GARD proposal for matters to be addressed by Ofwat/RAPID in its final decision on the SESRO Gate 3 report

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The trebling of the capital cost of the SESRO, as revealed in the SESRO Gate 3 reports, has fundamentally changed the case for the need for SESRO, as presented in the water companies' recent WRMP24s. Therefore, GARD welcomes the Regulators' instruction to the water companies to reassess the best value and affordability of SESRO by 22nd May 2026 and the supporting 'Priority Action Numbers 4 and 5' in RAPID's draft Gate 3 decision report.

However, the scope of the best value reassessment was not defined in detail in the Regulators' letters to the water companies, so GARD proposes that it should include:

1. Reassessment of the amount of abstraction reductions required to achieve 'Environmental Destination' in the South East, taking account of the effect of the trebling of SESRO's cost on the benefit-cost analysis and with due consideration of possible disproportionate costs of compliance with the Water Framework Directive and the Habitats Directive legislation. — 43, 148 and Appendix A 156-158

2. Reassessment of the need for the Thames to Southern Transfer (T2ST). This should include a proper and transparent assessment of the impacts of the continued use of drought orders and permits on the river flows and the ecology of the lower Rivers Test and Itchen. It should take account of the trebling of Southern Water's share of SESRO cost and the potential for disproportionate costs. — 43, 149 and Appendix A 159-161

3. Reassessment of the amount of economically justified leakage reduction, particularly of mains replacement, allowing for the trebling of SESRO costs. This should take account of the saving in future capital maintenance costs due to early replacement of potentially leaky mains pipes. — 43, 148 and Appendix A 165

4. Reassessment of the 'most likely' future deficits and their range to be used in adaptive planning, taking account of the uncertainty in the abstraction reductions required for 'Environmental Destination', the uncertainty of climate change impacts on source deployable outputs and the uncertainty in the population forecasts. — 43, 149 and Appendix A 165-166

5. Reassessment of a choice between SESRO and the Severn to Thames Transfer (STT) option should take account of not only the huge increase in SESRO costs, but the major changes in non-financial measures of best value resulting from the latest changes in SESRO design and scope. — 43, 149 and Appendix A 166-167

The reassessment of the need for new sources in the South East should be completed before any decision on the Development Consent Order (DCO) for SESRO. If this work cannot be done in time for the reassessment of best value and affordability of SESRO by — 43

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22nd May 2026, the reassessment should reflect this continuing uncertainty in its adaptive planning.

Actions by RAPID in overseeing the Gate process

In addition to the actions proposed above for reassessment of the need for SESRO and its size, it is proposed that RAPID should take the following actions in its oversight of the 'Gate' process for the strategic resource options:

1. The Gate 3 decision report should require a reassessment of the costs and carbon usage of SESRO, taking account of the criticisms in Chapter 2 of this response, the many design and scope changes revealed in the pre-DCO consultation documents and the likelihood of further cost and carbon emissions escalation as the currently 'indicative' design matures into a properly engineered scheme. 150

2. Ofwat should commission a genuinely independent review of the deployable output of SESRO. In view of the entrenched position of the water companies on this matter, this review should be commissioned and funded directly by Ofwat. 151

3. The Gate 3 decision report should require a reassessment of the non-financial best value metrics for SESRO, allowing for properly assessed air pollution, noise, human health, socio-economic and landscape impacts. 151

4. The Gate 3 decision report should require a properly detailed development programme to be publicly available, showing the timing of the many inter-related construction activities. The programme should be adjusted so that the reassessment of the need for SESRO is completed, including public consultation on it, before any decision to proceed with the DCO application. 152

5. RAPID should also take urgent action to bring forward the completion of the STT Gate 3 report, which appears to have been allowed to drift due to mistaken water company and regulator confidence in the previous estimates of SESRO costs. 152

The need for transparency in reassessing the case for SESRO

Although GARD welcomes the Regulators' actions in instructing a reassessment of the best value and affordability of SESRO by 22nd May 2026, the lack of publicity for this has been a failure in transparency, so the public are largely unaware of it. The water companies' pre-DCO consultation documents have misled the public into believing that the need for SESRO has been fully settled and is not open to further discussion. 152

The Regulators should issue an immediate and public statement that the huge escalation of costs of SESRO has undermined the credibility of the resource development proposals in

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the water companies' WRMP24s and necessitated a comprehensive and transparent review of the need for SESRO, which will affect the timing of the DCO process for SESRO. A public announcement on this matter is essential for restoring confidence that the Strategic Resource Option (SRO) programme is being properly and transparently managed.

Deficiencies in the assessment and reporting of SESRO costs and carbon emissions

The Gate 3 Cost Report contains many errors and inconsistencies, while failing to provide adequate evidence. This undermines the credibility of the latest SESRO cost estimates, the effectiveness of their quality assurance and the validity of board assurance statements:

1. There are arithmetic errors in the base estimate of risk and optimism bias percentage additions, which are significant enough to require the re-issue of the report with corrected figures. 15-16

2. No copy of the RAIDO (Risks, Assumptions, Issues, Dependencies and Opportunities) Log, is lodged within the Gate 3 Cost Report or as an appendix, to support how the cost estimate risk allowance of £1,212M has been assessed. 17-23

3. No details have been provided in the report to demonstrate how the optimism bias percentage has been evaluated. It is also noted that, unlike the risk allowance, no specific statement is given in the water companies' Main Board Assurance letters stating they are satisfised with the £1,098M optimism bias allowance. 23-24

4. There is no proper explanation of the tripling in SESRO costs between Gate 2 and Gate 3. Review of the design changes between the Gates shows that the majority are typical design development items, so if the base estimate, risk and optimism bias allowance had been sufficiently robust, they should not have resulted in a tripling of the cost estimate. 28

5. In attempting to justify the huge increase in costs between Gates 2 and 3, the uplift percentage on the Gate 2 cost estimate of 30% is excessive when compared with uplifts of only 11% to 12 % in BCIS Tender Price Indices from 2020/21 to 2022/23.

6. The only reasonable conclusion from the above is that before the Gate 3 Cost Report, and despite a 30-year prior gestation, there has been a gross under-appreciation of the scope and complexity of the project during the early stages of the design and cost estimation. 26

7. The Net Present Cost (NPC) total of £4,420M include non-depreciating items, with a capital value excluding land and risk allowance of £1,671M. This includes 'Client Indirect Delivery Costs' at £656M (e.g. design fees, and main contract preliminaries and method related charges). These should be apportioned over the works element 41

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items and depreciated in the WRMP24 Investment Appraisal. The Gate 3 and WRMP24 NPCs should be amended to resolve this error.	
8. No scope or definition is provided in the report to support the cost estimate expenditure on 'Other Non-depreciating Assets' at £674M or for 'Sunk Costs' at £99M, which are significant omissions and should be rectified.	27
9. Despite the length and complexity of the SESRO project, there is no development and construction programme to show the order, sequencing and duration of the major work activities. This is needed to show that the required operational date of 2040 is realistic and achievable. The cost estimate is not informed by a detailed schedule with the basic logic and critical path identified – how can the board assurances have been provided without this crucial information?	13
10. The SESRO Gate 3 carbon emission estimates contain many omissions and inconsistencies. Both capital and operational carbon estimates have ballooned in the pre-DCO submission (capital by 137%, operational by 80+%).	44-62
The costing and carbon flaws alone are sufficient to require the withdrawal of the current Gate 3 Cost Report pending their satisfactory resolution. This calls in to question the validity of the Thames Water, Affinity Water and Southern Water board assurance letters in support of SESRO.	22
The above is not an exhaustive list of valid concerns, but it highlights the need for RAPID's Gate 3 decision to prescribe a detailed review of the current Gate 3 cost and carbon estimates, with instructions for how they should be improved before acceptance.	150
Engineering design of the Reservoir and its infrastructure	
After five years of work to Gate 3, at a quoted cost of £65 million, equivalent to about 6,000 person-months of technical staff input, there is still no engineering detail available to demonstrate that the scheme will be fit for purpose and safe. The level of detail shown is far short of what is needed for reliable cost estimation, although some more detail must surely have been made available to cost estimators. Although the lack of engineering detail is recognised in RAPID's draft decision report, it should be more specific about the amount of detail required.	87
The Gate 3 and pre-DCO consultation documents provide minimal detail of the design of the reservoir embankment. There is insufficient information to form a judgement on whether its slopes will be stable and adequately protected against wave action. There is no information provided on what use has been made of the results of the clay compaction trial, if any.	87

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The full scale trial embankment, proposed in 2007 as essential for determining the feasibility and safety of the Reservoir, does not appear to be mentioned at all in the Gate 3 reports. However, the pre-DCO consultation reports suggest the trial embankment will be delayed until 2032. Allowing three years for essential soil pore pressure testing, this means that the design cannot be finalised until 2035 and the project completion will probably be delayed until 2046. RAPID's Gate 3 decision should require the construction of the full scale trial embankment and the availability of its test results to be clearly shown in the project development programme.	87
There are minimal design details of the Reservoir inlet/outlet works, so it is not possible to form any judgement of their safety and fitness for purpose. In particular, the proposals for emergency discharge appear under-developed and potentially dangerous. There seems no recognition of the difficulty and danger of passing the 75 cubic metres per second of emergency discharge safely through the reservoir embankment and the pumping station, while dissipating its energy – equivalent to the average annual flood in the Thames at Sutton Courtenay over a 25 metre waterfall.	87, 92-99
Lack of dam breach analysis	
Despite the demands of the local authorities, GARD and the Planning Inspectorate, SESRO's promoters continue to say that the dam breach analysis will not be done for the DCO application and can be left until after the reservoir has been built. The promoters' claim in the pre-DCO documents that the possibility of embankment failure can be "designed out" is arrogant, irresponsible and foolhardy. The consequences of the embankment breaching are being hidden from the from the people who might be affected.	89, 135
Defra's dam breach analysis method, applied by GARD to the proposed reservoir, shows that a breach would cause multiple fatalities in surrounding villages and would be a major threat to Abingdon and to travellers on highways and the Great Western Railway. Until full dam-breach modelling is made available for independent and transparent scrutiny, the project cannot be said to meet the requirements of lawful, informed and meaningful consultation. RAPID's Gate 3 decision should insist that the dam breach analysis is carried out prior to the DCO application and made publicly available.	90 and Appendix D
Lack of transparency of advice from reservoir experts	
The pre-DCO consultation brochure states that the safety of the Reservoir will be assured by the appointment of a statutory Construction Engineer and a Reservoir Advisory Panel, but no information is provided on what advice they have given and whether it has been heeded. We therefore welcome the Priority Action 2 in RAPID's Gate 3 decision Report but propose that this information should be publicly available.	88

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Flood risk from the Reservoir

Flooding is one of the most persistent public concerns in an area characterised by high fluvial and groundwater risk. The reservoir will occupy over 1.5 sq km of existing flood plain and it will significantly impact groundwater movement and water table levels. 100

The Gate 3 report acknowledges both groundwater and fluvial flood risks but confirms that the relevant modelling and assessments will not be completed until the 2026 DCO application. This is incompatible with the best practice advice given on flood risks by the Planning Inspectorate.

The problem of groundwater flooding has led to some design scope increase to include an additional 11 km underground ground water control drain around the full perimeter of the reservoir, but no detail is provided and it is not yet included in the Gate 3 costs. 101

In GARD's opinion, it is unacceptable to delay published flood modelling from being seen by stakeholders (which in this case include Local Authorities with emergency response roles, as well as the Environment Agency). The modelling should have been available in the Gate 3 submission and in the pre-DCO consultation material. 101

RAPID's draft decision report agrees with this view and includes some clear statements, decisions and directive actions to the SESRO scheme proposers, which we support. However, GARD believes that RAPID needs to produce stronger recommendations to ensure that Thames Water and proposers deliver a proper flood assessment well before the DCO application. This work should be actioned for mid-2026, rather than Gate 4. If not, it is almost certain that, on past behaviour, Thames Water will arrive at Gate 4 with these actions uncompleted. GARD believes that the Regulators, for their own credibility, should take a tougher line on the transparent examination and publication of the downsides of SESRO. 102

Reservoir water quality

The likelihood of algal blooms and the allied possibility of cyanobacteria creation were identified in the Gate 3 report. The upstream Farmoor Reservoir has suffered extensive operational shutdowns to avoid the inflow of pollutants. 105

SESRO inflow shutdowns are likely to be more serious than Farmoor, because inflow licence conditions mean the reservoir can only be filled when Thames flows are above median, so there will often be polluted water from sewer overflows upstream. The main control option will be to cease abstraction from the Thames during high pollutant concentrations, usually during the winter when agricultural runoff and wastewater spillage 105

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will be at maximum levels. Ceasing abstraction at such times, will limit the reservoir's supply output and drought resilience.

The validity of the water quality modelling for the project is compromised by the modelling software's inability to simulate the interactive dynamics of pollutants and using data from drought periods 30 to 50 years ago that do not reflect the increased wetness of winters due to climate change. 109

The pace of urban development within the Thames catchment, with sewage treatment plant upgrades lagging, will add to the pollution being pumped into the reservoir, so algal blooms and cyanobacteria populations can expand rapidly. Modelling needs to account of the wetter winters that will suit the production of algal blooms and associated hazards. 110

The report's proposed mitigation by ozonation and ultra-violet (UV) disinfection is likely to be ineffective because these technologies cannot deal with the large volumes of water entering and leaving the reservoir. Even the water companies' own experts have doubted the effectiveness of planned aeration in the reservoir and have proposed to cope by transfer of high algal loads to downstream water treatment works. As well as potentially polluting the river during summer low flow periods, this presupposes that the algal blooms will present themselves at the reservoir outlet rather than sticking to the perimeter. Algal blooms can block intakes, requiring pump downtime and clearance of intake screens. Severe problems of this type have been reported at Grafham Water and Rutland Water reservoirs, despite their aeration systems. 111

This is such an important factor, for both the health and water quality of the reservoir and its water supply function, and we are astonished that this key issue does not receive enough attention in the RAPID Gate 3 draft decision report. GARD believes that the Gate 3 decision report actions should specify that realistic mitigation plans are fully developed and publicly available well before submission of the DCO application or Gate 4. We believe the action on water quality in the report's Appendix B should be elevated to a priority action and strengthened to include clear technical descriptions of operational phase water quality, with an intermediate delivery date before Gate 4. 113, 151

Project management

SESRO is, by any standards, a major infrastructure project with a capital cost of over £7 billion, (2024/25 prices), a duration of 14 years and interfaces with another SRO project, the T2ST. It has a large amount of complex, non-standard civil engineering and requires the import of about 8.5 million tonnes of materials to a congested construction site. Even the preliminary works – rail sidings, access roads, storage areas, topsoil removal and construction of the full height trial embankment – will be major civil engineering projects. 129

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Despite the size and complexity of the project, the Gate 3 reports contain no Gantt bar chart to show how construction project will progress and interact with the T2ST, the transfer to Farmoor reservoir and their associated water treatment works (WTW). This is completely unacceptable for a set of projects so tightly shoe-horned into the available land area.

The absence of a detailed project programme in the Gate 3 reports contrasts with the Grand Union Canal, Minworth WTW and South Lincolnshire reservoir SROs which provide quite detailed project programmes in their Gate 2 and 3 reports.

The lack of a published programme in the SESRO Gate 3 reports is a symptom of the project being out of control. There is more evidence of this in the trebling of capital cost between Gate 2 and Gate 3 and the many major changes between Gate 3 and the pre-DCO documents, including: 129

- the increase in required land area from 12 km^2 to 38 km^2
- the increase in the number of site access points from 1 to 6
- the increase in imported materials from 2.5 to 8.5 million tonnes 131
- numerous design changes

Extraordinarily, RAPID's Gate 3 decision report makes no reference to the lack of a published construction programme, either in the body of the report or in the actions required in Appendix A. There is no recognition that any of this is a cause for concern. 131

GARD proposes that RAPID should alter its draft decision to insist on a 'hold' point where all the recent scope changes are assessed and a cost estimate for the new project is made, alongside completion and confirmation of all the other metrics in the 'best value' determination. 131

Terrestrial ecology impacts and BNG assessments

The lack of an update on the biodiversity net gain (BNG) status of SESRO is a major omission from the pre-DCO consultation process, given the trebling of land take that has occurred since the RAPID Gate 3 submission stage published only two months before the DCO consultation was launched. The huge scope-creep to be addressed in both the Biodiversity (and Natural Capital) Assessments is another reason for an urgent re-evaluation of SESRO as a 'Best Value' solution in the water companies' WRMPs. 115

The recent release of Oxfordshire's Local Nature Recovery Strategy (OLNRS) shows that the SESRO area has been included as a strategically significant area for nature recovery opportunities. Therefore, the BNG calculations must include an uplift factor in baseline 116

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BNG scores for habitats that have been recognised for their strategic significance within Local Nature Recovery Strategies. Thames Water ignored this factor, stating that the Oxfordshire Strategy had not been published.

The methodology used in the SESRO BNG assessments has numerous flaws which have led to substantial under-estimation of impacts and the extent of habitat replacement needed to meet the BNG targets. In particular, the tally of ancient and veteran trees has been manipulated by under-measurement of tree girths, thereby mis-classifying the majority of 'veteran' trees as 'notable'. This has a major bearing on the bespoke compensation that is required for the destruction of irreplaceable habitat, which must be included within the formal DCO BNG submission. 121

The Regulators and the Planning Inspectorate should insist that the BNG calculations are re-run for the Best Value reassessment, taking account of the Oxfordshire LNRS, the greatly expanded project area and the numerous other criticisms of the methodology detailed in this response. 121

Landscape and visual impacts

The Gate 3 landscape submissions do not reflect the measures now put forward in the pre-DCO consultation, particularly regarding the greatly increased land take. Therefore, they cannot be relied upon as an accurate response to the current scheme proposals.

The Gate 3 studies do not reasonably assess or describe the overall effects of the works at a technical level. In landscape and visual terms, the graphic representations can be as misleading as they are informing. In aerial perspectives, with no baseline date, proposed trees are shown at a scale in relation to the Reservoir that would equate to around 100m tall. This is probably 10 times the height that would be achieved in after 15 years, but would be entirely unachievable at any timescale. However, as a tree height is understood as a common visual reference, the combination of trees and water in '*illustrative*' representations has the effect of making the Reservoir appear 1/10th of its true size. Equally, illustrations of adjoining 'recreational lakes' show a greater water area than in a following reservoir view, and the recreational lake is the front to consultation leaflets. Images of happy families enjoying mature landscapes have no suggestion that this '*benefit*' may be around 30 years – i.e. a generation or more away. 128

In summary, the Gate 3 landscape technical studies are out of date, too narrowly focused and unreasonably hold back a range of assessment data that could inform decision-makers' (and the public's) understanding ahead of a future Environmental Statement and planning application. The studies are missing current baseline data, do not provide clear evidential analysis and do not even assess the currently promoted scheme. Even within their self-imposed narrow scope, the Thames Water studies demonstrably fail to address issues and 128

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impacts on the North Wessex Downs. Meanwhile public data (much of which is post-Gate 3) includes a range of misleading graphic information which will not help the public accurately understand landscape, or visual effects, or the extensive development and establishment timescales involved.

Failure of stakeholder engagement

Thames Water's public engagement has been characterised by a repeated pattern in which substantive concerns raised by consultees are deferred with assurances that further information will be provided at a later stage, followed by much of that information remaining undisclosed. Multiple stakeholders repeatedly requested information fundamental to assessing feasibility and risk, including fluvial and groundwater flood-risk modelling, dam-breach analysis, emergency drawdown scenarios, deployable-output reliability, cost escalation and environmental impacts. 133-142

Even at the pre DCO consultation, the last remaining opportunity for public engagement, most of the information was still missing. Consultation has therefore taken place without sufficient evidence for experts, local authorities and the public to understand the scheme's risks and consequences.

Moreover, consultation materials and engagement activities have placed disproportionate emphasis on speculative amenities and "*legacy benefits*", while substantive issues repeatedly raised by stakeholders – reservoir safety, flood risk, cost escalation, feasibility and alternatives – were largely absent from questionnaires and public-facing materials. 143-144

Thames Water has stated that key matters – including the scheme scale and strategic alternatives – are not now open for discussion, on the basis that SESRO has already been identified as the preferred option. This position has been maintained notwithstanding unresolved feasibility, safety and flood risks, and an unproven best value case, as evidenced by Ofwat's requirement that the WRMP be reopened and best value reassessed.

The consultation has required detailed interpretation of technical documentation to understand local impacts, but insufficient time has been provided for this to be undertaken effectively and shared with those affected, limiting meaningful engagement. 145

The cumulative effect of these failures is that consultation has not performed its essential function of de-risking the scheme at an early stage. The engagement and consultation process has not enabled stakeholders to influence the scheme on matters of substance, undermining trust and confidence in both the consultation and the decisions that follow.

1. Introduction

1.1 GARD's role

Group Against Reservoir Development (GARD) is a community-based organisation representing local residents and businesses, mainly in the South Oxfordshire villages of Steventon, Drayton, East and West Hanney and Marcham, and in the town of Abingdon, who would be affected by Thames Water's plans to build a major new reservoir near Abingdon.

GARD campaigns against this inappropriate reservoir solution and in favour of sustainable water resource options such as effluent reuse and raw water transfer from the River Severn to the River Thames. We also strongly support demand-side measures to reduce leakage of water and to promote efficient-use strategies, including metering. GARD's membership of around 500 includes many technically qualified people, and we are advised by water industry and ecology professionals.

GARD's website is at https://groupagainstreservoirdevelopment.org/.

1.2 The purpose of this response

This consultation on RAPID's draft decision on the Gate 3 report for the South East Strategic Reservoir Option (SESRO) has run concurrently with the promoting water companies' pre-Development Consent Order (DCO) consultation on the Reservoir:

- Gate 3 reports issued on 14th August, RAPID draft decision issued on 3rd December 2025 and consultation on decision closes on 29th January 2026.
- Pre-DCO consultation documents issued and consultation started on 28th October 2025, closed on 13th January 2026.

The pre-DCO consultation documents, although issued only ten weeks after the Gate 3 reports, showed substantial changes to the project scope and design of the reservoir. GARD has already commented in detail on the changed scope and design in response to the pre-DCO consultation[1].

This consultation response focuses on the scheme shown in the Gate 3 reports and RAPID's decision on it. However, where the scheme has changed substantially in the pre-DCO documents, we have discussed the implications, particularly on the scope of further investigations, either for satisfactory completion of the Gate 3 stage, or for work needed in Gate 4, if the scheme proceeds to that stage.

[1] GARD (2026), "GARD response to SESRO pre-DCO consultation", 13th January. (Henceforth, the "GARD pre-DCO response".)

1.3 RAPID actions in response to the trebling of SESRO cost

The Gate 3 report has revealed a trebling of the capital cost of SESRO from £2.2 billion (Bn) to £6.6Bn since the Gate 2 report in November 2022 and since the issue of Thames Water's WRMP24 in October 2024. This has profound implications for whether SESRO is the best-value scheme for the future needs of the South East, and for whether a scheme of this size is needed at all. We have detailed our concerns about this in section 2.5 of this response.

We are pleased to see that the Regulators have instructed Thames Water, Affinity Water and Southern Water to review the best value and affordability of SESRO in the light of the large increase in SESRO's cost, and to report on this by 22nd May 2026[2]:

> *"We request that you submit a revised WRMP annual review and formally communicate the implications of the SRO cost changes on your preferred plan, including up-to-date information on feasibility, best value and affordability of your plan."*

However, RAPID's draft Gate 3 decision report makes only brief reference to actions needed to support the reassessment of best value and affordability of SESRO[3]:

Priority Actions – to be addressed by the dates stated in each priority action				
Number	Area	Detail	Reason	Complete by:
4	Evaluation of costs and benefits	Provide a substantive update on preparations for the WRMP annual review in the 9 February 2026 checkpoint meeting. This should explain how the companies involved will use the statutory planning process (WRMP and related annual review) to conclude the best value decision making process.	The submission does not present any evidence of best value modelling with the updated solution costs.	9 February 2026

In view of the enormous increase in cost, GARD considers that the Gate 3 decision report should prescribe more specific actions to ensure that the water companies' review of best value and affordability of SESRO covers an appropriate range and depth of analysis. GARD has written separately to Defra and the Regulators about this[4], and we provide more details in Chapter 7 of this response.

[2] Ofwat letter to Thames Water, https://www.ofwat.gov.uk/publication/thames-water-wrmp-annual-review-2025-letter/, p. 5 (with similar letters to Southern Water and Affinity Water in Nov/Dec 2025).
[3] Draft decision report, Appendix A, p. 28.
[4] GARD letter to Martin Woolhead (Defra), Paul Hickey (RAPID) and Richard Thompson (Environment Agency), 22nd January 2026.

2. SESRO costs and carbon estimates

Sections 2.1–2.5 provide a commentary on the "Gate 3 Cost Report", v1.0[5]. We note that the A3 Cost Report reflects a Design Freeze in October 2024,[6] and that all costs in the report are given in 2022/23 prices. For both these reasons, the cost estimates in the report are already out of date.

We focus on:

- Where the report contains anomalies.
- The weaknesses, inconsistencies and lack of transparency in the cost estimation methodology.
- Where the report is considered deficient and lacking in detail.
- An examination of the reasons behind the increase of the Gate 3 total median capital cost estimate of £6,604m over the Gate 2 figure of £2,745M.
- A summary of the significant design changes since the design freeze (October 2024) on which the Gate 3 costs are based.
- The implications of the trebling of SESRO costs since Gate 2.

2.1 General comments on the SESRO costs and errors in the Gate 3 report

The report acknowledges that the SESRO scheme will be lengthy and complex to consent and develop and is required to be operational by 2040.

Consequently, it is a major omission not to issue a preliminary construction programme in support of the cost estimate to show the order, sequencing and duration of the major work activities and demonstrate that the required operational date of 2040 is realistic and achievable – i.e. the cost estimate is informed by a detailed schedule with the basic logic and critical path identified.

There are several major programme activity risk events which, if they occur, are likely to have a significant consequence in meeting the above target completion date. Examples include poor weather leading to loss of time during the major earthworks element of the project and the Reservoir filling phase to complete the operational commissioning.

With the significant increase in the SESRO cost estimate, it is difficult to accept that this has had no effect on the works duration programme, unless part of the cost increase is used to

[5] Thames Water, Affinity Water and Southern Water (2025), "South East Strategic Reservoir Option (SESRO) Supporting Document A3 Cost Report", 21st July. (Henceforth, the 'A3 Cost Report').
[6] A3 Cost report, "Position statement", p. 2.

accelerate the works. We believe the lack of a full appreciation of time-related risks and how they impact on costs, coupled with the low risk and optimism bias (OB) allowance, is one of the major contributory factors for the increase in the Gate 3 costs estimate over Gate 2.

GARD notes that, with the significant estimated cost increase between Gate 2 and 3, RAPID has issued under the query process a request[7] asking for the following:

> *"RAPID gate three guidance Section 8.1 provides that evidence to demonstrate that a solution remains best value for customers and the environment is required. RAPID typically relies on the best value assessments undertaken as part of the regional plans and company water resource management plans (WRMPs) to ascertain this. The financial cost estimates for SESRO have changed from the estimates that were used for best value assessment in the WRSE regional plan and Thames Water's WRMP24.*
>
> *We further note that within your submission, you have stated the following: 'Our initial analysis indicates that SESRO continues to be one of the preferred options in WRMP24. However further work is required to validate this, and we aim to complete this work and publish our findings in Autumn 2025.'*
>
> *Therefore, please provide a clear update on this work. This should include:*
>
> - *A specific date that this work will be shared with us*
> - *When and how you expect to make this information publicly available*
> - *What analysis the work will be based on and the arrangements in place for assurance of its inputs and outputs What data will be shared as part of this work.[…]*
> - *What form the work will take, for example […]*
> - *Who is leading which elements of the work […]"*

This request mainly relates to the need to reassess SESRO against the main alternative STT option.

We note that, despite the RAPID request, no formal response has been given as to when the submission confirming whether the 150Mm³ SESRO option remains the 'least cost' plan for the WRSE region will be available (as at the time of writing). If, following the WRSE reassessment, the STT is found to be the least-cost option, are mitigation plans in place to 'fast track' implementation of this scheme?

In addition to the above, with the significant increase in the SESRO cost estimate, it may alter the Thames Water WRMP24, as the now-abandoned low Gate 2 cost estimate has been

[7] RAPID (2025), "Gate three query process: Query number SER011", 23rd September.

used to justify deferring 40Ml/day of leakage reduction as representing poor value. With the significant increase in the cost of SESRO, this should by changing the economics of leakage reduction drive more mains replacement, further reducing leakage and thereby also reducing the SESRO needs case.

The RAPID Gate 2 stage is summarised by the Regulators themselves as: "Gate two – detailed feasibility, design and multi-solution decision making."

GARD believes that the reasonable expectation from this is that, in establishing the detailed feasibility and before moving on to Gate 3, a realistic project cost and programme target is established. This is especially relevant where the cost estimate at Gate 2 has been used in strategic planning as part of the WRSE Region option selection process and in selecting SESRO 150Mm^3 over other options and then for inclusion within Thames Water WRMP 24.

GARD's view is that, with the subsequent significant increase in the estimated cost between Gates 2 and 3, the detailed feasibility stage of the project in setting a realistic cost estimate target was not satisfactorily reached for Gate 2. The issue of the RAPID query SESRO 11, and the lack of satisfactory response from Thames Water or the WRSE region model taking account of the increase in the SESRO estimated cost, reinforces our view in this respect.

The question of the accuracy and validity of the Gate 2 cost estimate and Board Assurance process is reviewed in the sections below.

2.1.1 Errors

We start with the significant cross-referencing and calculational errors in the A3 Cost Report, as follows.

Base Capex estimate error

With reference to the summary of the QCRA results[8], the "*Base Capex*" total given under the 50th, 80th and 95th percentage column as "£4,168M" is incorrect and should read "£4,294M". This error is confirmed by reference to Table 7[9] where the Gate 3 Total (base Capex, costed risk and OB) total calculation is summarised below:

Base Capex	£4,294M
Costed Risk (total)	£1,212M
Optimism Bias	£1,098M
Total (Base Capex, Costed Risk and Optimism Bias)	£6,604M

[8] A3 Cost report, section 3.3.2, Table 4.
[9] Ibid., Table 7.

The Capex base estimate total of £4,294m is also confirmed as used in the Gate 3 Appendix A,[10] net present cost (NPC) calculation of £4,419.8M.

Costed risk percentage error

Once again, we refer to the A3 Cost Report, section 3.3.2, Table 4.

With the error in the base estimate, the stated Risk = EU (% of Base Capex) percentages given in the above table (Table 4 in A3 Cost Report) at 29.1% is incorrect and should read 28.2%, as the calculation below.

$$\frac{\text{Capex (Costed Risk)}}{\text{Capex (no Optimism Bias or Costed Risk)}} = \frac{£1{,}212M}{£4{,}294M} = 28.2\%$$

Under the 80th and 95th percentage field, the risk percentages are also incorrect (and should read 33.4% and 39.1% respectively).

Optimism bias error

Referring to section 4.1.5[11] with the above error in the base estimate, the stated OB at "26.8%" is incorrect and should read 25.6%, as per the calculation below:

$$\frac{\text{Capex (Optimism Bias)}}{\text{Capex (no Optimism Bias or Costed Risk)}} = \frac{£1{,}098M}{£4{,}294M} = 25.6\%$$

These errors are not forgivable in a high-level document such as the Cost Report. ***We suggest the A3 Cost Report is reissued with corrections.***

2.1.2 Estimating methodology

The A3 Cost Report makes an ostensibly standard estimation of capital cost (Capex) using the three quantities: "*Base Capex"*, "*Costed Risk*" and "*Optimism Bias*". It also, in a belated change of policy for Thames Water, adopts the RAPID guidance of "*Capex estimate reported should be considered at a point within a range of potential cost outcomes*"[12].

GARD has long criticised the lack of adequate allowances for Costed Risk and OB in Thames Water's SESRO estimates. Most recently, this was the conclusion of the GARD Independent Report on the SESRO Design, by Professor Chris Binnie, leading UK expert on the Earthdam Reservoir design and former member of the government's '*All Reservoir Engineers' Panel.* Prof Binnie's report states[13]:

[10] Thames Water, A3 Cost report: Supporting Document Appendix. Note this document is almost unreadable.
[11] A3 Cost report, section 4.1.5.
[12] A3 Cost report, sections 2.2.3–2.2.5.
[13] Binnie, C. (2024), "Report on aspects of the SESRO Dam design", p. 2, January.

> *"In my opinion, Thames Water's combined allowance of 51% for Costed Risk and Optimism Bias is far too low in view of the immature state of the of the reservoir design and the apparent failure to consider a lot of the cost risks that I have identified."*

As can be seen from the figures presented in section 2.1.1 above, the percentage of Costed Risk + OB has moved up only slightly from the 51% in the project estimates of the Gate 2 report. This is very low considering the findings of reports[14] from analysis of a wide range of dam projects in Australia, which found, *inter alia*, that:

> *"Sampled by dam type the largest median percentage cost overruns are recorded for earthfill embankment dams." and "The median cost overrun for embankment dams was 106%."*[15]

Given that we are now faced with a cost increase of at least 150% (see Table 2.4 below), Professor Binnie's views seem to be well-founded.

2.1.3 Risk identification and scoring, and approach to quantitative cost risk assessment

The A3 Cost Report does not confirm the use of either "Approaches for estimating and benchmarking costs for large scale water infrastructure projects, RAPID and Ofwat 22 June 2022"[16], or the "All Company Working Group (ACWG) Cost Consistency Methodology (Revision E)"[17] to inform the risk evaluation methodology. The report states[18] that risk is managed using a project-level RAIDO (**R**isks, **A**ssumptions, **I**ssues, **D**ependencies and **O**pportunities) log, but no copy of this is lodged within the A3 Cost Report or as an appendix to show how the cost estimate risk allowance has been assessed. In contrast, the Minworth SRO Gate 2 Cost and Carbon Report[19] provides copies of the Risk Register used in the quantitative Monte Carlo risk simulation to model the costs incurred by each risk event. For a project of the size complexity and duration of SESRO, the omission of this information is considered a major shortcoming in recording as part of the Gate 3 approval and assurance purposes that appropriate risk management processes are in hand – **especially considering the huge increase in the cost estimate risk allowance between Gate 2 from £386M to £1,212M for Gate 3 – an increase in percentage terms of 214%**.

[14] Petheram, P. and McMahon, T.A. (2021), "Dams, dam costs and damnable cost overruns", *Journal of Hydrology*, volume 3, April.
[15] Ibid., p. 3, Table 5.
[16] CEPA and aqua consultants (2022), "Approaches for estimating and benchmarking costs for large scale water infrastructure projects", RAPID and Ofwat, final report, 22nd June.
[17] RAPID (2023), "Strategic regional water resource solutions guidance for gate three", Version 2, August, p. 17.
[18] A3 Cost report, sections 3.1.1–2.
[19] Severn Trent (2022), "Annex A4: Cost and Carbon Report", 24th October.

The A3 Cost Report (section 3.1.3) identifies that risk items have increased from 75 at Gate 2 to "*more than 270*" at Gate 3. A request from GARD to Thames Water for details of the RAIDO log via EIR-25-26-355 (part thereof) was met by a refusal:

> *"Your Request*
>
> *We request that the RAIDO log should be made available for Stakeholders. We believe this can be made largely available, with only minor redactions for any commercially-confidential issues.*
>
> *Our Response*
>
> *The RAIDO log is a work in progress document, and we consider it is exempt from publication under the EIR pursuant to regulation 12(4)(d) of the EIR."*

This is a specious excuse, given that the whole project is work in progress! We draw the conclusion that Thames Water remains committed to cloaking the real situation regarding this project. ***We strongly urge RAPID to bring Thames Water's submission into line with the standards already achieved by some SROs at Gate 2.***

In fact, a request from RAPID[20] had already elicited that there are, in fact, 287 Risks on the Risk Register. Some breakdown of these risks was given in Thames Water's response to this request, to which we return in section 2.2.3 below. For now, we note that this response was given 26 days before the refusal to share any details at all with GARD.

The Costed Risk quoted throughout the Reports is the 'P50' Risk according to the Quantitative Cost Risk Assessment (QCRA) rules, this corresponds to the *median* risk produced by the Monte Carlo simulation probabilistic assumptions of the total Risk log. Thus, it is estimated to have a 50% probability of being exceeded in the real-world outcome for the SESRO project.

The A3 Cost Report is particularly weak on the impact of risks on SESRO programme activity durations. Although in section 3.2.3 of the report, it is noted that whilst the cost of time-related risks are considered, their impact on programme activity durations and dependencies in achieving the target project "*in-service*" delivery date of 2040 is not considered.

The SESRO Gate 2 Report documents included a "*Supporting Document F-1: Project Delivery Plan*"[21], with an overview of the proposed indicative programme, associated scope of work and costs and an assessment of the key delivery risks. No similar document exists in the A3 Cost Report, or reference to the details provided in the Gate 2 Project Delivery Plan and the

[20] RAPID (2025), "Gate three query process: Query number SER004", 3rd September.
[21] Thames Water and Affinity Water, "SESRO: Supporting Document F-1: Project Delivery Plan".

consideration of key delivery risks. No Gantt chart or similar is provided, scheduling the required scope of work in accordance with the current dependencies and assumptions.

Section 3.2.4 of the A3 Cost Report further elaborates and specifically states in relation to time risks:

> *"The costed time risk allowance is intended to account for uncertainty and risk associated with the programme timescales and the many risks which have the potential to impact the critical path."*

This statement reinforces the view that further work is required under the Gate 3 Reports to provide a programme risk register with a QCRA performed on the project programme activities and durations to establish a P50 baseline duration if risk events occur. For the SESRO project, with a site works duration of over 10 years and individual activities which can run over several years, the timing of a realised risk event is also important to consider, e.g. Earthworks delays due to poor weather will have a larger impact on works progress and critical path in the early years than if they occur during the latter part of the programme.

Section 3.2.5 identifies some potential SESRO delay drivers, but, as stated above, how they potentially impact on the programme and stated requirement that SESRO is required to be operational by 2040, is not detailed in the A3 Cost Report or elsewhere under the Gate 3 documents.

Further inadequacies in the QCRA, are seen in section 3.2.6 and the statement that: "*Gate 3 analysis was performed from a pre-mitigation perspective, not considering any potential mitigation measures.*" By not considering applying risk mitigation where possible, this is considered to miss the whole essence of project risk management, especially for SESRO as a project with a value of several billions, a works duration of over a decade and advised at RIBA stage 3 design status[22]. By comparison, ***even at RAPID Gate 2 design***, the SRO RAPID projects, the South Lincolnshire Reservoir[23] and Minworth[24] projects all considered risk mitigation.

The cost report identifies ten key risks from the Monte Carlo simulation.[25] These are said to be those most significantly driving the cost estimate. Table 3 in the report is reproduced below as Table 2.1 below.

---

[22] SESRO is advised as approaching RIBA Stage 3 in Thames Water, Affinity Water and Southern Water (2025), "Supporting Document A1: Basis of Design Report", 23rd July, table 1.2. (Henceforth, the 'Gate 3 Basis of Design report').

[23] Anglian Water and Affinity Water SLR_RAPID_Gate_two_submission.pdf., table 11.

[24] Affinity Water, Severn Trent (2022), "Strategic regional water resource solutions: detailed feasibility and concept design: Standard gate two submission for Minworth SRO", section 7.33–7.35.

[25] A3 Cost report, section 3.2.7, table 3, pp. 20–21.

Table 3 – Key Risks from Monte-Carlo Simulation

No.	Description
1	Enhanced renewable energy generation may be required (above that provided by the hydropower turbines) to achieve potential carbon commitments.
2	Unexpected overburden (e.g. solifluction clay) may be encountered during foundation excavation for the reservoir embankment.
3	Wetter foundation clay than predicted for the reservoir embankment may be encountered, complicating compaction efforts.
4	10% Biodiversity Net Gain (BNG) requirements may not be able to be achieved within currently assumed Order Limits.
5	Foundation of the perimeter embankment may be weaker than expected requiring a modification to the section and increased cut and fill volumes.
6	High plasticity, very stiff bedrock clay may be found within the borrow pit which impacts compatibility for use in reservoir embankment construction.
7	At a later stage in design development it may be necessary to introduce a surface water channel into the design for auxiliary emergency drawdown of the reservoir.
8	Utility Statutory Undertakers may not be able to deliver utility works within the currently assumed programme.
9	At a later stage in design development it may be determined that additional works are required to make provision for the potential Wilts & Berks Canal.
10	Main Works Contractor insolvency.

Table 2.1 - Key risks for SESRO costs (from A3 cost report)

From Table 2.1 we note the following.

- Key risks 2, 3, 5 and 6 relate to existing ground condition and earthworks, which the results of the recent clay compaction trials (CCT) may further impact on the embankment design and the cost estimate and project completion date as currently reported. We also note that the Binnie Report for GARD criticises the CCT as totally inadequate[26], and thus risks from the interpretation of the trial could be substantial. Further we note that the Gate 3 Design Report[27] states that the appointment of a Construction Engineer for the project under the Reservoirs Act 1975 only took place in August 2024. With the earlier reference to the design date freeze of October 2024 for the cost report, the current design is unlikely to have had any overview by the 'Construction Engineer', which is considered a significant risk.

- Key Risk 1 is related to the points made in our assessment of the Carbon report of the Gate 3 submissions (see section 2.6 below). In this section we note that Thames Water has not foreseen the use of floating solar panels to make a contribution to the loss of renewable energy that results from the destruction of several solar farms. In the aforementioned environmental request (EIR- 25-26-355), GARD asked for a

[26] Binnie (2024), op. cit., Executive summary, p. 1 and other references therein.
[27] Gate 3 Basis of Design report, p. 76.

commitment to floating solar panels on the Reservoir (a technique used on other Thames Water reservoirs) in order to improve the carbon footprint of operations and avoid the needless loss of generating capacity and materials. The reply to this EIR (dated 1st October 2025) was non-committal and largely negative. In spite of this, only 4 weeks later, we find that floating solar panels are indeed on the SESRO design for the DCO consultation, launched 28th October.[28] This issue is dealt with in section 2.6 below, but here we note that this is another concrete example of a risk having been mitigated by a design change, which will inevitably result in a clear further cost escalation.

- Regarding Key Risk 4, following the issue of the Gate 3 reports, Thames Water has finally admitted in its pre-DCO consultation submission (launched a mere two months after the Gate 3 reports) that the biodiversity baseline within the Reservoir site is considerably higher than its Gate 3 estimate. It has admitted that a net gain in biodiversity cannot be delivered with the previous Reservoir site and that to deliver a 10% net gain will result in material additional cost. It seems that Risk 4 has been realised, but presumably it was hoped this would slip unnoticed through the RAPID Gate 3 examination. We discuss this in more detail in section 4.1.

- Key Risk 7 concerns the need for the introduction of an emergency water drawdown channel. Surely, this risk is no longer considered extant, as it has been dealt with under design development between Gate 2 and 3, by the removal of the auxiliary drawdown channel (ADC) from the Gate 2 design, with the increase in diameter to the conveyance tunnel, from 4.0m to 6.2m to compensate? The reconsideration of this significant change would go against the currently declared RIBA plan of work stage 3 design status, where the design is not subject to further significant change.

- Regarding Key Risk 9, we merely observe that the issue of providing a corridor for restoration of the Wilts and Berks Canal, however important one section of the local population regards this plan, is hardly the most important function of a £6.6Bn Nationally Significant Infrastructure Project (NSIP). We speculate that this is here mainly to shore up Thames Water's fragile analysis that the Reservoir somehow has a positive effect on natural capital.

For all the following reasons:

- the absence of any analysis of the delivery time and schedule impact of identified risks;

- the absence of applying risk mitigation as part of the risk management process;

[28] https://thames-sro.co.uk/public-consultations/south-east-strategic-reservoir-option-sesro-statutory-consultation-2025/.

- the multiplicity of high cost-driving risks associated with the insufficient knowledge of the ground conditions of the SESRO site;
- the already-realised risks from design changes;
- the frivolous inclusion of peripheral issues which Thames Water has elevated to a kind of iconic status to bolster their public popularity;
- and others which will become evident in further sections of our analysis;

the validity of the various Boards' Assurance statements that risks are well managed is highly questionable.

In the Thames Water[29], Affinity Water[30], Southern Water[31] and Board Assurance letters, dated 8th, 11th, and 12th August 2025 respectively, it is confirmed that they are satisfied in meeting the Gate 3 requirements, with the statement below:

> *"[…the Board is…] is satisfied that the progress on the work carried out for gate three is of sufficient scope, detail and quality to ensure that applications can be made for development consent orders, planning applications and other necessary statutory consents and permits at the right time, in accordance with the schedule set out in the gate three report. The work carried out at gate three is commensurate with the solution being "construction ready" for 2025-2030; …"*

These assurances are given even though in the Gate 3 documentation to support and substantiate this statement, no Gantt chart or similar is provided, scheduling the required work in accordance with current dependencies and assumptions.

Furthermore, the three Board letters cited above all state in respect of risks and the statement that we have emphasised in bold text:

> *"3. [the Board] is satisfied that all significant risks to the delivery of the solution in accordance with the programme and within cost projections current at the time of preparing the Gate 3 submission have been identified and* ***that those risks are managed well through routine risk management processes****, recognising that not all risks are in the control of the solution;" [our emphasis added]*

[29] https://www.thameswater.co.uk/media-library/ttnmtzjp/supporting-document-h-sesro-gate-3-covering-letter-board-assurance-statement-thames-water.pdf.
[30] https://www.thameswater.co.uk/media-library/jm0nihp3/supporting-document-h-sesro-gate-3-covering-letter-board-assurance-statement-affinity-water.pdf.
[31] https://www.thameswater.co.uk/media-library/34bnrmse/supporting-document-h-sesro-gate-3-covering-letter-board-assurance-statement-southern-water.pdf.

It is very difficult to see how risks for which the mitigation processes have not been included in the cost and time-schedule estimates can be characterised as "***managed well through routine risk management processes***" [our emphasis added].

GARD concludes that RAPID should insist on a more detailed, transparent and thorough presentation of these risks and their effect on the project cost and schedule.

2.1.4 Optimism bias

A3 Cost Report sections 4.1.1 to 5 are a 'word for word' copy of the text from the SESRO A2 Gate 2 Cost Report (sections 4.1.1 to 5). Section 4.1.1, other than a broad reference that "*The assessment of optimism bias has followed an approach developed for the ACWG*", does not identify the methodology or how the SESRO OB allowance has been generated. In comparison, the Minworth SRO 24 October 2022, Gate 3 Cost Report[32] provides a more meaningful explanation in respect of the OB methodology that should be used for RAPID projects:

> *"2.3 Optimism Bias Methodology*
>
> *Optimism Bias (OB) was derived using the methodology outlined in the "Cost Consistency Methodology – Technical Note and Methodology Revision 3" (Mott MacDonald, 2020), which sets out recommendations for SROs on the common approach to OB assessment.*
>
> *The approach was agreed with the ACWG. The document recommends that the approach to OB should use an associated Excel template "ACWG - Appendix A-1 - Optimism Bias and QCRA - Rev C" provided for all SROs. The OB Template was developed by Mott MacDonald based on the HM Treasury Green Book and supplementary guidance by the HM Treasury.*
>
> *The OB Template was used to calculate OB percentage rates. Following L1 assurance, STW / Affinity provided an amended OB assessment to reflect their individual company's view on the level of OB to consider for the scheme taking into consideration other schemes being developed within the SRO framework."*

Although not specifically described under section 4.1.2 of the Cost Report as the first stage, OB is assessed using the Supplementary Green Book OB Guidance, by reference to the standard and non-standard civil engineering works adjustment range, to arrive at an "Upper Bound Optimism Bias" of 53.5%. At Gate 2 this was set at 66%, assuming a 100% non-standard civil engineering works.

Sections 4.1.3 and 4 describes how, under the second and third OB assessment stages, the "Upper Bound Optimism Bias" of 53.5% is scaled back to arrive at the OB cost estimate allowance of 26.8% or £1,098M, as stated under Section 4.1.5. At Gate 2 for comparison, the

[32] Severn Trent and Affinity Water (2025), "Minworth SRO Gate 3: Annex A6 Cost Report".

OB estimate allowance was 27.9% or £468M (2022/23), which at Gate 3 ignoring the increase in the OB value is a reduction of 1.1%.

The normal expectation is that as a project progresses and matures, ideally the OB allowance should reduce. This aligns with RAPID's own expectation[33] that, as a solution moves from Gate 2 to 3, the allowance for OB should reduce:

> *"At gate three, solution owners should present updated key cost information provided at gate two for the preferred option with reduced uncertainty in costs and benefits and an explanation of any material change in costs,* ***including where optimism bias has been reduced as costs firm up****." [Our emphasis added]*

The converse has occurred between the issue for the Gate 2 and 3 cost estimates, as the OB allowance has risen by £630M and requires an explanation as to how this has occurred.

With the previously advised error in the base estimate total, the stated OB percentage allowance at "26.8%" is incorrect and should read "25.6%", as per the calculation below:

$$\frac{\text{Capex (Costed Risk)}}{\text{Capex (no OB or Costed Risk)}} = \frac{£1{,}098.00\text{M}}{£4{,}294.00\text{M}} = 25.6\%$$

Further comments on OB are made in the section 2.2 (below) on the capital cost.

2.1.5 Potential capital cost range

As noted in section 2.1.2 above, Thames Water has belatedly adopted the RAPID guidance that the "*Capex estimate reported should be considered at a point within a range of potential cost outcomes".* The Cost Report makes reference to the methodology of providing this range estimate, where the following is stated at section 2.2.4:

> *"A recognised construction industry approach to assessing the range of a cost estimate has been defined by the American Association of Cost Engineers (AACE). The AACE Cost Estimate Classification System approach requires: […]"*

We note that at Gate 2, the SESRO Cost Report was silent in respect of the estimate accuracy range, although already at Gate 2 the comparable South Lincolnshire Reservoir Report[34] references AACE with a cost estimate accuracy range of -20% to 50%.

At section 2.2.5, the Cost Report states: "Following this approach, the SESRO project has been considered as Hydro Power Industry and assessed as a Class 4 Estimate with an evaluation of accuracy range within this class being -20% to +40%." Table 2.2 reproduces Table 1 of the AACE Cost Classification Matrix for Hydro Power Industry:

---

[33] See RAPID (2003), "Strategic regional water resource solutions guidance for gate three Version 2", August.
[34] Anglian Water and Affinity Water (2022), op. cit. [23], section 8.1.

	Primary characteristic	Secondary characteristic		
Estimate class	Maturity level of project deliverables (% of the complete definition)	End usage (typical purpose of the estimate)	Methodology (typical estimating method)	Expected accuracy range (typical variation in low and high ranges)
Class 5	0–2%	Concept screening	Capacity factored, parametric models, judgement or analogy	Low:–20% to –50% High: 30–100%
Class 4	1–15%	Study or feasibility	Equipment factored or parametric models	Low: –15% to –30% High: 20–50%
Class 3	10–40%	Budget authorization or control	Semi-detailed unit costs with assembly level line items	Low: –10% to –20% High: 10–30%
Class 2	30–75%	Control or bid/ tender	Detailed unit cost with forced detailed take-off	Low: –5% to –15% High: 5–20%
Class 1[a]	65–100%	Check estimate or bid/tender	Detailed unit cost with detailed take-off	Low: –3% to –10% High: 3–15%

Source: AACE International, "Cost estimate classification system – as applied in engineering, procurement, and construction for the hydropower industries".

Table 2.2 - AACE Cost Classification Matrix for Hydro Power Industry

The 'Class 4' AACE classification clashes quite markedly with the characterisation of the SESRO project, which has been cited elsewhere in the Cost Report. In Cost Report section 2.1.1 the design is stated, *inter alia,* to have been prepared to meet the requirements of a RIBA plan of works - Stage 3 status design, except for the DCO-ready element. This is hardly consistent with an end usage of "*Study or feasibility*", as cited in Table 2.2 above.

For all its faults, GARD considers the design for SESRO to be further advanced than the feasibility stage, with the use of the Estimate Class 3 considered more appropriate, leading to a smaller expected accuracy range or confidence level than currently stated.

We note that the use of a +50% / -20% accuracy range aligns with Infrastructure and Projects Authority (IPA)[35] guidance for cost estimates at Strategic Business Case stage (SESRO is beyond this stage). Whilst this IPA technical guidance is referred to in RAPID/Ofwat's "*Approaches for estimating and benchmarking costs for large scale water infrastructure projects*"[36] (referenced in the A3 Cost Report section 2.2.3), the RAPID/Ofwat document makes no reference to the "AACE Cost Estimate Classification System". GARD notes that using it at all is a departure from RAPID/Ofwat guidance. It seems to us that using the IPA Guidance for "Outline Business Case" (p. 30) would support the above estimate (Class 3) accuracy range of -15% to +30%.

[35] IPA (2021), "Cost Estimating Guidance".
[36] CEPA (2022), "Approaches for estimating and benchmarking costs for large scale water infrastructure projects – a report for Ofwat and RAPID".

2.2 Capital costs of SESRO

The total capital cost of SESRO (Capex) is stated in the A3 Cost Report (Table 7) as:

Base Capex	£4,294M
Costed Risk (total)	£1,212M
Optimism Bias	£1,098M
Total (Base Capex, Costed Risk and Optimism Bias)	£6,604M

Table 2.3 - Total Capex cost estimate summary (2022–23 prices)

The £4,294m Capex base estimate is also confirmed as used in the (near illegible) A3 Cost Report Appendix A. This represents a huge cost increase over the Gate 2 estimate – of around 150% (taken on an equivalent financial year basis). Below we explore whether this increase itself is fairly presented in the Gate A3 Cost Report.

The *range* within which this estimate sits is only very coyly referred to once in the main Gate 3 report (table 2)[37] as ***£5,500M to £7,500M***. We note in passing that this range (-17% to +14%) does not correspond on the high side to any of the guidance quoted in the Cost Report or the IPA, as discussed in section 2.1.5 above.

2.2.1 Gate 3 Capex cost estimate change from Gate 2

Given this very large increase over Gate 2 estimates (backed with 'Board Assurance' statements at the time), one would expect there would be a coherent, evidence-backed and transparent analysis and explanation in the A3 Cost Report. Unfortunately, this expectation is not satisfied by the document.

Summary comparison

Table 7 of the Cost Report gives an uplift to the Gate 2 cost estimate in the comparison with the Gate 3 cost estimate. The Gate 2 to Gate 3 comparison (2022/23 price base) is summarised in Table 2.4 below. GARD considers an average uplift of 25% for updating the 2020/21 Gate 2 estimate to 2022/23 price levels to be excessive and requires explanation. To allow a fair and meaningful comparison between Gate 2 and 3 costs, reference to BCIS Tender Price Indices for the period 2020/21 to 2022/23 indicates an uplift of approximately 11–12% as a more reasonable allowance.

[37] Thames Water, Affinity Water and Southern Water (2025), "Strategic regional water resource solutions: detailed feasibility and concept design: Gate three submission for South East Strategic Reservoir Option (SESRO)", August. (Henceforth the "Gate 3 Main Report".)

Ref.	Element	Gate 2 rept.[1]	Gate 2	Gate 3	% Uplift	% change
	Base Date	**(2020/21)**	**(2022/23)**	**(2022/23)**	**(2020/21) to (2022/23)**	**Gate 2 to Gate 3**
		£M	**£M**	**£M**		**(2022/23)**
1	Base Capex	1,455	1,891	4,294	30%	127%
2	Risk Allowance	335	386	1,212	15%	213%
3	Optimism Bias	406	468	1,098	15%	135%
	Total (Base Capex, Risk and Optimism Bias)	£2,196	£2,745	£6,604	25%	158%

Note: [1] Gate 2 SESRO Cost report A2, Appendix.

Table 2.4 - Capex elements cost comparison between Gate 2 and Gate 3, following Thames Water

Thus the Gate 2 estimate to 2022/23 price base is overstated, and the percentage increases between the Gate 2 and Gate 3 cost estimate forecast prices given in the A3 Cost Report are therefore considered to be too low.

Although not stated in the works element costs under the Gate 2 to Gate 3 Comparison (2022/23 price base)[38] include the following apportioned costs, as below:

1.	Planning and Development (Non depreciating)	£377.89M
2.	Other Non-Depreciating Assets (Non depreciating)	£674.16M
3.	Sunk Costs	£99.33M
4.	Client Indirect Delivery Costs - ND, Optimism Bias added	£519.99M
Total		**£1671.38M**

Note: Base Capex costs, excluding OB.

No scope or definition is provided in the report to support the expenditure on Other Non-depreciating Assets at £674.16M or for Sunk costs at £99.3M, which is considered a significant omission and should be rectified. We return to this in the discussion of NPC (section 2.4 below).

Table 7.1 includes a cost of £247M for "*Land costs*". We note two points about this: it is not consistent with the figure of £312.25M derived from the Cost Report Appendix A table; and the documents issued by Thames Water for the pre-DCO consultation exercise (launched

[38] A3 Cost Report, section 6.1 Summary Comparison, Table 7.

28th October) show a massive increase in land acquisition for SESRO,[39] presaging further cost increases.

2.2.2 "Influencers" of Capex increase

Section 6.2 of the A3 Cost Report identifies "*significant influencers*" (Table 8) driving the increased Capex and refers to a summary of key design changes since the Gate 2 report was issued[40]. Other than a very broad comment that these design changes are responsible for the more than doubled cost increase in the Base Capex cost estimate from £2,745M (2022/23) to £6,604M, no detailed analysis within the report has been provided.

A review of Table 2-1 carried out by GARD (see Appendix B) concludes that most of the design changes identified are typical design development items and that, provided the base estimate, risk and OB allowance had been sufficiently robust, they should not have resulted in a more than doubled cost estimate. To further support this view, a comparison of the "*Final Gate 2 Design Report Master Plan Drawing*" and the similar drawing lodged in the "*Gate three submission for South East Strategic Reservoir Option (SESRO)"* (August 2025) has been prepared (see Appendix C) and concludes that the differences between the Gate 2 and 3 proposals are not considered sufficient to support a more than doubling of the cost estimate. In respect of landscaping, the A3 Cost Report (Table 8) states this element as undergoing a 624% increase in estimated cost, citing the increased area of floating islands as a justification for the increase. However, comparison of the Gate 2 and 3 drawings (Appendix C) shows that the area of floating islands has not changed significantly, with several large floating islands shown to the south of the Reservoir and appropriate legend in drawing the key box.

The reasonable expectation is that, with the issue of a final status report with technical proposals that include a drawing, the associated cost estimate for Gate 2 should align with the design as described and/or shown; otherwise, it is a misrepresentation of the proposals**. This is considered relevant as the Gate 2 cost estimate was used to support WRSE optioneering and the selection of SESRO at 150Mm³ over competing options.**

The more than doubling of the cost estimate between Gate 2 and 3 is inconsistent with the Main Board-assured submission statement at Gate 2, where the proposals were supported by a Main Board joint Thames Water and Affinity Water assurance letter, dated 14 Nov 2022[41], which included the statement below. The proposals:

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[39] Thames Water, Affinity Water and Southern Water (2025), "SESRO Statutory Consultation Map Book", Autumn.
[40] Gate 3, Basis of Design report, Table 2-1.
[41] Thames Water and Affinity Water (2022), "Gate 2 covering letter and Board Assurance Statement" (unsigned), 14th November.

"have been subject to sufficient processes and internal systems of control to ensure that the information on design, costs and benefits contained in this submission are reliable;"

This requires an investigation by RAPID and issue of a report identifying how this situation arose.

2.2.3 Risk component of Capex

Section 6.3 of the Gate 3 A3 Cost Report deals with the updated risk allowance, but does not state explicitly that, as we identified in Table 2.4 above, the risk allowance has increased between Gate 2 and 3 by £826M (from £386M to at £1,212M). The only reasonable conclusion which can be drawn from the significant increase above is that the Gate 2 risk allowance was grossly under-assessed.

The very significant increase in the risk allowance between Gates 2 and 3, with a Main Board-assured submission stated as 'reliable', requires an investigation by RAPID and a definitive comment.

No comparison is offered under this section of the Gate 2 programme time-related risk events and how these are mitigated under the Gate 3 proposals. The extract from the Main Gate 2 SESRO report[42] promises such mitigation measure development at Gate 3, in the last sentence.

> 7.4 At this relatively early stage in the project life-cycle, it is difficult to accurately predict programme risk elements that might cause delay. Therefore, in line with the recommendations of the Treasury Green Book[29], the schedule has been adjusted to account for unknown risks in the delivery of future activities. The effect of this risk allowance is a delay of up to 5 years in project delivery, with a theoretical latest delivery of 2043/44. The mitigation measures to manage these programme risks will be developed during the next stage of the project to ensure effective and timely management.

As already remarked, section 3.1.3 of the A3 Cost Report states that the number of risks has increased from 75 at Gate 2 to "*more than 270*" at Gate 3, subsequently clarified in a response to a RAPID query to total 287 risks. The normal expectation is that, as a project progresses, although the number of risks may increase, ideally the value of the risk allowance should reduce. The converse has occurred between the issue of the Gate 2 and 3 cost estimates and requires an explanation as to how this has occurred.

The breakdown of risks by category, taken from the response to the RAPID query,[43] is shown in Table 2.5 below. Note that these risks are costed by expected monetary value. This is a

[42] Thames Water (2022), "Standard gate two submission for South East Strategic Reservoir Option (SESRO)", section 7.4, November.
[43] RAPID (2025), "Gate three query process: Query number SER004", 3rd September.

somewhat different evaluation from the "P50" Costed Risk used throughout the reports. Expected monetary value uses individual risk mean likelihood and value, rather than the complete Monte Carlo simulation for the P50. The two total values obtained (£1,283M and £1,212M respectively) are quite close, and the difference is not important for our analysis.

What is important is the characteristic of at least two of the numerically largest risk cohorts, and their effect on the costed risk. Between them, the 80 risks under "*Design uncertainty/complexity*" and 34 risks under "*Site Characteristics and project data*" account for 40% of the costed risk. This is simply unacceptable for a project in gestation for over 20 years, and shows how Thames Water has wasted huge amounts of public (customers') money and failed to get to grips with the basics of site characterisation and key design issues. We have, of course, no benchmark as to the risk breakdown for SESRO at Gate 2.

RAPID Risk Breakdown Structure	Qty	EMV (£m FY22/23 prices)
Business case	14	160
Communication	4	4
Design uncertainty / complexity	80	300
Ecology & environmental constraints	23	104
Financing	3	20
Health & safety	2	6
Information management	1	0.4
Planning and approvals	44	68
Procurement	33	61
Regulation	21	35
Resources	6	260
Site characteristics and project data	34	219
Stakeholder	21	37
Sustainability	1	8
Total	287	1,283

Table 2.5 - Breakdown of numbers of SESRO cost risks by RAPID-determined category

2.2.4 Optimism Bias component of Capex

While the OB of Capex is dealt with in the A3 Cost Report (section 6.4), there is no statement of the methodology used to assess OB. Although it appears to follow "*Supplementary Green Book Guidance on Optimism Bias*"[44], this should nevertheless be confirmed in the cost report. OB also applies only to the cost element of the project and has not been applied to the works duration forecast, which will be referred to later in this section. There is no justification or itemisation for the statement (in section 6.4.1) that: "*The project is considered to be 43% non-standard civil engineering project, rather than 100% non-standard at gate two. Therefore the 'Upper Bound Optimism Bias' has reduced to 53.5%.*"

This reinforces the view, established in earlier sections (and referred to in section 2.1.4 of this GARD report), that the quantification of the OB allowance is deficient. **We believe that,**

[44] HM Treasury (2013), "Green Book supplementary guidance: optimism bias", 21st April.

if a quantitative analysis has been carried out to assess the OB allowance, RAPID should demand that it be made available for review.

As we identified in 2.1.1, the OB percentage allowance referred to in section 6.4.3 of the A3 Cost Report of "26.8%" is incorrect and should read "25.6%".

We note that the above-mentioned August 2025 Thames Water, Affinity Water, Southern Water Board Assurance letters do not specifically confirm whether any of the companies have reviewed and understand how the OB allowance has been assessed. This is considered a major shortcoming in the process, as the cost estimate OB has a value of £1,098M and represents a significant 19.9% of the Gate 3 cost estimate total of £6,604M.

With no reason given for the significant increase in OB allowance other than a broad statement under A3 Cost report section 6.4.4, the only reasonable conclusion from the significant increase above is that the Gate 2 OB allowance was grossly under-assessed. In support of this statement, for comparison the OB percentage allowance for the South Lincolnshire Reservoir at Gate 2 was assessed as 37.4%[45], compared to 27.9% for SESRO at Gate 2.

