Technical Note

Project:	WRSE investment model option data inputs
Subject:	Methodology for option data preparation
Author:	Ryan Davies
Date:	21/08/2023

Document history

Revision	Purpose description	Originated	Checked	Reviewed	Authorised	Date
Rev 1.0	Draft for client review	RD	LH	JW	RS	17/06/2021
Rev 2.0	Draft for client comment	LH	RD	JW	RS	21/07/2021
Rev 2.1	Draft for client comment	LH	RD	JW	RS	02/08/2021
Rev 3.0	Final	HH	MZ	MS	SW	21/08/2023

Client signoff

Client	SES Water
Project	WRSE investment model option data inputs
Project No.	5197934

1. Introduction

SES Water requested Atkins to complete their Water Resources in the South East (WRSE) options data template for the WRSE investment model. To complete this task Atkins were asked to:

- Conduct a review of SES Water's Water Resources Management Plan 2019 (WRMP19) unconstrained options and screening methodology in light of WRSE Options Appraisal technical note on option screening[1]recommendations to generate a register of unconstrained options and reasons for rejection.
    - In addition to this we (Atkins) also reviewed the unconstrained options from WRMP14.
- Update WRMP19 option yields and other information (in light of a recent groundwater DO reassessment and an update to the water resource system modelling of Bough Beech reservoir, both completed by Atkins).
- Update 19 WRMP19 feasible option costs, including:
    - updating costs to present day (2020/21 cost base);
    - applying the WRSE Optimism Bias methodology[2]; and,
    - applying the WRSE Financing Costs methodology[2].

This technical memo details the methodology we have used to produce the above deliverables as presented in the WRSE options table template[3], which has been uploaded to the SES Water Category A document library on the WRSE SharePoint site.

1.1. Option identification

For this exercise we reviewed the option lists compiled for WRMP14 and WRMP19.

In terms of identifying any new options for inclusion in the WRSE modelling and consequently for WRMP24, whilst not part of Atkins' scope, we understand that the following has been undertaken by SES Water:

- SES Water had a bid assessment framework on their website to solicit new options ideas for the necessary length of time, but no options came forward.
- Any new options that are brought to the attention of the WRSE group relevant to SES Water's area would have been flagged to SES Water, giving them the opportunity to then take it forward into their assessment. No such options were identified by SES Water.
- Generic options such as tankering and demand management options are being assessed consistently across the WRSE group as separate pieces of work, so are excluded from this assessment. Additionally, catchment management options that yield additional DO and resilience options (drought options) are being assessed separately.

In summary no new options have been identified since WRMP19. All the options included in this version of SES Water's WRSE options data template come from WRMP14 and WRMP19 and focus on 'traditional' supply side options, e.g. new sources, treatment capacity upgrades, bulk transfers, artificial recharge (AR) schemes and reservoir raising options.

[1] Mott MacDonald (October 2020) Options Appraisal – Guidance on option identification, screening, and development
[2] Mott MacDonald (August 2020) Cost Consistency Methodology – Technical Note and Methodology
[3] CatA1_WRSE option upload_SES_20210108_Cost profile correction.xlsx

2. Options screening process

In WRMP19 AECOM developed the unconstrained options list for SES Water by using the WRMP14 constrained list of options and identifying some new options. These unconstrained options were screened using a primary and secondary screening approach that in both stages scored each option against a range of criteria leaving each option with a final score. To develop a constrained list, options were split into option type groups and approximately the top 50% of scored options were taken forward.

Following recommendations set out in WRSE review of WRMP19 submissions[4] the approach of selecting options above a score threshold was reviewed and revised. Instead each option was assessed on its own merits on a pass/fail basis so that all feasible options would be included in the investment modelling. To assess the options, we utilised the still applicable screening assessment carried out by AECOM for WRMP19 and any developments that have come to light since that screening had taken place.

The steps we took in re-screening were:

Stage 1 (collation):

- Collate the unconstrained options from WRMP19 and WRMP14.

Stage 2 (screening):

We excluded any options that could not be considered options anymore, including:

- Transfer options exporting water out of SES Water's Water Resource Zone (WRZ) – instead these options are to be followed up by the company receiving the water;
- Resilience options that do not provide extra DO, e.g. within zone transfers;
- Options where the DO benefit has already been realised or where the DO benefit is no longer available.

Stage 3 (review):

- For the remaining options we reviewed the multi-criteria assessment AECOM produced to identify whether any options should be rejected for specific reasons. These reasons were recorded to be included in the WRSE options template as part of the option 'rejection register';
- Options that passed the 1st and 2nd stages but not the third were included in the WRSE table upload with a reason explaining their rejection.

[4] Mott MacDonald (July 2020) Task 1 & 2a Technical Note – Review of rejection registers, gap analysis and screening

Table 2-1 - Assessment criteria for option screening.

Initial Screening Criteria	
CAMS status	Catchment Abstraction Management Strategy (CAMS) - The Environment Agency (EA) guidance on water availability within the option catchment, i.e. whether there is a sustainable source of water available for the option.
WFD status	Water Framework Directive (WFD) - Does the option affect the status of any WFD waterbody?
WFD Risk of Deterioration	Does the option add any risk of deterioration to a WFD waterbody?
Risk to Designated Sites	Are there any designated sites that could be affected by the option?
Secondary Screening Criteria	
Customers	Are customers likely to object to the option.
Other abstractors / water companies	Does the option affect other abstractors?
Yield uncertainty	Are there concerns that the option may not provide as much water as hoped for?
Water Quality	Are there any water quality concerns with the source water that are not treated by the option?
Change in DO of scheme	Does the option provide a significant volume of water?
Flexibility	Can the yield of the scheme be increased/decreased if needed?
Technical Difficulty	Are there any significant technical difficulties associated with delivering the option?
Sustainability	Is the option sustainable?
Social Impact (people and places)	Does the option affect people?
Social Impact (flood resilience)	Does the option impact flood resilience?
Social Impact (drought resilience)	Does the option impact drought resilience?
Landscape and Heritage	Does the option impact the natural landscape or heritage sites?

This process had the effect of taking more options forward to the costing stage than had been for WRMP19. Appendix A contains a table detailing the results of the screening process.

2.1. Environmental screening of options for WRSE

To support the consistent approach to environmental screening of options being undertaken by Mott MacDonald for WRSE, Atkins was asked by SES Water to review the application of the methodology on the company's options. This involved the following steps:

- Reviewing the Strategic Environmental Assessment (SEA), Habitats Regulations Assessment (HRA), Biodiversity Net Gain (BNG)/Natural Capital (NC) and Water Framework Directive (WFD) assessment sheets for a sample of five options:
  - Two options were selected that contained likely significant environmental impacts and high deployable output (DO) benefit, and
  - Three other options were randomly selected, covering different scheme types (e.g. transfer option, surface water option etc.).
- Considering the application of the methodology to each option, to determine whether the option has been fully considered. We were not providing a critique of the methodology itself.

The following method statements were referred to in the review:

- WRSE Regional Plan Environmental Assessment Methodology Guidance (Mott MacDonald, August 2020)
- WRSE Natural Capital & Biodiversity Net Gain Method Statement (Mott MacDonald, December 2020)
- WRSE Regional Plan Strategic Environmental Assessment Scoping Report – Draft (Mott MacDonald, September 2020)

Open source data[5,6] were utilised throughout the review of the SEA, HRA and WFD where applicable.

The following options were reviewed against the above guidance and results compared to those provided by Mott MacDonald:

- R1 (raising Bough Beech)
- R3 (Unconfined chalk AR)
- R21 (Bishopsford road extension)
- R9 (Thames Water bulk supply)
- R26 (Secombe Centre UV)

A summary of results is as follows:

- In general, of the five options we have considered, we agree with the overall assessment.
- We noticed that the groundwater bodies are missing from the WFD assessments, which will be particularly important when a groundwater option is being assessed.
- We also note that the BNG/NC assessments have generally not been undertaken due to limited data. For the options selected, we agree that there would be a minimal change to overall score. However, for options such as pipelines, we would question whether this approach is appropriate.
- The assessments appear to have used an older list of options (including options P1c and R28) and a few inaccuracies regarding option details were noted (e.g. R4 option is to recharge water into the LGS rather than the Chalk as suggested in the HRA). It was agreed that the updated list would be used following the review and more detailed GIS was provided by Atkins to aid in Mott MacDonald's screening following our comments and subsequent discussion between Atkins, Mott MacDonald, SES Water and WRSE in a meeting on the 4th of February 2020.

The full assessment results were provided as a table to WRSE, as set out in Appendix C. It should be noted that Atkins has not received the updated assessments from Mott MacDonald, however Atkins did liaise with Mott MacDonald regarding the GIS filed and provided them with a full and complete set.

[5] Magic.defra.gov.uk. 2021. Magic Map Application. [online] Available at: https://magic.defra.gov.uk/magicmap.aspx> [Accessed 1 February 2021].
[6] Environment.data.gov.uk. 2021. Environment Agency - Catchment Data Explorer. [online] Available at: https://environment.data.gov.uk/catchment-planning/ [Accessed 1 February 2021].

3. Option benefit assessment

The WRSE investment model takes into account input scenarios for DO. The template has the option for identifying the DO available during:

- 1 in 2 year average (normal year or NYAA)
- 1 in 10 year average (dry year or DYAA)
- 1 in 10 year peak (DYCP)
- 1 in 100 year average
- 1 in 100 peak
- 1 in 200 year average
- 1 in 200 peak
- 1 in 500 year average
- 1 in 500 peak

The template requires that at least the 1 in 2 average and the 1 in 500 average and peak are supplied, with any missing scenarios inheriting from the next most frequent event, e.g., the 1 in 200 scenarios if missing would inherit the values from the 1 in 500 scenarios. For all options we have provided at least the 1 in 2 scenario and 1 in 500 scenarios values. Table 3-1 summarises the how the DO has been assessed for the different options included in the upload.

Table 3-1 - DO Assessment Summary

Option Type	Description of assessment	Scenarios filled in	Options
Groundwater options**	Use the recent groundwater DO source assessment by Atkins to confirm or challenge the DOs presented in WRMP19 for groundwater options.	1 in 2 average 1 in 500 average 1 in 500 peak 1 in 200 average* 1 in 200 peak*	No change from WRMP19: R2, R3, R4, R23, R24, R25, R26, N4, N8 Change from WRMP19: R5, R6, R7, R8, R21, R22*N5, N6
Transfer options**	No further assessment made since WRMP19. N.B. this assumes that the capacity of the transfer is available during all scenarios.	1 in 2 average 1 in 500 average 1 in 500 peak	R9, R10, R11, R12, R13, R14, R15
Reservoir raising option**	The SES Water whole company PyWR model was used to assess DO.	1 in 2 average 1 in 10 average 1 in 10 peak 1 in 100 average 1 in 100 peak 1 in 200 average 1 in 200 peak 1 in 500 average 1 in 500 peak	R1

Option Type	Description of assessment	Scenarios filled in	Options
River Eden drought permit options***	The SES Water whole company PyWR model was used to assess DO. N.B. the 1 in 2 and 1 in 10 scenarios were set to 0 Ml/d as the drought permit scheme would not be used in droughts this frequent.	1 in 2 average 1 in 10 average 1 in 10 peak 1 in 100 average 1 in 100 peak 1 in 200 average 1 in 200 peak 1 in 500 average 1 in 500 peak	River Eden May Drought Permit River Eden Summer Drought Permit
Groundwater drought permit options***	No further assessment made since WRMP19. N.B. the 1 in 2 and 1 in 10 scenarios were set to 0 Ml/d as the drought permit scheme would not be used in droughts this frequently.	1 in 2 average 1 in 10 average 1 in 10 peak 1 in 500 average 1 in 500 peak	Outwood Lane Drought Permit Hackbridge Drought Permit Kenley and Purley Drought Permit
TUBs and NEUBs***	The percentage decreases in demand has not been reassessed, but has been reapplied to the most recent assessment of demand to calculate the absolute reductions in demand. N.B. For TUBs, the 1 in 2 scenario is set to 0 Ml/d, and for NEUBs the 1 in 2 and the 1 in 10 scenarios are set to 0 Ml/d as the options will not be used this frequently	1 in 2 average 1 in 10 average 1 in 10 peak 1 in 100 average 1 in 100 peak 1 in 200 average 1 in 200 peak 1 in 500 average 1 in 500 peak	TUB NEUB

*Only option R22 has values entered against the 1 in 200 year scenarios, as all other options have the same DOs for the 1 in 200 year scenarios as they do for the 1 in 500 year scenarios.

**Appendix B details the results of the option benefit re-assessment.

***Section 5 details the results of the drought option assessment, including DO benefits.

4. Update of WRMP19 costs and other option data

4.1. CAPEX

For options that were included in WRMP14 we had access to the cost build up sheets which detailed the bottom-up cost exercise. These costs were determined in 2012 and 2013. To rebase costs from 2013 to 2020 we applied three construction outturn indices as there is no single index which covers this period.

For options identified in WRMP19 the costs for these were determined in 2017 and a single index was used to uplift these costs. The sources and final uplift factor used are presented in Table 4-1.

Table 4-1 – Cost uplifts

Cost source	Cost indices data source	Final uplift factor to 2020 values
WRMP14 (Costs developed 2013)	Department for Business Innovation and Skills: Construction Output Price Indices, covers 1955-2014 Office for National Statistics: Construction Output Price Indices, covers 2014-2017 Office for National Statistics: Construction Output Price Indices, covers 2015-2020	1.149
WRMP19 (Costs developed 2017)	Office for National Statistics: Construction Output Price Indices, covers 2015-2020	1.085

For the options identified for WRMP14 bottom-up cost estimates were available. The itemised costs from WRMP14 were split into categories according to its own asset life. This is so that separate CAPEX profiles can be entered in the input table following the WRSE Cost Consistency Methodology Rev C[2] technical memo recommendations. Contractor costs were split proportionally to the construction categories and project on costs (project management etc.) were assigned to planning and land costs as appropriate.

The new options identified for WRMP19 had single all-in costs presented and thus it was not possible to use the same method as for the WRMP14 options. To enable separate asset life categories to be used, similar options from WRMP14 were identified and the WRMP19 cost was split proportionally into the asset life categories.

4.2. OPEX and electricity

Variable and fixed OPEX rates from WRMP14 and WRMP19 were used for the options and rebased using the same uplifts as for CAPEX.

To align with the methodology used in the WRSE options table, electricity costs have been taken out of the variable OPEX figures and entered into the table separately.

For options identified in WRMP19 where only the final OPEX figures were available with no back up calculation, the percentage difference in variable OPEX after removing electricity costs and the average of similar options was used to calculate electricity required per Ml.

The WRSE investment model gives the option to classify the source of electricity for an option. The source can be either Normal Grid, REGO Grid (renewable sourced), or Generated. As SES Water source all their electricity needs from wholly renewable sources it can be safely assumed that each option would be supplied with electricity from renewable sources. This will be included for the 31st March submission.

4.3. Embodied and operational carbon

RMP14 and WRMP19 option estimates of operational and embodied carbon were used. For operational carbon, WRMP14 estimates had included the contribution from electricity. To follow the WRSE method the carbon contribution of electricity has been separated out from the operational carbon metric.

4.4. Optimism bias

Following the approach as laid out in the Cost Consistency Methodology[2], construction cost items were categorised as standard and non-standard, e.g. a pipeline would generally be standard while an ASR borehole would be non-standard.

Following further guidance issued by WRSE via email[7], if the smaller proportion in the split of standard to non-standard was less than 35% then the option would be considered 100% of the larger part, otherwise the option could be considered a split type option.

Using the Supplementary Green Book Guidance on Optimism Bias and the Optimism Bias Template spreadsheet provided by WRSE[8], an assessment of mitigating factors was made. As option development is at a similar level for all options a single Optimism Bias Adjustment assessment has been completed and the percentage split of standard to non-standard work for each option has been used to produce an adjusted optimism bias figure.

4.5. Lead time

Lead time in the WRSE options table is the number of years construction takes. The lead times estimated in WRMP14 and WRMP19 have been used for the WRSE options table upload.

4.6. Dependent and Mutually Exclusive Options

The WRSE options table requires that any mutually exclusive or dependent options be identified in order that the investment model can take account of how the option are linked. All the options that had passed the screening process were assessed for whether there were any dependencies or mutual exclusivities, and these were added in to the WRSE options table following guidance from Mott MacDonald's. Table 4-2 shows the options which were assessed to be dependent or mutually exclusive of each other.

[7] From Bill Hume-Smith (Mott MacDonald) to Alison Murphy (SES Water), 3rd December 2020
[8] Appendix A - Green Book Optimism Bias Template RevB.xlsx

Table 4-2 - Table of Dependent and Mutually Exclusive Options

SES Company Code	Mutually Exclusive / Dependency Notes
R2	This option is required in order for R21 to be selected. Apply a phased group in the WRSE table.
R6	N.B. Scheme partially dependant on 3.4 Ml/d licence to be granted by EA. If both R6 and R23 are selected as options, a new independent 3.4 Ml/d licence must be granted for R6 in order for R23 to go ahead. This is not noted in the WRSE Options table but should be accounted for in any further option development.
R9	Mutually exclusive with the other two size variants of this option (R10, R11)
R10	Mutually exclusive with the other two size variants of this option (R9, R11)
R11	Mutually exclusive with the other two size variants of this option (R9, R10)
R21	Option dependent on implementation of Bishopsford road borehole scheme (R2). Apply a phased group in WRSE table.
R23	Mutually exclusive with R24. If R6 is implemented as well as R23, R6 requires its own 3.4 Ml/d independent licence.
R24	Mutually exclusive with R23
N5	Scheme mutually exclusive with N6 due to using the same spare capacity at Elmer WTW to treat additional water gained
N6	Scheme mutually exclusive with N5 due to using the same spare capacity at Elmer WTW to treat additional water gained

5. Drought options

In addition to the ‘traditional’ supply side options, SES Water was required to input ‘drought options’ to the WRSE regional plan investment modelling. Preparation of the company’s draft Drought Plan 2021 was ongoing at the time the options template for WRSE was being populated. Up-to-date information consistent with SES Water’s draft Drought Plan 2021 was therefore used in the WRSE submission. These options were thoroughly assessed and reviewed with the Environment Agency as the drought plan was developed. Full environmental assessment reports were completed for each drought permit option, summary information from which is provided in Table 5-1. Cost information has not been developed for these options as they form part of the company’s existing operations. Table 5-1 summarises the drought options in SES Water’s Drought Plan. The River Eden drought permits’ DOs were assessed using the company wide SES Pywr model. The groundwater drought permit options (Outwood Lane, Hackbridge, and Kenley and Purley) are detailed in Appendix E of the DRAFT Drought Plan 2021. The demand side drought options (TUBs and NEUBs) are detailed in Section 3.1 of the DRAFT Drought Plan 2021.

