OFWAT WATER BREAKTHROUGH CHALLENGE – FLEXIBLE LOCAL WATER SUPPLY SCHEMES (DIDCOT)

Project Final Report

Final v1.0

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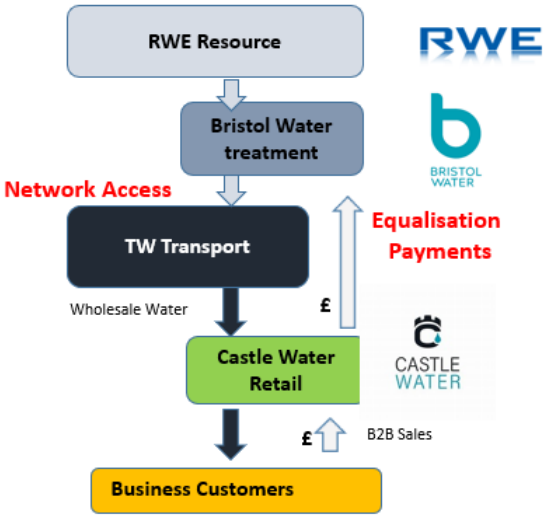
Executive Summary

The Flexible Local Water Supply Schemes pilot project tested the commercial viability of using multi-use abstraction licences and package water treatment plans to supply business customers and help solve water resource needs. The pilot aimed to unlock a number of the commercial, technical, and regulatory blockers associated with market access for small, local water supplies. It met the innovation priorities of the Ofwat Water Breakthrough Challenge by looking at experience in other sectors, encouraging new partnerships to deploy innovations and bringing new ways of working to the water sector.

This final report reflects the main output of this project. It includes the pilot design of the water treatment works, the Frontier Economics report into the economic approach to network access taken in other sectors, and the commercial and financial appraisal included from Castle Water. In addition to the original expectations, the UWE project provided a mapping tool from the Environment Agency open-source abstraction data which identified where other potential sites for flexible local supply solutions could apply. Finally, the project analysis allowed for outputs that fed into the Independent Water Commission investigation into the reform of the Water Sector and contributions from Pennon to the Regulatory and Commercial development of the Direct Procurement for Customers framework being developed by RAPID and Ofwat.

The driver for the project was to demonstrate how competition could enable more efficient use of water abstractions, including those not currently used for water supply. The project outcome would show how it would be possible to take smaller and underused water abstractions, treat the water and inject into the existing water networks. This would supplement major schemes and could provide greater resilience in the same way that distributed renewable energy sources do in that market.

The pilot commercial model developed as part of this project is based on the RWE site that was formerly Didcot power station in the Thames Water area and tested how this water supply could support Castle Water and its supply to business customers as a retailer.



Innovation Pilot Structure

The impact of the project is that the principles that applied in this work to smaller water resource sources also fed into the bulk supply development work for new major strategic water resource schemes that are currently being planned, such as Cheddar 2 in the Bristol Water area. It is a form of competition that could also support the evidence base for regional catchment planners and systems operation models.

In summary the project found:

- The current structure of legislation and regulation could not be navigated on a commercial basis. The split responsibilities of Ofwat, DWI, and Environment Agency was embedded in legislation which was risk-averse in terms of encouraging competition. This included challenges and barriers for Castle Water in obtaining a water supply licence, and then in obtaining a commercially viable access price from Thames Water.
- It is difficult to access abstraction data, and both the availability of spare abstraction and usage of current abstractions is not live data. This project developed a visualisation tool that provides a framework for identifying available abstractions to scale up this project approach, but the available data will remain historical and incomplete in order to easily scale up the market to new investors.
- There is a very “thin” (low) access price margin available to potential new entrants into the water supply market. This low margin was to protect wholesale incumbent suppliers (and customers’ bills if they paid for stranded unused water resources) who were paying for the main infrastructure development. However, this principle causes a problem with the value chain when competition in ongoing water supply competition for housing development (NAVs) is based on a “thick” margin model. Markets for new entrants to add value through treating water are squeezed commercially. Even a simpler market for water resources trading has not been a regulatory priority for further development.
- Based on a review of markets in other sectors by Frontier Economics, we identified that a “thick” (higher) margin available for new entrants for water resources and treated water should be developed. This will also be supported by the Defra Water White paper reforms establishing a single regulator and a clearer legislative framework. The economic benefits to justify a thicker margin will encourage the development of water resources and treatment markets, based on a benchmark set nationally or regionally and socialisation of this access price in incumbent wholesale charges to encourage competition and protect existing infrastructure supplies.
- Such a market could be developed incrementally with the benchmark margin initially set at a level to allow the market to develop slowly over time (potentially through auction arrangements as has been used in energy and telecoms sectors).
- The Didcot site for this pilot was one of the harder sites in terms of water quality (and therefore the cost of treating water in a package plant), but one of the greater economic opportunities as the area is a growing site for data centres who may want treated water such as this.

The redevelopment by RWE of the Didcot site contained a real opportunity during the course of this project to explore how flexible use of water resources could serve the business customer market, and also on site facilities such as data centres. Given that since the start of this project, data centres have become increasingly important for economic growth, while also highlighting the importance of efficient and sustainable water management, this project had a greater potential by its conclusion in 2025 compared to its beginning in 2017 to make an important contribution.

Throughout the project, the key question was whether regulatory, economic, and practical barriers to the use of diversified water resources could be overcome. During the course of the project, the regulatory landscape and appetite for refining the legislation changed. At PR19 and then PR24, Ofwat

deprioritised development of the water resources trading market, with a shift to planned development of major water resources schemes using Direct Procurement for Customers (DPC_ and Specific Infrastructure Procurement Regulations (SIPR).

The Independent Water Commission (IWC) and the Defra Water White Paper also did not see a role for expanding the forms of competition for the water sector that could enable the flexible use of water resources.

Ultimately, the project partners reluctantly concluded that this form of competition and the regulation needed to enable it will remain unfeasible for the foreseeable future. There were a number of factors that led to this conclusion:

- The environmental and quality barriers are very difficult to overcome. It is very difficult to assess an application for providing treated water that requires information on the quality of source water. A new entrant requires a licence to get access to information that may or may not support its application for a licence. The individual gains the licence, but to get a licence they have to prove for the site that they have the information that proves their technical competence to receive it.
- Applications to Ofwat to obtain a licence for this type of competition require support from the DWI and Environment Agency, which is very challenging for a new entrant within legislation and duties on the regulators designed to be risk averse to this form of competition.
- Even if environmental information was not required in advance of applying for access, there are economic barriers to entry. The legislation protects the existing supply infrastructure by only allowing a margin on avoided costs. This is based on indicative assumptions, as until the plant and water resources are connected in practice, it is very difficult.

This was an unusual innovation pilot project and the outputs presented in this report and its appendices have a widespread audience and use in water reform. The industry dissemination workshop held in May 2023 captured the potential wider benefits of the analytical approach undertaken, including the process for how a package plant was designed.

Finally, the commercial focus of the project team and partners has been a defining feature of a project that has successfully delivered a clear conclusion, which gives us confidence for the development of future water sector commercial markets. Pennon would also like to thank all the stakeholders involved in the project, the regulators for their forbearance and understanding as we tested the regulatory and commercial barriers, the project partners, and those who took part in the May 2023 industry dissemination workshop.

For those who wish to access any of the project materials or to discuss the approach and findings further, please contact finreg@southwestwater.co.uk

1 Introduction/Project Details

1.1 Summary Details

Project Name: Flexible Local Water Supply Schemes Pilot

Funding Competition and Stream: Water Breakthrough Challenge 1

Project outturn cost at completion: £411,152, excluding partner benefit in kind costs of £179,025. Funding awarded was £622,156, excluding partner contribution costs in kind of £188.084. This is summarised in the table below:

£	Actual cost	Project cost	Difference
Ofwat Innovation Fund	411,152	622,156	-211,004
UWE – in-kind time and student contributions	100,000	100,000	-
Castle Water overhead	11,105	11,105	-
Binnies overhead	38,054	38,054	-
Bristol Water time on project	30,095	38,925	-8,830
Total	590,406	810,240	-219,834

1.2 Programme

The pilot project is testing the commercial viability of using multi-use abstraction licences and package water treatment plans to supply business customers and help solve water resource needs. The pilot will unlock a number of commercial, technical, and regulatory blockers associated with market access for small, local water supplies. The project considered the network application for treated water to allow the full commercial case to be concluded. However, the network application for treated water proved to be unfeasible and the full commercial case was concluded at that stage. The final project report demonstrates why the commercial case proved to be unfeasible and the barriers to the commercial viability of multi-use abstraction licences that cause this.

The overall programme of work is summarised below:

Delivery phase	Start date	End date	Completion date	Summary of outputs
0 – Project management and general	04/01/2022	30/06/2023	31/12/2025	Completion of project as set out in the final report.

Delivery phase	Start date	End date	Completion date	Summary of outputs
1 – Regulatory and commercial barriers	04/01/2022	31/07/2023	31/12/2025	Engagement with RAPID and project transfer workshop. UWE involvement in project completed. Frontier project completed Regulators engaged through Wholesale Access Application. Trading and pricing solutions section of this report.
2 – Network Access	02/02/2022	02/02/2023	31/12/2025	Project closed with the decision by Castle Water that the project was not commercially feasible, given the access price offered by Thames Water. The process of challenging the access price with Ofwat would not have overcome the commercial barriers.
3 – Water Quality Compliance	02/02/2022	30/11/2022	30/11/2022	Assessment of the impact of water quality based on the available information led into the design of the package water treatment plant. The lack of historical information on the water quality did not prevent design of the plant, but it did delay approval of the wholesale access request which ultimately prevented commercial viability being established.
4 – Technical risk mitigation	02/02/2022	02/03/2023	31/03/2023	Design of the package water treatment works that mitigated water quality risks completed and discussed at technology transfer workshop in May 2023.
5 – Financial investment decision	02/02/2022	02/02/2023	31/12/2025	Financial investment decision completed by Castle Water and presented in this final report.

1.3 Overarching IPR and confidentiality statements

The contents of this final report are not considered confidential. The specific appendices include confidential site specific and commercial information. The project partners agree that we will consider providing this information to interested parties as the project conclusion was that proceeding with a pilot plant was not commercially feasible.

Foreground IPR was created in the form of learnings from this project and plant design. Background IPR will not be utilised as part of this project. The project is a pilot of taking a market concept through to the point at which the alternatives have been tested and is investible. The process, assessment, and nature of the pilot was shared openly with the water industry, RAPID, regulators, and through workshops and publications as part of the project.

1.4 Links to other Ofwat Innovation Fund Projects or Competition Entries

There are no direct links to other innovation projects. We considered this and the publication of the final report will allow other innovation fund projects to access aspects of this project that may be useful for current or future innovation fund challenges.

2. Innovation Challenge

2.1 Project Background and Context

The 2018 report by the National Infrastructure Commission – 'Preparing for a drier future. England's water infrastructure needs'[1] found that: "A reliable water supply is usually taken for granted but, despite its reputation for rain, England risks water shortages. Climate change, an increasing population (especially in the drier south and east) and the need to protect the environment bring further challenges.

The water supply system is already strained and the pressure will only rise over the coming decades. Concerted action is needed to address these challenges, but conflicting incentives, limited cooperation between water companies and a short-term focus mean that insufficient progress is being made. As a result, in the event of a serious drought, the nation faces an unacceptable risk of severe supply limitations and even homes and businesses being cut off."

The commission recommended that plans were in place to increase available supply by at least 400 million litres per day, including 1,300 Ml/d through (i) a national water network and (ii) additional supply infrastructure by 2030s. It estimated that £21 billion is the cost of building resilience to drought in the next 30 years.

The 2019 report by Defra 'Abstraction reform report. Progress made in reforming arrangements for managing water abstraction in England'[2] found that "as many as one-in-five of our surface water bodies are over abstracted." At the same time there are a large number of abstraction licences which are under-utilised (same report). We need to make better use of existing licenced abstractions during times of drought, including switching from non-essential use to use for potable water supply.

We have created a unique opportunity to deliver value to customers and the environment through a highly skilled collaboration across the water supply value chain. RWE holds a multi-use abstraction licence at Didcot and owns land where a water treatment plant could be built. This provides a pilot

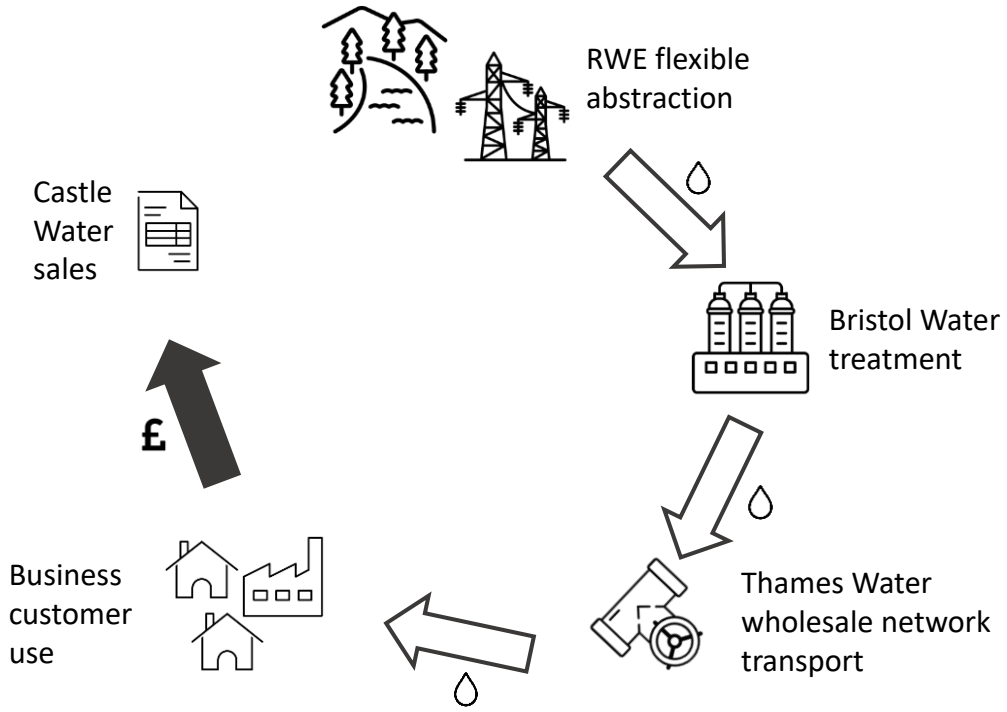
[1] https://nic.org.uk/studies-reports/national-infrastructure-assessment/national-infrastructure-assessment-1/preparing-for-a-drier-future/

[2] https://www.gov.uk/government/publications/abstraction-reform-report-2019

site to provide a real-life example to test and release blockers through a series of concurrent project work packages. Through these work packages this project will seek to:

- Overcome regulatory and commercial barriers.
- Overcome Network access constraints.
- Develop water quality standards and safety plans for package plants.
- Undertake a scalability assessment.
- Develop a new business model for investors.

The final stage will facilitate rapid scaling by identifying and publishing potential existing licences and sites which might be suitable for a replica package plant. It should be noted that the construction of the pilot plant is outside of this project.



Structure of proposed Didcot pilot project

As far as we are aware, this is the first project of its kind which brings together all parts of the value chain in an attempt to systematically work through the blockers to the market and deliver a solution which works at scale. RWE has an abstraction licence available at Didcot and has been trying to access the water supply market for the past six years. However, it has found that the legal and commercial blockers are too great to create an incentive for investment. RAPID – the regulatory alliance for progressing infrastructure development – is currently working on exploring regional transfer schemes but not local third party potable supplies.