The A3 Cost Report (section 6.4.2) states that, whilst the maturity of the design and understanding of the proposed Specified Infrastructure Project Regulations procurement route has increased, a contradictory warning is given, however, advising that further work is still needed "*to increase confidence in some elements of the design and land access has limited the progress of environmental and engineering data collection".* This statement looks inconsistent, and requires clarification, with a design stated to be approaching RIBA plan of works Stage 3 completion status and when read in conjunction with the following statement from the Gate 3 Design Report[46]:

> *"The RIBA Plan of Works describes Stage 3 as Spatial Coordination with core tasks including: design studies, engineering analysis, cost exercises and architectural concept. Resulting in spatially coordinated design aligned to the cost plan, project strategies and outline specification. The overall gate three design meets these requirements with the development of the design since gate two and consultation on option reports, an interim master plan and draft design principles for the project. The project design responds to Sponsors Requirements and SRO strategies developed by the client team within Thames Water (and agreed with Affinity Water and Southern Water).*

[45] Anglian Water and Affinity Water (2022), op. cit., p. 47.
[46] Gate 3, Basis of Design report, Table 1-2, p. 18.

However, it is recognised that the design is not DCO ready and further design development work is required as described in Section 5. The design development process for SESRO is described in Section 1.7."

We also know that work is currently in hand in developing groundwater controls to ensure the groundwater flood risk is not increased[47], and, as these proposals look substantial, they potentially could have a significant impact on the cost estimate and potentially the programme. In addition, the design of the embankment is still subject to the results of the recent CCT trials, which could also significantly impact on cost and programme.

GARD considers that the omission of any OB allowance from the programme to take account of unknown risks in the delivery of future activities, and hence provide assurance that the 2040 completion date can be met, is a major shortcoming.

2.2.5 Summary of 'design' changes declared since the Gate 3 design freeze

At this point, it is worth summarising the list of design changes which have been declared since the Gate 3 submission. None of these were included in the Gate 3 design or cost estimate, but most are included in the recently issued pre-DCO consultation documents[48]. ***Each of the following items will have a material impact*** on the cost estimate when they are included:

- The design of the embankment now incorporates a separate compacted clay core.
- An additional 11km underground ground water control drain has been included around the full perimeter of the Reservoir.
- The proposed works completion date has been put back to 2043 (3 years after the target in-service date).
- Design alterations are supposedly included that result from the lessons learnt from the small-scale CCT conducted in 2025. It needs to be emphasised that this extremely small trial sampled clay from less than 0.1% of the Reservoir area and was only about 10% of the height of the proposed embankment. In passing, we note that it is clear that there will be further design alterations resulting from lessons that would be learned from a full-scale trial. This proved to be the case after such a full-scale trial conducted at the Havant Thickett Reservoir. Even though the Havant Thickett Reservoir cost estimate had already increased by 150% before that trial, the trial revealed information that led to a highly material increase in cost. In Ofwat's words: "*In addition, during early construction in late 2023, ground issues (shear planes and related sand formations) were discovered on site that could not have*

[47] Many Thames Water statements at public engagement events, but most recently confirmed by email response to EIR25-26-355, dated 1st October 2025.

[48] https://thames-sro.co.uk/public-consultations/sesro-statutory-consultation-2025-document-library/

been reasonably foreseen by initial site investigations, as confirmed by our own technical advisors. The cost to rectify these will materially increase the overall project cost."[49]

- The proposed removal of 3.7Mm³ of topsoil from the site[50].
- The addition of 40MW floating solar panels on the Reservoir, and a commitment to replace the two solar farms on the Reservoir site that would be destroyed by the Reservoir. In the DCO consultation documents maps, the latter appears to be on new "*reserved*" land near Garford[51].
- A vastly expanded planning order area (now 38km^2), entailing a substantial material cost, partly to accommodate the afore-mentioned solar panels, but mainly:
    - to meet the requirement to deliver biodiversity net gain (BNG). As we have previously pointed out in independent reports,[52] the Gate 3 design continues to materially understate the biodiversity baseline, and Thames Water has finally had to admit to this;
    - to meet the commitment that the development of the Reservoir will not increase flood risk elsewhere for the lifetime of the Reservoir, taking into account climate change and considering each individual type of flood risk (fluvial, surface water and groundwater) separately across each of the areas affected by the Reservoir[53].

2.3 Operating costs of SESRO

The Opex for SESRO is given in the A3 Cost Report as a sum of *Fixed* and *Variable* Operating Costs. We note that some allowance is given in the report for the variable operating costs for the pumping of the water from SESRO to the Thames to Southern Transfer (T2ST) pipeline (to Southern Water) and to the transfer to Farmoor. Both these schemes – in particular the T2ST – are part of the justification for the need for SESRO, yet two very important items are omitted from the costs for SESRO:

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[49] Ofwat (2024), "*PR24 final determinations: Major projects development and delivery*", 19th December, p. 16.
[50] Thames Water (2025), "South East Strategic Reservoir Option: Preliminary Environmental Information Report: Non-Technical Summary", October.
[51] Thames Water, Affinity Water and Southern Water (2025), "SESRO Statutory Consultation Map Book", autumn. (Hereafter, the 'DCO map book'.)
[52] Parfitt, J. (2025), "Critical Review of SESRO Biodiversity Net Gain Reports", April. (Hereinafter referred to as the '2024-JPP Report'.)
[53] The "National Policy Statement for Water Resources Infrastructure" (Defra, 8th July 2025, para. 4.7.9) states: "*The applicant should ensure that the development is safe from flooding and will not increase flood risk elsewhere for the proposed development's lifetime, considering climate change*"; and the National Planning Policy Framework (MHCLG, 27th March 2022, para. 170) states: "*the development should be made safe for its lifetime without increasing flood risk elsewhere*."

1. Capital costs: the costs of the water treatment works (WTW) on site (with the exception of the items listed following the RAPID query to Thames Water, discussed in section 2.2.5 above).

2. Operational costs: any operational costs of the WTW for T2ST and Farmoor supplies.

These represent a continuing example of the lack of joined-up-thinking in the assessment of the Strategic Schemes by RAPID. The fact that the extra water supplied by the increase in the SESRO size from 100Mm^{3}to 150Mm^3 is wholly determined by the supply to T2ST requires that the two Strategic Schemes be assessed together. There are other obvious issues in the construction period clash between the base SESRO and the T2ST, which were not tackled at Gate 2 and are not transparently discussed in the Gate 3 report.

2.3.1 Fixed operating costs

The fixed operating costs included in section 2.3.5 of the A3 Cost report cover operational maintenance, operating staff, abstraction fees, as well as the power used for aeration and miscellaneous ancillary assets. At this point we note that the analysis of the Gate 3 Water Quality report (see section 3.5 below and the ancillary analysis in Appendix E) concludes that the aeration system power is grossly underestimated, casting doubt on this section of the fixed Opex.

2.3.2 Variable operating costs

The variable operating costs are calculated based on the forecast energy requirements as set out in the Gate 3 Basis of Design report (sections 3.7.2–4), with forecast energy requirements summarised in Table 2.6:

	Utilisation		
	Low	**High**	**Average**
	MWh/year	**MWh/year**	**MWh/year**
Generation from release to Thames	0	-2,650	885
Pumping to refill Reservoir	904	8,200	5,915
Pumping from Reservoir to Farmoor and T2ST	408	3,678	813
Air diffuser compressor power	n/a	n/a	n/a
Total MWh/year	**1,312**	**9,228**	**5,843**

Table 2.6 - Summary of low, high and average utilisation Reservoir energy requirement forecast

2.3.3 Total Opex: summary

Section 2.3.12 and Table 1 of the A3 Cost Report summarise fixed and variable Opex costs with the total of £6.44M, as shown in Table 2.7:

	Total
Fixed operational annual costs (£M/year)	4.18
Variable cost/year (£M/year) at theoretical high utilisation	2.26
Total Opex/year (£M)	**6.44**

Table 2.7 - Total Opex forecast cost summary

The variable cost/year has been calculated using the theoretical high-utilisation energy requirements forecast, as summarised in Table 2.7. The energy high-utilisation forecast is based on an annual 365-day pump duty, using the scenario as below

- A release of 237Ml/d to River Thames for 266 days.
- Pumping (where gravity discharge is not possible) of 74Ml/d from the Reservoir to T2ST for 365 days.
- Pumping of 24Ml/d for raw water transfer from the Reservoir to Farmoor for 365 days.
- Pumping of 1,000Ml/d to refill the Reservoir from River Thames for 99 days.

The above is considered an unrealistic assumption and inflates Opex costs. GARD believes that the more representative average utilisation energy cost/year requirement forecast should be used for net present value (NPV) estimate modelling purposes. This fact is not lost on RAPID, who asked in query SER0092[54] for the modelled usage of SESRO as was used to calculate the whole-life costs of SESRO (in comparison with other Strategic Resource Options) in the PR24 price summary.[55] The reply (also given in SER0092) is based on the modelled usage of SESRO of 38%, as given in the WRMP24 final plan. With this usage, SESRO's variable Opex becomes (see SER0092):

Item	Days	Max DO (Ml/d)	Average DO (38%) (Ml/d)	£/Ml	Total £/year	Total £m/year
Variable Opex	365	271	102.98	22.9	860,007	0.86

The revised value of Opex now becomes £5.04M pa (£4.14M + £0.86M) – this is of course at 2022/23 prices. It compares to the previous figure of £4.7M (table 9 of the PR24 Review document).

In the same request, RAPID asks for a cost of the whole life period (in the case of SESRO that is 250 years), and not the 65-year basis used in the Gate 2 submissions.[56] **This is in spite of**

[54] RAPID (2025), "Gate three query process: SER009", 22nd September.
[55] Ofwat (2025), "PR24 final determinations: Major projects development and delivery", table 1.
[56] A3 Cost Report, Appendix A, table 5.

the fact that Thames Water, in using table 5 of Appendix A of the A3 Cost Report, is using a format given to it by Ofwat, and the table is intended as the WRMP24 comparison table. Nothing could better illustrate the incoherence of the whole process of assessment of Strategic Options. The figure given by Thames Water is £1,259M, as below.

Item	Qty	Unit	Rate	Total for 250 years (£m FY22/23 prices)
Fixed Opex	250	Years	4.18	1,044.50
Variable Opex	250	Years	0.86	215.00
			Total	**1,259.50**

2.3.4 Replacement Capex

Many items on the SESRO system have a lifetime shorter than the "*whole-life totex*" of the resource, based on the Lifetime of 250 years for the Embankments. Over the years, replacement of these is a true extra cost component of 'operating' the Reservoir, and hence is considered an operating cost, separate from the pure Opex discussed so far. No Capex estimated cost summary divided into asset life categories has been provided, other than the summary in the Cost Profile WRMP24 Table (Table 5) lodged under A3 Cost Report Appendix A.

This "*Replacement Capex*" is referred to in the A3 Cost Report, but the values and the Cost Profile are buried deep in the illegible A3 Cost Report table 5 in Appendix A. GARD used proprietary software to produce a working Excel spreadsheet based on Table 5, but it seems that RAPID was also confused by the anti-transparent actions of Thames Water. Even when RAPID (and we) progressed to deciphering the data, it was established that, as with the Opex, the sums were carried out for the first 65 years of operation only (to 2105/06). Notwithstanding that, as above, this is the 'WRMP24' format, RAPID asked, via SER009, for a whole-life value for replacement Capex. The response (in SER009) is reproduced in Table 2.8:

Item	Period	Cost (£m FY22/23 prices)
Capex	2025-26 to 2039-40	6,604.03
Opex	2040-41 to 2289-90	1,259.50
Replacement Capex	2040-41 to 2289-90	6,791.22
	Total	**14,654.75**

Table 2.8 - SESRO whole-life totex, composed, as requested by RAPID, to match the format of PR24

The sum of £14,654.75M for the whole-life totex compares to the Ofwat PR24 value[57] of £7,523M (baselined for the same financial year 2022/23), confirming a cost doubling of SESRO on this metric.

It is to be noted that, as with the declared Capex for SESRO, this whole-life totex does not include the Replacement Capital costs for the WTW and the pipelines associated with either the T2ST pipeline to Hampshire, or the supply to Farmoor.

2.3.5 What is still missing from the whole-life totex

Sadly, for Thames Water customers, this is still not the whole story of the cost to be borne by the consumer. Of the above components of whole-life totex, the "*Operating Costs"* (Opex + replacement Capex) will clearly fall on the customer. The initial Capex will, on the other hand, be raised from the market. **What the customer pays for is the *financing* of the Capex, through bill rises to pay for the interest on the finance loans**. By the Ofwat formulae, these payments will run out over 250 years for a reservoir project like SESRO.

These financing payments are nowhere mentioned in the A3 Cost Report, and have not been the subject of any query by RAPID. RAPID of course knows of their existence, but has previously ignored GARD's expressed view that, as they are linked to affordability and cost to billpayers, they should form part of the SESRO appraisal process for comparison with other options.

The size of these costs is partly available by consulting the A3 Cost Report, Appendix A, table 5. The total runs for only the (WRMP24-based) period of 65 years of operation (to 2105/06), but it is £14,478M. This shows ***a minimum indication of*** the size of the financing costs; of course, we need the full 250-year period up to 2289/90 for that evaluation.

In an email of 24th September 2025, GARD put these figures to Thames Water, stating, *inter alia:*

> *"[…] From this table (A3 Cost Report, Appendix A, table 5), for the 65 years of operational life for SESRO between 2039-40 and 2103-04 that are assumed in the Gate 3 submission, you have derived the 'Operational cost' as a sum of 'Capex - capital replacement of assets' […of…] £1,911M. The sum reported by the BBC.*
>
> *However, you have neglected to include the interest on the financing costs - also listed in your table. When these are included, we have*

[57] Ofwat (2025), "PR24 final determinations: Major projects development and delivery", table 1.

		£M
Capex – capital replacement of assets		1,181
Opex - running costs		419
Capex	Costed risk	inc.
Capex	Optimism bias	311
	£1.90Bn or total (£M)	1,911
Interest at 2.92% pa including depreciation		14,776
Total running costs including interest and depreciation (£M)		6,687
or		£16.7Bn

> *Bringing the total running costs arising from SESRO over the 65 years to **£16.7Bn**.*
>
> *[…] As these costs are, by standard accounting practice, operating ('running') costs of the business (hence their inclusion in the Ofwat's standard table), and as they must be raised from customer bills (there being no other source), **we would like confirmation that the above £16.7 Billion is the running cost from consumer bills over the next 65 years.** […]"*

The reply, from Mark Mathews of Thames Water to GARD Chair, Derek Stork (6th October 2025), contains much largely irrelevant 'packaging', but also contains the following:

> *"Your email states that financing costs are, 'by standard accounting practice, operating ('running') costs of the business'. We do not agree with this**, although we do acknowledge that both financing and operating costs must be funded by customer bills across those companies that will benefit from SESRO, as is standard practice within regulated industries.***
>
> *We do not consider that summing estimated operating and financing costs over what is a relatively arbitrary period of time (65 years, in contrast to an asset life of 120 years or longer) provides useful information regarding the affordability of customer bill payments. It is noteworthy that the Infrastructure Provider will have a licence to own and operate SESRO that does not stipulate an end point. Financing costs are also uncertain." (Emphasis added)*

The point about the "*relatively arbitrary time period of 65 years*" is totally irrelevant, because, whatever time period is taken, up to the lifetime of the facility (250 years) the declared cost contains a major missing line item which, as Thames Water acknowledges, falls on customer bills. The point that '*Financing costs are uncertain*' is also irrelevant, and only adds to the possible total bill, especially as an Ofwat notional weighted average cost of capital (WACC) interest rate of 2.92% is used in summing up the finance, which is by current

standards low. In comparison, the current loan book interest rate for Thames Tideway Tunnel is approximately 5.5%[58].

Thus whilst the Opex has gone down by a more realistic assumption about SESRO usage (section 2.3.3 above), we can see that the 'operating costs' billed to the consumers are dominated by this financing cost by a factor of something close to 8:1. **We therefore urge RAPID to publish these costs in its examination of the SESRO Gate 3 submissions.**

2.4 Cost–benefit analysis

2.4.1 AIC calculation

The metrics NPV and average incremental cost (AIC) are used in the Gate 3 review to indicate the cost–benefit balance of the SESRO project. Once again, we note that, apart from some operational costs, the T2ST and Farmoor, water treatment and off-site pipelines are not included in these estimates. NPV and AIC are used by Ofwat to compare projects. Although no specific use is described for the AIC calculation in 'Best Value' calculations, such as that of WRSE, it is normally required by Ofwat to allow the benchmarking of projects by measuring the cost in relation to benefit and therefore efficiency of spend.

At Gate 2, the AIC at maximum utilisation (100%)[59] (2020/21 prices) was **92.91p/m³**, which was then uplifted in the A3 Cost Report, table 10 for comparison purposes to 2022/23 price levels at **116.3p/m³**, by the addition of 25%. The A3 Cost Report, Table 6 – "*NPV and AIC Estimates (2022/2023 prices)*" does not use the NPV (NPC) total taken from the A3 Cost Report Appendix A Cost Profile WRMP24 Table, which is **£4,419.8M**. **This is a material omission from the A3 Cost Report and should be summarised in the report**. This figure is confirmed, and table 2.9 provided, in the email dated 6 October 2025 sent to GARD Chairman, Derek Stork, in reply to EIR 25-26-379.

Item	£M (2022/23 prices)
NPV Finance	4,316.4
NPV Opex	103.4
Total Net Present Cost	4,419.8

Table 2.9 - Confirmation of NPC value for SESRO at Gate 3 (from EIR 25-26-379 reply)

This table is described as demonstrating "*how the two components are summed as Total NPC*". Unfortunately, nowhere in the table 6 is this value used, or the calculation explained. We reproduce Table 6 of the A3 Cost Report here:

[58] See Thames Tideway, "Table 4B Analysis of debt 2024/25 Bazalgette Tunnel Ltd (Tideway)".
[59] Thames Water and Affinity Water, "South East Strategic Reservoir Option (SESRO) Supporting Document A-2: Cost Report", Table 7-2.

Table 6 – NPV and AIC Esimates (2022/2023 prices)

	Units	Quantity
Option benefit	Mld	271
Capex NPV	£m	5,193.1
Opex NPV	£m	103.4
Total NPV	£m	5,296.5
AIC	p/m³	268.4

Note that, apart from anything else, GARD disputes the Deployable Output ('Option Benefit') of 271Ml/day – see section 3.1below.

This value of AIC of **268.4**p/m³ cannot be verified and is actually at variance with the AIC of **287.9p/m³** taken from the summary document of the Gate 3 submissions (see snapshot below).

Item	Details
Max utilisation average incremental costs (AIC)[1] (with sensitivity test figures)	287.9 p/m³ *(source: Gate 3 NPV cost template)*

Source: Key Facts, "At a Glance", p. 2 of Gate 3 Main Report.

At Gate 2, SESRO 150Mm³ AIC of 92.91p/m³ was calculated using the then NPC of £1.475M (2020/21), and a planning benefit based on "*Maximum Utilisation (100%)*". In a footnote to that calculation, Thames Water has written:

> *"Note * 100% utilisation is assumed for these calculations to enable comparison between options: 1 in 500 year deployable output for 365 days / year, and estimated maximum variable operating cost. Required utilisation to be confirmed through WRSE modelling."*

No reference to where the above utilisation by reference to WRSE modelling can be found in any of the Gate 3 reports.

GARD has applied the same methodology and utilisation used at Gate 2 to the Gate 3, (confirmed) NPC of £4,419.8M. The AIC is calculated in Table 2.10 below:

DO/day	271Ml/day
Days pa	365
Utilisation	100%
	98,915Ml pa
Y16 to Y80 discount factor 65 yrs	16.05
Total planning period benefit (m^3)	1,587,585,750m^3
NPC total	£4,419,800,000
AIC p/m^3	278.4

$$\frac{£4,419,800,000}{1,587,585,750m^3} = 278.4p/m^3$$

Table 2.10 - Recalculation of AIC at Gate 3 using "Maximum Utilisation"

The essentially tripled AIC estimate for SESRO at Gate 3, and the continued exclusion of the essential users in the T2ST and Farmoor treatment and pipelines, demonstrate that the re-evaluation of the STT system is needed contemporaneously with this Gate 3 submission. (We return to this in section 2.5 below.)

2.4.2 WRMP24 NPC

It is considered that 'Client Indirect Delivery Costs' at £656.2M, which as 'client and contractor costs', which facilitate the creation of the permanent solution, should be apportioned over the works element items and depreciated in the WRMP24 Investment Appraisal. This is not currently the case, therefore the Appendix A WRMP24 NPC[60] should be amended to resolve this error.

Depending on the missing definition in the A3 Cost Report of the expenditure on 'Other Non-depreciating Assets' at £674.16M or for 'Sunk Costs' at £99.3M, these costs may also require depreciation in the Appendix A WRMP24 NPC.

2.5 Implications of the trebling of SESRO cost on the WRSE programme

We have seen RAPID's request for evidence that SESRO is still the best-value solution[61]:

> *"RAPID gate three guidance Section 8.1 provides that evidence to demonstrate that a solution remains best value for customers and the environment is required.*
>
> *RAPID typically relies on the best value assessments undertaken as part of the regional plans and company water resource management plans (WRMPs) to*

[60] Supporting Document A3 - Cost Report - Appendix A.
[61] RAPID (2025), "Gate three query process: SER011", 23rd September, p. 1.

ascertain this. The financial cost estimates for SESRO have changed from the estimates that were used for best value assessment in the WRSE regional plan and Thames Water's WRMP24.

We further note that within your submission, you have stated the following: "Our initial analysis indicates that SESRO continues to be one of the preferred options in WRMP24. However further work is required to validate this, and we aim to complete this work and publish our findings in Autumn 2025."

Therefore, please provide a clear update on this work."

The water companies' response includes the following statement[62]:

"The updated cost estimate was larger than the Gate 2 estimate, and the cost estimate increase from Gate 2 to Gate 3 exceeded the cost sensitivity ranges explored in the Thames Water WRMP241. In the Thames Water WRMP24, the conclusions drawn in relation to cost sensitivity testing were:

- *If the construction Capex cost of SESRO were to escalate by more than c.£700-800m, SESRO may not be selected in a "least cost" plan for the WRSE Region. The Gate 3 construction Capex estimate is >c.£3Bn larger than the Gate 2 Capex estimate, and so breaches this indicative threshold.*
- *However, any increase in the SESRO cost estimate would need to be considered alongside an up to date view of the cost of the main alternative to SESRO, the Severn Thames Transfer (STT).*
- *While cost is an important factor to consider in making the decision between SESRO and the STT, it is not the only factor. The greater flexibility and simplicity of SESRO, for example, led us to further prefer SESRO over the STT."*

The water companies' response suggests that initial analysis indicates that SESRO is still preferred to the STT as the next major new source in the Thames Valley. However, they admit that complex further analysis is needed, including substantial contributions from United Utilities and Severn Trent Water, which are not expected before March 2026, and with no firm date set. This will then be followed by further analysis by WRSE before a proper comparison with the STT option can be made. There will also need to be updating of other resource option costs, including recycling, desalination and mains replacement, before the best-value sequence of resource development in the South East can be confirmed. This work all needs to be done before the target date of 22nd May 2026, set in the Regulators' instruction to the water companies to reassess the best value and affordability of SESRO, as referred to in section 1.3 of this response.

[62] Ibid., p. 2.

As well as affecting the best-value sequence for resource development in the South East, the huge cost increase affects the *need* for SESRO in several other ways, as detailed in Appendix A to this report.

- It affects the benefit–cost assessments of the large, planned abstraction reductions for '*Environmental Destination'*, which comprise about half of the estimated water supply deficits to be met by the Reservoir.

- Similarly, it affects the value-for-money justification for the T2ST, for which about 30% of the deployable output (DO) of SESRO is allocated.

- The amount of abstraction reduction under "*Environmental Destination*" and the justification of the T2ST also need to take account of the proportionality of the costs in relation to the benefits achieved. The cost of SESRO is now so high that the proportionality of costs should be properly and transparently considered for abstraction reductions that have been proposed for compliance with the Water Framework and Habitats Directives.

- It affects the economics of mains replacement as a leakage-reduction measure. Replacement of old mains pipes could now be more cost-beneficial than SESRO, especially when taking account of savings in future capital maintenance. This will reduce the deficit to be met by the Reservoir.

Therefore, GARD proposes that the Regulators should instruct the water companies to undertake a comprehensive and transparent review of the need for new sources in the WRSE area.

The review of need for new sources should take due account of the uncertainty in the deficit forecasts and the need for flexibility in the development programme to accommodate a range of deficit forecasts – both high and low forecasts. The review should recognise the danger of creating a white elephant by building a large inflexible source like the 150Mm^3 Reservoir and should give due consideration to the flexibility that would be provided by a phased development of the STT and its various support sources.

The review should be completed before the Planning Inspectorate's decision to accept the application for the DCO for SESRO. It should be linked to the programme for the draft WRMP29s. This should all be covered by specified actions in RAPID's Gate 3 decision report.

In addition, it is proposed that RAPID's draft decision on the SESRO Gate 3 report should require the development programme for SESRO to be adjusted so that the reassessment of the need for SESRO is completed before any decision on the DCO. There should also be urgent action to bring forward the completion of the STT Gate 3 report, which has been allowed to languish because of misplaced confidence that SESRO is the best-value option for immediate implementation.

GARD proposes that there should be an immediate and public statement by the Regulators that the huge escalation of costs between the SESRO Gate 2 and Gate 3 reports has undermined the credibility of the resource development proposals in the water companies' WRMP24s and necessitated a comprehensive and transparent review of the need for more water resources in the South East and the selection of preferred strategic resource options (SROs).

2.6 Carbon costs

The carbon costs of SESRO are presented at Gate 3 in the document "*South East Strategic Reservoir Option Supporting Document A2*"[63], with some shortened references in the Gate 3 Main document[64].

The 'headline' of the carbon assessments presented at Gate 3 are summarised in the Gate 3 Main document, table 5.1:

Table 5.1 SESRO, capital, operating and whole life carbon analysis for gate three

Category	Carbon Emissions (tCO2e)	Commentary
Capital carbon	495,700	24% increase of gate two, largely due to design changes, particularly with embankment earthworks and the sizing of major civil assets
Capital replacement carbon	219,600	Replacement of capital during 80 year appraisal
Operational carbon – power	2,660	Slightly higher than gate two due to more detailed appraisal of refill pumping power and lower energy recovery from river release hydroturbines, as direct use of water for SWS and TW has increased.
Operational carbon - non power	5,190	
Total whole life carbon (80 years)	**723,150**	Increase on gate two estimate

The '*whole life carbon*' increase from Gate 2 is 44%.

Whilst examining these headlines below, we also emphasise ***what is not accounted for in the Gate 3 estimate***, and there are many omissions. These omissions arise: partly from the removal (for most purposes) of the key systems associated with SESRO (principally concerning the T2ST project and the transfer to Farmoor Reservoir (the Swindon and Oxfordshire, SWOX transfer); but also from design changes declared since the freeze of the Gate 3 design in October 2024. Before considering the capital (or embodied) carbon (section 2.6.2), the operational carbon (section 2.6.3), the whole-life carbon (section 2.6.4) and the general omissions of sources of carbon (section 2.6.5), we discuss the major omissions from the SESRO carbon budget, as presented in the Gate 3 report.

[63] Thames Water, Affinity Water and Southern Water (2025), "South East Strategic Reservoir Option Supporting Document A2", July. (Hereafter the 'A2 Gate 3 Carbon report'.)
[64] Gate 3 Main Report.

Finally, we note that with the publication of the DCO consultation documents in October 2025, the carbon cost of the project has again radically changed (upwards!). We examine this, as presented in the DCO Preliminary Environment Information (PEI) Report (PEI Chapter 17),[65] in section 2.6.6.

2.6.1 Major omissions from the SESRO carbon costs

SESRO has long been acknowledged as the SRO with the largest *"capital"* or "*embodied*" carbon emissions. As such, Thames Water and partners have sought to use "*administrative*" or "*bureaucratic*" distinctions to exclude key systems for which SESRO supplies water, such as the T2ST and SWOX transfer systems, from the emissions considerations. This continues, in modified form, at Gate 3. In passing, we note that this applies not only to carbon but also to monetary costs, as discussed above in sections 2.2–2.4.[66] This exclusion serves only to cloud a proper evaluation, and this is why we call upon RAPID to evaluate the whole SESRO and STT systems consistently.

Exclusion of key systems of T2ST at Gate 3

The T2ST pipeline to Southern Water is an integral part of the reasons advanced for the choice of the larger size SESRO configuration (150Mm^3), as selected, without further public consultation, in the final Thames Water WRMP24, over the 100Mm^3 configuration which was the subject of the draft WRMP24 consultation. At peak supply, T2ST will take some 120Ml/day of the SESRO DO of 271Ml/day. In rough terms, this is 1/3 of the supply, and "*justifies*" in round terms, the post-consultation size increase. ***There is no justification, therefore, in excluding T2ST from either the cost of the carbon-emission implications of SESRO.***

Contrary to this interpretation of fairness and transparency, Thames Water states:[67]

> *"The SESRO design includes pumps in the pumping station and a pipeline to the WTW as well as a pipeline from the WTW to the southern boundary of the site.* ***Carbon emissions from the WTW form part of the T2ST SRO project and will be included in the T2ST gate three report****." [our emphasis].*

Similarly for capital carbon, the A2 Gate 3 Carbon Report states[68] that:

> *"[Exclusions from the capital carbon assessment include] T2ST WTW (as the design of T2ST WTW is under development and will be reported in T2ST SRO submissions)."*

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[65] Thames Water (2025), "Preliminary Environmental Information Report): Chapter 17 – Greenhouse Gases", October. (Henceforth, 'PEI Chapter 17').
[66] This omission of subsystems is not applied to the competing SRO to SESRO: the Severn to Thames Transfer (STT). See section 2.5 and Appendix A of this report.
[67] A2 Gate 3 Carbon report, section 1.6.4.
[68] A2 Gate 3 Carbon report, table 1, 'Asset groups and activities included in the capital carbon assessment'.

This is the very antithesis of a system approach, and is a major failing of the whole RAPID assessment of SESRO.[69] On the other hand[70]:

> *"The operational emissions due to pumping flows for T2ST … are also included."*

GARD believes that, as the treatment of water entering the T2ST pipeline is a necessary part of the water quality assessment of T2ST and, as it is Thames Water's intention on its plan to combine the WTW to serve both the T2ST and its own SWOX transfer, ***all carbon aspects of the SESRO-site WTW should be included in the Gate 3 carbon assessment. We call on RAPID to insist on this.***

The irony of the position adopted by Thames Water at the Gate 3 report is that, as we shall see in section 2.6.6, the embodied carbon for the T2ST WTW ***is*** included in the DCO consultation PEI Chapter 17.

Exclusion of key systems of the SWOX transfer

In a similar manner to the T2ST selective exclusion above, Thames Water has excluded the WTW for the SWOX transfer to Farmoor. There has to be a honing of its bureaucratic letter-of-the-law approach here, so it states[71]:

> *"SWOX WTW and potable water transfer – this is a potential future scheme that is on an adaptive pathway in WRMP24. Space will be reserved on the SESRO site for a WTW and space will be provided in the SESRO pumping station to install pumps in the future. The* ***implementation of this scheme does not form part of the SESRO DCO*** *and the related carbon is not assessed. "[our emphasis].*

Once again, the *pumping* of the SWOX transfer is included in the carbon estimate! Note that the reference to the *implementation* for the SWOX transfer means that the capital carbon associated with the 15+km pipeline is excluded from the capital carbon estimate, in spite of this being an absolute essential.

Estimation of the effect of excluding T2ST WTW and Farmoor WTW plus transfer

One can get some idea (probably accurate to ±20%) of the carbon emissions excluded by considering the Gate 3 submission for the Minworth WTW upgrade to supply the Grand Union Canal (GUC) SRO. In particular, the Carbon Report.[72] In passing we note that, reading this reveals that it is far superior to the Thames Water document.

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[69] It also applies, in many aspects, to the assessment of STT. GARD has frequently called for a system approach to be employed. See, for example, GARD (2023), "GARD response to Ofwat's Consultation on Draft Ofwat Gate 2 Decision: Volume 1 – Main report and appendices", section 4.1 et seq.

[70] A2 Gate 3, section 1.6.6.

[71] A3 Carbon report, para 1.6.4.

[72] Severn Trent and Affinity Water (2025), "Minworth SRO Gate 3: Annex A5 Carbon Report", February.

The Minworth SRO upgrade for the GUC quotes the *baseline* Whole Life Carbon emissions for the treatment plant upgrade as having a value of 104,628tCO2eq, with the *mitigated* budget at 63,881tCO2eq.[73] If we accept, conservatively, the *mitigated emissions* (the Minworth Report goes into some detail on mitigations), we can see ***missing carbon emissions which are at least 8–9% of the 'headline' SESRO figure***, and probably more, as the Minworth figure refers to an "*Advanced*" tertiary treatment upgrade to an existing plant, and the SESRO WTW would include the basic plant.

For the exclusion of the transfer pipeline to Farmoor, we note the Minworth SRO includes a pipeline to Atherstone of around 22km in length.[74] By comparison, the, as yet undetermined, length of the Farmoor pipe would be around 15km. The whole-life carbon emission for the Minworth–Atherstone pipeline is given as 26,067tCO_2eq (baseline) and 13,978tCO_2eq (mitigated).[75] If we scale by pipeline length, and accept the mitigated figure, we have a further 2% missing component of the whole-life carbon budget of SESRO.

From both sources, the missing SESRO whole-life carbon emissions estimate is around 10–11% of the headline figure.

Effect of excluding 'recent' design changes

As noted in section 2.2.5, a long list of design changes has been declared since the Gate 3 submission (the design for which was frozen ten months before submission). None of them was included in the Gate 3 design or cost estimate, but most are included in the recently issued pre-DCO consultation documents[76]. Some, though not all, of these changes will ***have a material impact*** on the carbon estimates when they are included. We list below only those that have carbon budget impact.

- An additional 11km underground ground water control drain has been added around the full perimeter of the reservoir[77].
- Design alterations are supposedly included that result from the lessons learnt from the small-scale CCT conducted in 2025.
- The proposed removal of 3.7Mm³ of topsoil from site[78].
- The addition of 40MW floating solar panels on the Reservoir, and a commitment to replace the two solar farms on the Reservoir site that would be destroyed by the

[73] Minworth Gate 3 report, Annex A5, tables 4.3 and 4.4.
[74] The actual length is redacted.
[75] Minworth Gate 3 report, Annex A5, tables 4.8 and 4.9.
[76] https://thames-sro.co.uk/public-consultations/sesro-statutory-consultation-2025-document-library/
[77] Confirmed as 11km long, 5 x 3 m^2 cross-section. Private communication, Simon Archer (Binnies and Partners) to Mike Greig (GARD), 21st November 2025.
[78] Thames Water (2025), "Preliminary Environmental Information Report Non-Technical Summary".

Reservoir. In the DCO consultation documents maps, the latter appears to be on new 'reserved' land near Garford[79] (but see section 2.6.6 below, as this is admitted into the 'new' DCO carbon budget).

The effect of the first three, all of which involve 'earthworks' (two of them, the *Groundwater Drain* and the *Topsoil removal,* of a very substantial nature) are likely to have a significant capital carbon impact (for the Earthworks categories in the previous design shown below in section 2.6.2). In addition, the groundwater drain is expected to involve a significant increase in the carbon associated with the amount of gravel to be needed and transported to site. We discuss the more nuanced situation with the major U-turn on solar panel provision in section 2.6.3below.

2.6.2 Capital carbon emissions

We have already remarked on significant exclusions from the capital carbon emissions estimate. The declared situation of what *is* included in the Gate 3 estimate is shown in the Table 2.11 below, taken from the A2 Gate 3 Carbon Report.[80]

There is a great deal of justification of the references and standards used in assessing the *capital* carbon. GARD does not wish to take any issue with these, as it seems industry-standard practice has been applied.

The errors in any interpretation are likely to be dwarfed by the inconsistencies in what is and is not included, and in the likely increases as the trajectory of the design is still not focusing down on options. It is only necessary to consider the fact that, as discussed in the A2 Gate 3 Carbon Report, the largest capital carbon 'hotspot' are the emissions associated with the embankment works (including landscaping), accounting for 51% of the total capital carbon of the SESRO scheme (250,500tCO_2eq).

[79] DCO map book.
[80] A2 Gate 3 Carbon Report, table 1.

Table 1 – Asset groups and activities included in capital carbon assessment

Inclusions	Exclusions
• Enabling works, diversions • Embankment and earthworks • Tunnels and shafts construction (including capital carbon impacts of consumed components of the tunnel boring machine (TBM) as well as power consumption by the TBM during tunnelling). • Temporary and permanent roads • Civil structures, pumping station • Pipelines • MEICA • Landscaping • Temporary rail sidings • Decommissioning of existing solar PV plant • Temporary site compounds • Construction plant fuel consumption – assumes all are diesel fuelled • Materials transportation fuel emissions • Hydro turbines • Buildings (including recreational buildings) • Power consumption for commissioning and initial impounding	• T2ST WTW (as the design of T2ST WTW is under development and will be reported in T2ST SRO submissions). • Other SROs and assets outside the gate three SESRO design. • Capital carbon of construction plant and other vehicles involved in construction activities (as these will be re-used on other projects apart from SESRO).

Table 2.11 - Asset Groups Inclusions/Exclusions for the Capital Carbon budget

The '*Key* [cost-driving] *Risks*' associated with lack of knowledge of the ground conditions affecting the SESRO site[81] have been discussed in section 2.1.3. To headline these four risks, we identify them as follows.

1. Unexpected overburden encountered in the foundation excavation for the Reservoir embankment. (Key Risk 2)

2. Encountering wetter foundation clay than predicted for the Reservoir embankment, complicating compaction efforts. (Key Risk 3)

3. Weaker than expected foundation of the perimeter embankment, requiring section modification and increased cut and fill volumes. (Key Risk 5)

4. High plasticity, very stiff bedrock clay found in the borrow pit, impacting compatibility for use in Reservoir embankment construction. (Key Risk 6).

It is difficult to see how these could not also have a serious effect on the embankment works' carbon impact. As with the costs, the judgement on this matter is too imprecise to satisfy the standards of a Gate 3 assessment.

[81] A3 Cost report, section 3.2.7, table 3, pp. 20–21.

The breakdown of categories of the capital carbon emissions is shown in Figure 2.1, taken from the A2 Gate 3 Carbon Report.[82]

Figure 6 – Comparison of capital carbon hotspots between gate two and gate three

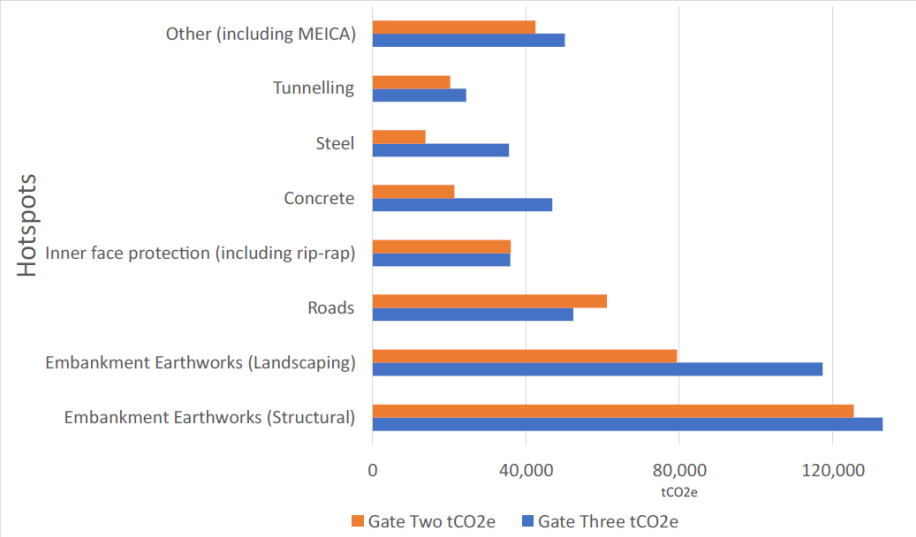


Figure 2.1 - Comparison of capital carbon 'hotspots' between Gate 2 and Gate 3

Figure 2.1 highlights the very large percentage increases in the "*Steel*", "*Concrete*" and "*Landscaping*" carbon emissions between Gate 2 and Gate 3. The "*Landscaping*" (which in Thames Water's very broad categorisation will include everything not structurally related to the embankments) is set, as we indicate above, to be substantially increased by the topsoil removal, and the 'groundwater drain' (at least 165,000m^3 of groundworks, according to Thames Water's consultant engineers). The latter will also increase the concrete budget and the amount of gravel brought to site.

According to Thames Water:

> *"The main reason for the increasing emissions from concrete in gate three are the increased structure sizes (shafts, pumping station and main tower). These have increased to provide space for the pumps, pipelines and valving necessary to deliver water to T2ST, Swindon and Oxfordshire (SWOX) Raw Water Transfer and potentially SWOX potable water transfer whilst filling the reservoir, as well as to facilitate the updated emergency drawdown arrangements…."*[83]

This increase in concrete will pale into insignificance if the proper carbon costing of the T2ST and SWOX WTW and the pipelines are added to the project, as they should be in a full system approach.

[82] A2 Carbon Report, figure 6.
[83] A2 Carbon Report, section 2.3.17.

2.6.3 Operational carbon emissions

The operational carbon assessment for SESRO is based on the power and operational maintenance requirements of the scheme. Specific components are as follows:[84]

- Power consumed (for pumping water to the reservoir, the air diffuser system and miscellaneous ancillary assets).
- Power generated – by the hydro turbine during periods when the reservoir releases water to the River Thames.
- Maintenance – annual/regular routine operational maintenance activities for civil and MEICA assets.

The pumping requirements of the T2ST and SWOX schemes *are* included in the estimates, but not, as we have already cited, the WTW, which will be absolutely essential to supply water from SESRO to those two schemes. (The water returned from SESRO to the Thames for the London zones and Affinity Water will not be treated under the current design, in spite of the identified risks from *cryptosporidium*, for example, and the complete inadequacy of the proposed (but not yet costed or designed!) mitigation measures.[85])

The operational carbon is calculated for a period of 65 years, with first operations in 2040. The definition of this period is necessary to extract the decarbonisation status of the grid supply, for which there are figures recommended by the Department for Energy Security and Net Zero (DESNZ)[86] used by Thames Water***. GARD has no issue with the figures used, but the period is arbitrary, and should be aligned with, for example, RAPID's selection of a 'whole life' (250-year) period for the whole-life cost totex.***[87]

The operational carbon (given the decarbonised grid scenario alluded to above[88]) is dominated by the "*Maintenance*" heading.

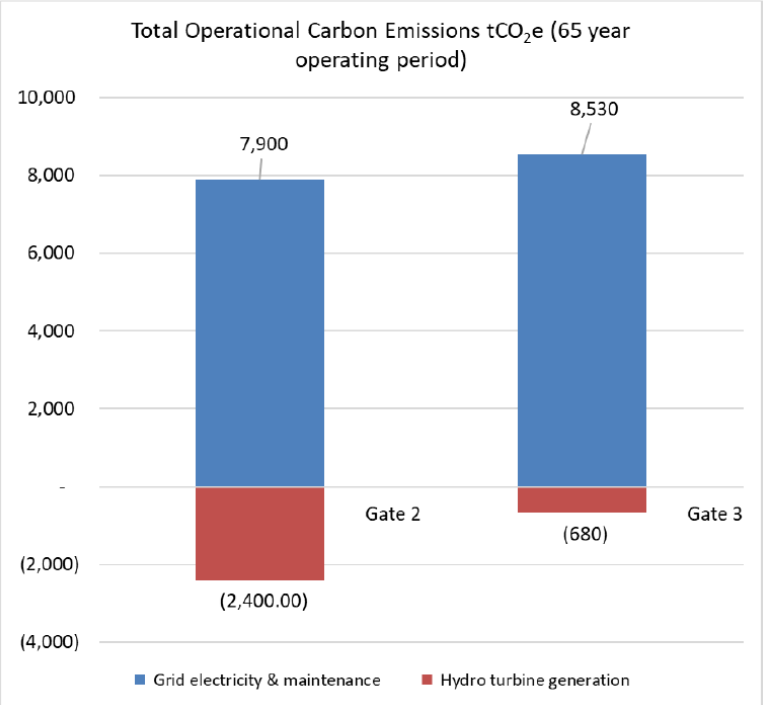
Note: see text for exclusions and caveats.

Figure 2.2 (taken from the A2 Carbon Report, figure 8.1) shows a total operational budget of around 8000tCO_2eq (once the returned carbon budget from the outlet hydro-turbines is allowed). The maintenance accounts for 5,190tCO_2eq over the 65 years[89]. A 'rule-of-thumb' would nearly quadruple this for a 'whole life' of 250 years, consistent with the cost estimate demanded by RAPID. The rough effect of the exclusion of the WTW can be seen by comparison with the figures for Minworth WTW upgrade (GUC transfer) of around

[84] A2 Carbon report, section 3.2.1.
[85] See, for example, this response, section 3.5.6.
[86] DESNZ, https://assets.publishing.service.gov.uk/media/6567994fcc1ec5000d8eef17/data-tables-1-19.xlsx.
[87] As discussed in section 2.3.5 of this report.
[88] The DESNZ figures show electricity grid carbon emissions falling to ~12% of their current level by 2040.
[89] A2 Carbon Report, section 3.3.14.

500tCO2eq per annum.[90] This equates to around 33,000tCO_2eq over a 65-year period, around four times the SESRO estimate.[91]

Figure 8 – Operational carbon emissions comparison between gate two and gate three



Note: see text for exclusions and caveats.

Figure 2.2 - SESRO operational carbon emissions from the Gate 2 and Gate 3 reports

Aerator power for water quality control

As discussed in section 3.5 of this response, on water quality, the SESRO design currently foresees an *air diffuser* system to control water quality. The concept design (it is no more than that) for the water aeration and mixing system is described in the "*Basis of Design*" Supporting Document A1, in the Gate 3 submission.[92] It consists of two 200kW aerator pumps. Although the power for this system is supposed to be covered by the operational carbon emissions, as stated above, there is nowhere a statement about the periods of operation of this system, and whether, for example, one pump is operational at any one time and one is on standby. From the A2 Carbon report[93], we know that the aeration system contributes about 2% of the operational carbon budget, and (see section 2.3.1) that the *power consumption* for this system is regarded as a *fixed* component of the operational

[90] Severn Trent and Affinity Water (2025), "Minworth SRO Gate 3: Annex A5 Carbon Report", February, figure 4-2.
[91] As noted, the DESNZ figures show electricity grid carbon emissions falling to ~12% of their current level by 2040.
[92] Gate 3 Basis of Design report, section 3.7.7, p. 65.
[93] A2 Carbon report, figure 9 pie chart, p. 34.

costs. This suggests a 'summer' operation of the system (April–September) as in other reservoirs (e.g. Rutland Water).[94] As shown in the Appendix E to this response, the Rutland system has 12 aerator 'helixor' pumps. Calculations in Appendix E show that the power estimate for the SESRO aerators is probably at least an order of magnitude too low, which would apply to the operational carbon allowance too. It is highly likely that the operational carbon figure over 65 years will be in the region of 20% of 8,000tCO2eq, rather than 2%.

Emissions from change of land use

The issue of emissions from change of land use has been dodged by Thames Water throughout the years. In GARD's response to Thames Water's dWRMP24 plan,[95] GARD cited that reservoirs have been shown by recent research[96] to be net carbon sources, and their calculated carbon footprint can be increased by over 50%. The recommendation of other supporting references[97] is that greenhouse gas (GHG) emissions from reservoir surfaces should be included in the anthropogenic emissions of the operational reservoir cycle. The evidence is increasing that reservoirs do not sequester carbon. These issues are completely absent from consideration in Thames Water's dWRMP documents and the RAPID Gate 2 and Gate 3 reports. Sources cited by GARD[98] point to CO_2 emissions for the 6.75km^2 surface area of the Reservoir in the range of *several thousand* tonnes CO_2eq per year. This would dwarf the operational carbon emission figures. Thames Water chose not to deal with this in its Statement of Response to the dWRMP24, diverting attention to point out that the figure was still smaller than the operational carbon difference between SESRO and the STT.[99] The irrelevance of this is not only that, at the time the heavy operational STT carbon budget was not assessed against the new DESNZ grid decarbonisation figures, but mainly that there is no 'decarbonisation profile' of GHG emissions from cyanobacteria in reservoirs!

The continuing dumping of raw sewage into UK rivers, including the Thames, the pumping of those waters into the reservoir, will provide the labile carbon and nutrients (eutrophication) for both the production of surface algal and vegetation matter, and as the detritus sinks to the bottom of the reservoir, it becomes the source of extra GHG emissions – mainly

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[94] Maddocks, S.L. (1982), "Vertical movements of the surface water and thermal stratification in Rutland Water", *Hydrobiologia*, volume 68, pp. 79–87.
[95] GARD (2023), "GARD response to Thames Water's Consultation on Draft Water Resource Management Plan 2024", 21st March, section 4.4.4, p. 86.
[96] Keller, P.S. Marcé, R., Obrador, B. and Koschorreck, M. (2021), "Global carbon budget of reservoirs is overturned by the quantification of drawdown areas", *Nature Geoscience*, volume 14, pp. 402–408.
[97] Deemer, B.R. et al. (2016), *"Greenhouse Gas Emissions from Reservoir Water Surfaces: A New Global Synthesis", BioScience*, 66:11, pp. 949–964.
[98] "Year 2020 reservoir CH4 and CO2 emissions as predicted by the G-res model", dataset accompanying Harrison, J.A., Prairie, Y.T., Mercier-Blais, S. and Soued, C. (2021), "Year-2020 Global Distribution and Pathways of Reservoir Methane and Carbon Dioxide Emissions According to the Greenhouse Gas from Reservoirs (G-res) Model", *Global Biogeochemical Cycles.*
[99] Thames Water (2023), "Thames Water Draft Water Resources Management Plan 2024: Statement of Response, Appendix G2", August, pp. 65–66.

methane. The creation of algal blooms will have a devastating effect on the biodiversity of both the reservoir and those visiting the reservoir (insects, birds, etc). When detritus from the algal bloom descends into the water column, bacteria communities rapidly increase which initially creates CO_2 emissions, but as the water oxygen is exhausted, reservoir inhabitants (fish, insects) will die and the emissions become largely methane. This process in stagnant water can produce the toxin producing blue green cyanobacteria harmful to many species including humans who drink the water or use its facilities[100] is discussed in section 3.5. ***GARD calls for the GHG emissions for the Abingdon Reservoir to be included with the Reservoir budget.***

That Thames Water is still keen to dodge and defer consideration of this issue can be seen in its response to GARD's EIR request EIR-25-26-355 (dated 1 October 2025), which states (*inter alia*):

> ***"Your Request***
> ***We note that the potential 'release' of carbon implied by a change of land character is not included. What is the justification for this? We also note no mention of reservoirs as potential GHG emitters (as cited in GARD's previous consultation reports). Why is this not calculated?***
> ***Our Response***
> *During Gate 3, consideration has been given to the carbon hotspot associated with land use change– from converting current agricultural land into a reservoir. There are still uncertainties in the science behind the direct emissions from the reservoir including emissions impacts during the drawdown and filling of the reservoir. This will be considered as understanding develops across the water industry in subsequent stages of the project.*
>
> *Another direct emissions related area that has not been assessed during Gate 3 is the emissions associated with excavating soils (within and beyond the vicinity of the site) that may cause disruption in the carbon balance stored in the soil. Emissions impacts from land use change and from carbon balance in the soil during construction and post-construction are being considered in subsequent phases of the project to better understand if they are likely to be a significant carbon hotspot or not."*

These '*uncertainties in the science*' do not inhibit Thames Water from claiming:[101]

> *"As part of the gate three design, carbon is likely to be sequestered (or removed) from changes in land use associated with the landscaping on the site. Natural capital analysis has been completed to support gate three including consideration*

[100] Ashworth, J. (2021), "The deadly effects of sewage pollution on nature", Natural History Museum, 4th November.
[101] A2 Carbon report, section 4.3.1

of whole life carbon sequestration opportunities from the landscape design, see Section 8.2 of the main gate three report for further information."

Sections 8.1 and 8.2 do not provide any justification for these supposed carbon sequestration effects, merely a list of unsubstantiated numbers from desk-based exercises.

2.6.4 Issues involving photovoltaic panel removal/replacement

Nothing illustrates better the tangled web one encounters when analysing the Thames Water Gate 3 submissions, than the case of the photovoltaic (PV) farms which will be destroyed to make way for SESRO. In numerous consultation responses, but most recently in March 2023,[102] GARD has pointed out that around 40 MW of solar farm generating capacity is torn up by the construction site of the Abingdon Reservoir. The Gate 2 reports[103] made it clear that there was no intention to re-site these on the post-construction site, something confirmed by Thames Water staff at dWRMP24 consultation events. There had previously been an assumption by local residents that a floating solar farm would be created on the Reservoir, but this was ruled out be Thames Water.

In the Gate 3 Carbon report, the carbon balance of destroying the solar farms ten years early (2029-30, ahead of their supposed planned retirement date of 2039) is finally discussed. An annual energy yield of approximately 67 GWh/year would be lost[104]. Construction of SESRO would require these solar PV plants to be decommissioned or relocated. The Gate 3 capital carbon estimate has assumed that the existing PV plants will be fully decommissioned to accommodate the SESRO scheme. The decommissioning and disposal off site of approximately 600,000 individual solar panels across the three existing solar farms, as well as the supporting infrastructure which includes 674km of electrical wiring would result in an additional capital carbon impact of 3,370tCO2eq, which is in the Gate 3 carbon figures.

The early decommissioning of the existing solar PV plants would result in the loss of 67 GWh/year annual renewable energy generation for the region (based on estimated yield in 2029/30). Replacing this energy through the national grid supply would result in total emissions of approximately 16,750tCO2eq, *this figure is missing from any of the Gate 3 capital carbon estimates[105].*

The Gate 3 submissions have coy references to the situation on the PV farms, with options '*still under consideration*' and '*being further explored*'[106]. With the issue of the pre-DCO consultation papers in October 2025, we now see that there has been a complete *volte-face* on the PV Farms policy. An extra 400 hectares of land around the village of Garford

[102] GARD (2023), "GARD response to Thames Water's Consultation on Draft Water Resource Management Plan 2024", p. 85.
[103] Table 6.8, SESRO Gate 2 Main report.
[104] A2 Carbon report, section 2.3.27.
[105] A2 Carbon Report, section 2.3.9
[106] Answers such as this were still being given, for example in response to EIR-25-26-355 (dated 1st October 2025 – just 27 days before the launch of the pre-DCO consultation).

(previously outside the SESRO reserved land footprint) is to be sought to site a solar farm specifically to replace at least part of what is being torn up.[107] In addition, there are now sketches of large floating solar panel arrays on the North side of the Reservoir Water Body.[108]

None of this helps the figures for the loss of grid renewable energy 2029-2039, as the new Panels will not be in operation (indeed it is not clear if they will be in operation before the end of the 'non-reservoir' section of the plan, now scheduled for 2043).

The overall conclusions are that:

- An amount of around 16,750tco2eq should be added to the *capital carbon* budget for the 'SESRO build'.
- The capital carbon figure for destroying the existing PV Farms remains unaffected at 3,370tco2eq.
- There will be some operational carbon reduction from the electricity generated by the new solar farms, this is estimated in the DCO documentation, as is discussed in 2.6.6 below.

2.6.5 Opportunities for reductions in capital carbon budget? Or missing items?

There are some half-hearted attempts to make the case for possible reductions in capital carbon budget. These are half-hearted and woefully under-researched probably because, ultimately, the authors are resigned to the fact stated in the A2 Carbon report:[109]

> *"It is acknowledged that a large proportion of capital and operational carbon emissions over the whole life of the SESRO scheme are considered to be Scope 3 emissions (capital carbon). These are mainly outside of the direct control of the water companies…."*

This, as has been pointed out in numerous GARD responses to consultations,[110] severely limits the scope of any significant reductions in the carbon footprints of steels and concrete, or in the adoption of alternative fuels such as Hydrogenated Vegetable Oil (HVO). No amount of '*working closely with the supply chain*' (sec 1.5.6 of A2 Carbon Report), or '*further consideration in subsequent phases to better understand the costs as well as availability of such fuels [ie. HVO] and plant in the market*.' (ibid, sec 6.4.1), or '*… more targeted engagement with the supply chain… to confirm the technical viability and scale of lower*

[107] DCO map book, p. 6.
[108] Ibid.
[109] A2 Carbon report, section 1.5.6.
[110] For example, GARD (2023), "GARD response to WRSE's Consultation on their Draft Regional Plan for South East England", 20th February, section 4.4.1, where the issues of the lack of any dated 'roadmap to decarbonisation' for materials like steel and concrete, and construction fuels like HVO are discussed.

carbon concrete, steel and other materials' (ibid, sec 6.4.2) is going to make any significant headway into the burgeoning capital carbon budget, and will certainly be much smaller than the already ignored items in the carbon budget.

In addition to the T2ST pipeline itself, which has a capital carbon budget estimation[111] of 351 $ktCO_2eq$, there are the following items missing from the capital carbon budget:

- WTW for T2ST and SWOX – est. 23ktCO2eq [*Minworth figures mitigated*].
- SWOX pipeline – est. 6.6ktCO2eq [*Minworth–Atherstone pipeline mitigated x 2/3*].
- Loss of grid electricity 2029-39 from removed PV panels – 16.75ktCO2eq [*Thames Water figures*].
- Design changes – groundwater drain and topsoil removal – est. 40ktCO2eq [*GARD, based on Gate2 to Gate 3 increase in 'Landscape capital carbon]*.

These items, *for the SESRO 150Mm^3 system as a whole* [SESRO 150], add up to an extra ~437 $ktCO_2eq$. ***Thus, the SESRO 150 system's capital carbon is under-reported at Gate 3 by some 88%.***

2.6.6 Changes to the carbon footprint of the project as presented in the DCO PEI report

The DCO consultation documents were released in October 2025, a mere eight weeks after the Gate 3 report. They feature radical changes to the GHG emissions. Some if the issues identified above are resolved, but there are still issues around the estimations.

This response is not aimed at criticising the DCO consultation, as GARD has already submitted its response elsewhere.[112] Here we concentrate on the 'headlines' of the changes from Gate 3. We have used as source documents the DCO PEI Chapter 17,[113] and the associated PEI Appendix 17.1[114]

Capital (embedded) carbon emissions

Table 17.10 of the PEI Chapter 17, shown below in Table 2.12, gives the GHG estimates for the construction ('*Lifecycle module A*').

[111] Southern Water (2024), "*Draft Water Resources Management Plan 2024 Technical Report*", July, figure 10.1.
[112] See GARD pre-DCO response.
[113] PEI Chapter 17.
[114] Thames Water (2026), "Appendix 17.1 – Greenhouse gases data and assumptions", October.

Table 17.10 Construction preliminary GHG emissions

Lifecycle module	Source of emissions	GHG (tCO_2e)
A1-A3 Product stage	Extraction of raw materials, transportation to the manufacturer, and manufacture of construction materials and products: SESRO	453,583
	Extraction of raw materials, transportation to the manufacturer, and manufacture of construction materials and products: Solar farm reprovision	56,643
	Extraction of raw materials, transportation to the manufacturer, and manufacture of construction materials and products: T2ST WTW	73,350
A4 Transport	Transport of construction materials and products to site: SESRO	108,341
	Transport of construction materials and products to site: T2ST WTW	9,169
A5 Construction and installation process	Fuel use in mobile plant and equipment: SESRO	488,053
	Transport of construction workers to and from site: SESRO	613
	Transport and disposal of waste	Transport aggregated within Module A4 for PEI Report.
		Disposal methods under development and to be reported in the ES.
	Land use change: disturbance of carbon stores (soils)	To be reported in the ES
	Embodied emissions of temporary construction materials: SESRO	68,817
	Construction and installation process emissions: T2ST WTW	9,169
	Transport of construction workers to and from site: T2ST WTW	36
Total Module A		1,267,774

Table 2.12 - Construction Phase ('*Lifecycle Module A* ') estimate of GHG from SESRO DCO PEI Chapter 17

We note that the T2ST WTW is now included in the capital carbon budget (one of GARD's criticisms in the sections above). Reprovision of destroyed solar panels is also now included (since the project has expanded in the two months August to October (!)), removing another of the shortcomings identified above. However, even if the associated capital carbon estimates for these two items are removed,[115] the ***total estimated construction carbon footprint for the construction phase of SESRO is 1,176,050 tCO_2eq.***

[115] Referring to Table 2.12: module A1-A3, sources 2 and 3; module A4, source 2: module A5, sources 6 and 7.

This new total represents a 137% increase in the Gate 3 figure. We have not made a detailed analysis of the new estimates, as the breakdown does not align with the categorisation of the Gate 3 sub-categories (an almost universal feature of the SESRO project's metrics estimates as it staggers from one stage to another). However, we note that:

- GHG emissions from disturbance of sequestered carbon via changes in land source are still not in the total (contrary to GARD's and others' urgings.
- There is no explicit figure mentioned for the *loss of solar energy generation* once the existing farms have been destroyed and before the replacement PV farms are built on the Reservoir and around Garford- in section 2.6.4 above, we estimated this to be some 16-17 $ktCO_2eq$.

Before leaving the capital carbon estimates, we observe that the increase over the Gate 3 figure must be related strongly to a huge underestimation of the emissions from *Fuel Use associated with the construction*. Figure 2.3 below (taken from the PEI Chapter 17)[116] shows a breakdown of this. It is difficult to see anything resembling the numbers in Figure 2.3 being contained in the Gate 3 breakdown in Figure 2.1. The rail sidings seem to have been completely forgotten in Gate 3, and the fuel emissions from the main earthworks is about 150% of the combine embankment and landscaping numbers in Figure 2.1.

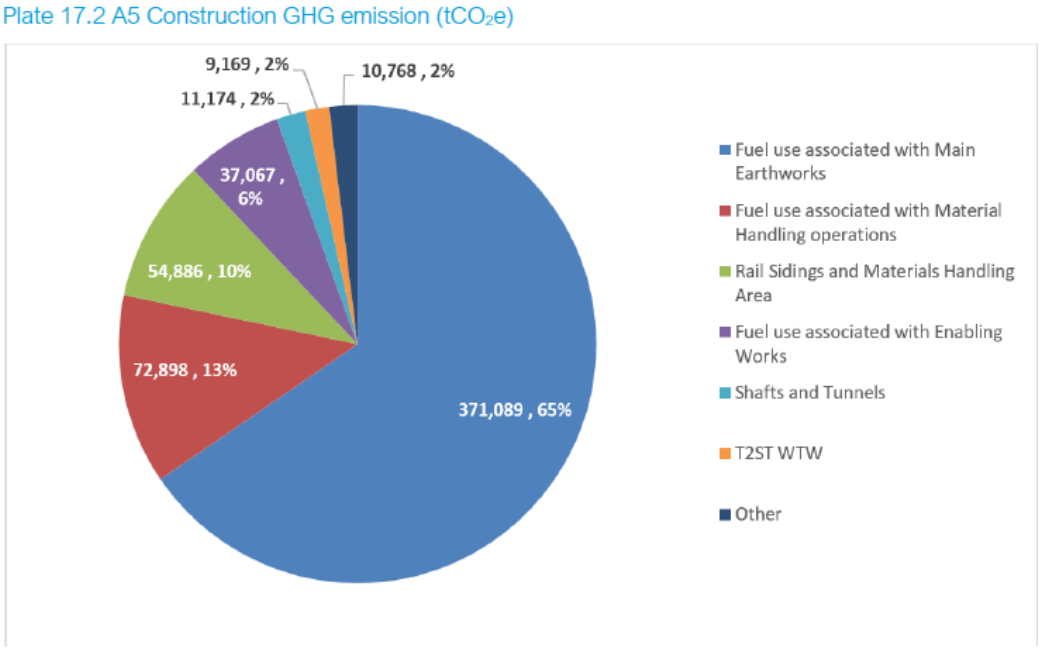


Figure 2.3 - Carbon emissions from fuel use associated with construction of SESRO, associated rail sidings and materials handling, and the T2ST WTW (from DCO PEI Chapter 17).

[116] PEI Chapter 17, plate 17.2, p. 34.

Operational carbon emissions

The operational carbon (GHG) emissions from SESRO, including the WTW for T2ST, are shown in Table 2.14 below (from table 17.1 of the PEI Chapter 17.)[117] This assessment is taken over a 60-year period, slightly different from the 65-year assessments used in Gate 3, for example.