Drought option	Option description	DO Scenario (Ml/d unless stated)									Summary of environmental impacts
		1 in 2-year ADO	1 in 5 year ADO	1 in 10 year ADO	1 in 20 year ADO	1 in 50 year ADO	1 in 100 year ADO	1 in 200 year ADO	1 in 500-year ADO	1 in 500-year PDO	
River Eden May drought permit	This drought permit would extend the abstraction period at the Chiddingstone river intake, which refills Bough Beech Reservoir, to allow abstraction up to 272.2 Ml/d from the River Eden during May, subject to a Minimum Residual Flow (MRF) in the river. The normal licensed abstraction period is September to April. The 1 in 2 year DO scenario has been assigned a zero value because SES Water would not implement drought permits as frequently as 1 in 2 years (its drought permit Level of Service is 1 in 20 years on average).	0.00	0.00	0.00	0.10	0.10	0.10	0.20	0.30	0.30	Minor environmental impact with High confidence. There are no designated conservation sites likely to be impacted by this drought permit; in addition the drought permit will likely be constrained by a MRF condition, to be agreed with the EA, which will act to protect the environment from low flow impacts.

Drought option	Option description	DO Scenario (Ml/d unless stated)									Summary of environmental impacts
		1 in 2-year ADO	1 in 5 year ADO	1 in 10 year ADO	1 in 20 year ADO	1 in 50 year ADO	1 in 100 year ADO	1 in 200 year ADO	1 in 500-year ADO	1 in 500-year PDO	
River Eden Summer drought permit	This drought permit would allow abstraction at the Chiddingstone river intake, which refills Bough Beech Reservoir, up to 272.2 Ml/d from the River Eden during June, July, and August, subject to a Minimum Residual Flow (MRF) in the river. The normal licensed abstraction period is September to April. The 1 in 2 year DO scenario has been assigned a zero value because SES Water would not implement drought permits as frequently as 1 in 2 years (its drought permit Level of Service is 1 in 20 years on average).	0.00	0.00	0.00	0.20	0.40	0.50	1.30	1.40	1.40	Minor environmental impact with High confidence. There are no designated conservation sites likely to be impacted by this drought permit; in addition the drought permit will likely be constrained by a MRF condition, to be agreed with the EA, which will act to protect the environment from low flow impacts.
Outwood Lane drought permit	An increase in the daily licence of 2 Ml/d and a 360 Ml increase in the Woodmansterne Group annual licence to accommodate 6 months (180 days) of pumping at the higher rate at Outwood Lane. The 1 in 2 year DO scenario has been assigned a zero value because SES Water would not implement drought permits as frequently as 1 in 2 years (its drought permit Level of Service is 1 in 20 years on average).	0.00	0.00	0.00	1.98	1.98	1.98	1.98	1.98	1.98	Minor environmental impact with Low confidence. Potential for prolonging of drought conditions with resultant impact on environmental features. Monitoring required to reduce uncertainty in assessment, with pre, during and post drought monitoring actions identified.

Drought option	Option description	DO Scenario (Ml/d unless stated)									Summary of environmental impacts
		1 in 2-year ADO	1 in 5 year ADO	1 in 10 year ADO	1 in 20 year ADO	1 in 50 year ADO	1 in 100 year ADO	1 in 200 year ADO	1 in 500-year ADO	1 in 500-year PDO	
Hackbridge drought permit	Decoupling the maximum abstraction at Hackbridge from the volume recharged in the preceding winter to allow the full permissible abstraction at the licence rate of 19 Ml/d over a 6-month (180 day) period. The 1 in 2 year DO scenario has been assigned a zero value because SES Water would not implement drought permits as frequently as 1 in 2 years (its drought permit Level of Service is 1 in 20 years on average).	0.00	0.00	0.00	4.00	4.00	4.00	4.00	4.00	4.00	Minor environmental impact with Low confidence. Potential for prolonging of drought conditions with resultant impact on environmental features. Monitoring required to reduce uncertainty in assessment, with pre, during and post drought monitoring actions identified.
Kenley and Purley drought permit	An increase of 380 Ml in the annual licence limit at Kenley and Purley to enable a 2.11 Ml/d increase in MDO over a 6-month (180 day) period. The 1 in 2 year DO scenario has been assigned a zero value because SES Water would not implement drought permits as frequently as 1 in 2 years (its drought permit Level of Service is 1 in 20 years on average).	0.00	0.00	0.00	2.10	2.10	2.10	2.10	2.10	2.10	Minor environmental impact with Low confidence. Potential for prolonging of drought conditions with resultant impact on environmental features. Monitoring required to reduce uncertainty in assessment, with pre, during and post drought monitoring actions identified.

Drought option	Option description	DO Scenario (Ml/d unless stated)									Summary of environmental impacts
		1 in 2-year ADO	1 in 5 year ADO	1 in 10 year ADO	1 in 20 year ADO	1 in 50 year ADO	1 in 100 year ADO	1 in 200 year ADO	1 in 500-year ADO	1 in 500-year PDO	
Temporary Use Ban (TUB)*	Phases 1 and 2 of Temporary water use restrictions are estimated to provide a total demand saving of up to approximately 3.2% of dry year annual average and 5.4% of dry year critical period demand (distribution input (DI) minus leakage). The volume calculated relates to base year demand (2019/20). TUBs would not be implemented as frequently as 1 in 2 years (SES Water's TUBs Level of Service is 1 in 10 years on average) so zero DO has been assigned to this scenario. N.B. for scenarios where only ADO is shown, the PDO values are the same as the 1 in 500 year value.	0.0%	0.0%	-3.2%	-3.2%	-3.2%	-3.2%	-3.2%	-3.2%	-5.4%	Positive environmental impacts will result from reduced demand, placing reduced requirements on SES Water's sources.

Drought option	Option description	DO Scenario (Ml/d unless stated)									Summary of environmental impacts
		1 in 2-year ADO	1 in 5 year ADO	1 in 10 year ADO	1 in 20 year ADO	1 in 50 year ADO	1 in 100 year ADO	1 in 200 year ADO	1 in 500-year ADO	1 in 500-year PDO	
Non-Essential Use Ban (NEUB)*	Up to approximately 8.5% of dry year annual average and 13.5% of dry year critical period demand (DI minus leakage) is estimated to be gained from a non-essential use drought order in addition to the savings already achieved through temporary water use restrictions. NEUBs would not be implemented as frequently as 1 in 2 years (SES Water's NEUBs Level of Service is 1 in 20 years on average) so zero DO has been assigned to this scenario. N.B. for scenarios where only ADO is shown, the PDO values are the same as the 1 in 500 year value.	0.0%	0.0%	0.0%	-8.5%	-8.5%	-8.5%	-8.5%	-8.5%	-13.5%	Positive environmental impacts will result from reduced demand, placing reduced requirements on SES Water's sources.

* The values assigned to each DO scenario for the drought demand management options are shown in terms of percentage reductions in demand (DI minus leakage). For the purposes of the options template, a profile of volumetric demand savings was provided, which reflected the relevant percentage applied to total demand in that year, as obtained from the latest version of the demand forecast (prepared for WRSE).

Appendix A. Option screening

SES Water Reference	Option Name	Include in upload	Reject option or populate table
R1	Raising of Bough Beech reservoir	Include	Populate table – Already in feasible list – scores low on sustainability but should still be considered at this stage.
R2	North Downs Confined Chalk AR extension 1 (Bishopsford Road). This scheme connects the existing licensed borehole into the WTW A East Main at Source 14	Include	Populate table – Already in feasible list and no red flags
R3	North Downs Unconfined Chalk AR (recharge at Eyhurst Park, Kingswood)	Include	Populate table – Previously not in feasible list presumably due to technical uncertainties with recharging the unconfined chalk. This Scheme could still provide DO benefit and is an additional feasible option.
R4	North Downs LGS ASR (recharge at Eyhurst Park, Kingswood)	Include	Populate table – Previously not in feasible list presumably due to technical uncertainties with recharging the unconfined chalk. This Scheme could still provide DO benefit and is an additional feasible option.
R5	New borehole (Mole Valley Chalk) – Fetcham Springs	Include	Populate table – Already in feasible list and no red flags.
R6	New borehole (Lower Greensand) – Chalk Pit Lane mains connection	Include	Populate table – This option scored highly in the WRMP19 assessment and we are unsure why it wasn't taken forward.
R7	Enhance borehole output (Lower Greensand) – Water Lane increase in pump capacity & pesticide treatment	Include	Populate table – Scored low previously based on perceived low DO benefit and scheme flexibility, this can now be screened in to allow the investment model to assess DO benefit compared to other schemes.
R8	Upgrade WTW (Lower Greensand) – The Clears ammonia and pesticide treatment	Include	Populate table – Already in feasible list and no red flags.
R9	30 Ml/d bulk supply from Thames Water (London WRZ) to SESW at Merton	Include	Populate table - Previously screened out due to mutually exclusivity, screen in now to allow investment model to assess against other options.

SES Water Reference	Option Name	Include in upload	Reject option or populate table
R10	15 Ml/d bulk supply from Thames Water (London WRZ) to SESW at Merton	Include	Populate table - Already in feasible list and no red flags.
R11	5 Ml/d bulk supply from Thames Water (London WRZ) to SESW at Merton (maximum existing capacity requiring no mains upgrade works)	Include	Populate table - Previously screened out due to mutual exclusivity, screen in now to allow investment model to assess against other options.
R12	20 Ml/d transfer from Langley Park/North Looe Reservoirs to Outwood PS	Exclude - In zone transfer should now be considered a resilience option	n/a
R13	12 Ml/d transfer from Langley Park/North Looe Reservoirs to Buckland	Exclude - In zone transfer should now be considered a resilience option	n/a
R12-Reverse	20 Ml/d transfer from Outwood PS to Langley Park/North Looe Reservoirs	Exclude - In zone transfer should now be considered a resilience option	n/a
R13-Reverse	12 Ml/d transfer Buckland to Langley Park/North Looe Reservoirs	Exclude - In zone transfer should now be considered a resilience option	n/a
R14	5 Ml/d bulk supply from SEW RZ2 (Maidenbower/Whitely Hill) to Outwood PS	Include	Populate table - Screened out previously as not above threshold, now include to allow investment model to compare against other options.
R15	10 Ml/d bulk supply from SEW RZ2 (Maidenbower/Whitely Hill) to Outwood PS	Include	Populate table - Screened out previously as not above threshold, now include to allow investment model to compare against other options.
R16	10 Ml/d bulk supply from Thames Water (Shalford WTW, Guildford WRZ) to SESW at Effingham SR.	Include	Reject - This option is now superseded by a new potential transfer scheme (Guildford to Reigate) being modelled by Mott MacDonald.

SES Water Reference	Option Name	Include in upload	Reject option or populate table
R21	North Downs Confined Chalk AR extension 2 (new borehole on SE side of Football Club)	Include	Populate table - Already in feasible list and no red flags.
R22	Outwood Lane	Include	Populate table - Already in feasible list and no red flags.
R23	Duckpit Wood replacement borehole (not Chalk Pit Lane)	Include	Populate table - Scored low based on low benefit and water quality issues; include at this stage but noting that Water Quality may be an issue for this option and will need further investigation if chosen.
R24	Duckpit Wood hydrogen sulphide treatment	Include	Populate table - Below threshold score previously, but now to be included.
R25	Pains Hill Springs refurb including UV	Include	Reject - The borehole source for this option affects a tributary of the Medway and the EA has indicated that there is little further water that can be sustainably abstracted.
R26	Secombe Centre UV	Include	Populate table - Already in feasible list and no red flags.
R28	Lowering pumps at Kenley and Purley	Exclude - The recent DO assessment shows an increase at these sources since this option was developed, and hence we believe there is no further increase possible.	n/a
E1 (previously n/a 1)	5 Ml/d bulk supply from SESW Outwood PS to SEW RZ2 (Maidenbower/Whitely Hill)	Exclude - Bulk export no DO benefit to SES Water	n/a
E2 (previously n/a 2)	10 Ml/d bulk supply from SESW Outwood PS to SEW RZ2 (Maidenbower/Whitely Hill)	Exclude – Bulk export no DO benefit to SES Water	n/a
E3 (previously n/a 3)	5 Ml/d (ADO or PDO) Bough Beech to Blackhurst (SEW) treated water transfer	Exclude – Bulk export no DO benefit to SES Water	n/a

SES Water Reference	Option Name	Include in upload	Reject option or populate table
E4 (previously n/a 4)	10 Ml/d (ADO) & 15 Ml/d (PDO) Bough Beech to Blackhurst (SEW) treated water transfer (1)	Exclude - Bulk export no DO benefit to SES Water	n/a
E5 (previously n/a 5)	10 Ml/d (ADO) & 15 Ml/d (PDO) Bough Beech to Blackhurst (SEW) treated water transfer (2)	Exclude - Bulk export no DO benefit to SES Water	n/a
E6 (previously n/a 6)	1.5 Ml/d (ADO) & 5 Ml/d (PDO) Release from Bough Beech to Forstall (R. Medway, SEW)	Exclude - Bulk export no DO benefit to SES Water	n/a
E7 (previously n/a 7)	3 Ml/d (ADO) & 10 Ml/d (PDO) Release from Bough Beech to Forstall (R. Medway, SEW)	Exclude - Bulk export no DO benefit to SES Water	n/a
E8 (previously n/a 8)	10 Ml/d (ADO) & 15 Ml/d (PDO) Bough Beech to Riverhill (SEW) treated water transfer	Exclude - Bulk export no DO benefit to SES Water	n/a
P1	Increase Bough Beech WTW capacity from 50 Ml/d to 70 Ml/d - Items 1, 2 & 3	Exclude - superseded by P1c	n/a
P1b	Increase Bough Beech WTW capacity from 50 Ml/d to 70 Ml/d – Items 1 & 2	Exclude – superseded by P1c	n/a
P1c	Increase Bough Beech WTW capacity from 50 Ml/d to 70 Ml/d - Items 1	Exclude - Option no longer valid due to works have progressed increasing the capacity to 65 Ml/d.	n/a
N1	Mole catchment 3rd party licence trading	Include	Reject - on basis of no contact made with licence holders
N2	Wandle catchment 3rd party licence trading	Include	Reject - on basis of no contact made with licence holders

SES Water Reference	Option Name	Include in upload	Reject option or populate table
N3	Eden catchment 3rd party licence trading	Include	Reject - on basis of no contact made with licence holders
N4	Leatherhead licence increase	Include	Populate table - Already in feasible list and no red flags
N5	New Lower Mole Abstraction source	Include	Populate table - Already in feasible list and no red flags
N6	New Middle Mole Abstraction source	Include	Populate table - Already in feasible list and no red flags
N7	Leatherhead new boreholes	Include	Reject - Previously rejected at WRMP19 due to uncertain yield and currently the sources are licence constrained. Additionally, WFD no deterioration concerns mean that this option is unlikely provide DO benefit.
N8	Pipeline linking Pains Hill, Duckpit Wood and Chalk Pit Lane to existing treatment works at Westwood and Godstone	Include	Populate table - Already in feasible list and no red flags
N9	Removal of constraints and or optimisation of source use.	Include	Reject - general scheme, each source needs to be assessed individually to comprise a viable option
R17	Effluent Reuse from New Properties in Horley	Exclude - uncertain DO and the development has already gone ahead and hence no longer an option.	n/a
R18	Effluent Reuse from River Mole and River Medway	Include	Reject - The River Mole is a tributary of the Thames and is classified as having no water available. Existing effluent discharges into the River Medway are already supporting downstream abstractions. Any utilisation of the effluent from these works would be to the detriment of the downstream abstractions, hence there is no available effluent for SESW.
R19	Mole Valley flood water storage	Include	Reject - The flooding of these areas would lead to increased risk of groundwater pollution and the proposed development of the area would also restrict the potential for additional future abstractions. WRMP14 investigations concluded that there were no economically viable flood water storage options along the Mole valley.

SES Water Reference	Option Name	Include in upload	Reject option or populate table
R20	Floodwater storage incorporating disused sand pits	Include	Reject - The pits are excavated in the Folkestone Beds of the Lower Greensand and are understood to be in direct hydraulic connection with a tributary of the River Mole which rises on the Folkestone Beds immediately to the east of the sand pits and then flows south over the Hythe Beds and Atherfield Clay to the River Mole. It is therefore likely that any flood waters or water pumped from the River Mole to the sand pits would drain back into the Mole via this tributary stream and would not be available for summer abstraction unless the pits were sealed. This is not considered to be a feasible solution and this option has been ruled out on this basis.
R27	Reducing size of pump at Bough Beech intake	Exclude - This was considered a resilience scheme in WRMP14, and discussions with SES Water have indicated that this option would make maintaining the MRF more difficult.	n/a

Appendix B. Option DO re-assessment

SES option code	Option Name	WRMP19 ADO	WRMP19 PDO	Revised MDO benefit 1:200	Revised PDO benefit 1:200	Revised MDO benefit 1:500	Revised PDO benefit 1:500	Reasoning / constraints revised
R21	North Downs Confined Chalk AR extension 2 (new borehole on SE side of Football Club)	2.16	5	0	5	0	5	This option is contingent on the Bishopsford Road borehole scheme (R2) being implemented as it is effectively an extension of that scheme and assumes that it would tap into a new main running to Bishopsford Rd. It is considered to have no environmental impacts of concern to the EA. This borehole would allow recovery of the water that has been artificially recharged at Hackbridge between November and March at a higher rate and over a shorter period of time than is currently possible. This would effectively increase the PDO to allow the Company to address increases in peak demand over the summer months. An increase of 5 Ml/d has been assumed based on the capacity of the existing boreholes at Hackbridge. The annual licence would remain unchanged. It is unlikely that there will be an ADO benefit. SES Water do not recharge the full volume due to cost and ecological constraints. This recharge volume can already be met from the Cheam group.
R1	Raising of Bough Beech reservoir	4.9	0	8.8	9.1	11.5	12.4	Surface water option. Not dependent on GW DO. Figures updated from the Bough Beech Pywr model, note that the 1in2yr benefit is 0.2 Ml/d for both ADO.

SES option code	Option Name	WRMP19 ADO	WRMP19 PDO	Revised MDO benefit 1:200	Revised PDO benefit 1:200	Revised MDO benefit 1:500	Revised PDO benefit 1:500	Reasoning / constraints revised
R5	New borehole (Mole Valley Chalk) - Fetcham Springs	4.78	3.148	5.35	2.7	5.35	2.7	Option includes the drilling of two new BHs. It is unclear if these would become part of the Fetcham Borehole licence, or part of the group Fetcham springs/borehole licence, although it is noted that the current DO assessment assumes 0 Ml/d from Fetcham boreholes. The Fetcham spring DO is uncertain due to limited total spring flow data, however the MDO has been set at 8.3 and PDO at 11 Ml/d compared to a licence limit (average annual and daily) of 13.68 Ml/d (group spring/borehole licence). Assuming the two boreholes can yield the difference, there is a potential yield of 5.35 Ml/d MDO and 2.7 Ml/d PDO. It is noted that the existing borehole licence is smaller at 1.4 Ml/d and the DO of these boreholes when last assessed in WRMP2019 was less than 1Ml/d. It is therefore uncertain whether new boreholes would a) be given the larger licence and b) be able to yield the higher rates.
R10	15 Ml/d bulk supply from Thames Water (London WRZ) to SESW (Sutton WRZ) at Merton	15	15	No change	No change	No change	No change	Pipeline (bulk transfer) option. Not constrained by GW DO. Mutually exclusive with R9, R10, R11
N8	Pipeline linking Pains Hill, Duckpit Wood and Chalk Pit Lane to existing treatment works at Westwood and Godstone	1.37	2.14	No change	No change	No change	No change	Pipeline and treatment option. Not challenged by GW DO. NB none of these sources are operational.

