designated areas.

7.5.2 Environment Agency Regional Action Plans for the South East and Anglian Regions

In March 2009, the Environment Agency launched the national water resources strategy for England and Wales, Water for people and the environment.²⁸ It set out how water resources should be managed up to the year 2050 so that there will be enough water for people and the environment. Each region within the Environment Agency developed a regional action plan (RAP). The plans explain what they will do to achieve the aims of the national strategy and deliver benefits for people and the environment.

Affinity Water's supply area falls within the RAP for the South East region which was published in 2012,²⁹ and the RAP for the Anglian region which was published in 2009.³⁰ There are overlaps / links between the RAP and other plans considered through this cumulative effects assessment. The national water resources strategy's aims include securing a better environment, which complement RBMPs. While the water resources strategies and the WFD have some common elements relating to achieving sustainable catchments, the regional action plans ensure a coherence to the suite of actions relating to water quantity.

In addition, some of the actions in the RAPs will be delivered by implementing the WRMPs: for example, actions on metering and tariff developments, leakage reduction and achieving the best public water supply solutions. It is also important to note that water company business plans will be key to delivering a number of actions in the RAPs including protecting critical infrastructure from flood events, delivering the schemes in the National Environment Programme (NEP) and achieving reductions in greenhouse gas emissions.

The RAP for the South East region identifies five priorities:

- Protecting our water environment
- Driving water efficiency and ensuring people understand the value of water
- Achieving Water Framework Directive objectives
- Sustainable planning of future water resources
- Assessing the impact of climate change on water resources in the South East

The RAP for the Anglian region identifies four priorities:

- Protecting the environment
- Driving water efficiency
- Ensuring resilience of water resources
- Sharing and development of water resources

²⁸ Environment Agency (2009) Water for people and the environment: Water Resources Strategy for England and Wales.

²⁹ Environment Agency (2012) Water Resources Strategy Regional Strategy Actions for South East Region.

³⁰ Environment Agency (2009) Water Resources Strategy Regional Action Plan for Anglian Region.

The actions proposed to achieve the priorities are predominantly high level and non-site specific. Overall, they are likely to have a cumulative positive effect alongside the rdWRMP19 by helping to ensure the needs of the population in terms of water supply are met without adversely affecting the water and wider environment. It is unlikely that there will be any cumulative negative effects arising as a result of interactions between the RAPs and the rdWRMP19.

7.5.3 Abstraction Licensing Strategies

The Environment Agency is responsible for managing water resources in England and controls how much water is taken through an environmental permitting approach involving abstraction licences. It uses the abstraction licensing strategies to regulate existing licences and grant new ones.

The Environment Agency has been closely involved in the development and refinement of schemes proposed through the rdWRMP19. The licensing/permitting system will allow for the implementation of schemes proposed within the rdWRMP19 that seek to amend or require new licences for abstraction. Requests from other parties to amend or secure a new licence will need to pass through the permitting system where the potential for cumulative effects will be considered by the Environment Agency, whose approach is to ensure that RBMP objectives for water resources activities are met and that deterioration within catchments is avoided.

7.5.4 Catchment Flood Management Plans and Shoreline Management Plans

Catchment flood management plans (CFMPs) consider all types of inland flooding, from rivers, groundwater, surface water and tidal flooding. Shoreline management plans consider flooding from the sea. The rdWRMP19 proposes schemes in areas that fall within the North Essex, Thames, Stour and Rother CFMPs. No schemes are proposed through the rdWRMP19 within any current Shoreline Management Plan areas.

The CFMPs set out a number of policy options, identifying sub-areas where further actions could be taken to reduce flood risk. The most likely area for interactions to arise is during construction of new infrastructure for schemes proposed through the rdWRMP19. The maintenance of and/ or construction of flood defences coming forward during a similar timeframe interact with proposed schemes with the potential for short term temporary cumulative effects in the local area that relate to traffic disruption, disruption to public rights of way, noise, disturbance and nuisance effects. However, this is dependent on the precise location of proposed works and delivery times. Ongoing and effective communication between Affinity Water and the Environment Agency should ensure that any potential negative cumulative effects are avoided or appropriate mitigation is provided.