Table 17.11 Operational preliminary GHG emissions over the adopted 60-year assessment period

Lifecycle module	Emission source	GHG (tCO_2e)
B1 In-use material emissions and removals	Land-uses (changes in carbon dioxide (CO_2) emissions from capture and release from plants and soils)	To be reported in the ES
B2 Maintenance	Activities and embodied carbon in maintenance materials, including preventative and planned maintenance: SESRO	12,371
B3 Repair	Activities and embodied carbon in materials to repair damage over and above the regular maintenance regime: SESRO	3,093
B4 Replacement	Activities and embodied carbon in materials to replace components at the end of their life expectancy: SESRO	147,063
	Activities and embodied carbon in materials to replace components at the end of their life expectancy: T2ST WTW	109,891
	Activities and embodied carbon in materials to replace components at the end of their life expectancy: Solar farm reprovision	84,441
B5 Refurbishment	Activities and embodied carbon in refurbishment materials	No planned refurbishment
B6 Operational energy use	Regulated and unregulated operational energy use: SESRO (including energy use by members of the public)	3,002
	Regulated and unregulated operational energy use: T2ST WTW	10,186
B7 Operational water use	Potable water use, including water use by members of the public	To be reported in the ES
B8 User activities	Operational transport of SESRO staff and visitors	189,247
	Transport, treatment and disposal of operational waste	To be reported in the ES
B8 Chemical consumption	Extraction of raw materials, transportation to the manufacturer, and manufacture of chemicals used for T2ST WTW	45,997
Total Module B		605,291

Table 2.13 - Operational carbon (GHG) emissions from SESRO, including the WTW for T2ST

The closest Gate 3 comparator to the total of 605,291tCO2eq for the 60-year period is shown in the Gate 3 Main Report, table 5.1 (shown at the top of section 2.6). In this table, if we add the emissions under the headings "*Capital replacement carbon*", "*Operational power-carbon*" and "*Operational power – non-carbon*", we arrive at a total of 227,450

[117] PEI Chapter 17, table 17.11, p. 35.

tCO2eq. However, we must subtract items from Table 2.13, relating to the ***replacement of components for the T2ST and solar panels***. These were not in the Gate 3 figures.[118] Once these figures (194,332 tCO2eq under Module B4) are stripped out of the total in table 2.13, we are left with an operational carbon emission estimate of 410,959 tCO2eq. ***Thus the DCO documents show an increase of 80% in the declared operational carbon emissions since the Gate 3 submission.***

Note that, from Table 2.13, the SESRO-induced land-change GHG emissions remain excluded from the new figures.

Overall conclusions from the DCO consultation carbon estimates
GARD draws the following conclusions:

- It is clear that the carbon emission estimates for SESRO have increased very significantly over the figures given to RAPID at Gate3. Both capital and operational carbon emissions estimates have ballooned (capital by 137%, operational by 80+%).
- Although the estimates now include some missing items, it is difficult to see how they relate to the Gate 3 figures.
- In particular, the new (DCO) breakdown makes the Gate 3 capital (embedded) carbon figures almost unbelievable.

Table 2.14 shows the relentless rise in the SESRO Carbon emissions, with inclusion of aspects which should have been declared long ago (in the 20-plus year gestation of this project).

[118] The Gate 3 operational emissions ***did*** include the T2ST operational carbon figures (power and chemicals), but not the capital replacement.

Documented estimation (date)	**Capital (embedded) carbon emissions (tCO2eq)**	**Operational carbon emissions (tCO2eq) (**per annum**)**	**Notes**
dWRMP24 (Mar 2023)	400, 000	200	Gate 2: A-3 Carbon Report, fig 2.1 (Capital) and fig 3.3 (Operational) (T2ST excluded) (Capital replacements excluded)
Gate 3 (Aug 2025)	495,700	3,500	Gate 3 Main document, table 5.1 (T2ST excluded)
DCO Consultation (Oct 2025)	1,176,050	6,850	DCO PEI Chapter 17, table 17.10 (T2ST and replacement PV solar farm figures excluded)

Table 2.14 - Evolution of declared capital and operational carbon emissions for SESRO core project

The 'carbon cost' of SESRO was a major metric in the 'best value' case for the project at the WRSE and WRMP24 stages. It is now imperative that the new carbon emission figures in the DCO submission are compared with the nearest competitors, we call on RAPID to insist on this in its action on the SESRO promoters to re-evaluate the 'best value' criterion for SESRO.

As a very limited way of visualising the monetary consequence of the huge increase in carbon emissions between Gate 3 and the DCO submission, we could apply the 'carbon credits' costs from the EU Emissions Trading Scheme (ETS). The cost of EU ETS carbon permits reached €90 per tonne in January 2026.[119] From January 2025 to January 2026, the costs varied between €75 and €90 per tonne (£65–£78 per tonne). Applying these figures to the carbon emissions in Table 2.14, we find the following 'cost increases' from the burgeoning carbon emissions between the Gate 3 and DCO estimates:

- **capital carbon costs: £44.2M–£58.1M**
- **60-year operational costs: £13.1M–£15.7M.**

[119] Carbon Credits (2026), "EU Carbon Prices Hit Highest Since August 2023: What Causes The Surge?", 21st January.

3. SESRO design

3.1 Deployable output and drought resilience

3.1.1 SESRO deployable output of 271Ml/d quoted in Gate 3 reports

The DO of SESRO is not covered at all in the Gate 3 Basis of Design report and is referred to only briefly in the Gate 3 Main Report, which states (at paragraph 2.61) that the DO of the scheme has not been reassessed for Gate 3. The quoted DO of 271Ml/d is the same value as assessed for Thames Water's first draft WRMP24 in 2022[120]. This was determined for a 1 in 500 year drought, taking account of the estimated impact of future climate change in the 2070s, using a scenario that was the median of the 28 different climate change scenarios from WRSE[121].

The Final Thames Water and Affinity Water WRMPs and the draft Final Southern Water WRMPs assume a split in the ownership of SESRO in the proportions 55% for Thames Water, 30% Southern Water and 15% for Affinity Water. The Gate 3 Main document shows the latest planned distribution of SESRO output between the water companies, as below:

Table 2.3 Summary of resource sharing for SESRO (Based on Thames Water Final WRMP24, Dry Year Annual Average resource share, reported pathway 4)

Ml/d	Thames Water, London ***	Thames Water, Transfer to SWOX	Thames Water, SWA (Medmenham abstraction)	TW, Kennet Valley (via T2ST)	T2ST*	T2AT**
2040	50	24	0	5	14	0
2050	97	24	16	10	63	58
2060	119	24	15	10	67	73
2075	122	18.1	14	10	70	72

** excl. Thames Water export via spur to Kennet Valley and SEW supply (peak only)*

*** Affinity Water 15% share is based upon utilisation of initial (50 Ml/d) phase of T2AT only. This is due to uncertainty with the scale of abstraction reductions expected by Affinity Water under their future Environmental Destination scenarios. However, the Final WRMP24 reported pathway 4 is based upon the more conservative scenario agreed with the EA, which requires a slightly higher utilisation of SESRO.*

**** the total resource share is more than 271 Ml/d (DYAA DO), as the conjunctive use benefit of the T2AT in London WRZ is accounted for.*

Table 3.1 - Gate 3 assumed utilisation share between water companies

The Gate 3 Main Report (paragraph 2.55) refers to modelling work for Gate 3 that explores how SESRO would actually be used to meet the various demands of about six supply zones for the four water companies mentioned in the table above:

[120] Thames Water (2022), "Draft Water Resources Management Plan 2024", first draft, November, Table 7-6.
[121] Gate 3 Main Report, paras 2.61 and 2.62.

"The utilisation of the SESRO scheme has been tested and analysed within the WRSE PyWR modelling platform. This involves the integration of the demand profiles for SWS, AFW and TW and the simulation of reservoir operations under different design conditions to mimic the preferred WRMP24 configuration, as outlined previously."

The Pywr modelling work referred to above used only 1,008 years out of the 19,200 years of available stochastic data[122], so it was not a DO reassessment of whether SESRO is able to meet all the various water company demands under 1 in 500 year drought conditions.

The DO of 271Ml/d quoted in the Gate 3 Main Report is out of date and does not take account of the SESRO utilisation now envisaged. GARD proposes that RAPID/Ofwat's Gate 3 decision should call for a full and transparent reassessment of SESRO's DO.

Although, the previously quoted DO of 271Ml/d is out of date, it was heavily criticised by GARD during the WRMP24 consultation process and all the criticisms should still be addressed in the reassessment of the SESRO DO that is now needed, supported by publicly available model output and analysis.

3.1.2 History of criticism of the 271Ml/d deployable output

In the Addendum to GARD's response to Thames Water's consultation on its draft WRM24, dated April 2023, GARD concluded that, using Thames Water's stochastically generated river flows, the correct DO for the 150Mm^3 Reservoir should be only 200Ml/d, as shown below[123]:

	Ml/d
DO with climate change as WRMP24 and Gate 3	271
Less: double-counting of droughts	-6
wrong value of Culham minimum flow	-2
wrong climate change scenario	-19
inadequate dead and emergency storage	-44
Corrected DO	**200**

Table 3.2 - GARD identified errors in SESRO 271Ml/d DO

In addition, GARD considered that the DO of SESRO will be a lot less than shown above, perhaps only half this value, when proper consideration has been given to the likelihood of a sequence of dry years which prevent the Reservoir from being full at the start of a major drought or delay its refilling after a drought. GARD criticised Thames Water's modelling of

[122] Gate 3 Main Report, footnote to Table 2.4.
[123] GARD (2023), "Volume 2 - Addendum to dWRMP24 consultation response: Review of WRMP aspects related to Pywr model output", submitted to Thames Water on 30th April, p. 7.

long-duration droughts, particularly the failure to include the historic data from the long droughts of 1921, 1934 and 1944 in the historic records used to generate the 19,200 years of stochastic daily data used in its modelling.

Some of GARD's criticisms of the assessed 271Ml/d DO for SESRO were addressed in Thames Water's Statement of Response (SoR) to the WRMP consultation in August 2023[124]. However, Thames Water rejected all GARD's criticisms and there was no change to the 271Ml/d DO in the revised draft WRMP dated August 2023. Consequently, GARD asked its consultant, John Lawson, to prepare a detailed rebuttal of the DO aspects of Thames Water's SoR, which was sent to the Environment Agency (EA) and RAPID in October 2023[125].

This was followed by a meeting between GARD, the EA, Ofwat and RAPID on 13th October 2023, at which GARD's concerns were discussed. There is no formal record of this meeting, but some of GARD's concerns about SESRO's DO were reflected in Issue 6 in Defra's letter requesting further clarification of Thames Water's draft WRMP in February 2024, as copied below[126]:

Issue 6: Provide further detail around the company's water resources modelling

Both the Group Against Reservoir Development (GARD) and ourselves raised concerns around the company's water resources modelling in response to the draft plan. The company has made some changes to its plan, but there are a number of topics where the company should provide further information including the:

- calibration of the rainfall run off model
- stochastic data set and its reflection of long duration droughts
- relationship between the deployable output benefit of a strategic resource option and the deployable output benefit it brings to the London supply system.

Defra request for Thames Water action on DO assessment

The requests for action listed above include some of the concerns that GARD raised at the meeting on 13th October 2023, relating to the stochastic data used in Thames Water's DO modelling and the resilience of SESRO in long-duration droughts. However, the Defra request for more information did ***not*** address the other concerns raised at the meeting relating to errors in Thames Water's modelling, incorrect climate change scenarios and insufficient emergency storage allowance for SESRO. These amount to an over-estimation of DO of 71Ml/d, as shown in Table 3.2.

[124] Thames Water (2023), "Thames Water Draft Water Resources Management Plan 2024: Statement of Response, Appendix G2", August, pp. 103–118.
[125] GARD (2023), "GARD rebuttal of Thames Water SoR on DO", 6th October.
[126] Defra letter to Thames Water of 5th February 2024, requesting further information in support of SoR.

The following sections of this response (3.1.3 to 3.1.7) provide summaries of GARD's continuing concerns over the validity of SESRO's 271Ml/d DO and the Reservoir's resilience in long-duration droughts. Section 3.1.8 gives GARD's proposal for how RAPID/Ofwat should address these matters in their draft decision on the SESRO Gate 3 report.

3.1.3 Error due to double-counting of droughts

Thames Water calculates deployable outputs for SESRO by using its Pywr model to simulate the frequency of London reservoir storage falling into the Level 4 emergency storage zone. The London demand that causes only 38 failure events in 19,200 years of simulation is then the 1:500 year DO (19,200 ÷ 500 = 38.4). The Pywr model is run repeatedly with small, stepped increases in demand to determine the frequency of failure at each demand level and hence DO.

However, on some occasions, drought events in which failure extends into two different years (with years defined as running from 1st April to 31st March) have been counted as two failure events instead of one. This error causes the DO of SESRO (without climate change) to be over-estimated by 6Ml/d for the 150Mm^3 Reservoir, as stated in GARD's Addendum to its consultancy response to Thames Water's draft WRMP[127].

Thames Water's SoR rejected GARD's criticism, stating[128]:

> *We do not agree that the approach taken in our Deployable Output calculation is incorrect. The Water Resources Planning Guideline states that we should plan so that our system is resilient to a 0.2% annual chance of failure caused by drought, where failure is defined as implementing an emergency drought order. We have, as GARD note, considered a year to be from April to March, and as such events which span across years represent additional failures.*
>
> *We note two additional factors:*
>
> - *The impacts which GARD note are very minor.*
> - *GARD have not been even-handed in their assessment, and have not considered whether the same issue should, in their consideration, impact the Deployable Output of the STT.*

GARD does not accept the excuse: "We have, as GARD note, considered a year to be from April to March, and as such events which span across years represent additional failures". The methodology which considers a year to run from April to March is clearly intended to avoid counting the use of a single emergency drought order that spans across a year end as two failures – as stated in by Thames Water in its EIR 22-23-390: "A year is defined from Apr to Mar, in order not to count L4 events which extend into January."[129] The fact that Thames

[127] GARD Addendum to dWRMP24 consultation response, April 2023, p. 29.
[128] Thames Water (2023), "Thames Water Draft Water Resources Management Plan 2024: Statement of Response, Appendix G2", August, p. 112.
[129] Thames Water (2023), EIR-22-23-390, 26th January, p. 5.

Water's analysis failed to notice that some emergency drought orders spanned the re-defined March-April year end is clearly an error and should be corrected, as GARD has done in the analysis which showed that the DO of the 150Mm^3 Reservoir is over-estimated by 6Ml/d.

GARD does not agree with Thames Water's comment that the impact of this error is "*very minor*". Multiple small errors can add up to large errors, so all errors should be corrected.

The points we make above are all stated, with supporting evidence, in GARD's detailed rebuttal of the DO aspects Thames Water's SoR[130] and as discussed with the EA and RAPID on 13th October 2023. Therefore, it is disappointing that the matter has not been taken up in Defra's request for more information from Thames Water in February 2024 and that there is no reference to it in Thames Water's response to Defra in October 2024. We propose that RAPID's Gate 3 decision should insist on correction of this error in the Gate 3 documentation.

3.1.4 Use of wrong value of Culham minimum residual flow

Thames Water's modelling to derive SESRO's 271Ml/d DO erroneously assumed that, when refilling the Reservoir, the minimum required flow (MRF) in the River Thames at Culham is only 450Ml/d, instead of the correct value of 1,450Ml/d. Thames Water has recognised this error and provided a correction in an appendix to the modelling technical report, showing that it reduces DO by only 2Ml/d. Our modelling shows a similar DO reduction due to this error, when simulating some stochastic variants of the 1975–76 drought.

As for the error due to double-counting of droughts, the Culham MRF error should not be ignored just because it has a relatively small impact – multiple small errors can add up to large errors. It should have been corrected in subsequent versions of Thames Water's WRMP and in the Gate 3 report.

Although the Culham MRF error does not appear to have a big impact on SESRO DO, it can greatly affect the speed of Reservoir refilling after droughts. The main Gate 2 report for SESRO claimed that the Reservoir refills in five months after extreme droughts, showing an example of recovery after a stochastic version of the 1976 drought. However, the historic drought of 1976 was followed by a wet winter, so that also tends to be the case with stochastic versions of the 1976 drought.

For some of the relatively few droughts in the stochastic record which are not modified versions of the 1976 drought, GARD's modelling shows that the Reservoir is less than half full at the start of the next summer and vulnerable to failure if another dry summer follows. Therefore, we suspect that, when applied to the modelling of 19,200 years of stochastic data, the assumption of a Culham MRF of only 450Ml/d instead 1,450Ml/d, could lead to a

[130] GARD rebuttal of Thames Water SoR on DO, pp. 27–29.

substantial over-estimate of DO, particularly the output that can be sustained in long-duration droughts.

The points we make above are all stated, with supporting evidence, in GARD's detailed rebuttal of the DO aspects of Thames Water's SoR[131] and as discussed with the EA and RAPID on 13th October 2023. As for the error due to double-counting of droughts, the matter was not taken up in Defra's request for more information from Thames Water in February 2024 and there is no reference to it in Thames Water's response to Defra in October 2024. We propose that RAPID's Gate 3 decision should insist on correction of this error in the Gate 3 documentation and in the reassessment of SESRO DO.

3.1.5 Use of wrong climate change scenario

Thames Water's modelling determined SESRO's 271Ml/d DO assuming the '*median*' climate change scenario. However, the water supply deficits in Thames Water's preferred plan (pathway 4) in the Final WRMP24 are based on the '*high*' climate change scenario[132], so the assessed DO for SESRO should also be for this '*high*' scenario.

Using Thames Water's figures, the DO of the 150Mm^3 Reservoir with '*high*' climate change allowance is 252Ml/d, rather than the claimed 271Ml/d[133]. In GARD's opinion, this is another serious error in Thames Water's DO assessment for SESRO.

In its SoR to the draft WRMP24 consultation, Thames Water's response to the criticism over the use of the wrong climate change scenario in assessing DO is shown below[134]:

[131] GARD rebuttal of Thames Water SoR on DO, pp. 29–32.
[132] Thames Water Final WRMP24, paras 11.10 and 11.11
[133] GARD rebuttal of Thames Water SoR on DO, p. 34.
[134] Thames Water (2023), "Thames Water Draft Water Resources Management Plan 2024: Statement of Response, Appendix G2", August, pp. 112–113.

We have considered a median climate change impact for both the SESRO and STT options, and our consideration is that applying a median climate change reduction is appropriate and even-handed. We do not agree that we should adopt the "High" climate change scenario in the assessment of option Deployable Output calculation, as the Deployable Output figures are used in all branches of our adaptive plan. Applying a climate change impact reduction to option Deployable Output values is a step taken to ensure that we have considered climate impacts in our option assessment, and our primary concern in this respect is ensuring that we are comparing alternatives against one another in an appropriate way.

We note that GARD have again not taken an even-handed approach in their consideration of which factors to consider in the calculation of different options' Deployable Outputs.

We have not made changes to our dWRMP following this response, for the reasons set out in our consideration.

In GARD's opinion, Thames Water's arguments are irrational and unacceptable. As Thames Water's forecast deficits are for the '*high*' climate change scenario, the DOs of all potential new sources should also be assessed for the '*high*' scenario.

The use of the of median climate change scenario in assessing DO for SESRO is an error which should be corrected, reducing the DO of SESRO by 19Ml/d. This is another matter that was brought to the attention of RAPID and Ofwat during, and discussed at, the meeting on 13th October 2023. We now propose that RAPID's Gate 3 decision should insist on correction of this error in the Gate 3 documentation and future modelling work.

If Thames Water is comparing options for different climate change scenarios, the DOs of options need to be adjusted for each climate change scenario. Otherwise, options that are climate change-resilient, such as leakage reduction, metering, recycling and desalination, will be unfairly assessed in comparison with options whose DOs reduce with climate change, like SESRO.

In the case of STT options, GARD agrees that the option DOs should be adjusted for each climate change scenario, but notes that several of the STT support options (e.g. the Netheridge and Minworth recycling options) are resilient to climate change. Therefore, in assuming a '*median*' climate change scenario for all DO assessments, Thames Water has biased the selection of SESRO ahead of the STT.

We also note that, if Thames Water's supply deficits are based on the '*median*' climate change scenario, the forecast future deficits in the London and SWOX zones would reduce by

63Ml/d[135], further undermining the case for SESRO that has already been greatly weakened by the trebling of its cost.

3.1.6 Inadequate allowance for emergency storage and dead storage

The allowances for dead and emergency storage are vital aspects of the Reservoir design, affecting its ability to provide water of acceptable quality, as well as the DO of the Reservoir. The Gate 3 documentation contains no information about the amounts of emergency and dead storage assumed in the design of SESRO and assessment of its DO. Therefore, we have assumed that emergency storage is still intended to be 6% of live storage, i.e. 9,000Ml, as assumed in Thames Water's Pywr modelling. We have found just this single reference to dead storage in section 3.1.5 of the Gate 3 Basis of Design report:

> *"In addition to the 'live' (useable) water, a zone of 'dead' (unused) water would be retained at the base of the reservoir to help maintain water quality within the entire live storage zone."*

Obviously, there must be a zone of dead, unused water at the base of the Reservoir – both from the perspective of maintaining acceptable water quality and for to provide sufficient depth of water above the lowest draw-off intake to make the required amount of regulation release to the River Thames at all times. The sole cross-section of the Reservoir presented in Figure 3-4 of the Gate 3 Basis of Design report shows no detail of the dead storage or the minimum live storage level. There is no cross-sectional detail provided of the draw-off arrangements, showing the minimum storage level relative to the invert of the outlet works and discharge tunnel. These are fundamental details that are needed to give confidence that the Reservoir will provide the 150,000Ml of live storage required and that the outlet works will be able to make the required supply release of 321Ml/d to the River Thames. RAPID should insist on these details being provided.

In GARD's response to the consultation on Thames Water's draft WRMP24, we proposed that Thames Water's emergency storage allowance for SESRO should be increased to 15% of live Reservoir storage to be in line with the emergency storage allowance in other major UK reservoirs.

- Clywedog reservoir 13%
- Llyn Brianne reservoir 14%
- Bristol Water (Chew, Blagdon) 18%
- Welsh Dee system 20%
- Thames Water London reservoirs 24%

[135] Thames Water Final WRMP 24, Table 4-19.

- Thames Water Farmoor Reservoir 33%

Therefore, we proposed that the allowances for emergency storage should be 15% of live storage to be similar to the Llyn Brianne, Clywedog and the Welsh Dee regulating reservoirs.

In the absence of any information in the Gate 3 reports or the WRMP24 documents about the amounts of dead and total storage, we reproduce in Table 3.3 the information provided in the SESRO feasibility report available for WRMP19[136]:

Reservoir Design

Property	Unit	Value
Live Storage	Ml	150,000
Total Storage	Ml	165,000
Range of embankment height	m	15-25
Embankment slope angle	V:H	1 in 6
Water surface area at Full Supply Level (FSL)	ha	675
Embankment crest perimeter	km	10.3
Structural fill volume	Mm3	26.3
Cut Volume	Mm3	50.3
FSL/Reservoir Base Level	mAOD	79 / 49

Table 3.3 - SESRO dead and live storage details from WRMP19

This shows gross storage of 165,000Ml and a live storage of 150,000Ml, so dead storage of 15,000 Ml. The Reservoir area at the base of the embankment is about 550ha, so the average depth of water in the dead storage is only about 2.7m.

In GARD's opinion, an average water depth of 2.7m for a 6km^2 lake will be insufficient to provide acceptable water quality. It should be borne in mind that the floor of the borrow pit has a very flat slope of about 1:100 down to the bottom of the central trench, so the water depth round the Reservoir margins will be extremely shallow and the mud at the bottom will be stirred by wave action.

Therefore, GARD has proposed that, at the base of the live storage there should be an average water depth of 5m. When combined with GARD's proposal for emergency storage to be 15% of live storage, the amounts of amounts in the various storage zones would be as shown in Table 3.4 below:

[136] Thames Water WRMP19 Reservoir Feasibility Report, July 2017, p. 249.

GARD reassessment of dead and emergency storage	150 Mm^3 reservoir	Comment
Gross storage	165,000 Ml	As per 2017 feasibility report
Dead storage with average 5m depth	27,570 Ml	Bottom area ha x 5m depth
Live storage, including emergency	137,430 Ml	Gross storage less dead
Emergency storage 15% of live storage	20,615 Ml	15% typical for regulating reservoirs
Storage available for normal operation	**116,816 Ml**	Live storage less emergency
Average depth of dead storage	5.0 m	GARD proposed minimum acceptable
Average depth of GARD emergency storage	3.7 m	Emergency storage ÷ bottom area
Average depth dead + emergency	**8.7 m**	Depth remaining at start of emergency

Table 3.4 - GARD reassessment of dead and emergency storage allowances

With these proposals for dead storage and emergency storage, Thames Water's modelling shows that the DO for the 150Mm^3 Reservoir would drop from 271Ml/d to 227Ml/d, a reduction of 44Ml/d[137].

Thames Water's response to GARD's criticism of the adequacy of the dead and emergency storage allowances is shown below[138]:

> *We do not agree with the amendments which GARD suggest to the dead/emergency storage provisions for SESRO, for the reasons set out below. As such, we do not agree the Deployable Output reductions suggested.*
>
> *The 6% emergency storage in SESRO is calculated as 30 days' worth of reservoir throughput, in line with other Thames water reservoir emergency storage calculations. Given that this is the standard on which other TW emergency storage requirements are determined, in the absence of other evidence we do not see a reason to amend this.*
>
> *The reservoir water quality modelling that was undertaken for the Gate 2 submission suggests that an acceptable level of water quality can be achieved with the current concept design and associated inlet / outlet and mixing arrangements. This will continue to be reviewed and re-analysed as the design progresses, to reflect the latest design of the reservoir and borrow pit, and appropriate inlet, outlet and mixing arrangements included as required.*
>
> *Our consideration is that GARD have taken the suggestion of 5m being required to ensure good water quality out of context. GARD have assumed that 5m depth is required, on average, to ensure good water quality, when this was intended to apply to the depth of storage required in the central trench to ensure good quality, considering the rest of the design of the reservoir (i.e., including the sloping banks of the borrow bit) and accounting for the aeration system which encourages mixing.*

[137] Technical Note Enhanced RSS Modelling of SESRO and Thames to Affinity Transfer Schemes, Table 6-1 and GARD Addendum to dWRMP24 consultation response, pp. 40–41.
[138] Thames Water (2023), "Thames Water Draft Water Resources Management Plan 2024: Statement of Response, Appendix G2", pp. 112–113.

As GARD said in the rebuttal of Thames Water's SoR on DO and discussed with RAPID, the EA and Ofwat during the meeting on 13th October 2023, we think Thames Water's arguments are wrong. On an intuitive and common-sense level, it seems foolhardy to allow for emergency storage that is so much less than at all other major UK reservoirs, including Thames Water's own reservoirs. We think that its statement that its existing reservoirs have 30 days of throughput is wrong, because it does not take account of the inflow to the existing reservoirs that will continue even in severe droughts. In contrast, there will be almost no inflow to the Reservoir in severe droughts because of the high hands-off flow at Culham.

As we showed in GARD's rebuttal of Thames Water's SoR on DO, the 'throughput' of Thames Water's London reservoirs in drought conditions is about 760Ml/d, as shown in Figure 3.1:

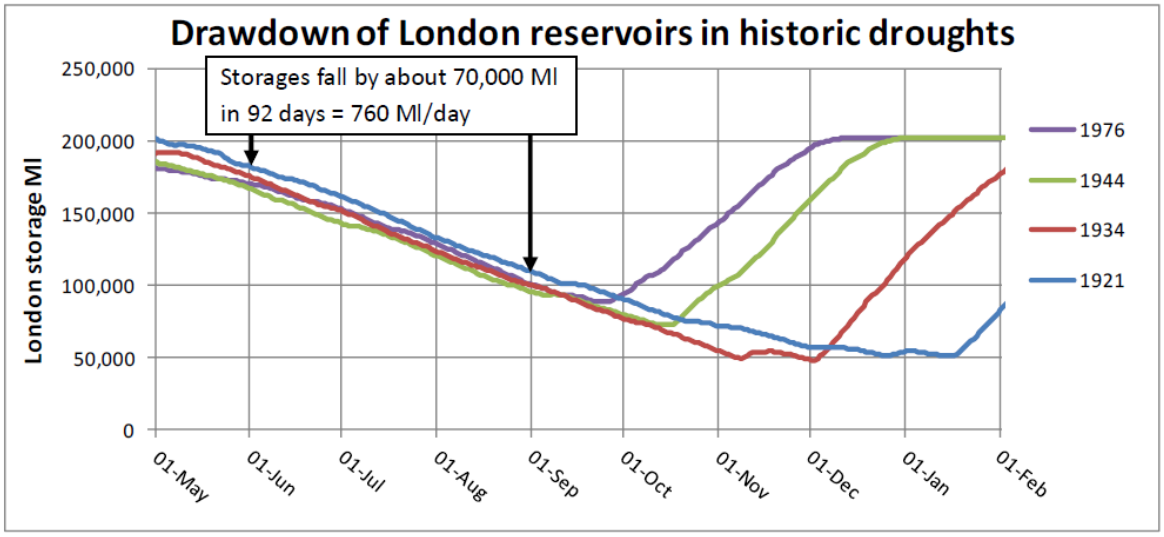


Figure 3.1 -Thames Water modelled throughput of London reservoirs in severe droughts

The emergency storage allowance for the London reservoirs is 48,500Ml, which is 64 days of throughput at 760Ml/d, not 30 days. For Farmoor Reservoir, the emergency storage of 4,500Ml is equivalent to 79 days of throughput at 59Ml/d[139].

The 15% emergency storage (20,615Ml) that GARD has proposed is equivalent to 64 days of throughput of the planned regulation releases of 321Ml/d, in line with the allowances at Thames Water's London reservoirs.

As noted in section 3.5 of this response, the Gate 3 reports provide no indication that the water quality in the emergency storage will be acceptable, taking account of the shallowness of the water and the water quality problems experienced at Farmoor Reservoir.

[139] GARD rebuttal of Thames Water SoR on DO, p. 40.

In GARD's opinion, the amounts of dead and emergency storage, and their influence on SESRO deployable output, should have been raised in Defra's letter to Thames Water in February 2024 and it should now be addressed in RAPID/Ofwat's decision on Gate 3, including the commissioning of an independent review

3.1.7 Resilience in long-duration droughts

GARD's Addendum to its response to Thames Water's draft WRMP 24 concluded that that the Pywr modelling of the London supply system is not fit for purpose and that, if proper consideration is given to the occurrence of long-duration droughts, the DO of SESRO would be in the region of 50% less than claimed by Thames Water. The Addendum included extensive evidence of this, identifying two main problems in the 19,200 years of stochastically generated flow data used in the Pywr modelling[140]:

- The stochastically generated Teddington natural flows are a poor fit to gauged natural flows and flows generated from historic weather data.
- The use of the period 1950–97 to "train" the stochastic modelling has replicated the pattern of droughts in that period and excluded the long droughts that occurred in 1921, 1933–34 and 1943–44.

We concluded that, if proper consideration is given to the occurrence of long-duration droughts, the DO of SESRO would be far less than that claimed by Thames Water, perhaps in the region of only 50% of the claimed amounts, when the deficiencies identified in sections 3.1.3 to 3.1.6 are also taken into account.

In its SoR to the WRMP24 consultation, Thames Water briefly dismissed all GARD's concerns about the validity of the Pywr modelling and SESRO's resilience in long-duration drought, with minimal supporting evidence. This was addressed at some length in GARD's rebuttal of Thames Water's SoR and discussed at the meeting with RAPID, Ofwat and the EA on 13th October 2023.

Some of GARD's concerns on this matter were recognised in Defra's letter to Thames Water in February 2024, which called for further information on the calibration of the rainfall run off model; and the stochastic data set and its reflection of long-duration droughts.

Thames Water's response to Defra on model calibration

Thames Water's response to Defra started with this elaboration of the request, which was a reasonable reflection of the concerns raised at the meeting on 13th October 2023:

[140] GARD (2023), "GARD Addendum to dWRMP24 consultation response", April, pp. 11–23.

6.4 The company should review the new rainfall runoff model's ability to consistently replicate winter flow recovery, particularly after severe or long-duration droughts. This should focus on the parts of the hydrograph critical at key locations, e.g. at thresholds controlling abstractions. The company should discuss consequences from uncertainties resulting from adoption of the rainfall runoff model, and investigate the impact on deployable output accordingly. The company should:

- investigate rainfall run-off model calibration fits in isolation from the DO model where possible, to provide confidence in the outputs of the rainfall runoff model
- ensure it presents comparisons of historic and modelled time series and flow duration curves for key locations
- provide explanations for any significant discrepancy, and consider amended inflow hydrographs if there are significant differences in flow magnitude, especially if such differences impact the drawdown of reservoir stocks as presented in the rdWRMP Appendix I
- consider alternative representations of the rainfall runoff model to investigate improved model fits where there is significant differences, particularly over multiple years, or over severe or long duration droughts.
- Use any improved fits from the alternative representations to reassess deployable output in the water resources model, for comparison with the current range of deployable output uncertainty within headroom.

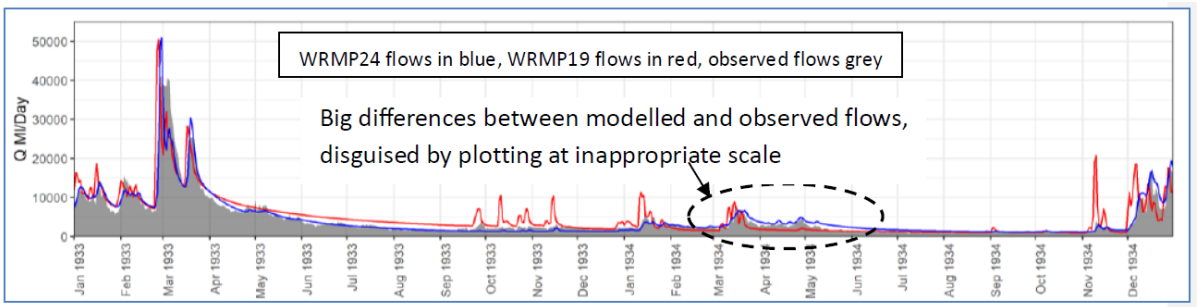
Thames Water's response to Defra included a lot of statistical data and plots, supposedly showing good fit between modelled and recorded river flows, concluding[141]:

The key values of Nash-Sutcliffe Efficiency (logNSE) being around 0.9 for both models [WRMP19 and WRMP24 models] , logNSE (a metric which is particularly important when considering low flow calibration) also being around 0.9 for both models, and Kling-Gupta Efficiency (KGE) being >0.9 for both models indicate strong model calibration performance.

The statistical analysis fails to address the key point at the start of Defra's request, namely that: "The company should review the new rainfall runoff model's ability to consistently replicate winter flow recovery, particularly after severe or long-duration droughts." This was a major part of the concerns raised by GARD at the meeting on 13th October 2023.

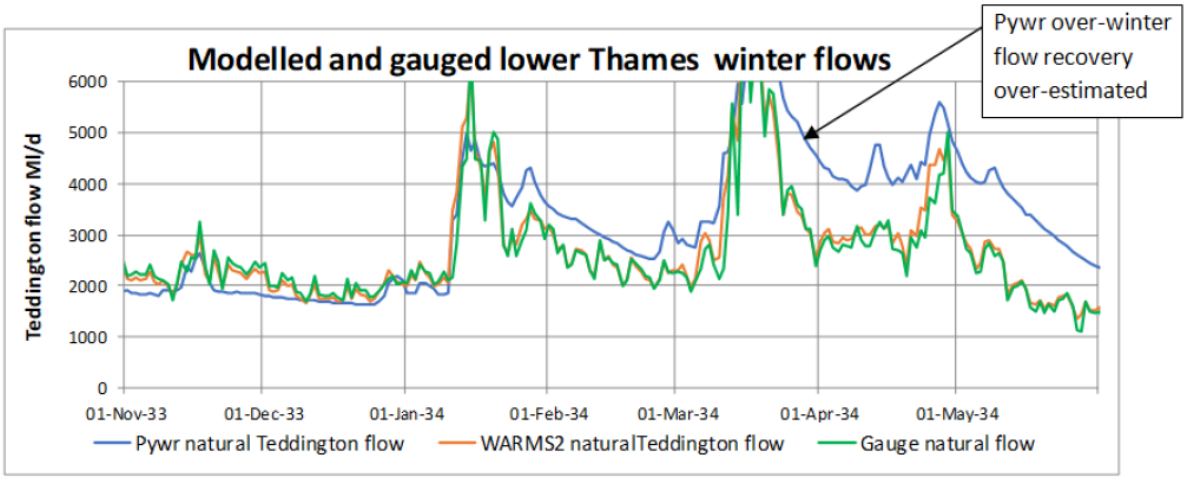
The inability of the WRMP24 rainfall run-off modelling to replicate over-winter flow recovery in long droughts is hard to see on the hydrographs provided in Thames Water's response to Defra. This is because they are plotted at a scale, which disguises the amount of mis-fit, for example:

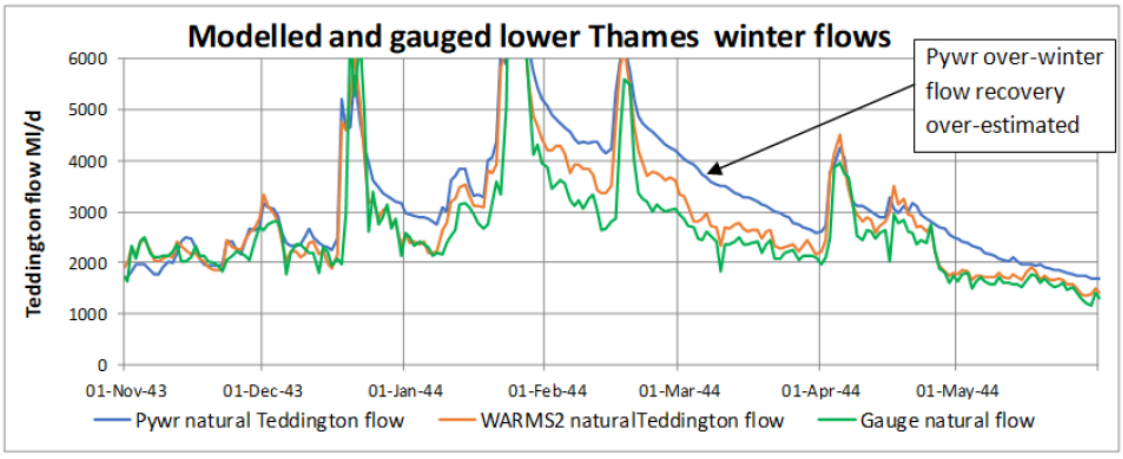
[141] Thames Water (2024), "Appendix: Defra request for further information", October, paragraph 6.18.



Note: Thames Water's plot of flows in the 1943–44 drought showed flows to the end of 1943 only, so failed to illustrate the overestimated flows in spring 1944, as shown in GARD's plots below.
Source: Thames Water (2024), "Appendix: Defra request for further information", October, Figure 6-5.

a) As shown in Thames Water's response to Defra





b) As re-plotted by GARD and discussed with RAPID/Ofwat/EA on 13th October 2023

Figure 3.2 - WRMP24 modelling over-estimation of winter flow recovery in long droughts

Comparing the latest Teddington modelled flows in the upper plot of Figure 3.2 with GARD's plot beneath of the previous version of WRMP24 modelled flows shows some slight changes in the latest over-winter flows in 1933–34, but they still greatly exceed the observed flows.

GARD's rebuttal of Thames Water's SoR on DO contains more details of GARD's concerns about the very poor calibration fits for the Pywr modelling of overwinter flow recovery in long-duration droughts[142]. It is extremely disappointing that, having been asked specifically by Defra to address the adequacy of modelling of over-winter flow recovery in long droughts, Thames Water has failed to do this. It is also disappointing that the Regulators seem to have failed to recognise this major weakness in Thames Water's response to Defra. GARD proposes that this should be rectified in RAPID/Ofwat's decision on the SESRO Gate 3 report.

Thames Water's response to Defra also attempted to justify the adequacy of its modelling by showing that modelling of historic droughts since 1920, using the new modelled flows, gives a London DO that is less than 1% different to the DO using WARMS2 flows based on historic data[143]. Therefore, in the Final WRMP24, Thames Water made no material changes to the Pywr modelling that was used to generate the SESRO DO of 271Ml/d.

However, the validation plots for the latest modelled London reservoir storages in the historic droughts, as shown in the plots on the next page, tell a different story.

- It is agreed that modelled reservoir drawdowns in the single-year critical drought of 1921 are almost the same, so the difference in modelled DOs is less than 1%.
- However, the Pywr modelled drawdowns in the severe 18-month droughts of 1934 and 1944 are about 25,000Ml less than the WARMS2 modelled drawdowns, equivalent to DO differences of about 50Ml/d.
- Winter refill of the reservoirs is still substantially overestimated in each of the 18-month droughts of the past 100 years: 1933–34, 1943–44 and 1975–76.
- There are large differences in summer drawdowns in many other years.

In GARD's opinion, the close match between modelled drawdowns and DOs in the 1921 drought was fortuitous. The widely differing drawdowns in many other years, especially the 18-month drought years, are indicative of the poor reliability of the Pywr modelling.

Overall, the plots of Pywr model validation on the next page[144] are damning evidence of the unreliability of the Pywr modelling, especially when simulating the long-duration droughts that are critical for the supplies using Thames Water's London reservoirs.

[142] GARD rebuttal of Thames Water SoR on DO, pp. 7–15.
[143] Thames Water (2024), "Appendix: Defra request for further information", October, paragraph 6.18.
[144] The plots are copied from Thames Water's Final WRMP Figure I-23: Step 2 Pywr Model Validation Plots (y-axis is London reservoir storage in Ml).

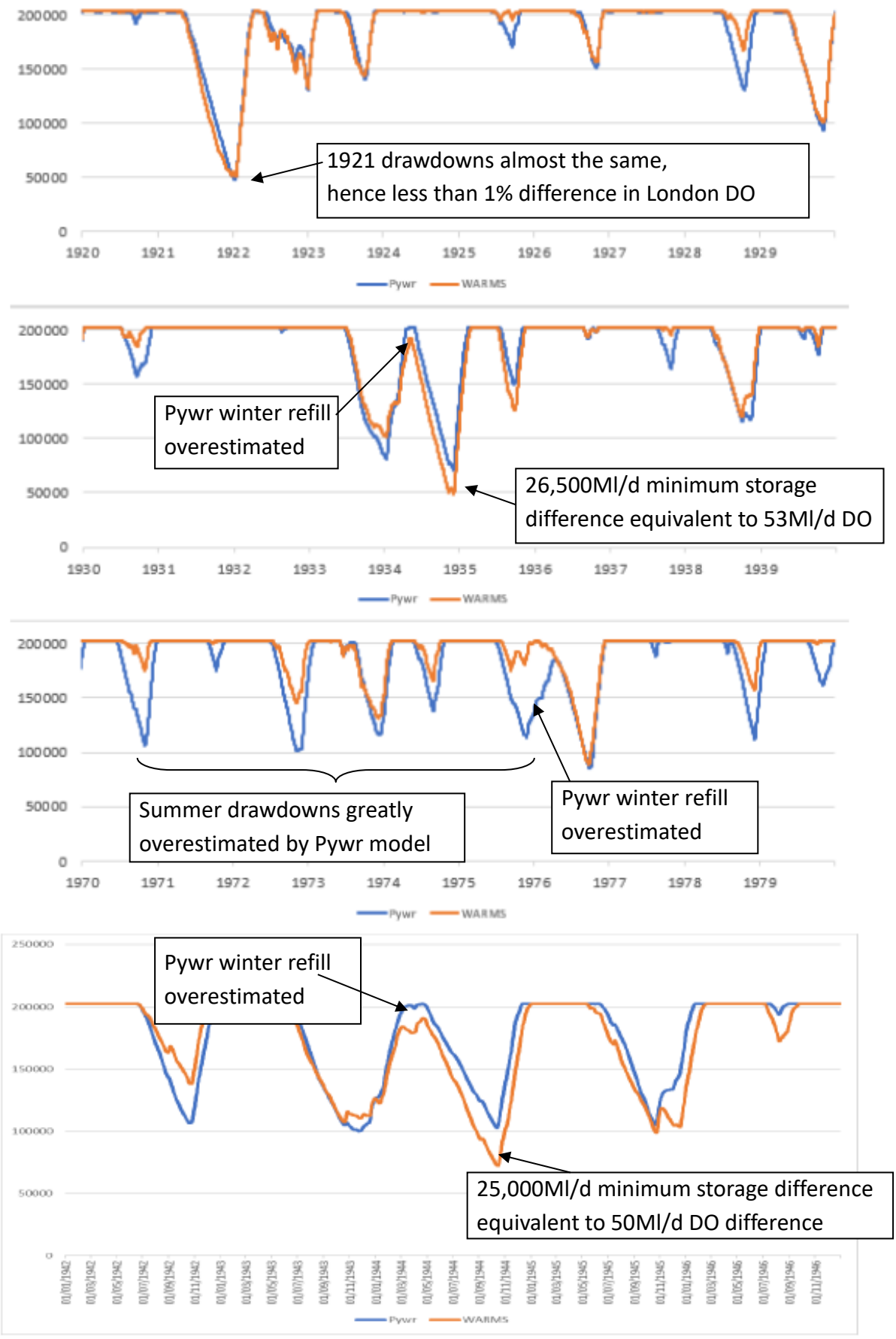


Figure 3.3 - Poor validation fits for Pywr modelling in historic droughts

Thames Water's response to Defra on long-duration droughts

Thames Water's response to Defra included this clarification of Defra's request:

> Further elaboration of request given in annex, or clarification given subsequently
>
> Annex Issue 6
>
> 6.42 Thames Water has not provided sufficient assurance that the stochastic dataset used adequately reflects long duration droughts. Thames Water should critically assess how well the stochastic dataset represents the range of durations of critical historic droughts. Thames Water should consider investigating the model's performance during long duration droughts, including those which may occur outside of the variants generated within stochastic replicates, and investigate the impact of such droughts on the deployable output of key supply schemes.

Thames Water has assessed how well the stochastic data set represents *"the range of duration of critical historic droughts"* by comparing rainfall accumulation plots for several stochastic and recorded data sets over durations of 1 year, 18 months, 2 years, 3 years and 4 years. It concludes that the stochastic rainfall datasets do not underestimate the likelihood of long-duration droughts, if anything overestimating their likelihood[145]. In GARD's opinion, the rainfall accumulation plots are not a valid test of the validity of the Pywr modelling of historic droughts because a) they do not test the reliability of converting the rainfall to river flows in long droughts and b) they do not take account of the complexity of the London supply system which is a mixture of reservoir, river and groundwater sources.

Thames Water has failed to address the Defra requirement to "investigate the model's performance during long duration droughts, including those which may occur outside of the variants generated within stochastic replicates, and investigate the impact of such droughts on the DO of key supply schemes". Instead, its response compares SESRO deployable outputs for four sets of river flow data: WRMP19 "worst historic", WRMP19 stochastic, WRMP24 model using WRMP24 stochastics; and WRMP24 model using WRMP19 stochastics, as shown below.

Assessment	Deployable Output Benefit to London WRZ of 150 Mm^3 SESRO scheme (Ml/d), without Climate Change
WRMP19 – "Worst Historical"	283
WRMP19 – Stochastic	282
WRMP24	285
WRMP24 Models, using WRMP19 Stochastics	300

Source: Table 17 in Thames Water (2024), "Appendix: Defra request for further information", October.

Table 3.5 - Thames Water assessments of SESRO deployable output using different river flow data sets

[145] Ibid., paragraph 6.50.

Using the WRMP19 stochastic data, which is "trained" on the historic weather of 1920–97, Table 17 (reproduced here as Table 3.5) shows the SESRO DO as 300Ml/d. Thames Water uses this to argue that SESRO DO *"may be more linked to the underlying vulnerabilities of the London WRZ (to c.18-month drought events) rather than the specific events contained within an underlying series"*[146]. In other words, Thames Water claims that training the stochastic data on historic weather including the severe 18-month droughts of 1933–34 and 1943–44 makes no difference to the DO of SESRO and its resilience to long-duration droughts.

To check the validity of Thames Water's statement, GARD asked for Pywr model output data for the existing London scenario and the SESRO 150 scenario, showing duration of Level 4 failure (i.e. emergency supply restrictions) in each of the 15,600 years modelled using WRMP19 stochastic data. Thames Water suppled these data under EIR-25-26-420, dated 24th October 2025. GARD has analysed the failure frequency and duration data to generate the SESRO DO versus return period plot shown below:

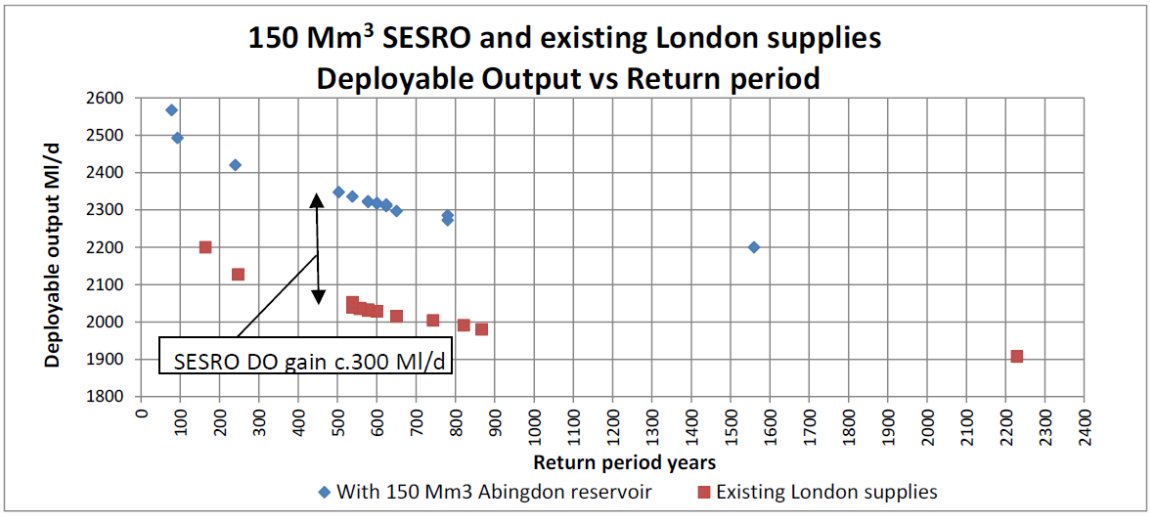


Figure 3.4 - DO vs return period for SESRO 150Mm³ using WRMP19 stochastic data

On the face of it, the above plot appears to show that SESRO still provides a 1:500 year DO gain of about 300Ml/d when assessed using stochastic data trained on the historic period 1920–97, which includes the 18-month droughts of 1933–34 and 1943–44. However, GARD's detailed inspection of the modelled failure data provided under EIR-25-26-420 shows anomalies which undermine the credibility of the data and Thames Water's conclusion that the data show that SESRO is resilient to droughts of longer duration than 18 months.

Firstly, the pattern of calendar years of failure using the WRMP19 data does not mirror the calendar years of the historic droughts, as was the case using the WRMP24 stochastic data. This is illustrated below:

[146] Ibid., paragraph 6.54.

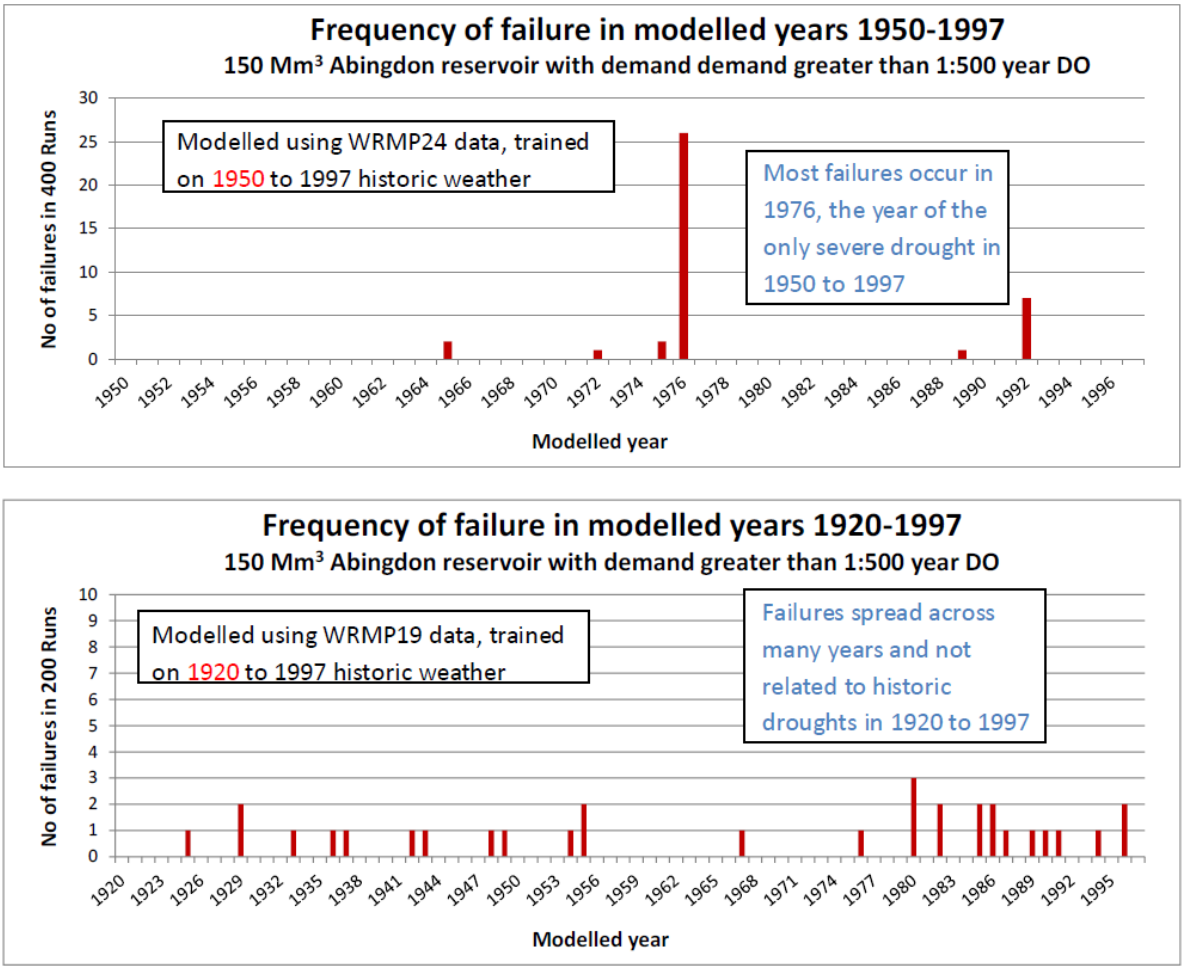


Figure 3.5 - Calendar-year failure frequencies using WRMP19 and WRMP24 stochastic data

The striking differences in the pattern of calendar years of failure between the WRMP19 and WRMP24 modelling suggests that there has been a fundamental change in the way that the stochastic data have been generated. This needs to be explained and justified by Thames Water.

The second concern over the validity of the analysis using WRMP19 data is that the modelled years of failure shown in the data supplied under EIR-25-26-420 bear no relationship to failure years shown by the stochastic data supplied to GARD in these files dated 29.05 2017. WRMP19:

Name	Size
Days_Weir_stochastic_flows_all	36,842 KB
FeildesWeir_stochastic_flows_all.csv	62,615 KB
Teddington_stochastic_flows_all.csv	56,003 KB

The data in these files are understood to be the data used in Thames Water's WRMP19 modelling. However, GARD's modelling of the London supply system using these data usually

shows no significant droughts in the years when EIR-25-26-420 data show London supply failures in droughts of more than 1:500 year severity. An example is shown below:

Excerpt from EIR-25-26-420 Abingdon Level 4 failure data[147], with failure in 1975:

record	stochastics	demand	1973	1974	1975	1976	1977	1978
LTOA L4	67	1.062	0	0	298	0	0	0

GARD modelling using WRMP19 stochastic data from Run 67, but showing no failure:

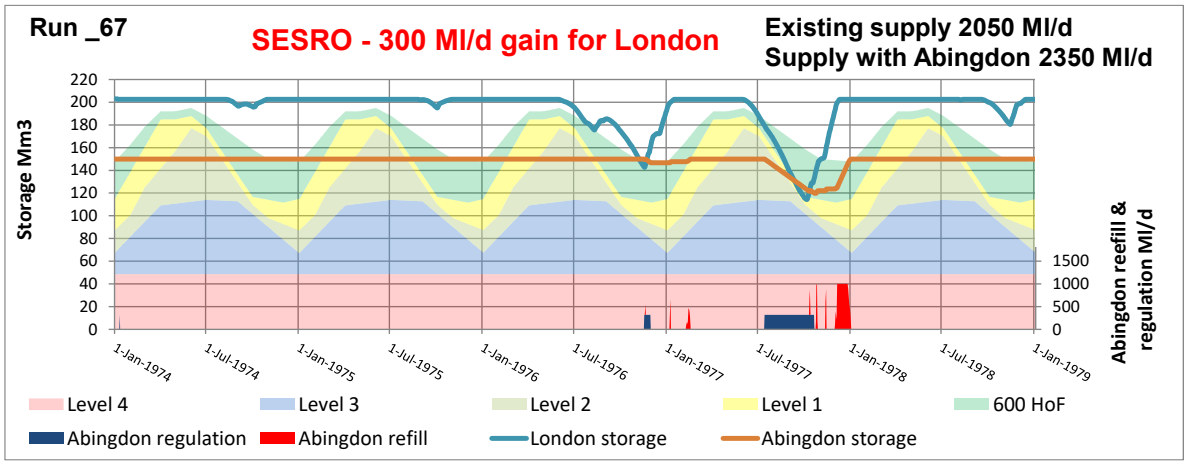


Figure 3.6 - Example of EIR-25-46-420 data showing SESRO failure but not replicated by GARD modelling using WRMP19 stochastics

The excerpt in the upper part of Figure 3.6 shows a value of 298 for the year 1975, which the text of EIR -25-46-420 describes as:

> *"From the information we have retained, we are not certain whether the figures represent the 'last day under the curve' (Apr-Mar year) or the 'duration under the curve', but this distinction does not impact the DO calculation."*

This is an extraordinary admission of Thames Water's ignorance of its own analysis. If the value of 298 days was the duration of Level 4 emergency restrictions in London, it would have a catastrophic economic impact. However, GARD's understanding is that 298 is the last calendar day of restrictions within the modelled year from April to March, i.e. 25th October.

The lower part of Figure 3.6 shows GARD's modelling of the SESRO and London supply system meeting an additional SESRO-supported demand of 300Ml/d with the stochastically generated river flows for Run 67 as supplied to GARD prior to WRMP19. The modelling shows little London reservoir drawdown in 1975 (or the surrounding years) and little use of SESRO storage. It appears that the stochastic data used to generate the data files provided

[147] EIR-25-46-420 data file "tw-baseline-old stoch – SESRO DS OFF – dy-failures.csv".

under EIR-25-46-420 were not the same as the stochastic data provided to GARD prior to WRMP19 and which raised big concerns over the presence of long droughts that would greatly reduce the DO of SESRO.

Similarly, long droughts that existed in the WRMP19 data provided to GARD in WRMP19, do not appear to be represented in the data provided under EIR-25-46-420. An example is shown below:

Excerpt from Abingdon Level 4 failure data supplied under EIR-25-26-420 with no failure:

recorde	stochasti cs	demand	1942	1943	1944	1945	1946	1947	1948
LTOA L4	151	1.062	0	0	0	0	0	0	0

GARD modelling using WRMP19 stochastic data Run 151 showing major supply failure:

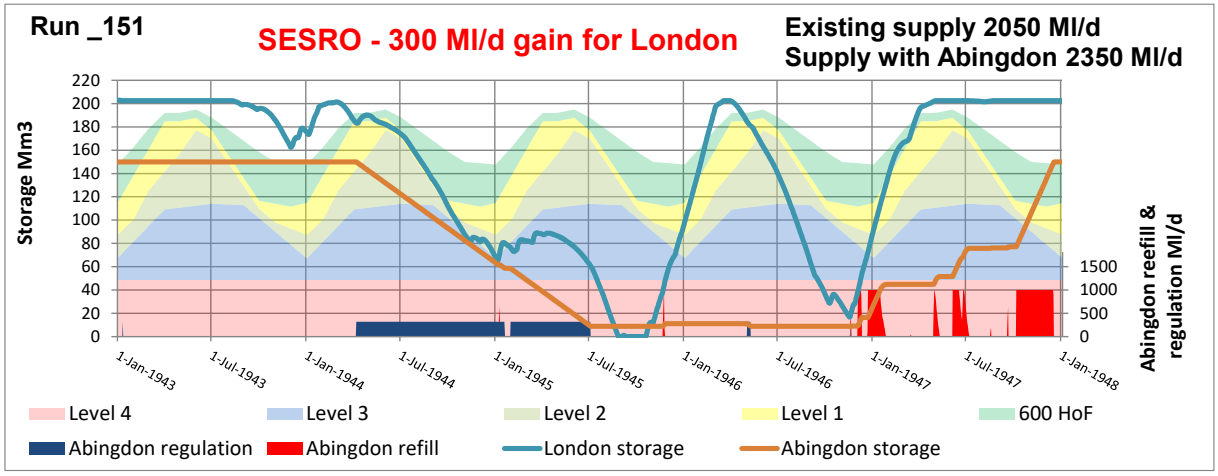


Figure 3.7 - Example of EIR-25-46-420 data not showing SESRO failure, when major failure is shown by GARD modelling using WRMP19 stochastics

The GARD model output in the lower part of Figure 3.7 shows that, using Run 151 stochastic data, SESRO would be empty by July 1945 and there would be about eight months of emergency restrictions in London, with the London reservoirs ***empty*** for several months. In the following winter, there would be a full recovery of storage in the London reservoirs, but no water available to refill SESRO. Consequently, with another severe drought following in 1946 and no water available in SESRO, there would be another several months of emergency restriction for London in 1946. The possibility of this nightmare scenario of a three-year drought was dismissed by Thames Water as being too improbable to contemplate. In GARD's opinion, Thames Water has provided no analysis or data that reliably proves that a catastrophic three-year drought does not need to be considered in assessing the DO.

The danger of excluding long historic droughts from the records used to train the stochastic modelling was identified in WRSE's Method Statement for Stochastic Climate Datasets[148]:

> *"As with any dataset generated based on existing datasets using statistical methods, the stochastic weather sequences are only as good as the datasets on which they are trained. As stated above, the stochastic dataset is formed of 400 48-year sequences and is trained on the 1950-1997 baseline period. There is a risk that extreme, extended droughts may not necessarily be well reflected in the dataset, although quantifying this risk is extremely difficult. Companies may complement the stochastic dataset with drought artificial weather series to represent prolonged drought events (which the stochastic generator will not have been trained on)."*

Despite this advice and the known concerns over long droughts, Thames Water has not followed WRSE's advice by generating artificial long droughts "*to represent prolonged drought events (which the stochastic generator will not have been trained on)".*

GARD's Addendum to the WRMP24 consultation response provided an example of a long artificial drought, with the historic drought of 1933–34 being preceded by the flows of the moderately dry years 1996–97. This showed there would be catastrophic failure of London's supplies during such an event and the DO of the 150Mm^3 SESRO Reservoir, without climate change, would fall from 285Ml/d to 163Ml/d[149]. GARD's modelling to support this conclusion is shown in Figure 3.8 below.

[148] WRSE Method Statement on Stochastic Climate Datasets: Consultation Version, July 2020, paragraph 2.7.
[149] GARD Addendum to dWRMP24 consultation response, April 2023, pp. 36 to 37.