SES option code	Option Name	WRMP19 ADO	WRMP19 PDO	Revised MDO benefit 1:200	Revised PDO benefit 1:200	Revised MDO benefit 1:500	Revised PDO benefit 1:500	Reasoning / constraints revised
R15	10 Ml/d bulk supply from SEW RZ2 (Maidenbower/Whitely Hill) to East Surrey WRZ (Outwood PS)	10	10	No change	No change	No change	No change	Pipeline option. Not challenged by GW DO. Mutually exclusive with R14.
R2	North Downs Confined Chalk AR extension 1 (Bishopsford Road). This scheme connects the existing licensed borehole into the WTW A East Main at Source 14	0	5	No change	No change	No change	No change	The objective of the scheme is to increase the PDO of the licence group by allowing recovery of the artificially recharged volume at Hackbridge at a higher abstraction rate over a shorter period of time. The pipeline at Bishopsford Road will connect the Bishopsford Road borehole to the Hackbridge boreholes. A 5 Ml/d PDO benefit has been assumed given the pump capacities of other Hackbridge boreholes. It is unlikely that there will be an ADO benefit. SES water do not recharge the full volume due to cost and ecological constraints. This recharge volume can already be met from the Cheam group.
R26	Secombe Centre UV	2.07	4.54	No change	No change	No change	No change	The DO of this source has not been assessed for WRMP24 as the borehole is out of supply due to water quality concerns. However, the Cheam group of which Secombe Centre is a part, is not licence constrained. The quantification of benefit of this scheme would benefit from reassessing the Secombe Centre DO. The source was historically assessed as having a PDO of 4.5 Ml/d and MDO of 3.9 Ml/d.

SES option code	Option Name	WRMP19 ADO	WRMP19 PDO	Revised MDO benefit 1:200	Revised PDO benefit 1:200	Revised MDO benefit 1:500	Revised PDO benefit 1:500	Reasoning / constraints revised
R8	Upgrade WTW (Lower Greensand) - The Clears ammonia and pesticide treatment	1.6	2.57	(1.85-1.4) =0.45	(1.85-1.4) =0.46	(1.85-1.4) =0.45	(1.85-1.4) =0.46	Scheme aims to increase PDO for the Clifton Lane group licence by 2.57 Ml/d by provision of ammonia and pesticide treatment to allow pumping reintroduction of The Clears or pumping Buckland beyond operational guideline of 1.4 Ml/d. • The Clears has been capped off and therefore this option will not increase the DO from this source unless the borehole is reconnected and recommissioned. There is currently no option to do this. The DO has not been assessed for this source for a number of WRMP cycles and therefore the potential DO is uncertain. • Abstraction from Buckland is currently constrained by water quality, believed to be ammonia. If this constraint is removed through this option, the MDO and PDO will only increase by 0.45 Ml/d until the source is constrained by pump capacity (for both 1 in 200 and 1 in 500 DO) d pump capacity. • Clifton Lane is constrained by DAWPL so this option will not increase capacity at this source. With the available information, the previous DO assessment is not realistic. A DO benefit of 0.45 Ml/d has been applied assuming the benefit is obtained from Buckland only.

SES option code	Option Name	WRMP19 ADO	WRMP19 PDO	Revised MDO benefit 1:200	Revised PDO benefit 1:200	Revised MDO benefit 1:500	Revised PDO benefit 1:500	Reasoning / constraints revised
N5	New Lower Mole Abstraction source	17	17	17	3.4	17	3.4	Scheme is to identify a new abstraction source, either a groundwater source from the Chalk (or river terrace gravels) or a surface water source in the lower Mole (below Leatherhead). The option includes a pipeline to transfer water to Elmer WTW for treatment. The reported capacity at Elmer WTW is 84 Ml/d. The 1 in 200 MDO of sources feeding Elmer is 62.32 Ml/d and the PDO is 80.61 Ml/d. This leaves a headroom at the WTW of 21.7 Ml/d and 3.4 Ml/d. However, it should be noted that there is a potential network constraint of 73 Ml/d which should be investigated. If this is found to be true, the DO benefit of the schemed would be reduced unless the Elmer WTW & network is improved. The MDO is further limited by the water available in the catchment as indicated in CAMS to 17 Ml/d.
N4	Leatherhead licence increase	2	2	No change	No change	No change	No change	Option to increase the Leatherhead, Elmer, and Young Street licence by 2 Ml/d. This is feasible as the DO is licence constrained at 42 Ml/d through from a 1 in 2 drought to a 1 in 500. This group is treated at Elmer WTW which has a capacity of 84 Ml/d. The combined DO of sources feeding Elmer is 62.32Ml/d MDO and 80.6 Ml/d PDO, leaving a spare treatment capacity to accommodate the 2 Ml/d increase. However, as noted in N5, there may be network constraints at Elmer which need to be investigated.

SES option code	Option Name	WRMP19 ADO	WRMP19 PDO	Revised MDO benefit 1:200	Revised PDO benefit 1:200	Revised MDO benefit 1:500	Revised PDO benefit 1:500	Reasoning / constraints revised
N6	New Middle Mole Abstraction source	40	40	21.7	3.4	21.7	3.4	Scheme is to identify a new abstraction source, either a groundwater source from the Chalk (or river terrace gravels) or a surface water source in the lower Mole (below Leatherhead). The option includes a pipeline to transfer water to Elmer WTW for treatment. The reported capacity at Elmer WTW is 84 Ml/d. The 1 in 200 MDO of sources feeding Elmer is 62.32 Ml/d and the PDO is 80.61 Ml/d. This leaves a headroom at the WTW of 21.7 Ml/d and 3.4 Ml/d. However, it should be noted that there is a potential network constraint of 73Ml/d which should be investigated. If this is found to be true, the DO benefit of the schemed would be reduced unless the Elmer WTW & network is improved. CAMS notes that the likely available water from this catchment is 40 Ml/d, therefore if the option was amended to include additional treatment further DO could potentially be realised.

SES option code	Option Name	WRMP19 ADO	WRMP19 PDO	Revised MDO benefit 1:200	Revised PDO benefit 1:200	Revised MDO benefit 1:500	Revised PDO benefit 1:500	Reasoning / constraints revised
R22	Outwood lane	0.4	5	(5.79-3.02) =2.77	(5.97-3.02) = 2.96	(5.68-3.02) =2.66	(5.85-3.02) =2.83	Option to increase output at Outwood Lane by 5 Ml/d, from 3 to 8 Ml/d. The current DO is licence constrained at 3 Ml/d, and the next constraint is pump capacity at 5 Ml/d. Beyond this, the DAPWL limits MDO and PDO to 5.97 Ml/d (1 in 500). Outwood Lane was test pumped at 8 Ml/d but the groundwater levels did not stabilise, so 8 Ml/d target may not be sustainable. It is suggested that the option is revised to the potential yield (5.97 Ml/d) and the DO benefits assigned reflect this. It is however noted that there is limited data from which to generate the operational curve.
R3	North Downs Unconfined Chalk AR (recharge at Eyhurst Park, Kingswood)	0	5	No change	No change	No change	No change	Artificial recharge option. Aim to use un-utilised headroom from Leatherhead during winter for artificial recharge over a 5-month winter period upgradient. Additional investigations required. Option may be mutually exclusive to other Leatherhead options such as R5 and N7.
R4	North Downs LGS ASR (recharge at Eyhurst Park, Kingswood	n/a	2.5	No change	No change	No change	No change	As with R3.

SES option code	Option Name	WRMP19 ADO	WRMP19 PDO	Revised MDO benefit 1:200	Revised PDO benefit 1:200	Revised MDO benefit 1:500	Revised PDO benefit 1:500	Reasoning / constraints revised
R6	New borehole (Lower Greensand) - Chalk Pit Lane mains connection	3.4	3.4	1.22	0	1.22	0	Option to connect and commission the Chalk Pit Lane borehole. This source is already licenced at 3.5 Ml/d, but it is unknown what the actual borehole yield is. The intention is that Chalk Pit Lane would connect to Godstone WTW. However, under the current DO assessment, this WTW is already at capacity 16 Ml/d and therefore the scheme would not provide any DO benefit. The option does suggest a future link to Westwood WTW. This WTW has a headroom of 1.22 Ml/d at ADO and negligible PDO. The applied DO benefit assumes this connection is made.
R7	Enhance borehole output (LGS) - water lane increase in pump capacity & pesticide treatment	2.95	1.85	2.2	2.2	2.2	2.2	Option to increase ADO and PDO at Water Lane by increasing pump capacity, lowering pump cut-out, and installing additional treatment. MDO and PDO are both currently constrained by pump capacity to 2 Ml/d, but the Westwood group licence is close to maximum (6.78 Ml/d compared to a group licence of 6.85 Ml/d). Therefore, this option will not deliver additional DO unless combined with an increase in group licence. Assuming the group licence was increased, and the pump capacity constraint was removed, the next constraint is the apportioned Water Lane WTW capacity which is approximately equivalent to the potential yield (4.4-4.9 Ml/d). Therefore, there is a potential MDO/PDO benefit of 2.2 Ml/d.

SES option code	Option Name	WRMP19 ADO	WRMP19 PDO	Revised MDO benefit 1:200	Revised PDO benefit 1:200	Revised MDO benefit 1:500	Revised PDO benefit 1:500	Reasoning / constraints revised
R9	30 Ml/d bulk supply from Thames Water (London WRZ) to SESW at Merton	30	30	No change	No change	No change	No change	Pipeline (bulk transfer) option. Not constrained by GW DO. Mutually exclusive with R9, R10, R11
R11	5 Ml/d bulk supply from Thames Water (London WRZ) to SESW at Merton (maximum existing capacity requiring no mains upgrade works)	5	5	No change	No change	No change	No change	Pipeline (bulk transfer) option. Not constrained by GW DO. Mutually exclusive with R9, R10, R11.
R14	5 Ml/d bulk supply from SEW RZ2 (Maidenbower/Whitely Hill) to East Surrey WRZ (Outwood PS)	5	5	No change	No change	No change	No change	Pipeline option. Mutually exclusive with R15.
R23	Duckpit Wood replacement borehole (not Chalk Pit Lane)	1.37	2.14	No change	No change	No change	No change	Replacement borehole for Duckpit Wood and Pains Hill. The DO benefit combines the DOs of Pains Hill (ADO 1.37 Ml/d, PDO 1.37 Ml/d) with Duckpit Wood (ADO 0 Ml/d, PDO 0.773 Ml/d). These DO numbers are from previous assessments, neither source currently being operational. These sources were disused due to water quality constraints; it is assumed the new borehole will not have the same issue and able to deliver the DO benefit.
R24	Duckpit Wood hydrogen sulphide treatment	0	0.77	No change	No change	No change	No change	Water treatment option. Would allow Duckpit Wood back into operation.

Appendix C. Review of environmental screening of SES Water's options undertaken by Mott MacDonald for WRSE

No.	Topic/ Assessment	Option (if specified, if whole SRO leave blank)	Key Issue	Comment/clarification	Has material impact on assessment?	Mott MacDonald Response	Agreed action(s) from review meeting (04/03/2021)
1	General		Overall assessment	• In general, of the sample five options we have considered, we agree with the overall assessment. • We have noticed that the GW bodies are missing from the WFD assessments, which will be particularly important when a groundwater option is being assessed. • We also note that the natural capital (NC) / Biodiversity Net Gain (BNG) assessments have generally not been undertaken due to limited data; from the options selected, we agree that there would be a minimal change to overall score. However, for options such as pipelines, we would question whether this approach is appropriate. • The assessments appears to have used an older list of options (including options P1c and R28). Note also that R4 option is to recharge water into the Lower Greensand (LGS) rather than the Chalk as suggested in the HRA.	n/a	Please see comments below in relation to these points. Options list used is from the 4th Dec upload. Reviewed NC pipelines - assessment carried out prior to upload of WRSE transfer options so will be updated	Pipeline routes NC/BNG assessments to be undertaken. P1c and R28 no longer included. Wording on R4 to be updated in HRA GW bodies to be covered in WFD Phase 2 assessment. GW bodies to be identified and stated for further assessment if required
2	HRA	R1 (raising Bough Beech)	Incorrect assessment	SSSI condition assessment - The condition assessment of Ashdown Forest SSSI slightly differs from that recorded on the Natural England website (accessed 02/02/2021: Favourable 16.59%, Unfavourable - Recovering 78.42%, Unfavourable - Declining 4.99%). However, no change expected to the conclusions.	No	Review and update as required. No change to assessment outcome.	Condition assessment to be updated
3	WFD	R1 (raising Bough Beech)	Incorrect assessment	WFD - WFD assessment incorrectly populates rows 67 to 70. However, including these scores will not change the overall conclusion for the water body.	No	Row 48, 65 and 66 are the only activities assigned to this option: New or increased surface water abstraction licence. Modification of and presence of storage reservoir. The reservoir activities were assigned as the option is to modify the reservoir by raising the banks. Discuss if this is appropriate.	No action required.
4	NC/BNG	R1 (raising Bough Beech)	Incomplete assessment	This option is screened out from the NC assessment due to lack of data. Whilst we are unclear if this is valid reasoning, we would expect that even if NC was undertaken there would be minimal change.	No	Are SES able to provide a indicative footprint of the embankment raising so an assessment can be carried out	Send list of options that require further GIS information to SES Water including this option
5	SEA	R1 (raising Bough Beech)	Audit comment	SEA - Data have been cross checked where possible, and application of the option to scoring criteria spot checked. We agree with the assessment.	No	No action required	No action required - assessment to be reviewed using updated GIS
6	HRA	R3 (Unconfined chalk AR)	Audit comment	HRA - Data have been cross checked were possible. We agree with the assessment.	No	No action required.	No action required.
7	WFD	R3 (Unconfined chalk AR)	Incomplete assessment	WFD - The assessment does not include the WFD groundwater body (Dorking North Downs Chalk). We would expect this to have been identified as a sensitive water body. The groundwater body should be included in the assessment and scored accordingly.	Yes	As part of the level 1 assessment, activities relating to groundwater have been included to capture where there is a potential impact on GW. Groundwater bodies are not explicitly included in the level 1 assessments. Where a surface waterbody's maximum impact score is 2 or 3, a level 2 assessment will be triggered.	See previous comment on WFD GW

No.	Topic/ Assessment	Option (if specified, if whole SRO leave blank)	Key Issue	Comment/clarification	Has material impact on assessment?	Mott MacDonald Response	Agreed action(s) from review meeting (04/03/2021)
						If the activities ongoing are also likely to impact groundwater, then the groundwater body should be included in the level 2 assessment. This is the list of activities where the GW body should be considered in the level 2 assessment: • Construction and presence of new below ground structures, within 500m of a sensitive groundwater feature • Construction of new cutting within 500m of a sensitive groundwater feature • New discharge of highly saline water to groundwater • Use of existing groundwater abstraction licences, within existing licence conditions but outside of the recent actual rates • Emergency or drought use of existing groundwater abstraction outside of licence conditions • New or increased groundwater abstraction I've created a summary of the options which I can send across which highlight which GW bodies would be included in the next stage. Also add into the cover sheet a comment highlighting the GW waterbodies	
8	SEA	R3 (Unconfined chalk AR)	Audit comment	SEA - Data have been cross checked where possible, and application of the option to scoring criteria spot checked. We agree with the assessment.	No	No action required	No action required
9	NC/BNG	R3 (Unconfined chalk AR)	Incomplete assessment	This option is screened out from the NC assessment due to current available option information. Whilst the exact location of the borehole is unspecified, a high-level NC assessment could be undertaken. However, we would expect that even if NC was undertaken there would be minimal change.	No	Are SES able to provide an indicative footprint of the embankment raising so an assessment can be carried out	See previous comment on NC GIS locations
10	SEA	R21 (Bishopford road extension)	Incomplete assessment	SEA - There is no SEA enclosed for R21 (or the connected option R2). Incomplete assessment therefore unable to comment.	Yes	GIS location and option description do not appear to align	Potentially wrong GIS layer or code & GIS confused. Needs to be reviewed. SES to provide new GIS & MM to updated assessment once received.
11	WFD	R21 (Bishopford road extension)	Incomplete assessment	WFD - The assessment does not include the WFD groundwater body (Dorking North Downs Chalk). We would expect this to have been identified as a sensitive water body. The groundwater body should be included in the assessment and scored accordingly.	Yes	Same comment as number 7	See previous comment on WFD GW Check assessment against updated GIS
12	HRA	R21 (Bishopford road extension)	Audit comment	HRA - We agree with the conclusion of 'likely significant effect'.	No	No action required	Check assessment against updated GIS
13	NC/BNG	R21 (Bishopford road extension)	Incomplete assessment	This option is screened out from the NC assessment due to current available option information. Whilst the exact location of the borehole is unspecified, a high-level NC assessment could be undertaken. However, we agree with the conclusion that if NC was undertaken there would be minimal change.	No		Check assessment against updated GIS

No.	Topic/ Assessment	Option (if specified, if whole SRO leave blank)	Key Issue	Comment/clarification	Has material impact on assessment?	Mott MacDonald Response	Agreed action(s) from review meeting (04/03/2021)
14	WFD	R9 (Thames Water bulk supply)	Incomplete assessment	WFD - We believe there will be a number of water body crossings. Similarly, the SEA notes that there will be main river crossings. However, no water course crossings have been noted in the WFD assessment (rows 54 and 55). However, this will not change the conclusion of the assessment. Whilst the option is not located on a WFD GWB, acknowledging this would demonstrate it has been considered.	No	Error in the assessment. This has also the case for R10 and R11. The overall score has not changed but assessments have been edited capture the watercourse crossings.	MM to update the assessment in line with comment Eliot to check who has ownership of these strategic transfer option and sign-off
15	HRA	R9 (Thames Water bulk supply)	Audit comment	HRA - Data have been cross checked where possible. We agree with the assessment.	No	No action required	No action required
16	SEA	R9 (Thames Water bulk supply)	Audit comment	SEA - Data have been cross checked where possible, and application of the option to scoring criteria spot checked. We agree with the assessment.	No	No action required	No action required
17	NC/BNG	R9 (Thames Water bulk supply)	Audit comment	NC - Given the setting of the option, it is understandable that a BNG and NC assessment has not been completed.	No	No action required	No action required
18	WFD	R26 (Secombe Centre UV)	Incomplete assessment	WFD - Option is located on the boundary of the unconfined Chalk and is very proximal to the WFD groundwater body (Dorking North Downs Chalk). The groundwater body (groundwater quality) may be impacted by the construction of the scheme which should be assessed.	Yes	Same comment as number 7	See previous comment on WFD GW
19	HRA	R26 (Secombe Centre UV)	Audit comment	HRA - Data have been cross checked where possible. We agree with the assessment.	No	No action required	No action required
20	SEA	R26 (Secombe Centre UV)	Incomplete assessment	SEA - More detail in water section required:- Beverley Brook, identified as needing further consideration in the WFD assessment, has not been mentioned- There is no acknowledgement of the adjacent WFD GWB Dorking North Downs Chalk.	No	Review and add more detail to water objective, update scoring if required	MM to add in extra detail to the assessment as identified in the comment.
21	NC / BNG	R26 (Secombe Centre UV)	Incomplete assessment	This option is screened out from the NC assessment due to current available option information. Whilst we are unclear on the reasoning of this, we would expect that even if a NC assessment were to be undertaken there would be minimal change.	No	Are SES able to provide a indicative footprint of the option raising so an assessment can be carried out	Send list of options that require further GIS information to SES Water including this option