Twenty years after legislation, there are no third parties providing treated water supplies to water company business customers. Individual investors such as RWE have attempted to overcome the various barriers in place but have found the process overly burdensome and not investable. Our project is the first which attempts to tackle this problem. The current approach of focusing on regional suppliers lacks the innovation of the potential to employ multi-use licences to allow water use to be flexed between essential and non-essential uses depending on levels of supply and demand and does not engage business retail customers.

Our project advances innovation through a unique collaborative approach which brings together all required expertise to open the market to third party water resources supplies. We will develop a new commercial business model, with targeted dissemination of our findings to potential new entrants, retailers, wholesalers and regulators.

We will share experience for a market which hasn't developed since the Water Act 2002 first enabled its development. Such schemes have the potential to compliment major strategic resource schemes by providing greater distribution flexibility – an innovation for water equivalent to distributed energy schemes.

Learnings from this project could stimulate a market for business water efficiency. This is an objective of the opening of the retail market in 2017 which is widely recognised to have failed so far. Our project will provide wider academic and research benefits through our partnership with the University of the West of England. We will provide learning opportunities for students supporting the project, together with experience in tackling real business and commercial challenges. This project only applies to England, reflecting the policy differences in Wales.

The redevelopment by RWE of the Didcot site contained a real opportunity during the course of this project to explore how flexible use of water resources could serve the business customer market, and also on site facilities such as data centres. Given that since the start of this project, data centres have become increasingly important for economic growth, while also highlighting the importance of efficient and sustainable water management, this project had a greater potential by its conclusion in 2025 compared to its beginning in 2017 to make an important contribution.

Throughout the project, the key question was whether regulatory, economic, and practical barriers to the use of diversified water resources could be overcome. During the course of the project, the regulatory landscape and appetite for refining the legislation changed. At PR19 and then PR24, Ofwat deprioritised development of the water resources trading market, with a shift to planned development of major water resources schemes using Direct Procurement for Customers (DPC_ and Specific Infrastructure Procurement Regulations (SIPR).

The Independent Water Commission (IWC) and the Defra Water White Paper also did not see a role for expanding the forms of competition for the water sector that could enable the flexible use of water resources.

2.2 Innovation Challenge

The innovation is best evidenced by the simple fact that there are no third-party potable treated water supplies into water company networks in England and Wales. Our vision is for an approach which is akin to the energy market, with smaller local schemes which can be utilised flexibly during periods of high demand for "peak lopping". When this water is not required for essential uses through the water network, it can be utilised elsewhere – such as for agricultural, industrial, or energy generation purposes. This is a potential game changer for the water industry, for abstraction licencing and for the environment. It seeks to manage the significant water resilience risk that we face in the future through an approach which fits supply with demand and is highly scalable across the county. It is an approach which fits with a low carbon future. This is an innovative approach which offsets the need for further investment in standalone resources, with accompanying new licensed abstractions which could result in degradation of the water environment. This approach makes the most of existing abstraction licences – directing the water to where it is most needed. This would provide significant benefits for customers in the form of lower bills and greater security of supply.

The schemes are also likely to be lower energy than the regional transfer alternatives and a better fit with a low carbon future. The main commercial challenge is pricing – because currently only the gap between bidding into water resources/ WRMPs (Ofwat's compensation payment) and the access price for treated water distribution would be payable. So far this has proven to be unattractive to investors.

The project final report sets out why this proved to be unattractive to investors involved in this project and more generally. The solution of a different pricing approach is also the outcome of this project, but the barrier is that Government policy has confirmed during the course of the project that this is not an area for further consideration ahead of embedding the changes in the Water White Paper.

The project findings helped to inform the Independent Water Commission submissions from Pennon and Castle Water which in turn informed the Water White Paper. This forms part of the project outputs.

The Water Breakthrough Challenge innovation fund themes that were directly addressed were:

> **1. Responding and adapting to climate change, including how to meet the sector's ambition of net-zero emissions.** This was considered through the potential better use of smaller water sources and the design of the package plant.
>
> **5. Exploring the opportunities associated with open data, stimulating innovation and collaboration, for example, encouraging new business models and service offerings that benefit customers, including those in vulnerable circumstances.** By definition this is a new business model and used open data through Environment Agency abstraction licence data.
>
> **3. Understanding long-term operational resilience and infrastructure risks to customers and the environment, finding solutions to mitigate these in sustainable and efficient ways.** More efficient use of water resources is one of the main themes of reform of the water sector, an increasing focus over the lifespan of this project.

The indirectly addressed themes were.

> **2. Restoring and improving the ecological status of our water environments, protecting current and future customers from the impacts of extreme weather and pollution.**
>
> **4. Testing new ways of conducting core activities to deliver wider public value.**

These themes derived from the directly addressed themes. The overall project final report sets out the findings.

2.3 Project Aims and Objectives

Outputs – The project final report reflects the main output of this project. It includes the pilot design of the water treatment works, the Frontier report into the economic approach to water supply access taken in other sectors, and the commercial and financial appraisal included from Castle Water. In addition to the original expectations, the UWE project provided a mapping tool from the EA open-source data for abstractions which identified where other potential sites for flexible local supply solutions could apply. Finally, the project analysis allowed for outputs that fed into the Independent Water Commission investigation into the reform of the Water Sector and contributions from Pennon to the Regulatory and Commercial development of the Direct Procurement for Customers framework being developed by RAPID and Ofwat.

Outcomes – The main outcome from the project was the conclusion for Castle Water, agreed with RWE, that there was no commercial case for this type of project. Whilst there are potential benefits for customers and wider society, the complexity and water quality/ environmental barriers mean that there is little appetite to develop this form of competition to directly encourage investors for the foreseeable future.

In terms of the predicted outcomes in the project application:

Influencing customer behaviour – the commercial barriers and the requirement to have specific customers to match the volume of water being input into the supply network means this approach will not influence customer behaviour because if this form of competition is not economically feasible, it cannot be used to influence customer behaviour.

Development of novel systems / processes – the potential to use a water abstraction licence was originally seen as just providing the potential to supply Castle Water's business customers within the "SWOX" water supply area of the Thames Water network where the Didcot pilot project was based. The novel process identified during the project could have supplied businesses on site with a direct water supply when they needed the water, whilst supplying the Thames network at other times. However, the commercial risk for on-site supply would need to be assessed against the risk of supplying other customers, which would require access to the Thames network at a reasonable price in order to make this commercially viable. The complexity involved in water supply means that even though the novel system provided a wider commercial possibility, and this arose because of the partnership developed for this project, it still proved not to be commercially feasible. On that basis it is unlikely to be commercially feasible elsewhere. There may be specific sites that are feasible, but this could not be identified from the EA open abstraction licensing data. However, the project outputs record how to approach this topic which provides a framework to achieve the outcomes on other projects in the future.

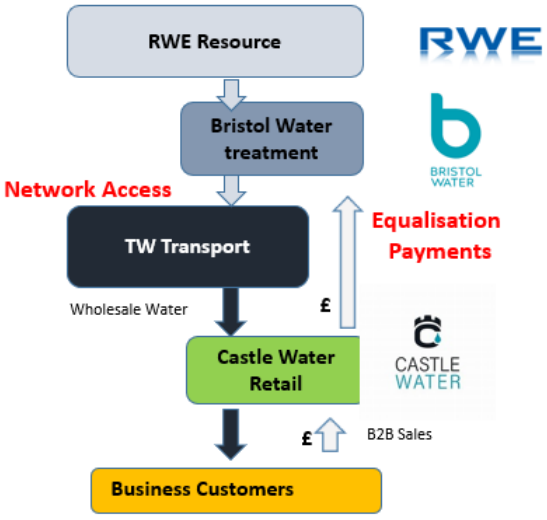
Impact – the wider sectoral impact has been that this form of competition is not being actively pursued. However, the case study below shows the wider impact that the project has had on future industry reform.

Case study included in submission to Independent Water Commission

Flexible Water Supplies innovation project

South West Water are leading the Ofwat innovation fund Flexible Local Supplies Project. This is a pilot project looking at how the existing (but so far unused in practice) combined water supply competition framework can be used in the water sector. The objective is to demonstrate how competition could work to take smaller and underused water abstractions, treat the water and inject into the existing water networks. This will supplement major schemes and could provide greater resilience in the same way that distributed renewable energy sources do in that market.

The pilot commercial model being developed as part of this project is based on the RWE site that was formerly Didcot power station in the Thames area and is testing how this water supply could support Castle Water and its supply to business customers as a retailer.



Innovation Pilot Structure

As well as the potential to unlock smaller water resources, the learnings should feed into the bulk supply development work for new water resource schemes such as Cheddar 2. This is a good example of how the innovation fund and Ofwat major projects framework can help to support long term planning and growth in the water sector. It is a form of competition that could also support the evidence base for regional catchment planners and systems operation models. The final report on this pilot project that will inform future water competitive market frameworks through Ofwat's innovation fund is due by the end of 2025.

3. Project Governance and EDI

3.1 Partnering

Bristol Water, and post the 2021 merger **Pennon/ South West Water** were the lead party and the only water company partner on this project. Bristol Water provided a leadership and coordination role as well as water sector regulatory and water quality expertise. Pennon completed the project and reviewed the final project report with contributions for the outputs from the project partners for each stage of the project.

Castle Water hold a water supply licence to business customers and obtained a wholesale combined supply licence as part of this project. This enabled them to consider the commercial financing of the project.

Binnies provided project management expertise to the project team and the technical and engineering design of the pilot water treatment plant

RWE are the owners of the multi-use water abstraction licence and the Didcot site where this pilot plant was considered.

University of the West of England (UWE) provided the abstraction licence and GIS mapping tools as well as providing the context from abstraction licence regimes in other jurisdictions.

3.2 Sponsorship and Leadership

This project was supported at CEO/MD level within each partner/organisation. It aligned with the commercial ambition and net zero aspirations of each organisation and is being driven from the very top. As we anticipated, personnel changed over the life of the project, but the sponsorship and leadership continued until the point that Castle Water reached the conclusion that the project was not commercially feasible. Each organisation benefitted from new expertise and partnerships. Pennon continued to discuss water reform with the project participants. Pennon also has continued the academic relationship with UWE and have recently explored the factors that affect attitudes to water recycling in different jurisdictions, which is a potential alternative source of water to direct abstraction which could then make this type of approach more commercially viable.

The project delivered its objectives, and it was a collective decision to end the project, which was taken with the full agreement of the project participants and the wider stakeholders involved in the project.

3.3 Stakeholders

The main stakeholders were Ofwat, DWI, and Environment Agency who were engaged through Castle Water's application for a Wholesale Supply Licence. This was supported by Bristol Water throughout. Bristol Water also supported UWE in obtaining open access data on abstraction licences from the Environment Agency, who were very supportive in unlocking access to this important data source.

Thames Water were also an important stakeholder in this project. Once Castle Water had obtained Wholesale Supply Licence, Bristol Water supported Castle Water in obtaining the connection point information from Thames Water and the indicative access price offer that is set out in the main report.

The wider industry stakeholders in water companies were engaged through a technology transfer workshop in May 2023.

3.4 Project Delivery Team

Castle Water is the Water retailer and owner of the commercial business model. Its role in this project was to work through the commercial blockers for new entrants to this market. Castle Water worked through the pricing model which provides water efficiency incentives for non-household customers. Bristol Water provides regulatory, strategy and water quality input from the perspective of an organisation that Castle Water with RWE would procure to operate the water treatment plant. Binnies project managed the study on behalf of all contributing partners and will lead the technical elements from a Process mitigation, Environmental Assessment (risk, impact, and benefit) as well as from a construction delivery perspective. As part of the wider RSK Group, Binnies will also introduce fellow RSK group company WRc to support the study. RWE is the owner of the multi-use licence at Didot, together with land owner for the site of the proposed pilot package treatment plant. RWE is a highly experienced investor in infrastructure projects, including water and energy projects. RWE bring experience to this project at each stage. UWE provides background technical assistance across a range of areas.

The project structure worked extremely well. Bristol Water had responsibility for the strategic aims and delivery of the innovation fund for the project. We are extremely grateful for the input of Challenge Works/ NESTA, ARUP and the Ofwat Innovation Fund team, and our project structure made the approach work well.

The independent project management of Binnies for the plan design also worked well. The separate commercial model ownership of Castle Water and the commercial decisions of RWE as the Didcot site was being developed kept a pilot innovative project be a real commercial aspect.

The role of UWE changed in the process as an opportunity to use master's students to support the abstraction licence mapping emerged. Bristol's use of Frontier Economics for the peer review of the regulatory commercial aspects developed into an independent report on the learnings from other sectors. Both projects built wider business relationships and informed sector reform.

The main challenge was the amount of organizational change during the extended lifespan of the project as regulatory barriers to Castle Water obtaining a Wholesale Licence Authorisation were encountered. The acquisition of Bristol Water by Pennon happened seamlessly despite organisational role changes. Even in the extended period when there was little progress as the licence application barriers was being resolved, we carried on with regular project meetings. This had an explicit decision as to whether to continue the project or close out the final report at that point, which was taken collectively.

Another learning point is how to keep CEO and senior engagement during the course of the project. In this case internal delegation within Pennon/ Bristol Water and Castle Water was successful and there was a clear and agreed commercial decision on viability which then allowed the project to conclude.

3.5 Equality, Diversity and Inclusion (EDI)

Of the project leads for the respective organisations, 60% of these were women, which reflects the diversity of approach in the existing organisations. This was maintained during the project. Bristol Water used the approach as a development opportunity for junior staff with the support of senior roles throughout the process. This included a diversity of cultural backgrounds and experience. The use of master's students at UWE in the abstraction licence mapping reflected a development opportunity and skills outside of the experience of the project team.

Castle Water is the Water retailer and owner of the commercial business model. Its role in this project will be to work through the commercial blockers for new entrants to this market. Castle Water will also work through the pricing model which provides water efficiency incentives for non-household customers.

Bristol Water will provide regulatory, strategy, and water quality input from the perspective of an organisation that Castle Water with RWE will procure to operate the water treatment plant.

Binnies will project manage the study on behalf of all contributing partners and will lead the technical elements from a Process mitigation, Environmental Assessment (risk, impact, and benefit) as well as from a construction delivery perspective.

RWE is the owner of the multi-use licence at Didot, together with land owner for the site of the proposed pilot modular water treatment plant. RWE is a highly experienced investor in infrastructure projects, including water and energy projects. RWE will bring its experience to this project at each stage.

UWE will provide background technical assistance across a range of areas particularly related to comparative experiences of flexible abstraction arrangements elsewhere around the world ("Learning Lessons from Elsewhere") and data visualisation for linking water traders.

4 Project Methodology/Approach/Delivery

4.1 Approach

The project was delivered through phases that operated in parallel, as set out in the project delivery programme summary. The original project plan had allocated delivery responsibility between the different partners. This approach worked very well and was not amended during the course of the project.

The recognised risk of this approach would be that the overall project outputs would not coordinate together. This was addressed through Binnies' project management and the strong business relationship between Bristol Water and Castle Water. Binnies challenged the participants in project meetings to ensure we were focused on the overall programme. We held separate face-to-face workshop sessions focusing on key outputs and issues, in particular the abstraction licence, plant and network design, water quality, and commercial model.