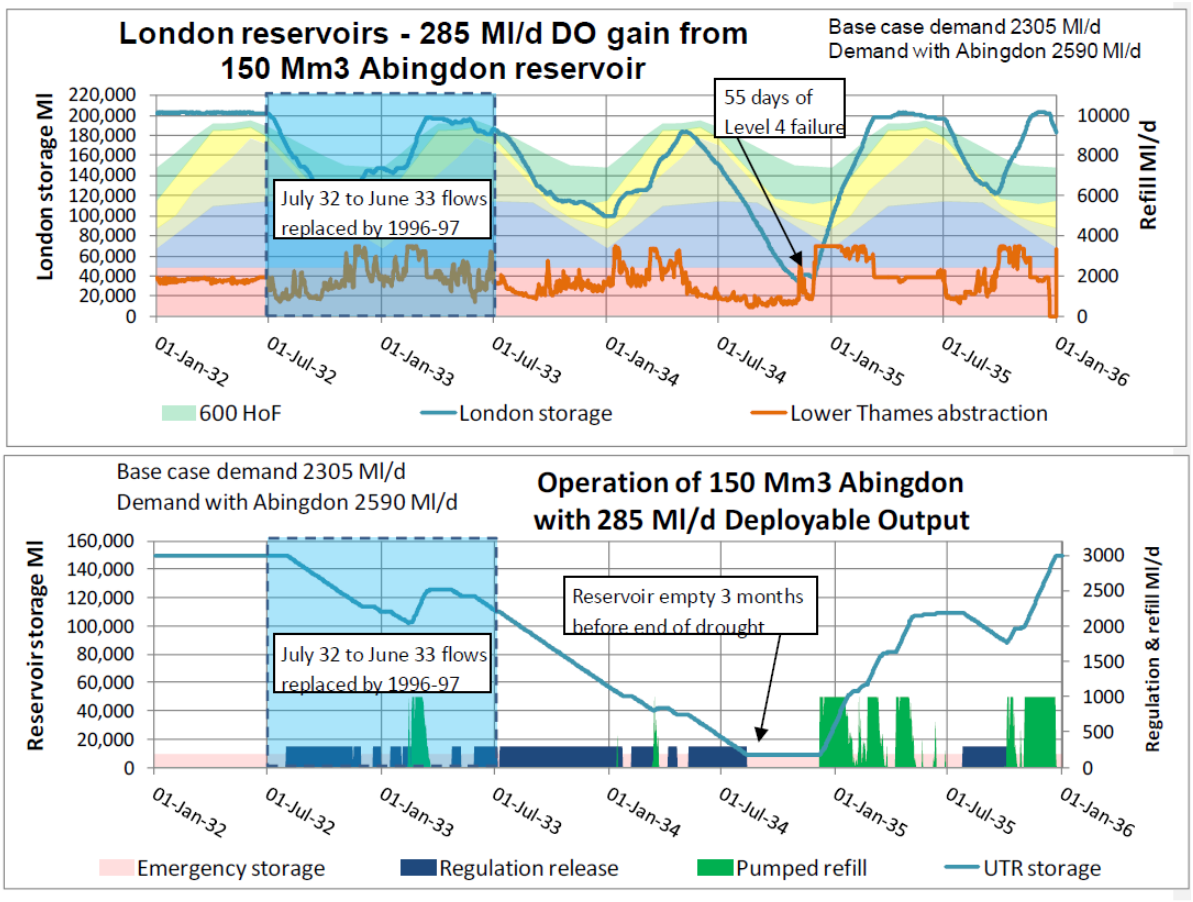


Figure 3.8 - Abingdon Reservoir in artificially extended historic 1934 drought

In this scenario, replacing the historic flows of mid-1932 to mid-1933 with the historic flows of mid-1996 to mid-1997 would lead to 55 days of Level 4 failures for London's supplies, with SESRO being empty three months before the end of the drought. This would be a catastrophic failure of London's supplies, with Level 4 restrictions starting in August 1934 at the peak of the tourism season. In this seemingly plausible scenario, the DO that can be sustained by SESRO is only 163Ml/d, not 285Ml/d.

3.1.8 Suggested DO matters to be included in the Gate 3 decision

Our review of the Gate 3 quoted 271Ml/d DO for SESRO has shown that the concerns previously raised by GARD have not been addressed, despite being brought to the attention of RAPID, Ofwat and the EA through the rebuttal of Thames Water's SoR on DO and the meeting on 13th October 2023. GARD's concerns relating to adequacy of stochastic flow data and modelling of long-duration droughts were reasonably reflected in Defra's letter to Defra in February 2024. However, as we show in section 3.1.7, Thames Water's response failed to address Defra and GARD's concerns. GARD's other concerns, relating to errors in the DO assessment and inadequate allowances for dead and emergency storage, as discussed in sections 3.1.3 to 3.1.6, were not raised in Defra's letter to Thames Water and have not been addressed at all.

Therefore, GARD proposes that RAPID/Ofwat's Gate 3 decision should call for a full and transparent reassessment of the DO of SESRO. We propose that RAPID/Ofwat should insist on correction of the errors due to the double-counting of droughts and the use of the wrong climate change scenario.

In GARD's opinion, the amounts of dead and emergency storage, and their influence on SESRO DO, should have been raised in Defra's letter to Thames Water in February 2024 and this should now be addressed in RAPID/Ofwat's decision on Gate 3, calling for a fully evidenced and transparent justification, taking account of the matters raised in section 3.1.6 of this response.

In GARD's opinion, the views of Thames Water and their consultants on the DO of SESRO are so entrenched that they will never concede the need to make any changes, regardless of the evidence presented. Their refusal to correct the obvious errors due to the double-counting of droughts and the use of the wrong climate change scenario are examples of this. Thames Water's failure to provide adequate answers to Defra's clear questions about adequacy of modelled flows and resilience in long droughts, as set out in section 3.1.7 of this response, is more evidence of its intransigence.

Therefore, we propose that RAPID/Ofwat should commission an independent review of SESRO's deployable output, especially the adequacy of the dead and emergency storage allowances, the validity of the stochastically generated flow data and the Reservoir's resilience in long droughts. It is important that this review should be genuinely independent, so it should be commissioned by Ofwat, reported to Ofwat and paid for by Ofwat. It should be undertaken by an organisation not currently working for Thames Water.

3.2 Engineering design

SESRO is a project to construct the largest bunded-reservoir in the UK, and probably in Europe. One would thus expect there to be design details of the Reservoir in these submissions, especially in reports titled "*Basis of Design*". One would not expect more details on 'standard engineering' peripherals, such as rail material handling facilities, and on road access than on the 'core' Reservoir and its key peripherals, such as the inlet/outlet channels, emergency drawdown and key flood measures such as the groundwater drain.

The above expectation is not satisfied. There is virtually no engineering design in the Gate 3 documents. The only single engineering drawing in all the documentation about the Reservoir is Figure 2.3 in the Gate 3 Main report[150], which shows the Reservoir plan at a scale of 1:10,000 on an A3-size drawing – this is at far too small scale to show any engineering detail. There are two sketches of Reservoir embankment cross-sections in Figure

[150] Gate 3 Main Report, p. 14.

3.4 in the "*Basis of Design Report*"[151], similar to previous sketches and with no engineering detail showing earthworks zoning, core dimensions, drainage layer thicknesses, rip-rap detail, etc. There are schematic sketches of inflow/outflow works and emergency drawdown works in Figures 3.3[152] and 3.5[153] of Basis of Design Report, but no engineering detail of these complex facilities, which have to pass a flood of 76m^3/s through the earth embankment – an inherently high risk process. We discuss the serious issues with the emergency drawdown system for SESRO, including the chopping and changing of the design (some of it post-Gate 3 submission) in section 3.3.2 below.

There are a few pages of text in the Basis of Design report with brief descriptions of some of these facilities, but they are just statements of intent and provide no detail that allows any assessment of the adequacy of the designs (if they exist).

The Gate 3 and pre-DCO consultation documents provide minimal detail of the design of the reservoir embankment. There is insufficient information to form a judgement on whether its slopes will be stable and adequately protected against wave action. There is no information provided on what use has been made of the results of the CCT, if any.

The full-scale trial embankment, proposed in 2007 as essential for determining the feasibility and safety of the Reservoir, does not appear to be mentioned at all in the Gate 3 reports However, the pre-DCO consultation reports suggest the trial embankment will be delayed until 2032. Allowing three years for essential soil pore pressure testing, this means that the design cannot be finalised until 2035 and the project completion will probably be delayed until 2046. RAPID's Gate 3 decision should require the construction of the full-scale trial embankment and the availability of its test results to be clearly shown in the project development programme.

In short, after five years of work to Gate 3, at a quoted cost of £65M at 2017/18 prices,[154] equivalent to perhaps 6,000 person-months of technical staff input, there is still no engineering detail available to demonstrate that the scheme will be fit for purpose and safe. The level of detail shown is far short of what is needed for reliable cost estimation, although some more detail must surely have been made available to cost estimators.

We believe it is impossible for RAPID judge the adequacy of the Gate 3 design development and the cost estimation in the absence of any engineering detail of the reservoir and its ancillary facilities. We believe the RAPID 'final determination' should reflect this dissatisfaction. We return to this point and our recommendations in Chapter 7.

[151] Gate 3 Basis of Design report, figure 3.4.
[152] Basis of Design Report, p. 38.
[153] Basis of Design Report, p. 47.
[154] Gate 3 Main Report, p. 59.

Lack of transparency of advice from reservoir experts

The pre-DCO consultation brochure states that the safety of the reservoir will be assured by the appointment of a statutory Construction Engineer and a Reservoir Advisory Panel, but no information is provided on what advice they have given and whether it has been heeded. RAPID's Gate 3 decision report should insist that this information is publicly available and referred to where appropriate in report sections that cover the design and safety of the reservoir.

'Design changes' and their effects on costs

As discussed in section 2.2.2 above, the SESRO promoters make much of key design changes since the Gate 2 report was issued[155].

As we discuss in Appendix B, our review of Table 2-1 concludes that most of the design changes identified are typical design development items, with the exception of the emergency drain, and should not have resulted in the huge cost escalation. It is also noted that, of the 35 design changes listed, some are repetitive, only 22 refer to the 'core' Reservoir design (and there are no actual details, outside of brief text), and at least seven are ancillary (landscaping, watercourse diversion, rail materials handling facility, roads, visitor facilities, etc) and not the 'core' project.

On the other hand, since the Gate 3 submission has been made, with the publication of the DCO consultation papers, there have been a large number of very substantial changes to the SESRO 'design' in the broadest sense. These are itemised in section 2.2.5 above, and are very likely to result in significant cost changes.

3.3 Reservoir safety

Reservoir safety is not dealt with in any serious way in the Gate 3 documents. In this section, we discuss the '*Dam Breach Analysis*' and '*Emergency Drawdown*'. It has long been a criticism of Thames Water's case for SESRO that it has ignored these two important issues, and even sought to scope them out in certain cases. GARD remains of the belief that, at this late stage in the consultation proceedings, local stakeholders deserve a full, transparent and open discussion. We are therefore disappointed to see that Thames Water's submission seeks to delay further a full account.

3.3.1 Dam breach analysis

The likelihood of a major fault developing in a dam wall constructed under modern practice is regarded as '*unlikely*' or '*rare*'. Nevertheless, given the high impact of such a fault, the risk (usually defined as a 'product' of likelihood x impact) must be evaluated, and there is an obligation for owners proposing to build dams to establish the effects of a breach on the

[155] Gate 3, Basis of Design report, Table 2-1.

local population and infrastructure. Dams are classified as 'High Risk' in the Reservoirs Safety Act 1975 (as amended by the Flood and Water Management Act 2010) if they have an above-ground volume of greater than 10,000m^3. In this case the process must comply with the provisions of the Reservoirs Act 1975.

The 150Mm^3 Reservoir design, with 20m–25m maximum high walls, falls obviously into the high-risk category defined above, as did the earlier 100Mm^3 design, proposed in the 2023 draft WRMP consultation (and similarly examined at the 2010 public inquiry), which had an above-ground water volume of at least 67Mm^3 (above the Thames Water quoted 'borrow pit' in the Conceptual Design). The SESRO proposal has thus a very long history (over 15 years) of being in the '*High Risk*' category. It is therefore completely unacceptable that no dam breach analysis (DBA) has been performed, or, if performed, has not been released: the proposed Reservoir is clearly a 'High Risk' facility within the terms of the Act

Rather than address this issue, Thames Water has instead sought to delay, or even scope out, the DBA from the Environmental Impact Assessment (EIA) process. The chapter and verse of this attempt is given in their submission to the Planning Inspectorate (PI), and the PI's decision[156] not to allow the scoping out of DBA and force Thames Water to produce an EIA *including* Dam Breach analysis. This opinion was adopted by the Secretary of State in October 2024. The PI's advice followed objections from the Oxfordshire County Council (OCC), Vale of White Horse District Council (VoWHDC) and the EA. As the PI states:

> *"Table 19-2 [of the Thames Water submission] explains that the Applicant proposes to scope reservoir/dam breach/collapse out of further assessment, as the design of the reservoir will follow the Reservoir Act 1975 to reduce the likelihood of dam failure to a low level. In view of the Environment Agency's advice (see Appendix 2 of this Opinion), the Inspectorate does not agree that this matter can be scoped out of further assessment at this stage. Accordingly, the [Environmental Statement] should include an assessment of these matters or information demonstrating agreement with the relevant consultation bodies and the absence of an LSE[157]" [158]*

Since then, Thames Water has resolutely sought to delay the production of the DBA, with almost no mention in either the Gate 3 submissions or in the more recent pre-DCO consultation. Chapter 19 of the Preliminary Environmental Report states that no DBA will be done for the DCO application and it will be delayed until embankment construction is complete and Reservoir filling starts. ***This is completely unacceptable, and it is only the***

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[156] The Planning Inspectorate (2024), "Scoping Opinion: Proposed South East Strategic Reservoir Option (SESRO)", Case Reference: WA010005, 8th October.
[157] Likely Significant Effects – as our Appendix D shows, there are significant effects (fatalities) in dam breach scenarios.
[158] The Planning Inspectorate (2024), "Scoping Opinion: Proposed South East Strategic Reservoir Option (SESRO)", Case Reference: WA010005, Recommendation ID 3.135, p. 43.

Regulatory Bodies that can address this obstinacy and insist on the production of a transparent analysis. As OCC states in its response to the PI scoping consultation, Table 19-4 [of Thames Water's submission to the PI]:[159]

> *"Reservoir / dam breach / collapse has been scoped out of the EIA due to its low likelihood. However, on the Thames Valley Local Resilience Community Risk Register, the risk of a reservoir or dam collapse is high with a significant impact. This is in addition to an incident occurring as recently as in 2019 at the Toddbrook Reservoir in Whaley Bridge, Derbyshire.* ***Due to these reasons, a reservoir / dam breach / collapse should be scoped into the EIA****." [our emphasis]*

The Defra advice on assessing the safety of 'small dams' (<25,000m^3, as defined in the Reservoirs Safety Act) contains formulae and procedures which can be used to estimate the impact for larger dams. GARD has employed these formulae and procedures which give an idea of the area and severity of damage for a catastrophic dam wall breach (as defined in the Reservoirs Safety Act). This was first brought to the attention of Regulators in our submission to WRSE's draft Regional Plan consultation in 2023.[160]

In response to Thames Water's repeated refusal to address the fundamental safety issues associated with what would be the largest fully bunded earth-embankment reservoir ever to be built in Europe, the potential risk to residents and travellers due to flooding from a breach of that embankment is addressed by GARD in Appendix D. As we note above, 'risk' is defined as "likelihood x impact" and, as Thames Water claims in its most recent 'justification' for delaying full risk assessment [161], the "*potential for failure is very remote*". However, earth dams can be breached by slope stability failure or internal erosion and the likelihood of a breach is proportionately higher, for a 10km long fully bunded reservoir, than it would be for a much shorter dam across a valley. Therefore, ***it is certain*** that the likelihood of such a breach during any finite reservoir lifetime ***is greater than zero*** and, with equal certainty, that it could be driven by factors completely beyond Thames Water's control and estimation, such as, to take three extreme examples, warfare, aircraft impact, and terrorism.

Thus, as is the practice with all large-scale infrastructure project management, e.g. in the design of nuclear fission and fusion reactors, or of advanced research projects such as those at the CERN large hadron collider, the estimation of risk addresses the deterministic question: ***when failure occurs,*** what will be the impact and what steps can be taken to mitigate that impact?

In Appendix D, responding to the lack of meaningful risk assessment from Thames Water, we apply Defra's recommended "*simplified method*" for approximate evaluation of risk and

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[159] Ibid., OCC response from 'Resilience Officer', p. 48.
[160] GARD (2023), "GARD response to WRSE's Consultation on their Draft Regional Plan for South East England", 20th February.
[161] Gate 3, Basis of Design report, paragraph 1.9.10, p. 17.

impact on local communities, given the proposed basic design of the Reservoir. This same procedure has been applied and published by GARD in previous responses to the Thames Water/WRSE100 Mm^3 Reservoir proposal[162], where the conclusions were made clear:

[SESRO 100Mm^3] in the event of a catastrophic breach, without warning, opposite any of the three communities nearest to the embankment, there would be multiple deaths at fatality rates of between 6% (E. East Hanney) and 29% (S. Drayton).

Following the 2023 WRSE public consultation, and ignoring GARD's repeated warning of risk to those communities, Thames Water, without further consultation, changed the design of the Reservoir: increasing its volume by 50%, its embankment height by 10%, its embankment length by 14%, and moving the western embankment approximately 600m closer to the A338 and communities such as East Hanney. ***Every one of those changes increases the risk to surrounding communities and travellers*.** Their combined effect is evaluated in Appendix D, where it is confirmed that:

[SESRO 150Mm^3] **all communities are at greater risk** – in particular, the no-warning fatality rate in the new estate to the east of East Hanney increases by a factor of 10, to 62%, with 'likely loss of life' above 60.

In addition to residential communities, we must also extend the risk assessment to include travellers on roads and railways adjacent to the Reservoir, who are now at up to 4 x higher risk due to Thames Water's increase in the Reservoir dimensions, without their consultation.

[SESRO 150Mm^3] Travellers on the A338 between East Hanney and the River Ock, or passengers on the GWR railway, close to the southern embankment, now face community-averaged fatality rates of between 8% and 12% in the event of direct flooding from a breach.

The problems outlined in Appendix D can only be and should already have been addressed fully by Thames Water in consultation with qualified reservoir engineers. It is Thames Water's responsibility to define the extent of risk and provide appropriate mitigating design features and procedures. Not only do we still see no sign of that happening, but the reckless increase in the Reservoir size, proposed without meaningful public consultation, significantly increases the level of risk for all communities and travellers adjacent to the Reservoir and the downstream River Thames. Until full dam-breach modelling is made available for independent and transparent public scrutiny, local individuals and services do not know where and with what impact such flooding might occur; they cannot evaluate their risks or plan their responses, nor even gauge if any response is feasible. That must be changed.

[162] GARD (2023), "GARD response to Thames Water's Consultation on Draft Water Resource Management Plan 2024 21st March 2023", Appendix B.

3.3.2 Emergency drawdown

Reservoir legislation in the UK mandates an emergency discharge facility for the case where a serious fault is detected in the dam embankments, or, worse, where an actual dam breach occurs. The standard for UK reservoir emergency drawdown is the achievement of at least a 1m drop in reservoir level per day.[163]

For a huge reservoir the size of SESRO, with an area of 6.7km^2, this equates to a discharge of about 76m^3/s (76 tonnes of water per second). This discharge must be ready to function at any time, and must be sustained, day after day, until the reservoir water has reached a safe level. For SESRO, this level might be as much as 15m–20m below the normal Reservoir level. We are thus looking at a system capable of discharging reliably over a period of a fortnight or more.

The emergency discharge of SESRO clearly raises some important issues, the key ones being:

- The damage to the River Thames banksides, and the flooding risks to the downstream communities.
- The engineering feasibility of the present 'design'.
- The testing regime for the emergency drawdown system (which, by law, must be tested regularly).

Environmental and community damage from an emergency discharge

There are obvious problems one could imagine with the emergency drain procedure. The average flow in the River Thames at Culham is only 17m^3/s.[164] A flow of 76m^3/s corresponds to a river in full spate, on the verge of flooding – conditions that exist on fewer than one day in ten. Thames Water has not assessed the downstream flood risk of suddenly releasing such volumes into the river. Serious damage to the local river banks and downstream flooding are real risks. Without entering the details of any engineering design, which we do below, the simple physics of the situation show that the Reservoir water level is around 25m above the level of the River Thames. How and where would the 25m of energy head from the 76m^3/s flow be dissipated? This is the energy equivalent to a winter flood at Sutton Courtenay plunging over a waterfall that is 25m high.

None of these questions is answered in Thames Water's submission.

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[163] Defra, Welsh Government, Natural Resources Wales and Environment Agency (2017), "Guide to drawdown capacity for reservoir safety and emergency planning", SC130001 Volume 1 – main guide, Table 6.2, p. 38. Defra's dam breach analysis, applied by GARD to the Reservoir using Defra's rules, would place SESRO in category A: dams "*where a breach could endanger lives in the community*". Thames Water seems to have adopted this assessment in targeting 1m/day as a drawdown rate.

[164] National River Flow Archive: https://nrfa.ceh.ac.uk/data/station/liveData/39046.

Until Thames Water can show by detailed design that the system works, model its impacts on communities, and commits to proper full-flow testing, the safety case for the proposed Reservoir remains incomplete and the downstream public are at unassessed risk.

Concerns about the present design of the emergency discharge

Before we discuss the present, chaotic, twists and turns in the Thames Water design for the emergency discharge, we note that the design of such a system for a huge reservoir is a significant engineering challenge. The problem of emergency drawdown itself cannot be taken as having been solved for a reservoir as large as SESRO 150Mm^3. Rutland Water, at 122Mm^3, was commissioned in 1975, ***but the saga of the Emergency Drawdown design continued over more than four decades***.

A 2005 study[165] concluded that the emergency drawdown should be 50% in 10–20 days, but by 2011 the calculations on the existing emergency drawdown system for Rutland Water concluded that drawdown would take 75 days. The situation was not rectified until after 2016. Thus, the emergency drawdown of one of the most modern dams in England was inadequate for at least 40 years. This shows the dangers of not considering the safety systems at an early stage.

With this background, the design and modelling of the proof of principle of the SESRO emergency drawdown should have been a priority long before now. The reality is sadly different, and this has been allowed to pass by the several WRMPs and Gate reports in the Ofwat/RAPID strategic water resource options process. GARD has called on numerous occasions for this to be addressed, but without result. One of our obvious conclusions was that, if the detailed design of essentially mandatory safety systems is left until very late stages, the inevitable design changes would lead to strong cost escalation. We are beginning to see that this is the case.

GARD has commissioned a report on the SESRO engineering design and safety by a leading expert on the design and construction of earth dams, and a former member of the government's '*All Reservoir Panel*' of engineers, Professor Chris Binnie[166]. Although the emergency drawdown facility would only rarely or perhaps never be used in genuine emergencies, there would need to be quite regular trial uses, to test that the system is working. The release of this flood flow through or under the earth embankment would be an inherently hazardous operation, as described in Professor Binnie's report (page 26):

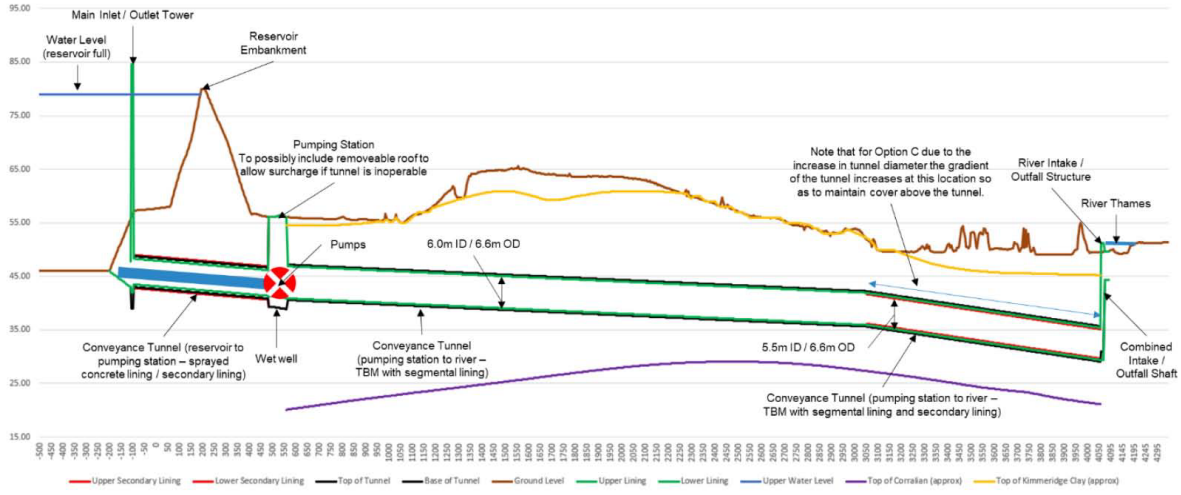
> *"Whilst it would be possible to construct a 76 m^3/s outlet facility to give the required drawdown rate of 1m per day, it would entail very substantial hydraulic engineering works and no details are provided in the [Gate 2] Concept Design*

[165] Black & Veatch (2025), "Reservoir draw down rates study for Anglian Water Services Ltd", as cited in Tam, M and Humphrey, M. (2012) "Improving Anglian Water's emergency response for reservoir safety".
[166] Binnie, C.J.A. (2024), "Report on Aspects of SESRO Dam Design", GARD, 12th January.

Report. The transmission of 76 m^3/s through an earth embankment, including the dissipation of about 25 m of energy head, is an inherently risky engineering operation, which requires careful design and, probably, physical model testing. The Gate 2 reports contain no reference to the requirements of model testing of these works."

By the time of Thames Water's pre-DCO non-statutory consultation in August 2024 (long before the announced cost tripling of August 2025), the Gate 2 'design' had moved on. The 'favoured' design in that consultation ("*Option C*") was an enlarged (6.0m i.d.) tunnel, connected partly directly to the Reservoir main water body, and partly fed by siphons whose output passed over the Reservoir embankment.[167] No engineering details were provided for the siphons, but they were quoted as intended to supply 45m^3/s to the pumping station "*wet well*",[168] with the remaining 30m^3/s passing via the normal inlet/outlet tunnel under the embankment. The cross-section of the tunnel at the non-statutory consultation is shown in Figure 3.9. (Note that this tunnel is also used for the normal filling from the River Thames and the normal outlet of water to supply Thames Water's London Zones and Affinity Water.)

Figure 8.7: Emergency Discharge Option C Longitudinal Section
Note: This figure is the longitudinal section showing the tunnel for Option C.



Source: Thames Water, Affinity Water and Southern Water (2024), "*SESRO Connectivity to the River Thames: Options Appraisal Report*", May.

Figure 3.9 - Favoured option (option C) for emergency discharge tunnel as at August 2024

[167] Thames Water, Affinity Water and Southern Water (2024), "SESRO Connectivity to the River Thames: Options Appraisal Report", May, figure 8.6.
[168] Ibid., section 12.1.4.

GARD's criticism included[169]:

> *"No details are provided in the consultation documentation and concerns remain about safely passing such a large flow under an earth embankment. For example, what would be the type, and location of the huge valves and gates needed to control the release of 76 m^3/s? How would these fit alongside the intake pumping system? How would the 76 m^3/s outflow get past the pumps and gates at the pumping station? Would there need to be a separate intake tower for the emergency drawdown and a separate tunnel under the dam, joining the outlet tunnel downstream of the pumping station? "*

None of these points has been answered in the more recent submissions.

The design on which the RAPID Gate 3 cost report was based was frozen in October 2024 (note that this is ten months before the actual cost report was made public). Although no further maps are included, the Option C for the emergency drain tunnel is confirmed. The auxiliary drawdown siphons are retained.[170] (These siphons were originally a key part of the design of emergency drawdown in the "*Option B*" (part-tunnel, part open-channel design) proposed as a second option in the August 2024 non-statutory consultation.[171]) However, the relative roles of the enlarged direct tunnel and the siphons have been reversed. The discharge passing through the direct tunnel is now 56m^3/s, whilst the siphons pass on 19m^3/s.[172] The pre-DCO statutory consultation has revealed yet more turmoil in the design of the emergency drawdown. Below we list the recent changes, and our concerns about them. As an overall remark, we note that there are no outfall or pump house designs; there is no bathymetric or geological data; and the designs are generally poorly presented, with paper drawings strewn with errors.

- The routing of the charge/discharge tunnel is in a state of design flux. The current position at which the tunnel joins the River Thames has moved 250m north-east without any reason being given.

- The siphons have been abandoned, with all water passing through the embankment via the tunnel.

- The tunnel design and construction must be capable of handling a sustained discharge of water: 76 tonnes per second travelling at speed through an enclosed 3.5km tunnel discharging into the river outfall. This implies a robust, strengthened

[169] Pre-DCO non-statutory consultation response https://groupagainstreservoirdevelopment.org/wp-content/uploads/2025/12/GARD-Response-to-1st-pre-DCO-SESRO-consultation-Final-v3-26-8-24.pdf , pp. 17–18.
[170] Gate 3, Basis of Design report, section 2.4.1.
[171] Thames Water, Affinity Water and Southern Water (2024), "SESRO Connectivity to the River Thames: Options Appraisal Report", May, multiple references.
[172] Gate 3, Basis of Design report, section 3.3.18.

design, yet the last 1.5km of tunnel reinforcement, present in the previous (Option C) design, has been removed in the latest (October DCO consultation) design. The design requires the flow to arrive at the outfall at an acute angle (to the vertical) and then it must be directed *vertically upwards* through a height of 15m to reach the Thames. For this design to work, the water from the outfall must be capable of falling under gravity to the pumping station inlet pumps and must have a positive head. However, the deeper that one has to make the outfall, the more acute becomes the tunnel at the outfall.

- The key issue is the *overburden* allowed for in Thames Water's design. The overburden is the soil depth above the outer surface of the tunnel. By a rule of thumb, this should be 1.5x the tunnel outside diameter[173] (6.6m, see Figure 3.9) or, in this case, 10m. Anything less will weaken the structural strength of the tunnel, quite possibly with catastrophic consequences. ***There are two places and a possible third where this tunnel is close to or significantly below that measure***.

- Figures 3.11 and 3.12, from Thames Water's DCO drawings[174], show where and why Thames Water should not be allowed to proceed with this tunnel. At about 3,350m, there is a gravel pit shown on Google Earth (see Figure 3.10), but this is not shown in any Thames Water drawing.

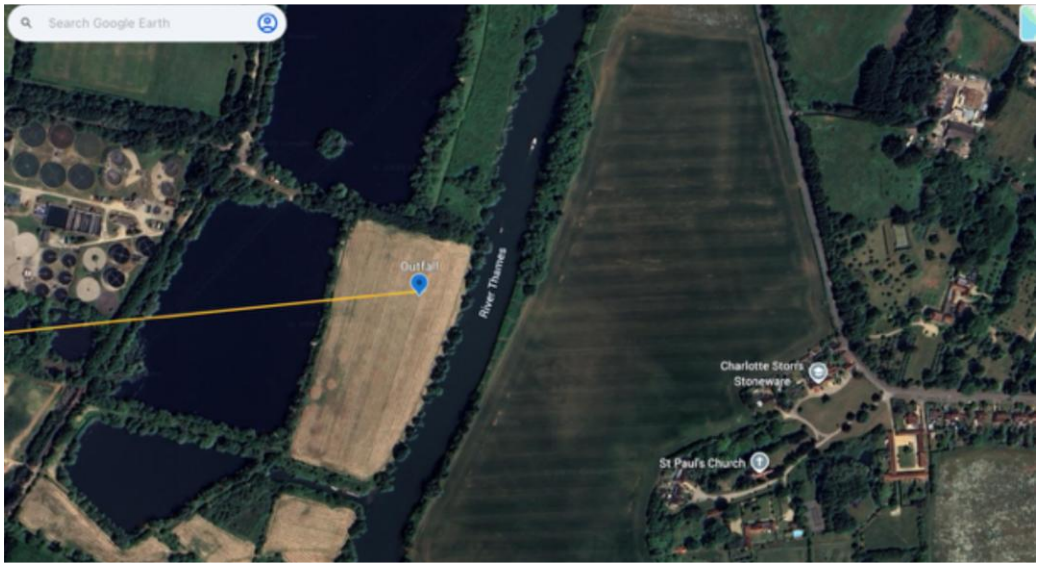


Figure 3.10 - Emergency discharge outfall area, from Google Earth

Here there can be no doubt that the overburden is much less than could be implied. **What might appear to be overburden is actually water plus overburden.** The estimate by the

[173] KVU Oslo-NAVET, "Tunnelboremaskiner", p. 16.
[174] DCO map book, Thames Water Drawing No. J696-ARB-A01A-ZZZZ-DR-LT-250043 rev C01, p. 22.

locals of the water depth in the pit is 5m, which gives a pit ground depth of (47.6 - 5.0) 42.6m above ordnance datum (AOD[175]). The tunnel crest will be the invert depth (31.81mAOD) plus the width of the tunnel (6.3m), giving a height above the tunnel crest of 38.11mAOD and an overburden of (42.6 - 38.11) 4.5m. ***This makes it all the more surprising that the increased gradient at the end of the tunnel has been abandoned (see Figure 3.9).***

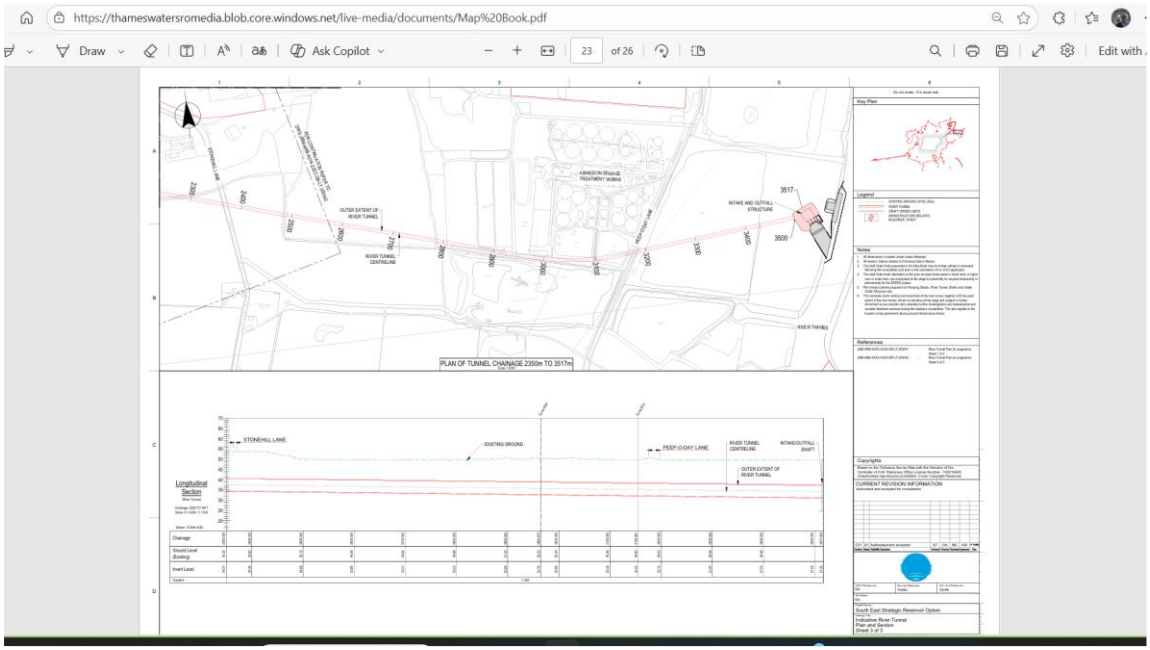
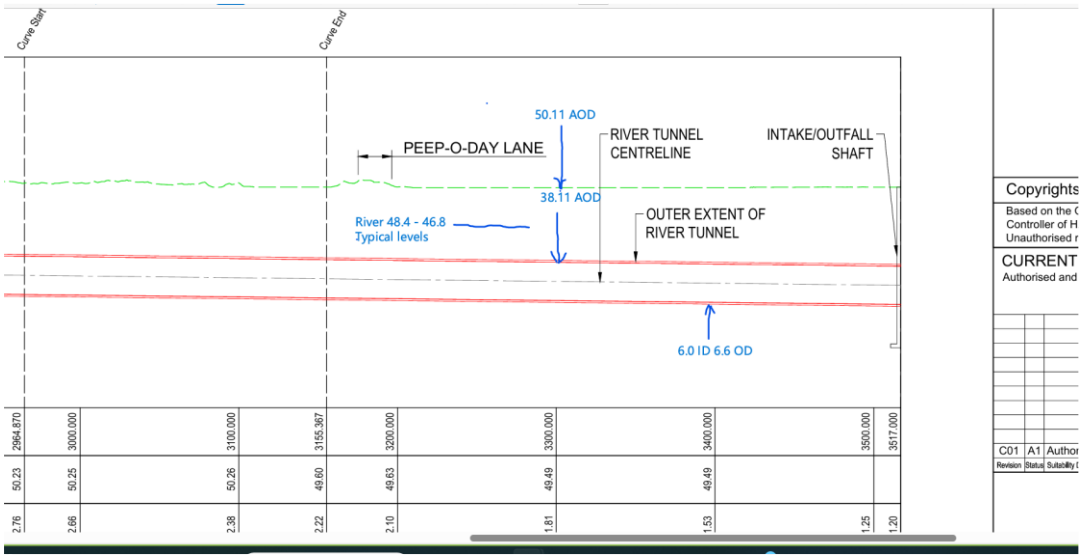


Figure 3.11 - Plan and elevation of discharge tunnel at the River Thames end



Note: The blue markings (GARD) show AOD values.

Figure 3.12 - Expanded view of vertical section in Figure 3.11

[175] A UK-wide reference for elevation (relative to the sea level at Newlyn, Cornwall).

- The Emergency Discharge Tunnel has an internal diameter of 6m. The key component in construction is a 6.5-metre diameter tunnelling machine using an earth pressure balance (closed) tunnel boring machine (EPB closed TBM). These machines are designed to handle soft ground by using the excavated soil to balance the pressure at the tunnel face, preventing collapse. The 'closed' aspect means the entire excavation chamber is sealed and pressurised, ideal for soft and unstable ground and high water tables. They work by mixing the material with polymer or other appropriate materials into the face which stiffens the surface, preventing it from collapsing. They are a complex, specialised, TBM; the last thing the project would need would be for such a device to be stuck in the ground that had collapsed onto it.

- The real significance of the data in Figure 3.11 can be seen in that the nearest river datum is 44.9mAOD and the typical range is 1.9–3.5m above surface datum (ASD[176]), giving an average river level of (44.9 + 2.7) = 47.6mAOD. This should also be the water level in the gravel pit. This level is determined by the river level, not directly as there is no such connection, but indirectly through ground water transfer. This is why the gravel pit water is clear and pollutant-free. Thames Water will have to build a coffer dam at the outfall tall enough to ensure that the river is kept out of the construction during a flood flow; for example with a Q5% exceedance[177] of 100m^3/s.[178] The consequences of failure of this coffer dam, under emergency discharge conditions of an extra 76m^3/s, would be serious for the local population.

- There does not seem to have been much gathering of data about the ground condition by Thames Water prior to producing this 'design'. There is no sign of any boreholes at the river end (where access with machinery would be difficult); neither is there any record in the British Geological Society's[179] GeoIndex data. The most recent record is 2005, and there are no data for any of the boreholes locally drilled and completed this year, and which would be >15m in depth. The lack of physical or recorded evidence of such activity or bathymetric data is troubling.

- Finally, it will not have escaped notice, in looking at Figure 3.9 and Figure 3.10, how close this emergency drain tunnel is to the Abingdon treatment works. We have no details (either written or verbal) on how the discharge would be designed, other than a rather flimsy assertion that it would be directed (somehow) downstream. It is a common observation on structures like this that a counter current would be

[176] The range of exceedance of the Thames level above the standard AOD.
[177] Volume per second flow exceeded for 5% of the year.
[178] National River Flow Archive: https://nrfa.ceh.ac.uk/data/station/liveData/39046.
[179] Any party conducting ground investigations for public work projects must deposit its data to BGS-NGDC using AGS. See British Geological Society, "Drilling legislation and obligations".

created which would bring the effluent from the treatment plant into the charge point.

Testing the emergency discharge

A key part of the guidance and legislation is that the emergency drawdown system must be *regularly* tested. There has always been a reluctance on the part of Thames Water to state *in writing* that it is committed to a *full system test* at regular intervals. The guidance document is clear on the necessity for a full-system test, whilst admitting that there may be issues about downstream flooding which such a test causes:[180]

> *"However, it is acknowledged that in some cases fully opening a low-level outlet may cause localised flooding downstream or cause undesirable environmental impacts. These issues need to be managed [as described below] and should not generally be an excuse for not properly exercising drawdown facilities. However, this may be easier said than done in some situations, and where major issues prevent routine exercising of critical valves under full head then advice should be sought from an inspecting engineer. Where low-level outlets are fitted with multiple valves (e.g. an upstream guard valve and a downstream control valve) it is possible to exercise each valve independently without actually releasing any significant discharge and this can be useful to mitigate downstream impacts during routine exercising. However, there is a risk that this approach can cause the pipe to become filled with silt and* ***it is recommended that outlet valves should be exercised under full head conditions (i.e. with full discharge being released) on a sufficient number of occasions to establish and maintain confidence that the discharge can be achieved.*** *This is because while valves may operate satisfactorily under balanced head conditions there are more likely to be issues operating them under full head conditions." [our emphasis.]*

In GARD's view, it is absolutely essential that the full system be tested for a sustained period before any operation is allowed, and that a full test be regularly scheduled, and be subject to EA permits, at meaningful intervals, with supervised annual inspections and multi-annual system components tests.

The reluctance of Thames Water to commit to full-system tests is a testament to the fact that it realises how destructive the emergency discharge is, and that scheduling would be tricky with the river flow variations, especially in winter and early spring months.

We are still awaiting a written statement from Thames Water regarding our request for a commitment to full-system tests.

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[180] Defra, Welsh Government, Natural Resources Wales and Environment Agency (2017), "Guide to drawdown capacity for reservoir safety and emergency planning", SC130001 Volume 1 – main guide, section 2.3, p. 14.

3.4 Flooding

Flooding is one of the most persistent public concerns in an area characterised by high fluvial and groundwater risk. The Reservoir will occupy a substantial amount of existing flood plain (well over 1.5km^2) and it will significantly impact groundwater movement and water table levels.

Despite more than a decade of warnings from communities, councils, experts and statutory bodies, no fluvial or groundwater flood-risk modelling has been published. This omission is critical given that, since 2017, Thames Water's own feasibility work had identified a red-rated floodplain encroachment risk for reservoir sizes above 75Mm^3[181]—reflecting the Reservoir site's inherent fluvial and related hydrological constraints—with the rating repeated in subsequent internal addenda.[182]

Furthermore, Thames Water's limited groundwater modelling, revealed at a stakeholders' meeting convened by OCC on 12th February 2024, showed a serious risk of raising of groundwater levels of up to 1 metre due to the presence of SESRO. It was very difficult to get Thames Water to make an 'on the record' statement about this, but it was eventually forced to send the following statement:[183]

> *"The slides we presented on the 12 February were sent out to attendees on the 13 February, and they included a section on our current understanding of ground-water flood risk and mitigation. Our ground-water specialist stated at the briefing that the results from our preliminary groundwater modelling were that the reservoir* ***would increase ground-water levels locally by up to 1metre****, but she was clear that this is without mitigation. She then went onto explain what form of mitigation would be required to address this risk, highlighting specifically how a ground-water drain would form a key part of our plans, and take ground-water flows around the reservoir to mitigate ground-water flood risk.*
>
> *It is worth noting that our ground-water flood risk modelling work is preliminary, with our model currently being verified and calibrated. Our ground-water flood risk assessment work continues and will be completed and shared with the public next year as part our statutory consultation. We will provide a detailed breakdown of our planned ground-water mitigation including maintenance and operational regimes at that time. In the meantime, I would like to confirm we will*

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[181] Thames Water (2017), "WRMP19 Resource Options – Reservoir Feasibility Report", Rev 01A, July. Internal report referenced in Thames Water (2023), "Reservoir Feasibility Report Addendum", August.
[182] Thames Water (2022), "Draft WRMP24 – Resource Options: Reservoirs Feasibility Report Addendum". November.
[183] Mark Mathews (Thames Water), 15th May 2024, email to (inter alia), Derek Stork, Cllr Andy Cooke (VoWHDC), Cllr Peter Sudbury (OCC), Cllr Liz Leffman (OCC), Helen Marshall (CPRE Oxon), Chris Wilding (Steventon PC).

be providing a summary update on our flood risk assessment work as part of our SESRO summer 2024 consultation…." [our emphasis].

Thames Water did not provide its promised summary of flood-risk modelling during the 2024 non-statutory consultation. This trend now continues with the Gate 3 report (where everything relating to flooding is still "*under discussion*"), and the DCO consultation.

For a long time, Thames Water had continued to downplay the groundwater risk based, in part, on an estimate of the groundwater level as 2.5m below the surface. This completely ignorant assumption, which could have been easily shown to be incorrect by true community liaison, is now shown to be false by its own experience, as the autumn/winter groundwater levels are much less than 1.0m below the surface – something which Thames Water found to its cost when its CCT were delayed for over five months in late 2024–spring 2025 due to flooding.

It is evident that the problem of groundwater flooding, in particular, has led to some design scope increase to include an additional 11km underground ground water control drain around the full perimeter of the Reservoir. However, this remains a mere cartoon in the DCO consultation material, and, as discussed in section 2.2.5, is not yet included in the Gate 3 costs.

In short, the Gate 3 submission acknowledges both groundwater and fluvial risks, but confirms that the relevant modelling and assessments will not be completed until the 2026 DCO application. This is incompatible with the best practice advice given on flood risks by the Planning Inspectorate Advice Note 11, Annex D:

> *"The Environment Agency recommends that Applicants…. start pre-application consultations at the earliest possible stage and factor in other regulatory requirements when planning project timelines to avoid delays. The Environment Agency also encourages Applicants to allow sufficient time to discuss and agree technical matters. For example, resolving complex flood modelling can take a considerable amount of time and Applicants are encouraged to consider the time needed to discuss and agree technical matters in advance of the submission of their DCO application to the Planning Inspectorate."*[184]

It is thus unacceptable to delay published flood modelling from being seen by stakeholders (which in this case include local authorities with emergency-response roles, as well as the EA). The modelling should at least have been in the DCO consultation material, and in the Gate 3 submission.

[184] Planning Inspectorate (2012), "Nationally Significant Infrastructure Projects - Advice on working with public bodies in the infrastructure planning process - Annex D: Environment Agency", 16th November.

It is clear that RAPID agrees with this view. Its Draft Decision document on the Gate 3 SESRO submission[185] includes some clear statements, decisions and directive actions to the SESRO scheme proposers:

> *"The flood risk assessment currently falls short of our expectations with a number of outstanding risks identified that require further work."*[186]

[And consequently]

> *"**Decision 30:** Solution owners should ensure that all aspects of flood risk are assessed in line with the Planning Inspectorate Environmental Impact Assessment (EIA) scoping advice and planning legislation and guidance. The requirements of the flood risk assessment should be agreed with the Environment Agency and other relevant bodies by 30 April 2026**. Priority action 9** has been included to address this."*

Priority Action 9 is repeated in the table of actions.[187]

However, GARD believes that RAPID needs to produce stronger recommendations to ensure that Thames Water and proposers *actually deliver a proper flood assessment well before the DCO submission.* Thus, Decision 31:

> *"**Decision 31:** Solution owners should consider producing a flood risk assessment method statement to set out the approach for each element of flood risk. Recommendation 9 has been included to address this."*[188]

which is supported by:

> ***"Reason:** This could help prevent abortive work being done within the flood risk assessment including modelling work."*

should be backed up by an action, rather than the Recommendation 9:

> *"Consider producing a flood risk assessment method statement to set out the approach for each element of flood risk."*[189]

There is no reason for this work not to be actioned for mid-2026, rather than Gate 4. If not, it is almost certain that, on past behaviour, Thames Water will arrive at Gate 4 with these actions uncompleted. As RAPID itself observes, the action on flood modelling at Gate 2 was not completed satisfactorily.[190] GARD firmly believes that the Regulators, for their own

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[185] Ofwat (2025), "Gate three draft decision for South East Strategic Reservoir Option", December.
[186] Ibid., p. 19.
[187] Ibid., p. 29.
[188] Ibid., p. 19.
[189] Ibid., table, line 9, p. 32.
[190] Ibid., Appendix B, p. 33.

credibility, should begin to take a tougher line on the examination of the downsides of SESRO.

3.5 Water quality

As Gate 3 is still at a pre-planning stage, it has to demonstrate that the proposed project is technically feasible and that a credible pathway exits to achieve the next stage of planning consent and delivery (Gate 4). It does not have to provide detailed engineering details for the solution of identified risks, only that the risk has been identified and there is an intent to create a solution.

For water quality, this involves not just those aspects within *"Supporting Document B – Drinking Water Quality Risk Assessment*"(where the chemical and biological risks are assessed)[191], but also within "*Supporting Document A1 – Basis of Design"*, where the means to control chemical and biological risks are assessed[192]. In this section, we assess these details, looking at the shortcomings for water quality in the "*Drinking Water Quality Risk Assessment*".

Questions to be asked:

- do the above documents provide a clear description of any proposed solution, what the objectives are, and how the identified need is addressed?
- is there an evaluation of alternatives providing a preferred option?
- have the environmental impacts of any proposed solution been identified?
- have any potential risks been identified and outline mitigation measures provided?

3.5.1 Drinking Water Quality Risk Assessment (DWQRA) – general points

Several specific terms are used in water quality risk assessment, derived from the All Companies Working Group (ACWG) report[193]:

> **Limiting hazard**: A limiting hazard is the hazard that, because of its risk level or regulatory limit, sets the main constraint on whether the scheme can go ahead, continue operating, or expand. Essentially, it's the bottleneck.
> If this hazard isn't managed or removed to safe levels, the scheme won't meet safety standards or regulatory requirements. It becomes the decisive factor for designing and approving the scheme.

[191] Thames Water, Affinity Water and Southern Water (2025), "Supporting Document B – Drinking Water Quality Risk Assessment", 21st July. (Henceforth, the 'DWQRA report'.)
[192] Thames Water, Affinity Water and Southern Water (2025), "Supporting Document A1 - Basis of Design", 23rd July.
[193] ACWG (2021), "Strategic WQ Risk Framework – FINAL Report", B19589BJ-DOC-001|06, 19th January.

Standard limiting hazard: a standard limiting hazard is anchored specifically to water quality standards or regulatory thresholds (e.g. WHO, EU, UK drinking water standards). It means the hazard that limits the scheme's development or viability because it is closest to, or exceeds, the official standard.

As an example of a standard limiting hazard: nitrate has a drinking water standard of 50mg/l (EU/UK). If raw water levels are at 48–55mg/l, nitrate becomes the standard limiting hazard because it bumps up against a defined legal limit.

Likely to drive: in technical planning, "likely to drive" usually means "is expected to strongly influence" or "will determine the direction or feasibility of" a project. In this context, it implies something like nitrate levels will be the key factor shaping:

- design choices (e.g., what treatment processes to use)
- viability (whether the scheme can operate at all within regulations)
- costs and complexity (high nitrate may require expensive treatment like ion exchange or reverse osmosis)

The document states that it adheres to the Drinking Water Safety Plan methodology and the ACWG guidance.

In section 2.3.2 of "Supporting Document B", Thames Water make specific reference to: "Gate 3 – **Finalised feasibility,** pre-planning investigations and planning applications".

The following sections show that the information in the DWQRA document is insufficient for any **finalised** feasibility study.

3.5.2 Clear omissions of current experience and future known system scenarios

In section 2.6 of the DWQRA document, there is an assumption that there will be no changing source waters and that abstraction and discharge patterns are static. **This limits any response to future developments, especially expected climate-driven changes in water sources (wetter winters with intense frequent storms and drier summers).**

> *"The discharge of water from SESRO into the River Thames is expected to have a minimal (or no) impact on water quality, with the exception of algae which may be impacted by the reservoir."*[194]

The impact of algae, if present, will have a major impact on the water quality of the River Thames unless there are treatment facilities upstream of the transfer of water into the River Thames.

The document expressly states that the "*impacts on water quality from the STT interconnector have not been included in these assessments*."[195] **With the interconnected**

[194] DWQRA report.
[195] Ibid., p. 12–13.

nature of regional water infrastructure, excluding such transfer risks underestimating cumulative risks.

The T2ST, Farmoor and SWOX downstream interconnections are included but their risk assessments are assumed to be incorporated in their individual DWQRA and not part of SESRO.

Apart from an appalling lack of system vision, this expressly sweeps the Farmoor water quality problems under the carpet and appears to assume the scenarios are completely different. Inflows into the Farmoor Reservoir have had to be restricted at times because the river water was too muddy, dirty or had too much debris, especially after rainstorms. For example, after Storm Henk (Jan 2024), there was so much dirt and debris in the River Thames that Thames Water paused abstracting water into Farmoor[196]. Again, in February 2025, storage increase at Farmoor were held back because turbidity issues made refill difficult. Both of these events were during the annual period when recharge of SESRO should be at its maximum. While turbidity and muddiness were the stated reasons for the Farmoor crises, in those waters there would be excessive nutrients (phosphates, nitrates) helping to increase algae production, as the Farmoor intake is downstream of the Swindon sewage treatment works (STW) plant – which during these heavy storms would be discharging sewage overflow into the Thames (similarly for the SESRO intake downstream of the Oxford STW, which would also be discharging sewage into the Thames). What is to stop the "shutdown" at Farmoor not being repeated for SESRO, especially as the past few years and climate predictions show wetter winters with increased total numbers of storms frequency? Both of the above events meant that the Farmoor Reservoir had low water levels in winter. There is little reason to think that a similar scenario will not afflict SESRO.

The SESRO situation is also far worse than Farmoor, because the median flow statistic of Q50 at Culham means that the Reservoir can only be filled when Thames flows are above median, so there will often be polluted water from Combined Sewer Overflow relief points. How is this being addressed in the water quality modelling? Will there need to be operating rules for the filling, which stop the Reservoir filling when WQ falls? What monitoring and telemetry system is planned for this? Is Thames Water planning a huge Combined Sewer Overflow investment programme for upstream areas; in which case, should this be added to SESRO costs?

In section 2.6.1 of the DWQRA, it states: "*As SESRO encompasses a reservoir but no treatment works within its concept design…*".[197] GARD considers this to be a gross oversight, considering: the experience at Farmoor; the poor quality of the inflowing River Thames

[196] BBC (2024), "Reservoir water levels low despite widespread flooding", 16th January,; and Environment Agency (2025), "Monthly water situation report", March, section 1.5 Reservoir Storage "Reservoir stocks at Farmoor in southeast England increased after turbidity issues restricted refill in February".
[197] DWQRA report, section 2.6, p. 13.

water at the intake side; and the attendant high risk of algal blooms, cyanobacteria and other pathogens. It is foolhardy not having treatment works that could ameliorate and limit the outflow of these pollutants.

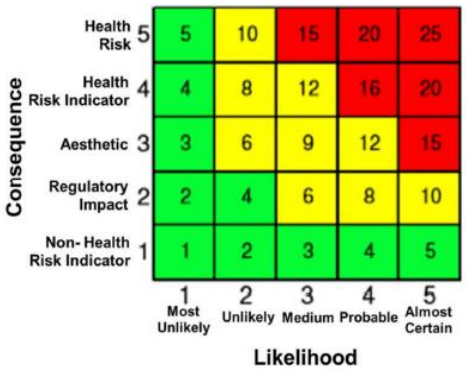
3.5.3 Limiting hazards to water quality from SESRO's supply

Aligning with the ACWG report, Thames Water defines "**limiting hazards**" according to the WQ Framework as:[198] "Hazards and hazardous events which are most likely to drive the development and/or acceptability and/or viability of the SRO or water supply scheme."

With the definition above of limiting hazards, and recognition, acknowledged in the report, of the numerous waterborne pathogens and chemicals that could affect drinking water quality has led Thames Water to provide *"the practical suggestion to consider the few (pathogens and chemicals) that are limiting"…* [thus allowing] "*a more focussed assessment of risks, better aligned with […] early stages of RAPID gated analysis*"[199].

This approach risks missing emerging or compounding hazards that may not, at present, appear prominent but are probably significant, especially in our expected evolving climate and environment conditions.

The proposed SESRO actions to contain or mitigate risks are contained in its DWQRA document Appendix A spreadsheet. It adopts a WQ risk matrix of 5x5, reproduced in Figure 3.13 (taken from the figure 3.2 in the DWQRA document). Concentrating on those risks labelled as "*Limiting Hazards*" and that conform to a Risk matrix score of >15 in the Matrix, this equates to the **Health Risk Indicator** or actual **Health Risk** being either **Probable** or **Almost Certain**. In terms of the report's Figure 3.3 (reproduced below as figure 3.5.2), likelihood "*Probable*" becomes *"Likely to occur once per year"* with *"Serious impact"* while *"Almost certain"* becomes a *"Major impact"* with consequent *"water unpotable, health impact".*



Source: ACWG WQ Risk Framework Report

Figure 3.13 - WQ risk framework 5x5 Risk Matrix

[198] DWQQA report, section 3.2.3, p. 16.
[199] DWQRA report, section 3.2.4, p. 16.

Level	Likelihood *during SRO operation* – example definitions	Consequence
1	Very unlikely / rare	No impact, >50% PCV, insignificant
2	Unlikely / possibly within 5 years	Low impact, single PCV, DWI event level1,2, minor compliance
3	Moderate / possibly within 3 years	High impact, multiple PCV, DWI event level 3, aesthetic impact
4	Likely to occur once per year	Serious impact, precautionary advice, DWI event 4, major regulatory
5	Almost certain / Likely to occur > once this year	Major impact, precautionary advice, DWI event 5, water unpotable, health impact

Source: ACWG Strategic WQ Risk Framework

Figure 3.14 - Likelihood scoring according to breaches on an annual basis

Table 3.6 below[200] itemises those risks with a score >15. To reiterate, a limiting hazard is: the hazard that, because of its risk level or regulatory limit, **sets the main constraint on whether the scheme can go ahead, continue operating, or expand.** Essentially, it is the bottleneck. If this hazard is not managed or removed to safe levels, the scheme will not meet safety standards or regulatory requirements. It becomes the decisive factor for designing and approving the scheme.

Limiting Hazard	Source	Control	Action	Monitoring
Escehida Coli	Catchment sewage, livestock, human activity	Little scope to control	Move abstraction upstream of Abingdon STW	
Cryptosporidium	Catchment sewage, livestock	long survival time - sedimentation problem	Problem passed to Treatment works	
Pesticides	Catchment agriculture	Reservoir reduces risk - but return load to river in Summer	Cease abstraction when high concentrations	At Intake
Odour	Biological activity in catchment, Thames, Reservoir	Difficult to mitigate	Cease abstraction when high odour levels	At Intake
Taste	Biological activity in catchment, Thames, Reservoir	Difficult to mitigate	Cease abstraction when high taste levels	At Intake
Bacteria, Viruses, Protozoa	Sewage, livestock, human activity	Uncontrollable catchment sources - Reservoir reduces risk	Problem passed to Treatment works	
Perfluoro octane Sulfonate (PFOS)	Flame retardant	Difficult to control	No action	At Intake
Perfluorooctanoic acid (PFOA)	Flame retardant	Difficult to control	No action	At Intake
Somatic coliphage	Faecal Viruses - Widely present in sewage	Difficult to control	Problem passed to Treatment works	
Turbidity	Catchment sediment transport/algae association	Reservoir sediment reduces turbidity	Cease abstraction when high turbidity	At Intake
Algae	Thames population especially in Spring	Reservoir generate/increase populations	Cease abstraction when high concentration	At Intake
Microcystin/algal toxins	Cyanobacteria production	Reservoir primary source of risk	Cease abstraction when key species present	At Intake
Aluminium	Naturally occurring	Reservoir Aeration will reduce sediment release	Cease abstraction when reservoir levels high	At Intake

Note: Data derived from DWQRA, table 3.4.

Table 3.6 - 'Limiting hazards' for SESRO water quality

It is evident that the placement of the Reservoir within the River Thames catchment is creating a lot of the risk factors for water quality, many of which are difficult to control or mitigate. **The majority of the control options are to cease abstraction from the Thames when concentrations are high –** these will usually be during the major winter Reservoir fill period when heavy rainfall and early crop treatment produces agricultural runoff and treatment works unavoidably create sewage discharge, both of which will be at maximum levels. Ceasing abstraction at such times would prejudice the supply from the Reservoir as being resilient to climate changes and drought. The action to mitigate ***E coli*** (moving

[200] Derived by GARD from DWQRA report, Table 3.4, p. 25.

abstraction upstream of the Abingdon STW) is not even in the concept design of the Reservoir at this stage, demonstrating an appalling lack of joined-up thinking for such a late-identified issue. Some risks have no proposed action at all, and there are gaps in the monitoring location proposals.

While hazard levels at abstraction intakes have been identified as a result of monitoring, many of these hazards are the production of the Reservoir internally, e.g. algal growth and attendant cyanobacteria production, and the various other pathogens that will take advantage of the nutrient content available within the Reservoir.

With the actions of ceasing abstraction during high concentrations of hazards noted above, the stated SESRO ambition *"aims to reduce pressure on the abstraction from the River Thames during severe drought conditions"*[201] may prove difficult in practice if the Reservoir is at a low level as a result of wintertime cessation of abstraction.

Type of SRO -> Likely limiting hazards	Reservoir source	Ground water source	Influence of sewage	Raw water transfer	Treated water transfer
Pathogens – e.g. Cryptosporidium, viruses	✓	✓	✓	✓	✓
Emerging hazards – e.g. nitrosamines, 1,4-dioxane, PFAS	✓	✓	✓		
Acceptability due to change in chemistry – e.g. alkalinity	✓	✓	✓	✓	✓
Acceptability - taste and odour	✓	✓	✓	✓	✓
Pesticides – e.g. metaldehyde	✓		✓	✓	
Nitrate/Nitrite		✓	✓	✓	
Corrosion potential					✓
Change in metal types and form	✓	✓		✓	
Disinfection byproduct formation potential	✓		✓	✓	✓

Figure 3.15 - Water Quality Risk Framework: limiting hazard categories

Figure 3.15 is reproduced from the DWQRA report's Figure 3.4, which is itself taken from the ACWG WQ Risk framework: limiting hazard categories. It can be seen that the Reservoir itself will be complicit as a production source of all the hazards noted, except nitrate/nitrite and corrosion potential. Although the Reservoir is not a source of nitrate/nitrite, their presence can promote growth in pathogens not included in the hazards list. Nitrates and

[201] DWQRA report, section 3.2.8, p. 17.

nitrites can create environmentally favourable conditions, e.g. low-oxygen (anoxic) conditions for the growth of denitrifying, enteric, nitrate-reducing sulphur and nitrite-oxidising bacteria. These will promote the formation of biofilms (which can protect other pathogens – e.g. Legionella), lead to further oxygen depletion and promote algal blooms. Cyanobacteria can directly utilise nitrates to produce the toxins harmful to humans and animals. According to Table 3.4 of the report, both nitrate and nitrite need to be removed as they have associated health risks, although they score low (10) on the Likelihood/Consequence Matrix above, and are expected to be controlled by *"Inlet jet system and bubble aerators, recirculation pumps",* as outlined in the table in Appendix A of the report.

3.5.4 CEH PROTECH modelling

The UK Centre for Ecology and Hydrology (UKCEH) '**PROTECH**' (**P**hytoplankton **R**esp**O**nses **T**o **E**nvironmental **CH**ange) has been used to support the Gate 3 development of SESRO with particular respect to algal biomass. PROTECH is a process-based one dimensional (1-D) model for lakes and reservoirs. While it can simulate community composition as opposed to just total biomass (useful for separating individual species responses – e.g. cyanobacteria) and allows scenario testing through its ability to be driven by multiple interacting parameters (e.g. nutrients, light, temperature, mixing), it does have limitations.

PROTECH requires detailed daily input data of meteorology, inflow nutrients and initial conditions. As a 1-D model, it is unable to simulate any horizontal variability which would be very important in modelling the extensive and variable depth SESRO. It also assumes that growth is limited by one factor at a time, which is simplistic when many of the factors in water quality in reservoirs are interactive in their dynamics. It also operates on daily time-steps and vertical stratification which may miss the fast dynamics that algal blooms display.

The CEH PROTECH model results are not available for examination. From the graphical results shown in the report's Figures 4.1 and 4.2[202], neither period modelled (1974–79 or 1992–95) reflects the recent change in the local climate where winter storms are becoming more intense and frequent, often occurring within a couple of days of each other.

Choosing periods of drought years for the modelling exercise minimises the effect of agricultural runoff and sewage discharge into the River Thames upstream of SESRO during high-rainfall winter months. The Thames during winter drought periods will be less polluted because the flow will largely be comprised of water from largely uncontaminated groundwater fed streams emanating from the Cotswolds chalk aquifer. Lower winter rainfall onto agricultural fields will, through vegetation interception and soil infiltration, remain within the field catchment, providing little of the nutrients into the streams. Lower winter rainfall also means that STW are under less pressure to release sewage into the river

[202] DWQRA report, p. 31.

network. The nutrient and pathogen input into the Reservoir during winter filling would be much lower than in the much heavier winter rainfall regime that we are experiencing now and that is expected to continue and probably become worse.