Appendix D. Feasible option summary details

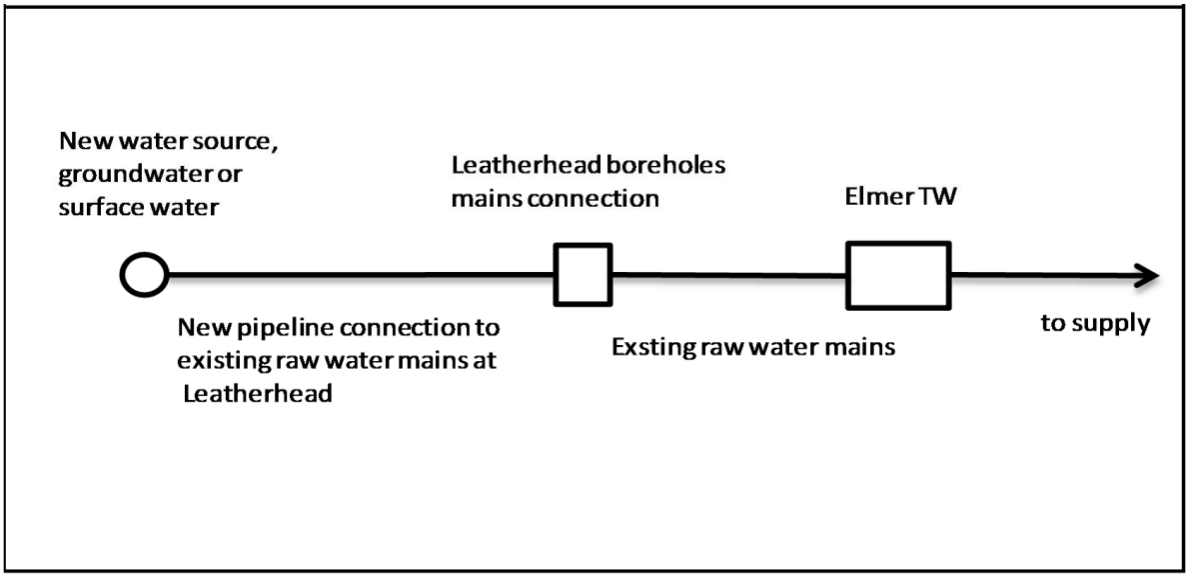
D.1. New Lower Mole Abstraction source

Option ID	SES_SES_HI-GRW_ALL_ALL_n5
ID Name	N5
Option name	New Lower Mole Abstraction source
Option description	Water availability as indicated in CAMS is below Leatherhead at least 50% of the time. The scheme is to identify a new source location for groundwater abstraction from the Chalk or surface water abstraction (or river terrace gravels). A pipeline would be required for treatment at Elmer WTW where there is existing capacity for treatment. Depending on land access, this can be as short a pipeline distance as possible, once down gradient of CAMS assessment point at Leatherhead.
Option type	Supply
ADO increase at 1in500-yr (Ml/d)	17
PDO increase at 1in500-yr (Ml/d)	3.4
Lead-in time (yrs)	3
Risks and uncertainties	**Water availability:** 2019 surface water (and, by proxy, groundwater) availability suggests there is no water available at flows <Q30 and at flows >Q30, there is only 'restricted water available for licensing' e.g. from licence trading. However, a new groundwater licence in the confined Chalk may conceivably be considered as policy is that water is available where the aquifer pressure head is in the London Clay, and in order to protect infrastructure, the London Licensing Strategy encourages abstraction in these areas[9]. Based upon Figure 14 of the Management of the London Basin Chalk Aquifer Status Report (Environment Agency, 2018)[9], it is believed that the pressure surface is within the London Clay underneath the Mole catchment. **WFD RA status:** Mole (Horley to Hersham) has 'Supports Good' hydrological regime at RA. Dorking North Downs Chalk is 'Good' quantitative at RA. There is no confined GW body so no WFD status for confined Chalk. **WFD Risk (i.e. at FL abstraction):** Dorking North Downs Chalk GW balance test is 'At Risk' under FL abstraction but as the confined Chalk has no official WFD status and GWLs are at level allowing abstraction, then the confined Chalk may be an option. Mole (Horley to Hersham) is ‘Compliant’ and ‘No Risk’ at FL (which appears contradictory with 2019 water availability classification). **Viable option:** Yes – Groundwater abstraction from the confined Chalk appears to be an option. Surface water abstraction is viable only if from licence trading and abstraction at flows >Q30.
Risk to drinking water quality	Low - likely similar quality to that abstracted from existing Leatherhead source

[9] Environment Agency (2018) Management of the London Basin Chalk Aquifer Status Report https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/735451/2018_Final.pdf

Dependencies	Scheme mutually exclusive with N5 due to using the same spare capacity at Elmer WTW to treat additional water gained
Option constraints	The option includes a pipeline to transfer water to Elmer WTW for treatment. The reported capacity at Elmer WTW is 84 Ml/d. The 1 in 200 MDO of sources feeding Elmer is 62.32 Ml/d and the PDO is 80.61 Ml/d. This leaves a headroom at the WTW of 21.7 Ml/d and 3.4 Ml/d. However it should be noted that there is a potential network constraint of 73 Ml/d which should be investigated. If this is found to be true, the DO benefit of the schemed would be reduced unless the Elmer WTW & network is improved. The MDO is further limited by the water available in the catchment as indicated in CAMS to 17 Ml/d.
Customers' support	TBC if option selected prior to 2050
Flexibility of the option to adapt to future uncertainty	TBC if option selected prior to 2050
Capex last year	3
Opex start year	4
Total base Capex (£)	3,800,000
Max fixed Opex (£)	3,150
Max variable Opex (£/Ml)	56
Total Embodied Carbon (tCO2e)	590
WRMP Plan type - BVP	N/A
WRMP Plan type - LCP	N/A
WRMP Plan type - LCP SWS Delay	N/A
WRMP Plan type - BESP	N/A
SEA construction effects	Positive 1 Negative -37
SEA residual construction effects	Positive 1 Negative -33
BNG - Total Net unit change (habitat units)	*Further NC and BNG Assessment has been scoped out due to the current available option information. The option is unlikely to result in further potential impacts due to the construction of the new pipeline within existing roadways and the construction on previous developed land. Any additional impacts within the option Zone of Influence (ZoI) will be captured within the SEA, WFD & resilience assessments.*
BNG - Total Percentage change	0
HRA	No Likely Significant Effects - The Natura 2000 (N2k) site is considered to be located at enough of a distance (1.2km) to not be at risk from physical and non-physical disturbance such as dust, noise or light pollution etc. N2k site is located upstream from the proposed option and so is unlikely to be at risk from potential water pollution as a result of the scheme.
Natural Capital assessment	*Further NC and BNG Assessment has been scoped out due to the current available option information. The option is unlikely to result in further potential impacts due to the construction of the new pipeline within existing roadways and the construction on previous developed land. Any additional impacts within the option ZoI will be captured within the SEA, WFD & resilience assessments.*

WFD - Max impact score per waterbody	3 - GB106039017621:Mole (Horley to Hersham) 1 - GB106039017610:Rye Brook at Ashtead



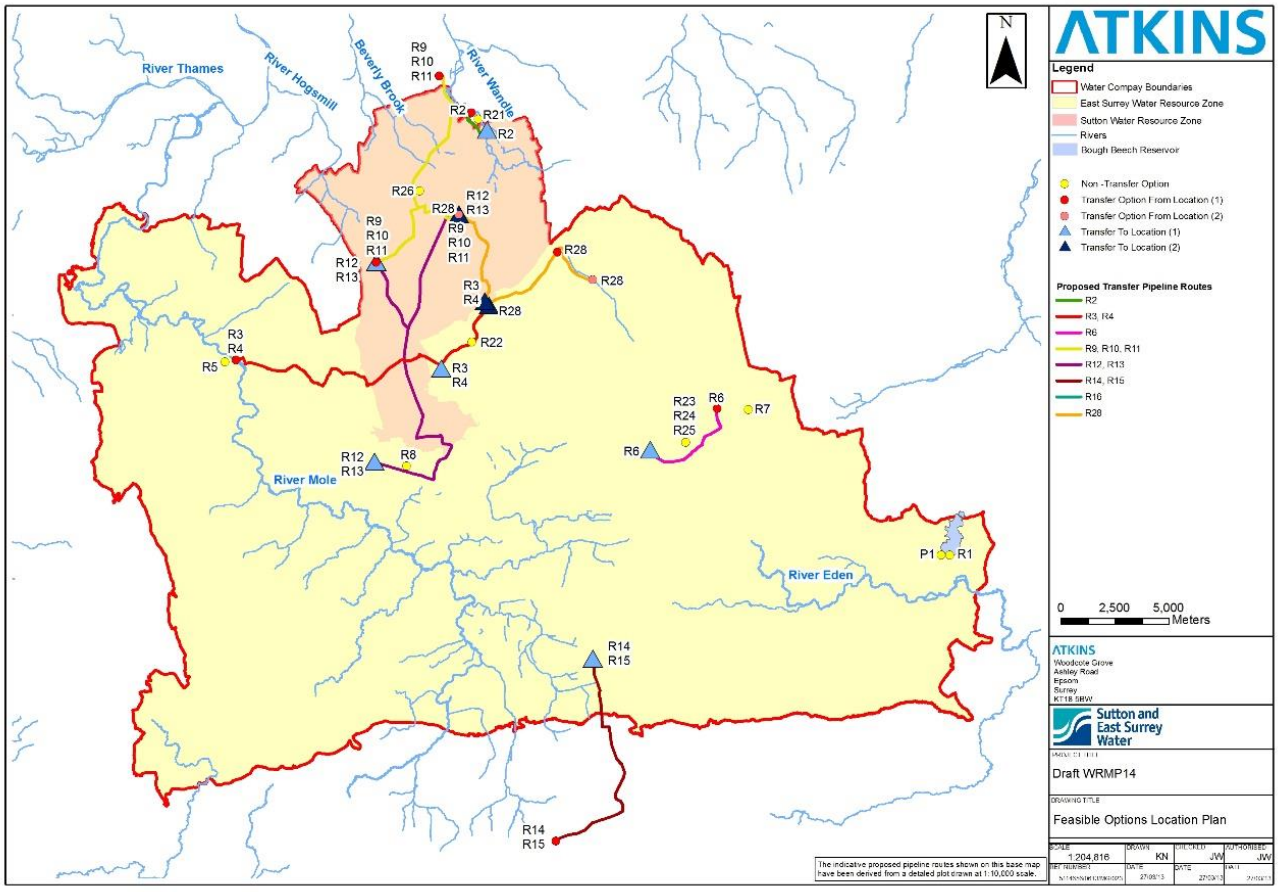
Reproduced from Aecom (2018)[10]

[10] Aecom (2018) Water Supply – Constrained Options Appraisal, 60527524-540-Rev6 20180822

D.2. Raising of Bough Beech Reservoir

Option ID	SES_SES_HI-ROC_ALL_ALL_r1
ID Name	R1
Option name	Raising of Bough Beech reservoir
Option description	The scheme is to raise the Bough Beech reservoir embankment
Option type	Supply
ADO increase at 1in500-yr (Ml/d)	11.5
PDO increase at 1in500-yr (Ml/d)	12.4
Lead-in time (yrs)	10
Risks and uncertainties	This option doesn't change abstraction licence conditions, rather it provides more reservoir storage. WFD 'L2' further assessment acknowledges potential for 'significant (moderate) adverse effects' although there is a River Eden MRF in place within the abstraction licence that aims to protect river ecology. The previous WRMP14/WRMP19 DO benefit for this option was based on assessing the extra yield achievable from Bough Beech reservoir and was stated as an additional 5.5 Ml/d average yield increase, while the peak would be constrained by the downstream water treatment works. This was calculated using an Aquator model of the Bough Beech reservoir surface water source which excluded all of SES Water's groundwater sources. For the dWRMP24, a combined surface water and groundwater conjunctive use model was developed to assess the DO benefit of increasing storage in the reservoir. The modelling indicated that the overall benefit to company-wide DO was greater than the 5.5 Ml/d previously determined for WRMP14/19 using the Bough Beech only Aquator model. The increase in MDO/PDO across the company was 8.8/9.1 Ml/d during a 1 in 200-year drought and 11.5/12.4 Ml/d during a 1 in 500-year drought. These values were used in the WRSE investment model to determine suitable options for our WRMP24.
Risk to drinking water quality	Low - likely similar quality to that abstracted from existing reservoir source
Dependencies	None
Option constraints	Approvals
Customers' support	TBC if option selected prior to 2050
Flexibility of the option to adapt to future uncertainty	TBC if option selected prior to 2050
Capex last year	10
Opex start year	11
Total base Capex (£)	16,000,000
Max fixed Opex (£)	31,200
Max variable Opex (£/Ml)	54
Total Embodied Carbon (tCO2e)	9,074
WRMP Plan type - BVP	N/A

WRMP Plan type - LCP	2051
WRMP Plan type - LCP SWS Delay	2053
WRMP Plan type - BESP	2053
SEA construction effects	Positive 1 Negative -18
SEA residual construction effects	Positive 1 Negative -17
BNG - Total Net unit change (habitat units)	*Further NC and BNG Assessment has been scoped out due to the current available option information. The option has potential to generate impacts on NC and Ecosystem services however these cannot be confirmed due to the available option information. Any additional impacts within the option ZoI will be captured within the SEA, WFD & resilience assessments.*
BNG - Total Percentage change	0
HRA	No Likely Significant Effects
Natural Capital assessment	*Further NC and BNG Assessment has been scoped out due to the current available option information. The option has potential to generate impacts on NC and Ecosystem services however these cannot be confirmed due to the available option information. Any additional impacts within the option ZoI will be captured within the SEA, WFD & resilience assessments.*
WFD - Max impact score per waterbody	3 - GB106040018160:Lower Eden

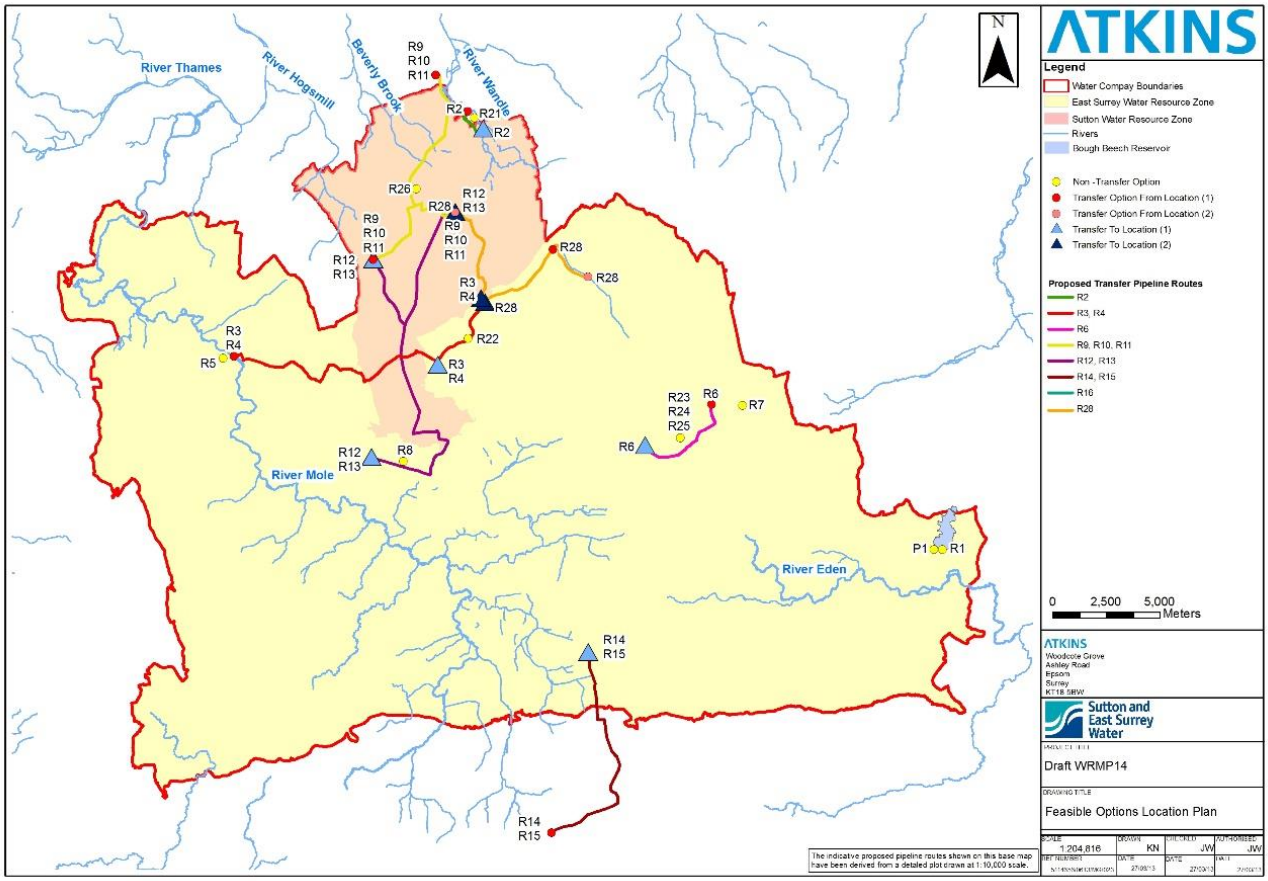


North Downs Confined Chalk AR extension 1 (Bishopsford Road)

D.3. North Downs Confined Chalk AR extension 1 (Bishopsford Road)

Option ID	SES_SES_HI-GRW_ALL_ALL_r2
ID Name	R2
Option name	North Downs Confined Chalk AR extension 1 (Bishopsford Road).
Option description	Bishopsford Rd borehole was drilled and constructed in 2008. This scheme connects the borehole into the Cheam WTW East Main at Goatbridge. The objective of the scheme is to increase the PDO of the licence group by allowing recovery of the artificially recharged volume at Hackbridge at a higher abstraction rate over a shorter period of time during the subsequent peak demand period.
Option type	Supply
ADO increase at 1in500-yr (Ml/d)	0
PDO increase at 1in500-yr (Ml/d)	5
Lead-in time (yrs)	3
Risks and uncertainties	Requires test pumping of Bishopsford Road borehole and analysis of results together with Hackbridge AR scheme to prove abstraction rates can be achieved and prove DO benefit. A preliminary quantified assessment of capacity and environmental impact may be possible using the regional groundwater model.
Risk to drinking water quality	Low - likely similar quality to that abstracted from existing source and existing treatment at Cheam WTW.
Dependencies	None
Option constraints	
Customers' support	TBC if option selected prior to 2050
Flexibility of the option to adapt to future uncertainty	TBC if option selected prior to 2050
Capex last year	3
Opex start year	4
Total base Capex (£)	2,780,000
Max fixed Opex (£)	10,900
Max variable Opex (£/Ml)	55
Total Embodied Carbon (tCO2e)	304
WRMP Plan type - BVP	N/A
WRMP Plan type - LCP	N/A
WRMP Plan type - LCP SWS Delay	N/A
WRMP Plan type - BESP	N/A
SEA construction effects	TBC
SEA residual construction effects	TBC