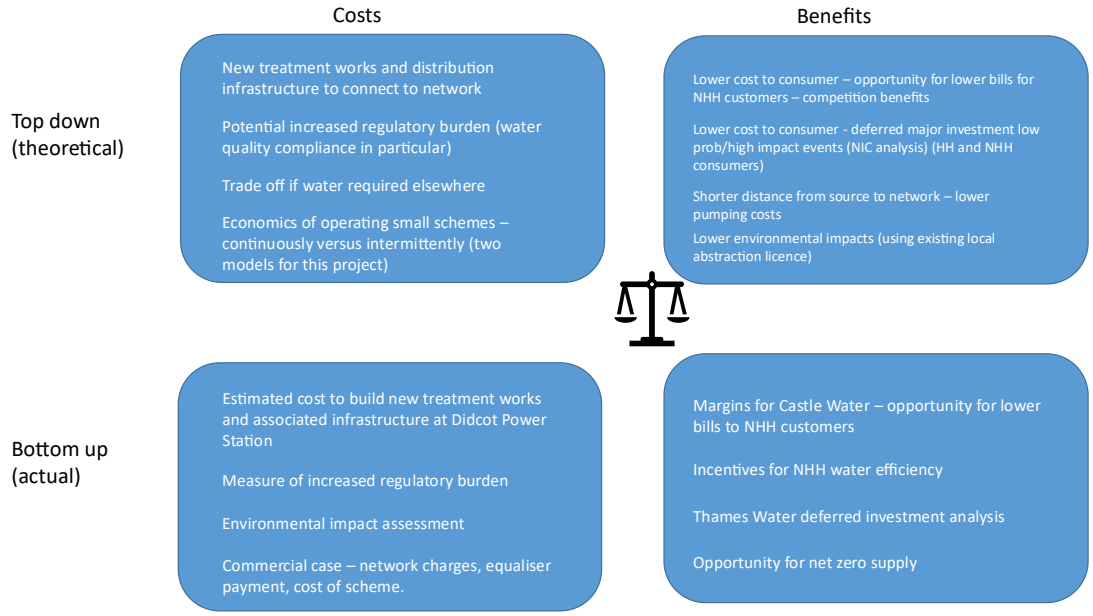
The innovation is the nature of the project itself. In this case the water sector framework could not adapt to meet the commercial needs of RWE and Castle Water. This provides evidence for future reform of the water sector competition framework, and the conclusions of this project have been used to inform industry reform and the form of competition currently being promoted for Strategic Resource Options for water resources.

The original 18 month pilot project was split into the following stages:

Stage	Description	Outputs
1	Project management, risk management, gateways, and reporting activities: Project management and controls, reporting, gateway submissions, review meetings, stakeholder engagement	Execution plan, risk management plan, gateway approval, monthly progress reports, monthly programme updates, quarterly CEO meetings, and Ofwat progress reports.
2	Regulatory and commercial barriers Activities: Review of market and pricing proposals including variable pricing linked to water efficiency, external peer review, engagement with regulators via RAPID, industry engagement, market testing with business customers	Recommendation for changes to market to Ofwat. Industry workshop on replication and scale up
3	Network access constraints Activities: Network access review with wholesaler, learning from gas/power system operator models	Network access industry model and guidance
4	Water Quality Activities: Scientific review of water quality impacts on network. Developing new standards and drinking water safety plans for package plants. Exploring continuous monitoring technology – linking into other innovative projects	DWI approval of proposal. Model standards and quality plans
5	Technical design, technical risk mitigation, and scalability assessment Activities: Design standards for a modular water treatment plant, impact review and optimisation (including ecology, carbon, environmental screening, energy optimisation). Identifying other licences where this model could apply, assessing 'switchability' and market demand. Licence holder engagement	Design report with site specific and non-specific requirements, outline plant design. Recommended scale up route. Environmental Impact Assessment, Benefits Valuation, Risk Register, CDM risk register, Construction cost estimate and programme

6	New business model for investors Activities: Legal and contractual review, capital and operating costs, investor model and engagement	Investor model with market acceptance, standard contracts, 'play book'

The project summary and cost and benefits framework used as a reference point throughout the project summarised the flexible local supply systems concept.



4.2 Delivery

The project was on track after a delayed start between December 2021 and May 2022 related to the release of funds for the first Water Breakthrough Challenge. External costs were managed through fixed price negotiation (e.g., plant design, Frontier report). The time costing for the project partners was also as expected. This was because the focus of this project was to support work that the project participants would have done anyway within their organisations, with the cost of the innovation fund project efficient because it was a benefit of coordination which the innovation fund was funding in order to achieve the coordinated outcome. The contributions in kind were delivered in full, with a c15% reduction in Bristol Water time than that originally budgeted for.

This project funding was underspent by c30%. This reflects two factors. First, it was unfeasible to take water quality samples and analyse these and ultimately the plant design was done based on a more limited set of water quality information. These source waters were considered risky and difficult to treat so other sites may have lower water quality risks and therefore a cheaper package plant design. The other cost saving was in the final commercial and bulk supply application process. The commercial modelling confirmed that it was highly unlikely that there was a bulk supply price that could make this project commercially viable, which meant the cost of challenging the very low bulk supply discount offered by Thames Water was not incurred. We had anticipated further engagement with Ofwat and incurring cost to develop this bulk supply pricing further, however Ofwat could not identify an individual to engage with as this form of competition was not a priority for Ofwat or Defra to develop further by the end of the project. Instead, the project learnings had informed the current forms of competition being developed, through the bulk supply pricing for Cheddar 2 reservoir and other Strategic Water Resource schemes through Direct Procurement for Customers. This meant the work was partly funded through Pennon work with RAPID, including the funding received for developing the Cheddar 2 DPC scheme.

4.3 Risk Management

The project was clear about the risks related to this market at the start of the project. RWE has been trying to enter this market for six years and has faced four principal blockers:

No "statement of need" – no regulatory or government criteria or public support for the use of a multi-purpose licence within the water industry.

Constrained options – development funds are only available through the five-year business planning cycle, and these funds are provided to the network operators (water companies) rather than potential competitive entrants.

Competitive structure – there is missing money in the market which makes it unattractive to new investors – the pricing structure needs to be reviewed.

Network access – owned by network operators and does not currently allow third party potable supplies via remote sales (i.e., a model of total volume in the network rather than direct supply from source to tap for business retail customers).

These blockers created risks in achieving our objectives:

Lack of regulatory engagement – the project relies on active engagement from Ofwat, EA, and DWI. This was mitigated through stage 0 – project planning: which agrees responsibilities, engagement routes and ways of working and through working with RAPID. This is a ready formed group of regulators with a complimentary remit. Ofwat agreed to engage on this project and encouraged Bristol Water to enter it within this competition. This worked well through the project, until the point of Castle Water Wholesale Licence application where the lack of clarity on the framework and lack of application process track record meant significant delays. Ultimately working together helped to resolve this, but the commercial margin just wasn't available for this type of project.

Prolonged discussions and decision making extends duration of project – we included some time contingency to help mitigate this, together with an approach which allows us to close the project early if it proves to not be an effective use of time. Ultimately, the project partners agreed to extend the project to the point at which it could be fully completed buy testing commercial viability, but not past the point that significant further delays in trying to force access price agreement for through the regulatory framework was required, including in dispute with Thames Water. A faster and more effective approach that requires third party engagement would be required. The legislation requires the potential new entrant to have the same level of knowledge as an incumbent in order to get the information and access price they need from the incumbent, assuming that the same lack of experience is not a barrier to getting a licence from the regulators.

The risk that emerged in the project is risk aversion in the regulatory framework, legislation, and in incumbent companies. There are significant parallels to John Fingleton's findings in the nuclear review for government to our findings in this project[3]. As part of our additional project outputs Pennon took part in a learning session with Fingleton consultancy on the link between regulatory incentives and economic growth. Topics such as supervision and the role of investors in competitive markets are topics in water sector reform and the risks managed and experienced as part of this project have informed these reform discussions.

Agreement cannot be reached with regulators – this will create valuable learnings which will feed into longer term regulatory policy which supports competition. Although the Castle Water licence process took an extended time, regulators showed flexibility to ensure that the learning points from this project could be realised.

Commercial model is not viable – again this exposed and evidenced the broken market. Regulators will understand the problem and will be able to take longer term steps to fix it. The main finding is that it requires a clear Government steer on competition policy and will also benefit from a single water regulator so that potential conflicts between the duties of Ofwat, DWI, and Environment Agency do not delay competitive market entry. In this project, Ofwat were the lead regulator and the other regulators worked well to avoid delays, but the legislation and the roles and duties of regulators made such delays inevitable. Although the Independent Water Commission and Defra White Paper conclusions that a single water regulator and legislative reform are required cannot be attributed directly to this project, the learning points are consistent.

Water quality risks are too high – we developed local package schemes, which will generally have the same water quality as the local network they are supplying too. The conclusion for the Didcot site is not that the water quality risks are too high, but the cost of the plant to resolve them was too expensive for the available commercial margin. This is partly a cost of scale, and there may be other sites with cheaper package solution that are more feasible. The ability of incumbents to change network operations for new sources of water is a strategic advantage compared to the expectation of new entrants to meet tightly defined standards.

Partnership commitment – each partner was highly committed to this project. Its goals align with partner commercial goals and environmental and social ambitions.

Project unknowns – the specific technical and commercial barriers on inputting water into the existing network. This is what this project had to explore and tackle. We used project gateways which allow rapid pivoting in the event that these barriers are too high.

[3] Nuclear Regulatory Review 2025

4.4 Lessons Learned

The project delivery lessons learned are set out in section 3.4 above. The lessons from the project findings are set out in section 4.3 in terms of the blockers we identified on project delivery and the techniques we used to overcome these

Our main lesson is to bring a clear commercial model together before the start of the innovation fund and then ensure that project partners are part of this. That was a very clear driver of this project and helps in our view to determine whether the innovation should proceed or the project terminated. Projects evolve, but having a clear commercial arrangement helps partners to stay on board. In addition, independent project management (independent of investors or commercial arrangements for the project outcomes) helps to avoid the risk that commercial pressures between parties affect the quality of the project management.

We would not change the approach to the project given our findings and project conclusions. The other lesson related to this is whether we should in hindsight have pressed regulators and Government further and at an earlier stage to reform their approach to the sector. This would have been the right action in normal circumstances, but in the context of wider water sector challenges and reform, it was not a practical step at the time in this project. The effectiveness of project management that was agreed between the parties and kept under review is an additional lesson from this project.

5 Key Findings and Outputs

This section sets out the findings and outputs. In addition the appendices to this report list the technical outputs that are documented and are separately available from Binnies or Bristol Water

5.1 Innovation Maturity Level (IML)

The innovation maturity level was 1 (initial research) at the start of the project and the project outputs include level 2 (concept and feasibility), level 3 (development and verification) and partly level 4 (validation but not optimisation). Level 5 (deployment and post launch) may have been achieved at the end of this pilot project (designed to reach the commercial go/no-go decision on deployment), but ultimately was instead partly achieved post launch with the option to the IWC/Defra reform of the water sector to take the learnings on the barriers for deploying this approach to the redesign of the water sector.

5.2 Key Findings and Conclusions

5.2.1 Financial Investment Decision

Ultimately, the project investment decision was that this form of access is not feasible in the current regulatory framework.

The timeframe to consider an application, particularly where there are alternative uses of the water (through existing incumbent company Water Resource Management plans), is such that there are always likely to be overhead costs that a higher than the potential margin available. In addition, the risks fall on the new entrant, and there is no single source of either water availability or water quality information.

The market is likely to remain unattractive to investors, even if the regulatory barriers could be resolved. The factors set out in this report should be reconsidered once Water Sector reform, as envisaged in the Water White Paper is implemented. The costs of not doing so for economic growth include the cost of water scarcity, and local flexible supplies if investible will help to resolve this. For instance, a research report by Public First (2025 – *The cost of Water Scarcity*) found that £6.4bn of economic growth could be lost if housing growth is not possible because of water scarcity. They also

estimated £10.8bn of wider economic growth forgone, with £1.3bn alone for sectors such as Artificial Intelligence for data centres. This is directly relevant to the Didcot site that will need a source of water from Thames Water supplies rather than from the abstraction licence available to the site without a commercial model to use this supply flexibly – the potential to switch between on-site use of treated water and providing to other business customers of Castle Water is not supported by the access pricing regime for the water sector.

5.2.2 Constraints

The key constraints are:

- Availability of suitable technical information on available water. Although the Environment Agency had open access data, it generally did not distinguish between maximum and used volumes. The reliability and quality of source water is not available.
- The various elements of the water market (water resource trading market, business retail market with wholesale authorisation, combined supply network access market) are not designed as a coherent framework.
- The legislative landscape is opaque and not understood by incumbents or regulators. This in part is because it has not been used in practice, which we believe is because of the separation of quality, environmental, and economic regulation, and because of the economic access price concepts used.
- Ofwat has developed the concepts incrementally. Ultimately, the lack of competitive market access suggests the opportunities are not significantly large enough, and even if they were the timeframe for access prohibitive.
- It has not been a government priority to develop the combined supply/ wholesale authorisation water competition framework. There has been a greater focus on the business retail market, but not in terms of the business water efficiency and trading markets, which were envisaged by Martin Cave review of water competition potential in 2009[4].
- The lack of clear commercial opportunities for investors, third parties with development sites, or potential commercial brokers for water resources and energy plants is a barrier to a larger market developing. The lack of a clear commercial case then results in regulatory and legislative reform being deprioritised as the benefits are unclear but there is a clear cost of introducing change and regulating it. There is a clear contrast to the energy sector where offshore wind markets, net zero, and security of supply risks with traditional/ fossil fuels provide a clear imperative for a competitive market to develop. The potential benefits in water are more long term and dispersed.

5.2.3 Opportunities

Key opportunities remain:

- With climate change, as water resources become scarcer and new water resources more expensive, there will be an increasing value in a competitive market to allow optimal use of such water resources.
- The Frontier review identifies the way forward: entry costs below a centrally set benchmark should be socialised across the whole customer base rather than applied to the individual new

[4] Competition and innovation in the water markets (Cave review) - GOV.UK

entrant or putting the incumbent company at a financial loss. Setting this benchmark centrally using Water Resource Management Plan information could allow such entry to develop. The commercial model developed as part of this project provides a benchmark.

- There have been wider benefits from this project beyond its original scope. The commercial and economic thinking and the commercial modelling has fed into the commercial modelling for the Cheddar 2 Direct Procurement for Customers scheme and contributions from Bristol Water/ Pennon to the development of bulk supplies for this market.

5.2.4 Scalability

Licence Scalability

We had intended to test licence scalability. In principle the UWE project using open data from the Environment Agency identified a number of water resource sites across the country that could allow licence scalability. However, the application process in the legislation requires each application to be considered separately. The barriers relating to water quality information within the application process will also limit licence scalability.

This finding mirrors the additional work undertaken as part of an added benefit from this project that related to bulk supplies and commercial modelling for Direct Procurement for Customers form of competition. Even for that market however each water resource and bulk supply agreement is currently being considered separately, although there is guidance to allow for consistent approaches to develop. This may allow future licence scalability for flexible local supply systems such as envisaged for this project.

Process Scalability

The water treatment plant developed as part of the Water Breakthrough Challenge project was designed to treat a maximum of 20 Mld raw water abstracted from the River Thames at Dicot Power Station. The process was selected to utilise prefabricated process units where possible to maximise off-site fabrication, minimise concrete construction and permit scalability for other potential locations with multi-use abstraction licences.