With low initial "seeding" of the Reservoir's nutrient and pathogen concentration, it is expected that pathogen and algal populations, denied the nutrient load to exploit, will remain at low levels. This is at variance with a high rainfall winter Reservoir filling, where intense rainfall will rapidly exceed the field capacity of the agricultural fields, leading to overland runoff into the many streams and brooks that feed into the Thames. The pace of urban development within the Thames catchment – with sewage treatment plant upgrades to cope with the increased sewage lagging far behind the necessary capacity – creates both urban runoff and sewage discharges that will add to the nutrient/pathogen load being pumped into the Reservoir. Once certain critical concentrations or predator/prey balances are exceeded, algal blooms and cyanobacteria can rapidly expand in their populations. The tipping point for this rapid growth to occur is >1mg/litre of nitrate if sufficient phosphorus (at 20–50µg/litre) is present. From the Report's Table 4.1 Water Quality summary[203] at the Culham Intake, average nitrate levels were 20 mg/litre – which in warm stable water columns, where predation losses are overwhelmed by growth, nutrients are recycled from dying algae, and phosphorus release occurs from sediments experiencing oxygen depleted conditions – the conditions are all there for accelerated algal blooms.

Modelling conditions for the most favourable outcome needs to be better balanced, taking into account the more typical climate conditions that we are currently in – conditions that are expected to favour the production of algal blooms and associated hazards in the future.

3.5.5 Modelling of SESRO effects downstream

To justify the proposition that "SESRO is not likely to increase concentrations of chemicals downstream of the discharge location but will likely reduce concentrations of certain parameters"[204], the report again resorts to Modelling (Infoworks) using drought years to justify this contention. This claim was previously made at Gate 2 from Infoworks modelling[205]. The low SESRO phosphorus concentration compared to the Culham intake values[206] could be viewed as the uptake of phosphates by algae and other organisms. With Reservoir refilling being at a premium during drought periods, phosphates would be actively scavenged by algae and converted into organic phosphorus – reducing the Reservoir's overall concentration. Subsequently, when the algal growth goes into retreat, the organic

[203] DWQRA report, pp. 29–30.
[204] DWQRA report, section 4.3.1, pp. 31–32.
[205] Thames Water and Affinity Water, "Gate 2: Technical Annex C - SESRO Water Quality Risk Assessment", section 3.11, pp. 3–7.
[206] Culham reference values are 0.12–0.35mg/litre. See p. 57 in Severn Trent, Thames Water, United Utilities (2022), "Strategic Regional Water Resource Solutions: Annex B3.2: Water Quality Assessment Report: Standard Gate Two Submission for River Severn to River Thames Transfer (STT)", November.

phosphorus would be released and mineralised back into phosphates. SESRO's "total phosphorus" includes the particulate, dissolved, organic and inorganic (which includes the bioavailable phosphates linked to algal growth).

The Reservoir could trap particulate phosphorus internally, which would lower downstream export. Also, it could accumulate nutrients (including phosphates) internally, creating eutrophication risk inside the Reservoir.

Both of these actions would reduce the total phosphorus concentrations leaving the Reservoir, thus seeming to point to a "positive" for SESRO by reducing the risk to drinking water. But all that has happened is that the risk factor has been moved from the river to the Reservoir and possibly amplified its overall effect. The modelling is too simplistic to justify the proposition of beneficial consequences.

3.5.6 'Gate 3 results' section of the report

Section 5.1 of the report (pp. 33–38) summarises the results, and comments on possible mitigation strategies for high risk.

Mitigation technologies

Cryptosporidium is seen as a major limiting hazard issue above. The report's proposal that *"mitigation technologies which may be considered for protection from cryptosporidium including ozonation and UV disinfection"*[207] is misplaced. Such technologies are not capable of dealing with the volumes of water that either enter or leave the Reservoir. With effective ozone doses of 1–5g m^{-3} and UV treatment of 10-40J m^{-3}, the practical application of these measures to reservoir volumes is not possible. Turbidity also reduces the effectiveness of the treatment. Any such treatment is typically applied at a water treatment plant. As a result, this will likely remain a hazard within the Reservoir with *"the risk to water quality from cryptosporidium as high"* – without even considering the threat to the health of local residents visiting the Reservoir boundary.

Algae

In section 5.1.4, the report recognises that *"the River Thames supports large populations of algae, particularly in the spring"* and that "*the reservoir is also likely to generate or increase large algal populations."* By choosing drought years for its modelling exercise, as noted above in section 3.5.4, Thames Water has minimised algal growth in the Reservoir. During the expected autumn/winter increase in rainfall due to predicted climate change, increasing volumes of agricultural runoff and inevitable sewage release into the catchment brooks and main river channels will, during the crucial Reservoir refilling period, provide all the nutrients required to replace those consumed by the previous year's biological activity. The statement

[207] DWQRA report, section 5.1.3, p. 33.

"a decrease in algal populations after river abstraction ceases, as nutrient concentrations decrease due to biological activity"[208] fails to understand that this biological activity reducing nutrients is the same process that is creating algal growth. If nutrient concentrations remain high, the risk probability for algal growth and blooms remains high.

The report understands that algal growth will occur – and that "*the algal risk score should remain high*." What the report underestimates, because of Thames Water's drought model analysis, is the actual volume of algal growth and opportunity for algal blooms to develop following expected increased nutrient import during the future climate change rainfall regime.

In section 5.1.6, the report pins its faith in mitigation on: *"Mixing within the reservoir…*[which]… *was identified as a method of mitigating the impacts of algal growth".* Nevertheless, confidence in this approach was so frail that the workshop of expert decided to "*transfer the process of coping with high algal loads to downstream water treatment works"*[209]. This presupposes that the algal blooms will present themselves at the outlet point rather than literally sticking to the perimeter. Algal blooms (especially filamentous green algae or cyanobacteria mats) create a sticky mat that can block intake screens leading to reduced flow, cavitation risk and damage to the pumps, corrosion in pumps and pipes – requiring pump downtime and clearing of intake screens and other trash collectors. Worldwide, clogging of intakes is a risk – a 2025 US report states: "*Reduced treatment plant capacity through clogging of intakes, screens, and filters.*"[210]

Both Grafham Water (in 1976) and Rutland Water (1989) reported severe problems with cyanobacterial blooms, in spite of the latter's modern "*Helixor gun*" aeration system (see 7.3Appendix E). Specifically:

> *"By July Grafham reservoir was affected by a severe bloom of Microcystis (cyanobacteria). The normal treatment was found to be incompatible with removing the offending bloom and the breakdown products that ensued."*[211]
>
> *"Last year's problems of blue-green algae became apparent when reports were received […] in September of a small number of deaths in dogs and sheep following contact with Rutland water […] Water for treatment is drawn from 15 m deep in the main body of the reservoir, where algal concentrations were relatively low."*[212]

[208] DWQRA report, section 5.1.4, p. 34.
[209] Ibid., section 5.1.6, p. 34.
[210] Washington State Department of Health (2025), "Dealing with Cyanobacteria: Time to Make a Plan Guidance for Developing a Harmful Algal Bloom Management and Response Plan", p. 1, 31st March.
[211] Barker, L. (2016), "Compiling Drought Impact Reports for the UK", February, DrIVER project report, p. 24.
[212] UK Parliament (1990), "Rutland Water", Hansard, column 1373.

For Rutland Water, the problems caused blockages:[213]

"In spite of the pumps, blue-green algal blooms developed in Rutland water and continued to cause concern for several reasons; firstly, many species were large and could block filters and cause taste and odour problems, thus increasing water treatment costs; secondly, many of these algae could exude toxic substances; and thirdly, the unsightly scums and large particles in the water could affect the recreational use of this waterbody."

This is such an important factor for both the health and water quality of the Reservoir and the ability to operate SESRO's stated reason – "*to supply water to the South East during the summer period*" – that to summarily dismiss the problem with a possible method seems gross negligence at this late stage.

Emerging hazards

These are dealt with in DWQRA sections 5.1.7–5.1.20. The hazards are well-known chemical substances present in water which follow easily modelled trends with data from the general use in the population and do not present the ability to increase their risk factor rapidly. Thus the report is able to define what needs to be done to control these hazards, which include monitoring on a regular basis and to place the Reservoir within a Tier 2 classification risk for PFAS (which includes the PFOS and PFOA substances in the table 3.5.1 above). Mitigation for these substances includes Granular Activated Carbon (GAC) filtration, but capacity is finite. If the hazard level for the Reservoir began to climb towards the more severe Tier 3 classification, a GAC scheme would need to treat the DO at a rate of around 2,000m3 of GAC (1,000 tonnes). That is a large costly plant that will need to replace the exhausted GAC at some stage. As this has been designated as a limiting hazard, such a large costly plant would need to be installed before Reservoir filling and will raise the overall cost, even if never required. It has not been included in the cost estimates discussed in section 0.

Customer acceptability

This is discussed in DWQRA report sections 5.1.16–5.1.20. It is very pertinent that the pre-DCO consultation in June 2024 "*did not focus on drinking water quality*", when in many ways maintaining water quality will be the biggest challenge for the Reservoir. While the risks regarding constructional reliability are probably deemed catastrophic in nature, those regarding water quality are daily risks and should have been given more attention at the public consultation. While treatment works for processing the "source to tap" pathway are established and have an everyday ongoing monitoring and mitigation strategy, the Gate 3 Report seems to presume that the Reservoir will take care of itself, with monitoring at the level of boat visits and inlet monitoring when most of the hazard action will be within the

[213] National Rivers Authority (1990), "Toxic Blue-Green Algae", Water Quality Series No.2.

Reservoir, with any consequent hazard production and removal passed onto the downstream treatment works.

Other physical limiting hazards and water quality events

There are some very telling comments regarding the issues related to failure to mix the water layers properly in the Reservoir to inhibit algal growth and high turbidity. As report section 5.1.22 states[214]: "*If abstraction from SESRO were to occur during suspension of sediment in the water, this could cause severe operational and compliance issues in the treatment process. Poor mixing in the reservoir could also cause a lack of oxygenation and therefore increase the presence of hazardous parameters. Issues with mixing and aeration are to be mitigated by appropriate maintenance and inspection strategies, of the reservoir assets to minimise the risk of equipment malfunction.*" Thus it is of prime importance at this stage is to identify the means by which mixing and aeration can be achieved.

The concept design (it is no more than that) for the water aeration and mixing system is described in the "*Basis of Design*" Supporting Document A1, in the Gate 3 submission. Section 3.7.7 of that document states[215]: "*As discussed in Section 3.2, to reduce the risk of deteriorating water quality, the concept design includes for a network of air diffusers connected to two 200 kW air compressors in the pumping station.*" GARD contends that this is entirely inadequate to provide the aeration and mixing required to prevent the production of algal blooms and cyanobacteria or to reduce the problems associated with thermal stratification of the water column.

Will the two 200kW air compressors be operating together during the six-month period between April and September, or is one a standby in case the other fails? Appendix E calculates the disparity between what is documented and what is needed for the SESRO project, by comparison with the installed Rutland Water system. ***The proposed size of compressor provision is shown to be completely inadequate for the size of the Reservoir.***

Without adequate thermal destratification and allied oxygenation of the water column during the April to September period, the risk of massive algal and cyanobacteria production will become a major problem, and will impact the overall water quality, as well as creating major health hazards for the proposed recreational activities. In such a scenario, to consider the risk of bringing in Invasive Non-Native Species via boats and water sport equipment seems rather out of place at this juncture.

[214] DWQRA report, section 5.1.22, p. 37.
[215] Gate 3 Basis of Design report, p. 65.

4. Environmental issues

4.1 Biodiversity

In previous sections of this response, we have made reference to the major changes occurring since the submission of the Gate 3 reports, as demonstrated in the publication of the DCO consultation on 28th October 2025.[216] This has made it nigh impossible to critically analyse the documents in the Gate 3 submission, which are now often out of date[217]. In fact, the analysis of the current *Biodiversity Gain/Loss* in the SESRO proposal (as 'shared' in the DCO) is the hardest task of all.

The terrestrial ecology and BNG scoring in the Gate 3 report and the pre-DCO consultation have been reviewed by GARD's ecology expert, as shown in more detail in Appendix F.

The lack of an update on SESRO's BNG status is a serious omission from the DCO consultation process, given the significant changes made since the RAPID Gate 3 submission stage (published only two months before the DCO consultation was launched).

The 2025 Statutory Consultation Map book's *Indicative Masterplan*[218] contains a very different set of habitat creation compared with 2024. However, the map cannot be used as a basis for any serious BNG calculations as it does not follow the formal system for UK habitat classification (UKHab[219]); rather, it uses much vaguer terminology (*"lowland meadow*", *"seasonal wetland", "woodland and copse"*) and a vast new area labelled *"Project Priority Areas for Biodiversity"* (the major part of the SESRO project's footprint escalation to 38km^2). ***As there were no new BNG calculations provided as part of the DCO consultation, it was not possible to consult on how this area might be used and whether it is needed.***

The issue of BNG is one of the key metrics used in the evaluation of the 'best value' programme for Thames Water's WRMP24. As GARD has emphasised in past consultations and summarised in our Independent Expert report',[220] the evaluation of Thames Water's claims for positive BNG are out of date, flawed and have been based almost exclusively on desk-based studies. After our exercise on the DCO, which can be seen in GARD's response to the DCO consultation,[221] we are essentially left with the Gate 3 BNG calculations, based on the 2024 Interim Landscape and Environmental Master Plan, as the only assessable data. ***The huge scope creep in the biodiversity (and natural capital) assessments are just another***

[216] https://thames-sro.co.uk/public-consultations/south-east-strategic-reservoir-option-sesro-statutory-consultation-2025/
[217] Thames Water, Affinity Water and Southern Water (2025), "Supporting Document C5: Gate 3 Biodiversity Net Gain Assessment", 21st July. (Hereinafter referred to as the 'Gate 3 Biodiversity report'.)
[218] DCO map book, pp 7–14.
[219] UK Habitat Classification: https://www.ukhab.org/ukhab-documentation/
[220] 2024-JPP Report.
[221] GARD pre-DCO response, section 9.1 and Appendix D.

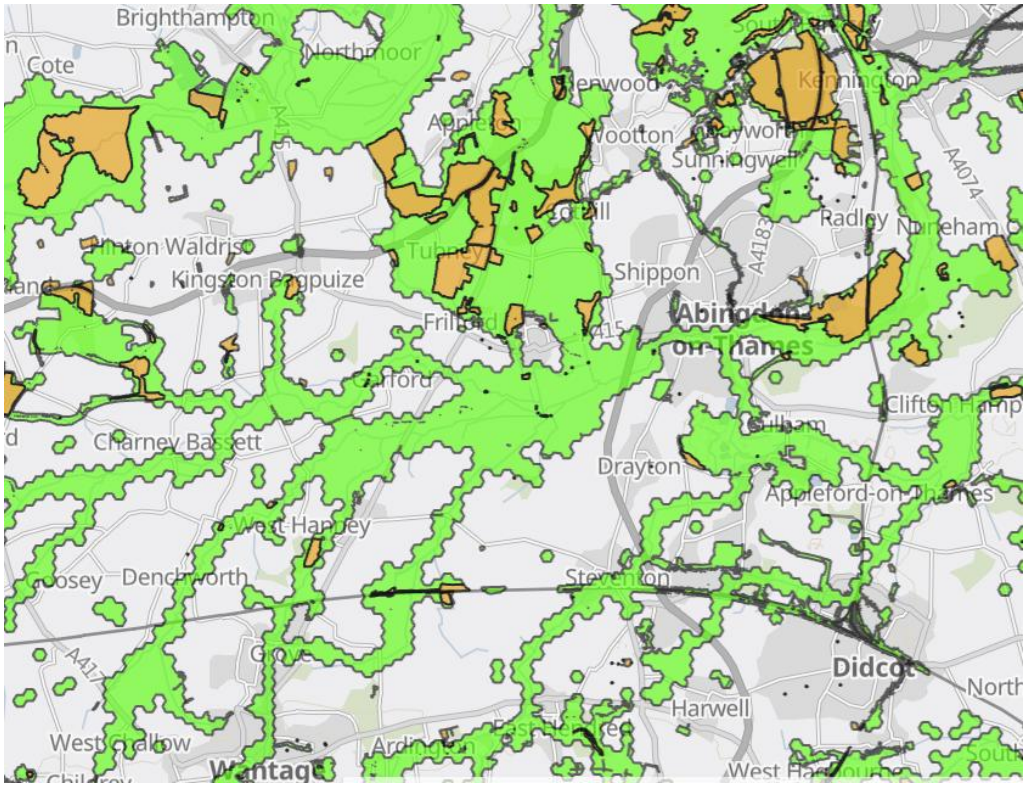
reason for an urgent re-evaluation of SESRO as a 'best-value' solution in the WRMP24s of Thames Water and Affinity Water.

4.1.1 Issues of concern in the Gate 3 Biodiversity report

A new development follows the release (12th November 2025) of Oxfordshire's Local Nature Recovery Strategy (OLNRS)[222] showing that the SESRO area has been included as a strategically significant area for nature recovery opportunities (i.e. an important green corridor). This matters because the BNG calculations must include an uplift factor in baseline BNG scores for area habitats, watercourses and hedgerows that have been recognised for their strategic significance within Local Nature Recovery Strategies. Thames Water ignored this factor, stating that the OLNRS had not been published,[223] but admitting it was in draft form and out for consultation:

> *"As this plan is currently a draft and the BNG calculations had already been run before the [O]LNRS consultation commenced, it has not been included in this BNG Assessment."*[224]

The green corridors in the SESRO area are shown in the OLNRS map below:



Source: LNRS Local Habit Map, https://experience.arcgis.com/experience/ea43e0bc07c044ef8ca4b16803c5e59c?views=View-5

Figure 4.1 - Map detail from published OLNRS local habitat guide

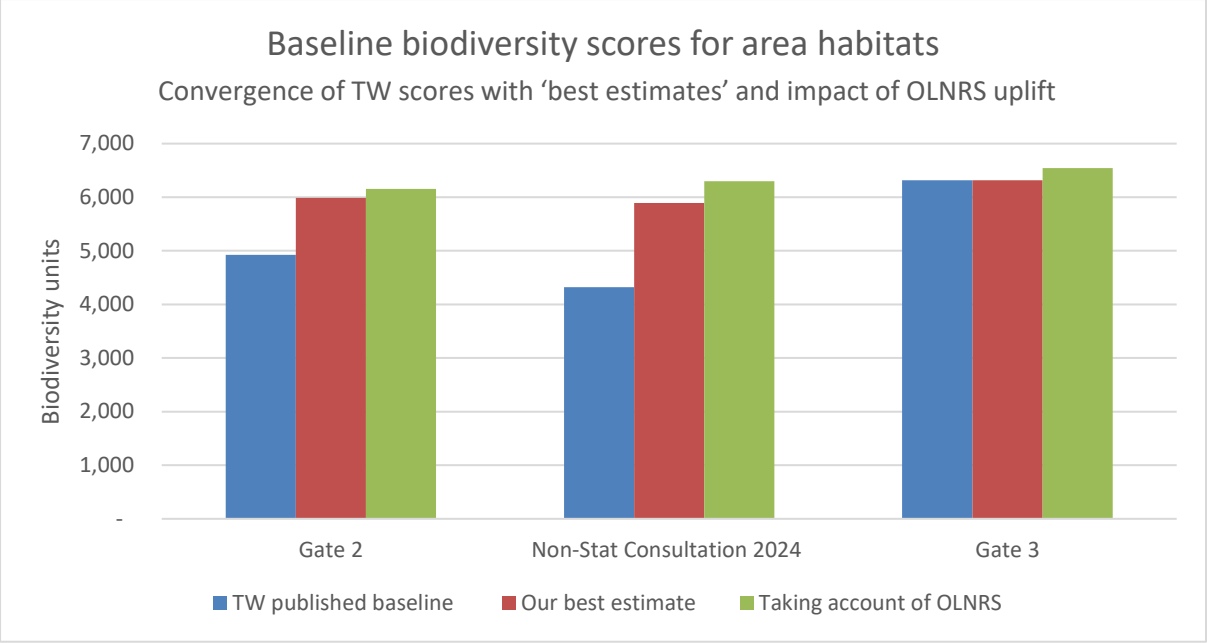
[222] Oxfordshire LNRS Strategy.
[223] Gate 3 Biodiversity report, section 2.10.2.
[224] Gate 3 Biodiversity Report, section 4.3.4.

An important background factor in SESRO's designation within the OLNRS was the ancient and veteran tree survey that we shared with the Local Nature Recovery team as part of the OLNRS consultation process. ***GARD believes that, now the OLNRS has been adopted, RAPID and the PI should insist that Thames Water reruns the calculations***.

The more realistic treatment of baseline habitats since the RAPID Gate 2 is a major factor in the drastic expansion of SESRO to control 38km^2, under draft Order limits, of which less than half of this area relates to the 'red lines' of previous SESRO iterations. The main strategy used in SESRO's BNG reporting in relation to area habitats to keep BNG above statutory targets has included a mix of:

- Suppression of baseline biodiversity values.
- Inappropriate allocation of habitats on the Reservoir embankment.
- Unrealistically high 'time to condition' assumptions for created habitats.
- Unexplained changes to habitat allocation and scoring that provide extra units of biodiversity needed to meet the targets.
- Within the Gate 3 BNG calculations, the timetable for habitat creation for certain wetland and grassland habitats has been brought forward rather than commencing after the end of the construction phase. The implausibility of this is discussed further in Appendix F.

The evolution of reported BNG scores are compared with our expert evaluation below in Figure 4.2 and detailed in Appendix F. This shows scores for the SESRO land-take prior to the latest expansion for the pre-DCO consultation.



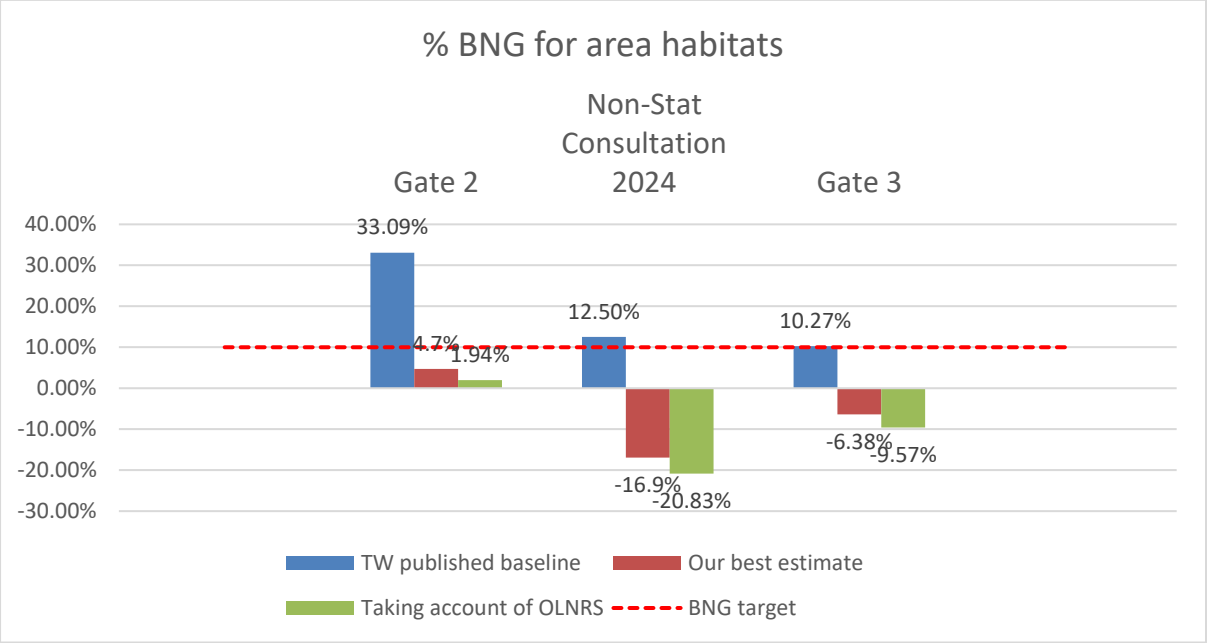


Figure 4.2 - Evolution of 'Baseline' habitat scores for 'core' SESRO area

'Our best estimate' indicates the result of the evaluations in GARD's 2024-JPP Report. The picture is very inconsistent across the different habitat maps and BNG calculations. Overall, at each stage, different assumptions have been made, with poor levels of justification. Our main concerns with SESRO's approach to BNG at each stage of the SESRO process to date are summarised below.[225]

[225] Remarks here relate to area habitat scores, but GARD's 2024-JPP Report found similar issues with BNG calculations for watercourse and hedgerow habitats.

- At Gate 2, very low biodiversity scores were attributed to existing area habitats. These were 20% below the best estimates from the GARD's own 2024-JPP report[226] and failed to consider the strategic importance of the area to nature recovery.

- For the non-statutory consultation on Reservoir options (pre-Gate 3, 2024), the baseline biodiversity scores were lowered from those used in the Gate 2 assessment without any written explanation or evidence of new fieldwork.

- In the Gate 3 Reports and in the DCO consultation, the impacts of the draft OLNRS on BNG calculations were not considered.

- From the non-Statutory Consultation onwards, the BNG has been maintained above 10% by extensive tree planting on the Reservoir embankment, which is likely to jeopardise Reservoir safety. The use of Reservoir embankments to maximise BNG opportunities on site is a cause for concern in terms of the integrity of the embankment, particularly from root growth and from burrowing animals, such as badgers. Figure 4.3 below shows that the proportion of embankment with woody habitats has risen from 6% at Gate 2 to 29% at the Statutory Consultation stage. These habitats are vaguely defined as "*intermittent trees and shrubs*", "*woodland and copse*", "*scrub*" (2024) and "*woodland and copse"* and "*scrub*" in the Statutory Consultation (2025). It has been suggested in informal discussions[227] that this planting would be hawthorn and other low-growing species; however, the consultation brochures and artists' impressions show lust woodland, rather than low scrub.

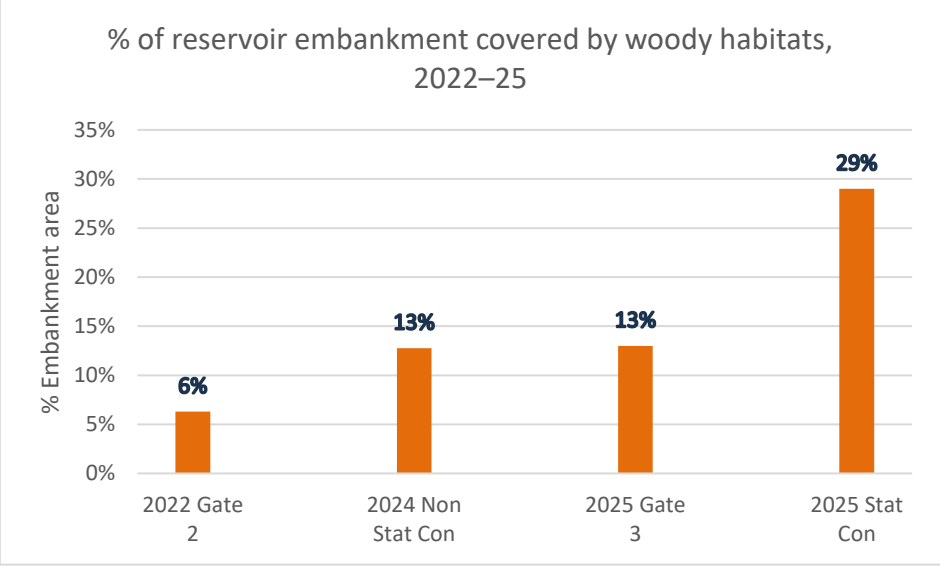


Figure 4.3 - Increase of Reservoir embankment covered by woody habitats, 2022–25

[226] 2024-JPP Report, section 5.2.7.
[227] Dr Julian Parfitt, private communication, attributed to Thames Water SESRO Event staff.

- The decision to downgrade the biodiversity value of sheep pastures contained in the pre-Gate 3 consultation documents has been reversed—this change was sufficient to nudge the BNG score above 10%. Without this tweak, a BNG of -10.7% would have been obtained, rather than +10.27%. ***With such a massive impact on the BNG score, such a change should have warranted at least some explanation.***

- The DCO Map Book shows many large areas labelled *"Project Priority Areas for Biodiversity"*. It is extremely difficult to see why these areas of predominantly productive farmland are required *unless the conclusion has been reached within the project team that BNG targets cannot be reached within the original 12km^2 of the SESRO site*.

- The Gate 3 Biodiversity Report is based on a habitat survey which is still only 41%[228] of the land and habitat creation plans based on the 2024 Interim Landscape and Environmental Master Plan, thus the BNG assessments remain essentially desk-based.

- In particular, the tree survey (including ancient and veteran trees) for the BNG scores covers only 41% of the SESRO area. The survey and the analysis of satellite data were used in the Gate 3 BNG Report '*UK Habitat and Hedgerow Survey*' (UKHab) to estimate area and habitat units lost from the felling of rural trees. GARD's experts have compiled a database[229] of trees within the SESRO area comprising 2,500 trees from which an assessment of the tree survey coverage can be made. Analysis has found that the contractors have missed 42% of 'rural trees' that met the size and location criteria (200 trees) for inclusion in the BNG metric.

- Drayton Copse, an important area of lowland mixed deciduous woodland at the centre of the SESRO site, was included in the UKHab tree survey with 57% of the trees assessed so far. Although further work was being conducted during December 2025, none of the northern stands of oak were included. This is concerning as the condition score included within the Gate 3 BNG metric was "*moderate*", whereas previously it had a condition score of "*good*". Changes made to the condition scores of such important habitats have a significant impact on baseline scores and should be a priority in fieldwork.

- In relation to irreplaceable ancient and veteran trees to be listed within the BNG metric, the latest release in the DCO consultation includes an assessment of ancient and veteran tress commissioned by Thames Water.[230]

[228] Gate 3 Biodiversity Report, p. 8.
[229] Detailed in Appendix F.
[230] SESRO DCO PEIA, Appendix 9.7, AIA.

- The Arboricultural Impact Assessment (AIA) prioritised trees recorded as ancient or veteran on the publicly available ATI website (accessed June 2025). Rather than accepting the records validated by experts at the Woodland Trust, the contractors chose to use the proprietary RAVEN 2 methodology (Recognition of Ancient, Veteran and Notable trees). Justification for this is found in Appendix 9.7 of the Assessment, which states that the South Oxfordshire and VoWHDC Tree Officer and Planning Specialist Team Leader agreed to the use of the RAVEN 2 approach:

  > *"Stakeholder agreed to the proposed approach including the application of the NPPF [National Planning Policy Framework] definition of ancient and veteran trees (as opposed to other definitions which have less stringent criteria)"* [231]

  This is an inaccurate statement as the NPPF does not itself advocate a single methodological approach to the definition of ancient and veteran trees. RAVEN 2 is one of a number of methodologies used to determine ancient and veteran tree status in relation to the NPPF. These include the use of the Woodland Trust's published guidance and the records contained within the ATI database, which remains the primary source for government and planning authorities for existing records of ancient and veteran trees.

The details are given in section F6 in Appendix F of this response, but the tally of ancient and veteran trees has been manipulated by a statistically significant under-measurement of tree girths, thereby misclassifying the majority of 'veteran' trees as 'notable'. This has a major bearing on the bespoke compensation that is required for the destruction of irreplaceable habitat, which must be included within the formal DCO BNG submission.

We conclude that the current Gate 3 BNG assessment is out of date (not including the huge new proposed project land-take), still incomplete for the core area, and deeply flawed.

4.1.1 The RAPID Gate 3 draft decision

The draft decision on the Gate 3 submissions includes Action 10 in Appendix A:[232] "Update the biodiversity net gain assessment for the Development Consent Order", with the reason that: "Further work is required to meet biodiversity net gain expectations".

The action is required by Gate 4, timed for January 2027. Whilst it is difficult to dispute the action and the reason, the action is far too lenient. The issue of inability to reach BNG in the SESRO project is the *overwhelming reason* for the massive scope creep and request to hand over huge areas of the Oxfordshire countryside to the project. ***GARD calls for the Action***

[231] Ibid., Table 3.2.
[232] Ofwat (2025), "Gate three draft decision for South East Strategic Reservoir Option", Appendix A, p. 30.

(Action 10) to become one of the priority actions, with a timed delivery date within 2026, well before the DCO is submitted.

Ideally, in view of the importance of the BNG assessment in assessing the 'best value' justification that has now been demanded by Ofwat by May 2026***, the reassessment of the BNG scores and the measures needed to achieve BNG of 10% across all three BNG metrics are now needed as a matter of urgency.***

4.2 Landscape issues

The landscape submissions appear to be unnecessarily limited in their approach and utilise outdated material as part of their baseline. The proposals do not reflect best practice and the limited conclusions drawn do not appear to be based on objective analysis. Whilst baseline elements to the landscape study were outdated at the time of the SESRO Gate 3 submission, the submissions do not reflect the measures now put forward in the Autumn 2025 SESRO Statutory Consultation. As the Gate 3 submissions appear to incompletely assess an earlier design iteration, they cannot be relied upon as an accurate response to the current scheme proposals.

4.2.1 Failure to adopt best practice in progressing from Gate 2

"*Appendix A: Supporting Documentation*" of the Gate 3 submission for SESRO[233] describes the intended progression from Gate 2, and Gate 3 outcomes.

> *"Summary of gate two actions and recommendations*
>
> *Table 0.1 includes a summary of the progress made against any actions and recommendations given by RAPID at gate two and signposts where further detail can be found in the main report and/or appendix.*

Action/ Recommendation	Progress at gate three	Signpost to further detail
A6: Review and update landscape and visual impact assessment (LVIA) methodology with Natural England	Extensive engagement with Natural England since gate two, including development of Landscape Character Assessment and LVIA appraisal methodology, via EIA Scoping Report	Main Report, Section 4 Supporting Document C3: EIA Scoping Report Supporting Document C4: Strategy for managing impacts on North Wessex Downs National Landscape

Table 0.1 Summary of progress against gate two actions and recommendations"

[233] Thames Water, Affinity Water and Southern Water (2025), "Gate three submission for South East Strategic Reservoir Option (SESRO)", August, p. 62.

The requirement for extensive engagement to agree methodologies is a surprising action, as there exists very clear best-practice methodology for LVIA and Landscape Character Assessment (LCA) studies, as set out in:

- "Guidelines for Landscape and Visual Impact Assessment";[234]
- "An Approach to Landscape Character Assessment", authored by Natural England.[235]

Best-practice methodology is established and universally recognised, with GLVIA3 identified in the August 2024 EIA scoping report, which was published a year before the Gate 3 submission, giving Thames Water opportunity to utilise the agreed methodologies and take landscape reports further had it so wished[236]. It is clear that Thames Water's failure to follow GLVIA3 and LCA guidance has led to error and omission in its submission.

4.2.2 Impacts on the North Wessex Downs National Landscape

The Gate 3 submission (p. 65) intends to assess Strategy for managing impacts on the North Wessex Downs National Landscape (NWDNL) only, as in the excerpt below:

Table 0.2 Summary of documents within gate three submission

Document	*Synopsis of contents*
C4: Strategy for managing impacts on North Wessex Downs National Landscape	*Strategy and discussion on the strategy to assess and manage potential impacts on the North Wessex Downs National Landscape (formally Area of Outstanding Natural Beauty)*

The EIA Scoping Report provides the landscape study context, but does not form part of the Gate 3 submissions. While the Scoping Report lists a range of landscape character assessment studies and defines how it intends to adapt landscape-character area studies to project-specific character areas, it fails to reference (or demonstrate) the standard source methodology for LCA or why, with wider reading, landscape-character areas are adjusted to fit the study area boundary, rather than recognising that the Reservoir site is integrated into the wider landscape pattern.

Supporting Document C4[237] as per the summary reference, is dated 21.07.25 and intends to assess and manage impacts on the NWDNL. A lack of engagement with local landscape character for the site and context is explained through focus on the valued National Landscape and by updated District Landscape Character Assessments being in development. However, the Gate 3 submissions were issued in August 2025, whilst the "*Landscape*

[234] The Landscape Institute and the Institute of Environmental Management and Assessment (2013), "Guidelines for Landscape and Visual Impact Assessment", Routledge, ISBN 978-0-415-68004-2 (henceforth "GLVIA3").
[235] Natural England (2014), "An Approach to Landscape Character Assessment", October, Christine Tudor.
[236] Thames Water (2024), "South East Strategic Reservoir Option EIA Scoping Report", August.
[237] Thames Water, Affinity Water and Southern Water (2025), "South East Strategic Reservoir Option Supporting Document C4: Outline Strategy for Addressing Potential Effects on the North Wessex Downs".

Character Assessment for South Oxfordshire and Vale of White Horse"[238] was issued as a final report a year earlier, in September 2024. There was also a new draft "*North Wessex Downs Landscape Character Assessment"* published in July 2025.[239] Given Thames Water's professed close consultation process, it is hard to understand why this impending report was not referenced.

The Gate 3 landscape report emphasises that the NWDNL is 2km south of the SESRO project site. However, that is well within the Thames Water 7km Zone of Theoretical Visibility study area and therefore at risk. Meanwhile, the required Reservoir area in the Autumn 2025 DCO consultation[240] extends to around 100m from the NWDNL boundary at Ardington Wick.

As noted, the Gate 3 landscape report has no reference to local LCAs published a year before the Gate 3 issue, or the NWDNL LCA that was contiguous with the Gate 3 issue, and the study can be seen to be based on superseded materials. There is an emphasis on effects on the National Landscape and insufficient attention to local landscape character (through District-level LCAs) in the Gate 3 report. The European Landscape Convention definition of "landscape" recognises that all landscapes matter, be they ordinary, degraded, or outstanding. The Convention came into force in the UK in 2007 and its concepts are embodied in the above-mentioned Natural England 2014 guidance and therefore all following LCA studies. It is a failing of the Gate 3 process not to take account of District LCA studies in assessing the Reservoir, as well as not to be abreast of the published LCAs in the first place.

There is a systemic failing of the Project presentation in considering the Reservoir separately from the other infrastructure elements that are required to support it. This is systemic failing not only by Thames Water, but within the implementation of the RAPID Gated process itself. GLVIA3 requires assessment of "cumulative effects", and the August 2024 EIA scoping report also advises that cumulative effects be recorded. However, as one example, the Gate 3 only refers to indirect effects on the NWDNL, where it is categoric that the T2ST water transfer pipeline – a key determinant of the Reservoir's size – will cut through the NWDNL in its entirety, and potentially cause substantial direct landscape and visual impacts[241]. The Thames Water reports are meant to accurately and professionally inform decision-makers, as well as providing an iterative mechanism to inform the development of the project itself. Cumulative and consequential effects should be described and, where elements cannot be fully assessed, they should be flagged so that a reader can understand the likely scope of effects and make further cross-references.

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[238] LUC (2024), "Landscape Character Assessment For South Oxfordshire and Vale of White Horse South Oxfordshire District Council and Vale of White Horse District Council", final report, September.
[239] LUC (2025), "North Wessex Downs Landscape Character Assessment", draft report, July.
[240] DCO map book, p. 6.
[241] GARD (2024), "GARD response to Southern Water's Consultation on Revised Draft Water Resource Management Plan 2024", 4th December, section 5.7.

In identifying impacts, the report refers to assessment stages at Construction, Operation winter Year 1 and Summer Year 15. It identifies potential adverse landscape and visual effects during Construction and at Year 1 winter, but that these would have reduced by the Year 15 Summer assessment, and concludes that "*it is, therefore, considered unlikely that effects on the National Landscape would be significant long-term assuming that appropriate mitigation is implemented."*[242] However, this can only be taken as an opinion, as it is made without demonstrating proper evidence, analysis or standard impact assessment matrices, and just leads the reader to surmise that things will get better.

The report claims no significant long-term effects. However, the consultation identifies 14 years from construction start to landscape works completion, with a further 15 years until Year 15 Summer assessment. That is a 29-year period and a truly generational impact. Meanwhile, whilst requiring case-related definition, GLVIA3 judges 10–25 years as a "*long-term*" effect.

The EIA scoping report refers to winter photomontage as best practice, so why refer to Year 1 Winter and then Year 15 Summer? Seasonal landscape variation will obviously have an effect on receptors and should be explained, not used partially. How will Year 15 winter be? The Gate 3 landscape report (pages 19 and 20) sets out purported mitigation measures for impacts on the NWDNL:

> *5.1.2 Elements of the Interim Master Plan design that could reduce effects on the National Landscape, its setting and its special qualities, by helping to integrate the proposals into the surrounding landscape and views and reinforce existing landscape character, include:*

- The introduction of new views from new PRoW or permissive paths within SESRO towards the scarp of the North Wessex Downs National Landscape. (page 19)
- Medium term, these would be views from between the Reservoir and railway, with the diverted Hanney Road and sidings, etc; long term, the views would be from the Reservoir crest, from an 'alien' landscape setting, across a road and railway. Meanwhile, the Reservoir will close out and interrupt wider existing views towards the scarp. This is not a benefit to the NWDNL.
- Removal of existing detractors in the landscape, such as solar farms. (page 19)
- The DCO Consultation proposals, issued a mere two months after the Gate 3 documents, show the introduction of a huge solar farm 2km across, north of the Hanneys. Meanwhile, major rectilinear floating solar blocks are shown across a

[242] Thames Water, Affinity Water and Southern Water (2025), "South East Strategic Reservoir Option Supporting Document C4: Outline Strategy for Addressing Potential Effects on the North Wessex Downs", section 4.2.2, p. 16.

1.5km x 0.5km sector of the Reservoir itself[243]. Therefore, beyond the impacts of the immediate Reservoir, the new solar proposals must also be introducing permanent landscape and visual detractors, to the detriment of the NWDNL.

- Sensitive design and siting of permanent buildings, structures and infrastructure.
- The DCO Consultation proposals show buildings scattered through the landscape, bearing no relationship to the scale, form, function or setting of established farmstead pattern rural development with, for example, the water sports centre and extensive car parking prominently positioned on the Reservoir crest. Meanwhile, infrastructure elements such as the T2ST pipelines are conveniently omitted.
- Sensitive design of Reservoir embankments, including curvatures within the crest alignment that provide a more natural visual waterline and gentle undulations and dips in the earthworks.
- This is most unlikely to be perceived from the NWDNL, although the water sport centre jetties and the consistent drawdown margins will be apparent and negative elements in NWDNL views.
- Planting of hedgerows, small woodlands and woodland copses on the Reservoir embankments, to help integrate the embankment into the surrounding landscape.
- The Reservoir will be seen from the NWDNL as a huge body of water with associated topography, buildings and infrastructure that will remain alien elements in the landscape and will redefine, rather than integrate with, the existing landscape character. At a fairly fundamental level, the Reservoir setting and mitigation works can be seen as a 'landscape doughnut' around the Reservoir, with rings of bunding, watercourses, roads and disconnected planting groups. Whilst these are based on construction requirement and mitigation intent, they are clearly at odds with the surrounding landscape structure defined by the geometric Parliamentary Enclosures field pattern. This strong variation within the wider landscape will be more apparent from the elevated viewpoints within the NWDNL.

  At completion Year 15 (29 years into the development), planting measures are still likely to read as an immature landscape in longer views from high (NWDNL) ground, where the Reservoir and any planting will be seen in the context of the fully mature trees and woodland to the wider Enclosures pattern landscape.
- Lagoons with marginal habitat and wet woodland for biodiversity and visual amenity enhancement at the Reservoir's edge.

[243] DCO map book.

- This is a potential local measure and not a benefit to the NWDNL.
- Floating islands of as natural a shape as practicable to soften the Reservoir edge.
- In views from the NWDNL, the floating islands will be entirely separate from the Reservoir edge, which will be characterised by a consistent drawdown margin with the islands unnaturally placed at a consistent offset distance. Meanwhile, the huge rectilinear floating solar islands will dwarf other mitigation measures and present an entirely unnatural focus to NWDNL views.
- Existing vegetation along retained watercourses enhanced and gapped up with native trees and scrub.
- Given the emphasis on watercourse diversion, this could be at best a minor local measure and not a benefit to the NWDNL.
- Characteristic pattern of wide verges with swales for road drainage and hedgerows with standard trees along the access road from the A415 Marcham Road.
- This is a potential local measure and not a benefit to the NWDNL.
- Wetland habitat mosaic with reeds, species rich wet grassland and floodplain marsh, as well as localised areas of wet woodland along the western watercourse diversion.
- This is a potential local measure and not a benefit to the NWDNL.
- Wet woodland, wetland habitat mosaic, wildlife ponds, scrapes and nature trails along the eastern watercourse diversion.
- This is a potential local measure and not a benefit to the NWDNL.
- Enhancement of existing retained hedgerows and tree belts.
- Existing hedgerows and tree belts could only be retained at the periphery of the Reservoir site, or within the wider (public consultation indicative masterplan) defined "*project priority areas for biodiversity*". Enhancement of those elements would have the function of reinforcing the rectilinear Enclosures landscape pattern and emphasise the discordance of the Reservoir development. Thus, potential local landscape enhancement measures would be likely to exacerbate the impact of the Reservoir on NWDNL views.

Thames Water's measures will fail to meet their narrowly framed NWDNL mitigation intent. There will undoubtedly be a range of LVIA matters that could, and should, be considered in relation to the local landscape as well as the NWDNL, but that will require Thames Water to prepare a full LVIA of all aspects of the works.

4.2.3 General conclusions

The Gate 3 studies demonstrate shortcomings and do not reasonably assess or describe the overall effects of the works at a technical level. However, members of the public must typically rely on published consultation materials to inform their understanding of the scheme. In landscape and visual terms, the graphic representations can be as misleading as they are informing. In aerial perspectives, with no baseline date, proposed trees are shown at a scale in relation to the Reservoir that would equate to around 100m tall. This is probably 10 times the height that would be achieved in Year 15, but would be entirely unachievable at any timescale. However, as a tree height is understood as a common visual reference, the combination of trees and water in 'illustrative' representations has the effect of making the Reservoir appear 1/10th of its true size. Equally, illustrations of adjoining 'recreational lakes' show a greater water area than in a following Reservoir view, and the recreational lake is the front to consultation leaflets. Images of happy families enjoying mature landscapes have no suggestion that this 'benefit' may be around 30 years – i.e. a generation or more – away.

In summary, the Gate 3 landscape technical studies are too narrowly focused and unreasonably hold back a range of assessment data that could inform decision-makers' (and the public's) understanding ahead of a future Environmental Statement and planning application. The studies are missing current baseline data, don't provide clear evidential analysis and do not even assess the currently promoted scheme. Even within their self-imposed narrow scope, the Thames Water studies demonstrably fail to address issues and impacts on the NWDNL. Meanwhile public data (much of which is post-Gate 3) includes a range of misleading graphic information which will not help the public accurately understand landscape, or visual effects, or the extensive development and establishment timescales involved.

5. Project management

The SESRO project is at current estimates (2025 prices) a £7.2Bn project, with a duration of 14 years. It has significant interfaces with another SRO project, the T2ST. It has a significant amount of non-standard engineering.

Given the assurances cited about the Project being assessed as RIBA design stage 3,[244] one should expect a proper Project Plan for this massive infrastructure endeavour. Instead, as far as can be discerned, the Gate 3 submission on Project Management[245] merely covers those project actions to go to Gate 4, to complete the DCO preparation, and to sort out issues like procurement and land policy.

There is not a single Gantt chart or similar on how the actual construction project will move forward and nothing at all on how it would interact with the T2ST, SWOX pipeline to Farmoor and the Water Treatment Infrastructure for these two projects. This is completely unacceptable for a set of projects so tightly shoe-horned into the available land area.

This GARD response has already covered the inadequate way in which Project Risks, as they relate to costs, are covered by the submission (see section 2.1.3). Having seen the overall lack if project management evidence in the Gate 3 submission, GARD strongly believes that the stakeholders, whether local residents, or authorities, or customers of the three water companies should be very worried indeed about whether the project is under any control at all.

5.1 Standards reached by other SROs at Gate 3

The position for SESRO is in complete contrast to other submissions for SROs at Gate 3 such as:

Grand Union Canal:

GUC%20SRO%20Gate%203%20Submission%20May%202025%20v1.0%20Redacted.pdf

Minworth WTW
(for supplying the GUC but a separate SRO)

Minworth%20SRO%20Gate%203%20Submission%20May%202025%20v1.0%20Redacted.pdf

In these, there are proper project plans and Gantt charts and discussions of phasing and subprojects in these (though, disappointingly, for the GUC most actual costs are redacted). There are even heavy goods vehicles (HGV) movement draft schedules in the Minworth SRO.

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[244] "*Supporting Document A1: Basis of Design Report*", 23 July, table 1.2. (July 2025)
[245] SESRO, Supporting Document D *Project Management Plan*, J696-AA-XXXX-XXXX-PL-CP-100001 Version: 1.0, August 4th 2025. (Thames Water, Affinity Water and Southern Water).

None of this exists in the SESRO Gate 3 documents, even though in the DCO Consultation, released shortly after the Gate 3 submission[246] there are quite detailed *consequences* of a project plan (HGV movements, rail movements, etc) shown, albeit still without any semblance of a Gantt chart or assessable project plan.

For the South Lincs Reservoir there was already a proper construction project plan at Gate 2 SLR_RAPID_Gate_two_submission.pdf (p. 36). This reservoir has the further advantage that its transfer pipelines and water treatment are included in the Project plan.

5.2 A project out of control?

The absence of any meaningful Project Plan for SESRO, either in the Gate 3 submissions or the DCO consultation, or any proper Construction Plan in the latter[247] really leads one to ask the question: "*Is the SESRO project out of control?*". For GARD there are many worrying indications. As highlighted in many other sections, we re-iterate them here (with sections in this response, or the DCO response where they are covered).

1. The cost of the project suddenly tripled in August 2025 from £2.2Bn to £6.6Bn (at 2022–23 prices). This was in spite of communications as late as June 2025 that the cost of the project was absolutely £2.2Bn (section 2.2)

2. Once the RAPID Gate 3 submission was made, there were a mere two months' delay before a *substantially different project*, was released for the public DCO consultation, featuring:

    a. A tripling of the land required to be reserved, from around 12km^2 to around 38km^2) (DCO response section 9.1[248]).

    b. A multiplication of the site access points for HGV transport of materials to site, from 1 to 6.[249]

    c. The increase of materials brought to site for construction from around 2.5 million tonnes (Mt) to more than 8.5Mt.[250]

    d. The removal of 6Mt of topsoil from the site.[251]

[246] So closely following that it would hardly have delayed the SESRO schedule to wait until the **same** SESRO design could be submitted to both processes!
[247] For GARD's detailed criticism of the poor quality of the Reservoir Construction Plan, see GARD pre-DCO response, pp. 83–92.
[248] Ibid., pp 92–98.
[249] Ibid., pp. 98–108.
[250] Ibid., pp. 99–100.
[251] Ibid., p 84.

e. An increase in the capital carbon emissions from 495,700 tCO2eq to 1,176,050 tCO2eq (see this response, section 2.6).

f. The '*announcement*', mainly via responses to detailed probing, of many substantial changes to the design (see section 2.2.5), such as: the clay-cored embankment; the 11 km length Groundwater drain; the removal of siphons from the Emergency Drain and the change in the reinforcement of the last section (see section 3.3.2); the replacement of 400 hectares of solar panels on land near Garford and the assembly of floating solar panels on the northern side of the main reservoir water-body.

3. The land-take changes listed in 2a, the materials changes in 2c and 2d, and the design changes listed in 2f, the have all been made since the design (on which the £6.6Bn cost was based) was frozen, in October 2024 – ***ten months before the Gate 3 submission.*** There can be little confidence that the costed risk amounts could accommodate these changes and so the median cost is bound to rise.

4. Around 22km^2 of the land-take is now assessed as *'Best and Most Versatile (BMV) Land'*.[252] This completely alters any natural capital assessment of the project's effects made to date.

5. The project risks have mushroomed along with almost everything else. As already remarked[253], section 3.1.3 of the A3 Cost Report states that the number of risks has increased from 75 at Gate 2 to "*more than 270*" at Gate 3, subsequently clarified in a response to a RAPID query to total 287 risks. The normal expectation is that, as a project progresses, although the number of risks may increase, the value of the risk allowance should reduce. The converse has occurred between the issue of the Gate 2 and 3 cost estimates and requires an explanation as to how this has occurred.

Astonishingly, there seems to be absolutely no recognition in the RAPID Draft Decision document that any of this is a cause for concern. Perhaps the draft decision (coming as it did on 3rd December 2025, only half-way into the DCO consultation) gave insufficient time for RAPID to assess in full the ramifications of these further escalations in scope, project footprint and duration, land-take and design/construction program changes. That does however seem a rather weak excuse.

GARD believes that RAPID should alter its draft decision to insist on a 'hold point' where all these scope changes are assessed and a cost estimate for the new project is made, alongside completion and confirmation of all the other metrics in the 'best value' determination.

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[252] Thames Water (2025), "Preliminary Environmental Information Report: Appendix 20.2 – Cumulative soils assessment", October, table 1.2.
[253] See this response section 2.2.3.

6. Stakeholder engagement

6.1 Introduction

Stakeholder engagement is a statutory and regulatory requirement for all nationally significant infrastructure for water resources. Under the Planning Act 2008 and the associated guidance issued by the PI (PINS),[254] promoters must consult prescribed bodies, affected communities and technical experts at an early, formative stage; provide clear, balanced and accessible information; and demonstrate how stakeholder feedback has influenced scheme development. RAPID further requires that evidence for safety, feasibility, cost, DO and environmental impact is made available in time to inform meaningful consultation.[255]

The proposed Reservoir is exceptional in scale, risk profile and duration of impact. It would be the largest artificial reservoir of its type ever constructed in the UK; relies on an embankment design not previously delivered at this magnitude; and the construction period is 12+ years, with cumulative effects on neighbouring communities, transport links, floodplains, biodiversity and land use. For a project of this scale, government policy emphasises the need for enhanced openness, early de-risking and robust engagement, recognising that local communities often hold critical insights essential to minimising risk and improving scheme design.

Given SESRO's unprecedented scale, design and cost, and its impacts across multiple authorities, customer regions and downstream communities, the project requires a transparent, evidence-led and fully accessible consultation process. We have assessed Thames Water's Gate 3 engagement against the guidance from RAPID and PINS, the Gunning Principles[256] and Ofwat's Public Value Principles[257], focusing on whether stakeholders have been provided with the information and opportunities necessary for informed participation. The findings presented here identify the key areas where Thames Water's Gate 3 submission falls short of these standards and where further action is required to ensure regulatory compliance and public accountability.

6.2 Systemic, procedural and legal non-compliance

Thames Water's engagement record reveals a **systemic pattern of non-compliance** with regulatory, procedural, and ethical duties, as detailed in the table below.

[254] Planning Inspectorate Advice Note 11 (2023) and Annexes A–H, esp. Annex B (Front-Loaded Engagement) and Annex D (Environment Agency).
[255] Ofwat (2024), "RAPID Final Gate 3 Guidance", January, paras 3.2–3.4 and Appendix 2.
[256] R v Brent LBC ex p Gunning [1985] and reaffirmed in R (Moseley) v Haringey LBC [2014] UKSC 56.
[257] Ofwat (2022), "Ofwat's Final Public Value Principles".

Failure to meet RAPID requirements	● Critical evidence on safety and feasibility (dam breach, flood-risk modelling, carbon, and cost escalation) was deferred until after consultation deadlines, preventing informed participation. ● The submission lacks transparent mapping of stakeholder issues raised and how they have been addressed – contrary to RAPID Appx 2. 1. RAPID requires completion of non-statutory consultation and commencement of statutory pre-planning consultation before Gate 3.[258] Thames Water's statutory consultation began only in late 2025, after submission, and thus breaching the required timing sequence.
Breach of Planning Inspectorate Advice Note 11	● Advice Note 11 (Annex B) demands front-loaded, accessible, and iterative consultation SESRO engagement was neither front-loaded nor iterative: information was withheld, feedback loops were absent, and consultation materials were promotional rather than evidential.
UK government's 2024 consultation on NSIPs[259]	● The consultation sets out a clear and immediate policy direction. "Infrastructure promoters must provide high-quality early, meaningful and constructive engagement and consultation with those affected… thereby enabling positive changes to be made to them without causing undue delays." The expectation is for front-loaded, proportionate, and timely consultation with open and transparent communication, acknowledging that local people often hold critical insights that can help de-risk proposals. ● For a project of SESRO's scale and potential impact, failure to align with these priorities is not only out of step with best practice; it risks undermining the legitimacy of the consultation process.
Violation of the Gunning Principles	1. Consultation occurs when proposals are still at a formative stage.

[258] Ofwat (2024), "RAPID Final Gate 3 Guidance", January, p. 37.
[259] Department for Levelling Up, Housing and Communities (2023), "Consultation on Streamlining Infrastructure Planning".

	2. Sufficient information is provided to enable intelligent consideration and response. 3. Adequate time is given for participants to respond. 4. Consultation responses are conscientiously taken into account. Thames Water's approach breaches all four principles.
Conflict with Ofwat Public Value Principles	Ofwat's framework requires transparency, inclusivity, and demonstrable influence of feedback.[260] Thames Water's process, by contrast, is opaque, exclusive, and unresponsive.

These combined breaches render the SESRO engagement process non-compliant with public-law standards for consultation. Under RAPID's Gate 3 assurance framework, this should constitute a show-stopper condition, preventing progression until compliance can be demonstrated.

6.3 Lack of cost transparency, failure of best-value demonstration and impact on consumers

As noted in the table below, and seen in sections 2.1 to 2.5 above, Thames Water has consistently violated the expectations of stakeholder engagement in relation to the costs and value of the project.

Failure to re-assess best value	Following the major cost escalation of August 2025 (£2.2Bn to £6.6Bn), Thames Water failed to engage stakeholders in reassessing the "Best Value" proposition required under RAPID's guidance.[261] No transparent comparison has been undertaken of SESRO against alternative SROs (e.g. the STT). We discuss this in section 2.5 of this response.
Evasion of customer impact disclosure	Despite the tripling of costs, calls for transparency on impact on customer bills have been ignored,[262] Thames Water has not transparently disclosed any quantified impact, other than be non-specific admissions in an email[263]. In our view, this omission

[260] Ofwat (2024), "Strategic regional water resource solutions guidance for gate three", version 3, January, section 9.
[261] Ibid., section 8.
[262] Thames Water (2025), "Supporting Document G – Stakeholder and Customer Engagement Strategy: SESRO Gate 3 Stakeholder and Customer Engagement Report", Appendix 2, p. 47.
[263] Thames Water email to GARD, 6th October 2025.

	breaches RAPID's transparency expectations and Ofwat's customer-engagement principles.
Regulatory and ethical implications	Failure to disclose cost escalation and consumer impact breaches RAPID Guidance § 3.2 ("transparency and completeness of financial data"), Ofwat Public Value Principle 2 ("customers must be informed about value trade-offs") and the Gunning Principle 4 and thus invalidate the adequacy of consultation at Gate 3.

6.4 Evasion of life-critical safety and feasibility

Thames Water's stakeholder engagement demonstrates a systematic pattern of **avoidance of safety-critical dialogue** (see also sections 3.3 and 3.4). Evidence central to life safety, flood risk, and feasibility has been withheld or deferred—contrary to RAPID para. 3.4.2 and PINS Annex F requirements for early safety engagement.

6.4.1 Dam breach risk

Despite repeated requests from GARD, local authorities and independent experts, Thames Water has not published dam-breach modelling, downstream hazard mapping or emergency-drawdown feasibility analysis at formative consultation stages. The Gate 3 submission contains only high-level references to these matters and provides no substantive evidence. As a result, communities, including those who would be subject to emergency drawdown flows or future evacuation protocols, have not been provided with the information necessary to understand or comment on the implications of SESRO.

This approach does not meet the expectations for high-hazard infrastructure set out in PINS Advice Note 11 (Annex D), which requires early, transparent engagement on site-specific risks affecting life and property. On the contrary, Thames Water has actually sought to scope out a DBA from its EIA. This attempt, in the scoping submission of its EIA to the Planning Inspectorate, was contested by the EA, supported by the OCC and the VoWHDC, amongst others. Consequently, in its scoping opinion to the Secretary of State, the Inspectorate ruled that Thames Water had to produce a DBA[264]. It also diverges from modern reservoir-safety practice, including risk-tolerability and ALARP principles. (Whilst not yet statutory, these are widely recognised as the established professional standard for a reservoir of SESRO's scale, ands were emphasised in the report following the Toddbrook Reservoir emergency in 2019[265].)

For a project with significant potential consequences and where lower-risk alternatives exist, early application of risk-tolerability and ALARP frameworks is essential for responsible option

[264] The Planning Inspectorate (2024), "Scoping Opinion: Proposed South East Strategic Reservoir Option (SESRO)", Case Reference WA010005, 8th October.
[265] Balmforth D. (2021), "Independent Reservoir Safety Review Report", March.

appraisal. In the absence of a DBA, GARD's use of Defra's methods indicates that increasing the volume from 100Mm³ to 150Mm³ could result in a **tenfold rise in the estimated fatality rate** for East Hanney, with over 60% of residents falling within the critical depth-velocity zone (see Appendix D). Given the availability of alternative water supply options that pose no comparable risk to life or infrastructure, the lack of engagement on this material change is indefensible. Public-facing materials from Thames Water consistently minimise the risk, citing statistical improbability and legal compliance with largely irrelevant legislation, ignoring the government (Defra) guidance,[266] not to mention the ethical imperative to assess low-probability, high-consequence events. The literature misleadingly emphasises the "safer" nature of a bunded reservoir, while disregarding siting risks that contravene Institution of Civil Engineers **benchmark standards**: "*No dam above a village or town should be designed knowingly with a finite chance of a disastrous breach*."[267]

There is no discussion of evacuation planning, no admission of breach scenarios, and no transparency around how these risks are being assessed or mitigated. A clear purpose of the DBA is to provide the flood risk map for a reservoir[268], without which the Emergency Planning responsible organisations cannot plan their responses (hence the pushback from the county and district councils). The Defra guidance emphasises that such information should be available for making siting decisions,[269] so, in SESRO's case, should have been performed years ago. Communities have been denied the opportunity to understand, question, or influence decisions that could affect their safety. Without published dam-breach modelling, stakeholders and Regulators cannot test whether the scheme's risk profile is acceptable or mitigation is feasible. This omission undermines the de-risking expectations for Gate 3 and leaves SESRO's risk–benefit balance unproven at a time when its best-value justification is increasingly uncertain. Until full dam-breach modelling is made available for independent and transparent scrutiny, the project cannot be said to meet the requirements of lawful, informed and meaningful consultation.

6.4.2 Emergency drawdown and downstream risk

Emergency drawdown poses direct and foreseeable risks to downstream communities, yet Thames Water has undertaken no public consultation on this life-critical issue. No modelling of drawdown flows, evacuation feasibility or downstream hydraulic impacts has been shared, and there has been no engagement with residents, parish councils or local authorities within the emergency-drawdown zone. The proposed volumetric expansion

[266] See this report, Appendix D. Communicated by GARD to Thames Water on numerous occasions.
[267] Institution of Civil Engineers (1996), "Floods and Reservoir Safety", 3rd edn, London: Thomas Telford, ISBN 0727725033.
[268] https://check-long-term-flood-risk.service.gov.uk/map
[269] Defra and the Environment Agency (2014), "Small Reservoirs Simplified Risk Assessment Methodology", Guidance Report, January, prepared by HR Wallingford.

further increases potential drawdown volumes, but this heightened risk has not been addressed.

Non-statutory consultation instead has focused on peripheral matters (e.g. pipeline vs infeasible canal transfer), while omitting downstream feasibility and safety impacts once water enters the River Thames. The Gate 3 Stakeholder Engagement Report contains no reference to drawdown consequences. This approach falls short of RAPID's requirement to engage "*all stakeholders affected by solution development*"[270] and PINS Advice Note 11 (Annex D), which requires early engagement with anyone facing physical risk. Without drawdown modelling and open consultation, downstream communities cannot understand or comment on risks, and SESRO cannot be regarded as de-risked at Gate 3.

6.4.3 Flood risk and feasibility failures

Flooding is one of the most persistent public concerns, in an area characterised by high fluvial and groundwater risk. Despite more than a decade of warnings from communities, councils, experts and statutory bodies, no fluvial or groundwater flood-risk modelling has been published. This omission is critical given that, since 2017, Thames Water's own feasibility work has identified a red-rated floodplain encroachment risk[271]—reflecting the site's inherent fluvial and related hydrological constraints—with the rating repeated in subsequent internal addenda.[272]

Throughout this period, stakeholders repeatedly raised concerns that SESRO would also exacerbate groundwater levels. Nevertheless, Thames Water continued to downplay the flood risk, stating as late as Gate 2 in 2022[273] – that groundwater flooding was *"a potential risk"*. This was based, in part, on an estimate of the groundwater level as 2.5m below the surface. This completely ignorant assumption, which could have been easily shown to be incorrect by true community liaison, is now known to be completely false, as the autumn/winter groundwater levels are much less than 1.0m below the surface – something which Thames Water found to its cost when its CCT trials were delayed for over five months by flooding. Its Gate 3 submission now acknowledges both groundwater and fluvial risks, but confirms that the relevant modelling and assessments will not be completed until the 2026 DCO application. As a result, a core feasibility risk remains unassessed at the point when stakeholders are required to provide meaningful input.