7.5.5 Land use and development plans

There are a range of different land use and development plans (either adopted or emerging) within and surrounding Affinity Water's supply area. These include but are not limited to:

- **The London Plan:** the Mayor's Spatial Development Strategy, providing the 33 London boroughs with an overarching framework for their Local Plans, assisting them to tackle strategic as well as local issues effectively. It ensures, for example, that boroughs identify enough land to meet local as well as strategic housing needs, and provides guidance to common challenges like climate change and air quality.³¹
- **Local Plans and Neighbourhood Plans:** set out a vision and a framework for the future development of an area, addressing needs and opportunities in relation to housing, the economy, community facilities and infrastructure - as well as a basis for safeguarding the environment, adapting to climate change and securing good design.
- **Local Transport Plans:** set out the transport challenges for an area and the strategy to address them over the next 15-20 years.
- **Waste and Minerals Plans:** seek to ensure that the waste and minerals needs for an area are met as well as sets out the framework and policies for future minerals / waste planning applications.

³¹ <https://www.london.gov.uk/what-we-do/planning/london-plan>

In general these plans seek to provide sufficient housing, employment and infrastructure to meet the needs of a growing population. They also set the framework/ policies for determining various planning applications that come forward in the future. The forecasted population growth considered through these plans has also informed and been factored into the development of the rdWRMP19. The rdWRMP19 is seeking to ensure that there is sufficient water supply available to meet the growing demands of an increasing population in the future. As a result, it is considered that there will not be any cumulative effects during operation of the schemes proposed through the rdWRMP19.

There is the potential for interactions in the short term during the construction stage, in particular for schemes that propose long stretches of new mains. Infrastructure growth coming forward during a similar timeframe has the potential for short term temporary cumulative effects in the local area that relate to traffic disruption, disruption to public rights of way, noise, disturbance and nuisance effects.

The key to avoiding and minimising the potential for cumulative negative effects during construction is to have ongoing and effective communication between the relevant authorities' (local planning, transport, minerals and waste authorities) and key stakeholders (Environment Agency, Historic England and Natural England). Local collaboration should be encouraged along with more transparent decision-making when both planning and delivering activities to deliver infrastructure.

It is noted that the adopted Vale of White Horse Local Plan Part 1 (2016) includes some allocations that are adjacent or close to the safeguarded area for the South East Strategic Reservoir. Furthermore there are also three Neighbourhood Plan Areas that fall within or are adjacent to the safeguarded area. The Drayton Neighbourhood Plan was made in 2015 and the East Hanney and Steventon Neighbourhood Plans are currently being prepared. Development proposed through these plans could interact with the South East Strategic Reservoir, in particular during construction, to increase traffic on the surrounding road network and disturbance to local communities.

On-going communication between the Vale of White District Council, Thames Water and other key stakeholders should ensure that there are no significant negative cumulative impacts arising during the construction of the South East Strategic Reservoir. This includes agreeing the phasing of development coming forward through the various plans.

7.5.6 Major projects

There are a number of major infrastructure projects going on or that are proposed within the region. These include:

- **High Speed Rail 2 (HS2)** - Phase one (London to West Midlands) passes through WRZs 4 and 1 and crosses over new mains proposed under AFF-RTR-WRZ1-4010 (Abingdon Reservoir to Harefield Transfer (50MI)), AFF-RES-WRZ4-0832 (Brent Reservoir) and adaptive future scheme AFF-CTR-WRZ3-0028. The rdWRMP19 schemes will not be delivered until 2053 and 2034 respectively by which point HS2 Phase one should be completed; therefore, there will not be any cumulative effects. Whilst a delivery date for the adaptive futures scheme is unknown at this stage, HS2 Phase one is expected to be complete by late 2026 and as such, it is unlikely that there will be any cumulative effects.
- **Cross Rail** - permanent track installation of the Elizabeth Line, which passes through Affinity Water's supply area, was completed in September 2017. The Cross Rail 2 route ends just within WRZ 6 at Shepperton, there are unlikely to be any cumulative effects given the distance of proposed schemes within the rdWRMP19;
- **Heathrow Rail Link** - new rail tunnel to link the Great Western Mainline to London Heathrow Terminal 5. The proposed route crosses new mains to be delivered under AFF-CTR-WRZ4-4001 (Egham to Iver) and AFF-RTR-WRZ4-4011 (Abingdon to Iver 2 (50MI/d)). The rail link is due to be completed by 2024; however, works may overlap with scheme AFF-CTR-WRZ4-4001 which is due to be delivered in 2022. It is considered that standard construction practices and effective communication with key parties will ensure that the risk of significant cumulative effects is low.
- **Heathrow Airport expansion** - plans for a third runway have been proposed but this is unlikely to interact with any of the schemes proposed through the rdWRMP19 to the airport.