The table below summarise the number and size of key process units that would be required for water treatment plants capable of treating a range of raw water flows from 5 Mld to 48 Mld. These figures are provided on the following basis:

- Raw water quality is similar to that of the River Thames at Didcot.
- The number and size of the Actiflo® units are based on Veolia's range of standard prefabricated units and a nominal maximum mirror rating of 45 m/h.
- No standby Actiflo® is provided. When one Actiflo® unit is off-line for maintenance, the capacity of the treatment plant must be reduced pro-rata.
- The number and size of the primary filters are based on a nominal maximum design filtration rate of 7.5 m/h with one filter off-line for backwashing.
- With the exception of the 5 Mld water treatment plant, the GAC adsorption process is based on standard 4m diameter vertical pressure vessels, each containing a 40m^3 charge of GAC media.
- The chlorine contact tanks, which are horizontal cylindrical vessels, operate in series. When one vessel is taken off-line for inspection, the capacity of the treatment process must be temporarily reduced pro-rata.
- The wastewater lamella units are based on standard Nordic Water Johnson type lamella units, supplied in the UK by Jacopa.

- Sludge from the Actiflo® and wastewater lamella units can be discharged to a local sewer and no additional sludge thickening and/or dewatering process is required.
- The design working capacity provided for various tanks is the total working capacity required. In the case of the interstage pump station, this is envisaged to be a below ground twin-compartment structure. For all other tanks, it is envisaged that these would be above-ground prefabricated steel circular or rectangular steel tanks. The number of tanks for each application to be determined based on availability of standard sized tanks.

Raw water flow	5 Mld	10 Mld	20 Mld	30 Mld	40 Mld	48 Mld
Veolia Actiflo® prefabricated units	2 No. model AS2	2 No. model AS3	2 No. model AS4	2 No. model AS5	3 No. model AS5	3 No. model AS5
Primary filters (prefabricated tanks)	4 No. 4m x 2.5m	4 No. 7.5m x 3.0m	6 No. 7.5m x 3.0m	8 No. 7.5m x 3.0m	12 No. 7.5m x 3.0m	14 No. 7.5m x 3.0m
GAC vessels	4 No. 2.5m dia.	4 No. 4.0m dia.	6 No. 4.0m dia.	8 No. 4.0m dia.	12 No. 4.0m dia.	15 No. 4.0m dia.
UV System	2 No. Trojan D6	2 No. Trojan D12	2 No. Trojan D30	2 No. Trojan D30	2 No. Trojan D30	2 No. Trojan D30
Chlorine contact tanks (horizontal vessels)	2 No. 19m x 1.9m dia.	2 No. 24m x 2.4m dia.	2 No. 30m x 3.0m dia.	3 No. 30m x 3.0m dia.	3 No. 33m x 3.3m dia.	3 No. 35 x 3.5m dia.
Wastewater lamella (packaged unit)	2 No. model LS25	2 No. model LS40	2 No. model LS40	2 No. model LS40	2 No. model LS60	2 No. model LS60
Tank working volumes (total)						
Raw water balance tank	60m^3	120m^3	225m^3	340m^3	450m^3	570m^3
Interstage pump station	50m^3	100m^3	200m^3	300m^3	400m^3	500m^3
Treated water pump station	65m^3	125m^3	250m^3	375m^3	500m^3	625m^3
Clean washwater tank	80m^3	180m^3	180m^3	180m^3	180m^3	210m^3
Wastewater tank	90m^3	210m^3	210m^3	210m^3	210m^3	210m^3
Supernatant balance tank	50m^3	100m^3	120m^3	140m^3	160m^3	180m^3
Sludge balance tank	15m^3	30m^3	60m^3	75m^3	150m^3	180m^3

5.3 Project Outputs

Each section below sets out the Project Outputs, with appendices that refer to the individual technical outputs.

5.3.1 Abstraction Management Background

England & Wales

Key Points:

- As a matter of principle, the EA wants to encourage licence trading because it may facilitate allocation of water resources in a way that meets demand and supports the environment without the abstraction of additional water.
- Water trading scenarios can involve permanent or temporary trades and/or trading all or part of existing permits.
- Trading conditions applied by the EA for environmental protection may considerably reduce the volume of water available via a trade mechanism.
- The trading system is going digital, with a view to creation of “self-service” options to decrease time to decision/transaction.

Across England and Wales, abstraction licences are required when organisations and individuals want to abstract over 20 cubic meters per day of water from either a surface water source (river, stream, reservoir, lake, pond, canal, or spring) or a groundwater source. The Environment Agency (EA) and

Natural Resources Wales (NRW) regulate water abstraction in England and Wales respectively through a licencing system offering three different types of abstraction licences[5], including:

- Full licence – for most types of water abstraction over 20 cubic metres a day.
- transfer licence – to move over 20 cubic metres of water a day from one source to another without intervening use.
- Temporary licence – to abstract more than 20 cubic metres of water a day over a period of less than 28 days.

There are a number of types of abstraction situations that do not require a licence, but may require formal notification to the EA.

From 2023 new regulations, the *Environmental Permitting (England and Wales) Regulations (EPR) 2016*, affecting England mean that new "licences" will become known as "permits" and will be subject periodic review and renewal (i.e., not enduring or permanent permitting of water abstraction).[6][7] Importantly, water abstraction permits will no longer have time limits but will be subject to periodic review which could result in significant change to the permit. A permit review can be undertaken by the EA at any time to assess the permit in its current form and whether any changes need to be made to it. It is proposed there will be two different types of review:

- Programmed periodic reviews – these will be periodic planned reviews that are primarily focused on catchment sustainability and an assessment as to whether abstraction is sustainable in catchments that are approaching their end dates.
- Individual review – it may be necessary in some cases for the EA to review and potentially vary a permit outside of the periodic review programme.

The new permitting regime is designed to accommodate trading of abstraction volumes between permit holders and potential users, with safeguards in place to protect the environment. Trading can only take place where there is a surface water or groundwater link between the seller's abstraction point and the buyer's proposed abstraction point. Water cannot be traded without this pre-existing hydraulic connection. Where the trade involves a change in purpose, the EA will apply a consumptive loss factor. This takes account of the change in the proportion of water that is returned to the environment after use. More water will be returned from vegetable washing, for example, than from spray irrigation and the quantities allowed for in the trade will reflect this change in purpose. In water stressed parts of southern and central England, the EA applies a sustainability reduction which caps the quantities allowed for a trade to the peak historic licence uptake between the years 2005 and 2015 (2000 to 2015 for spray irrigation).

The EA and NRW divide England and Wales into 100 distinct 'water management catchments'. Each of these has a bespoke Abstraction Licensing Strategy, reflecting local conditions, which sets out how water resources within the catchment will be managed by the EA. The approach to abstraction licence

[5] Environment Agency (2012) *Bristol Avon and North Somerset Streams WFD Management Area Abstraction Licensing Strategy Bristol Avon, Little Avon, Axe and North Somerset Streams CAMS* [online].

[6] Department for Environment, Food & Rural Affairs (2019) *Abstraction reform report Progress made in reforming the arrangements for managing water abstraction in England* [online].

[7] Department for Environment, Food & Rural Affairs (2021) *Changes to the regulatory framework for abstraction and impounding licensing in England Moving into the Environmental Permitting Regulations regime* [online].

trading varies for each catchment according to local conditions but the same basic rules apply across the board:

- Trades must occur within the same waterbody and/or aquifer.
- Surface water licence trades can generally only be made downstream.
- Most trades are subject to a 'sustainability reduction' which removes any spare or previously unused water from the system.
- Changes in consumptive losses must be accounted for. (e.g., an irrigation licence returns less water to the environment than an equivalent vegetable washing licence. The increase in consumptive loss is deducted from the available quantity).

EA trading rules are becoming increasingly restrictive in the more water stressed eastern and southern parts of the country. For example, the Anglian area trading policy issued in December 2020 applies a substantial 'sustainability reduction' to licence trades, requiring that the quantity available to the 'donor licence' is reduced to the average annual licence uptake between the years 2007 and 2012, before a trade can even be considered. These regulatory factors of the *EPR 2016*, combined with the reduction in summer rainfall expected with climate change will continue to put pressure on the UK's water resources, driving up both the 'asset value' and the 'use value' of sustainable abstraction licences/permits well into the foreseeable future.

As part of modernising the abstraction licensing service, the EA have since March 2018 moved away from the existing outdated paper-based system (DEFRA, 2019). The move is intended to create a more flexible licensing system that would better meet the needs of customers and improve access to water, while better protecting the environment. The long term aims of this digital service is to enable licence holders to:

- View licence details and manage contact information online.
- Access information on local water availability more readily.
- Submit water usage data online.
- Apply for/ renew licences online, and
- More effectively enable trades between users.

An innovative software solution, Wheatley Watersource, is a project developed in collaboration with Anglian Water and Essex & Suffolk Water, supported by Water Resources East and the Environment Agency that seeks to facilitate and co-ordinate trades between different parties including farmers and other abstractors such as golf courses and water companies (NFU, 2021). The Environment Agency made data available highlighting licences which could potentially be made available for trade. Information was displayed via a geographical information system, shown in Figure 1, indicating recent levels of actual abstraction for licences (excluding public water supply) and identifying the potential for trading to take place and for discussions with existing licence holders and the Environment Agency to be initiated. The EA's information on licences having the potential for trade was promoted by the National Farmers' Union alongside its tools to facilitate trading. Following positive user feedback, proposals are in place to make this a permanent feature of the digital service and to roll it out nationally (DEFRA, 2019).

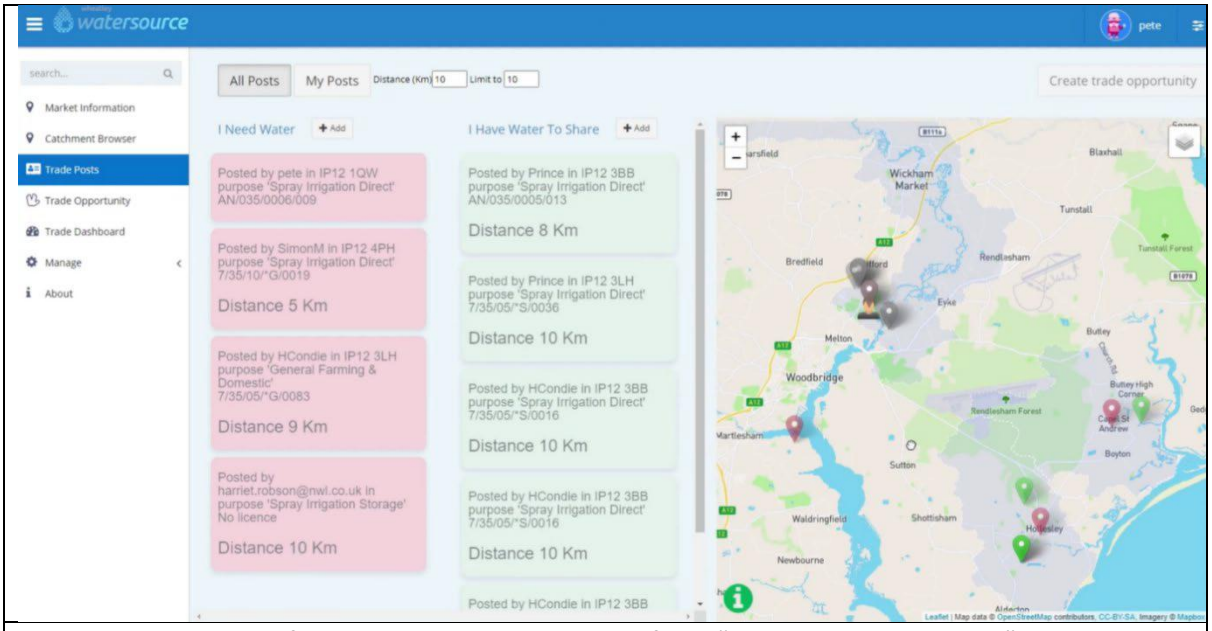


Figure 1. Screenshot of the online water trading platform "Wheatley Watersource" which aims to facilitate sustainable trade in water. Funded by Anglian Water and Essex & Suffolk Water, with support from Water Resources East (WRE) and in consultation with the Environment Agency.

Abstractors in the area can advertise through the platform where they are actively looking to share/trade water, or need water (including water rights), as can other users who don't have an abstraction licence but rely on a potable water supply – such as golf courses, nurseries, or industry. A potential buyer and a potential seller can then set up a 'trade opportunity' that is automatically assessed against a set of rules agreed with the Environment Agency (EA). This will indicate if 'fast trade' is possible (i.e., EA approval isn't necessary) or if referral to EA is required for a variation of a licence, for example. If referral is needed, the platform will support the gathering of 'pre-application' information and email this to the EA Permitting Office.[8]

International Experience

As water scarcity is a global challenge, there is a growing interest in developing water markets and related trading flexibilities as mechanisms to tackle the challenge. The peer-reviewed published literature suggests that market-based incentives can lead to more efficient allocation of scarce resources compared with traditional top-down administrative systems. Markets may allow users to transfer water towards more productive uses, thus creating incentives to use water more efficiently, to sell unused available water. Conversely, clearer market signals regarding the price of water may trigger input substitution amongst those current users with lower cost alternatives available to them.

Water trading is most advanced in parts of the United States (USA). To assess the rights of private individuals in surface water, three separate use allocation schemes have evolved in the USA. The riparian approach, which originated in the eastern US, is the first. The second is the "first-in-time, first-in-right" system of prior appropriation, which originated in the western United States. Finally, a small number of governments have implemented a hybrid system that combines elements of the riparian system and prior appropriation approaches. This differentiation in approaches to surface water

[8] The Water Report (2021) *Water trading platform opened for Suffolk abstractors* [online].

management is complicated further by different approaches taken to groundwater, even where there is direct connection between groundwater and surface water.

The decoupling of water rights from land rights via the Prior Appropriation doctrine was necessary for the development of water trading in the western United States. It grants a Prior Appropriation rights holder permission to treat water as a private commodity even if they don't own the land over which it flows.[9] In addition, a similar "de-coupling" has been seen in riparian law states, where a specific use, like extracting and selling or diverting water out of a watershed for mining or hydraulic fracturing, might allow water trading so long as it is reasonable when balanced against other watershed uses.

In the western United States, a water right is either sold or, more accurately, temporarily leased when it is traded. A water right owner gains perpetual access to a certain amount of water, subject to conditions like priority, time, and location. A water "lease" is an agreement between the owner of the right and the buyer, to provide or grant access to a specific amount of water over a specific length of time, subject to terms like timing and location of access. Sometimes referred to as "spot market" deals or "rental" transactions, one-time transfers of water are effectively short-term leases (Brown, 2006).

Until the creation of water markets in the early 1900s, and the recognition around the benefits of water conservation by state legislators, high volume extractors, such as farmers, could do little with their excess water due to the benefits only reaching the next priority user along a watercourse.[10] California eliminated this perverse incentive to conserve through a statute, whereby water use reductions through means of conservation in turn allowed the sale, lease, or transfer of conserved water.[11] The separation of appropriative rights from the land further allowed the basis of private water trades to occur.[12]

Water trading has also come as a collateral from activities such as shale oil fracking in states like Colorado and Texas. Extra water is required for mining operations like fracturing shale plays for oil abstraction and a single operation can use between 3-8 million gallons, or 2-5 million gallons per well.[13] In Texas, groundwater is the main water source for fracking and by law the surface owner owns the rights to the underlying groundwater source. This means that fracking companies would have to gain leasing rights or buy the land from a third party to source groundwater, on or off tract. In Colorado, prior appropriation governs water rights for both surface and ground water. Therefore, buying or leasing water rights from the most senior appropriator would secure a lower risk water source.