Thames Water also continues to assure both the public and the Regulators overseeing SESRO's progression that the scheme will satisfy the NPPF Flood Exception Test and cause

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[270] Ofwat (2024), "RAPID Final Gate 3 Guidance", January, p. 37.
[271] Thames Water (2017), "WRMP19 Resource Options – Reservoir Feasibility Report", Rev 01A, July. Internal report referenced in Thames Water (2023), "Reservoir Feasibility Report Addendum", August.
[272] Thames Water (2022), "Draft WRMP24 – Resource Options: Reservoirs Feasibility Report Addendum", November.
[273] Thames Water (2022), "Standard gate two submission for South East Strategic Reservoir Option (SESRO)", 14th November, para. 4.27 et seq.

"no increased flood risk". These assurances rely on outdated internal assessments completed before groundwater considerations were incorporated and cannot therefore be substantiated.

Stakeholder engagement has been further undermined by:

- **Unfulfilled commitments**—Thames Water did not provide its promised summary of flood-risk modelling during the 2024 non-statutory consultation.
- **Reliance on generic factsheets**—consultation materials offered only high-level reassurance without modelling, uncertainty analysis, or opportunities for technical questioning.
- **Deferral of all critical evidence**—both groundwater and fluvial assessments have been deferred to the DCO, contrary to RAPID's requirement for early de-risking.
- **Omission of stakeholder feedback**—concerns raised by GARD, parish councils, MPs, local authorities and the EA were materially absent from the Gate 3 stakeholder-engagement report.

Regulatory implications: these actions breach RAPID's requirement for early de-risking and transparent evidence at Gate 3 and conflict with PINS Advice Note 11, which requires early engagement on site-specific risks affecting life and property. By deferring the publication of flood-risk modelling until the DCO stage, Thames Water has:

- Prevented stakeholders from understanding or testing SESRO's feasibility.
- Withheld evidence necessary for informed participation.
- Left unresolved a red-rated risk identified since 2017.
- Made it impossible to verify claims of NPPF Exception Test compliance.
- Eroded public trust in the engagement process.

Flood risk is not a peripheral concern – it is a **core feasibility determinant** for a reservoir proposed on a floodplain. The continued absence of modelling, despite a decade of requests, represents a significant procedural deficiency and undermines the legitimacy of SESRO's progression at Gate 3.

6.5 Technical transparency and inappropriate timing of disclosure

A core requirement of RAPID's Gate 3 process is that solution owners provide timely, accessible,[274] and complete information to stakeholders so that consultation can

[274] Ofwat (2024), "RAPID Final Gate 3 Guidance", January, p. 37.

meaningfully influence design. Thames Water has done the opposite. Evidence critical to feasibility, safety, cost, water quality, and design viability has been strategically deferred, or released after key consultation windows had closed.

6.5.1 Strategic deferral of evidence

As evidenced in this section above, across multiple domains (including carbon, flood risk, safety and cost) Thames Water has consistently relied on the phrase "*work in progress*" to justify non-disclosure. This pattern has systematically deprived stakeholders of the opportunity to test or challenge assumptions at the formative stage, contrary to RAPID Gate 3 (requirement for iterative, transparent engagement),[275] PINS Advice Note 11 (Annex B, "*front-loading*") and Gunning Principle 2. Stakeholders have been routinely assured that data would be shared "*later*," "*near DCO*," or "*at detailed design stage*." This frustration has been echoed by parish councils, MPs and OCC, all of whom repeatedly requested modelling and evidence that never materialised.

The CCT is a salient example **of withheld transparency, misleading public framing, and procedural evasion** – contrary to the "*transparent engagement*" requirement. It highlights a pattern of procedural opacity designed to avoid scrutiny at the critical moment when public participation could shape design decisions.

Case study: The Clay Compaction Trial

Lack of early engagement

Although GARD and Professor Chris Binnie had been calling for meaningful trials since 2007, Thames Water failed to involve stakeholders in scoping or planning the trial. The trial ultimately undertaken was smaller than originally recommended by early consultants[276]. It was presented to the public as an "early" trial, despite occurring more than a decade after initial feasibility concerns were raised.

Restricted access and withheld data[277]

During the 2024 site visit:

- GARD's technical advisers were denied close inspection of the embankments and borrow pit.
- Requests for core geotechnical data, revised embankment cross-sections, and settlement information were refused.
- Thames Water used semantic deflection ("zones existed previously") to deny that the embankment design had been changed as a result of the CCT, even though drawings and descriptions clearly indicated a redesign.

[275] Ibid., p. 15.
[276] Binnie, C.J.A. (2024), "Report on Aspects of SESRO Dam Design", GARD, 12th January.
[277] GARD (2025), "Notes of Visit to SESRO Clay Compaction Trial Site, 20 May 2025", 11th June.

Timing and withheld results

- Trial delays (caused by waterlogged conditions) were not disclosed to the public or stakeholder groups.
2. A planning application to extend trial operating hours revealed delays only indirectly.[278]
3. Key findings have been ***withheld from the Gate 3 submission***, even though trumpeted as key in the journal *Ground Engineering*[279], meaning that feasibility, deliverability, and cost implications arising from the CCT remain unknown to stakeholders and Regulators.
- Concerningly, Supporting Document D (Project Management Plan) shows that weather-related delays, geological conditions and embankment design—initially rated as red key risks in the RAG-rated register (Table 5.1)—were downgraded on the basis of historic investigations, lessons from other projects, and the expectation of future trials. These are not evidence-based mitigations. Timely disclosure of SESRO's own trial results would, if anything, demonstrate that uncertainty is considerably higher than assumed. Instead, the trial has been publicly described as a success while material operational difficulties—including leaks, saturation and delays—were not disclosed to stakeholders or RAPID, resulting in unjustified risk downgrading and a lack of transparency at a critical regulatory stage.

6.5.2 Deployable output suppression

Significant questions remain over the Deployable Output of SESRO (see section 3.1) This issue goes to the core of SESRO's justification within the WRMP, yet it was not made transparent to stakeholders and is not addressed in Thames Water's Gate 3 submission.

6.6 Exclusion of elected and expert stakeholders

As set out in the guidance from Ofwat and the Planning Inspectorate, a lawful consultation must be inclusive, accessible, and responsive to all affected parties. Thames Water's engagement with elected representatives, parish councils, statutory bodies and technical experts has been limited in scope, inconsistently documented, and not enabled meaningful participation.

6.6.1 Exclusion of MPs and local authorities

Three MPs, every affected district and parish council, and OCC have expressed clear and consistent opposition to SESRO, citing concerns over flood risk, cost escalation, safety and

[278] Savills (2024), "Section 73 Application to Vary Condition 11 of Planning Permission P23/V2559/FUL – Clay Compaction Trial, Cow Common", submitted on behalf of Thames Water.
[279] Ground Engineering (2025), "Reservoir renaissance: Clay trials advance Thames Water project in Oxfordshire", 12th August.

dam-breach implications, environmental impacts, the omission of viable alternatives, and procedural and transparency shortcomings. Yet Thames Water's Gate 3 submission:

- Mentions MPs only briefly and does not reflect the extent of their formal objections.
- Does not acknowledge motions passed by district and parish councils opposing SESRO[280].
- Provides no record of correspondence, meeting outcomes, or evidence of how feedback from elected representatives has informed design choices (except for one table in Appendix G which predominantly records deferral, promotional framing and non-committal responses).
- Does not reference the united cross-party call from local MPs and councils for a Public Inquiry—an indicator of the seriousness of the concerns and the level of trust breakdown.
- Does not summarise or engage substantively with the issues raised in correspondence, including the request by Layla Moran MP[281] for a transparent account of how Thames Water has considered consultation responses and how these have influenced decision-making.

Activities described by Thames Water to demonstrate engagement – email updates, newsletters, topic briefings, and invitations to public events – expose one-way communication, designed to inform not involve. This does not constitute meaningful engagement and is inconsistent with PINS Advice Note 11 (Annex A),[282] which identifies elected representatives as key statutory consultees, and with Ofwat's Public Value principles requiring inclusive and balanced participation.

6.6.2 Exclusion of technical experts

A further concern is the limited engagement with independent technical experts, including Professor Chris Binnie, one of the UK's most experienced reservoir construction and safety engineers. Despite repeated requests for technical dialogue: meetings were held only after consultation windows had closed[283]; Professor Binnie's expert safety report was not referenced or addressed in the Gate 3 submission; Dr Julian Parfitt's biodiversity analysis[284], which raises substantive questions about deliverability of BNG, largely proven correct by the

[280] See https://groupagainstreservoirdevelopment.org/#latest-news.
[281] Moran, L. (2024), Letter to Thames Water regarding SESRO consultation, 28th August.
[282] See footnote 254.
[283] GARD (2024), "Response to First Pre-DCO SESRO Consultation", 26th August.
[284] 2024-JPP report.

new large-scale land requirement in the DCO statutory consultation[285], was not acknowledged or discussed.

GARD has participated constructively for over two decades, supported by advisors with expertise in dam engineering, hydrology, biodiversity, water-resource planning and finance[286]. Treating GARD solely as a "*campaign group*," without substantive technical engagement, mischaracterises its role and seeks to limit the value of its contributions. Such an approach falls short of expectations for early engagement with expert stakeholders. It is also inconsistent with government NSIP engagement principles, which emphasise the importance of incorporating "*critical local and technical insight*" during early design stages.

6.6.3 Exclusion of downstream communities

Downstream residents—those most directly affected by emergency drawdown—were not consulted on structural safety, drawdown flows, evacuation feasibility, or local vulnerabilities. This absence of engagement does not meet Gunning Principle 3, particularly where issues may impact danger to life.

A downstream councillor recently contacted GARD for information after hearing concerns from residents in Hanney. The fact that affected residents are seeking information from third parties rather than the promoter highlights gaps in communication and a lack of trust in the consultation process.

6.7 Community feedback failure and quality of materials

Community engagement has been characterised by promotional content, selective presentation of information, and limited opportunities for stakeholders to provide meaningful input. Thames Water's Gate 3 Stakeholder Engagement Report[287] contains minimal reference to the substance of the community feedback and states that "*although the voices we hear the loudest oppose the scheme, they do not represent the overall community*", contrary to the evidence in their consultations and presented here.

Hundreds of community members have repeatedly responded to Thames Water's consultations over multiple years. The Wantage and Grove Campaign Group publicly noted a "*complete discounting of local residents' and organisations' views*" in the 2023 dWRMP24 consultation[288]. Many residents who submitted detailed written responses to the 2024 non-statutory consultation found that their comments were not reflected in the Gate 3 reporting, despite overwhelmingly negative feedback recorded by Ipsos during the analysis period.

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[285] DCO map book.
[286] GARD (2025), About GARD web page.
[287] Thames Water (2025), "Supporting Document G: Stakeholder and Customer Engagement Report", 21st July.
[288] Wantage and Grove Campaign Group (2024), "Response to the SESRO consultation – "complete discounting of local residents and organisations' views in the 2023 dWRMP24 consultation".

Cllr Povolotsky (VoWHDC, Steventon and the Hanneys) summarised widespread local sentiment:

> *"We have thousands of residents who have responded to consultations with genuine, evidence-led concerns, and yet their voices – a flood of voices – have been ignored. Local groups like CPRE Oxfordshire and SaferWaters are not saying 'not here'; they are saying 'do better'."*[289]

6.7.1 Barriers to meaningful input

At Gate 2, RAPID explicitly requested "*much more detailed community engagement*". In response, Thames Water produced a suite of promotional materials and held seven community events, however none of this provided structured or recordable mechanisms through which participants' views and community feedback could be meaningfully captured or used to influence design decisions. The "*legacy benefits*" perception-testing exercise was presented as though it constituted consultation evidence, despite not addressing issues of feasibility, safety or environmental impact.

The consultation questionnaires were tightly curated, focusing on illustrative design themes, access routes and speculative amenity concepts. They did not provide sections for stakeholders to comment on the issues of greatest concern to them. Ipsos's analysis of the non-statutory consultation[290] also shows that some participants relied on campaign templates because the consultation materials were highly technical and narrowly framed. This reliance reflects barriers to understanding, not organised bias. However, these responses were excluded from the quantitative analysis, leading to an under-representation (by c. 10%) of negative feedback in precisely those areas where stakeholders were attempting to comment on the issues most important to them.

Question 9 asks directly about: "*The process undertaken to identify infrastructure associated with the reservoir*". Of the 379 consultees who responded, only 26 (c. 7%) were positive or supportive, while 351 (c. 93%) raised concerns, in particular about how the process was planned and thought through (109); lack of consideration for local people and local communities (85); that local people/ communities had not been properly consulted (70); and that public opinion had not been fully taken into account (57)." This is clear evidence that the consultation process was lacking.

Thames Water's Statement of Response to the 2024 non-statutory consultation admits that there were over 500 complaints about the consultation itself – including the process and framing of questions; the lack of meaningful information; the misleading nature of images and visuals. The report states: "*However, not all the comments received relating to the*

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[289] Povolotsky, S. (2025), "Statement on SESRO Judicial Review Outcome", 24th July.
[290] Ipsos (2024), "South East Strategic Reservoir Option Consultation: Feedback Report", produced for Thames Water Utilities Ltd.

consultation were negative. There were 20 positive and supportive comments…"[291] That is barely 1.25% of responses.

Residents frequently report that they rely on GARD and other community groups for technical advice because they lack confidence in Thames Water's consultation materials, reflecting a persistent deficit of trust.

6.8 Promotional bias, imbalanced information

6.8.1 Substituting amenity marketing for transparent consultation on safety and feasibility

Thames Water has placed significant emphasis on speculative "*legacy benefits*" and amenities in both its Gate 3 submission and public-facing materials. These claims—covering paddleboarding, walking routes and leisure access—have been presented as alignment with Ofwat's Public Value Principles despite being uncosted and technically uncertain. This promotional focus displaced engagement on core issues repeatedly raised by stakeholders: safety, flood risk, biodiversity loss, cost justification, feasibility and alternatives.

This pattern reflects the shortcomings highlighted in Ofwat's 2022 Public Value Principles report[292], which noted wide variation in companies' maturity in delivering genuine public value. Thames Water's focus on early-stage leisure concepts, while substantive issues remain unresolved, exemplifies this gap. The 2023 Yonder Survey[293] provides a further example. Respondents were presented with a stimulus document stating that the Reservoir "*would play a crucial role*" in drought resilience and "*could*" provide leisure and wildlife benefits. No equivalent information was provided about safety, flooding, water-quality risk, cost, clay compaction or environmental impacts. Nevertheless, in its Gate 3 Supporting Document, Thames Water claims that: "*the majority of people within 5 km… support the reservoir*."[294] This is not a reliable reflection of informed public opinion. It is a measure of how effectively promotional messages landed, not an assessment of support for SESRO itself.

Promotional presentation of the Reservoir as a future public park is inconsistent with the infrastructure's scale and risk profile, and with disclosures elsewhere in the Gate 3 submission. Thames Water acknowledges serious water-quality issues[295] requiring aeration by two 200kW compressors – proposed mitigation likely to be insufficient for a reservoir of this scale (see section 3.5 and Appendix E) – yet stakeholders were not consulted on the

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[291] Thames Water, "Non-Statutory Public Consultation: Our Statement of Response", section 6.1.2, p. 36.
[292] Ofwat (2022), "Ofwat's Final Public Value Principles", March.
[293] Yonder (2023), "Community Research for Thames Water's WRMP Consultation", commissioned by Thames Water.
[294] Canvassing by volunteers for GARD in summer 2025 in Letcombe Gardens, less than half a kilometre from the proposed location of rail sidings, found that, of the c. 100 households visited, around one in ten knew absolutely nothing about the Reservoir when asked. They had not even heard about it.
[295] DWQRA report.

implications for water quality, amenity feasibility, public health or access restrictions. This disconnect between promotional messaging and operational reality undermines the credibility of the engagement strategy and falls short of Ofwat principles requiring openness about both positive and negative aspects, collaboration with communities, transparency about performance, and attention to risks as well as benefits.

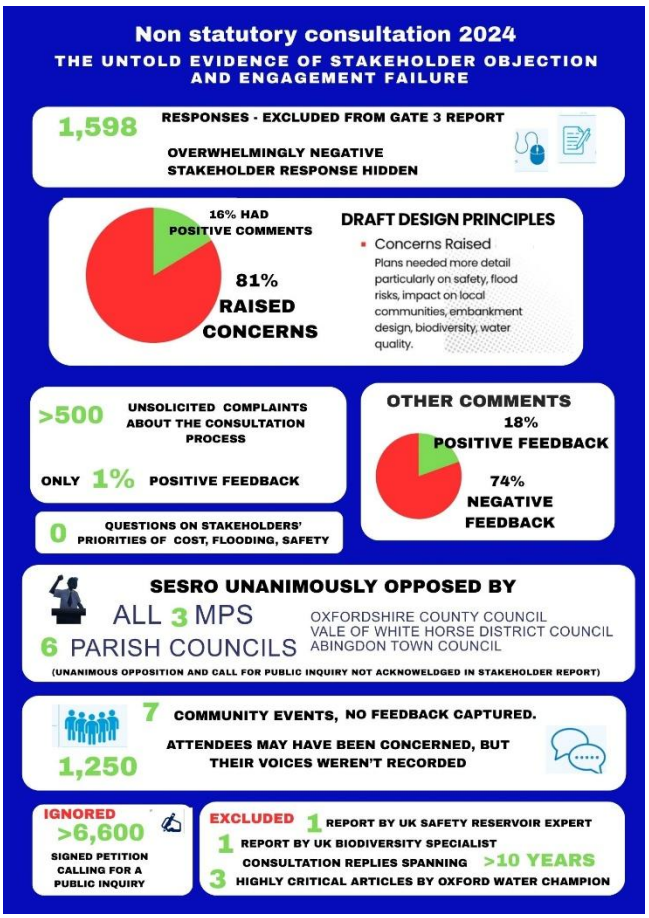
By substituting amenity marketing for transparent engagement on safety, feasibility, flooding, environmental risk and cost, Thames Water has not provided stakeholders with the information required for informed participation. Thames Water chooses to emphasise uncosted and premature leisure concepts rather than engage with the fundamental issues repeatedly identified by communities as critical to their assessment of SESRO. Thus, across all consultation windows, the concerns most frequently raised by communities[296] have been largely absent from consultation questionnaires and public-facing materials. These concerns must come before speculative surveys on leisure activities.

The consultation did not fulfil its core purpose under public-law standards: to enable informed participation and for feedback to influence emerging design. This approach does not meet the expectations in PINS Advice Note 11 (Annex B) for clear, balanced and accessible information.

[296] Relating to reservoir safety and dam-breach scenarios; flooding and groundwater risk; environmental harm and biodiversity loss; cost escalation, bill impacts and best value; consideration of alternatives; and long-term construction disruption.

6.8.2 Omission of feedback and evidence distortion

A central procedural failing is the exclusion of the results of the 2024 non-statutory consultation from the Gate 3 submission. The above-mentioned Ipsos analysis contains clear and significant levels of negative feedback. Thames Water did not publish analysis of these results nor disclose them to RAPID by Gate 3, despite being essential to understanding stakeholder views. As a result, it failed to meet RAPID's deadline and to demonstrate how this information influenced the project.



Crucially, the only places where stakeholders could comment on the substantive issues were the sections on design principles, the interim masterplan, and general comments, because the structured questions focused almost entirely on peripheral or promotional matters. It is therefore these sections that best reflect what stakeholders actually wished to raise. Across these key question areas, Ipsos reported overwhelming negative sentiment: **80% negative** on design principles; **65% negative** on the interim masterplan and **73% negative** in general comments. Negative feedback unrepresented by a factor of c. 10%, as any duplication of guideline text provided by GARD, where stakeholders had required guidance due to the opaque and technical nature of questions, was discounted.

Thames Water's *Statement of Response*[297]—which was *not* included at Gate 3—places greater emphasis on amenity and peripheral design issues and does not reflect the scale of substantive concerns recorded by Ipsos. Although Ipsos is more representative, the tightly framed consultation questions still limited direct expression of core issues. Together, these factors resulted in significant under-representation of stakeholder concerns in the material submitted for Gate 3, contrary RAPID's requirement for transparent reporting of stakeholder concerns and Gunning Principle 4.

[297] Thames Water (2024), "Non-statutory Public Consultation 2024: Our Statement of Response".

6.9 Regulatory compliance summary

Regulatory requirement	Standard	SESRO Performance (Gate 3)
RAPID – timing of Consultation	Non-statutory complete; statutory under way	Non-compliant (statutory began post-submission)
RAPID – de-risking before Gate 3	Safety, flood, cost data disclosed	Non-compliant (data withheld)
PINS Advice Note 11	Front-loaded, transparent, accessible	Non-compliant (promotional, opaque)
Gunning Principles	Information, fairness, conscientious consideration	Breached
Ofwat Public Value Principles	Transparency, inclusivity, customer impact	Breached

The compliance matrix shows systemic failure across ***every major regulatory standard***.

6.10 Conclusion: ethical implications and recommendations to RAPID

The evidence demonstrates that the SESRO stakeholder-engagement process does not meet the standards required for water-resource nationally significant infrastructure. Material information has not been made available, safety-critical risks remain unassessed at the formative stage, and stakeholder feedback– including overwhelmingly negative consultation results – has not been transparently reported. Flood risk, groundwater interaction, cost escalation, deployable-output uncertainty, biodiversity loss, and alternative-option comparison all remain unresolved. These deficiencies undermine procedural legitimacy, regulatory compliance, and public confidence.

Given the scale of withheld or deferred information, the persistence of red-rated feasibility risks, and the availability of lower-risk alternative solutions, SESRO does not currently meet the evidential threshold for progression through Gate 3.

To ensure transparency, accountability, and regulatory integrity, RAPID should require independent scrutiny before the scheme advances further.

7. Proposed actions by Regulators and RAPID

7.1 Proposed actions by EA and Ofwat

This report has provided evidence that the case for the need for SESRO, as presented in the water companies' recent WRMPs and WRSE's regional plan, has been fundamentally changed by the trebling of the capital cost of the SESRO, as revealed in the SESRO Gate 3 reports. Therefore, GARD welcomes the Regulators' instruction to the water companies to reassess the best value and affordability of SESRO by 22nd May 2026 and the supporting Priority Action Numbers 4 and 5 in RAPID's draft Gate 3 decision report. The scope of this reassessment was not defined in detail in the Regulators' letter to the water companies, but GARD proposes that it should include the following.

1. **A reassessment of the amount of abstraction reductions required to achieve "*Environmental Destination*" in the South East**, which should take account of:

    - The much higher cost of replacement water sources due to the trebling of SESRO's cost and its effect on the benefit-cost of *'Environmental Destination*', with due consideration of the possible disproportionate costs of compliance with the Water Framework Directive and the Habitats Directive legislation.

    - The impact of the abstraction reductions on customer bills and the acceptability of bill increases to customers, who should be properly informed of the magnitude and location of these reductions, the benefits they will bring to the rivers affected and the impact on their bills.

    - The potential groundwater flooding caused by rising groundwater levels following abstraction reductions, particularly on post-World War II housing developments in heavily urbanised valley bottoms.

    - The environmental impact of replacement sources like SESRO, when compared with the environmental benefits of the abstraction reductions.

    The Regulators should issue guidance to water companies on how this review is to be undertaken, including the assessment of benefit–cost, the applicability of Water Framework Directive and Habitats Directive legislation, the criteria for 'disproportionate cost' and the transparent determination of acceptability to customers. The timing of the review should be linked to the timetable for production of the water companies' draft WRMP29s.

2. **A reassessment of the amount of economically justified leakage reduction,** particularly of mains replacement, should be instructed, allowing for the trebling of SESRO's costs. This assessment should take account of the expected lifespan of

existing aged pipe networks and the saving in future capital maintenance cost due to early replacement of potentially leaky mains pipes.

3. **A reassessment of the need for the T2ST** should be undertaken, as proposed in Appendix A, section A1.3. This should include a proper and transparent assessment of the impacts of the continued use of drought orders and permits on the river flows and the ecology of the lower Rivers Test and Itchen, taking account of:

    - The optimised use of the Havant Thicket/recycling scheme to reduce the need for abstraction from the rivers at all times, not just in droughts.

    - The potential reduction of impact on the lower River Itchen by moving the existing abstraction near Winchester down to Gaters Mill.

    - The potentially disproportionate costs of abandoning the use of drought orders and permits, aggravated by the trebling of Southern Water's share of SESRO.

    - The environmental impacts of construction of SESRO and the T2ST pipeline, in comparison with the environmental benefits of abandoning use of drought orders and drought permits.

    - The impact of the T2ST on Southern Water customers' bills and the acceptability to customers, after they have been properly informed of the costs and potential benefits.

4. **A reassessment of the 'most likely' future deficits** and the range of future deficits to be used in adaptive planning, which should take account of:

    - The uncertainty in the abstraction reductions required for '*Environmental Destination*' after allowing for continuing concerns over affordability, potential groundwater flooding and customer acceptability.

    - The uncertainty of climate change impacts on source deployable outputs, taking account of evidence that increasingly wet winters are leading to more over-winter recharge of the chalk aquifers that provide a lot of the supplies in the South East and much of the summer base flows used to fill reservoirs.

    - The uncertainty in the population forecasts – upwards pressure from immigration and downwards pressure from declining birth rates – as well as the large difference between ONS forecasts and the local authority forecasts mostly used in current WRMPs.

5. **A comprehensive updating of the assessment of the best-value programme** for water resource development in the South East, which should focus on the supply zones previously intended to benefit from SESRO. Reassessment of a choice between

SESRO and the STT option should take account of not only the huge increase in SESRO costs, but the major changes in non-financial measures of best value resulting from the latest changes in SESRO design and scope.

The reassessment of the need for new sources in the South East should be completed before any decision on the DCO for SESRO and should be linked to the programme for the draft WRMP29s. If this work cannot be fully done in time for the reassessment of SESRO best value and affordability of SESRO by 22nd May 2026, as instructed by the Regulators, the reassessment should reflect this continuing uncertainty in its adaptive planning for new resource developments in the South East.

7.2 Proposed actions by RAPID

In addition to the Regulators' actions proposed above for reassessment of the need for SESRO and its size, it is proposed that RAPID should take the following actions in its oversight of the 'Gate' process for the SROs.

1. The Gate 3 decision report should require a reassessment of the costs of SESRO, taking account of the criticisms in Chapter 2 of this response and design changes since the Gate 3 report (see page 20 of GARD's pre-DCO consultation response)[298]:
    - The addition of a separate clay core in the embankment.
    - A new 11 km groundwater drain around the reservoir perimeter.
    - Extending the construction duration by 3 years to 2043.
    - The addition of 40 MW floating solar panels on the reservoir.
    - The proposed removal of 3.7Mm³ of topsoil from the site.[299]
    - A vastly expanded planning order area (now 38km^2) to allow for the requirements of BNG and flood alleviation.
2. The reassessment of the costs of SESRO should take account of the likelihood of further cost escalation as the currently 'indicative' design matures into a properly engineered scheme, with changes likely due to (with bracketed references to GARD's pre-DCO consultation response):
    - The findings of the full-scale trial embankment (pages 36–39).

[298] GARD (2026), "GARD response to SESRO pre-DCO consultation", 13th January.
[299] Thames Water (2025), "South East Strategic Reservoir Option: Preliminary Environmental Information Report: Non-Technical Summary", October.

- Unforeseen ground conditions when the full 6 km^2 of borrow pit is opened (pages 34–35).
- Extended construction duration due to wet weather, taking account of local and political pressure to refuse working outside core hours (page 89).
- The proper design of the reservoir inlet/outlet works, especially the emergency drawdown (pages 45–47 and 54–63).
- Increased highway up-grade costs, taking account of congestion shown by the latest traffic modelling (pages 104–108).
- Increased cost of achieving the BNG target once the proper habitat surveys have been done (pages 92–98).

At the very least, all of the above need to drive consideration of a big range of SESRO costs in the adaptive planning for the best-value reassessment.

3. We support Decisions 3 and 4 on page 12 of the draft Gate 3 decision report, requiring more engineering drawings to be provided, but propose that Recommendation 1 in Appendix A should be extended to make it clear that outline engineering design drawings should be provided for all the Reservoir infrastructure, including the dam embankment, the draw-off towers, pumping station, the outlet tunnels and the intake/outfall at the River Thames.

4. In view of the importance of water quality in the reservoir, the known problems and the lack of coverage in the Gate 3 and pre-DCO reports, the action on water quality in Appendix B of the Gate 3 decision report should be elevated to a priority action and strengthened to include clear technical descriptions of operational phase water quality, with an intermediate delivery date before Gate 4.

5. The Gate 3 decision report should require reassessment of the carbon usage of the Reservoir, taking account of the criticism of the previous carbon assessment in the Gate 3 report, as detailed in section 2.6 of this response.

6. Ofwat should commission a genuinely independent review of SESRO's DO, addressing the criticisms in section 3.1 of this response. As we say in section 3.1.8, in view of the entrenched position of the water companies on this matter, it is important that this review should be genuinely independent. Therefore, it should be commissioned by Ofwat, reported to Ofwat and paid for by Ofwat. It should be undertaken by an organisation not currently working for Thames Water.

7. The Gate 3 decision report should require a reassessment of the non-financial best-value metrics for SESRO, allowing for (with bracketed references to GARD's pre-DCO consultation response):

- Properly assessed air pollution, noise, and human health impacts, taking proper account of the scale and duration of use of the construction plant needed to build the 100 million Tonne embankment (pages 108–114).

- Properly assessed socioeconomic impacts, taking account of the doubling of land take, loss of farmland, closure of businesses, travel time delays (pages 115–117).

- Properly assessed landscape impacts, taking account of the greatly increased land-take and other changes since the Gate 3 report (pages 118–121).

- Realistic allowances for recreation and amenity benefits taking account of the likelihood of restricted access on security grounds (pages 80–82).

8. The draft decision on the SESRO Gate 3 report should require the development programme proposed for SESRO to be adjusted so that the reassessment of the need for SESRO is completed, including public consultation on it, before any decision on the DCO.

9. RAPID should also take urgent action to bring forward the completion of the STT Gate 3 report, which appears to have been allowed to drift due to mistaken water company and the Regulators' confidence in the previous estimates of SESRO costs.

7.3 The need for transparency in reassessing the case for SESRO

Although GARD welcomes the Regulators' actions in instructing a reassessment of the best value and affordability of SESRO by 22nd May 2026, the lack of publicity for this has been a failure in transparency. There has been minimal (if any) media publicity of the trebling of SESRO's cost and the Regulators' action, so the public are largely unaware of it. The lack of transparency has been compounded in the water companies' pre-DCO consultation brochure and supporting documents, which have misled the public into believing that the need for SESRO has been fully settled and is not open to further discussion – see Chapter 2 of GARD's pre-DCO consultation response, especially section 2.9 (on pages 27–28).

RAPID and the other regulators should publicly recognise that the trebling of SESRO's cost has fundamentally altered the plans for development of SROs in the South East. There should be an immediate and public statement that the huge escalation of costs between the SESRO Gate 2 and Gate 3 reports has undermined the credibility of the resource development proposals in the water companies' WRMP24s and necessitated a comprehensive and transparent review of the need for SESRO, which will affect the programme for development of SROs in the South East. This will affect the timing of the DCO process for SESRO.

In GARD's opinion, a public announcement on this matter is essential for restoring public confidence that the SRO programme is being properly and transparently managed by RAPID and the other regulators.

Appendix A Need for SESRO

A1 Summary of Appendix A

This appendix reviews the need for the Reservoir in the light of the trebling of its estimated capital cost from £2.2Bn in the Gate 2 report in November 2022 to about £6.6Bn in the Gate 3 report in August 2025. This large cost increase affects the need for the Reservoir in several ways.

- It affects the benefit–cost assessments of the large, planned abstraction reductions for "*Environmental Destination*", which comprise about half of the estimated water supply deficits to be met by the Reservoir. In effect, the costs of these abstraction reductions have also trebled, probably making many disproportionately costly and calling into question their value for money and affordability to customers.

- Similarly, it affects the value for money justification for the T2ST, for which about 30% of SESRO's DO is allocated, to allow reduced abstraction from the Rivers Itchen and Test in droughts.

- It affects the economics of leakage reduction measures because the replacement of some old mains pipes will now be more cost-beneficial than SESRO, particularly if savings in future capital maintenance are taken into account. More leakage reduction will reduce the need for the Reservoir.

- It affects the choice of the Reservoir as the best-value option – other options like the STT, wastewater recycling and desalination may now be better value than the Reservoir, particularly when taking account of the Reservoir's inability to adapt to uncertain future needs for more water.

Therefore, GARD proposes that the Regulators should instruct the water companies to undertake a comprehensive and transparent review of the need for new sources in the WRSE area. The review should include reassessments of the amount of abstraction reductions required to achieve 'Environmental Destination', the amount of economically justified leakage reduction, the need for the T2ST and a reassessment of the range of future deficits to be used in adaptive planning. This should be followed by a comprehensive updating of the assessment of the best-value programme for water resource development in the South East, taking account of the need for adaptability to cope with the continuing uncertainty in future deficits.

The reassessment of the need for new sources in the South East should be completed before any decision on the DCO for the Reservoir and should be linked to the programme for the draft WRMP29s.

In addition, it is proposed that RAPID should take the following actions[300] in its oversight of the 'Gate' process for the SROs:

- The draft decision on the SESRO Gate 3 report should require the development programme for the Reservoir to be adjusted so that the reassessment of the need for the Reservoir is completed before any decision on the DCO.
- There should be urgent action to bring forward the completion of the STT Gate 3 report, which has been allowed to languish because of misplaced confidence that SESRO is the best-value option for immediate implementation.
- The water companies should be required to issue an addendum to the documents issued for the statutory consultation on the DCO for SESRO, launched on 28th October, stating that, following the trebling of the cost of SESRO, the need for the Reservoir is being reassessed.

In GARD's opinion, there should be an immediate and public statement that the huge escalation of costs between the SESRO Gate 2 and Gate 3 reports has undermined the credibility of the resource development proposals in the water companies' WRMP24s and necessitated a comprehensive and transparent review of the need for the Reservoir.

A1.1 Introduction

A1.1.1 Purpose of Appendix A

As noted above, this appendix reviews the need for the Reservoir in the light of the trebling of its estimated capital cost from £2.2Bn in the Gate 2 report in November 2022 to about £6.6Bn in the Gate 3 report[301] in August 2025.

Although the need for the Reservoir has supposedly been established by the government's approval of Thames Water's and Affinity Water's Final WRMP24s (but not yet Southern Water's Final WRMP), the trebling of the estimated cost of the Reservoir between Gate 2 and Gate 3 has cast major doubts on both the selection of the Reservoir as the next major new source and the need for **any** major new source.

Therefore, this appendix makes the case for a thorough and transparent review of the need for SESRO, before any decision is made to proceed with the scheme.

[300] This appendix, and these recommendations, were communicated to the Chief Executive of the Environment Agency (Philip Duffy), the Chief Executive of Ofwat (Chris Walters), and the Managing Director of RAPID (Paul Hickey) by email letter on 10th November 2025.

[301] We note that this cost is at 2022–23 prices (the report's statement). If one adds the 7.5% inflation on construction costs, the 2024–25 equivalent figure is around £7.1 billion.

A1.1.2 Re-statement of need for SESRO in Gate 3 reports

The main Gate 3 document, reproduced below in Table A.1, provides a summary of the need for SESRO, referring to the four main drivers of the need for new sources identified in water company WRMPs, as below:

Table 2.1 Primary water resource drivers for increased demand for water

Driver	WRSE Implication
Future Population Growth	Results in the need to supply water to more customers. Forecast methodologies are contained in the UK Government's Water Resources Planning Guidance[3]. The impacted companies should plan for future population growth. WRSE uses the latest regional forecasts produced by the Office of National Statistics, local authority housing plans and estimates of the significant additional potential growth between Oxford and Cambridge.
Impacts of climate change	Forecast reductions in available flows in rivers or groundwater recharge, reducing the amount of water that can be supplied from existing water sources during droughts.
Impacts of existing abstractions	Taking water from rivers, streams and underground sources during periods of lower flow can cause damage to the environment. Water companies need to reduce how much they take from some of their most sensitive water sources to prevent damage in the coming years and help improve them. This reduces available supply. Under the Environment Agency's National Framework for Water Resources', regional water resource groups are required to explore and implement the steps required to achieve a shared Environmental Destination to reduce the most environmentally unsustainable abstractions.
Improved drought resilience	The Environment Agency's National Framework for Water Resources', requires companies to plan for a higher level of resilience to drought, so that restrictions such as rota cuts and standpipes will be needed no more than once every 500 years on average.

Table A.1 - Gate 3 summary of drivers of need for SESRO

The drivers of need for the Reservoir, shown in this table, were critically reviewed in GARD's responses to Thames Water's, Affinity Water's and Southern Water's consultations on their draft WRMP24s. The following sections of this response summarise GARD's previous criticism of the SESRO need case, taking account of the new information on the vastly increased cost of SESRO.

A fundamental part of GARD's criticism of the case for the need for SESRO is failure to follow the WRMP24 Water Resource Planning Guidelines' (WRPG) recommendation for adaptive planning to deal with uncertainties, with preferred programmes based on the most likely future[302]:

> *"When you produce a preferred plan, there are uncertainties. We therefore recommend using adaptive planning. In this concept, when we refer to a preferred programme, this can also be referred to as representing the 'most likely' future (based on the uncertainties) and the pathway through it. That is, the route through the adaptive planning you will most likely follow."*

In GARD's opinion, rather than producing preferred plans based on the "*most likely*" future, the water companies' preferred plans for WRMP24 were based on assumptions for

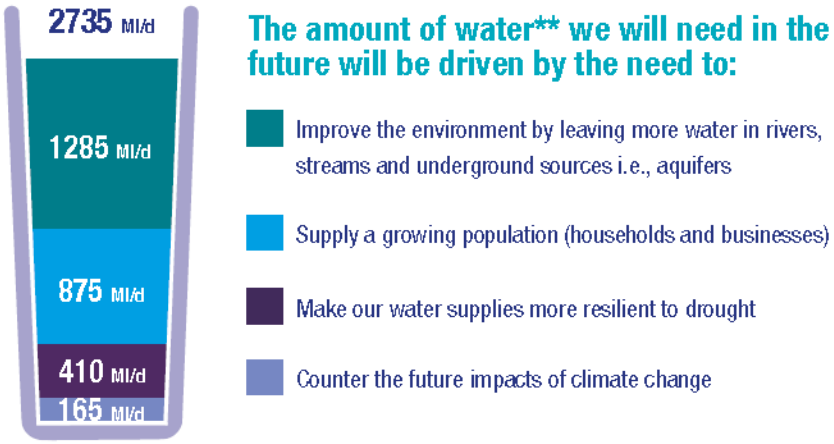
[302] Gov.UK (2023), "Water resources planning guideline", p. 3.

environmental destination, population growth and climate change, which are close to worst-case scenarios, and which are highly unlikely to materialise. This will lead to gross over-provision of new supplies, with consequent high costs, unnecessarily high customer bills and irreversible environmental impacts from the new supplies. The failure to produce adaptive plans for the "*most likely*" future is a recurring theme in our comments on the various drivers of the need for SESRO in the following sections.

A1.2 The need for SESRO to enable abstraction impact reductions

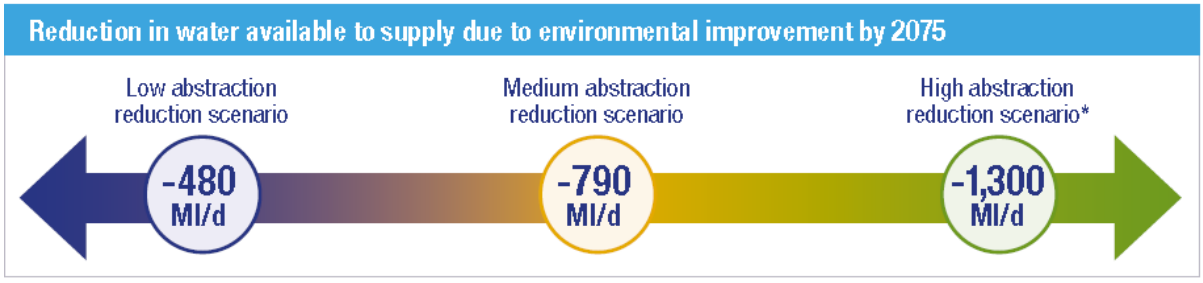
A1.2.1 Abstraction reductions planned for WRMP24 in the South East

Abstraction reductions to improve river flows and ecology account for 1,285Ml/d of the total 2,735Ml/d of the WRSE's forecast water supply deficits in the South East, as shown below:



* By 2075, we need to find alternative sources for 1.2Bn litres of this water to protect the environment and an additional 1.5Bn litres of new water to secure the region's public water supplies.

* * The figures used in this graphic represent the pathway of our adaptive plan that aligns with the requirements of the WRPG.



* The high abstraction reduction scenario reflects the EA's BAU+ projection plus locally agreed reductions in certain zones.

Source: Upper graphic and notes: WRSE's Non-Technical Summary to its Final Plan, June 2025, page 4; lower graphic and notes: https://www.wrse.org.uk/media/opanojjv/wrse-final-regional-plan-non-technial-summary-june-2025.pdf, page 5.

Figure A.1 - Drivers of demands for more resources in WRSE's Final Regional Plan

The 1,285Ml/d of abstraction reduction scenario assumed by WRSE and the water companies in their Final Plans is at the upper end of the range of reduction scenarios considered. Much of the reduction would be in areas which would be served by the Reservoir. The 1,285Ml/d of lost supply is equivalent to nearly five SESROs, with a cost of about £33 billion, based on the Gate 3 SESRO cost of about £6.6 billion.

The High abstraction reduction scenario is based on the EA's assessment of the **potential** need for abstraction reductions to achieve compliance with Environmental Flow Indicators (EFIs), whilst saying it is the water companies' responsibility to decide what abstraction reductions to include in their plans, taking account of costs and benefits[303]. However, the water companies have included **all** the EA's potential reductions, saying they have followed EA guidance that full EFI compliance is necessary for Water Framework Directive (WFD) compliance[304].

There was no benefit–cost assessment to justify the new resources needed to replace the 1,285Ml/d of abstraction reductions in the water companies' Final WRMP24s. Moreover, the EA states in its "*Environmental Destination technical report - June 2025*", appended to the government's National Water Framework:[305]

> *"There has been no assessment of the actual ecological benefits that flow compliance [abstraction reductions] would deliver, or of their total cost, best value timing or affordability."*

The trebling of the costs of SESRO in the Gate 3 report has made the need for a proper benefit–cost assessment of the abstraction reductions even more urgent.

The need for consideration of lower abstraction reduction scenarios (Environmental Destination) is reflected in WRSE's July 2025 letter to the EA on the recently published revised National Framework for Water Resources, which stated[306]:

> *"We will be submitting separate feedback to your colleagues on the draft Environmental Destination guidance. Given the scale of investment that the Environmental Destination scenarios have and could continue to drive, we believe the guidance could be enhanced by allowing more flexibility in approach, and that by considering different scenarios will enable the identification of better long-term solutions for the environment."*

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[303] Environment Group (2024), "EA response to GARD FoI request for details of abstraction reductions", 3rd June, p. 4, email reference NR355420.
[304] Thames Water (2024), "Water Resources Management Plan 2024, final report", section 5 – Environment Forecast, paragraph 5.19. (Henceforth 'TW WRMP'.)
[305] Gov.UK (2025), "National Framework for Water Resources 2025: water for growth, nature and a resilient future", Appendix C, p. 35.
[306] WRSE letter to Environment Agency on the new National Framework for Water Resources, p. 2, 18th July 2025.

WRSE's follow-up letter to the EA about its guidance on Environmental Destination includes these statements[307]:

> *"we feel the guidance could be enhanced by setting out […] which element of the bundled up Environmental Destination scenarios are subject to cost benefit analysis, and which are legally required"*

"There should also be a clear and transparent process for incorporating the findings from these [individual reduction] investigations into the finalisation of the Environmental Destination programme, to ensure that investments are justified and provide tangible benefits."

> *"We consider that it is important for the EA to share the underlying information and calculations [on amounts of ED] with all abstractors so the data is used is transparent and they can scrutinise it and check it against their own understanding."*
>
> *"It is essential to understand this breakdown [whether or not reductions are legal requirements] to provide companies and regional groups with the necessary information to allow them to undertake cost benefit analysis where necessary.*
>
> *If this information is not available, then it will introduce a vulnerability into all the investment decisions that follow on from complying with these targets. We consider that this legal vulnerability could be reduced, if not eliminated, by clearly setting out a better breakdown of the ED numbers per category of driver stating which are a legal requirement and which are subject to a cost benefit analysis."*
>
> *"We are concerned that, under the current guidance, there is a risk that most abstraction reductions will default to the 'fastest technically possible' pathway. This could overlook important considerations such as cost, affordability, and uncertainties in existing information."*

GARD wholeheartedly supports the sentiments in WRSE's letter. However, regarding whether or not abstraction reductions are legal requirements (e.g. compliance with the Water Framework or Habitats Directives), we believe that the matter of disproportionate costs will also need to be considered, even for the reductions deemed to be a legal requirement. The need to consider disproportionate costs has become much more relevant with the Gate 3 trebling of SESRO costs.

A1.2.2 GARD assessment of need for abstraction reductions

GARD totally supports the urgent need to re-naturalise flows in iconic chalk streams, especially those that have been severely impacted in the Chilterns, the Darent catchment and to the west of London. However, the High scenario abstraction reductions in WRMPs go

[307] WRSE letter to Environment Agency on Environmental Destination Guidance, 18th July 2025.

far beyond these iconic rivers, often including canalised, lower reaches of rivers in urban environments, where the river ecology is not dependent on river flow. In total, GARD considers that it would be appropriate to allow for a total 255Ml/d of net DO loss from the Thames Valley supplies of Thames, Affinity, South East and Sutton & East Surrey water companies. This compares with WRSE's allowance of 758Ml/d deployable output loss for these four companies from their Thames Valley supplies. Hence, the amount of required abstraction reduction in the SESRO supply areas has probably been over-estimated by about 500Ml/d (excluding the areas supplied by the Thames to Southern transfer)[308].

GARD's anticipates that the "*most likely*" abstraction reductions, after proper assessment of costs and benefits, would include **all** the proposed High scenario abstraction reductions for ecologically sensitive rivers in the SESRO supply areas, comprising the Colne and Lea tributary chalk streams, the upper and middle River Lea, the upper and middle River Darent, the Thames tributary chalk streams and Cotswold limestone rivers. However, the cost–benefit assessment is likely to exclude the large reductions planned for the lower reaches of the Rivers Colne, Lea and Darent, and in other locations where GARD thinks it unlikely that the reductions would be justified by a proper benefit–cost analysis, taking account of the environmental impact of replacement sources.

Even for the proposed reductions in potentially iconic chalk streams, there are likely to be constraints on how much abstraction can be reduced, because of the risk of groundwater flooding, particularly in catchments where there has been a lot of recent housing development in the bottom of valleys. This adds to the likelihood that abstraction reductions will turn out to be a lot less than indicated by strict compliance with EFIs.

A reassessment of planned abstraction reductions should also take account of the environmental impact of replacement sources. In our opinion, it defies common sense to suggest that the currently planned abstraction reductions, mostly affecting rivers that are not iconic chalk streams, bring more benefit than the environmental impact of five SESROs or other equivalent water sources.

GARD believes that a detailed and transparent review of the need for abstraction reductions should be a key part of the review of need for the Reservoir before any decision is made to proceed with the Reservoir. We propose that inclusion of this review into the SESRO development programme should be specified in RAPID/Ofwat's decision on the draft Gate 3 report.

A1.3 The need for the Thames to Southern transfer

GARD recognises that the Rivers Itchen and Test are the crown jewels of England's iconic chalk streams, but this should not mean that any impact on the rivers, however slight or

[308] GARD (2023), "GARD response to WRSE's consultation on their draft regional plan", pp. 30–31.

temporary, must be prevented regardless of cost. The trebling of the cost of the Reservoir is, therefore, highly relevant to the justification of the T2ST.

The T2ST is not needed to deal with public supply shortages due to population growth, climate change or local reductions in chalk groundwater supplies (particularly for Portsmouth Water) – these needs are to be met by leakage reduction, demand management (e.g. smart metering) and the new 60–90Ml/d Havant Thicket reservoir, combined with a new scheme using recycled Portsmouth sewage effluent. The Havant Thicket/recycling scheme will also allow substantial reductions in the Rivers Itchen, Test and other chalk streams at all times, including severe droughts. The T2ST is only needed to allow discontinuation of use of drought orders and permits, perhaps once in 50 years[309].

Southern Water's only justification for not continuing to use drought orders is an incorrect assumption that it is required by the WRPG[310.] It has ignored Ofwat warnings of the excessive cost of abandoning use of drought orders and the impacts of replacement supplies such as the T2ST and SESRO, as below:[311]

> *"It [Ofwat] considered that WRSE should explore the cost, benefit and option selection impact of retaining the use of some drought orders and permits beyond 2040. It stated this was important to avoid unnecessary costs from resource development and to avoid the associated environmental impact that the additional development likely to arise from ruling out the use of drought orders and permits could bring."*

The trebling of SESRO costs has made the abandoning the Test and Itchen drought permits even more questionable.

When pressed for evidence of impacts of continuing to use drought orders, Southern Water provided reports showing that the impacts would be mostly rare, minimal and temporary. Only a relatively minor drought order for the Candover drought scheme carried enough risk to justify its discontinuation[312].

The T2ST scheme and Southern Water's 30% share in SESRO, at its greatly increased Gate 3 cost, would have a capital cost of about £3 billion. WRSE's assessed benefits for the Rivers Itchen and Test are only £29 million[313]. The T2ST pipeline would have adverse impacts on the

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[309] GARD (2024), "GARD response to Southern Water's consultation on its revised draft WRMP24", October, pp. 23–24.
[310] Ibid., p. 48.
[311] WRSE (2022), "Emerging Regional Plan Water Resources South East: Consultation Response Document", May, paragraph 13.4, p. 40.
[312] GARD (2024), "GARD response to Southern Water's Consultation on Revised Draft Water Resource Management Plan", pp. 48–57.
[313] Ibid., p. 61.

North Wessex AONB, several protected sites and a number of ancient woodlands, which offset the minimal benefits achieved for the Rivers Itchen and Test[314].

The existing lower Itchen abstractions affect river flows for about 10km downstream of Winchester, all of which is heavily used for salmon spawning. These impacts, and general impacts on the lower river ecology, could be entirely eliminated, in times of normal operation as well in droughts, by moving all the lower Itchen abstractions down to Gaters Mill. The cost of this would be a fraction of the £3Bn for the T2ST plus SESRO. The benefits to the Itchen SAC would be much greater than those of the T2ST because they would be all year, every year, and not just for a few months perhaps once in 50 years[315].

In GARD's opinion, the T2ST scheme should be abandoned because of its small benefits and excessive cost. The rare, minimal and temporary impacts of using drought orders should be mitigated by habitat and water quality improvements and moving some Itchen abstractions downstream, using some of the £3Bn saved by scrapping the T2ST.

We propose that the Regulators should now call for a transparent review of the need for the T2ST. RAPID should insist that this is allowed for, prior to the SESRO DCO, in the development programme for the Reservoir. The review should include a proper assessment of the impacts of future water supplies on the flows in the lower Rivers Test and Itchen, with the continued use of drought orders and permits, but taking account of optimised use of the Havant Thicket/recycling scheme to reduce the need for abstraction from the rivers. The review of the need for the T2ST review should be undertaken before any decision to proceed with SESRO.

A1.4 Population growth

In 2024, GARD commissioned a review of Thames Water's and Affinity Water's WRMP24 population forecasts from Mr Neil Tiley of Pegasus Group. A copy of Mr Tiley's report is available from GARD on request. Mr Tiley's report showed that the population forecasts are flawed because:

- they are based on local authority plan housing growth forecasts which have been repeatedly shown to substantially exceed actual delivery of new housing.
- they don't allow for reduced housing occupancy as more homes become available.
- they don't take account of plans for "levelling up" that will focus housing and population growth away from the South East.

[314] Ibid., pp. 63–69.
[315] Ibid., pp. 79–80.

Mr Tiley's report proposed that population growth forecasts should be based on the ONS 2018 population forecast data, with consideration of a range of forecasts for adaptable planning, as for Thames Water's total population below:

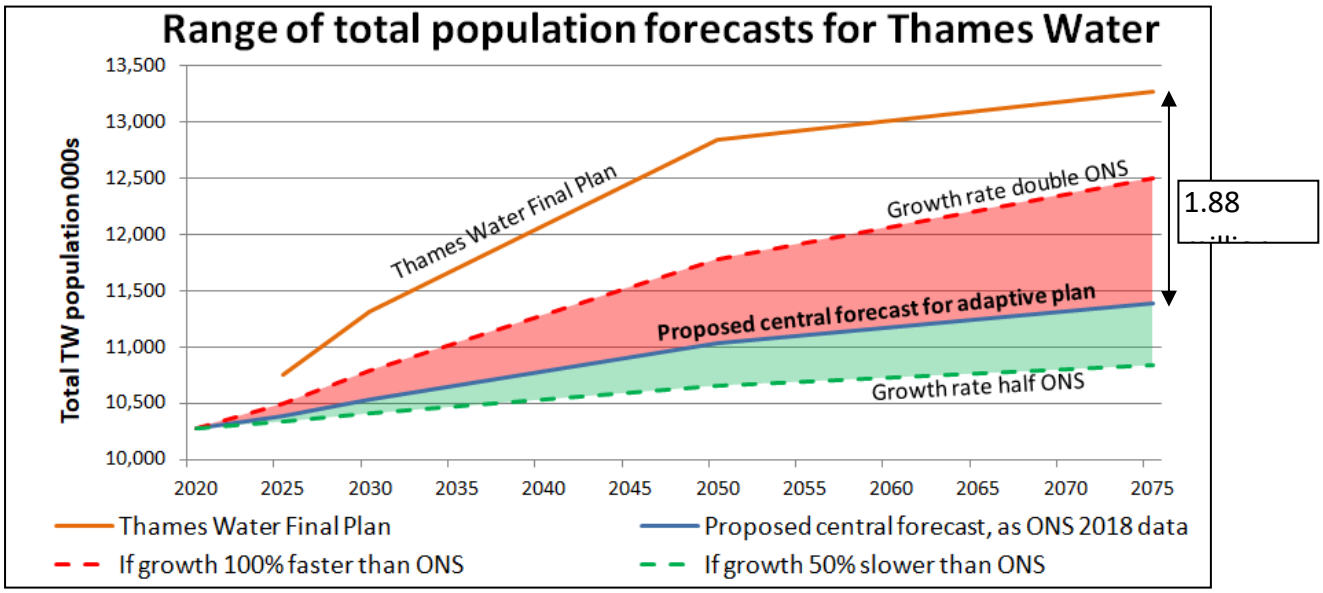


Figure A.2 - Potential range of total population forecasts for Thames Water

Figure A.2 shows the extent by which population forecasts based on local authority planned housing growth would exceed the official ONS forecasts. The 1.88 million population difference in 2075 is equivalent to 225Ml/d of household supply. There is a similar pattern in all Thames Water's and Affinity Water's supply zones potentially served by SESRO:

Water resource zones	2075 population over-forecast ('000s)	Demand over-forecast (Ml/d)
Thames Water London WRZ	1,397	168
Thames Water SWOX WRZ	267	32
Thames Water Thames Valley WRZs	216	26
Total for all Thames Water zones	1,880	226
Affinity Water WRZs 1-6	748	90
Totals for zones supplied by SESRO	2,627	315

Figure A.3 - Over-forecasting of population and household demand in zones served by SESRO

Assuming a per capita consumption of 120 litres per head per day, the total over-forecasting is equivalent to a household demand of 315Ml/d – well in excess of Thames Water's estimated 271Ml/d DO of the proposed Reservoir.

Although there is considerable uncertainty in the population forecasts – upwards pressure from immigration and downwards pressure from declining birth rates – in GARD's opinion, the forecasts used in Thames Water's and Affinity Water's Final Plans greatly exceed the "*most likely*" future, which the WRPG says should be the basis of preferred plans.

A1.5 Climate change

In its Final WRMP24, Thames Water considered a range of scenarios for climate change impacts on its existing supplies, as below[316]:

Total 64Ml/d difference between High and Medium

	London	SWOX	SWA	Kennet Valley	Total
High Impact (Ml/d)	-168	-13.2	-0.4	-4.7	-186.3
Medium Impact (Ml/d)	-110	-7.9	-0.2	-3.8	-121.9
Low Impact (Ml/d)	-39	-5.4	-0.1	-3.1	-47.6

Note: Thames Water assumed zero climate change impact for Henley and Guildford zones, which are mainly supplied by groundwater.

Figure A.4 - Scenarios for 2070 climate change impacts on existing DO in the final Thames Water WRMP

In its Final WRMP24, Thames Water described its selection of climate change scenario for planning future supplies as follows[317]:

"Thames Water, aligned with the WRSE Regional Group, has considered a 'median' climate change scenario as the central forecast"

Selection of the Medium impact scenario for climate change would have been consistent with the WRPG advice to plan for the most likely future. However, for the actual deficit forecasts in the WRMP Tables, Thames Water assumed the **High impact** climate change scenario from 2040 onwards[318], contrary to the WRPG advice. The assumption of the High climate change scenario after 2040 adds 64Ml/d to Thames Water's 2070 deficit. The same use of incorrect climate change scenario was shown in its earlier draft WRMPs. In GARD's opinion, this is a serious error in Thames Water's plan that the Regulators should have picked up.

In GARD's opinion, even the Medium Impact scenario shown in Figure A.4 above is likely to be a substantial over-estimate of the climate change impact on Thames Water's supplies. Although we believe unreservedly that major climate change has already occurred and will continue to be a worldwide threat, it does not necessarily mean that the impact on all water

[316] TW Final WRMP24, Table 4-19.
[317] TW Final WRMP24, paragraph 4.191.
[318] TW Final WRMP24, WRMP Tables, rows 33 in zonal balance tabs.

supplies is negative. In fact, evidence suggests that climate change to date has **increased** the availability of water supplies for London.

Thames Water's modelling of existing London supplies shows that the three most severe droughts of the past 100 years, in terms of impact on London's supplies, were in 1921, 1934 and 1944 – all at least 80 years ago[319]. Thames Water's most severe drought of the past 80 years, in 1976, was appreciably less severe than the earlier droughts, in terms of its impact on London's supplies. Droughts since 1976, including those of the past decade, have all had relatively little impact on Thames Water's supplies. Droughts of the type that would affect London's supplies – i.e. two summers and a winter – have become less frequent and less severe, because winters are becoming wetter, as is widely perceived from increased winter flooding and shown by rainfall data such as the example below[320]:

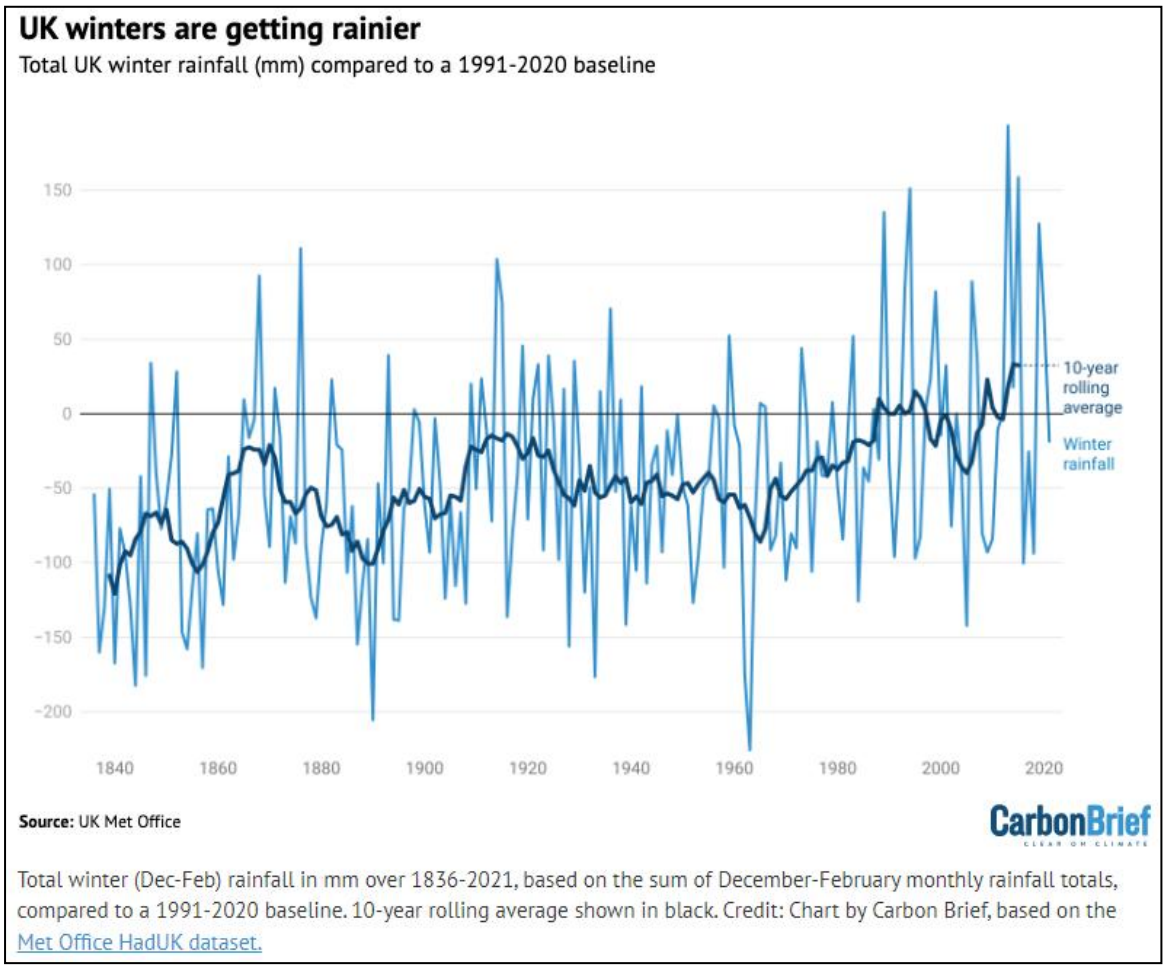


Figure A.5 - Winter UK rainfall trend since 1840

The Carbon Brief report referred to above also notes that 7 of the 10 wettest winters in the UK have occurred in the past 35 years and comments that this makes sense because, as the

[319] GARD (2023), "GARD response to TW's draft WRMP24", 21st March, section 2.4.2 and Figure 10.
[320] Carbon Brief (2024), "Analysis: How UK winters are getting warmer and wetter", February.

atmosphere heats up, it is able to hold more moisture, which can then fall as rain. The increasing trend in winter rainfall improves the resilience of London's supplies in the multi-season droughts which govern their deployable output. The winter rain is stored in the chalk aquifer and released slowly through the summer, raising drought flows and reducing the rate of depletion of the London reservoirs.

If the DO of London's existing supplies is determined only using the 80 years of river flow records since the 1940s, modelling shows that it **increases** by more than 200Ml/d, compared with the DO assessed using historic records since 1920[321].

In GARD's opinion, the realistic range of climate change impact on the DO of Thames Water's supplies can lie between a **gain** of 200Ml/d and the High impact scenario loss of 186Ml/d. By adopting the High impact scenario loss in its preferred plan, Thames Water has assumed a highly improbable worst case.

The large conceivable range of climate change impacts on Thames Water's supplies is a strong argument for selecting a highly adoptable scheme like the STT as the next major source for the South East, rather than the totally inflexible 150Mm^3 SESRO.

A1.6 Economic case for more leakage reduction

The trebling of SESRO cost affects the comparative economics of leakage reduction versus SESRO, thereby justifying more mains replacement, more leakage reduction and, therefore, less need for SESRO.

In considering the economics of mains replacement, there ought to be recognition that the pipe networks have a finite life (and a lot of existing pipes are more than 100 years old), so sooner or later all pipes will need to be replaced as part of "capital maintenance". Therefore, if pipes are being replaced to reduce leakage, there is a saving in future capital maintenance cost which should be credited to the leakage options when comparing with SESRO.