- **Highways England improvements** - there are various proposed and ongoing improvements to the strategic road network, which includes junction improvements along M25. None of these are likely to have any cumulative effects with the rdWRMP19.

There are unlikely to be any cumulative effects arising between any of the above projects and the rdWRMP19 schemes or the additional schemes under the adaptive futures during the operational phase. There is the potential for cumulative effects due to overlapping construction activities in terms of noise, traffic and disruption. However, this is unlikely due to the delivery dates of schemes proposed through the rdWRMP19 as well as mitigation available at the project level.

It is recognised that a small proportion of the safeguarded area for the South East Strategic Reservoir also falls within an area safeguarded for flood alleviation within the adopted Vale of White Horse Local Plan. The Environment Agency is working together with the Vale of White Horse District Council, Oxfordshire County Council and the Thames Regional Flood and Coastal Committee to find ways to reduce flooding in Abingdon. The EA are in the early stages of investigating an option to put a flood storage area at Abingdon Common and this is referred to as the **Abingdon Flood Alleviation Scheme**. There is close and on-going co-operation between the EA, Vale of White Horse District Council, Thames Water and other key stakeholders to ensure that the impacts of the South East Strategic Reservoir are minimised and that any existing issues relating to flood risk are not exacerbated.

7.6 Summary of cumulative effects assessment

7.6.1 rdWRMP19 schemes

Water Resources for the South East (WRSE) carried out a study to identify potential cumulative effects arising as a result of interactions between schemes being proposed through emerging dWRMPs (2019) within their area. The study identified eight schemes proposed within Affinity Water's rdWRMP19 that could interact with schemes proposed in other WRMPs to have a cumulative effect. These are:

- AFF-RES-WRZ4-0832 (BREN Reservoir) - identified as having the potential to have cumulative effects on the Thames surface water catchment as a result of interactions with options being considered through the emerging WRMPs for Thames Water and South East Water.
- AFF-RES-WR5-0809 (Birds Green Reservoir) has the potential to result in the deterioration in the status of the Lower and Upper Roding surface water bodies during operation as a result of interactions with options being considered through the emerging WRMP19 for Thames Water. As a result, there is the potential for cumulative effects on the Thames (wider catchment).
- AFF-EGW-WRZ7-0629 (LYEO Licence Variation) and AFF-EGW-WRZ7-0908 (TAPS) - identified as having the potential to interact with Southern Water option GWA_Fle (Flemings and Woodnesborough WSW licence variation) to have a cumulative effect on the East Kent Chalk - Stour groundwater body.
- Five schemes located within the Southeast Region (WRZ 7 - Dour) which are identified as having the potential to have cumulative effects on the Kent Downs AONB as a result of interactions with options being considered through the emerging WRMP19 for Southern Water (BS_Win, IZT_Sel, and BR_Lug)

Affinity Water's WFD assessment found that AFF-EGW-WRZ7-0629 (LYEO Licence Variation) and AFF-EGW-WRZ7-0908 (TAPS) do not pose a significant risk to deterioration and that any impacts would be minimal, localised or temporary and not affect the overall status of the water bodies. AFF-RES-WRZ4-0832 (BREN Reservoir) was found through the WFD assessment to have the potential for minor, local and temporary impacts during construction with benefits during operation. It also identified a risk in terms of the potential movement of INNS as it involves the movement of water between a reservoir and surface water body.

The WFD assessment found that AFF-RES-WR5-0809 has the potential to result in the deterioration in the status of the Lower and Upper Roding surface water bodies during operation. As a result, there is the potential for cumulative effects on the Thames (wider catchment). The WFD assessment recommends that further assessments and discussions with the EA are required. It is important to

note that the delivery date for this scheme is 2078; it is therefore considered that there is ample time to undertake further investigations (including a more detailed WFD assessment) and identify specific mitigation measures to reduce the likelihood and significance of any residual cumulative effects.