Other countries with notable experience with water trading include Australia and Spain. Many other countries have long discussed water trading (e.g., Canada) but have yet to take definitive steps. However, the nature of the England water sector, the relatively small size of catchments and the principles of flexible local supplies for this project means a bespoke approach for the UK Water Sector based on the economic and legislative framework in England is appropriate. The legislative approaches

[9] Varghese, S., 2013. *Water Governance in the 21st Century*. Institute for agriculture and trade policy.
[10] Payne, T.M & Root, S. (2011). Water Markets in the USA. *Water Resources IMPACT*, *13* (5), 6–8.
[11] Brewer, J., Glennon, R., Kerr, A. and Libecap, G. (2008). 2006 "Presidential Address Water Markets in the West: prices, trading and contractual forms," *Economic Inquiry*, 46(2), pp.91–112. doi:10.1111/j.1465-7295.2007.00072.x.
[12] Getches, D., Zellmer, S. and Amos, A., 2015. *Water Law in a Nutshell*, 5th (Vol. 80). West Academic.
[13] Buono, R.M., Elena López Gunn, McKay, J. and Staddon, C. (2019). *Regulating Water Security in Unconventional Oil and Gas*. Springer Nature; Rahm, D (2011) "Regulating hydraulic fracturing in shale gas plays: the case of Texas". *Energy Policy* 39(5):2974–2981

for Scotland and Wales are different and water trading for this project again is appropriate for England rather than elsewhere.

5.3.2 Scalability and Visualisation of Opportunities for Flexible Abstraction

Water Resource Availability

Visual assessment based on the 2019 EA Abstraction Licensing Strategies for Thames catchments

In the absence of precise and public geocoded abstraction licensing data, information can be drawn from the Environment Agency's previous Abstraction Licensing Strategies (ALSs) for England. The EA produce Abstraction Licencing Strategies for English river basins as part of the wider Catchment Abstraction Management System (CAMS). CAMS is a standard approach for assessing water availability across catchments for further abstraction licensing, with consideration of environmental requirements, ensuring river basin management plans (RBMPs) and Water abstraction plans are translated into policy. These plans must also comply with Water Framework Directive (WFD) requirements.

CAMS supports river basin planning. It:

- Provides an indication of whether there are sufficient water resources to support a healthy ecology and sustainable abstraction.
- Provides information on how much water is available for future licensing whilst protecting the environment.
- Helps to identify water bodies that are failing or are at risk of failing to meet Good Ecological Status (GES) by 2027 due to water resource pressure.

CAMS is divided into 3 stages that is continually reviewed and updated:

- Resource assessment and management (RAM).
- Interpreting the results of RAM to achieve sustainable abstraction.
- Abstraction licensing strategy (ALS).

How does RAM work?

The RAM process is as follows:

1. Estimates natural flows using information on river flows, groundwater levels and abstractions and discharges.
2. Represents ecological requirements by selecting the appropriate ecological sensitivity using local ecological information – producing the EFI[14].
3. Produces scenario flows using abstraction and discharge information – not all abstractors use the full quantity of water they have on their licence, so the scenario flows in recent years may be significantly different compared to abstractors taking their full licensed quantities.

[14] The UK Technical Advisory Group (UKTAG) is responsible for developing environmental standards and conditions for achieving WFD requirements for rivers and lakes of Good Ecological Status (GES). The standards vary by river type and flow, with stricter standards at lower flows and for water body types considered more sensitive to abstraction. DEFRA translate the UKTAG river flow standards into the EFI for use in England as part of RAM.

4. Assigns the water resource availability status colour; the colours are used to indicate the amount of water available for additional abstraction; these are determined by comparing the scenario flows with the EFI.

Additionally, RAM determines the "hands off flow (HoF)"[15] that would be used for any new water resource licences issued within the watershed. To ensure that enough water is still accessible for the environment when more of the available water is dedicated to abstraction, licences are issued with more stringent HoF restrictions. Additional restrictions are also expressed in flow percentiles. For example, within the Kennet and Vale of Whitehorse (or Kennet and Tribb) catchment, the Upper Kennet River has been set a HoF of 8.2ML/day, as well as the Q50 flow of the Thames at the time.

The flow percentiles of each catchment are used as benchmarks for how much water is available for abstraction.

What are flow percentiles?

To assist in the selection and interpretation of river flow data, the National River Flow Archive (NRFA) calculates flow statistics for specific flow records and gauging stations. Flow percentiles are computed using daily flow data from these gauging stations to understand the low and high flows of a river over a specific extended period. They have an inverse relationship, by which a lower Q-value indicates a higher flow.

The NRFA calculates and uses the following percentiles:

- **Q10** (the 90-percentile flow): The flow in cubic metres per second which was equalled or exceeded for 10% of the specified term – a high flow parameter which, when compared with the Q95 flow, provides a measure of the variability, or 'flashiness', of the flow regime.
- **Q50** (the 50-percentile flow): The flow in cubic metres per second which was equalled or exceeded for 50% of the flow record.
- **Q70** (the 30-percentile flow): The flow in cubic metres per second which was equalled or exceeded for 70% of the flow record.
- **Q95** (the 5-percentile flow): The flow in cubic metres per second which was equalled or exceeded for 95% of the flow record. The Q95 flow is a significant low flow parameter particularly relevant in the assessment of river water quality consent conditions. Q95 values should be used with caution in view of the problems associated with both the measurement of very low discharges and the increasing proportional variability between the natural flow and the net impact of artificial influences, such as abstractions, discharges, and storage changes as the river flow diminishes.

The EA use Q95, Q70, Q50, and Q30, rather than Q10, in their RAMs for all catchments. All HoFs and flow quartiles can be found in tables at the bottom of each ALS. Quartiles can be found on the NRFA website.

Abstraction Licensing Strategies

[15] "HoF" is a condition attached to an abstraction licence which states that if flow (in the river) falls below the level specified on the licence, the abstractor will be required to reduce or stop the abstraction.

ALSs are technical documents summarising the findings of the RAM process and hence the water resource availability of catchments across the UK at their natural flows[16]. Each catchment has its own ALS and it determines the availability of water for abstraction licensing against the forementioned flow quartiles. This is done both before and after a modelled ALS is applied. They aim to guarantee that the goals of the RBMPs for the use of water resources are met and deterioration is prevented. This method is used in the water body where the abstraction is located. It also covers all groundwater bodies affected by any decrease in groundwater level or change in flow directions, as well as all downstream surface water bodies that might be impacted by any reduction in abstraction-related river flow. See annex for a list of ALS used in this report.

Water resource availability based on the 2019 ALSs for the Thames catchment

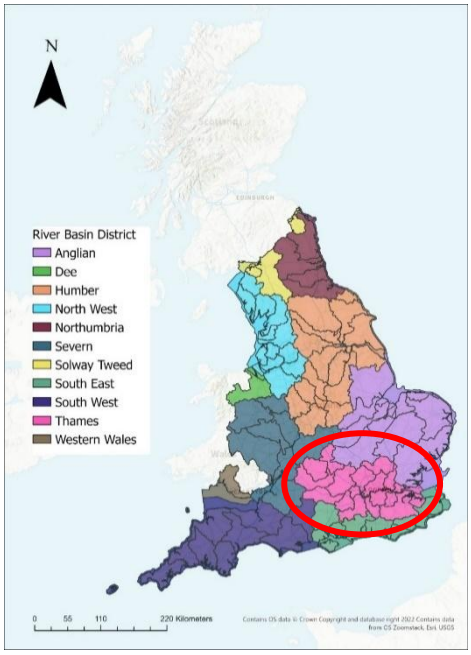


Figure 2: English RBD's and Catchments, with Thames RBD highlighted.

[16] Natural flow in the RAM refers to Estimated flow using information on river flows, groundwater levels, and abstractions and discharges.

Figure 3: A map displaying the catchments that make up the Thames RBD, with the Thames corridor running through the centre. Source: EA, 2019 – Thames ALS.

Understanding the maps

The EA provide a traffic light-based visualisation for four different flow percentiles. This is done for both before the implementation an ALS and after, for each operational catchment. By evaluating the amount of water available at various flows, it is possible to determine when there is a surplus or deficit of water and the reliability of an abstraction that goes along with it.

Water Available for Licensing = Green

- In this flow scenario, there is more water than required to meet the needs of the environment. New licences can be considered at this flow but may be constrained to protect local features.

Restricted Water Available for Licensing = Yellow

- In this flow scenario, full licensed flows fall below the Environmental Flow Indicator (EFI) in this water body and/or a downstream water body(ies).
- If all licensed water is abstracted there will not be enough water left for the needs of the environment.

- No new consumptive licences[17] would be granted at this flow. Water may be available if you can trade the entitlement to abstract water from an existing licence holder.

No Water Available for Licensing = Red

- In this flow scenario, recent actual flows are below the EFI in this waterbody and/or a downstream water body(ies).
- This scenario highlights water bodies in which abstraction is contributing to flows falling below the EFI. Flows should meet the EFI to help support a healthy ecology in our rivers.
- No new consumptive licences would be granted at this flow. Water may be available if you can trade the amount of water equivalent to that recently abstracted from an existing licence holder.

Water resource availability of the Thames RBD

The following maps have been compiled using ALSs from the catchments composing the Thames RBD. They are based off 2019 assessment data and more up-to-date RAM data can be explored here. The compilation of the maps has been completed to understand water availability across the Thames RBD in a more accessible format.

The following catchments have been excluded due to their ALSs being outdated: Mole, Darent & Cray, Medway, North Kent & Swale and Essex South.

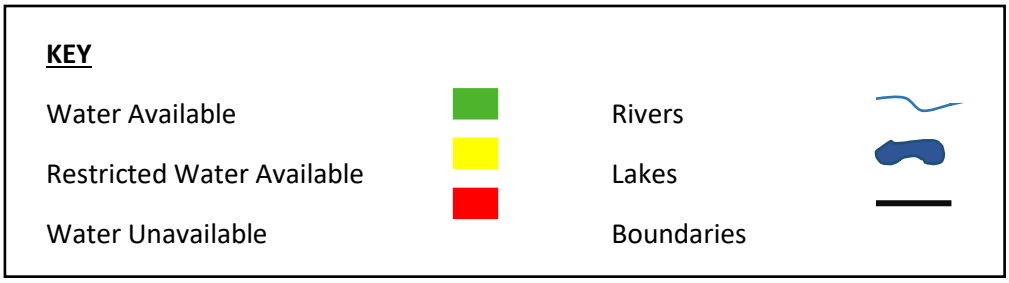


Figure 4: Thames catchment highlighted as the assessment area

[17] Consumptive Abstraction licenses refer to those abstractions where a significant proportion of the water is not returned either directly or indirectly to the source of supply after use. For example, for the use of spray irrigation.

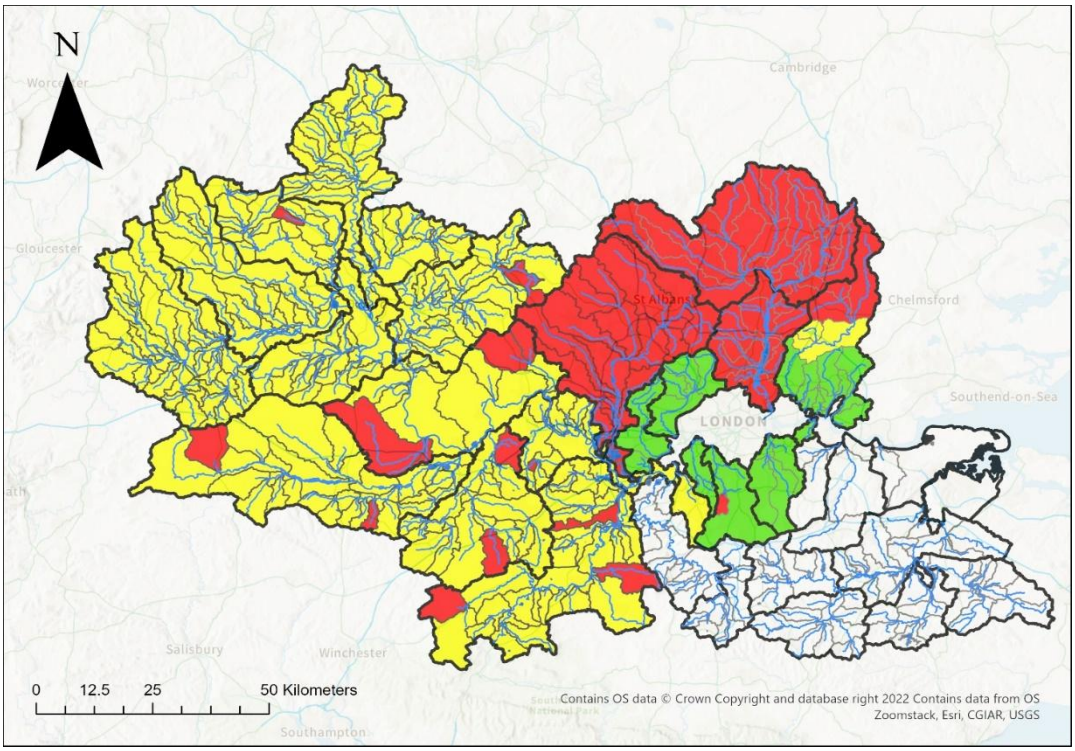


Figure 5: Map displaying water resource availability at Q30.

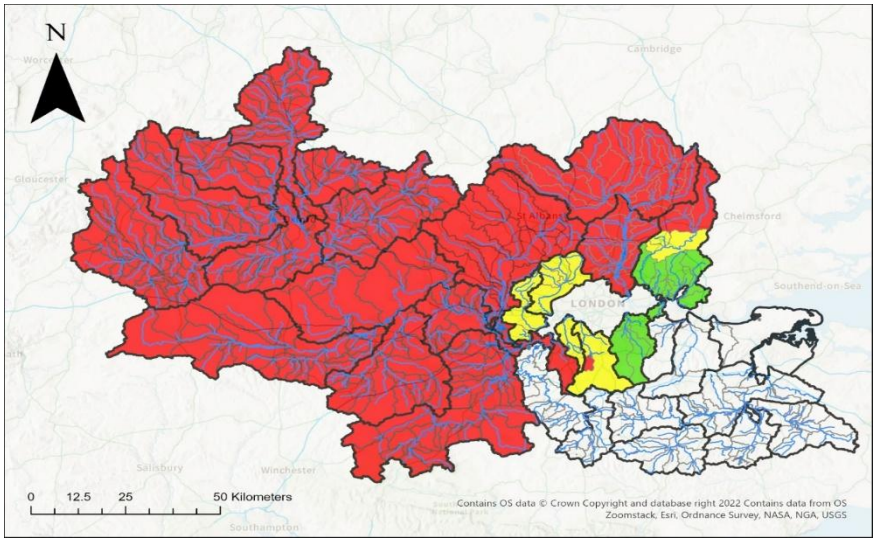


Figure 6: Map displaying water resource availability at Q50.