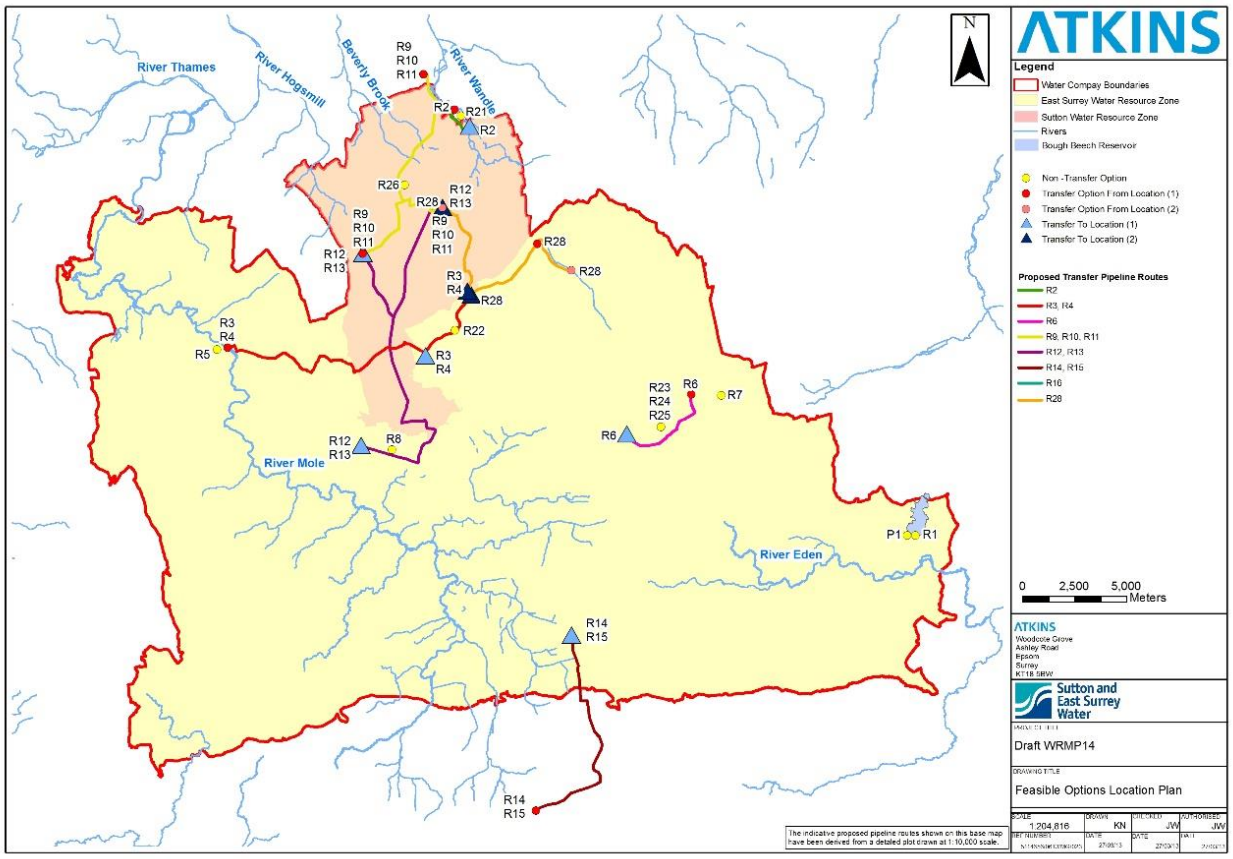
BNG - Total Net unit change (habitat units)	*Further NC and BNG Assessment has been scoped out due to the current available option information. The option is unlikely to results in any potential impacts based on available information. Any additional impacts within the option ZoI will be captured within the SEA, WFD & resilience assessments.*
BNG - Total Percentage change	0
HRA	Uncertain Effects - No potential effect pathways have been identified between the option and the N2k site. Construction of the new pipeline infrastructure for the option appears to be located within the footprint of existing roads within a highly urbanised area, therefore any risk of pollution from the construction is considered unlikely. Increased abstraction as a result of the scheme has the potential to impact on qualifying habitats.
Natural Capital assessment	*Further NC and BNG Assessment has been scoped out due to the current available option information. The option is unlikely to results in any potential impacts based on available information. Any additional impacts within the option ZoI will be captured within the SEA, WFD & resilience assessments.*
WFD - Max impact score per waterbody	3 - GB106039023460:Wandle (Croydon to Wandsworth) and the Graveney



D.4. 15 Ml/d bulk supply from Thames Water to SESW at Merton

Option ID	SES_SES_HI-TFR_LON_ALL_r10
ID Name	R10
Option name	15 Ml/d bulk supply from Thames Water to SESW at Merton
Option description	The scheme is a 15 Ml/d bulk transfer from Thames Water's London ring main into the north of SES Water's area at Merton.
Option type	Bulk transfer
ADO increase at 1in500-yr (Ml/d)	15
PDO increase at 1in500-yr (Ml/d)	15
Lead-in time (yrs)	10
Risks and uncertainties	
Risk to drinking water quality	Medium - different type of disinfection in imported water
Dependencies	Mutually exclusive with the other two size variants of this option (R9, R11)
Option constraints	
Customers' support	TBC if option selected prior to 2050
Flexibility of the option to adapt to future uncertainty	TBC if option selected prior to 2050
Capex last year	10
Opex start year	11
Total base Capex (£)	49,400,000
Max fixed Opex (£)	159,000
Max variable Opex (£/Ml)	908
Total Embodied Carbon (tCO2e)	2092
WRMP Plan type - BVP	N/A
WRMP Plan type - LCP	N/A
WRMP Plan type - LCP SWS Delay	N/A
WRMP Plan type - BESP	N/A
SEA construction effects	Positive 1 Negative -19
SEA residual construction effects	Positive 1 Negative -12
BNG - Total Net unit change (habitat units)	*Further NC and BNG Assessment has been scoped out due to the current available option information. The option is unlikely to result in any further potential impacts due to the construction of the new pipeline within existing roadways and the construction on previous developed land. Any additional impacts within the option ZoI will be captured within the SEA, WFD & resilience assessments.*

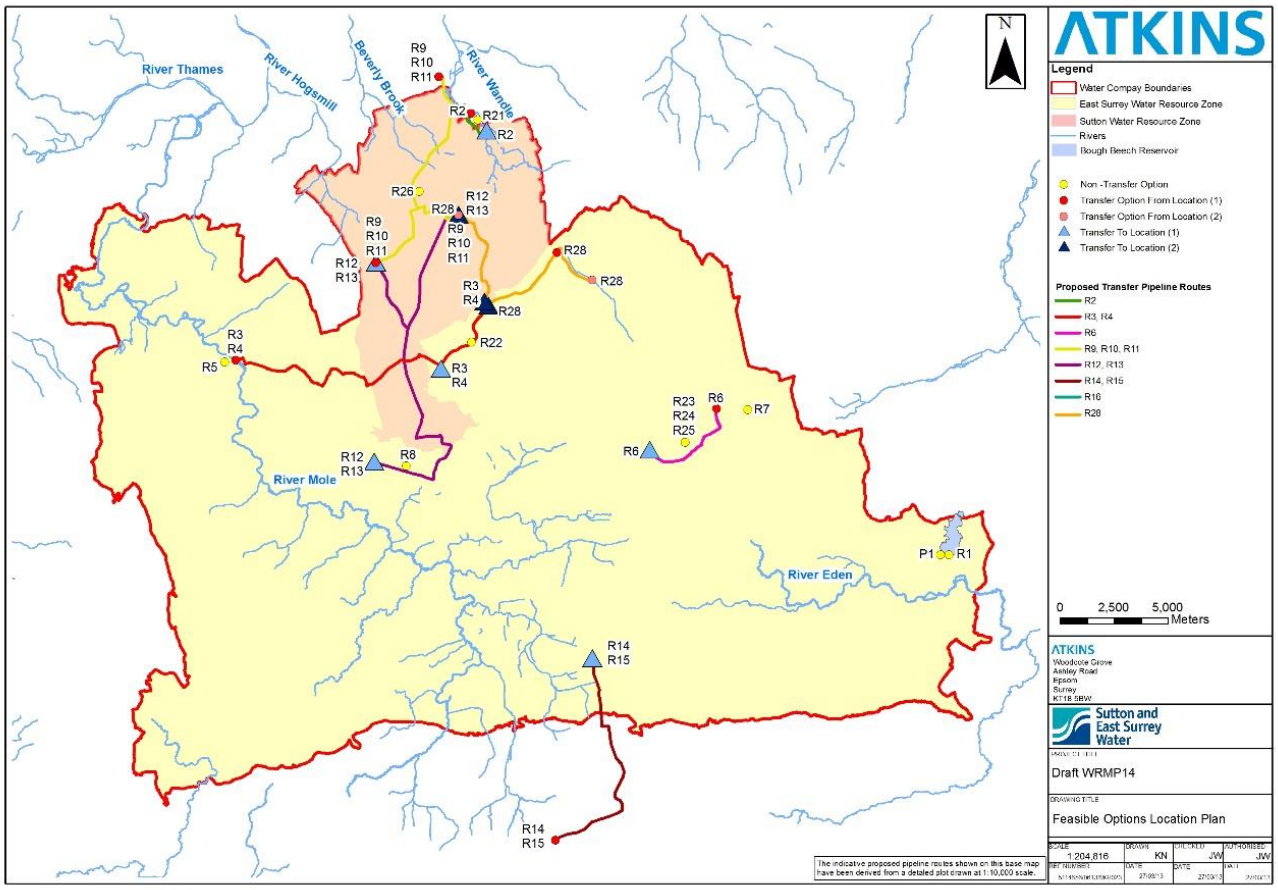
BNG - Total Percentage change	0
HRA	No Likely Significant Effect - due to the distance between the option and N2k sites (2.5km/5.0km) it is considered unlikely for the N2k site to be at risk from physical damage or non-physical disturbance from construction or operation of the option. Considering the highly urbanised and modified landscape isolating the N2k site from the option, it is considered highly unlikely that the option will cause a significant effect on the qualifying species Stag beetle or its habitat of decaying timber.
Natural Capital assessment	*Further NC and BNG Assessment has been scoped out due to the current available option information. The option is unlikely to result in any further potential impacts due to the construction of the new pipeline within existing roadways and the construction on previous developed land. Any additional impacts within the option ZoI will be captured within the SEA, WFD & resilience assessments.*
WFD - Max impact score per waterbody	1 - GB106039023460:Wandle (Croydon to Wandsworth) and the Graveney 1 - GB106039022850:Beverley Brook (Motspur Park to Thames) and Pyl Brook at West Barnes 1 - GB106039017440:Hogsmill



D.5. North Downs Confined Chalk AR extension 2 (new borehole on SE side of Football Club)

Option ID	SES_SES_HI-GRW_ALL_ALL_r21
ID Name	R21
Option name	North Downs Confined Chalk AR extension 2 (new borehole on SE side of Football Club)
Option description	The scheme comprises the drilling of another borehole approximately halfway between Goatbridge and Bishopsford Road boreholes.
Option type	Supply
ADO increase at 1in500-yr (Ml/d)	0
PDO increase at 1in500-yr (Ml/d)	5
Lead-in time (yrs)	2
Risks and uncertainties	Land availability and unknown yield/water quality as requires new borehole.
Risk to drinking water quality	Medium – as the scheme requires a new borehole, the water quality is unproven. Although, as the borehole is within a confined aquifer, it is expected to have similar water quality to existing sources
Dependencies	None
Option constraints	
Customers' support	TBC if option selected prior to 2050
Flexibility of the option to adapt to future uncertainty	TBC if option selected prior to 2050
Capex last year	2
Opex start year	3
Total base Capex (£)	2,220,000
Max fixed Opex (£)	10,400
Max variable Opex (£/Ml)	55
Total Embodied Carbon (tCO2e)	216
WRMP Plan type - BVP	N/A
WRMP Plan type - LCP	N/A
WRMP Plan type - LCP SWS Delay	N/A
WRMP Plan type - BESP	N/A
SEA construction effects	TBC
SEA residual construction effects	TBC
BNG - Total Net unit change (habitat units)	-3.49
BNG - Total Percentage change	-0.243

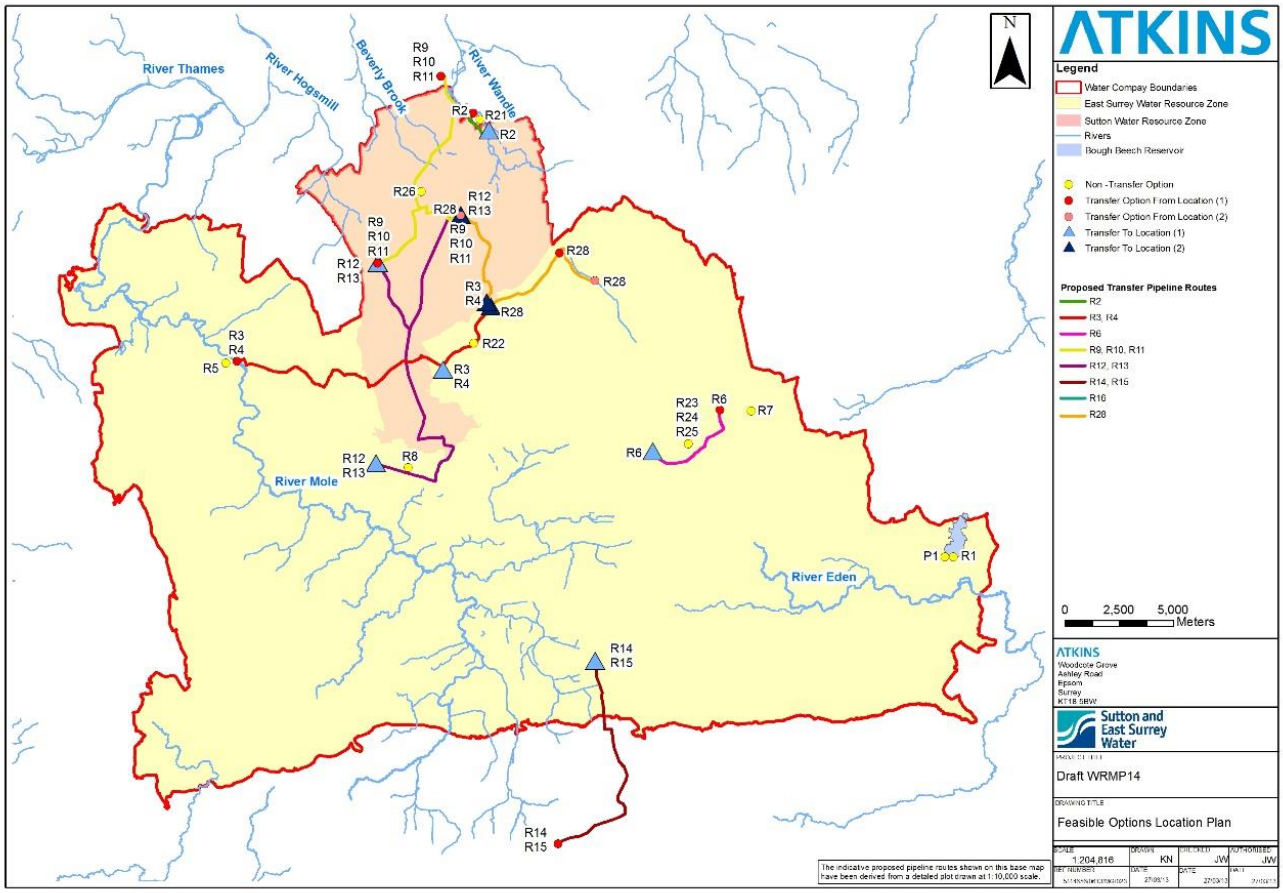
HRA	Likely Significant Effect – The option footprint is unclear but appears to encompass N2k site. The site supports groundwater-dependent habitats which are at risk from increased abstraction from additional borehole drilling. Dependent on the footprint of the option, there is potential for both physical and non-physical effects to the N2k site from construction activities damaging habitat through loss, degradation, pollution etc. Any degradation to ground water quality and availability on site is likely to negatively effect the Annex I qualifying habitats and associated Annex II qualifying species, Bechstein's bat and Great crested newts.
Natural Capital assessment	The option will likely cause the temporary loss of stock during construction.
WFD - Max impact score per waterbody	2 - GB106039017621:Mole (Horley to Hersham) 2 - GB106039017610:Rye Brook at Ashtead



D.6. Duckpit Wood replacement borehole

Option ID	SES_SES_HI-GRW_ALL_ALL_r23
ID Name	R23
Option name	Duckpit Wood replacement borehole
Option description	The scheme involves the construction of a new Lower Greensand borehole to replace Duckpit Wood and Paines Hill spring licences.
Option type	Supply
ADO increase at 1in500-yr (Ml/d)	1.37
PDO increase at 1in500-yr (Ml/d)	2.14
Lead-in time (yrs)	8
Risks and uncertainties	Land availability and unknown yield/water quality as requires new borehole. The SEA of the Duckpit Wood option includes reference to the landfill in close proximity to the site. This has been reflected both within the 'Soil' SEA topic ('To Protect and enhance the functionality, quantity and quality of soils') and the 'Population and Human Health' SEA topic ('To maintain and enhance the health and wellbeing of the local community, including economic and social wellbeing'). Appropriate mitigation has been identified and presented within the SEA, including the need for further investigation. Pre and post mitigation scores are considered reflective of the risk.
Risk to drinking water quality	High - unproven as new borehole
Dependencies	The option is mutually exclusive with R24. If R6 is implemented as well as R23, R6 requires its own 3.4 Ml/d independent licence.
Option constraints	
Customers' support	TBC if option selected prior to 2050
Flexibility of the option to adapt to future uncertainty	TBC if option selected prior to 2050
Capex last year	8
Opex start year	9
Total base Capex (£)	5,150,000
Max fixed Opex (£)	19,800
Max variable Opex (£/Ml)	35
Total Embodied Carbon (tCO2e)	604
WRMP Plan type - BVP	N/A
WRMP Plan type - LCP	2068
WRMP Plan type - LCP SWS Delay	N/A
WRMP Plan type - BESP	2068
SEA construction effects	Positive 3 Negative -34