In line with recommendations within the WRSE study, the SEA suggests that further discussions between Affinity Water and the relevant neighbouring water companies should continue to take place as each WRMP is finalised and moves to implementation. Once proposed schemes and their delivery dates are confirmed through the next stages of delivery of the WRMPs, it will allow for a more informed consideration of potential interactions and the likelihood for cumulative effects to arise.

The potential for interactions with other plans and programmes, including other Affinity Water plans, were explored and it was found that there is a low risk for cumulative effects. The potential for interactions predominantly arises through the delivery of new infrastructure that is proposed through other plans during the construction phase of rdWRMP19 schemes. In the majority of cases the delivery dates for the schemes and infrastructure mean that cumulative effects will be avoided.

The key to avoiding and minimising the potential for cumulative negative effects during construction is to have ongoing and effective communication between the relevant authorities' (local planning, transport, minerals and waste authorities) and key stakeholders (Environment Agency, Historic England and Natural England). Local collaboration should be encouraged along with more transparent decision-making when both planning and delivering activities to deliver infrastructure.

7.6.2 Adaptive future schemes

The WRSE study identified one scheme proposed under the Adaptive Futures that could interact with schemes proposed in other WRMPs to have a cumulative effect. AFF-RTR-WRZ7-0842 (Aldington to Saltwood Import Increase by 3Mld) falls within WRZ7 and is identified as having the potential to have cumulative effects on the Kent Downs AONB as a result of interactions with options being considered through the emerging WRMP19 for Southern Water (BS_Win, IZT_Sel, and BR_Lug) as well as five other schemes proposed in the rdWRMP19 within WRZ7.

Given the scale of the schemes and potential mitigation available, including screening/ planting, it is considered unlikely that there will be any significant cumulative effects with options being proposed through Southern Water's WRMP19 on the AONB. Any schemes that propose new infrastructure should ensure that it is sensitively designed and is in conformity with the Kent Downs AONB Management and Local Plans.

The potential for interactions with other plans and programmes, including other Affinity Water plans, were explored and it was found that there is a low risk for cumulative effects with the additional adaptive future schemes.

8. Mitigation and areas for further investigation

8.1 Introduction

This Chapter presents the mitigation identified through the SEA for the rdWRMP19 and adaptive futures as well as areas for further investigation/ assessment. It is important to remember that further studies and environmental assessments will be carried out to inform the detailed design stage for schemes. Further assessments will also be required at the project level once detailed planning and design has been carried out. These will be able to set out detailed mitigation measures to avoid and/ or reduce the significance of any residual negative effects as well as enhance the potential for positive effects.

8.2 Mitigation measures and areas for further investigation

The assessment identifies a range of mitigation measures that are relevant to the majority of schemes proposed within the rdWRM19. These include the following:

- The phased delivery of new infrastructure as well as the creation of temporary road diversions and haul roads at the start of the construction, agreement of HGV routes and working hours.
- Minimise waste during construction and reuse materials and source them locally where possible.
- Use of best practice methods including the development and implementation of Construction Environmental Management Plans should be considered.
- The temporary diversion of public rights of way where necessary.
- In terms of the landscape and historic environment schemes should retain hedgerows, trees, fields, walls and soil/land should be re-instated following construction wherever possible. Use construction methods and barriers/ hoardings that are sympathetic to the aesthetics of the surrounding landscape and deliver screening/ planting. Any new visible should be sensitively designed.
- Methods should be adopted to minimise the impact of localised flooding during construction, including dewatering and treatment of the groundwater prior to discharge (in line with discharge permit conditions) where necessary.
- Appropriate pipe-laying techniques to minimise impacts on the environment and water bodies.
- Seek to avoid the loss of important habitats, including priority habitats, at the detailed design stage by re-routing pipelines. Appropriate buffers should also be provided between new infrastructure and important habitats to minimise impacts during construction and operation.

Specific mitigation measures for schemes are identified where necessary in **Appendix V** and in **Chapter 6**. **Table 8.1** below sets out some of the key areas for further investigation/ assessment that need to be addressed.