If this is properly taken into account in the water companies' "best value" programmes, there will be more leakage reduction justified and a corresponding fall in the need for SESRO.

A1.7 Uncertainty and the need for adaptability

The preceding sections have highlighted the large uncertainty in the estimates of the drivers of need for new resources due abstraction reductions, population growth and climate change. In GARD's opinion, the lower ends of the ranges for these drivers are the most likely outcome. We think that the upper ends of these ranges, as adopted in the water companies' WRMP24s, are extremely unlikely to occur, especially in combination. Therefore, the present

[321] GARD (2023), "GARD response to TW's draft WRMP24", 21st March, p. 39 and Figure 12.

WRMPs, which have determined the supposed need for SESRO, have utterly failed to follow the WRPG advice to plan for the "*most likely*" future.

The estimates of need for abstraction reductions, including the need for the Thames to Southern transfer, are a particular concern because of the trebling of the cost of SESRO in Gate 3. This has fundamentally affected the benefit-cost and customer affordability of the planned abstraction reductions.

The recent letters from WRSE to the EA calling for clarification of the legal requirement for Environmental Destination and associated benefit-cost analysis, referred to in Section 2.1 above, is an indication that water companies are pushing back against the blanket imposition of abstraction reductions based on the EA's EFI methodology. There are also growing concerns about the effect that the planned abstractions will have on groundwater flooding in urban areas. In our opinion, the most likely outcome of all this is that the eventually agreed abstraction reductions will turn out to be far less than currently planned.

The trebling of the cost of SESRO will also have a fundamental effect on the economics of mains replacement for leakage reduction, especially if the savings in future capital maintenance are considered in best value assessments. This will further reduce the need for SESRO.

In these circumstances, we think it is essential that a review of the need for SESRO, should be part of the process of deciding whether to proceed with the scheme. The government and the Regulators have urged the water companies to be adaptable in their plans. The trebling of the cost of SESRO should trigger a re-think by the water companies in the development of their next draft WRMPs due by the end of 2028, affecting the need, timing and choice of new resources. We propose the RAPID/Ofwat should recognise this in their draft decision on Gate 3 by calling for the SESRO development programme to include the review of need prior to the formal DCO process. The timing should be linked to the programme for the draft WRMP29s.

A1.8 The need for re-evaluation of the STT vs SESRO choice

The uncertainty in future needs for water highlighted in the previous sections has demonstrated the importance of having a resource development programme that is adaptable to uncertain needs. In our opinion, the choice of the 150Mm^3 SESRO as the next major new source in the Thames valley only makes sense if there is a high degree of confidence that the deficit forecasts in current WRMP24s are genuinely the "*most likely*" future. In the light of the trebling of SESRO costs and its effect on the benefit-cost of planned abstraction reductions and leakage reductions, this is no longer the case (if it ever was).

The STT scheme is far more adaptable than SESRO to uncertain future needs – an initial scheme of, say, a 300Ml/d aqueduct with some support from Netheridge effluent recycling

could be followed by successive increments of support from redeployment of Vyrnwy reservoir and recycled Minworth effluent.

Trebling of the cost of SESRO will fundamentally change the comparison of its costs with the STT scheme. Therefore, we propose that RAPID/Ofwat's decision on SESRO Gate 3 should include a requirement for the reassessment of the cost and benefits of SESRO vs STT prior to any decision on the Reservoir.

There should also be urgent action to bring forward the completion of the STT Gate 3 report, which appears to have been allowed to drift due to mistaken water company and regulator confidence in the previous estimates of SESRO costs.

Appendix B Summary of Gate 3 Design Changes since Gate 2 with GARD Comments

To assist the GARD investigation into the reasons for the threefold increase in the SESRO reported cost estimate from £2,745M to £6,604M, the key changes in the design since the issue of Gate 2 proposals (as described in the Gate 3 – Design Report) have been reviewed, with GARD comments added in the final column of

Table B.1 and additional GARD notes at the foot of the table.

Table B.1 - Summary of design changes since Gate Two with GARD comments

Ref	Asset	Changes Since Gate Two	Explanation	GARD comments
1.	Reservoir	Reservoir shape, embankment heights and borrow pit profile remain similar to Gate Two. Interpretation of the ground has been updated, slightly lowering the foundation elevation of the dam and leading to the inclusion of a 'dig and replace' trench within the dam foundation. It has also led to increased instrumentation within the dam to enhance monitoring during construction. General engineering design development has led to changes in thicknesses and gradings of internal drainage and inner face protection zones, updated (increased) settlement allowance and removal of the wave wall.	1) Reinterpretation of ground model has included re-evaluation of the level of the bottom of periglacially disturbed material – this has the effect of lowering the level of the general dam foundation (therefore increasing fill volumes) and reducing the proportion of borrow pit excavation which can be used as 'structural fill'. 2) Reinterpretation of the ground has lowered the assumed strength of the upper part of the dam foundation, which is to be mitigated through inclusion of a 'dig and replace' trench under the inner shoulder of the embankment. A1 - Basis of Design Report, page 28, Asset Changes Since Gate Two Explanation Following	Increase in the cost estimate for the Reservoir earthworks element from Gate 2 £907M to Gate 3 £1,939M is £1,032M or 114% at base estimate level. Agreed that Reservoir shape, bank profile and borrow pit profile under the Gate 3 design remains similar for Gate 2 proposals. See also separate GARD drawing review compares the Gate 2 drawing with the Gate 3 drawing. Changes in the Reservoir design since Gate 2, with explanations given under items 1 to 8 are all considered design development changes and are typical ground condition and excavation risk type items, which become apparent as more and better details emerge – see

Ref	Asset	Changes Since Gate Two	Explanation	GARD comments
			ground investigation during Gate 3 the design of the structural embankment has been developed to include a core. There have been some changes to the landscape scheme that affect the external face of the Reservoir embankments and the location of floating islands. The project design continues to achieve a cut and fill balance to minimise import and export of construction material. 3) The Reservoir now also includes enhanced instrumentation to enable monitoring of movement and porewater pressures in the dam foundation during construction and operation. 4) An updated assessment of the expected settlement of the embankment has increased the end of construction crest level slightly, increasing fill volumes. 5) The width of the chimney drain has increased, and its alignment changed from vertical to sub vertical, in response to comments from the independent SESRO Reservoir	highlighted reference to ground investigation. Item 1 under the explanation field is a good example, of a typical variable excavation works risk item, with following ground investigation work the depth of reduced level excavation under the dam to formation level subsequently increased. Normal three point estimating methodology is to prepare three different estimates: optimistic estimate, pessimistic estimate, and most likely estimate. For depth of reduced level excavation under the dam this could be calculated as below: • Optimistic estimate 1.50m deep, • Pessimistic estimate 2.50m deep, • Most likely estimate 2.00m deep. With the base estimate established by using the most optimistic value, using a risk value tool the risk allowance can be established for items. The risk value tool takes account that not all risks may occur and if they do occur the impact may vary. The OB allowance should be sufficient to allow for any shortfall in the risk

Ref	Asset	Changes Since Gate Two	Explanation	GARD comments
			Advisory Panel, increasing volume of filter sand. 6) Riprap sizes on the inner face have been updated in response to updated climate change allowances on windspeeds and updated fetch lengths. 7) The wave wall has been removed due to updated assessment of wave overtopping. 8) Further discussions with landscape stakeholders, landscape character assessments and development of design principles has informed updates to the landscape design.	allowance or cover risks or changes which develop as the project moves forward and evolves towards final design proposals. Noted that under Gate 3 both the risk and OB allowances have in cash terms substantially increased which goes against normal project evolution, where the reverse should occur, i.e. risk and OB allowance normally reduce to reflect the improving project maturity. It is considered all the items 1 to 8 here are typical design development items, which if the base estimate had been sufficiently robust together with an appropriate risk and OB allowance, it should not have resulted in a major total cost estimate increase such has occurred. It should be noted that the results of the recent CCT trial may further impact on the embankment design and the cost estimate and project completion date as currently reported.
2.	Reservoir Air Diffuser Network	Limited design of the Reservoir air diffuser network had been carried out prior to the Gate Two submission. Some initial concept	The design includes an air diffuser network to ensure water quality. The design has had minor updates and will be updated again before gate four / DCO submission.	The design for this item is described as having had miner updates, if this is the case it is considered any increase in the cost estimate should have been able to be absorbed within the Gate 2 risk

Ref	Asset	Changes Since Gate Two	Explanation	GARD comments
		level design has been undertaken as part of Gate Three.		allowance and should not have resulted in an overall increase in the subsequent Gate 3 estimate for this item.
3.	Conveyance: Operating Requirements	Changes to key operating requirements of the conveyance system.	1) Introduction of the requirement for the Reservoir to be able to release flows to WTWs at the same time as filling the Reservoir from the River Thames. At gate Explanation two the release was only to the River Thames. 2) Requirement for the conveyance system to be able to pass the full emergency drawdown flow without the need for an ADC. As documented in the Connectivity to the River Thames Options Appraisal report.	It is agreed this is a change in requirement with the base estimate adjusted accordingly. Nevertheless, in agreeing to this it should be remembered that the justification under Gate 2 for selection of the 150Mm³ Reservoir over the 100Mm³ scheme was that it would provide water supplies to Southern Water. The Gate 2 base estimate should therefore have included some allowance for releasing flows to WTW's whilst at the same time filling the Reservoir.
4.	Conveyance: River Intake/Outfall Structure and River Tunnel (between SESRO pumping station and the River Thames)	The preferred intake/outfall structure location has moved approximately 240 metre upstream from the Gate Two location. The river tunnel alignment has been updated accordingly. The river tunnel internal diameter has increased from 4.2m to 6m. A 1.4km length of secondary lining has been introduced to the river tunnel. Increase to the size of intake / outfall structure. Review and update of the plant / process	1) The change to intake / outfall structure location was informed by option appraisal (see Connectivity to the River Thames Options Appraisal report). 2) To pass the full emergency discharge the internal diameter of the river tunnel increased from 4.2m to 6m. Design development of the larger diameter tunnel indicated secondary lining of a 1.4km length is required.	See also following item 8 for comments on the conveyance tunnel estimate. Intake/outfall structure estimate costs under Gate 3 is at £6M compared to £25M for Gate 2, an increase of £38m or 153% at base estimate. Notes 2 & 3 under the explanation field are all linked to the omission of the ADC. Explanation Items 5 and 6 are considered design development changes.

Ref	Asset	Changes Since Gate Two	Explanation	GARD comments
		design. This has included introduction of a method for tunnel dewatering (to replace the need for tunnel sweetening flows when the tunnel is not in use). Update of the alignment and design of the access road to the intake / outfall structure. Introduction of Replacement Floodplain Storage (RFS) to account for raised areas in River Thames floodplain.	3) To allow for the larger tunnel size the internal diameter of the shaft at the intake / outfall structure has increased. 4) The outfall structure and the associated gates have increased in size to allow for the full emergency discharge flow. 5) Plant / process design has been updated, including: review of number and layout of intake screens; use of pipework to replace intake culverts; addition of control valves / flow meters; introduction of tunnel dewatering pumps; consideration of access requirements; consideration of stoplog requirements; addition of a fuel tank for back-up generation; and update to the proposed control building. 6) The introduction of tunnel dewatering pumps removes the need for a sweetening flow to be passed through the river tunnel when not in operation. Annual emptying of the river tunnel is also considered to reduce the extent of mussel encrustation in the tunnel.	

Ref	Asset	Changes Since Gate Two	Explanation	GARD comments
5.	Conveyance: Reservoir Tunnel (between SESRO pumping station and the main tower in the Reservoir) and Main Tower	Review and update of the plant / process design given changes to the operating requirements. The internal diameter of the Reservoir tunnel has increased from 4.8m to 5.8m to provide space for two 2.2m diameter pipes (whereas in Gate Two design there was a single bi-directional pipe). Given the inclusion of two 2.2m diameter pipes in the Reservoir tunnel, a higher proportion of the emergency drawdown flow now passes through the Reservoir tunnel. The main Reservoir tower diameter is now 31m. The design of the tower has been revisited to facilitate the larger diameter (including the addition of piles).	1) The requirement for the Reservoir to be able to release flows to WTWs at the same time as filling the Reservoir from the River Thames results in a need for two separate pipes in the Reservoir tunnel. To be able to fit two 2.2m diameter pipes the tunnel diameter has increased. 2) The structural form of the Reservoir tunnel has been reconsidered given the larger diameter. 3) Plant / process design in the main tower and Reservoir tunnel has been updated to meet updated operational requirements, including (but not limited to): pipework arrangement; addition of control valves / flow meters; introduction of a fast filling mode of operation; consideration of access requirements; consideration of crane requirements; and update to the proposed control building at the top of the main tower. 4) The main tower diameter has been increased to 31m to provide sufficient space for the updated pipework / valve arrangement.	This relates to the tunnel under the Reservoir excavated using a manual (non-TBM) tunnelling shield. The justification under Gate 2 for selection of the 150Mm³ Reservoir over the 100Mm³ scheme was that it would provide water supplies to Southern Water WTWs. The need to increase the diameter and structural form of the tunnel to accommodate the two separate 2.2m diameter pipes is therefore considered design development of the Gate 2 design.

Ref	Asset	Changes Since Gate Two	Explanation	GARD comments
6.	Conveyance: Secondary Towers	Limited design of the secondary towers had been carried out prior to the Gate Two submission. Design development has been undertaken as part of Gate Three. Plant / process design has been carried out based on the latest operating requirements.	1) The number of gate openings in the secondary towers has been based on the Gate Three flows required to be released from the Reservoir (for the WTWs as well as releases to the River Thames). 2) The design of the towers at Queen Mother reservoir informed the development of the towers with 10 sides and 5 levels of gate openings. 3) The design of fish screening at Farmoor Reservoir was used to inform the update to the proposed screening arrangements.	At Gate 2 design concept status the expectation is the risk register should include an allowance to cover the inevitable need to meet relatively minor changes in project requirements as the design develops. The changes described between Gate 2 and 3 under this item are considered typical design development items and should not result in an overall increase in the estimate.
7.	Conveyance: Intake Pumping Station	The pumping station plant / process design has updated to respond to the changes to the operating requirements (discussed above). The civil design has been updated to account for the revised plant / process design. Through these design updates the pumping station plan area has increased.	1) Plant / process design for the pumping station has been updated to meet updated operational requirements, including): intake pumps (larger number of smaller pumps), adjustment of hydropower turbines (for revised proposed releases), inclusion of additional energy dissipation valves (to provide capacity for the full emergency drawdown); inclusion of booster pumps (for providing flow to WTWs); review of pipework arrangement, inclusion of sump pumps; consideration of crane requirements;	Intake pumping station estimate costs under Gate 3 is at £279M compared to £115M for Gate 2, which is an increase of £164M or 143%. It is agreed some uplift in the base estimate is required as the change is linked to the omission of the ADC – see also item 8 below. On the intake side, pumping capacity remain unchanged although agreed a larger number of smaller pumps is more expensive, but this is design development and should have been able to be absorbed with the design

Ref	Asset	Changes Since Gate Two	Explanation	GARD comments
			review of access requirements; and update to the proposed control building. 2) Civil design has changed from a rectangular box to three interlinked cells. This provides the space required for the adjustments to the plant / process design outlined above. 3) An indicative above-ground building has been included in the design to cover two of the three above-mentioned interlinked cells. A second indicative above ground building has also been included in the design to house control and electrical components for operation of the pumping station.	development risk allowance, without an overall increase in cost. Variation to the pumping station chamber size which also acts as the launch chamber for the conveyance tunnel boring machine is not considered a main driver for the 143% increase cost for this element. The requirement for a structure to weatherproof the pumping chamber and for building to house control and electrical components is not considered additional work.
8.	Conveyance: Emergency Discharge	The river tunnel diameter has increased from 4.2m to 6.0m. Siphons are retained in the design with discharge into an enlarged pumping station rather than an ADC.	Based on options appraisal, the preferred option for discharge of emergency flow is through the River Tunnel only and for the purposes of Gate Three the ADC has been removed from the design (note that this is subject to the outcome of the summer 2024 consultation).	It is agreed this is a change in requirement with the base estimate adjusted accordingly. Shaft/Tunnel estimate costs under Gate 3 is at £28M compared to £126M for Gate 2, is £157M or 80% higher. Part of this increase should be offset by the significant costs saving omission of the ADC (a canalised navigable water way with reinforce banks and concrete bed to allow control of water flows), the

Ref	Asset	Changes Since Gate Two	Explanation	GARD comments
				need to cross the A34 and B4017 and lay as contingency works, the STT pipeline. Note: Reference to publicly available bench marking data: Case Study: Benchmarking tunnelling costs and production rates in the UK published by the Infrastructure Project Authority, indicated the Gate 2 estimate was potentially at least £30M–£40M low for a 4.2m diameter tunnel.
9.	Watercourses and Floodplain	Watercourse alignments and sections have been updated as part of the master planning and design development process. Changes have been made to the main RFS area to the west of the Reservoir. Smaller RFS areas have been updated or introduced.	Multidisciplinary work has developed the watercourse design informed by stakeholder feedback and technical work. Updates to flood risk modelling to account for design development of roads and watercourse alignments has informed changes to RFS areas.	Landscaping costs under Gate 3 at £331M compared to £46M for Gate 2 is an increase of £286M or 624% higher. Noting that the Gate 2 landscape drawing is essentially similar to the Gate 3 landing drawing, the only conclusion which can be drawn from the very large increase in estimated cost for this element is that the cost was grossly underestimated. See applicable drawings lodged in the following reports: 1.See Final Gate 2 submission drawing for SESRO Date: 14th November 2022 – dwg Figure 2.1 LANDSCAPE AND ENVIRONMENTALDESIGN STRATEGY PLAN, referred to as fig 3.1 in the report, which is essentially similar to the 2. See

Ref	Asset	Changes Since Gate Two	Explanation	GARD comments
				Gate 3 submission for SESRO August 2025 – DWG Interim Landscape and Environmental Master Plan with Below Ground Emergency Discharge Tunnel, referred to as fig 2.3. A more detailed comparison between the Gate 2 and Gate 3 drawing
10.	Associated Infrastructure: Recreational Facilities and Architecture	The number and location of recreational buildings has changed through the master planning process and architectural review.	Discussions with stakeholders and further technical work have informed development of the design. The design will continue to develop based on feedback from the summer 2024 public consultation.	It is agreed this is a change in requirement with the base estimate adjusted accordingly. Nevertheless, at design concept status the expectation is the risk register should include an allowance to cover the inevitable need to meet changes in project requirement.
11.	Associated Infrastructure: A415 to SESRO Main Access Road	The road alignment and location of the junction with the A415 have changed.	Road drainage design developed. Changes reflect the preferred arrangement identified in the options appraisal (see the Roads option appraisal report). The appraisal was subject to consultation in summer 2024 and the design will be reviewed against the consultation responses after Gate Three.	The Gate 3 access road design is over a 1km shorter than the Gate 2 alignment and requires less land take. Development of road drainage design is considered a typical risk register item. On a multi-billion pound scheme any increase in access road drainage requirements is considered a very minor change and unlikely to add significant cost.
12.	Associated Infrastructure: Steventon to East Hanney	Minimal change to alignment, junction and road design further developed. Alignment was reviewed as part of options	Alignment was reviewed as part of options appraisal; however minimal changes were identified.	Described as a minimal change, this item is a very typical risk register item in allowing for the development of a road scheme design.

Ref	Asset	Changes Since Gate Two	Explanation	GARD comments
	Road Diversion	appraisal; however minimal changes were identified.		
13.	Associated Infrastructure: Temporary Rail Siding and Materials Handling Area	The preferred location of the rail siding has changed and the design has been updated accordingly. The Gate Three location is approximately 3km to the west of the Gate Two location. The arrangement of the rail siding and materials handling area has been developed to suit the new location.	Changed to reflect the preferred location in the options appraisal. The appraisal was subject to consultation in summer 2024 and the design will be reviewed against the consultation responses after Gate Three.	Again, this is a very typical risk item in allowing for the development of temporary works locations away from Steventon village.
14.	Associated Infrastructure: Utilities	Minimal change in approach since Gate Two.	Whilst the design changes are minimal discussions have continued and are ongoing with utility providers and statutory undertakers. Existing solar farm decommissioning will require agreements with existing owners and SSE and discussions are ongoing.	Again, this item is a very typical design development risk register item in allowing for the development of utility diversions and connections proposals.
15.	Associated Infrastructure: Drainage	Embankment toe drain alignment adapted to suit other changes to embankment slopes. Highway drainage added. Surface water and foul drainage concept developed. Groundwater drainage design reviewed.	Multidisciplinary work has informed updates to drainage alignments within the master plan. A site drainage strategy has been developed.	Again, this item is a very typical risk register item in allowing for the development of a drainage infrastructure as the design phase progress. Any variance to the embankment toe drain design is considered minor, i.e. water collection from blanket drain remains unchanged.

Ref	Asset	Changes Since Gate Two	Explanation	GARD comments
				Main watercourse diversions proposals remain unchanged between Gate 2 and 3 proposals. At Gate 2, road costs should have included an allowance for highway drainage. Foul drainage requirements is considered a very minor element for SESRO. It is noted that the groundwater interceptor drainage design is currently under development, which may have a significant impact on the cost estimate and project completion date as currently reported.
16.	Landscape Scheme	Development of a comprehensive interim master plan with updates to landscape topography (including noise bunds), planting and habitat creation.	Multidisciplinary work has developed a more comprehensive landscape scheme informed by discussions with landscape and environmental stakeholders, landscape character assessments, environmental requirements and draft design principles.	Again, this item is considered design development as more detail is added to design. Overall SESRO Site Area – no major scheme change; slight reduction in land take under Gate 3 for shortened access road, River Thames intake relocated and omission of drawdown channel, small additional land take with woodlands and copse to NE of retained Steventon substation. The Gate 3 drawing does show more landscape treatment types, but in the main although more details added,

Ref	Asset	Changes Since Gate Two	Explanation	GARD comments
				landscape areas remain similar for both Gate 2 and Gate 3 schemes. The explanation given under this item is considered insufficient to justify the Gate 3 increase over Gate 2 proposals in landscape costs from £46M to £331M or a rise of 634% at base cost. If the base estimate at Gate 2 had been realistic, any increase due to design development should have been able to be absorb within the risk allowance and not have resulted in an overall increase in the subsequent Gate 3 estimate.
17.	Facilities for Other Water Resource Projects: Local water supply facilities	The SESRO design includes a raw water pipeline route / corridor through the SESRO site for local raw water supply to Farmoor Reservoir.	Since Gate Two it has been confirmed that SESRO needs to facilitate transfer for potential future local water supply projects (initially raw water to Farmoor, later potential WTW at SESRO with a treated water transfer pipeline).	This change is limited to design work and reservation of the Farmoor Reservoir pipe route with any additional cost to the project is therefore considered minimal.
18.	Facilities for Other Water Resource Projects: STT	At Gate Two the concept design allowed for the lower sections of the STT pipeline to be constructed at the same time as the ADC, located in the towpath of the canal. The ADC has been removed from the Gate Three design (i.e. it is not currently the preferred emergency drawdown option) and SESRO does	In the WRMP24 plan STT is on a post 2040 adaptive pathway and not in the preferred plan, therefore there is greater uncertainty about whether the project will be implemented.	This change as the item 17 above is again limited to design work and pipe route reservation. Omission of the STT pipe with the removal of the ADC from the scheme is cost-saving to the scheme. The requirement for the shaft and connecting adit is not new work, as this would have been required under the

Ref	Asset	Changes Since Gate Two	Explanation	GARD comments
		not facilitate this section of pipeline. A reserved corridor has been identified through the SESRO site to facilitate the future delivery of STT should it be required. A shaft and connecting adit are included in the SESRO design to facilitate future connection of STT to the SESRO river tunnel.		Gate 2 proposals to connect the STT pipeline to the conveyance tunnel.

Note: The sizes / volumes / rates in this table (and elsewhere in this report) solely reflect the design position at Gate 3. They are provided for context to the revised cost estimate at Gate 3 but will be subject to refinement and change as the scheme design progresses towards DCO submission.

Additional GARD notes:

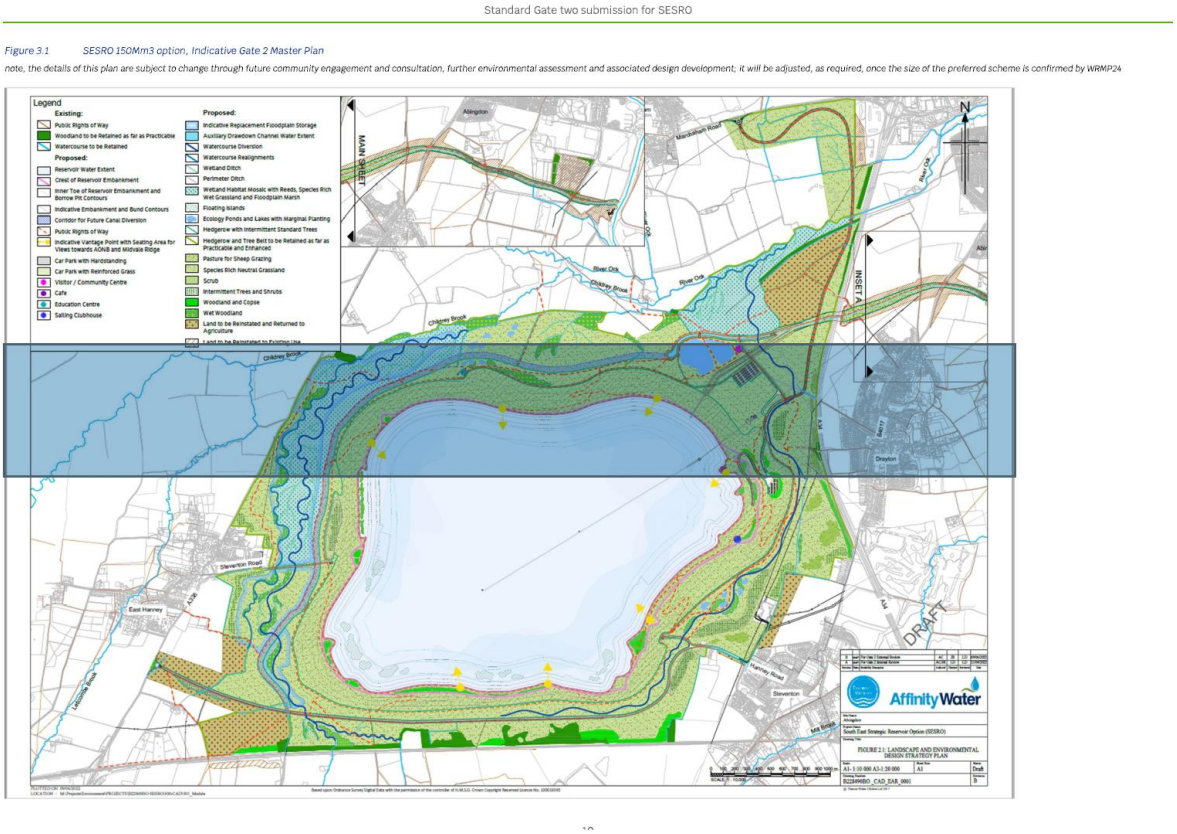
- Where costs have been referred to, they have been taken from the Gate 3 Cost Report Table 7 – Summary of Gate Two to Gate Three Comparison (2022/2023 price base).
- Under item 1 Reservoir, the explanatory note, "*Following ground investigation during Gate 3 the design of the structural embankment has been developed to include a core*", would appear to contradict the statement given below following the GARD visit to SESRO CCT site (20th May 2025). See the statement below:

  Subsequently, in an email dated 10th June, commenting on the draft of the notes, Thames Water said: "*The design change from a homogenous internal design for the Reservoir embankment to a clay core and shoulders formed part of our design development following on from Gate 2. This detailed design change is not as a result of the CCT trial. An explanation of the clay core and shoulder design will be presented in our Gate 3 reports*."

  The above does not seem the case, as Figure 3-4: Indicative Cross Sections of the Reservoir Embankment, lodged in the Gate 3 Design Report, does not show a clay core design.

Appendix C SESRO Gate 2 and Gate 3 design proposal comparison drawing review notes

This appendix identifies any major changes between the SESRO Gate 2 and 3 high-level design proposals that could explain the significant tripling of the Capex estimate, from £2,745M to £6,604M (2022/23 price base). In undertaking this comparison, the expectation is that the cost estimate for each Gate aligns with the design description, as shown in the drawings for the proposed works (see Figure C1 and Figure C.2 below).



Source: Thames Water (2022), "Strategic regional water resource solutions: detailed feasibility and concept design. Standard gate two submission for South East Strategic Reservoir Option (SESRO)", 14th November, Figure 3.1, p. 10.

Figure C.1 - Standard Gate Two submission for SESRO, 2022

14

Figure C.2 - Gate 3 submission for SESRO, August 2025

Source: Thames Water (2025), "*Strategic regional water resource solutions: detailed feasibility and concept design. Gate three submission for South East Strategic Reservoir Option (SESRO)*", August, Figure 2.3, p. 14.

The main differences are highlighted below.

- Overall SESRO site land area – no major scheme change; slight reduction in land-take under Gate 3 for shortened access road, River Thames intake relocated and omission of an ADC. Small additional land-take to form woodland copes area to NE Steventon substation.
- Above-ground ADC – removed from Gate 3 drawing, with this drawing now showing the plotted route of the underground conveyance tunnel.
- T2ST – alternative indicative locations now shown on the Gate 3 drawing for the Southern Water WTW.
- Legend key annotation showing landscape treatments – expanded in the Gate 3 drawing to show more landscape treatment details, but in the main, although more details added, landscape areas remain similar for both Gate 2 and Gate 3 schemes. Floating islands are shown in Gate 2 and 3 drawings and referenced in drawing legend. Recreational lakes shown in the Gate 2 and 3 drawings, but only referenced

in the Gate 3 drawing legend. Under Gate 3, enlarged car parks and recreational facilities are shown in greater detail on the drawing.

The Gate 3 drawing landscape annotation is the same as the Gate 2 drawing except for the additional annotations, copied from the drawing as a snapshot below:

The addition of the above design details to the landscape scheme is not considered sufficient to justify the £286M increase in the base cost for this element.

In summary, other than the changes referred to above, the overall high-level design for SESRO, as shown in the Gate 2 and 3 master plan drawings, is considered similar.

The only high-level design change of any magnitude is the omission of the ADC with an increased sized conveyance tunnel in lieu. In the Gate 3 Cost Report, the Shaft/Tunnel cost estimate, which covers this element, has risen from £157M to £28M, an increase of £126M at the base estimate, or in percentage terms 80%. There is no mention in the Gate 3 Cost Report of the cost saving by omitting the drawdown channel as a credit in reducing the cost increase to this item.

Following the issue of the Gate 3 cost estimate at £6.62Bn, the design as shown in the drawing lodged under the Final Standard SESRO Gate 2 report clearly does not align with the total Capex estimate of £2.196Bn at the 2020/21 base date, subsequently updated in Gate 3 to £2.74Bn at the 2022/23 base date.

The reasonable expectation is that, with the issue of a final status report with technical proposals which include a drawing, the associated cost estimate should align with the design as described and/or shown; otherwise, it is a misrepresentation of the proposals.

Appendix D Defra reservoir flood assessment – Simplified Method – applied to the proposed 150Mm^3 Abingdon Reservoir

Items enclosed within black borders are directly taken from the relevant Defra publications[322], which were produced by Defra's water engineering consultants HR Wallingford Ltd. All flood spreading and flow equations used in this appendix were developed by HR Wallingford Ltd.

Defra's Guidance Report defines the following 'Risk Category' table:

Table : Typical reservoir risk classification types

Risk Category	Typical reservoir types
High	• Reservoirs in dense urban areas • Reservoirs with high dams (>5m) or large volumes of water (>100,000m^3) • Reservoirs perched on hillsides above properties
To be determined	• Any reservoir where it is not immediately obvious that it could pose a danger to people and property if the dam were to fail suddenly **Use this guide to help you better understand the risk posed by your reservoir**
Not high	• Reservoirs in remote or rural areas • Reservoirs with low dams (<2m) or small volumes of water (<10,000m^3) • Reservoirs surrounded by flat land far away from any properties

The proposed Abingdon Reservoir, with a dam height of ~22 metre and a water volume of ~150Mm^3, falls immediately into the **High Risk** category, without further consideration. Defra also notes, in the same document that:

> It was decided that the size of reservoir covered by this project would be reservoirs not exceeding 100,000m^3, and dam height not exceeding 10m, on the basis that:
>
> - ·This is a typical range of size of new small reservoirs;
> - ·Larger dams are likely to have greater engineering input into their siting and design, such that this rapid screening would be of less value.

Thames Water has repeatedly refused to share its supposed 'greater engineering input into […] siting and design' regarding safety, so the best GARD can do is to use Defra's Simplified Method to make our own assessment of the risks and impacts of the Reservoir. This Appendix investigates, at successive levels, what 'High Risk' equates to in terms of impact on local communities, as estimated by Defra's Simplified Method. Defra defines three High Risk tests[323]:

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[322] H.R. Wallingford Ltd (2014), "Small reservoirs simplified risk assessment methodology: Guidance Report", and (2013), "Research Report", for Defra and the Environment Agency.

[323] Binnie & Partners (1991), "Estimation of flood damage following potential dam failure: guidelines", 1989 report for the Department of the Environment, FR/D 0003, Foundation for Water Research, Marlow.

> Test 1 uses an approach defined by the Health and Safety Executive (HSE) as the risk to an individual person, and is based on research undertaken on the depth and velocity of flows that would cause structural damage to houses (Binnie 1991). Tests 2 looks at the extent of the flooding, and Test 3 looks at the combined risk to the society or community downstream.

Defra requires the risk assessment to assume 'catastrophic failure' in order to deterministically quantify a breach in the 'dam wall' and the resulting rate of water flow through it. After a number of breach simulations by computer, Defra concludes:

> Runs undertaken using a range of erodibility considered applicable to the UK shows that certain reservoir combinations, and in particular small non-impounding reservoirs built of high plasticity clay, are unlikely to erode at a rate that would lead to a catastrophic failure.
>
> However, as this project relates to government regulation of dam safety it has been agreed with Defra that the Guide would provide peak breach flows resulting from catastrophic failure for all dam sizes. This is in effect acknowledgment that at any individual dam there may be site specific failure modes that could lead to rapid failure (for example, physical damage by digger, aircraft impact etc.), and that to demonstrate beyond reasonable doubt that none could lead to catastrophic failure at a specific dam it would be necessary to carry out a full failure modes analysis for all credible failure modes. For the purposes of this project, catastrophic is defined as a time base for the breach hydrograph similar to that for a breach hydrograph defined using Froehlich (1995).

which leads to the following definition of the peak flow rate Qp released from the Reservoir[324].

[324] Froehlich, D.C. (1995), "Peak outflow from breached embankment dam", ASCE Journal of Water Resources Planning and Management, 121:1, pp. 90–97.

Example of the Environment Agency RIM method for calculating the potential release of water from a reservoir

The reservoir flood risk maps are created from numerical modelling of potential flood flows. Prediction of the catastrophic release of water from the reservoir is made by assuming reservoir conditions and applying a simple formula for predicting how large the rate of release of water might get.

The Environment Agency assumes that at the point of failure, water levels in the reservoir will be above the dam crest level by 0.5m. The height of the dam plus 0.5m is then used in the following equation, along with the estimated volume of water stored when the water level is at crest level plus 0.5m:

$$Q_p = 0.607 V_w^{0.295} H_w^{1.24}$$

Where:

Q_p	Peak flow rate released from the reservoir
V_w	Volume of water stored above ground level at the time of failure
H_w	Height of the water level above ground level at the time of failure

This equation (Froehlich, 1995) is based upon analysis of historic dam failures. It provides an approximate estimation of potential flow rate, but does not take into account site specific dam and topographic features. It therefore provides an initial estimate for consideration and emergency planning, rather than an exact prediction.

For the Reservoir in flood Vw ~ 139Mm^3 and the flooding 'dam crest level+0.5m' is ~22.5m.[325] With those values, the above equation for the estimated peak flow rate gives:

Qp = 0.607 x 252.7 x 47.50 = 7286 m3/sec

We note that this is an *average* value for Qp and, for a specific community, the base height below the Reservoir crest closest to that community may differ from the average, leading to a different Hw, Vw and Qp; this important detail is addressed later, below.

D1.1 High Risk Test 1

Test for determining high risk		Comments
Test 1 - Force of inundation	If the velocity of the flow of water escaping from the reservoir, multiplied by the depth of water at an individual house is high enough to cause structural damage to the property, the reservoir is high risk. This is taken to be greater than 3m^2/s.	This is not necessarily the first house downstream of the reservoir. The velocity of the flow of water can increase if the valley narrows or steepens further downstream.

In a detailed analysis it would be the depth and velocity of water at the individual house (or other occupied space) that would be used in assessing risk. However, for this simplified screening method detailed ground levels and thus variation of flood level across the flow path are not available, so instead the maximum depth and average velocity across the flow path are used for Test 1.

[325] Assuming "borrow pit" volume 46Mm^3 below ground level leaves ~139Mm^3 up to flooding crest level.

Defra uses a simplified flow model, where the water spreads over a horizontal angle of 45 degrees (Ω = 0.79 radians) in front of the breach, so at distance *r* from the breach, the flow front has flooded width W = Ω *r* = 0.79 *r* (the *spreading equation*). The average depth-velocity (DV) across the flooded width is Qp/W, but the local depth varies between zero at the left and right extremes of that flooded width, reaching a maximum in the centre of the flow front, directly opposite the breach. That maximum DV is taken as 1.5Qp/W in Defra's simplified method (the shaded paragraph above).

Defra's *flow equations* for computing the velocity *v(r)* and the depth *d(r)* at distance *r* from the breach are:

$$d = \left(\frac{13}{3}\frac{n^2 Qp^2}{\Omega^2}\right)^{3/13} r^{-3/13}$$

$$v = \sqrt{\frac{3}{13}}\, d^{7/6} n^{-1} r^{-1/2}$$

and include the (Manning's) Friction coefficient '*n*', which is tabulated below. Note that the above two equations multiply to give (after some algebra) *d x v* =

DV = Qp /(Ω *r)* = Qp / W

So the above factor 1.5 ***must be applied to this DV*** for Test 1.

Note also that '*n*' cancels in the multiplication of *d* by *v*, so friction does not change the resulting DV; increasing friction reduces *v* and therefore increases *d*, so that DV at fixed *r* remains constant and unaffected by friction, but new communities at slightly higher altitudes may become vulnerable as a consequence of that increase in depth.

Type of surface of surrounding land	Friction coefficient, n
Bare soil (agricultural land)	0.020 – 0.040
Short grass (tended playing fields)	0.025 – 0.035
Long grass (wild meadows)	0.030 – 0.050
Woodland (forest)	0.080 – 0.120
Concrete and tarmac (urban areas)	0.012 – 0.017

Since the areas between the Abingdon Reservoir and nearby towns/villages are mainly open fields, with a few roads but little woodland/forest, we take a value of *n* intermediate between the minimum, 0.02 for bare soil and the maximum, 0.04 for agricultural land and long grass or meadows: n = 0.03.

The critical High Risk DV is 3m^2/sec (e.g. 3m deep water moving at 1m/sec). With *no flood warning*, it leads to a fatality rate of 3% and a building destruction rate of 20%; DV=7 m^2/sec

(e.g. 3.5m deep water at 2m/sec) leads to 16% fatalities and 100% building destruction. At DV=20 m2/sec the fatality rate is 100%. These Defra figures are based on many studies of actual dam and reservoir failures, and fatalities, at those observed DV rates (see High Risk Test 3, below).

Assuming a *flat environment*, 1.5xDV=3 can be converted into a critical distance *Rc*, within which all communities are at High Risk for Test 1, given the above Qp= 7286 m3/sec and averaging over the perimeter of the Reservoir. The result is *Rc* = 4.6km from the breach. This simple average will be replaced by a location specific *Rc* when the risks for specific communities are analysed in section D1.5.

Communities within that range include Steventon (population 2,268)[326], Drayton (2,987) and East Hanney (1,070) and, with >20% chance of buildings being destroyed ***the Reservoir fails High Risk Test 1*** and we need go no further, according to Defra. However, since there has been no 'greater engineering input' available from Thames Water to carry the study further, we will continue to the next level of Defra tests.

D1.2 High Risk Test 2

Test 2 - Extent of Inundation	If more than 200 people (~83 houses) or 20 businesses would be flooded by the escaped water from the reservoir, the reservoir is high risk.	Within the flood outline from the reservoir count the number of properties and businesses within the flooded area in order to estimate the number of people that could be affected.

Note that this test considers the whole community affected by the flood from the breach, not just those facing the centre peak of the flood. Thus the average depth across the flood front is used, and the factor 1.5 multiplying depth in the previous test is dropped. This test concerns which communities the flood water reaches, without specific focus on damage to property or injury to individuals.

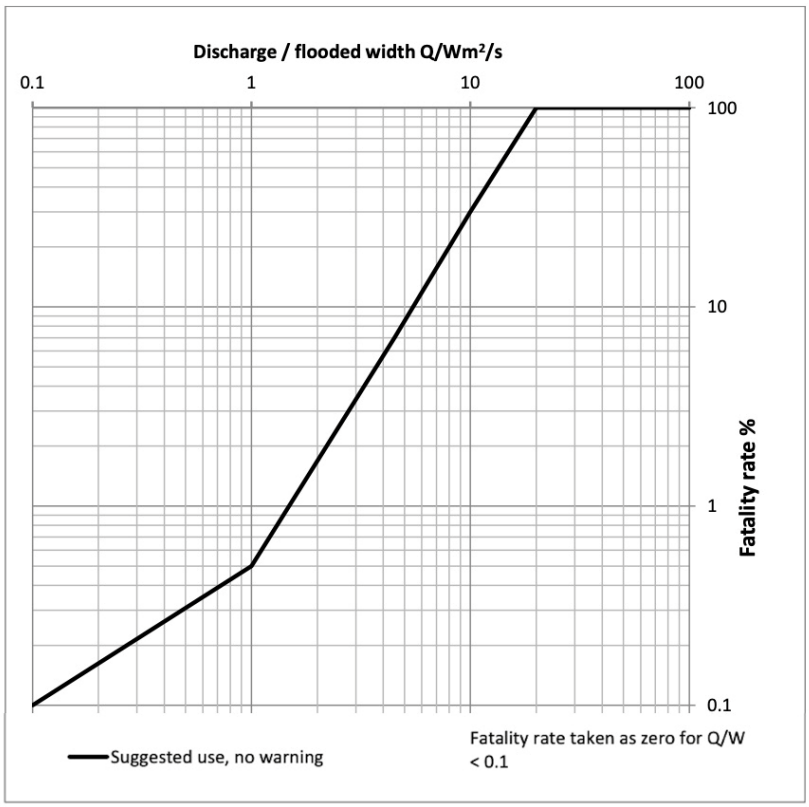
Several communities would be flooded, apart from those above at identified High Risk. These include Marcham (population 2,470), Milton (1,396), Abingdon (34,569), Culham (453), Sutton Courtenay (2,952) and Appleford (250), which again and unsurprisingly confirms the Reservoir as High Risk.

D1.3 High Risk Test 3

Test 3 - Likely Loss of Life	If the combined risk to life (the 'Likely Loss of Life' or LLOL) within the flood is greater than 1.0 fatality, the reservoir is high risk.

[326] Population figures, taken from official sources, may not be the most recent available, so are approximate.

Figure is taken from the Interim Guide (ICE, 2004) with the suggested line being for no warning and being a best fit to observed fatalities in flash floods and dam failures provided in the US Bureau of Reclamation Report no DSO -99-06.



Fatality rates for Q/W (no warning)

Using the above figure and the computed Q/W for any location within the DmaxV =3 (Q/W=2)[327] High Risk zone enclosing the Reservoir, it is possible to estimate the LLOL for every affected community. Suffice to say that, with a number of nearby villages in that zone (see High Risk Tests 1 and 2 above), each with average fatality rate > 1% and population > 100, the average LLOL from a single breach is significantly greater than 1, so ***the Reservoir fails High Risk Test 3***. Specific cases are considered in section D1.5.

D1.4 High Risk Additional Test(s)

Additional Test(s)	There may be other unusual factors that can lead to a high risk designation such as the potential damage to critical infrastructure or the environment. The Environment Agency will consider all such factors on a case by case basis.	This could for example include destruction of a busy road or railway line with a moving population, or the destruction of a chemical plant leading to the release of a hazardous substance.

[327] See section D1.5, below.

We note that, in addition to its three principal Risk Tests, Defra defines the above 'High Risk Additional Test' that evaluates the impact on critical infrastructure and the environment, which we also briefly address here.

The proposed Abingdon Reservoir will be surrounded by a combination of major roads (A338, A34, A415, A417), some minor roads (B4017, and Thames Water's proposed new Hanney–Steventon road) and the GWR London–Bristol railway line; all potential 'moving populations' within the DV>3 High Risk zone. The Reservoir itself would constitute *critical water resource infrastructure* if we believe Thames Water/WRSE's justification for its construction. Thus the Reservoir also fails the High Risk Additional Test(s). Specific cases will be discussed in section D1.5.

D1.5 Specific cases of high risk

The Defra analysis outlined in D1.1 above uses Defra's *spreading equation* to compute DV and explains how 1.5xDV > 3 is the zone of High Risk to individuals and buildings. We define DmaxV = 1.5xDV in what follows. DV reduces in proportion to 1/*r* as the flood moves away from the breach. We invert that *spreading equation* to obtain the distance (*Rc*) within which DmaxV is greater than 3 m2/sec. The result is: *Rc* = Qp /(2 Ω**)**.

We compute Qp for any point around the mapped crest of the Reservoir and project outwards from a model breach at that point by the above distance *Rc*. The result is the dotted red boundary shown in the following figure, where the increased range of High Risk can be seen w.r.t. (black dots) the 100Mm^3 Reservoir:

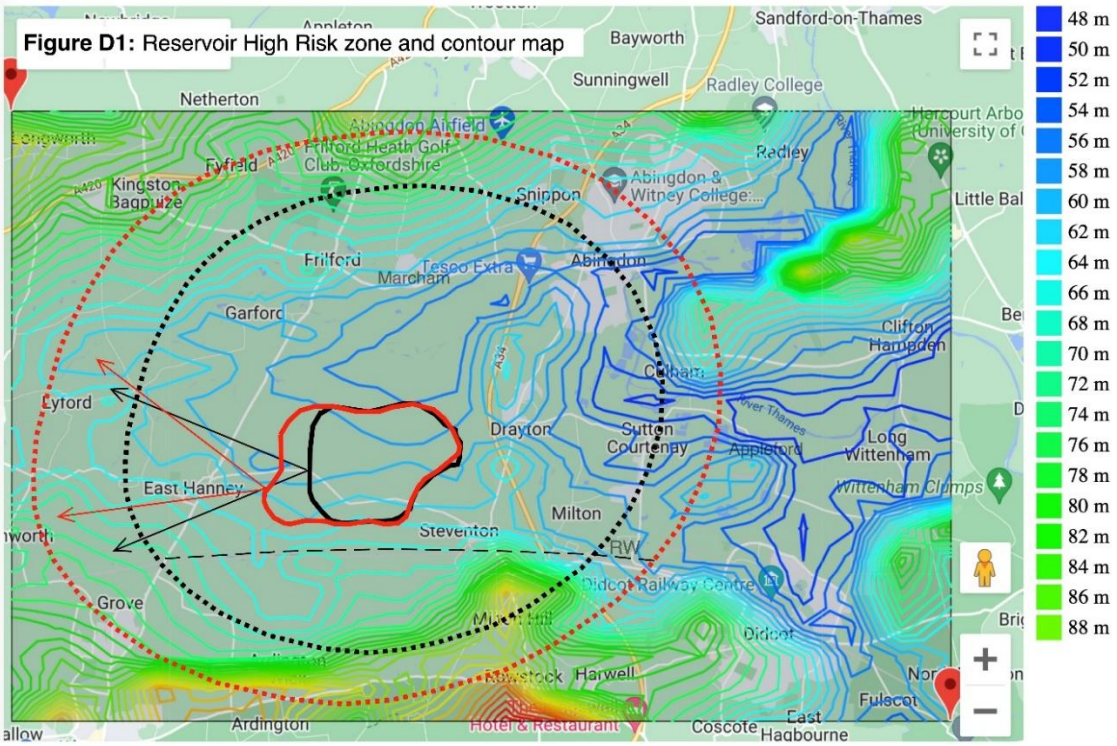


Figure D.1 - Reservoir High Risk zone and contour map

Every location within that boundary is potentially at High Risk with DmaxV >3 m2/sec. The figure also includes the Reservoir's crest (solid red (black 100Mm^3) boundary[328]) superimposed on a contour map of the region (altitude contour colour coding on the R). The flow zone from a breach opposite a single community (e.g. East Hanney) is also shown; the model flood water moves in the direction of and between the two arrows, with opening angle Ω = 45 degrees.

Communities outside the High Risk zone *and* at higher altitude than the Reservoir may be safe. Altitudes above 80m – the altitude of the water surface in the flooding Reservoir – are certainly safe. Those above 68m are also safe according to Defra's simplified model as explained below. Communities outside that zone but at lower altitude than the Reservoir base (below 58m, dark blue contours) may still be in danger (South Abingdon and downstream Thames villages) and ***their risks must be properly addressed by Thames Water, because the Thames Valley topography is too complex for the Defra Simplified Method we apply here***.

We next consider a vertical projection of the problem, in order to further isolate and identify those communities that are most at risk by excluding those whose altitude is above the flood's surface level.

Figure D.2 below thus gives an overview of all communities possibly affected directly by a breach of the Reservoir. It uses the above Defra analysis to display (solid blue line, LH scale) the peak depth (i.e. average x 1.5) of the floodwater as a function of distance (X) from the breach in the Reservoir wall. The centre of each community is shown at its distance (X) to the closest point below the Reservoir crest, with its height above the nominal base level of the Reservoir on the LH scale and altitude above mean sea level (AMSL) on the RH scale:

[328] Thames Water and Affinity Water (2022), "South East Strategic Reservoir Option (SESRO) Supporting Document A-1: Concept Design Report"; Appendix A.1 Indicative layout plan - 150 Mm^3 capacity reservoir, Drawing Title: Site Overview 150Mm^3 Option.

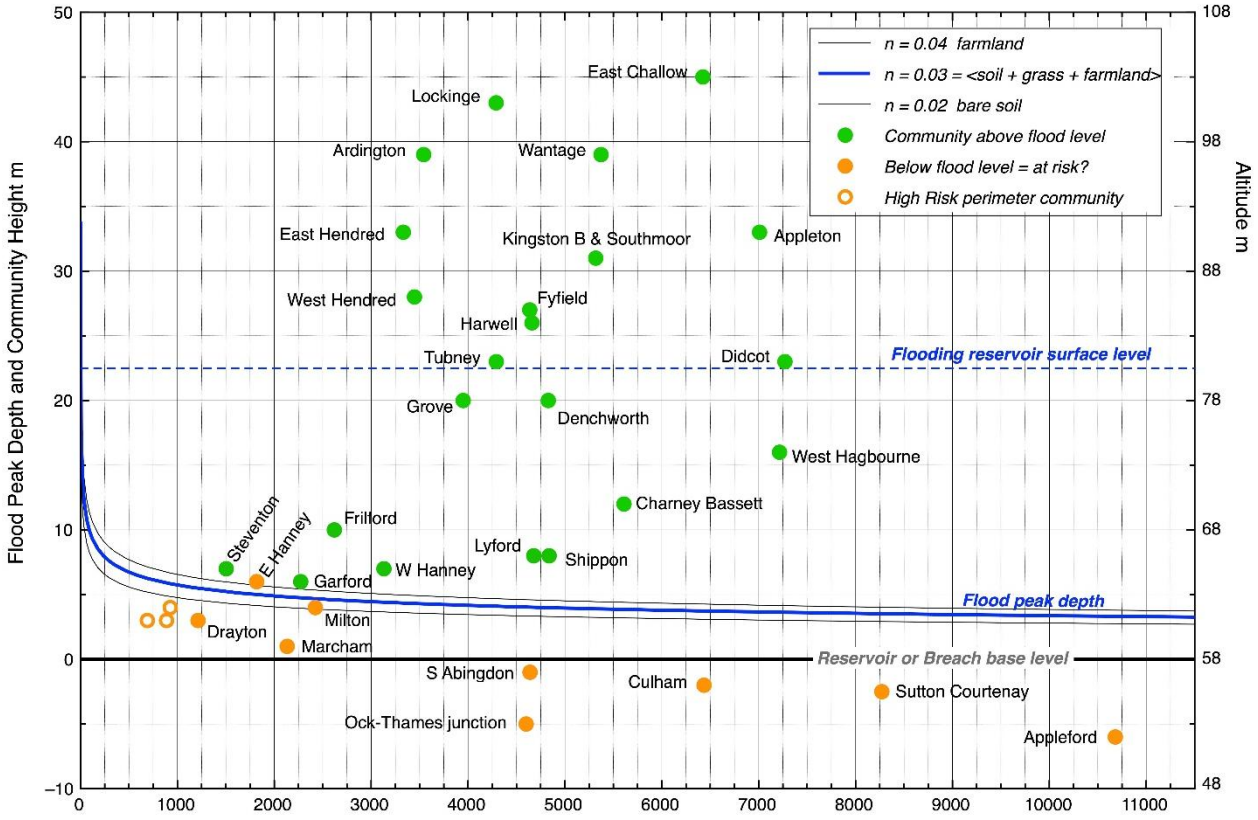


Figure D.2 - 150Mm^3 flood peak depth and community height vs distance from breach

The displayed depth is computed for the *average breach* with the flood progressing over *flat terrain* and takes no account of possible obstructions to flow, such as major roads or local topography. It is intended to be indicative only, allowing us to eliminate those communities not at High Risk, in order to focus on those most at risk. With those qualifications, communities above the peak flood level (indicated by a green marker) are unlikely to be flooded at High Risk; communities below the peak flood level (indicated by an orange marker) are likely to be directly affected by the flood and might be at High Risk.

To err on the side of caution, after also studying possible variation in depth due to friction (the thin black lines) and the fact that a community typically spans a range in distance and altitude, we identify those communities above 68m altitude as out of danger, to concentrate on those below and including Frilford.

Of those communities, we choose the three closest to the Reservoir crest, with flat open fields and no obstruction to the flood between breach and community, for which Defra's Simplified Method is most appropriate. Each of them is on the perimeter of one of the named communities on the above plot and they are represented (but unnamed) there by the open orange circles: 'West' Steventon, 'East' East Hanney and 'South' Drayton.

For each community the distance and *base altitude* of the closest possible breach point are determined[329], these are used to define community specific values of Hw, Vw and Qp, and the resulting flood is transported *at that base altitude* to the target community, using the Defra procedure above. The effective flood depth D'max at the community is then defined by subtracting the height of that community from the peak depth of the flood water and this is used to compute an effective D'maxV for estimation of risk and impact.

The results are shown in Table D.1, with previous results for the 100Mm^3 Reservoir below that, in Table D.2.

Location	X m	Alt m	Alt (br) m	Hw m	Vw Mm3	Qp m3/s	W m	DV m2/s	D m	V m/s	Dmax	D'max	D'maxV	D'(V=0)	Alt-Altbr	%Fatal	<%F>	Pop.	LLOL
E.East Hanney	690	61.0	61.0	19.5	120.8	5848.8	580.9	10.07	3.77	2.67	5.65	5.65	15.10	6.02	0.00	62.4	39.72	161	64.0
W.Steventon	926	62.0	61.0	19.5	120.8	5848.8	766.3	7.63	3.52	2.17	5.28	4.28	9.28	4.52	1.00	26.2	11.96	122	14.6
S.Drayton	888	61.0	60.0	20.5	127.0	6315.5	738.4	8.55	3.68	2.32	5.52	4.52	10.51	4.80	1.00	32.8	25.68	67	17.2

Table D.1 - 150Mm^3, flood model results for perimeter communities

Location	X m	Alt m	Alt (br) m	Hw m	Vw Mm3	Qp m3/s	W m	DV m2/s	D m	V m/s	Dmax	D'max	D'maxV	D'(V=0)	Alt-Altbr	%Fatal
E.East Hanney	1319	61.0	59.0	19.4	89.9	5325.7	1055.3	5.05	3.11	1.62	4.66	2.66	4.32	2.79	2.00	6.3
W.Steventon	825	62.0	61.0	17.4	80.6	4506.5	665.4	6.77	3.21	2.11	4.81	3.81	8.05	4.04	1.00	20.2
S.Drayton	740	61.0	60.0	18.4	85.2	4910.2	599.6	8.19	3.42	2.39	5.13	4.13	9.89	4.42	1.00	29.4

Table D.2 - 100Mm^3, flood model results for perimeter communities

Note: See the 'Notes on Tables in Appendix D' at the end of this appendix for column content.

In every case, the Defra-defined "*%Fatal*" rate has **increased** w.r.t. the publicly consulted 2022 Gate 2 design and, in the case of E. East Hanney, ***by a factor of 10***! The reasons for those unacceptable increases in negative *impact* (hence also in risk, *= impact x likelihood*, to each community) are not difficult to identify: the 50% increase in Reservoir volume, the 10% increase in embankment height and the ~600 m movement further W of the western embankment, towards the A338 and E. Hanney (increasing the water surface area by about 1/3rd). For an unexpected catastrophic breach, the time to first impact of the flood-wave at those three communities would be very short:

E. East Hanney 2.4 minutes; W. Steventon 4.3 minutes; S. Drayton. 3.8 minutes

So, unless warning anticipated the breach, there would be little time for residents to save themselves.

Other 'orange' communities in Figure D.2 above are also likely to be at risk, but calculation of flood impact for them is more challenging, due to topographic features; e.g. the flood must cross the River Ock then climb 4m to reach Marcham. Man-made obstructions, such as the

[329] Distances measured using https://www.google.co.uk/maps/, altitudes using https://routecalculator.co.uk/elevation.

A34, will also shield some communities, but at the expense of others (including those in vehicles on the A34), as the obstruction diverts or slows (deepens) the flood.

However, the shielding will be temporary, since the water will eventually find its way, following natural topography and driven by gravity, into the Thames.

Catastrophic breach of the Reservoir's N embankment, where the head of water would be more than 25m above local ground level, would release at least 158Mm^3 of water at about 8.8k m3/second in the direction of Marcham and Abingdon. When that flood enters the Thames at the Ock–Thames junction, it would exceed the average flow in the Thames at Abingdon by a factor of over 300, with potentially disastrous consequences for residents around St Helen's Wharf and Caldecott. Even as far as Appleford-on-Thames the effects of such a breach will certainly be felt, gravity assisting the water down the 7.7m fall in 10.7km along the Thames Valley, flooding St Peter's and St Paul's Church, which is only 200m from the Thames and ~1M above it. Defra's procedures are too simplified to accurately predict D and V down a complex valley, at that distance.

We next consider the impact of such a breach on travellers using railway and roads close to the Reservoir; mobile populations with flat open fields and no obstruction to the flood between a breach and their specified locations, as briefly outlined in section D1.4 above. shows results from application of Defra's flood model to estimate the impact on those populations, as for:

Location: closest approach.	X m	Alt mGL	Alt(br) m	Hw m	Vw Mm3	Qp m3/s	W m	DV m2/s	D m	V m/s	Dmax	D'max	D'maxV	D'(V=0)	Alt-Altbr	<%F>	Pop [1]	LLOL
B4017 - S Drayton	912	62.7	60.0	20.5	127.0	6315.5	757	8.34	3.660	2.279	5.49	2.79	6.36	3.05	2.70	3.6	98	4
GWR - SW Steventon	426	66.0	63.0	17.5	108.4	4953.7	370	13.40	3.900	3.437	5.85	2.85	9.80	3.45	3.00	8.0	46	4
A338 - Venn Mill	840	60.0	58.5	22.0	136.3	7038.5	704	10.00	3.921	2.551	5.88	4.38	11.18	4.71	1.50	12.3	120	15
A34 - Drayton	709	59.0	58.0	22.5	139.4	7285.6	602	12.11	4.143	2.922	6.21	5.21	15.24	5.65	1.00	25.7	102	26
New Hanney-Steventon Rd	230	65.0	64.0	16.5	102.2	4525.9	214	21.18	4.313	4.912	6.47	5.47	26.86	6.70	1.00	70.9	36	26

Table D.3 - Critical infrastructure 150Mm^3 – ground-level impacts

For roads and rail we assume a moving population equivalent to one person every 6m (every car has 1.5 occupants separated by one car length from the car in front). The listed population 'Pop[1]' corresponds to that number of people in such a queue/train extending across the flood front above ground level at the specified location. It is important to note that, in general, roads and (particularly) railways are often constructed on a raised embankment that smooths out ground-level variations. In some cases this might mean that the car or train will be above local ground level by enough to be out of danger (D'max is the peak depth of the flood water above local ground level). That is not the case at the listed locations of the B4017, A338 and A34, which are all close to ground level at those specific locations.

The Great Western Railway south west of Steventon, with a passenger train heading W, can be seen in the image on the following page.

We have used this train as a model for assessment of the likely impact of a flood from a catastrophic breach, at the point of closest approach of such a train to the Reservoir, which is about 1km ahead. The vertical altitudes in the image (the broad red lines) are defined by the white end of the standard shipping container (2.6m high) and the GWR passenger carriages (roof 3.8m above track level). These are enough to locate the peak flood surface in the image (the container is not quite parallel to the track).

The purple arrow shows the peak height and direction of flow of the flood from a breach in the 150Mm^3 Reservoir: 2.85m above track ground level flowing at 3.44m/sec → D'maxV= 9.8m2/sec; peak fatality rate = 29%, average <F%> = 8%, and, with approximately 46 passengers in the flood, LOLL ~ 4.

With little variation in altitude along this track, past the Reservoir – it is 66m at Steventon and remains 66m past that point of closest approach – it is reasonable to assume that the track height above ground level is similar in both places. Although precise GWR track altitude details are unpublished, this image is consistent with that track base being very close to ground level. The altitude of the *road* here is 65m AMSL, 1 metre lower than the ground under the nearby track; the standard shipping container with its white end facing the camera is 2.6m high, so its roof is at an altitude of 67.6m. That corresponds closely to peak flood level (altitude 67.9m) from the previous 100Mm^3 proposed Reservoir, from which the average fatality rate <F%> was 'only' 2%. Passengers on the GWR train are thus at ***four times higher risk*** than the previous proposal and precise knowledge of track height with proper simulation of the flooding is required from Thames Water in order to reliably determine that increased impact, caused by its unjustifiable 50% increase in the size of the Reservoir.

Finally, Thames Water proposes to build a 'Steventon to East Hanney road diversion', to replace the present Hanney–Steventon road, which will run parallel to the GWR track but approximately 200m closer to the S embankment of the proposed Reservoir. If this road, like the present version, is constructed at ground level, this would present a fatal risk to motorists in the event of a catastrophic breach. Although Table D.2 shows the resulting impact (D'maxV=27 m2/s) at the point of closest approach (100% fatalities, not shown),

averaging over the complete width of the flood (± 107m along the track, with flood depth decreasing towards those limits) reduces the overall fatality rate <F%> to 71%, with 26 fatalities estimated. Placing the road on or behind a 5.5m embankment might transfer the risk elsewhere, which requires careful assessment. However Affinity, Southern and Thames Water's recently published 'Master Plan' [330] indicates no attempt to mitigate this risk to users of that proposed road, but invokes the developers' well-rehearsed all-purpose 20-year old qualifying mantra: 'subject to further design development'!

The problems outlined in this appendix can only be, and should already have been addressed fully by Thames Water in consultation with qualified reservoir engineers. It is Thames Water's responsibility to define the extent of risk and provide appropriate mitigating design features and procedures. Not only do we still see no sign of that happening, but the reckless increase in Reservoir size, proposed without meaningful public consultation, significantly increases the level of risk for all communities and travellers adjacent to the Reservoir and the downstream River Thames.

Notes on tables in Appendix D

Summary of the column contents of Table D.1 and Table D.2 of this appendix.

Column	Content	Column	Contents
X m	Location distance from breach	D'maxV	D'max x V (peak DV)
Alt m	Location altitude AMSL	D'(V=0)	Turning point flood depth
Alt (br) m	Breach altitude AMSL	Alt-Altbr	Alt m- Alt (br) m
Hw m	Water surface height above Alt (br)	%Fatal	% Fatality rate due to D'maxV
Vw Mm^3	Water volume above Alt (br)	<%F>	Fatality rate due to averaged
Qp m^3/s	Peak flow rate from breach		<D'>V across the flood front
W m	Flood front width at X		D' = Model flood depth > Alt m
DV m^2/s	Average depth x Velocity at X	Pop.	Impacted population
D m	Average depth at X	LLOL	<%F> x Pop. = Likely loss of life
V m/s	Flood velocity at X		
Dmax	Peak depth = 1.5 x D m		
D'max	Dmax- (Alt-Alt(br))		

[330] Gate 3 Basis of Design report, p. 80, Figure "Interim Landscape and Environmental Master Plan…".