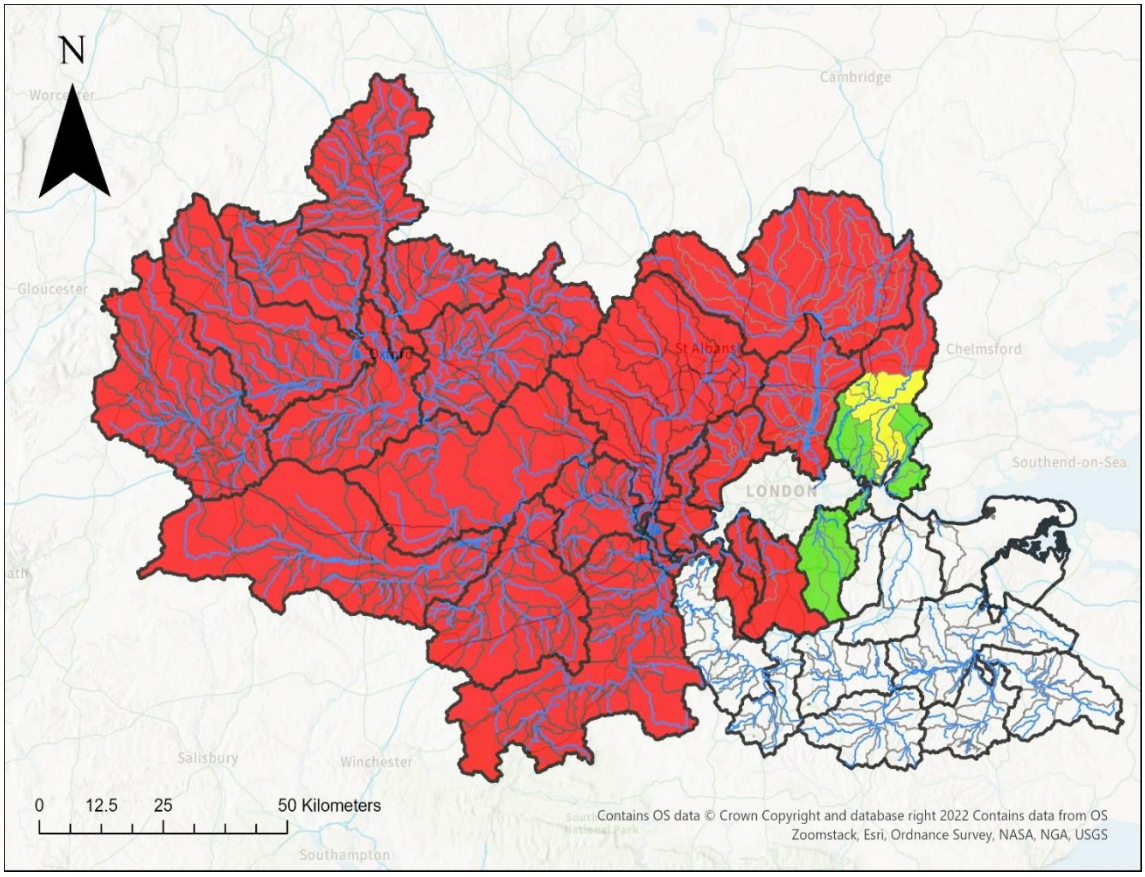


Figure 7: Map displaying water resource availability at Q70.

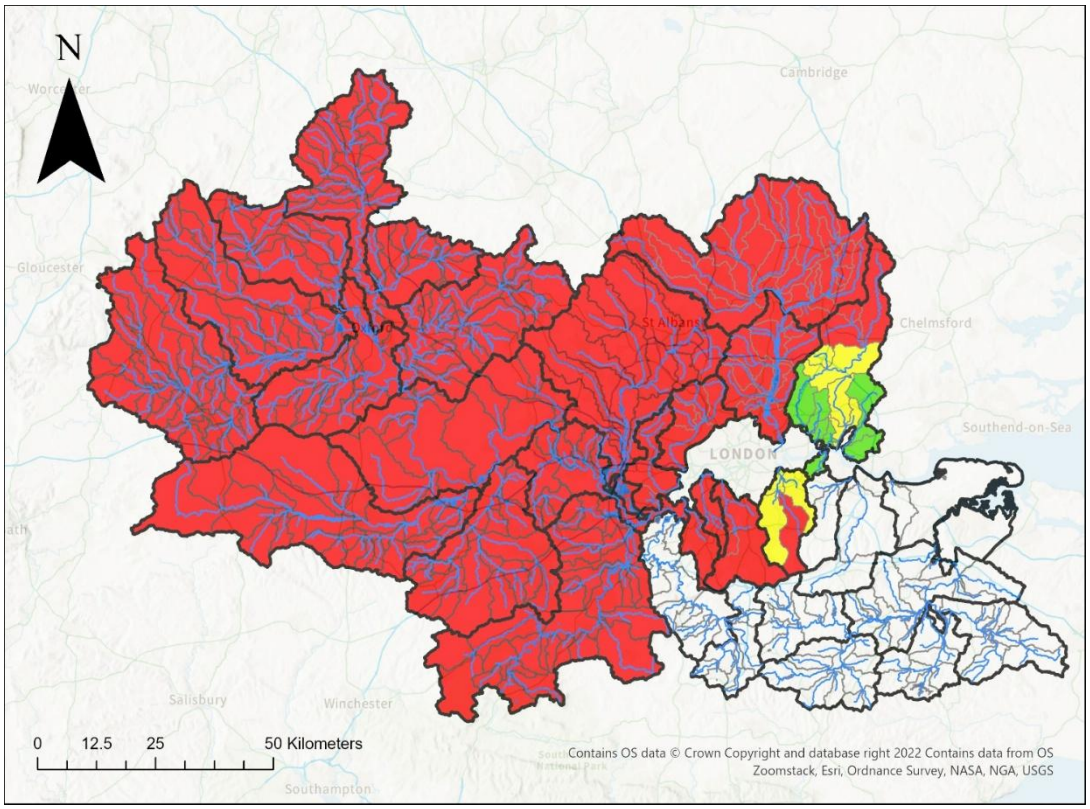
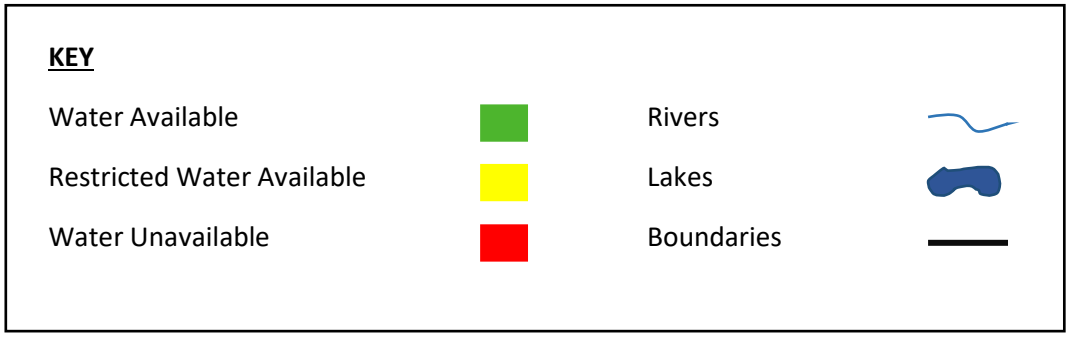


Figure 1: Map displaying water resource availability at Q95.

Estimated water resource availability of the Thames RBD after modelled ALS is applied

The following maps have been compiled using ALSs from the catchments composing the Thames RBD. They are based off 2019 assessment data and more up-to-date RAM data can be explored here. The compilation of the maps has been completed to understand water availability across the Thames RBD in a more accessible format.

London, Lee Upper and Roding, Beam & Ingrebourne catchments are greyed out due to lack of ALS application. Moreover, Mole, Darent & Cray, Medway, North Kent & Swale and Essex South have not been included at all due to ALSs being older than 2019.



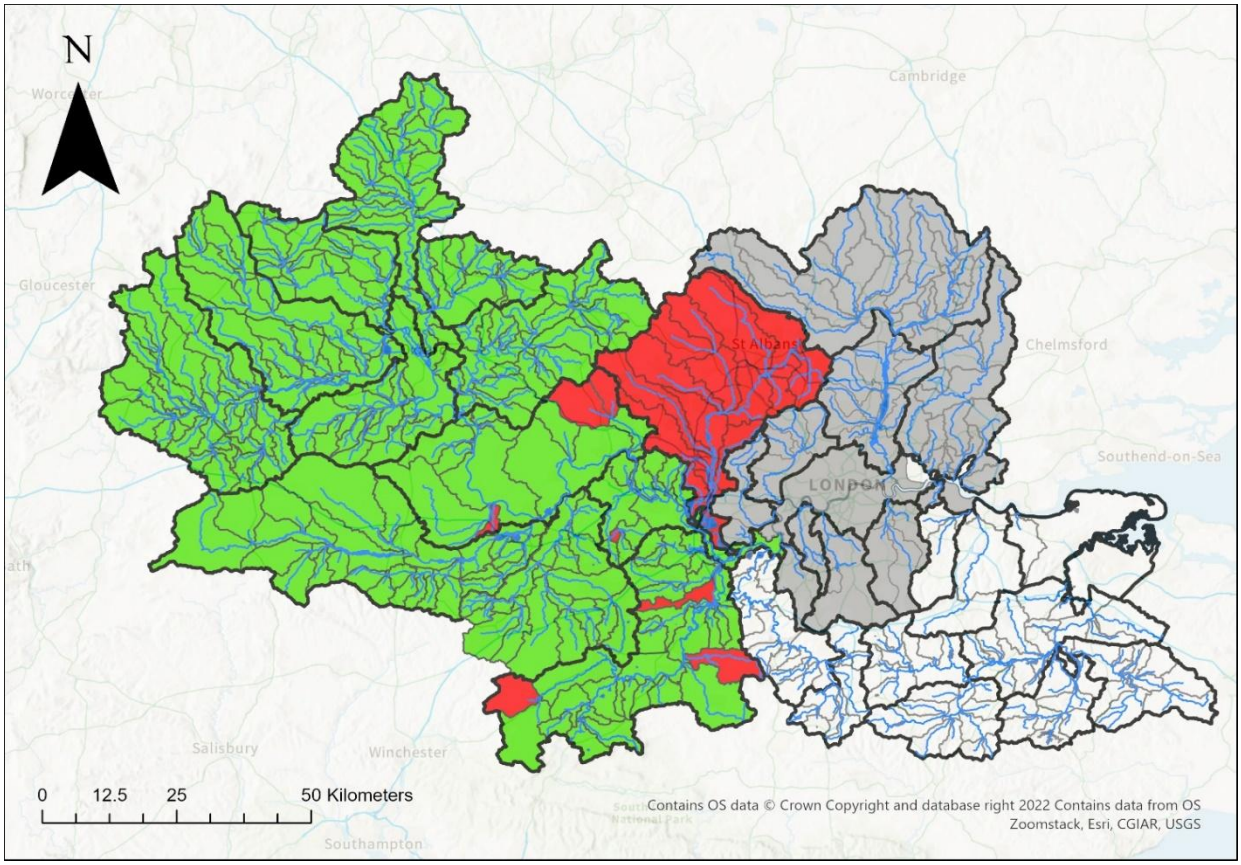


Figure 2: Map displaying water resource availability at Q30 after ALS is applied.

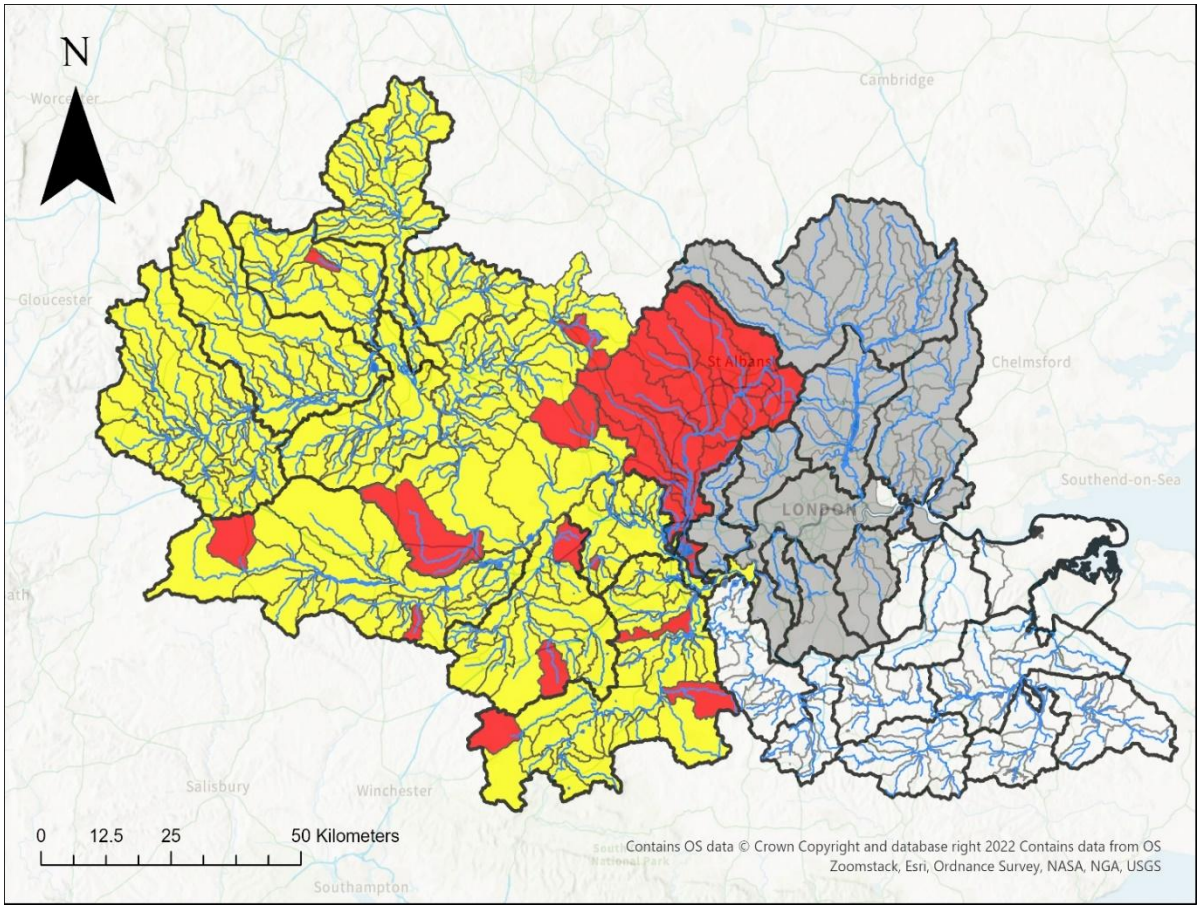


Figure 3: Map displaying water resource availability at Q50 after ALS is applied.