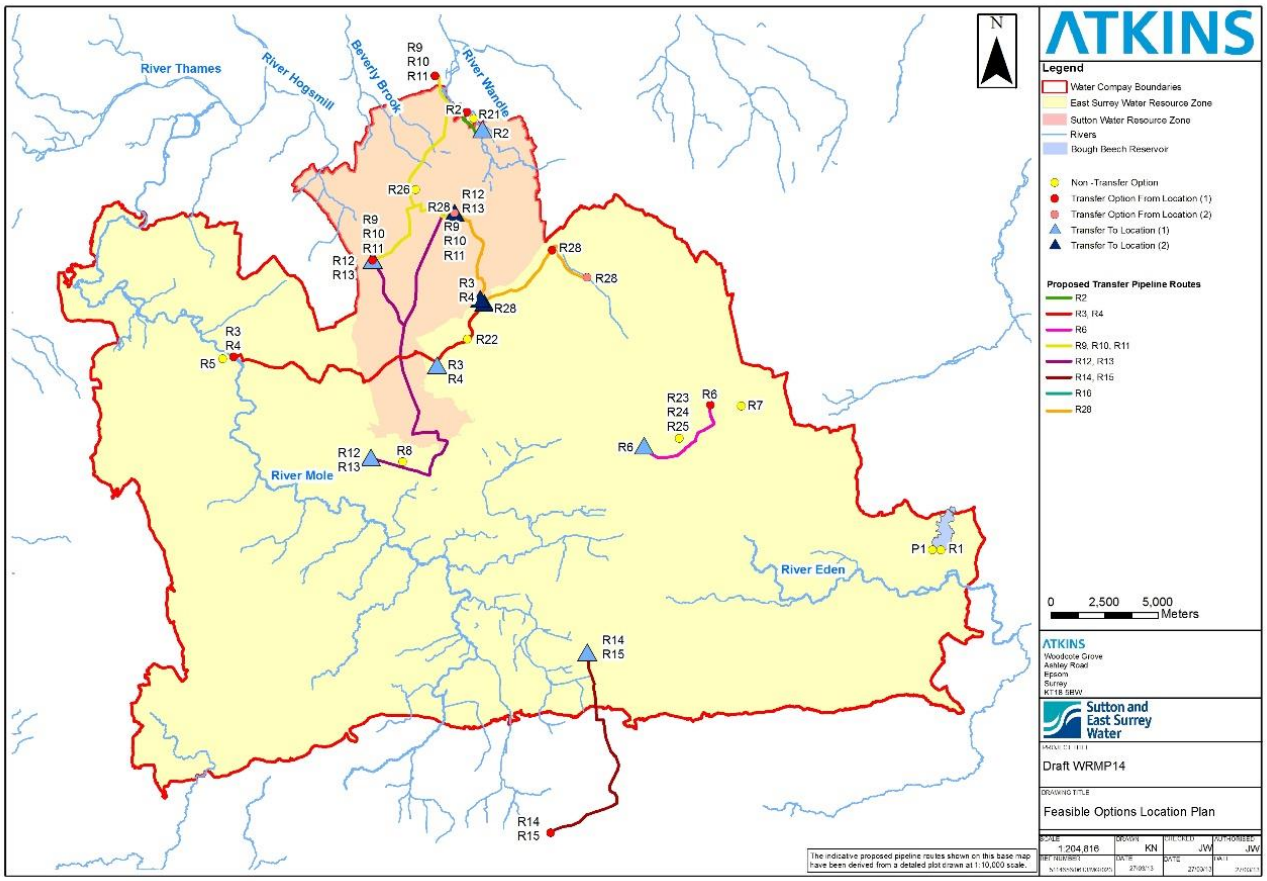
SEA residual construction effects	Positive 3 Negative -30
BNG - Total Net unit change (habitat units)	-3.21
BNG - Total Percentage change	-0.195
HRA	No Likely Significant Effects - No N2k sites within a significant distance (9km) of the scheme. No likely significant effects from the option construction or operation.
Natural Capital assessment	The option will likely cause the temporary loss of stock during construction.
WFD - Max impact score per waterbody	3 - GB106039017621:Mole (Horley to Hersham) 3 - GB106040018630:Upper Eden



D.7. Outwood Lane

Option ID	SES_SES_HI-GRW_ALL_ALL_r22
ID Name	R22
Option name	Outwood Lane
Option description	This scheme seeks an increase in daily licence from 3.02 Ml/d to 8 Ml/d and requires an equivalent increase in pump capacity. The hydraulic capacity of the source has been proved during previous test pumping, however, analysis has shown that during drought conditions (1 in 500 year event) the peak DO would be limited to 5.97 Ml/d. The increase in PDO associated with the scheme would be 2.96 Ml/d.
Option type	Supply
ADO increase at 1in500-yr (Ml/d)	2.66
PDO increase at 1in500-yr (Ml/d)	2.83
Lead-in time (yrs)	1
Risks and uncertainties	Implementation of this option will slightly lower the groundwater levels in the unconfined Chalk aquifer in the vicinity of the abstraction. These groundwater heads ultimately drive the groundwater gradient that results in springflow 6 - 8 km north at Waddon Ponds and Carshalton Ponds. As observed during historical pumping tests, due to the high transmissivities in the Chalk, particularly along the dry valleys, and the large distance to these ponds, any lowering of groundwater levels in the vicinity of the pond springs as result of this option is likely to be very small. However, it is acknowledged that these small groundwater level changes may result in changes to springflow rate and duration. The risk of reduced springflow adversely impacting on the ecological and amenity value of the River Wandle is partially mitigated by licence conditions preventing abstraction from certain sources (including this source) unless SES Water maintains a minimum residual flow from Carshalton Ponds by recirculating the river flow from the Beddington STW confluence. Previous WINEP and Drought Permit Environment Assessment investigations of SES Water's and Thames Water's existing abstractions closer to the ponds have demonstrated a complex surface water and groundwater interactions without a directly proportional impact on springflow. Improved insight into the impact of this option is likely to require groundwater modelling. The Environment Agency's London Basin Model has only just been updated with better calibration in the North Downs area and with the option not selected until 2049, SES Water proposes to undertake further investigation as part of future WINEP.
Risk to drinking water quality	Low - existing source
Dependencies	None
Option constraints	
Customers' support	TBC if option selected prior to 2050
Flexibility of the option to adapt to future uncertainty	TBC if option selected prior to 2050
Capex last year	1
Opex start year	2
Total base Capex (£)	696,00

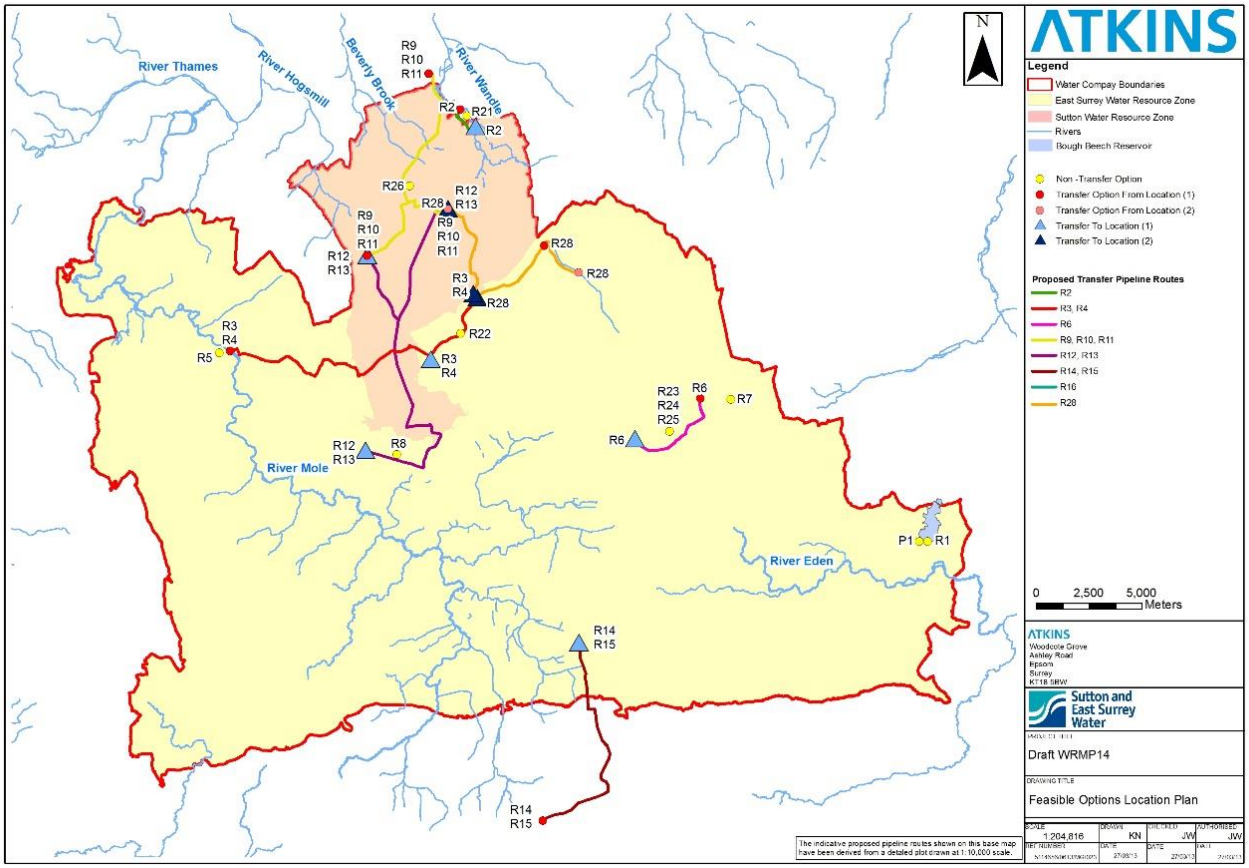
Max fixed Opex (£)	2,400
Max variable Opex (£/Ml)	33
Total Embodied Carbon (tCO2e)	20
WRMP Plan type - BVP	2049
WRMP Plan type - LCP	2050
WRMP Plan type - LCP SWS Delay	2052
WRMP Plan type - BESP	2051
SEA construction effects	Positive 2 Negative -10
SEA residual construction effects	Positive 2 Negative -10
BNG - Total Net unit change (habitat units)	*Further NC and BNG Assessment has been scoped out due to the current available option information. The option is unlikely to results in any potential impacts based on available information. Any additional impacts within the option ZoI will be captured within the SEA, WFD & resilience assessments.*
BNG - Total Percentage change	0
HRA	No Likely Significant Effects - No effect pathways have been identified between the option and the N2k site qualifying species. No new infrastructure is required for the scheme and the scheme is unlikely to significantly affect groundwater availability to the ground-water dependent qualifying habitats on the N2k site considering the distance.
Natural Capital assessment	*Further NC and BNG Assessment has been scoped out due to the current available option information. The option is unlikely to results in any potential impacts based on available information. Any additional impacts within the option ZoI will be captured within the SEA, WFD & resilience assessments.*
WFD - Max impact score per waterbody	3 - GB106039023460:Wandle (Croydon to Wandsworth) and the Graveney


River Thames
River Hogsmill
Beverly Brook
River Wandle
River Mole
River Eden
R9
R10
R11
R2
R21
R26
R28
R12
R13
R3
R4
R22
R5
R23
R24
R25
R6
R7
R8
P1
R1
R14
R15
N
ATKINS
Legend
Water Compay Boundaries
East Surrey Water Resource Zone
Sutton Water Resource Zone
Rivers
Bough Beech Reservoir
Non -Transfer Option
Transfer Option From Location (1)
Transfer Option From Location (2)
Transfer To Location (1)
Transfer To Location (2)
Proposed Transfer Pipeline Routes
R2
R3, R4
R6
R9, R10, R11
R12, R13
R14, R15
R10
R28
0 2,500 5,000
Meters
ATKINS
Woodcote Grove
Ashley Road
Epsom
Surrey
KT18 5BW
Sutton and East Surrey Water
Draft WRMP14
Feasible Options Location Plan
1:204,816
KN
JW
JW
The indicative proposed pipeline routes shown on this base map have been derived from a detailed plot drawn at 1:10,000 scale.

D.8. Duckpit Wood hydrogen sulphide treatment

Option ID	SES_SES_HI-ROC_ALL_ALL_r24
ID Name	R24
Option name	Duckpit Wood hydrogen sulphide treatment
Option description	The scheme aims to provide hydrogen sulphide treatment to enable the Duckpit Wood source to come back into supply.
Option type	Supply
ADO increase at 1in500-yr (Ml/d)	0
PDO increase at 1in500-yr (Ml/d)	0.77
Lead-in time (yrs)	3
Risks and uncertainties	Current hydrogen sulphide concentrations are unknown as the source has been out of service. Test pumping and characterisation of water quality trends would be required to determine viability of treatment. The SEA of the Duckpit Wood option includes reference to the landfill in close proximity to the site. This has been reflected both within the 'Soil' SEA topic ('To Protect and enhance the functionality, quantity and quality of soils') and the 'Population and Human Health' SEA topic ('To maintain and enhance the health and wellbeing of the local community, including economic and social wellbeing'). Appropriate mitigation has been identified and presented within the SEA, including the need for further investigation. Pre and post mitigation scores are considered reflective of the risk.
Risk to drinking water quality	High - extent of treatment not certain
Dependencies	The option is mutually exclusive with R23.
Option constraints	
Customers' support	TBC if option selected prior to 2050
Flexibility of the option to adapt to future uncertainty	TBC if option selected prior to 2050
Capex last year	3
Opex start year	4
Total base Capex (£)	1,260,000
Max fixed Opex (£)	24,000
Max variable Opex (£/Ml)	35
Total Embodied Carbon (tCO2e)	186
WRMP Plan type - BVP	N/A
WRMP Plan type - LCP	N/A
WRMP Plan type - LCP SWS Delay	N/A
WRMP Plan type - BESP	N/A
SEA construction effects	Positive 3 Negative -33

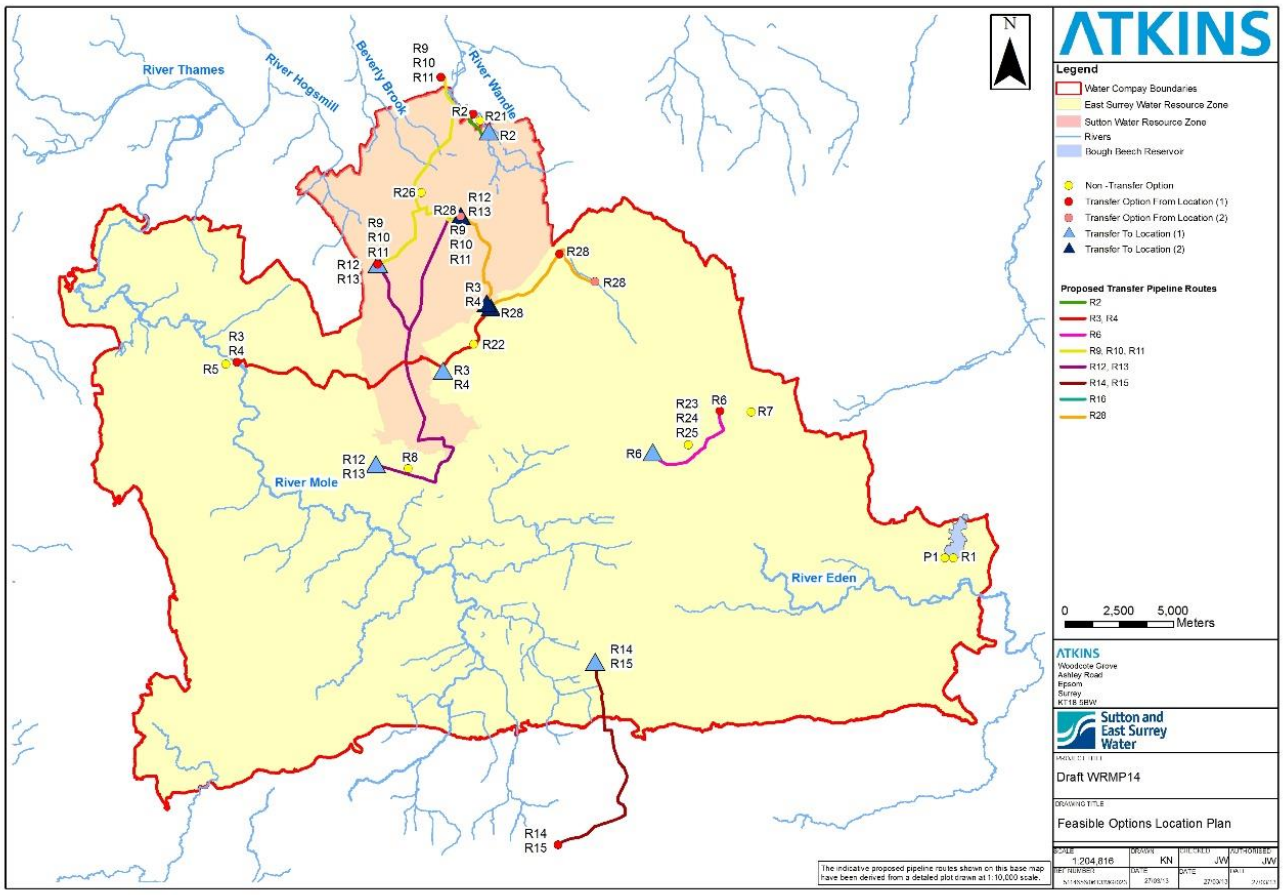
SEA residual construction effects	Positive 3 Negative -29
BNG - Total Net unit change (habitat units)	*Further NC and BNG Assessment has been scoped out due to the current available option information. The option is unlikely to results in any potential impacts based on available information. Any additional impacts within the option ZoI will be captured within the SEA, WFD & resilience assessments.*
BNG - Total Percentage change	0
HRA	No Likely Significant Effect - No N2k sites within a significant distance (9km) of the scheme. No likely significant effects from the option construction or operation.
Natural Capital assessment	*Further NC and BNG Assessment has been scoped out due to the current available option information. The option is unlikely to results in any potential impacts based on available information. Any additional impacts within the option ZoI will be captured within the SEA, WFD & resilience assessments.*
WFD - Max impact score per waterbody	0 - GB106040018640:Gibbs Brook 0 - GB106040018630:Upper Eden



D.9. North Downs Unconfined Chalk AR (recharge at Eyhurst Park, Kingswood)

Option ID	SES_SES_HI-GRW_ALL_ALL_r3
ID Name	R3
Option name	North Downs Unconfined Chalk AR (recharge at Eyhurst Park, Kingswood)
Option description	This scheme seeks to abstract groundwater from Leatherhead during groundwater highs and artificially recharge down into the unconfined chalk to support summer groundwater levels further north (i.e. Chipstead, Holly Lane, Woodmansterne, Smitham and Purley). It is expected that the recharge of the aquifer and resulting increase in peak period DO would be approximately 5 Ml/d.
Option type	Supply
ADO increase at 1in500-yr (Ml/d)	0
PDO increase at 1in500-yr (Ml/d)	5
Lead-in time (yrs)	12
Risks and uncertainties	Yield and water quality of an AR scheme is highly uncertain and requires multiple phases of cycle testing after construction to prove yield and water quality before treatment requirements can be determined and provided.
Risk to drinking water quality	High - AR scheme water quality very uncertain until proven.
Dependencies	None
Option constraints	Needs construction and testing before DO benefit can be proven.
Customers' support	TBC if option selected prior to 2050
Flexibility of the option to adapt to future uncertainty	TBC if option selected prior to 2050
Capex last year	12
Opex start year	13
Total base Capex (£)	22,100,000
Max fixed Opex (£)	88,700
Max variable Opex (£/Ml)	42
Total Embodied Carbon (tCO2e)	2461
WRMP Plan type - BVP	N/A
WRMP Plan type - LCP	N/A
WRMP Plan type - LCP SWS Delay	N/A
WRMP Plan type - BESP	N/A
SEA construction effects	Positive 6 Negative -32
SEA residual construction effects	Positive 6 Negative -31