Appendix E SESRO aeration system power estimate using Rutland Water system as basis

The Rutland Water reservoir (**124m square-metre capacity**) uses 12 Helixor guns for water de-stratification.[331] [332] However, the system has not been without its problems. We note:[333]

> *"The problem of stratification was the first to be addressed.* ***Twelve 'Helixor' air lift pumps*** *[see Figure E.1 below] vertical stack pipes into which air is introduced from a compressor located at the Empingham pumping station) were installed into the main body of the reservoir, close to the Iimnological tower […]. The original plan was to switch on these pumps once stratification had developed so that the water column would become mixed and de-oxygenation of the deeper waters would be prevented.* ***However, in 1978, the 'Helixors' were shown to be too underpowered*** *to overturn a full reservoir if it had already stratified [op cit]. As a consequence, in 1979 and 1980, the 'Helixors' were turned on as soon as a small temperature difference had been recorded between the surface and bottom water, i.e. in May, and run almost continuously until the end of August. This strategy of prevention rather than cure was found to be much more effective in reducing stratification [op cit]. In more recent years, the period of operation has been further extended, and the Helixors are now operated from March to October each year [op cit]. Even so, thermal layering still develops occasionally during very calm weather.*
>
> *In spite of the pumps, blue-green algal blooms developed in Rutland water and continued to cause concern for several reasons; firstly, many species were large and could block filters and cause taste and odour problems, thus increasing water treatment costs; secondly, many of these algae could exude toxic substances; and thirdly, the unsightly scums and large particles in the water could affect the recreational use of this waterbody. Eventually, during the dry summer of 1989, a toxic bloom of these algae (mostly Microcyslis) led to the deaths of several sheep and dogs."*[334]

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[331] Maddocks, S.L. (1982), "Vertical movements of the surface water and thermal stratification in Rutland Water", Hydrobiologia, **68:**79–87

[332] Institute of Freshwater Ecology Report (1994), "Rutland Water: An assessment of the effects of recent reductions in phosphorus loads on algal growth, especially Blue-Green species, and of the likely effects of proposed changes in the current phosphorus management programme, commissioned by Anglian Water Services Ltd.

[333] Ibid., p. 2.

[334] National Rivers Authority (1990), "Toxic Blue-Green Algae", Water Quality Series No.2.

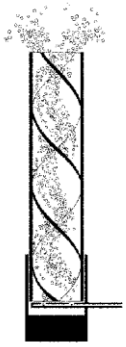


Figure E.1 - Helixor pump

Figure E.2 shows the amount of oxygen that could be transferred to the water column for various “free air flows” and for different depths. With increasing depth, maintaining an equilibrium oxygen transfer throughout the water column will require increased Free Air Flow, not just to provide the necessary oxygen, but also to overcome the hydrostatic head pressure exerted by that depth of water.

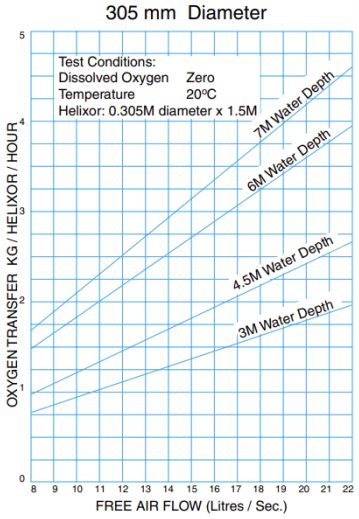


Figure E.2 - Oxygenation transfer for free air flow at different depths

Literature regarding deep reservoirs– both Rutland and SESRO reservoirs are in this category – recommends mixing the entire water column every 20–30 days in summer for bloom prevention if no river drawdown occurs and often requires continuous operation in a lengthy summer period, as evidenced by the extract from the Rutland situation above.

Calculation:

SESRO: Volume = 150 Mm^3.

Assume target turnover of 30 days (i.e. minimum turnover rate).

So Qmix (m3s-1) is the necessary rate of entrained water for turnover of full water column turnover in 30 days.

$$Q_{mix} = \frac{150{,}000{,}000m^3}{30daysx24hrsx3600sec} = 57.9m^3sec^{-1}$$

To reiterate: the aeration system would need to entrain 58 m3 sec-1 of water continuously to achieve one full-column turnover in 30 days.

Based on the PROCON Helixor literature – a Helixor air gun can entrain ~ 1.5–3 m3 sec-1 at moderate depth (~15–20m). Deep reservoirs reduce efficiency.

Assuming 3 m3 sec-1 per gun, a 12-gun system would deliver 36 m3 sec-1 –below the required ~58 m3 sec-1 needed for SESRO 30-day turnover.

To achieve the ~58 m3 sec-1 requires ~20 guns running at 3 m3 sec-1. At lower entrainment rates (e.g. 2 m3 sec-1), ~30 guns are required.

How much power is required to run 20 or 30 guns continuously?

SESRO assumptions:

Max. depth = 25m → hydrostatic head = 2.45 bar (245 kPa)

Compressed air requirement per gun: ~0.5 – 1.0 m3 sec-1 at reservoir depth (from Helixor datasheet/entrainment modelling*)

Operating pressure: ~2.5–3 bar (250–300 kPa) (hydrostatic + overpressure for entrainment)

Compressor efficiency: 70% overall (mechanical + thermodynamic losses)

Continuous operation: 3 months during summer

* Air-to-water entrainment ratio ~ 1:2–1:3 based on published Helixor performance for deep reservoirs. Exact per-gun flow varies with depth, helix design and duty cycle.

Estimated total flow required:

0.75 m3 sec-1 compressed air per gun (middle of range) – these are supply flow rates at gun inlet

20 guns: 15.0 m3 sec-1

30 guns: 22.5 m3 sec-1

Ideal power to compress air: power = energy per unit time = work per unit time

Rate of doing work on a fluid (i.e. power) is given by:

Pideal = Δp x Q,

where: Δp = pressure increase (Pa) & Q = volumetric flow (m3 sec-1) [Pa =Nm-2 = Jm-3]. Pressure increase: 25m x 9.807 kPa m-1 ≈ 245 kPa + overpressure for entrainment and piping losses ≈ 50 kPa = 295 kPa

Theoretical power per total system:

[Pa x m3 sec-1 = Nm-2 x m3 sec-1 = N m sec-1 = J sec-1 = W]

20 guns (15m^3 sec-1 of air): $P_{ideal} = \Delta p \times Q$ = 295,000 Pa x 15m^3 sec-1 = 4.425 x 106W = 4.425MW

30 guns (22.5m^3 sec-1): $P_{ideal} = \Delta p \times Q$ = 295,000 Pa x 22.5m^3 sec-1 = 6.638 x 106 W = 6.638MW

Account for efficiency: overall compressor efficiency η = 70%

Pelectrical = Pideal / η: 20 guns = **6.33MW** and 30 guns = **9.49MW**

This is at least 10 times the installed 500kW power quoted for the SESRO aeration system

A check could be made if the power required for the Rutland Water Helixor 12-gun system came anywhere near to the calculated (based on Rutland Water volume, depth, etc. parameters) came close to 1–2MW.

Appendix F Review of terrestrial ecology in Gate 3 and pre-DCO documents

F1 Terrestrial ecology and biodiversity in pre-DCO documents

As noted in section 4.1, the lack of an update on SESRO's BNG status is a serious omission from the DCO Consultation process. However, it is important to comment on the process to date, rather than to use the lack of an update to push the issue into the long grass.

The 2025 Statutory Consultation Map book's *Indicative Masterplan*[335] contains a very different set of habitat creation compared with 2024. However, the map cannot be used as a basis for any serious BNG calculations as it does not follow the formal system for UK habitat classification (UKHab), and has a vast new area labelled *"Project Priority Areas for Biodiversity"* (the major part of the SESRO project's footprint escalation to 38km^2 under draft Order limits). ***As there were no new BNG calculations provided as part of the DCO consultation, it is impossible to consult on how this area might be used and whether it is needed, and the Gate 3 BNG submission is no guide to the BNG status of SESRO associated with the DCO consultation.***

The issue of BNG is one of the key metrics used in the evaluation of the 'best value' programme for Thames Water's WRMP24. As GARD has emphasised in past consultations and summarised in the 2024-JPP Report, the evaluation of Thames Water's claims for positive BNG are flawed and have been based almost exclusively on desk-based studies. This situation has persisted into the Gate 3 submissions[336]. ***For now, we note that the huge scope creep in the biodiversity (and natural capital) assessments are just another reason for an urgent re-evaluation of SESRO as a 'best-value' solution in the WRMP24s of Thames Water and Affinity Water.***[337] In the interim, to give some background, we also list below issues of concern to give an update of our concerns in the RAPID submission.

F2 Issues of concern in the pre-DCO consultation and Gate 3 reports

F2.1 Recent upgrade in the 'baseline' for the reserved area

A new development follows the release of OLNRS[338]. The map of the SESRO area shown in the OLNRS document indicates (see Figure F.1 below) that it has been included as being a strategically significant area for nature recovery opportunities. This means that Thames Water has failed in its lobbying efforts to get the SESRO area excluded from being designated as strategically significant.

This matters because the BNG calculations must include an uplift factor in baseline BNG scores for area habitats, watercourses and hedgerows that have been recognised for their

[335] DCO map book, pp. 7–14.
[336] Gate 3 Biodiversity report.
[337] We note that Southern Water's WRMP24 is not yet approved by the Secretary of State.
[338] https://www.oxfordshire.gov.uk/residents/environment-and-planning/local-nature-recovery-strategy-lnrs

strategic significance within Local Nature Recovery Strategies. Thames Water ignored this factor, stating that the Oxfordshire Strategy had not been published,[339] but admitting it was in draft form and out for consultation.

> *"As this plan is currently a draft and the BNG calculations had already been run before the LNRS consultation commenced, it has not been included in this BNG Assessment."*[340]

Hence, Thames Water ignored any possible local strategy guidance to refer to. This is a dishonest approach given the significant green corridor that the Cow Common Brook and the Old Canal represent. Indeed, Thames Water's pre-emptive attitude to the OLNRS being agreed is typified by this extract:[341]

> *"The current alignment of the Cow Common Brook is within the LNRS area; however, the proposed Cow Common Brook realignment moves the watercourse out of the LNRS area. As the LNRS opportunity here is specific to restoring river diversity, it is unclear in the BNG guidance whether* ***the new alignment*** *of the Cow Common Brook could receive 'high' strategic significance status* ***despite no longer being in the LNRS area****. It is recommended a bespoke approach to deal with this situation be agreed with the Local Planning Authority and the Environment Agency." [our emphasis]*

GARD is sure the arrogance of this approach, 'oh we moved your priority area to somewhere else, how can it be a priority now', is apparent to anyone.

The green corridors in the SESRO area are shown in the OLNRS map below[342]:

[339] See remarks in section 2.10.2 of the Gate 3 Biodiversity Report.
[340] Gate 3 Biodiversity Report, section 4.3.4.
[341] Gate 3 Biodiversity Report, section 4.3.4.
[342] LNRS Strategy map, https://experience.arcgis.com/experience/ea43e0bc07c044ef8ca4b16803c5e59c?views=View-5

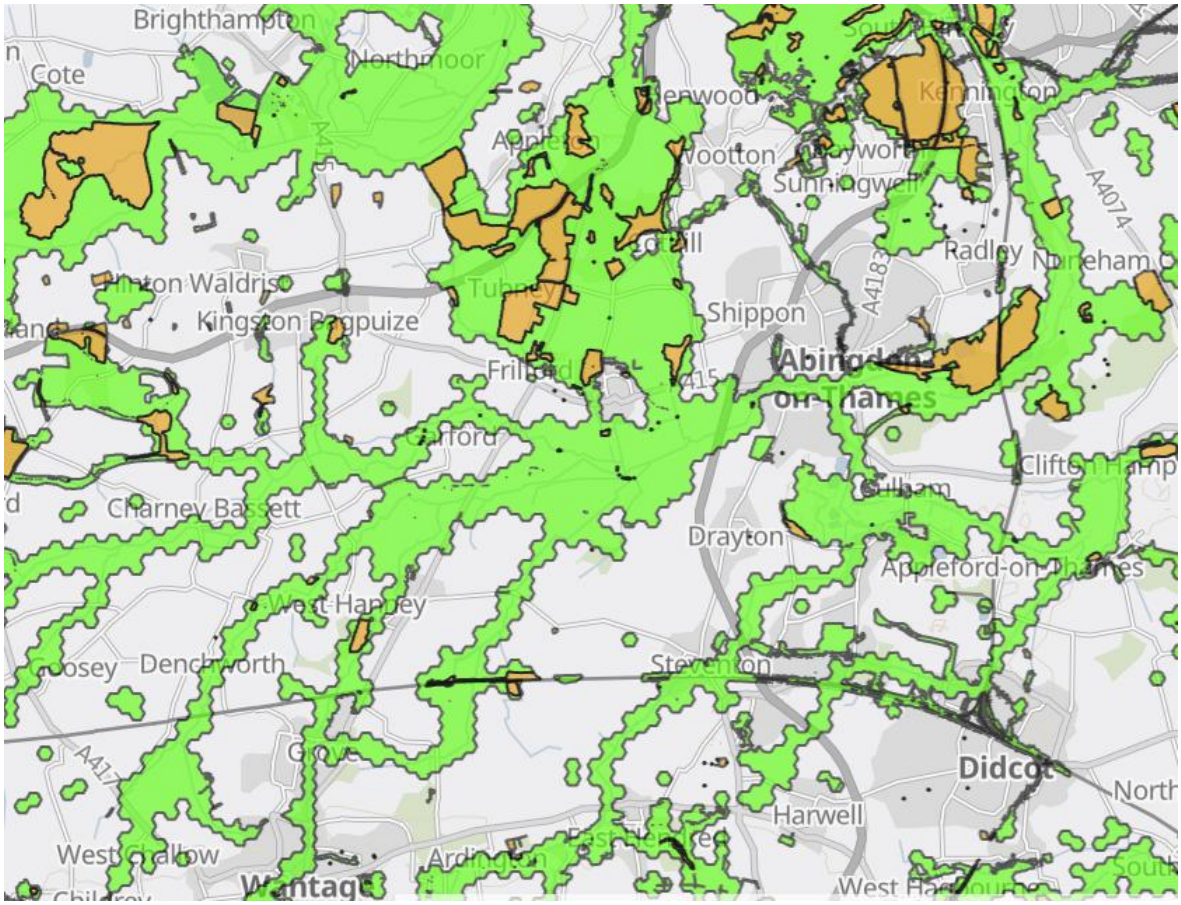


Figure F.1 - Map detail from published OLNRS Local Habitat guide

An important background factor in SESRO's designation within the OLNRS was the ancient and veteran tree survey that we shared with the OCC Local Nature Recovery Strategy team as part of the OLNRS consultation process. Thames Water's approach to ancient and veteran trees has been revealed in documents released as part of the DCO Statutory Consultation (discussed below in F6).

GARD experts have rerun the BNG calculations with the uplift factor included for Gate 2, 2024 Options Consultation and Gate 3 BNG calculations to see what difference it makes (discussed in next section). Thames Water admitted that this would have to be done if the OLNRS were to be adopted. ***GARD believes that, now that the OLNRS has been adopted, RAPID and the Planning Inspectorate should insist that Thames Water reruns the BNG calculations.***

F2.2 Baseline area habitat scores moving upwards

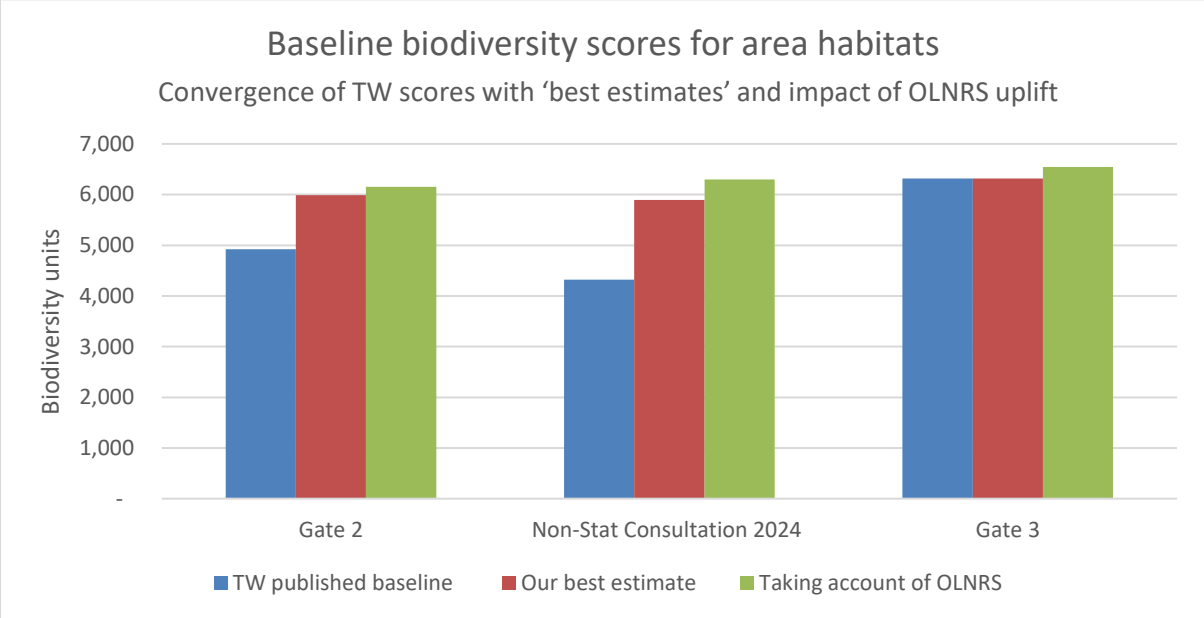
Across the three different sets of BNG calculations so far, the assumptions about both the baseline habitats and habitat creation have been widely inconsistent. All three sets of calculations have involved bending the assumptions to meet or bring closer to meeting the 10% BNG targets. GARD has examined the new Gate 3 baseline area habitat scores and concluded that they are moving far closer to the baseline area habitat scores in the 2024-JP Report. There are several reasons for this:

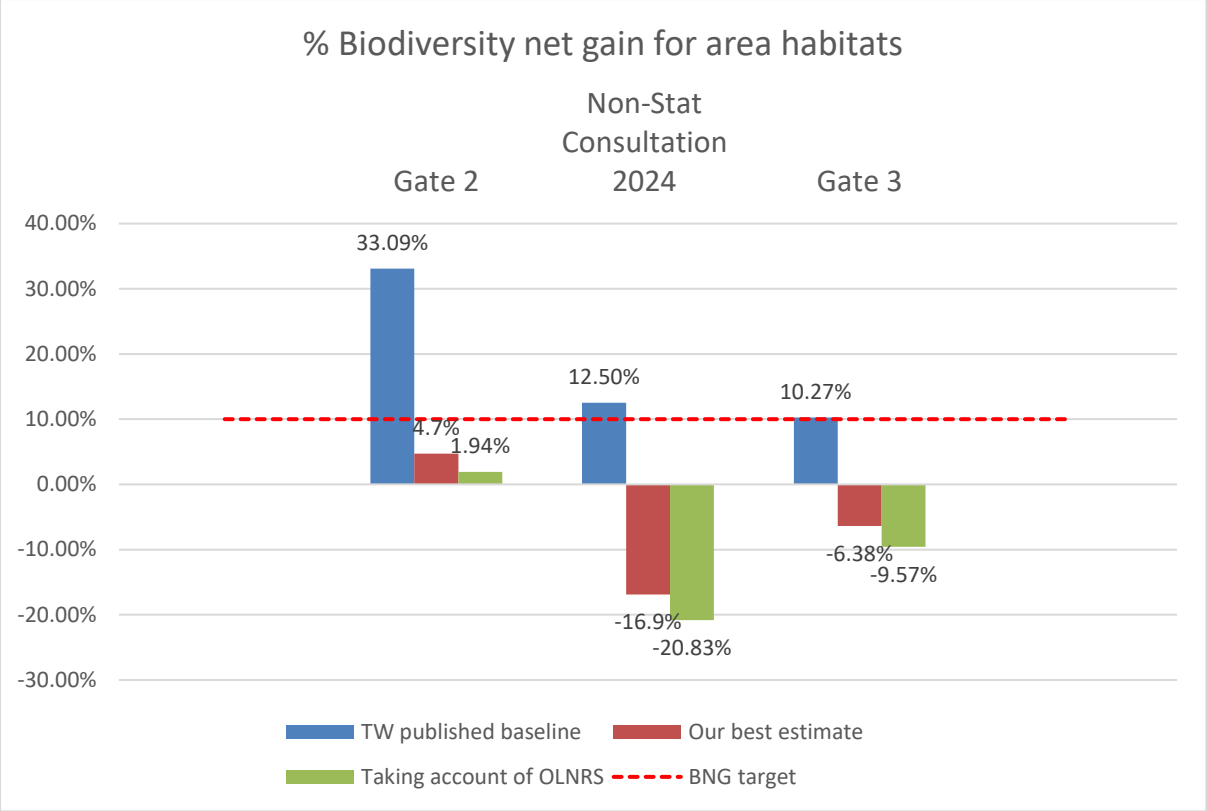
- arable margins have now been included and score higher than arable fields;
- there has been more accurate mapping of grassland and scrub areas;
- different types of woodland and scrub habitat have been more accurately mapped.

As GARD's field data on area habitats is much more comprehensive than the 41% coverage so far achieved by Thames Water, we believe this demonstrates the direction of travel of a full assessment.

The more realistic treatment of baseline habitats since the RAPID Gate 2 is a major factor in the drastic expansion of SESRO to control 38km^2, of which less than half relates to the red lines of previous SESRO iterations. The main strategy used in SESRO's BNG reporting to keep BNG above statutory targets has included a mix of:

- suppression of baseline biodiversity values;
- inappropriate allocation of habitats on the Reservoir embankment;
- unrealistically high 'time to condition' assumptions for created habitats;
- unexplained changes to habitat allocation and scoring that provide extra units of biodiversity needed to meet the targets (tweaks to both baseline and habitat creation biodiversity scores).





Note: This shows scores for the SESRO land-take prior to the latest expansion for the pre-DCO consultation.

Figure F.2 - Evolution of 'Baseline' habitat scores for (pre-Statutory DCO consultation) SESRO area

'Our best estimate' indicates the result of the evaluations in GARD's 2024-JPP Report. The picture is very inconsistent across the different habitat maps and BNG calculations. Overall, at each stage, different assumptions have been made, with poor levels of justification. The following outlines some of our main concerns with SESRO's approach to BNG at each stage of the SESRO process to date.

Gate 2 – very low biodiversity scores were attributed to existing area habitats. These were 20% below the best estimates from the GARD's own 2024-JPP report[343] and failed to consider the strategic importance of the area to local nature recovery.

The 33.0% BNG score claimed for area habitats was achieved through:

- the inclusion of solar farms as arable agriculture (very low score), despite of species-rich meadow habitats created under and around the installations;
- the exclusion of arable field margins and buffer strips along watercourses;

[343] 2024-JPP report, section 5.2.7.

- the limited habitat assessments carried out at inappropriate times of year;
- lack of full access to the area was used as an excuse throughout, even though areas with public access (including alongside solar farms) would have given a more adequate picture and many of the features were also apparent from satellite imagery;
- poor and unjustified assumptions were made in relation to habitat creation – for instance, the likely condition of grassland habitat created on the Reservoir embankments and grazed by sheep.

Key habitats, such as Hutchins's Copse in the south, were excluded from the impact area for BNG purposes, without any firm assurances that they would be safe from the development, and the status of this area is in doubt as the Copse is not marked as retained woodland within the Statutory Consultation Masterplan[344] and instead shows the area dotted with ecological ponds. Appendix 7.1 of the PEI does not clarify the situation.[345]

Non-Statutory Consultation on Reservoir Options (pre-Gate 3, 2024) – the baseline biodiversity scores were lowered from those used in the Gate 2 assessment without any written explanation or evidence of new fieldwork. This factor alone was enough to keep BNG for area habitats above 10% for cosmetic purposes[346]. The baseline biodiversity scores were 30% below the 2024 -JPP report[347] best estimate.

The assumptions relating to grassland grazed by sheep, previously classified as "*other neutral grassland in good condition*" was reclassified to "*modified grassland in poor condition"* on the basis that it was a more realistic category for a sheep pasture. Although this reduced the number of biodiversity units associated with created habitats, it was more than offset by the unexplained lowering in the baseline biodiversity scores.

Gate 3 (October 2025) + DCO Consultation (October 2025) – fieldwork carried out by Thames Water contractors in 2024 supplied revised baseline habitat assessments (UKHab) for 41% of the SESRO area, including a large section of the green corridor classified as strategically important for local nature recovery in the OLNRS. The UKHab surveys brought the baseline habitat assessment closer to the best estimates for pre-Gate 3 BNG scores for area habitats by addressing some of the criticisms made within the 2024 JPP Report[348]. Key changes were inclusion of field margins and watercourse buffer strips, recognition of

[344] 2024-JPP report, section 5.2.8.
[345] 2024-JPP report, section 5.2.8.
[346] SESRO Interim Landscape and Environmental Master Plan Report, para. 6.3.1.
[347] https://groupagainstreservoirdevelopment.org/wp-content/uploads/2025/06/BNG-Review-GARD-April-2025.pdf, p. 31.
[348] Ibid., table 20.

grassland habitats under solar farms (previously classified as "*arable*") and classification of smaller parcels of land (including trackways and areas of scrub).

- The impact of the draft OLNRS on BNG calculations was not considered, and Thames Water had requested that the SESRO area be excluded from the Local Habitat Map[349] which indicates local nature recovery opportunities.

- BNG was maintained above 10% by additional habitat creation on the Reservoir embankment and elsewhere.

- The decision to downgrade the biodiversity value of sheep pastures contained in the pre-Gate 3 consultation documents was reversed – this change was sufficient to nudge the BNG score above 10%. ***Without this tweak, a BNG of -10.7% for area habitats would have been obtained, rather than +10.27% in the Gate 3 submission. With such a massive impact on the BNG score, such a change should have warranted at least some explanation.***

The issues of concern are listed below and relate to area habitat BNG calculations within the Gate 3 submission (we have had insufficient time to look at the hedgerow and watercourse habitats in enough detail). First, however, there are two overriding concerns which are, at this stage, very revealing:

10. The Gate 3 Biodiversity Report is based on a habitat survey which is still only 41%[350] of the land and habitat creation plans based on the 2024 Interim Landscape and Environmental Master Plan. Thus, the BNG assessments remains essentially desk-based.

    1. The DCO Map Book shows many large areas labelled *"Project Priority Areas for Biodiversity"*. It is extremely difficult to see why these areas of, predominantly productive farmland, are required ***unless the conclusion has been reached within the project team that BNG targets cannot be reached within the original 12km^2 of the SESRO site***.

       This, which is nowhere mentioned in the Gate 3 submission nor any of the DCO consultation documents, comes as no surprise to GARD's experts, as it is essentially the message of our expert report:

       > *"The 150Mm^3 reservoir option is too large to have sufficient scope for peripheral habitat creation and enhancement to off-set the baseline biodiversity losses through on-site habitat creation and enhancement."*[351]

[349] Oxfordshire Local Nature Recovery: Local Habitats Map.
[350] Gate 3 Biodiversity Report, p. 8.
[351] 2024-JPP Report, section 6, p. 53.

We have undertaken an analysis of the different SESRO size options, based on more realistic biodiversity baseline scores – presented below.

F3 Area habitats in the Gate 3 Biodiversity Report and Statutory Consultation Masterplan

GARD's expert has created a digital version of the 2024 *Interim Master Plan map* [352]*and the Statutory Consultation Masterplan.* The detail in both have been examined on how the latest iteration of BNG as part of the Gate 3 submission purports to achieve a BNG of > 10% for Area Habitats (one of the three BNG metrics). The Masterplan submitted as part of the Statutory Consultation does not have associated BNG calculations, so these have not been updated since Gate 3. In the following paragraphs, we list some conclusions in relation to Gate 3 BNG to show our concerns.

The *Interim Master Plan* map does not use the same habitat types listed in the Gate 3 Biodiversity Report and provides insufficient resolution to cross-check how different habitats depicted relate to UKHab classifications used in BNG calculations.[353] For instance, the map contains habitats labelled as "*scrub*" and "*intermittent trees and shrubs*", whereas the BNG Report tables use the category "*mixed scrub*" only. There is significantly less "*scrub*" shown on the map than "*mixed scrub*" included in the Report's BNG tables.[354] Only by assuming that "*scrub*", "*intermittent trees and shrubs*" and *all the floating islands* contain this habitat can the total for "*mixed scrub*" be reached. There is no statement in the Gate 3 Biodiversity report that mentions raft habitats – all we know is that they are intended to boost biodiversity (a rather desperate measure). We do know that the Gate 3 Cost report[355] cites the floating islands as a major driver of the cost increase. As there is currently no evidence that rafts on this scale (approximately 7 hectares in total) can actually be realised (all those shown in the catalogues are miniscule in comparison to the rafts in the Master Plan), it is a reasonable conclusion that this lack of space for scrubland and other habitat creation is one of the drivers for the large increase in the project's land area as proposed in the DCO.

With a more realistic biodiversity baseline for area habitats in the Gate 3 assessment, there is more pressure to find space to create new habitats. The strategy so far has been to create sufficient habitat on site to mitigate these losses. This has resulted in much more extensive new habitat creation and use of areas that are less than ideal for those habitats and potentially unsafe.

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[352] Thames Water, Affinity Water and Southern Water (2024), "Interim Landscape and Environmental Master Plan Report", June, p. 98.
[353] Gate 3 Biodiversity Report, tables 5 and 6.
[354] Gate 3 Biodiversity Report, tables 5 and 6.
[355] A3 Cost Report.

Habitat rafts on the Reservoir and planting more woody habitats on the Reservoir embankment are two aspects of this.

Pressure to meet BNG for area habitats has driven a tripling of on-site woodland and scrub habitat creation from 90 hectares at Gate 2, 119 hectares at Gate 3 and 270 hectares indicated (but not enumerated) in the Statutory Consultation Masterplan.

The use of reservoir embankments to maximise BNG opportunities on site is a cause for concern in terms of the integrity of the embankment, particularly from root growth that may directly facilitates seepage and from burrowing animals, such as badgers. Figure F.3 shows that the proportion of embankment with woody habitats has risen from 6% at Gate 2, 13% at Gate 3 to 29% at the Statutory Consultation stage. These habitats are vaguely defined as "*intermittent trees and shrubs*", "*woodland and copse*", "*scrub*" (2024) and "*woodland and copse*" and "*scrub*" in the Statutory pre-DCO Consultation (2025). It has been suggested that the planting is more likely to be hawthorn and other low-growing species, however the optics are not as good with an embankment planted with 'scrub' rather than lush woodland. The SESRO artwork therefore depicts tall trees on sections of embankment, whereas text in the PEIA mentions low-growing shrubs.

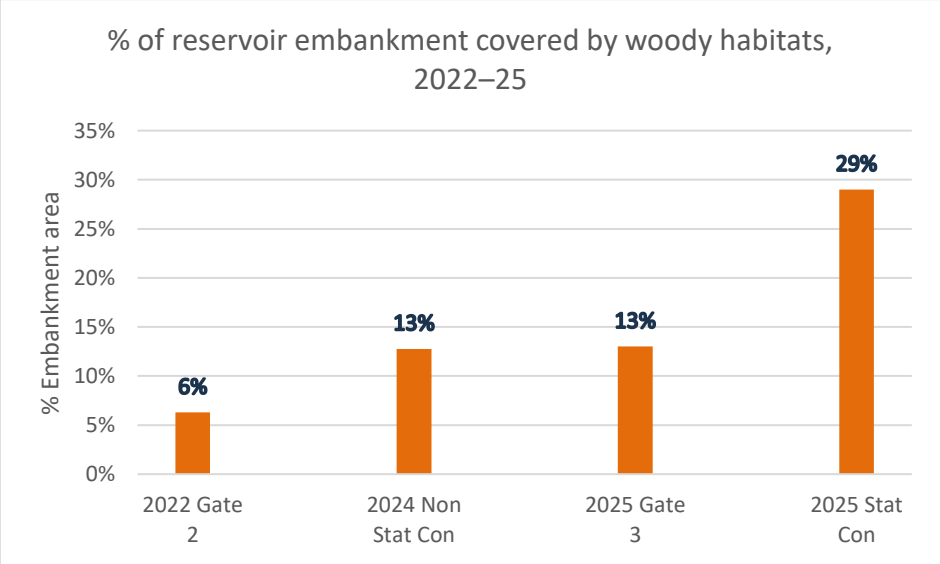

Figure F.3 Increase of Reservoir embankment covered by woody habitats, 2022–25

Another issue with the Gate 3 BNG calculations is the way in which embankment grassland habitats have been classified and scored. As two-thirds of the new habitat creation around the Reservoir relates to "*other neutral grassland*", this is an important issue within BNG scoring. The map shows grassland as either "*pasture for sheep grazing*" or "*species-rich neutral grassland*". Again, neither of these terms equates to UKHab classification used in BNG calculations (which refers to "*other neutral grassland*" and a small amount of "*modified grassland*"). A large area (220 hectares) of the embankment grassland is designated as sheep grazing. This grass must be kept short. In the BNG calculations presented in the 2024

pre-DCO non-statutory consultation, the grazed area was partly downgraded from "*other neutral grassland*", to "*modified grassland*" (which has a lower biodiversity score than the former)[356]:

> *"A precautionary approach has also been taken with regards to the amount of other neutral grassland ('good' condition) indicated to be created as part of the Interim Master Plan. This is because further soil survey and analysis is required to inform the proposals for grassland creation. Consequently, for the purposes of the BNG analysis, it has been assumed that the grassland areas indicated on the Interim Master Plan would comprise 50% modified grassland ('poor' condition'), including the areas indicated as pasture for sheep grazing, and 50% other neutral grassland."*

However, the Gate 3 BNG submission assigns all sheep pasture to "*other neutral grassland*" in 'good' condition, without any acknowledgement of the assumptions made in 2024. This unexplained change adds significantly to the Gate 3 BNG area habitat scores, but it is unlikely that sheep pasture should be allocated the same biodiversity score as all ungrazed areas, for the reasons stated in 2024. Clearly this is a nudge factor to get the BNG score for area habitats above +10%.

The allocation of grassland habitats within the Statutory Consultation IMP includes a different arrangement of habitats across the site, with inclusion of "*lowland meadows*" in wetter areas, "*neutral grassland*" (assumed to be 'other neutral grassland') and "*modified grassland*". The last of these is again shown on the Reservoir embankment, but covering only 15% of the area (around car parks, the café and other recreational features), the rest is "*other neutral grassland*". In this Masterplan there is no indication of sheep grazing, but presumably the requirement remains to keep grass short on the embankment on safety grounds.

Hollowing-out of important baseline habitats in Gate 3 BNG calculations – the UKHab survey work carried out for Thames Water during 2024 to assess habitats within the 41% of area surveyed[357] appears to have hollowed out several important baseline habitats that attract the highest biodiversity scores. For instance, Drayton Copse, an area of lowland mixed deciduous woodland, appears on the detailed habitat map with an area marked as "*other developed land*" (ID 10579) at its centre (Figure 3 Uk Habitat Classification Maps, page 3). Although the designated area contains a mound previously used for clay pigeon shooting, it is under a closed canopy of oak trees and therefore should not be excluded from the total area of woodland habitat in BNG calculations.

[356] Thames Water, Affinity Water and Southern Water (2024), "Interim Landscape and Environmental Master Plan Report", para. 6.2.9.
[357] SESRO UK Habitat and Hedgerow Survey Technical Report J696-AJ-A02X-ZZZZ-RP-EN-100043.

Analysis from our SESRO tree database shows that the area highlighted as "*Other developed land*" is a section of Drayton Copse containing approximately 30 trees. The Copse has an average tree density of 210 trees/hectare, whereas the area indicated "*other developed land*" in the UKHab Report has a density of approximately 300 trees/hectare. "Other developed land" receives an area habitat score of "0", whereas an area of "lowland mixed deciduous woodland" in "good" condition scores 20 biodiversity units per hectare, making it one of the most valuable habitats in the biodiversity baseline.

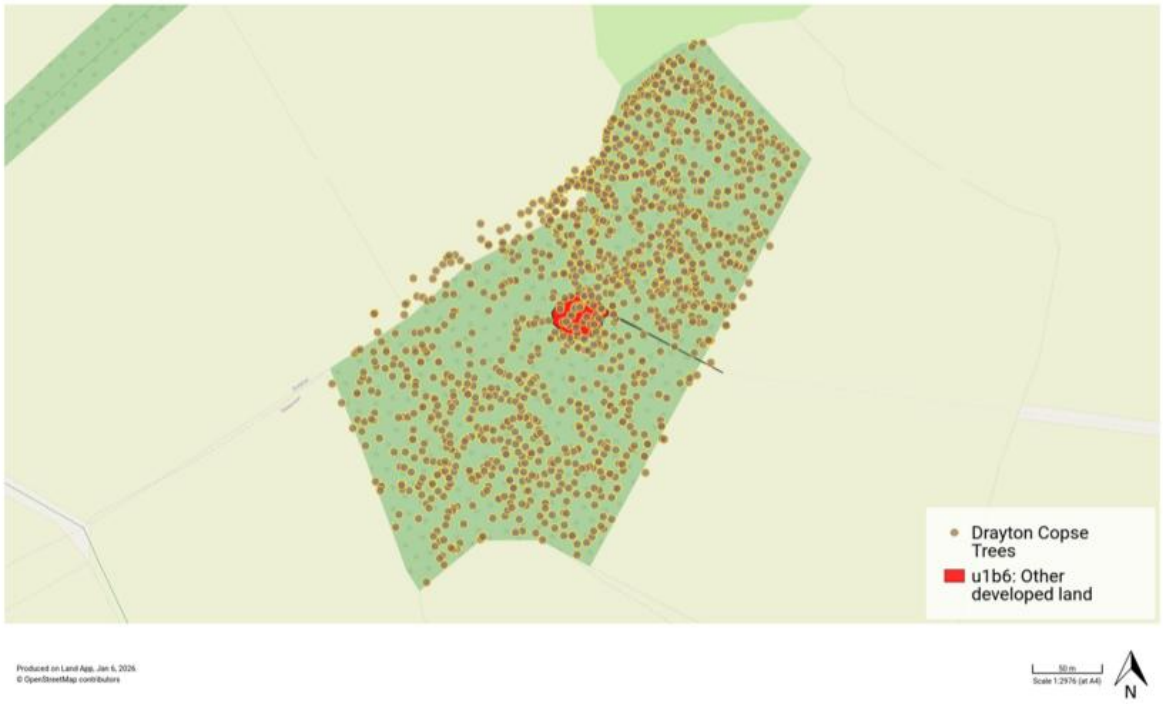

Figure F.4 - Drayton Copse's 1,500 trees with a section marked "*Other developed land*" in the UKHab assessment (data from tree database and mapping system)

Other instances of hollowing-out of existing biodiversity include mixed deciduous woodland along the Old Canal to the west of Drayton Copse, where the bed of the Old Canal has not been indicated as woodland in the habitat map and has instead been left blank.

Changes to the timetable for biodiversity remediation – another strategy deployed in the Gate 3 submission to nudge the BNG scores upwards is the bringing forward of start times for new habitat creation. Previously a nine-year lag had been generally assumed before new habitat creation commences, i.e. it was scheduled towards the end of the project timeline. The Gate 3 submission brought forward habitat creation timelines for two habitat types that account for 80% of new habitat creation, excluding that associated with the Reservoir itself. For wetland areas, all new habitat creation would be started in year 5 rather than in year 9[358]. In the case of "*other neutral grassland*", a staggered approach would be taken across

[358] Gate 3 Biodiversity Report, section 2.11.3.

five equal areas of land, starting in year 5 and ending in year 9. The feasibility of doing this is questionable and no strong evidence is put forward to justify it in relation to either habitat type. This points perhaps to another reason behind the proposed vastly increased land area shown in the DCO consultation, giving more access for contractors to start the wetland habitat mosaic and grassland creation whilst work continues on the main Reservoir construction areas. The Gate 3 report justifies bringing forward these dates, basically because they will have to be advanced[359]:

> *"Additionally, a delay of only five years has been assumed for the terrestrial wetland mosaic as this habitat will need to be established before protected species such as water vole (Arvicola amphibius) can be translocated. This excludes the ditches associated with the wetland mosaic and all other watercourse diversions and realignments. These habitats will have to be enhanced/created prior to any watercourse loss in order for the watercourses to function effectively for mitigation. Therefore, no delay in time to target condition for these habitats has been included."*

F4 SESRO size options and impact on biodiversity

The adoption of the 150Mm^3 SESRO was partly justified at Gate 2 by high-level BNG calculations suggesting that all six of the size options would produce significant improvements to local biodiversity[360]. This stage involved the only published cross-comparison of different SESRO size options and their impact on biodiversity. For BNG area habitats, analysis below shows that application of the updated Gate 3 baseline habitat scores, *as used at Gate 3*, actually over-turns the conclusion used to justify 150Mm^3, which really is the most environmentally damaging option[361]:

> *"As much of the baseline habitats will be lost to SESRO, this significant net gain in biodiversity for all options indicates that the replacement habitats and future landscape surrounding SESRO will be far more beneficial to biodiversity than the current landscape."*

Based on revised biodiversity baselines discussed above and keeping the 2022 "Landscape and Environmental Design Plan" for post-construction habitat retention and creation, only the 100Mm^3 and 75Mm^3 options would have met the 10% statutory BNG target. Clearly, the new evidence does not support the original conclusion of "*significant net gain in biodiversity for all options*".

[359] Gate 3 Biodiversity Report, section 2.11.3.
[360] SESRO Technical Supporting Document B 6 BNG report, Table 4.16 (report no longer available online).
[361] Ibid., para. 5.2.

Selected SESRO size options ($Mm^{3)}$	Gate 2 report BNG % for area habitats – original scores	Gate 2 report BNG % using revised baseline biodiversity scores
150	33.09%	2%
125	37.16%	5%
100	45.08%	13%
75	51.64%	28%

Table F.1 - Summary of BNG results for area habitats for selected SESRO size options

F5 Incomplete tree survey to identify individual trees to be included within BNG calculations

The BNG area habitat metric within Defra's statutory BNG tool requires individual trees to be listed when they are likely to be felled as a result of a development. "*Individual trees*" refers to those occurring outside of woodland habitats – for instance, in open fields, hedgerows and lines of trees. Trees that meet these criteria are entered into BNG calculations and given a biodiversity score depending on their size and condition.

The Gate 3 UKHab includes a tree survey with 41% coverage of SESRO's area in which 274 individual trees were identified. The survey and the analysis of satellite data were used in the Gate 3 BNG Report to estimate area and habitat units lost from the felling of rural trees that stand outside woodland. GARD's experts have compiled a database of 2,500 trees within the SESRO area, from which an assessment of the Gate 3 tree survey coverage was conducted. Analysis has found that the contractors have missed 42% of "*rural trees*" that met the size and location criteria (200 trees) for inclusion in the BNG metric. Whilst lack of full access to the SESRO site has often been cited as a reason for highly provisional estimates being made within BNG assessments, in this case, full access to 41% of the area has resulted in under-representation of habitat on the ground.

Drayton Copse was included in the UKHab tree survey, with 57% of the trees assessed so far. Although further work was being conducted during December 2025, none of the northern stands of oak were included. This is concerning as the condition score included within the Gate 3 BNG metric was "*moderate*", whereas previously it had a condition score of "*good*". Changes made to the condition scores of such important habitats have a significant impact on baseline scores and should be a priority in fieldwork.

F6 Omission of the existing database on irreplaceable habitats within Gate 3

As a matter of principle, all ancient and veteran trees should also be accounted for and listed in the record of individual trees (regardless of whether in a woodland habitat or out in the open), even though they are not themselves scored within the BNG metric. The UKHab survey (2024) and AIA (2025) across 41% of the site in 2024 has resulted in contractors attaching their metal tags to 85% of the ancient and 49% of veteran trees that GARD's experts have had validated by the Woodland Trust. Most of the untagged ancient and

veteran trees are in wooded habitats, where it is a specific requirement of the Defra metric to record all ancient and veteran trees as "*individual trees*". However, the Gate 3 submission has not referred to anything other than the original "*single ancient tree*" included in the 2022 BNG report identified by a member of the public and posted on the ATI website in 2020[362]. This is certainly a case of suppressing the evidence that Thames Water probably already has and which is readily available on the Woodland Trust's ATI site[363]. The Gate 3 Biodiversity report states that the ATI site was accessed in February 2024.[364] This is a full *eight months* before the Gate 3 report was submitted for 'assurance' and *over 16 months* before the report is dated.

GARD's report on biodiversity, and subsequent work identifies[365]:

- 248 trees in total, including 23 ancient trees, 214 veteran trees and 11 notable trees;[366]
- 8 main types: oak, field maple, hawthorn, purging buckthorn, wild apple, ash, wild pear, and willow species (crack willow, white willow and grey/goat willow). Willows accounted for over 70% of the trees uploaded to the ATI;
- that many of these trees were in areas readily accessible or visible from public rights of way or roads.

As we say in the GARD report[367]:

> *"Although Thames Water's preliminary desk study recognised a single ancient tree within the SESRO impact area, work carried out since the reservoir was first proposed in the 1990s has identified ancient and veteran trees of a size and condition to support bat roosts. Dr Robert Stebbings carried out tree searches across the SESRO area and identified 16 trees with evidence of bat roosts during the 1997-1998 Thames Water tree survey. Similar survey work carried out for Thames Water in 2006 found 27 trees with high potential to support roosting bats, particularly around Hutchins's Copse, Drayton Copse and the route of the Old Canal. Results of the current ancient and veteran tree survey are therefore unsurprising, and several of the trees identified in the current survey had evidence of potential."*

[362] Gate 3 Biodiversity Report, section 3.5. and Appendix D.
[363] Woodland Trust, Ancient Tree Inventory, available at https://ati.woodlandtrust.org.uk/.
[364] Gate 3 Biodiversity Report, section 3.5.1.
[365] 2024-JPP Report, section 5.5.2.
[366] View ATI records for SESRO area here
[367] 2024-JPP Report.

Ancient and veteran trees

The release of the PEI Report as part of the DCO consultation stage includes the results of ancient and veteran tree assessments commissioned by Thames Water[368] The AIA prioritised trees recorded as ancient or veteran on the publicly available ATI website (accessed June 2025). Rather than accepting the records validated by experts at the Woodland Trust, the contractors chose to use the proprietary RAVEN 2 methodology. Justification for this is found in Appendix 9.7 of the Assessment, which states that South Oxfordshire and VoWHDC Tree Officer and Planning Specialist Team Leader agreed to the use of the RAVEN 2 approach:

> *"Stakeholder agreed to the proposed approach including the application of the NPPF definition of ancient and veteran trees (as opposed to other definitions which have less stringent criteria)" [369]*

This is an inaccurate statement as the NPPF does not itself advocate a single methodological approach to the definition of ancient and veteran trees. RAVEN 2 is one of a number of methodologies used to determine ancient and veteran tree status in relation to the NPPF. These include the use of the Woodland Trust's published guidance and the records contained within the ATI database, which remains the primary source for government and planning authorities for existing records of ancient and veteran trees.

Thames Water contractors have previously used ATI records to identify ancient and veteran trees likely to be affected by SESRO (fieldwork February to May 2024). The UK Hab Technical Report [370] identified a single ancient tree and 13 veteran trees within the EIA Scoping Boundary during field surveys in 2024.[371] The AIA was carried out in March, April and May 2025. It is an open question as to whether a full-scale assessment of ancient and veteran trees would have been carried out as part of the PEI without the release of the most recent ATI data for the SESRO area. Having conducted UK Habitat and Hedgerow Surveys across 41% of the then SESRO site, during 2024, it was concluded in paragraph 1.1.6:

> *"A total of 274 individual trees were recorded within the area surveyed and included trees within hedgerows, lines of trees, and standalone trees. Of these, 13 were recorded as being Veteran trees."*

Presumably these 13 veteran trees identified by the Survey were also processed by the AIA fieldwork.

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[368] Thames Water (2025), "Preliminary Environmental Information Report: Appendix 9.7 – Aboricultural Impact Assessment (Annex 1 – Aboricultural impact assessment plan". (Henceforth, the 'Arboricultural Impact Assessment'.
[369] Ibid., Table 3.2.
[370] SESRO UK Habitats and Hedgerow Survey Technical Report, para. 1.1.6 (internal SESRO document, March 2025).
[371] Ibid., para. 5.2.49.

The outcome of the RAVEN 2 assessment in relation to ATI records is another instance of Thames Water going to great lengths to suppress baseline levels of existing biodiversity – in this case, for irreplaceable habitat. If lost, such habitats require bespoke compensation to be arranged as part of the DCO BNG submission.

From the ATI total of 248 trees from the draft Order area, 118 trees (48%) were included in the AIA report. By linking data in that report with the original field data, photographs and notes taken during the recording of trees for the ATI survey, it has been possible to compare RAVEN 2 results directly with the Woodland Trust data for 118 trees (as shown in Table F.2 and F.3).

The result of the RAVEN 2 assessment is to virtually eliminate veteran tree status across the SESRO area by placing nearly all veteran trees in the "*notable*" category. This is an illogical outcome as all ancient trees are veteran trees, but unusually large for their species. Veteran trees are trees that are developing characteristics that may eventually become ancient. This natural progression is not acknowledged in outcomes from RAVEN 2. It is ironic that if RAVEN 2 were to be applied to the entire ATI database, there would be too few reference points left from which to derive Step 2 girth thresholds used in RAVEN 2, as described below.

	Ancient Tree Inventory		**RAVEN 2**
ATI status	Total for SESRO area	ATI status identified in RAVEN 2 assessment	Outcome of RAVEN 2 assessment
Ancient	23	12	9
Veteran	214	104	1
Notable	11	2	108
Total	248	118	118

Table F.2 - Elimination of veteran trees through the RAVEN 2 survey

RAVEN 2 is a multi-stage process of evaluation of both physical and biological characteristics of trees and their ageing and decay processes. Looking in detail at the RAVEN 2 assessment in relation to the 118 ATI status trees, Stage 2 of the process accounts for the greatest drop-out of ATI ancient and veteran tree status. The size threshold for different tree species was not met by 94% of veteran and 58% of ancient trees validated by the Woodland Trust. Step 2 in the RAVEN 2 process is therefore highly restrictive, despite many of the other tree features that are important for the biodiversity value of these trees being met, particularly at the Secondary stage.

	Step 1 – **Age** Assessment		**Step 2** – **Size** Assessment	Step 3 – Primary Features At least two of the following should be present (or refer to Step 4)				Step 4 – Secondary Features If no primary features are present, tree requires six secondary features to qualify. If only one primary feature is present, tree requires three secondary features to qualify									**Step 5** - Recognition Guide Ancient - veteran tree with extremely large girth; age likely 50% of estimated species maximum Veteran - relatively old and very large for species and qualifies under either Step 3 or Step 4		
Ancient Tree Inventory		Tree age is minimum 25% of life expectancy (Y/N)	Tree has required girth (Y/N)	Extensive decay (Y/N)	Extensive hollowing (Y/N)	Senescence (Y/N)	Retrenchment (Y/N)	Large quantity of deadwood in crown (Y/N)	Major storm damage (Y/N)	Habitat spaces (Y/N)	Aerial Rooting (Y/N)	Sap run/slime flux (Y/N)	Water pool (Y/N)	Bark Loss (Y/N)	Fungi (Y/N)	Other epiphytic plants (Y/N)	Ancient RAVEN	Veteran RAVEN	Notable RAVEN
Ancient Trees	Yes	10	5	11	9	1	1	4	6	12	5	0	0	11	2	12	4	1	7
	No	2	7	1	3	11	11	8	6	0	7	12	12	1	10	0			
Veteran Trees	Yes	91	6	91	67	3	4	40	64	104	31	0	0	90	23	104	5	0	99
	No	13	98	13	37	101	100	64	40	0	73	104	104	14	81	0			
Notable	Yes	2	0	2	1	0	0	0	0	0		0	0	2	2	2	0	0	2
	No	0	2	0	1	2	2	2	2	2	2	2	2	0	0	0			
		118	118	118	118	118	118	118	118	118	118	118	118	118	118	118	9	1	108

Table F.3 - RAVEN 2 process applied to 118 records from the Woodland Trust's Ancient Tree Inventory

Step 1 - Age: the age and historical significance of ancient and veteran trees included in the ATI dataset has been researched as part of the Woodland Trust recording process for the 118 trees. The historical context is not an aspect that the RAVEN 2 method considers. Aerial images of the SESRO impact zone have been analysed and include sources such as the work of Major George Allen from 1933, the Historic England Aerial Photo Explorer, and historical records relating to the Wilts and Berks Canal. The analysis has been carried out alongside a GIS system and use of a light aircraft to help locate trees likely to be of ancient or veteran status. Although there is no guarantee that trees on the ground today are the same as those that appeared in early photographs (e.g. crack willows are notorious for regeneration through fragmentation and root suckering), it has proved to be a useful guide. For instance, the even spacing of willows along the Old Canal towpath can be seen in the historical record and has been used to locate some of the original trees dating from the early nineteenth century or before.

Step 2 – Girth: the girth thresholds used at Stage 2 in the RAVEN methodology are derived from the Woodland Trust ATI data and guidance. However, the Woodland Trust's approach differs from RAVEN 2 as being more holistic and ecologically based[372]. It regards veteran status for a particular tree species to be determined more by its characteristics (such as hollowing, decay, and a wide, squat shape) than a single fixed girth measurement, as the age at which a tree becomes a veteran greatly varies and is influenced by growing conditions.

Section 5 of the AIA report discusses the approach to selecting tree girths for the species encountered across the SESRO survey area. Mainly the RAVEN 2 values are averages obtained from ATI records with additional references from the arboriculture literature. For four of the ten tree species included, RAVEN 2 has adopted higher girth thresholds than those used within Woodland Trust guidance: Ash, Hybrid Black Poplar, Wild Pear and Grey/ Goat Willow. For Purging Buckthorn, the contractors were unable to find a value for setting the girth threshold and this species was automatically recorded as "*notable"*, rather than "*ancient*" or "*veteran*". Within the surveyed area close by to the AIA recorded specimen, ATI records include an ancient purging buckthorn that was overlooked in the AIA work. It has a 2.1-metre girth, compared with a nearby ATI veteran with a girth of 1.46m.

[372] Woodland Trust Ancient Tree Guide No 4.

	Ancient Tree Inventory	RAVEN 2
Acer campestre (field maple)	2.5	2.5
Crataegus monogyna (hawthorn)	1.8	1.8
Fraxinus excelsior (ash)	3	3.7
Malus sylvestris (wild apple)	2	2.1
Populus x canadensis (hybrid black poplar)	4.5	5.6
Pyrus pyraster (wild pear)	1.5	2.3
Quercus robur (pedunculate oak)	4.5	4.5
Rhamnus cathartica (purging buckthorn)	1.5	?
Salix caprea (grey/ goat willow)	2.5	3
Salix fragilis (crack willow)	4.5	4.5

Table F.4 - Tree girth threshold values (metres) – veteran status for different tree species

Cross-comparison of tree girth measurements obtained from ATI and RAVEN 2 fieldwork has found discrepancies that significantly impact Step 2 outcomes and ultimately the status of the ATI trees according to the RAVEN 2 approach.

Looking at the simpler case of maiden and pollard crack willow trees rather than multi-stem, 68 ancient and veteran ATI crack willows did not meet RAVEN 2's 4.5 metre threshold. When the original ATI girth measurements were used in place of those obtained from AIA fieldwork, 35% of the rejected trees would have met the threshold. Figure F.5 below shows that AIA girth measurements were systematically lower in relation to the original ATI measurements; these differences were found to be highly statistically significant. Although there are normal sources of variability associated with tree girth measurement (trunk irregularities, trunk flaring, fragmented tree bowls, multi-stem forms, etc.), these factors alone cannot account for the differences across a sample of 68 trees.

Three main factors have demolished the number and ancient and veteran trees recorded with the SESRO area according to the RAVEN 2 assessment:

1. the RAVEN 2 methodology uses an overly zealous approach based on girth thresholds;

2. the setting of higher girth threshold values for four out of ten tree species than used within ATI guidance;

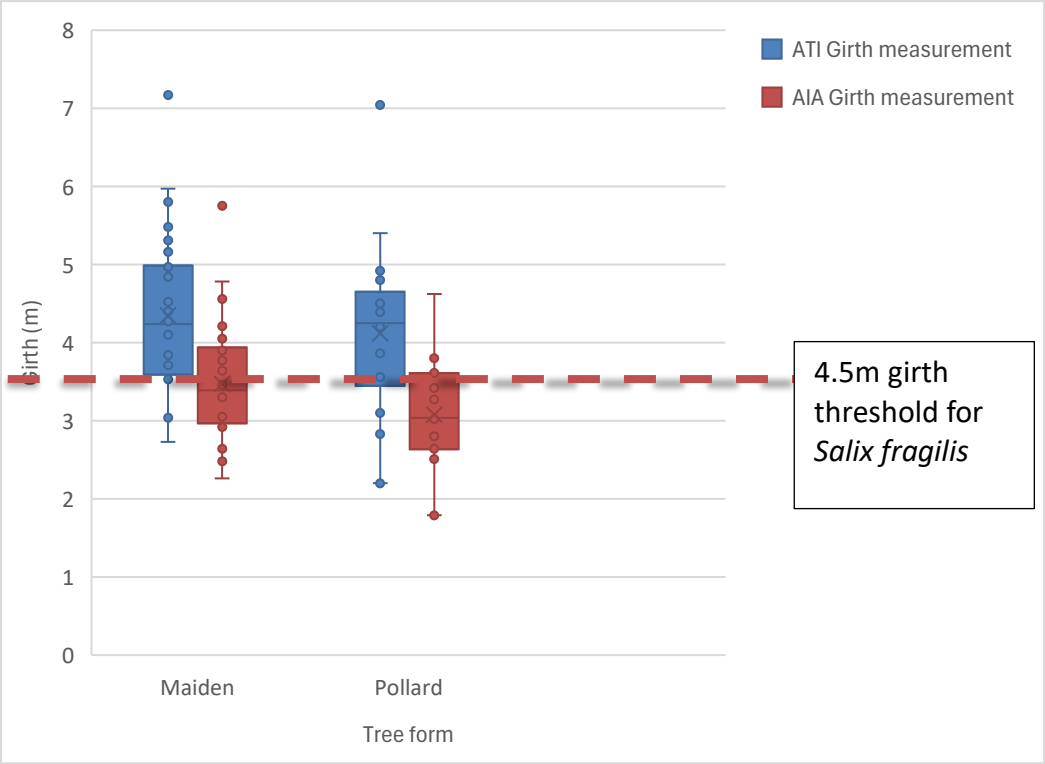
3. fieldwork that produced girth measurement that were systematically lower than those obtained during ATI fieldwork.

Trees re-classified as "*notable*" within the CRAVEN 2 process had many primary and secondary characteristics of veteran trees (decay, hollowing, habitat spaces, bark loss and epiphytes), and were hence classified as such by the Woodland Trust. Of the 99 ATI veteran trees classified by RAVEN 2 as "*notable*", 40 were recorded by the AIA survey as having 'a

large quantity of deadwood in the crown' (Step 4, first secondary feature). As part of the ATI fieldwork an extensive photographic library of trees was created and stored in a linked GIS system to each tree. Checking back on these images and field notes, 70 of the veteran trees (rather than AIA's 40) had large quantities of deadwood in the crown.

The use of the RAVEN 2 methodology results in a significant under-representation of the biodiversity value of the large number of ancient and veteran trees that are found across the SESRO impact zone. Whilst advocates emphasise the stringency of the RAVEN 2 approach, that has little merit if it fails to capture the biodiversity value of ancient and veteran trees through over-zealous application of tree girth thresholds. ***The work of the Woodland Trust in seeking greater protection for ancient and veteran trees is greatly undermined by the ease with which veteran trees can be declassified by RAVEN 2 for planning purposes***. This is another example of attempts to suppress baseline biodiversity measurements that have already been apparent in successive BNG calculations.

The value of these trees to local wildlife is beyond any doubt – notes collected during the ATI fieldwork have identified many examples of the value to wildlife: bat and owl roosts, bird nesting sites, rare fungi, habitats for saproxylic invertebrates and shelters along watercourses for otter.



Note: Differences between ATI and Thames Water contractor girth measurements were tested using a two-tailed paired t-test and found to be highly statistically significant ($p < 0.0001$).

Figure F.5 - Comparative analysis of crack willow girth: ATI and Thames Water contractors

The AIA ancient and veteran tree assessment identified seven ancient and veteran trees additional to those within the ATI records. Since the assessment was carried, more ancient and veteran trees have been added by GARD experts to the ATI in areas that the AIA survey has marked as "*complete*" (Figure 7, Appendix 9.7). Figure F.6 below shows the Woodland Trust ATI trees for the area (January 2026) plus an enclave of five 'ancient' willows added by Thames Water contractors as part of the AIA fieldwork. It is significant that these ancient trees were 'discovered' on the margins of the SESRO development (more mitigation potential) in an area previously excluded from the proposed SESRO impact area. An ancient tree missed by the AIA fieldwork was recently added to the ATI map is located within the core impact area where trees would be felled as part of the development. The five ancient trees identified by the AIA were measured by GARD experts and uploaded to the ATI (January 2026). These have been subsequently validated by the Woodland Trust as "*veteran*" rather than "*ancient*" trees, contradicting the RAVEN 2 assessment results. Two of the trees were found to have had girths significantly over-stated in the AIA assessment. ***Irreplaceable habitats are of such importance to the existing biodiversity baseline that the final tally of ancient and veteran trees submitted as part of the DCO application should be carried out in a more objective and fully independent manner.***

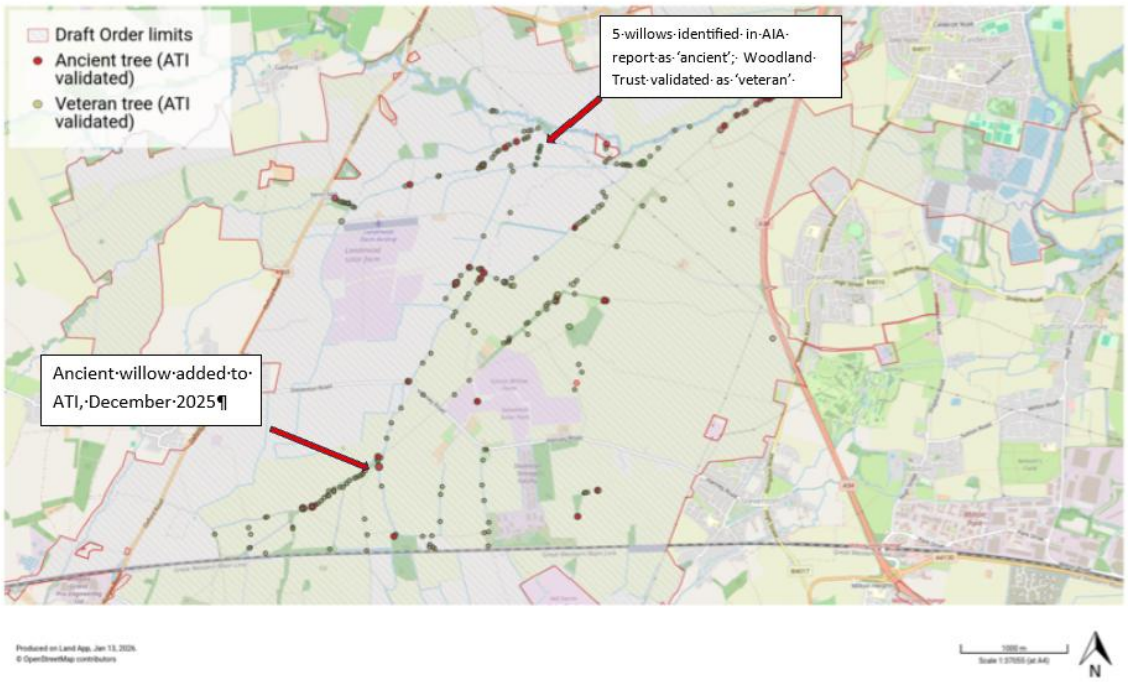


Figure F.6 - Ancient and veteran trees across the SESRO area - Woodland Trust ATI, January 2026