Table 8.1: Proposed mitigation and areas for further investigation

Scheme	Potential impact	Mitigation / further investigation
AFF-RES-WRZ4-0832 (BREN Reservoir)	The scheme proposes the release of water from the Brent Reservoir, which is designated as a SSSI. There is uncertainty at this stage with regard to the extent and frequency of drawdown in the reservoir as a result of this proposed scheme.	There ongoing discussions between Affinity Water and the Rivers and Canals Trust who operate the reservoir. More detailed hydrological investigations need to be carried out in order to determine the extent and frequency of drawdown as a result of this scheme and how the hydrological conditions affect the wetland habitats and birds they support. The assessment proposes that the water levels in the Brent Reservoir are monitored to inform the need and use of hands-off flow conditions to restrict the release of water when levels are low. Furthermore, the release of water could also be restricted during the breeding/ nesting seasons (broadly March to July). The Challenging Adaptive Future explored the potential for reducing the yield of this scheme by 50% to mitigate the extent and frequency of any drawdown.
AFF-NGW-WRZ4-0624 (Canal & River Trust and SGSK Boreholes)	The WFD assessment found that the cessation of discharge could cause deterioration in status of the Salthill Stream surface water body.	The discharge volume needs to be quantified and further WFD assessment undertaken to determine if could impact the status of the Salthill Stream surface water body. Given that the delivery date of this scheme is 2039 there is sufficient time to investigate this issue further. Mitigation could include the use of hands-off flow conditions when water levels/ flows are low. The Challenging Adaptive Future explored the potential for reducing the yield of this scheme by 50% to mitigate the extent and frequency of any drawdown.
AFF-RES-WRZ5-0809 : Birds Green Reservoir	The WFD assessment found that there the scheme could reduce water flow and levels as well as quality in the Lower Roding (Cripsey Brook to Loughton) Surface Water Body	The WFD assessment recommends that further assessments and discussions with the EA are required to explore the need for and potential of compensatory flows. Given that the delivery date of this scheme is 2078 there is sufficient time to investigate this issue further. Mitigation could include the use of hands-off flow conditions when water levels/ flows are low. The Challenging Adaptive Future explored the potential for reducing the yield of this scheme by 50% to mitigate the extent and frequency of any drawdown.
AFF-NGW-WRZ3-1053 : Kings Walden AFF-NGW-WRZ3-1068 : Runley Wood (AMP7 LGS Borehole)	The WFD assessment identifies that the two schemes have the potential for impacts on surface water (River Ivel) if abstraction from confined Lower Greensand affects Woburn Sands groundwater body input to surface water. Abstraction may impact Restoring Sustainable Abstraction (RSA) programme	Further investigations should be carried out, including a more detailed WFD assessment. There should also be discussions with the Environment Agency to ensure compliance with the WFD. Mitigation could include the use of hands-off flow conditions when water levels/ flows are low. The Challenging Adaptive Future explored the potential for reducing the yield of this scheme by 50% to mitigate the extent and frequency of any drawdown.
AFF-RTR-WRZ1-4010 : Abingdon Reservoir to Harefield Transfer (50MI) AFF-RTR-WRZ4-4011 : Abingdon to Iwer 2 (50MI/d)	The HRA identified that there is the potential for a likely significant effect on the South West London Waterbodies SPA/ Ramsar site	The HRA concluded that there would not be any adverse effects on the integrity of any European sites if the following recommendations are included in the rdWRMP19: It is recommended that the inclusion of this option within the WRMP is accompanied by an explicit commitment to ensure that the programming and construction processes for this scheme take into account the proximity of the SPA and that construction works on the short section of pipeline adjacent to the SPA are programmed to avoid the winter (October to March) period entirely or are accompanied by an impact