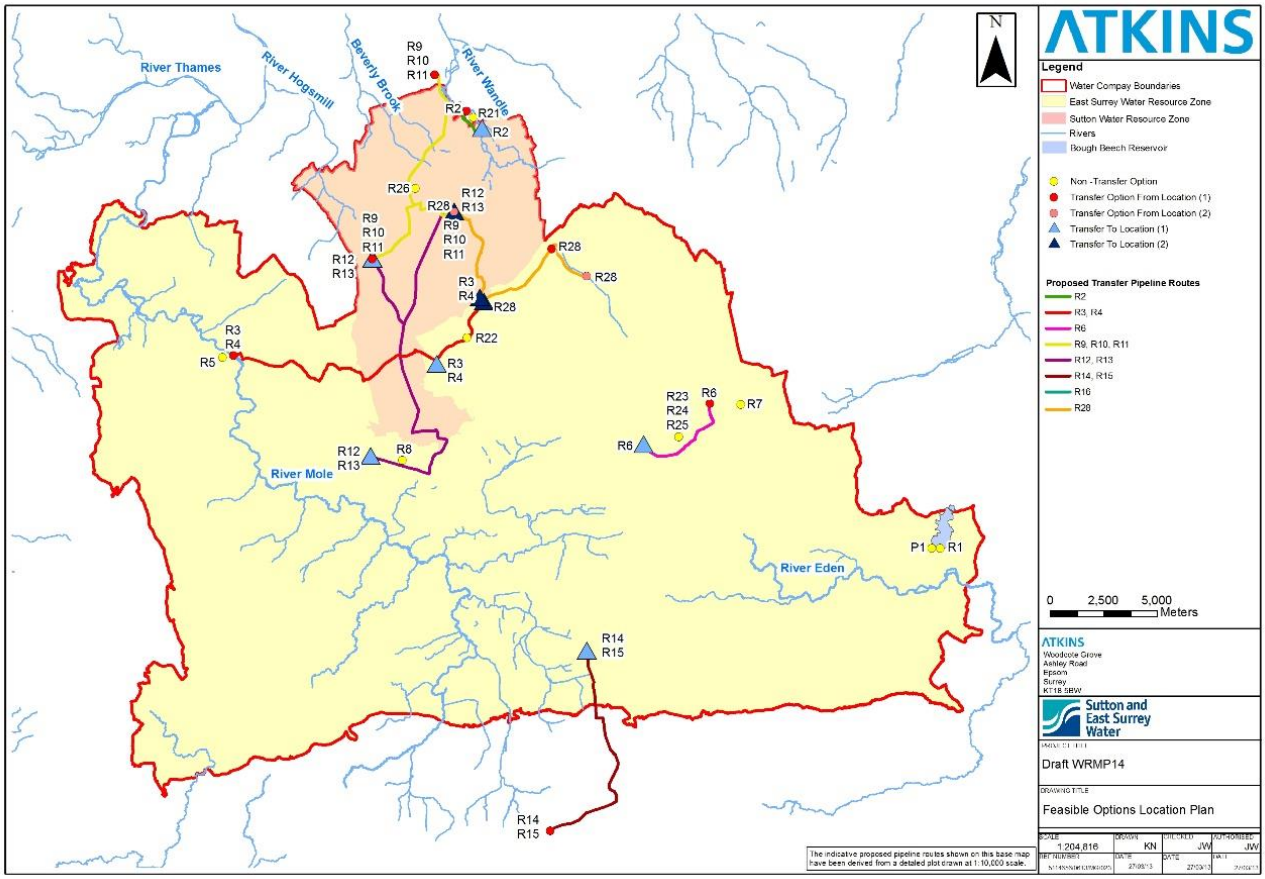
BNG - Total Net unit change (habitat units)	-48.56
BNG - Total Percentage change	-0.367
HRA	Likely Significant Effect – The scheme is likely to be located within or directly adjacent to the N2k site. Habitats within the site are groundwater-dependent and are therefore at risk from abstraction at the site. Increased fluctuations in the water-availability on the site are likely to have a detrimental impact on the qualifying habitats and the habitats supporting the qualifying species of the site. There is also a risk of direct habitat loss as a result of the construction of a new pumping station and transfer main within or directly adjacent to the N2k site. Construction activities are also likely to pose a risk of air, water, dust, water and light pollution to the site which may impact and disturb the qualifying habitats and species.
Natural Capital assessment	The option will likely cause the temporary loss of stock during construction.
WFD - Max impact score per waterbody	2 - GB106039017621:Mole (Horley to Hersham) 2 - GB106039017440:Hogsmill



D.10. North Downs LGS ASR (recharge at Eyhurst Park, Kingswood)

Option ID	SES_SES_HI-GRW_ALL_ALL_r4
ID Name	R4
Option name	North Downs LGS ASR (recharge at Eyhurst Park, Kingswood)
Option description	This scheme seeks to abstract groundwater from Leatherhead during groundwater highs and artificially recharge down into the unconfined chalk to support summer groundwater levels further north (i.e. Chipstead, Holly Lane, Woodmansterne, Smitham and Purley). It is expected that the recharge of the aquifer and resulting increase in peak period DO would be approximately 2.5 Ml/d.
Option type	Supply
ADO increase at 1in500-yr (Ml/d)	0
PDO increase at 1in500-yr (Ml/d)	0.77
Lead-in time (yrs)	12
Risks and uncertainties	Yield and water quality of an AR scheme is highly uncertain and requires multiple phases of cycle testing after construction to prove yield and water quality before treatment requirements can be determined and provided.
Risk to drinking water quality	High - AR scheme water quality very uncertain until proven.
Dependencies	None
Option constraints	Needs construction and testing before DO benefit can be proven.
Customers' support	TBC if option selected prior to 2050
Flexibility of the option to adapt to future uncertainty	TBC if option selected prior to 2050
Capex last year	12
Opex start year	13
Total base Capex (£)	23,700,000
Max fixed Opex (£)	104,000
Max variable Opex (£/Ml)	42
Total Embodied Carbon (tCO2e)	1900
WRMP Plan type - BVP	N/A
WRMP Plan type - LCP	N/A
WRMP Plan type - LCP SWS Delay	N/A
WRMP Plan type - BESP	N/A
SEA construction effects	Positive 1 Negative -17
SEA residual construction effects	Positive 1 Negative -16

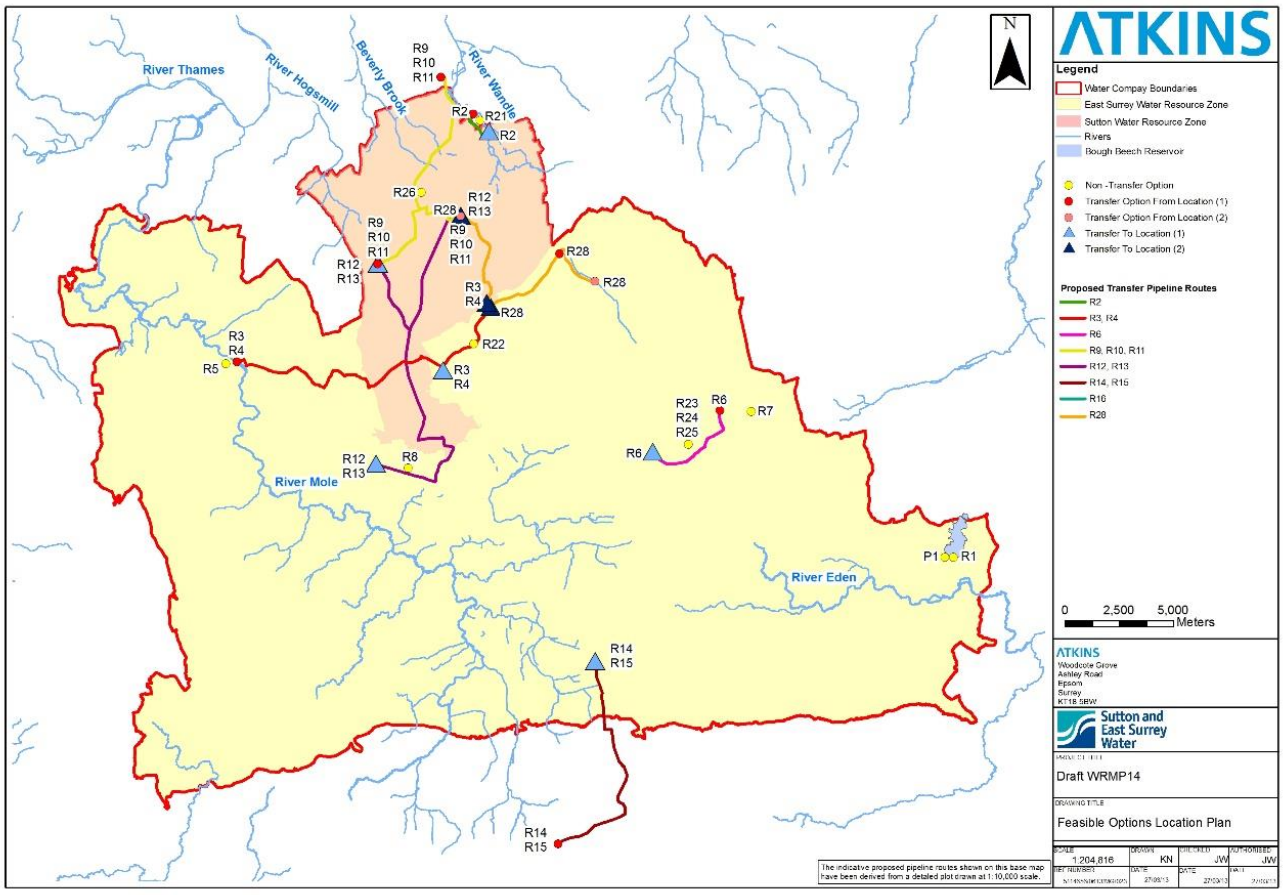
BNG - Total Net unit change (habitat units)	-97.99
BNG - Total Percentage change	-0.617
HRA	Likely Significant Effect - Scheme is likely to be located within or directly adjacent to the N2k site. Habitats within the site are groundwater-dependent and are therefore at risk from abstraction at the site. Increased fluctuations in the water-availability on the site are likely to have a detrimental impact on the qualifying habitats and the habitats supporting the qualifying species of the site. There is also a risk of direct habitat loss as a result of the construction of a new pumping station and transfer main within or directly adjacent to the N2k site. Construction activities are also likely to pose a risk of air, water, dust, water and light pollution to the site which may impact and disturb the qualifying habitats and species.
Natural Capital assessment	The option will likely cause the temporary loss of stock during construction.
WFD - Max impact score per waterbody	2 - GB106039017621:Mole (Horley to Hersham) 2 - GB106039017440:Hogsmill 1 - GB106039023460:Wandle (Croydon to Wandsworth) and the R.Gr



D.11. 5 Ml/d bulk supply from SEW RZ2 (Maidenbower/Whitely Hill) to Outwood PS

Option ID	SES_SES_HI-TFR_RZ2_ALL_r14
ID Name	R14
Option name	5 Ml/d bulk supply from SEW RZ2 (Maidenbower/Whitely Hill) to Outwood PS
Option description	The scheme is a 5 Ml/d bulk transfer from South East Water's (SEW's) RZ2 at Whitley Hill into SESW's WRZ at Outwood. The scheme would require a new treated water transfer main to transport water north to Outwood would be required, and a new softening plant at Outwood to soften the water prior to distribution throughout the SESW's WRZ. A pumping station would not be required as water can flow via gravity (the head drop is approximately -90m). This variant of the option is not mutually exclusive with the 10 Ml/d option, i.e. there could be in total a 15 Ml/d transfer.
Option type	Bulk transfer
ADO increase at 1in500-yr (Ml/d)	5
PDO increase at 1in500-yr (Ml/d)	5
Lead-in time (yrs)	5
Risks and uncertainties	
Risk to drinking water quality	Medium - mixing of water from different water companies and WRZs.
Dependencies	None
Option constraints	
Customers' support	TBC if option selected prior to 2050
Flexibility of the option to adapt to future uncertainty	TBC if option selected prior to 2050
Capex last year	5
Opex start year	6
Total base Capex (£)	14,600,000
Max fixed Opex (£)	121,000
Max variable Opex (£/Ml)	1353
Total Embodied Carbon (tCO2e)	1125
WRMP Plan type - BVP	N/A
WRMP Plan type - LCP	N/A
WRMP Plan type - LCP SWS Delay	N/A
WRMP Plan type - BESP	N/A
SEA construction effects	Positive 6 Negative -32

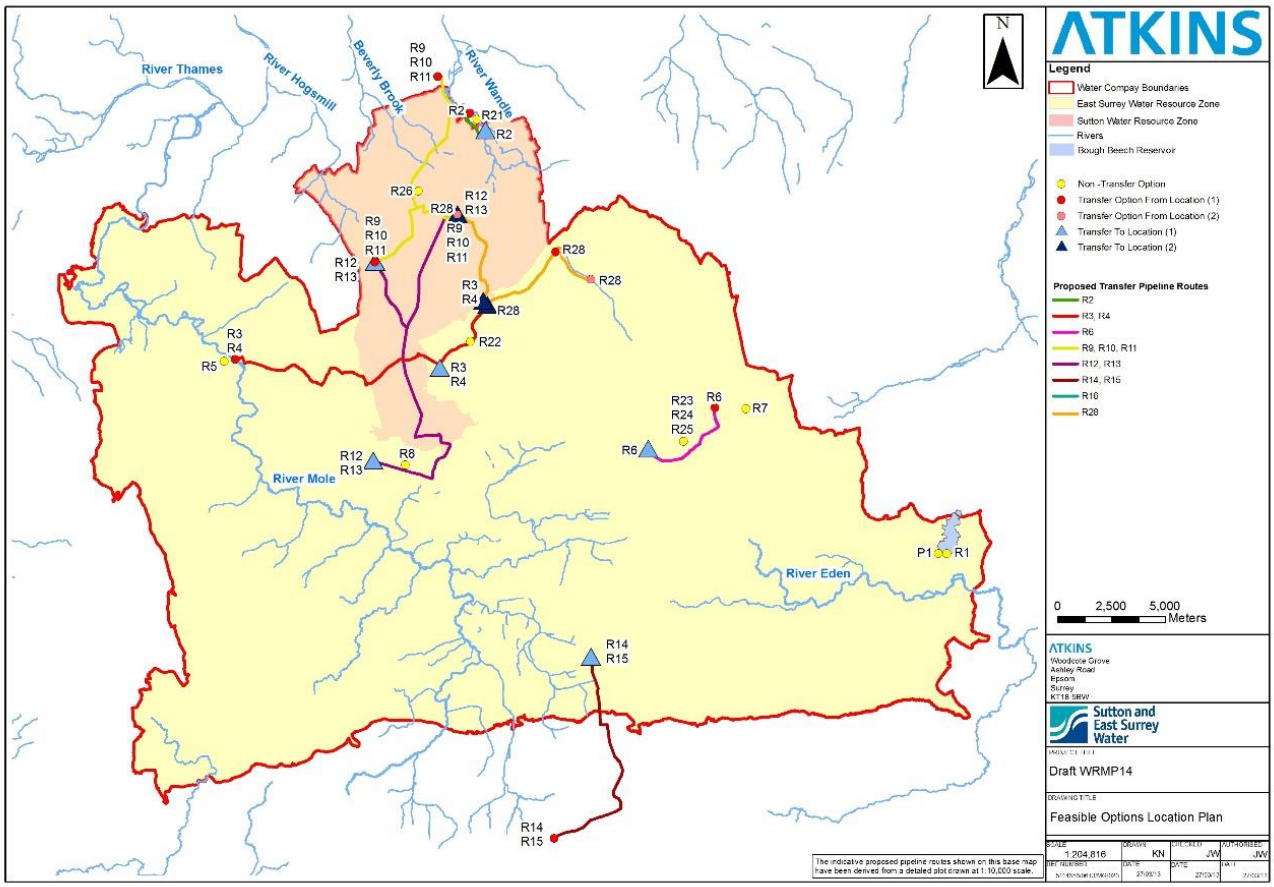
SEA residual construction effects	Positive 6 Negative -31
BNG - Total Net unit change (habitat units)	-16.8
BNG - Total Percentage change	-0.192
HRA	No Likely Significant Effect - Due to the significant distance between the option (over 3 km) and the N2k site, and the localised nature of the construction, the site and its qualifying species and features are considered to not be at risk from the development. No additional extraction is required for the scheme and so water availability is not likely to be affected at the N2k site.
Natural Capital assessment	The option will likely cause the temporary and permanent loss of stock during construction.
WFD – Max impact score per waterbody	1 – GB107041018000:Shell Brook upstream of Ardingly Reservoir 1 – GB107041012740:Cockhaise Brook 1 – GB106040018070:Medway at Weir Wood 1 – GB106040018660:Eden Brook 1 – GB106040018340:Ray Brook 1 – GB106039017520:Burstow Stream 1 – GB106039017500:Tilgate Brook and Gatwick Stream at Crawley 1 – GB106039017450:Stanford Brook



D.12. Enhance borehole output (Lower Greensand) – Water Lane increase in pump capacity & pesticide treatment

Option ID	SES_SES_HI-GRW_ALL_ALL_r7
ID Name	R7
Option name	Enhance borehole output (Lower Greensand) – Water Lane increase in pump capacity & pesticide treatment
Option description	The scheme seeks to increase ADO and PDO by increasing pump capacity and lowering pump cut-out at Water lane groundwater source. The scheme aims to remove water quality constraint increasing ADO and PDO to potential yield of the borehole.
Option type	Supply
ADO increase at 1in500-yr (Ml/d)	2.2
PDO increase at 1in500-yr (Ml/d)	2.2
Lead-in time (yrs)	3
Risks and uncertainties	
Risk to drinking water quality	Medium – water quality known although may change in future
Dependencies	None
Option constraints	
Customers' support	TBC if option selected prior to 2050
Flexibility of the option to adapt to future uncertainty	TBC if option selected prior to 2050
Capex last year	3
Opex start year	4
Total base Capex (£)	1,820,000
Max fixed Opex (£)	19,200
Max variable Opex (£/Ml)	31
Total Embodied Carbon (tCO2e)	82
WRMP Plan type - BVP	2062
WRMP Plan type - LCP	2051
WRMP Plan type - LCP SWS Delay	2059
WRMP Plan type - BESP	2055
SEA construction effects	Positive 2 Negative -12
SEA residual construction effects	Positive 2 Negative -12