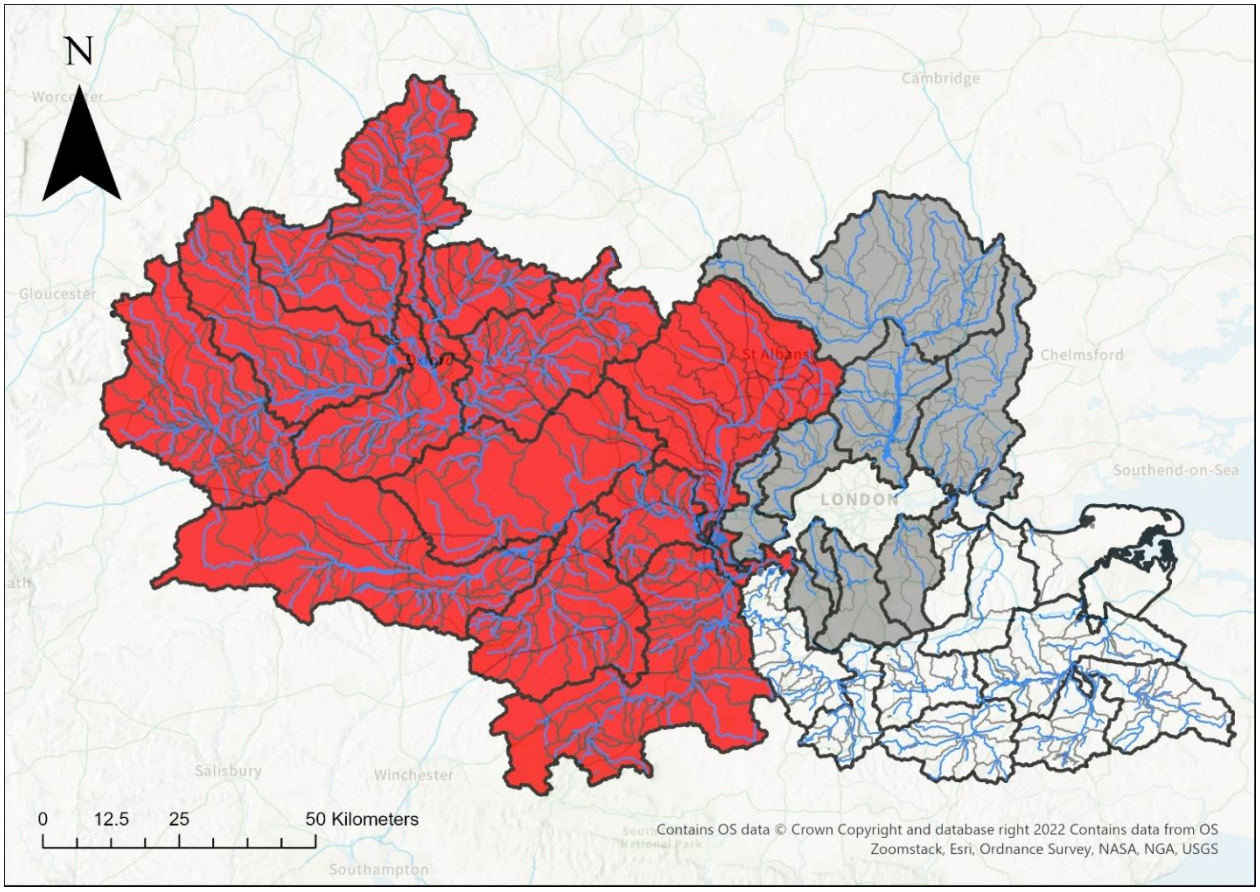


Figure 4: Map displaying water resource availability at Q70, and Q95, after ALS is applied.

Persistent areas where water is unavailable for abstraction licensing, and why.

Upper Lee

Water availability is severely limited due to the requirement to protect flows for the Lower Lee, which contains significant surface water bodies for public water supply abstraction. Those flows which may be available are restricted to periods of very high flows and they may not provide a reliable source of water due to seasonal and annual variations.

Colne

South West London Water Bodies SPA is the only Special Protection Area (SPA) in the Colne CAMS area. This location is also designated as a Ramsar site[18]. The area consists of a succession of internationally important gravel pits and reservoirs for wintering wildfowl. Gadwall and Shoveller are the most common species of interest. These locations rely on the area's water resources and will be impacted by changes in water levels and water use. There are also nine water-dependent Sites of Special Scientific Interest (SSSIs) in the Colne CAMS area. These provide a variety of essential habitats and host a number of nationally important species.

Lower Lee

[18] Ramsar Sites are wetlands of international importance that have been designated under the criteria of the Ramsar Convention on Wetlands for containing representative, rare, or unique wetland types or for their importance in conserving biological diversity (JNCC, 2022).

Lack of reliable seasonal and annual flows.

Top of Roding, Beam and Ingrebourne catchment

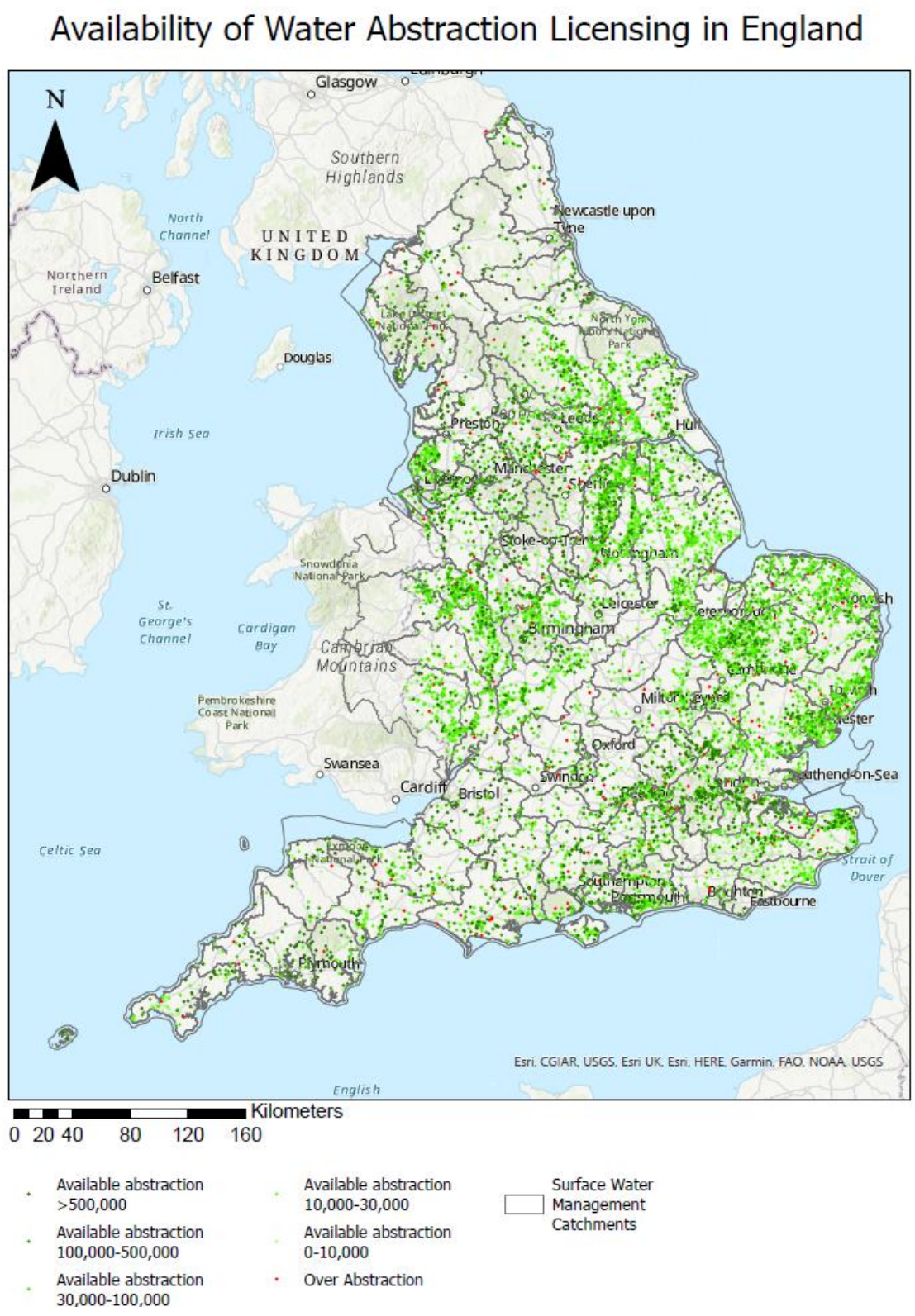
Upper Roding (to Cripsey Brook) and Cripsey brook water courses are subject to abstractions with high flow constraints. Therefore, any new abstraction applications would require protective limits to maintain existing abstraction rights.

Upper Roding (to Cripsey Brook) and Cripsey brook water courses are subject to abstractions with high flow constraints. Therefore, any new abstraction applications would require protective limits to maintain existing abstraction rights.

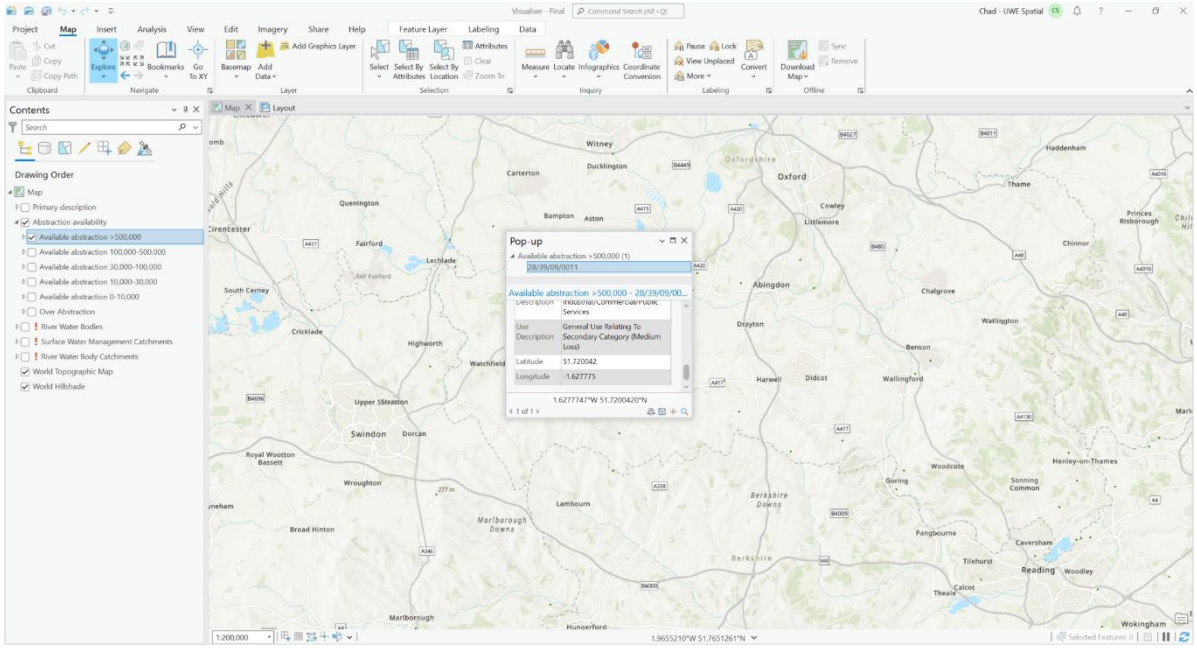
National Scalability and visualisation

The section above looks at the Thames area and considered whether new abstractions for water supply for local package plants are feasible. It also considers abstraction trading and the potential for environmentally sensitive areas to see less abstraction and more abstraction in less sensitive areas. The analysis that the EA carries out to produce these maps has limitations in that it is carried out without a trading model. With we EA's agreement, we therefore accessed their open access data and developed a visualisation model that considered the size of existing abstractions and what volumes were available. The illustration below highlights areas of available and existing over abstractions. The darker green colours indicate larger potentially available abstractions from the available data and provides an indication of where more flexible water supplies are possible. The Didcot site is dark green (7,300,000MLA) compared to the 500,000 threshold for dark green. There are very few abstractions and no other multi use abstractions of a similar scale, and those below 500,000 are not likely to be feasible for any small package plants or water sector abstraction use.

The data set used 2021 abstraction data and the source code data and data set are available, although an open data licence from the Environment Agency needs to be obtained in order for us to share this data. It took three months for us to obtain the licence and data which therefore limits the degree to which this is open, although the EA does make it available in its own visualisation tool this cannot be combined with data analysis such as the map we show below. In our tool, criteria can be amended in order to look at locations and types of abstraction in order to explore commercial opportunities for water trading. The code and the data use ARCGIS, a standard geographic data visualisation tool.

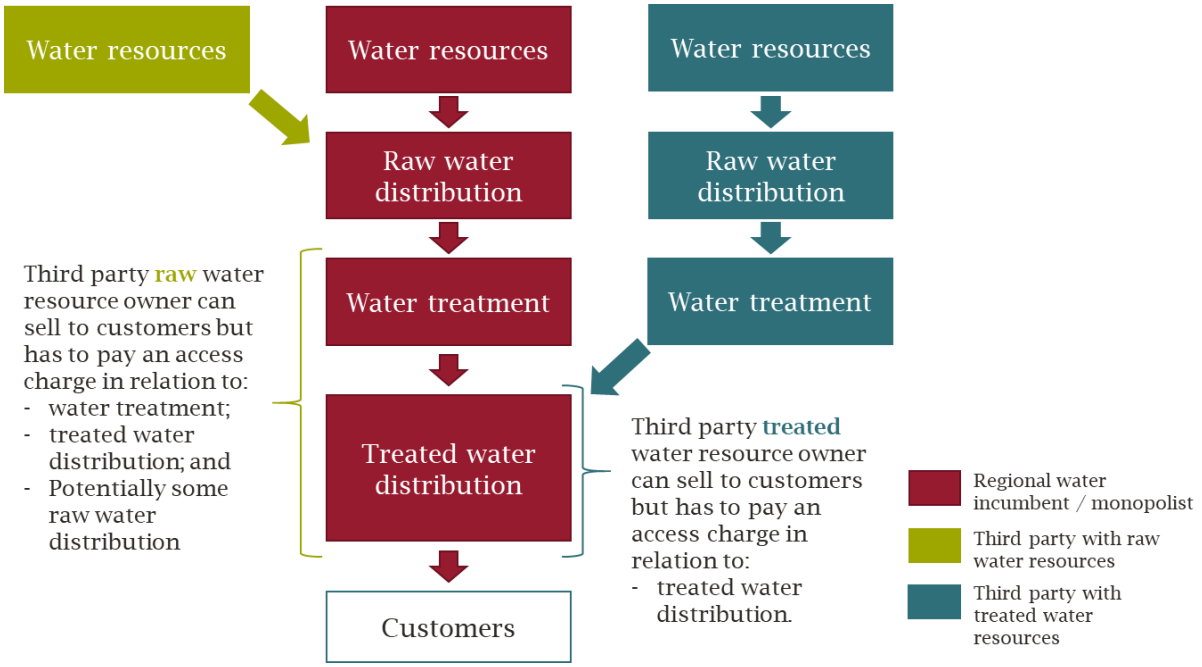


Use of visualisation to drill down to the Didcot area.


Contents
Drawing Order
Map
Primary description
Abstraction availability
Available abstraction >500,000
Available abstraction 100,000-500,000
Available abstraction 30,000-100,000
Available abstraction 10,000-30,000
Available abstraction 0-10,000
Over Abstraction
River Water Bodies
Surface Water Management Catchments
River Water Body Catchments
World Topographic Map
World Hillshade
Pop-up
Available abstraction >500,000 (1)
28/39/09/0011
Available abstraction >500,000 - 28/39/09/00...
Use Description
General Use Relating To Secondary Category (Medium Loss)
Latitude
51.720042
Longitude
-1.627775
1.6277747°W 51.7200420°N
Oxford
Abingdon
Swindon
Reading
Witney
Carterton
Ducklington
Bampton
Aston
Quenington
Fairford
Lechlade
Cirencester
South Cerney
Cricklade
Highworth
Watchfield
Upper SStratton
Dorcan
Royal Wootton Bassett
Wroughton
Broad Hinton
Marlborough
Lambourn
Marlborough Downs
Berkshire Downs
Berkshire
Drayton
Harwell
Didcot
Wallingford
Benson
Chalgrove
Watlington
Goring
Woodcote
Pangbourne
Tilehurst
Calcot
Theale
Caversham
Woodley
Henley-on-Thames
Sonning Common
Wokingham
Chinnor
Princes Risborough
Thame
Haddenham
Cowley
Littlemore
Oxfordshire
Hunnerford
1:200,000
1.9655210°W 51.7651261°N

5.3.3 Regulatory & Commercial Barriers to the Project

Where the provision of water to customers is delivered through an incumbent's network (such as Thames Water's), the pricing between the water provider and the retailer will need to take account of access charges paid to the incumbent for using parts of their value chain. This is shown in the diagram below.