Scheme	Potential impact	Mitigation / further investigation
		<p>assessment including noise modelling and mitigation in line with British Standard BS5228 as required in order to ensure that noise levels can be maintained at an acceptable level.</p> <p>As a precaution, it is recommended that the inclusion of this option within the WRMP is accompanied by an explicit commitment to carefully design the pipeline, informed by geotechnical and hydrogeological investigations as necessary, to ensure that there is no requirement for dewatering of the excavation, or that any dewatering that is required is returned immediately to ground. These would enable the pipeline to be installed at a suitable depth and in a suitable manner that groundwater continuity to the gravel pits would not be disrupted and groundwater quality would be protected.</p>
<p>AFF-RTR-WRZ1-1066: Grand Union Canal (GUC - Berkhamstead/ Hemel Hempstead)</p> <p>AFF-RTR-WRZ1-4020: Grand Union Canal (GUC - Berkhamstead/ Hemel Hempstead 100 MI/d)</p>	<p>The WFD assessment identifies that the abstraction has the potential for impacts during operation on water levels/ flows and quality in the Tame (R Rea to R Blythe and from R Blythe to River Anker) surface water body.</p>	<p>Further investigations should be carried out, including a more detailed WFD assessment. There should also be discussions with the Environment Agency to ensure compliance with the WFD. Mitigation could include the use of hands-off flow conditions when water levels/ flows are low. It is anticipated that these schemes would be delivered later in the planning horizon, i.e. after AMP8, so there is sufficient time to undertake further investigations.</p>

9. Next steps and monitoring

9.1 Introduction

The Chapter sets out the next steps for the WRMP19 and SEA as well as the measures envisaged for monitoring.

9.2 Consulting on and finalising the WRMP19

The rdWRMP19 and revised Environmental Report will be sent to the Department for Environment, Food and Rural Affairs (Defra) for review and published for wider consultation. Any comments received will be taken into account when finalising the WRMP19.

Once the final WRMP19 is approved by the Secretary of State, published and adopted, Affinity Water will publish a SEA Post Adoption Statement, describing how the SEA and the responses to consultation have been taken into account during the preparation of the WRMP19. This statement must include:

- How environmental considerations have been integrated into the WRMP;
- How the Environmental Report has been taken into account;
- Any changes to or deletions from the WRMP in response to the information in the Environmental Report;
- How consultations responses have been taken into account;
- Reasons for choosing the WRMP as adopted, and why other reasonable alternatives were rejected; and
- Monitoring measures.

9.3 Monitoring

At the current time, there is a need only to present 'measures envisaged concerning monitoring'. The SEA Regulations expect monitoring and mitigation to be linked, and that the focus should be on any significant negative effects identified through the assessment. The UKWIR SEA guidance recommends that existing arrangements for monitoring should be used where possible to avoid duplication of effort.

Based on the findings of the SEA at this stage, the following monitoring measures are proposed:

Table 9.1: Proposed monitoring measures

SEA topic	Potential indicator	rdWRMP19 and adaptive future schemes
Water	Groundwater levels/ flows/ quality and WFD status for the Lower Greensand (already monitored by the Environment Agency);	<ul style="list-style-type: none"> AFF-NGW-WRZ4-0624 : Canal and Rivers Trust and GSK Slough Boreholes AFF-NGW-WRZ3-1053 : Kings Walden AFF-NGW-WRZ3-1068 : Runley Wood (AMP7 LGS Borehole)
	Surface water levels/ flows/ quality and WFD status for the Salthill stream (already monitored by the Environment Agency);	<ul style="list-style-type: none"> AFF-NGW-WRZ4-0624 : Canal and Rivers Trust and GSK Slough Boreholes
	Surface water levels/ flows/ quality and WFD status for the Lower Roding (Crispey Brook to Loughton) (already monitored by the Environment Agency);	<ul style="list-style-type: none"> AFF-RES-WRZ5-0809 : Birds Green Reservoir
	Surface water levels/ flows/ quality and WFD status for the River Ivel (already monitored by the Environment Agency);	<ul style="list-style-type: none"> AFF-NGW-WRZ3-1053 : Kings Walden
	Groundwater levels/ flows/ quality and WFD status for the Woburn Sands (already monitored by the Environment Agency);	<ul style="list-style-type: none"> AFF-NGW-WRZ3-1053 : Kings Walden AFF-NGW-WRZ3-1068 : Runley Wood (AMP7 LGS Borehole)
	Surface water levels/ flows/ quality and WFD status for the River Flit (already monitored by the Environment Agency);	<ul style="list-style-type: none"> AFF-NGW-WRZ3-1068 : Runley Wood (AMP7 LGS Borehole)
	Groundwater levels/ flows/ quality and WFD status for the East Kent Chalk Stour (already monitored by the Environment Agency);	<ul style="list-style-type: none"> AFF-EGW-WRZ7-0629: Lye Oak Licence Variation
	Brent Reservoir water levels (already monitored by the Canal & River Trust);	<ul style="list-style-type: none"> AFF-RES-WRZ4-0832 : Brent Reservoir
	Surface water levels/ flows/ quality and WFD status for the Tame (R Rea to R Blythe and from R Blythe to River Anker) surface water body (already monitored by the Environment Agency);	<ul style="list-style-type: none"> AFF-RTR-WRZ1-1066 : Grand Union Canal (GUC - Berkhamstead/Hemel Hempstead) AFF-RTR-WRZ1-4020 : Grand Union Canal (GUC - Berkhamstead/Hemel Hempstead 100 MI/d)
Biodiversity	Brent Reservoir SSSI condition status (already monitored by Natural England);	<ul style="list-style-type: none"> AFF-RES-WRZ4-0832 : Brent Reservoir
	South West London Waterbodies Ramsar and SPA as well as the Wraysbury No.1 Gravel Pit SSSI condition status (already monitored by Natural England).	<ul style="list-style-type: none"> AFF-RTR-WRZ1-4010 : Abingdon Reservoir to Harefield Transfer (50MI) AFF-RTR-WRZ4-4011 : Abingdon to Iver 2 (50MI/d)
	Roding Valley SSSI condition status (already monitored by Natural England);	<ul style="list-style-type: none"> AFF-RES-WRZ5-0809 : Birds Green Reservoir
	Lydden and Swingfield Woods SSSI	<ul style="list-style-type: none"> AFF-EGW-WRZ7-0629: Lye Oak Licence Variation
Landscape	Number of objections from AONB management boards in relation to new schemes.	<ul style="list-style-type: none"> AFF-RTR-WRZ1-4010 : Abingdon Reservoir to Harefield Transfer (50MI) AFF-RTR-WRZ4-4011 : Abingdon to Iver 2 (50MI/d) AFF-RTR-WRZ1-1066 : Grand Union Canal (GUC - Berkhamstead/Hemel Hempstead) AFF-RTR-WRZ1-4020 : Grand Union Canal (GUC - Berkhamstead/Hemel Hempstead 100 MI/d) TR-WRZ3-1099 : Boxted to Chaul End AFF-NGW-WRZ3-1068 : Runley Wood (AMP7 LGS Borehole)

SEA topic	Potential indicator	rdWRMP19 and adaptive future schemes
		<ul style="list-style-type: none"> All schemes proposing new visible infrastructure within WRZ 7.
Historic Environment	Number of objections from Historic England in relation to new schemes.	<ul style="list-style-type: none"> AFF-RTR-WRZ1-4010 : Abingdon Reservoir to Harefield Transfer (50MI) AFF-RTR-WRZ4-4011 : Abingdon to Iver 2 (50MI/d) General for all schemes that propose new visible infrastructure.
	Condition of buried archaeology would be monitored during construction works as part of a Watching Brief and associated response measures as set out in the Environmental Management Plan agreed as part of the planning permission process.	<ul style="list-style-type: none"> AFF-RTR-WRZ1-4010 : Abingdon Reservoir to Harefield Transfer (50MI) AFF-RTR-WRZ4-4011 : Abingdon to Iver 2 (50MI/d) General for all schemes that propose new visible infrastructure.
	Reference to Historic England's monitoring of heritage assets such as Listed Buildings and Scheduled Monuments, Registered Battlefields, Registered Parks and Gardens, in particular the 'Heritage at risk' register.	<ul style="list-style-type: none"> AFF-RTR-WRZ1-4010 : Abingdon Reservoir to Harefield Transfer (50MI) AFF-RTR-WRZ4-4011 : Abingdon to Iver 2 (50MI/d) General for all schemes that propose new visible infrastructure.

Monitoring measures will be given further consideration and set out within the SEA Post Adoption Statement.

Appendices (available separately)

Appendix I: Regulatory requirements

Appendix II: Scoping information

Appendix III: Statutory consultee responses

Appendix IV: SEA screening criteria

Appendix V: SEA of constrained options (supply, demand and drought)

Appendix VI: Cumulative Effects Assessment