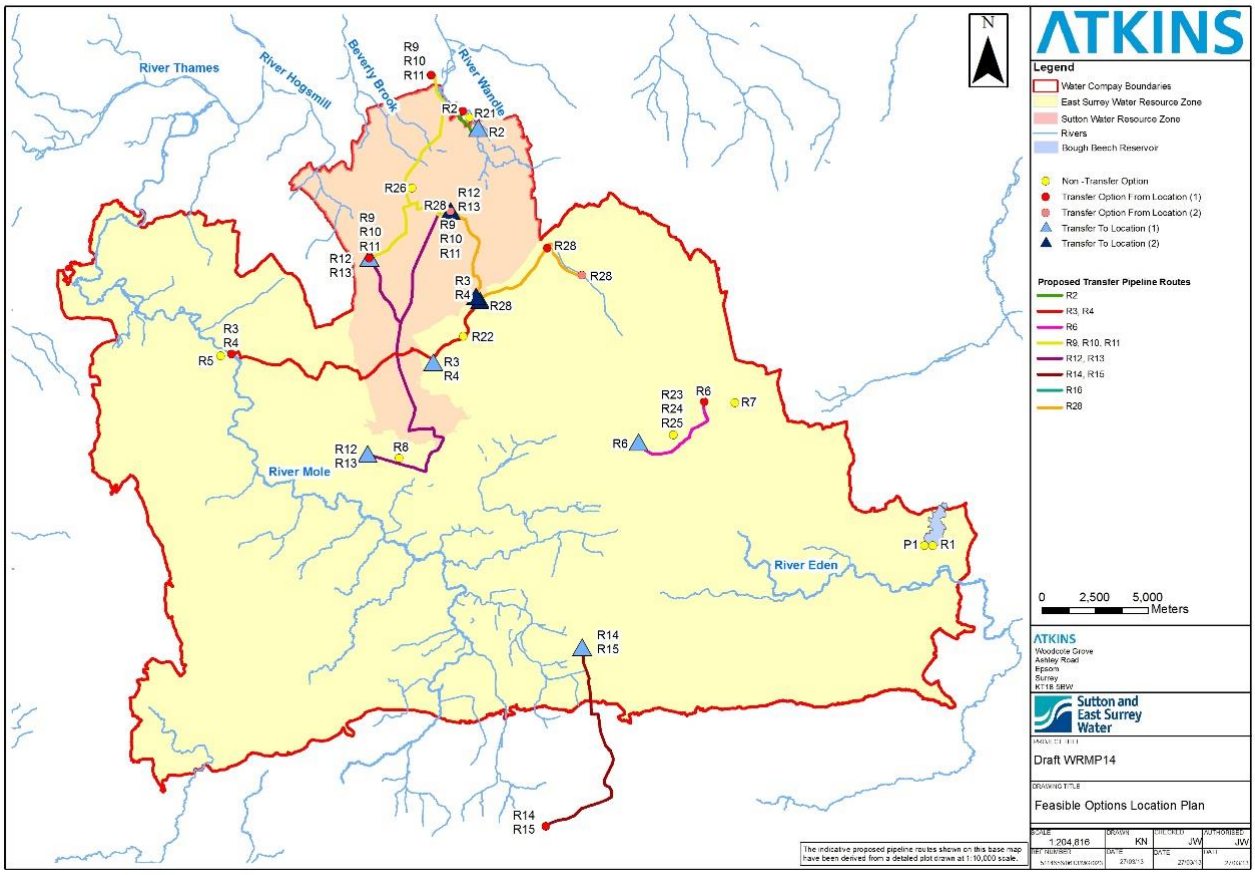
BNG - Total Net unit change (habitat units)	*Further NC and BNG Assessment has been scoped out due to the option type and available option information. The option is not expected to generate any land use change or direct impacts on NC. Any additional impacts within the option ZoI will be captured within the SEA, WFD & resilience assessments.*
BNG - Total Percentage change	0
HRA	No Likely Significant Effects - No N2k sites within a significant distance (14 km) of the scheme. No likely significant effects from the option construction or operation.
Natural Capital assessment	*Further NC and BNG Assessment has been scoped out due to the option type and available option information. The option is not expected to generate any land use change or direct impacts on NC. Any additional impacts within the option ZoI will be captured within the SEA, WFD & resilience assessments.*
WFD - Max impact score per waterbody	3 - GB106040018630:Upper Eden



D.13. Secombe Centre UV

Option ID	SES_SES_HI-LRE_ALL_ALL_r26
ID Name	R26
Option name	Secombe Centre UV
Option description	This scheme provides UV treatment for the Secombe Centre groundwater source which is currently out of supply due to bacti detections on the raw water. Due to the limited footprint available at the Secombe Centre site, the UV treatment plant would be located at Cheam WTW on the 'East Main' which feeds water from Hackbridge, Goatbridge, Woodcote, Oaks, Langley Park, Sutton and Sutton Court Rd boreholes as well as Secombe Centre.
Option type	Supply
ADO increase at 1in500-yr (Ml/d)	2.07
PDO increase at 1in500-yr (Ml/d)	4.54
Lead-in time (yrs)	3
Risks and uncertainties	
Risk to drinking water quality	Low - disinfection solution.
Dependencies	None
Option constraints	
Customers' support	TBC if option selected prior to 2050
Flexibility of the option to adapt to future uncertainty	TBC if option selected prior to 2050
Capex last year	3
Opex start year	4
Total base Capex (£)	1,800,000
Max fixed Opex (£)	39,100
Max variable Opex (£/Ml)	21
Total Embodied Carbon (tCO2e)	575
WRMP Plan type - BVP	2055
WRMP Plan type - LCP	2051
WRMP Plan type - LCP SWS Delay	2068
WRMP Plan type - BESP	2051
SEA construction effects	Positive 2 Negative -18
SEA residual construction effects	Positive 2 Negative -11
BNG - Total Net unit change (habitat units)	*Further NC and BNG Assessment has been scoped out due to the current available option information. Any additional impacts within the option ZoI will be captured within the SEA, WFD & resilience assessments.*

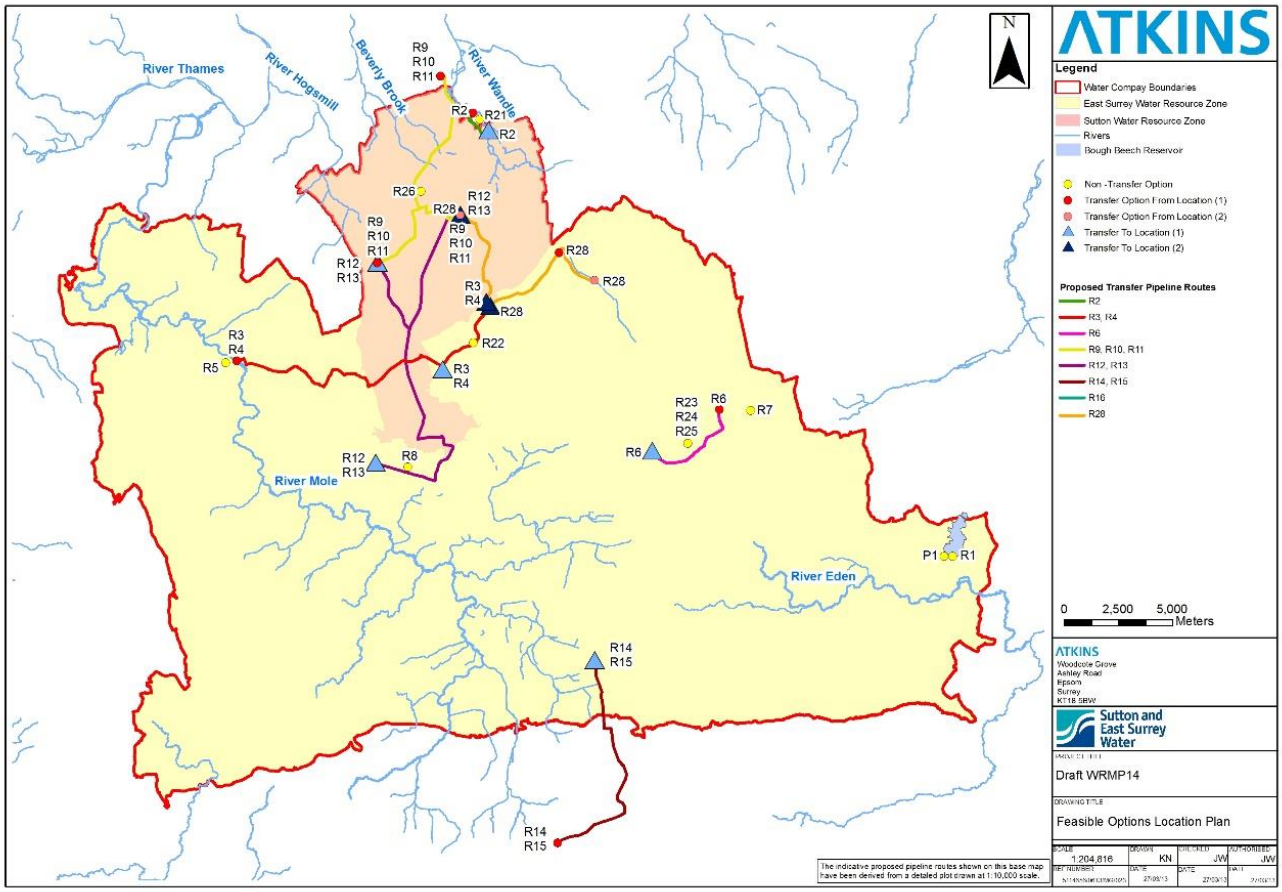
BNG - Total Percentage change	0
HRA	No Likely Significant Effect - The option is considered to be located at enough of a distance (with no effect pathways identified) to be at risk of causing an effect on the N2k sites' qualifying species Stag beetle, or its associated habitat of decaying timber.
Natural Capital assessment	*Further NC and BNG Assessment has been scoped out due to the current available option information. Any additional impacts within the option ZoI will be captured within the SEA, WFD & resilience assessments.*
WFD - Max impact score per waterbody	0 - GB106039017450:Stanford Brook 2 - GB106039017520:Burstow Stream



D.14. Upgrade WTW (Lower Greensand) - The Clears ammonia and pesticide treatment

Option ID	SES_SES_HI-ROC_ALL_ALL_r8
ID Name	R8
Option name	Upgrade WTW (Lower Greensand) - The Clears ammonia and pesticide treatment
Option description	The scheme provides an upgrade to the Lower Greensands WTW. The Cliftons Lane Licence Group (Cliftons Lane, Buckland and The Clears) ADO is constrained by combination of DAPWL (Cliftons Lane) and water quality (Buckland) but is only 1.6 Ml/d short of licence based on difference between daily average licence and abstraction returns from 2010 2016, so there is little scope for a significant increase in ADO.
Option type	Supply
ADO increase at 1in500-yr (Ml/d)	0.45
PDO increase at 1in500-yr (Ml/d)	0.46
Lead-in time (yrs)	3
Risks and uncertainties	
Risk to drinking water quality	Medium – current water quality is known although this may change in future
Dependencies	None
Option constraints	
Customers' support	TBC if option selected prior to 2050
Flexibility of the option to adapt to future uncertainty	TBC if option selected prior to 2050
Capex last year	3
Opex start year	4
Total base Capex (£)	2,430,000
Max fixed Opex (£)	33,900
Max variable Opex (£/Ml)	47
Total Embodied Carbon (tCO2e)	410
WRMP Plan type - BVP	N/A
WRMP Plan type - LCP	2073
WRMP Plan type - LCP SWS Delay	N/A
WRMP Plan type - BESP	N/A
SEA construction effects	Positive 2 Negative -25
SEA residual construction effects	Positive 2 Negative -21

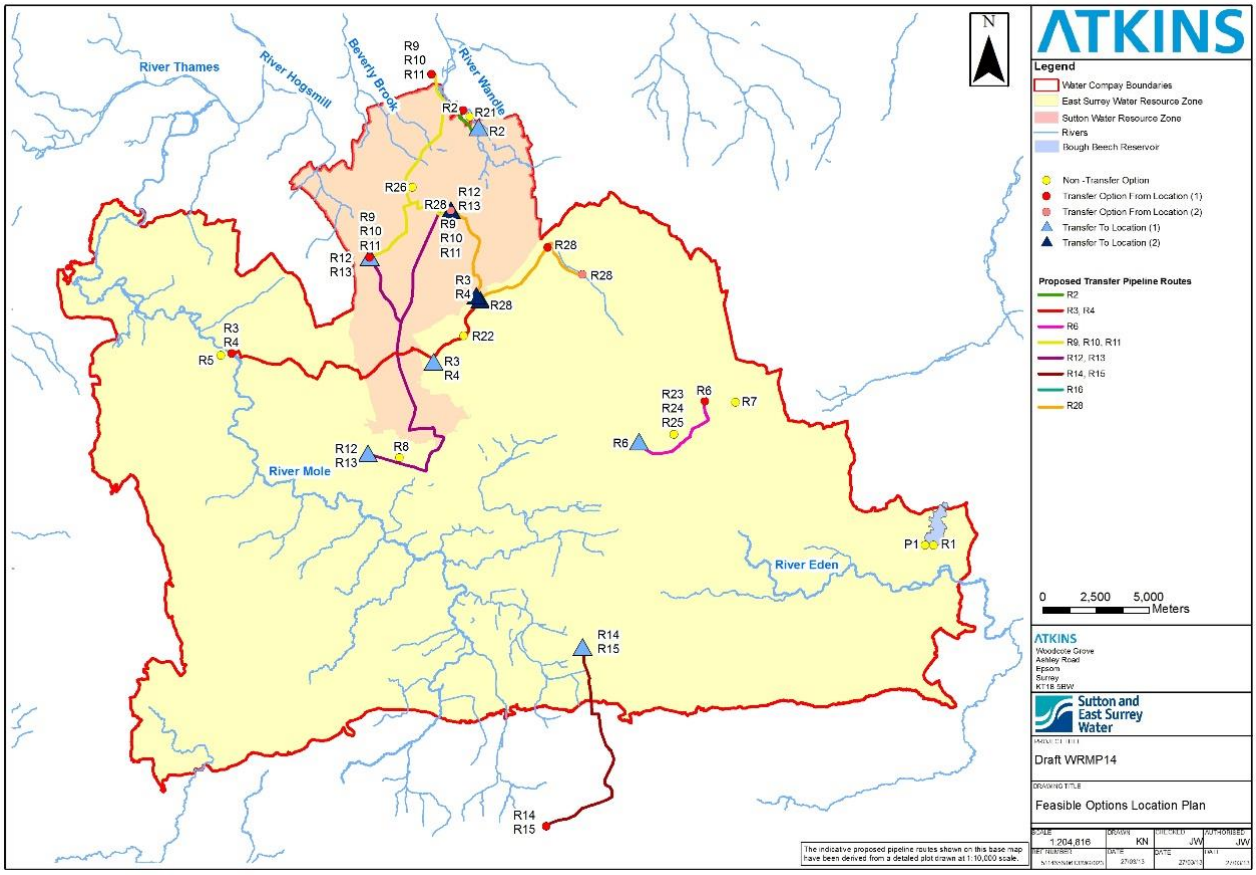
BNG - Total Net unit change (habitat units)	*Further NC and BNG Assessment has been scoped out due to the current available option information. Any additional impacts within the option ZoI will be captured within the SEA, WFD & resilience assessments.*
BNG - Total Percentage change	0
HRA	Likely Significant Effect - The apparent works footprint encompasses a part of the SAC. If the footprint could be narrowed down to be more specific the risk of likely significant effects may be lower.
Natural Capital assessment	*Further NC and BNG Assessment has been scoped out due to the current available option information. Any additional impacts within the option ZoI will be captured within the SEA, WFD & resilience assessments.*
WFD - Max impact score per waterbody	2 - GB106039017621:Mole (Horley to Hersham)



D.15. 10 Ml/d bulk supply from SEW RZ2 (Maidenbower/Whitely Hill) to SES Water (Outwood PS)

Option ID	SES_SES_HI-TFR_RZ2_ALL_r15
ID Name	R15
Option name	10 Ml/d bulk supply from SEW RZ2 (Maidenbower/Whitely Hill) to SES Water (Outwood PS)
Option description	The scheme provides a 10 Ml/d bulk transfer from SEW RZ2 (Maidenbower/Whitely Hill) to SES Water (Outwood PS). The scheme would require a new pumping station at Whitely Hill, a new treated water transfer main to transport water north to Outwood, and a new softening plant at Outwood to soften the water prior to distribution throughout the area.
Option type	Bulk transfer
ADO increase at 1in500-yr (Ml/d)	10
PDO increase at 1in500-yr (Ml/d)	10
Lead-in time (yrs)	10
Risks and uncertainties	
Risk to drinking water quality	Medium - mixing of water from different water companies and WRZs.
Dependencies	None
Option constraints	
Customers' support	TBC if option selected prior to 2050
Flexibility of the option to adapt to future uncertainty	TBC if option selected prior to 2050
Capex last year	10
Opex start year	11
Total base Capex (£)	16,500,000
Max fixed Opex (£)	140,000
Max variable Opex (£/Ml)	1353
Total Embodied Carbon (tCO2e)	1426
WRMP Plan type - BVP	N/A
WRMP Plan type - LCP	N/A
WRMP Plan type - LCP SWS Delay	N/A
WRMP Plan type - BESP	N/A
SEA construction effects	Positive 1 Negative -18
SEA residual construction effects	Positive 1 Negative -17

BNG - Total Net unit change (habitat units)	-16.8
BNG - Total Percentage change	-0.192
HRA	No Likely Significant Effect - Due to the significant distance between the option (over 3 km) and the N2k site, and the localised nature of the construction, the site and its qualifying species and features are considered to not be at risk from the development. No additional extraction is required for the scheme and so water availability is not likely to be affected at the N2K site.
Natural Capital assessment	The option will likely cause the temporary and permanent loss of stock during construction.
WFD - Max impact score per waterbody	1 - GB106039017440:Hogsmill 1 - GB106039022850:Beverley Brook (Motspur Park to Thames) and Pyl Brook at West Barnes



D.16. 30 Ml/d bulk supply from Thames Water (London WRZ) to SESW at Merton

Option ID	SES_SES_HI-TFR_LON_ALL_r9
ID Name	R9
Option name	30 Ml/d bulk supply from Thames Water (London WRZ) to SESW at Merton
Option description	The scheme is a 30 Ml/d bulk transfer from Thames Water's London ring main into the north of SES Water's area at Merton.
Option type	Bulk transfer
ADO increase at 1in500-yr (Ml/d)	30
PDO increase at 1in500-yr (Ml/d)	30
Lead-in time (yrs)	5
Risks and uncertainties	
Risk to drinking water quality	Medium - different type of disinfection in imported water
Dependencies	Mutually exclusive with the other two size variants of this option (R10, R11)
Option constraints	
Customers' support	TBC if option selected prior to 2050
Flexibility of the option to adapt to future uncertainty	TBC if option selected prior to 2050
Capex last year	5
Opex start year	6
Total base Capex (£)	53,600,000
Max fixed Opex (£)	162,000
Max variable Opex (£/Ml)	906
Total Embodied Carbon (tCO2e)	3047
WRMP Plan type - BVP	N/A
WRMP Plan type - LCP	N/A
WRMP Plan type - LCP SWS Delay	N/A
WRMP Plan type - BESP	N/A
SEA construction effects	Positive 1 Negative -25
SEA residual construction effects	Positive 1 Negative -14
BNG - Total Net unit change (habitat units)	*Further NC and BNG Assessment has been scoped out due to the current available option information. The option is unlikely to result in further potential impacts due to the construction of the new pipeline within existing roadways and the construction on previous developed land. Any additional impacts within the option ZoI will be captured within the SEA, WFD & resilience assessments.*

BNG - Total Percentage change	0
HRA	No Likely Significant Effect - Due to the significant distance between the option and N2k site (2.5 km) it is considered unlikely for the N2k site to be at risk from physical damage or non-physical disturbance from construction or operation of the option. Considering the highly urbanised and modified landscape isolating the N2k site from the option, it is considered highly unlikely that the option will cause a significant effect on the qualifying species Stag beetle or its habitat of decaying timber.
Natural Capital assessment	*Further NC and BNG Assessment has been scoped out due to the current available option information. The option is unlikely to result in further potential impacts due to the construction of the new pipeline within existing roadways and the construction on previous developed land. Any additional impacts within the option ZoI will be captured within the SEA, WFD & resilience assessments.*
WFD - Max impact score per waterbody	1 - GB106039023460:Wandle (Croydon to Wandsworth) and the Graveney 1 - GB106039022850:Beverley Brook (Motspur Park to Thames) and Pyl Brook at West Barnes 1 - GB106039017440:Hogsmill