There are different options for how the access charging of incumbents (such as Thames Water's) could be structured, and Ofwat has previously discussed the principles of charging for untreated water. However, aside from plans for large water resource schemes (covered by Direct Procurement for Customers (DPC)), the provision of water from third parties to customers via an incumbent's network remains limited.

Against this context of limited provision, we reviewed cross-sector case studies where access charge paid by the party accessing the network has been "shallower" and to assess their relevance for the water sector. Here, "shallower charges" describes a situation where the access seeker only bears a portion of the cost of access, with the remainder of cost being socialised, or distributed, among other parties within the network.[19]

The case studies we review cover both: (a) connection charges: which are associated with the initial connection to a network, and could also include up-front reinforcement to the existing network to support additional capacity; and (b) on-going usage charges: which are associated with the ongoing use of a network over time.

This review aimed to: identify a set of case studies where shallower access charging has been applied; review the regulatory rationale in these case studies; and to consider the implications for the water sector in England and Wales.

[19] It does not mean that efficiently incurred costs are not recovered.

The case studies

We identified six case studies where regulators have proposed to put in place shallower charges. We focus on markets and sectors where, like the water sector, duplication of network infrastructure is expensive, and network users are typically seeking access to existing incumbent network. We also focus on case studies from Europe and Australia as access charging in these geographies are most likely to have similarities to the UK. Table 1 provides an overview the six case studies.

Table – Charging case studies IDENTIFIED for this review

CASE STUDY	SECTOR AND JURISDICTION	OVERVIEW
Ofgem electricity connections	UK energy sector (2021)	In a 2021 review, Ofgem proposed to reduce the charges directly borne by customers *connecting* to the electricity distribution network
UK/EU Rail access charges	Rail sector in the UK and EU (2012-present)	Legislation issued by the EU in 2012 provides that rail infrastructure managers, as the default, can only recover those costs from access seekers that are directly incurred as a result of the service
Ofcom cost principles	UK telecommunications sector	To assess whether pricing arrangements are fair and reasonable, and only recover the 'right' level of costs, Ofcom has established a framework based on six principles of cost recovery
IPART review of recycled water pricing arrangements	Australian water sector (2018)	The water regulator in Australia reviewed existing pricing arrangements for recycled water schemes and concluded that the costs and benefits must be assessed from a broader perspective
ACCC's Review of access charges for fixed telecommunications services	Australian telecommunications sector (2005)	The competition commission in Australia reviewed, and subsequently rejected, a proposal by the incumbent network owner to charge a geographically averaged access price

CASE STUDY	SECTOR AND JURISDICTION	OVERVIEW
UREGNI Profile adjustment for Gas Distribution	Northern Irish Gas Distribution	The Utility Regulatory in Northern Ireland (UREGNI) applied an adjustment such that the distribution charges paid by customers in the early years of natural gas network development were more affordable

All six case studies contain insights that can be relevant to the situation in the water sector in England and Wales, though the two that may be of most relevance are the Ofgem electricity connections decision from 2021 and the IPART review of recycled water from 2018. This is because these case studies are more recent and are a response to some of the latest challenges facing the utilities sector. For example, the challenges posed by climate change and population growth.

Key findings

There are six themes that emerge from these case studies. These themes capture the key reasons that regulators have, in these situations, set shallower access charging. The six are:

1. **Environmental externalities** – some regulators have identified that entry into the market can lead to positive outcomes for the wider society in the form of environmental externalities. Charging regimes have been structured to incentivise such entry to help support environmental objectives. This has been achieved through greater socialisation of costs where this is willingness-to-pay for environment benefits in the wider customer base.
2. **Distribution of benefits across the network** – regulators have also identified that in some cases, the benefits of entry accrue not only to the entrant, but also to other users in the wider customer base. Therefore, some regulatory reforms have been made on the basis of similarly distributing the recovery of associated costs across all those who benefit from the new entry.
3. **Promoting effective competition** – another important consideration has been the prospect of promoting competition by setting shallow charges to incentivise new entry. New entrants are an important source of maintaining and improving competition. By setting favorable charging structures, regulators can incentivise new entry, which would lead to beneficial, competition-related, outcomes for the entire market.
4. **Promoting efficient use of resources and network resilience** – regulators have also considered the impact of new entry on promoting efficient utilisation of the network and improving network resilience. In markets where resources and scarce or limited, a key objective for policy makers is to ensure that the network is resilient and can respond it times of shortage.
5. **Accounting for cumulative benefits** – some regulatory decisions have recognised a potential bias against smaller scale schemes. Smaller schemes, in isolation, could struggle to demonstrate material avoided costs to an incumbent. However, when many schemes are combined, the avoided costs can be larger. Therefore, there is a risk that these 'avoided costs' are all attributed to the marginal scheme that avoids network augmentation, hence underestimating the benefits from the other schemes.
6. **Location pricing** – finally, some regulators have identified the importance of setting prices that are individually cost-reflective. In markets where the underlying cost of providing a service varies geographically, economic efficiency dictates that the price varies similarly, to maintain cost-reflectivity. If an operator in a low-cost region has to bear a higher, 'deeper' price, than that suggested by the underlying cost, it could reduce the operator's competitiveness and lead to inefficient outcomes in the market.

Looking across these themes, there is a focus on understanding and capturing a wide set of costs and benefits – whether these are environmental, resilience focused, or operational. The regulatory rationale for adopting shallower charges has often centered around encouraging activity that provides a net social benefit.

Implications for the water sector

The key implications arising from our assessment are set out below:

- Where access can give rise to anticipated environmental externalities, there is scope to set charging based on the expected scale of externalities. In practical terms, adopting a broader strategic approach to reflecting externalities through access charging offers ease of administration. The alternative of attempting to make specific payments on a case-by-case basis is likely to more burdensome. Given the limited amount of third-party water sources, even if the shallower regime does not fully align with the scale of the externalities the scale of impact would be limited. Therefore, any adverse effects (e.g., in terms of cost recovery and volatility in water charges), arising from any inaccuracy, would be limited.
- While the concept of avoided costs is considered within assessment frameworks applied by Ofwat, there may be situations where the scale of potentially avoided costs is greater and covering more of the value chain, particularly in instances where the incumbent is able to defer investment as a result of third-party activities. It may be beneficial to review whether existing approaches are potentially acting as a barrier to activities that are to customer benefit, for example, whether the scope of avoided costs is sufficiently broad, such as avoided treatment costs.
- Faced with the growing demand due to population growth, along with the challenges posed by climate change, network resilience is an increasingly important consideration. Promoting greater operational resilience is something that brings benefits to wider customer bases and can be supported through greater connectivity to existing water assets. The benefits of resilience can be factored into charging schemes on a case-by-case (placing values on resilience each time), or work can be done to set a broader strategic direction for charging based on the expected scale of resilience benefits more generally.
- The focus on marginal benefits may pose a risk for smaller schemes that in isolation may not avoid a given network augmentation. For example, in the case of treated water, the avoided augmentation could be the incumbent constructing or upgrading an existing treatment works. One scheme alone is unlikely to avoid these activities, but many smaller schemes, collectively, could. There could therefore be merit in considering cumulative benefits when appraising schemes.
- A key consideration when promoting competition is for prices to appropriately reflect costs. Where costs are averaged over broad geographies or sets of assets then there is a risk that the prices, they generate do not send appropriate market signals and the benefits of competition would be foregone.

Overall, the issues considered in the case studies, grouped into the themes above, overlap to a large extent with issues that are relevant to the water sector today. While there may be many reasons that there has been a lack of water provision from third parties to customers via an incumbents' network, the charging structure is one potential barrier for Ofwat to explore, particularly if creating a step-change in the market is considered to be an important objective.

5.3.4 Network Barriers and Resolutions

Background

The Non-Household (NHH) water retail market works like many other open utility markets, i.e., telecoms, electricity, and gas. Licensed retailers buy wholesale water and sewerage services from wholesalers. Wholesalers continue to supply water, treat wastewater, and maintain the network. The retailer provides all the customer-facing services, such as invoicing and meter reading. Wholesalers charge water retailers for the water and sewerage services used by their customers, and the retailer passes these charges through to the customer with an uplift.

In November 2016, the water market codes were updated to allow the NHH market to open to licenced retailers, the NHH market opened in England on 1st April 2017. There are 4 main Water Sewage Supply Licences (WSSL's) available to apply for, as follows.

- An **(English) retail authorisation**: this allows the licensee to supply water to NHH premises using the public water networks operated by water undertakers whose areas are wholly or mainly in England.
- A **(Welsh) restricted retail authorisation**: this allows the licensee to supply water to large NHH premises (consuming at least 50 Ml of water a year) using the public water networks operated by water undertakers whose areas are wholly or mainly in Wales.
- An (**English) wholesale authorisation**: this allows the licensee to introduce water into the public water networks of water undertakers whose areas are wholly or mainly in England in order to supply the licensee's own customers if their NHH premises consume at least 5 Ml of water a year.
- A **(Welsh) supplementary authorisation**: this allows the licensee to introduce water into the public water networks of water undertakers whose areas are wholly or mainly in Wales in order to supply the licensee's own customers if their NHH premises consume at least 50 Ml of water a year.

A Licenced retailer with Wholesale Authorisation can supply water to their own customers via the incumbents' water network. This requires the Retailer to have a source of DWI standard water. They must then apply to the incumbent for "Combined Supply Access". This ensures that the incumbent will receive water in an area they have capacity, it is of the quality required and will access the network at a suitable point using the correct pressure etc. As part of this process the incumbent will evaluate the details and decide on the cost for the use of their network, this cost would be instead of the wholesale charge normally charged when the incumbent treats, supplies and delivers the water on behalf of the retailer.

Network Access Barriers to Entry

During our pilot we have dealt with several barriers and with regards to network entry these are based around 3 main areas. Current Regulations are not developed for small scale new entrants; the industry focus is on large schemes; and the age of existing schemes means it is hard to compete due to sunk costs. Each area has a set of barriers which will now be discussed in more detail.

Current Regulations have not been developed for small scale new entrants

Network access pricing

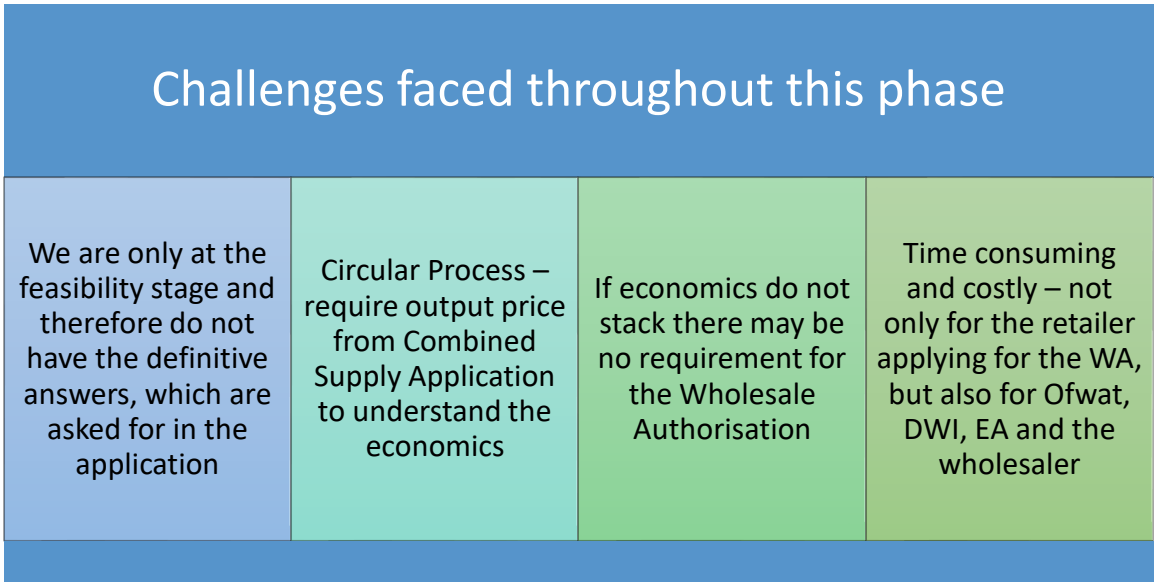
Combined Supply Access

Accessing the network for a new entrant is not a simple process. To allow a financial viability study to be completed, the entrant needs to understand the cost of accessing the network. As a regulatory requirement, this information is provided by the wholesaler in the form of an indicative price: there is no price methodology advice provided by the regulator for this price and as such this figure can vary greatly from one year to the next. In order to receive an accurate price, the entrant must request this from the wholesaler by completing a Combined Supply Access application. As per the Water Act 2014 a requirement of the Combined Supply Access agreement is for the retailer to hold a Wholesale Authorisation as part of their WSSL.

Wholesale Authorisation

As stated in the above table there are currently no Retailers who hold a Wholesale Authorisation Licence or have even applied for this. We are therefore testing the process specified in the Market Codes. The Wholesale Authorisation application is supplementary to the WSSL and requires the full WSSL application to be completed. Therefore, any existing retailer requiring to complete this application must provide all details provided in the original application, which is quite an onerous task. The framing of the application is from a startup company perspective; it asks for financing details and business plans, whereas the project we have identified is only at a feasibility stage and cannot provide the level of detail required.

We have been working closely with Ofwat and Thames to ensure any challenges encountered can be worked through together and ensure the application processes go as smoothly as possible.



To ensure this project and other projects can progress past the feasibility stage the process could be updated. For example:

a. A variation to WSSL application process to allow a Wholesale Authorisation to be added. The variation to licence could consider the term of the retailer, its compliance with the regulations and current financial state. To allow the wholesaler to carry out their assessment instead of granting the Wholesale Authorisation at this stage Ofwat could review an application and provide a "minded to", or not, as the case may be. If the variation to licence received a "minded to" stamp, this could allow the wholesaler to complete the Combined Supply Access process.
b. The whole process could be revamped, and a standardised calculation established for access costs to the network; this would provide a clear and consistent pricing structure and enable businesses to carry out a feasibility assessment.

Industry Focus on large schemes

The drought of 2022 has only served to highlight the well-acknowledged need for alternative water sources in many areas of England. To date, the focus has been on large scale schemes that provide large volumes of water, such as bulk water transfers from one wholesale area to another and new large reservoirs. These schemes can provide large volumes of water over extended periods; however small schemes could also play a vital role in strategic water supplies in local areas. Large schemes can use the bid in mechanism to get financial support. In the Southeast region, the cut off point for schemes to be consider by the RAPID group was 40Ml/d rate. Any scheme smaller than this is not considered for financial support or inclusion in the decision-making process regardless of the benefits that small strategic schemes could have environmentally, socially, and financially.

To allow for these schemes to be considered, the cut off figure should either be removed, or a separate process should be created to allow small schemes to be fully considered in water planning.

Age of existing schemes means it is hard to compete due to sunk cost

The existing historical assets of wholesalers means that their costs appear far lower than a new scheme: this is a recognised issue in the market. Due to this factor, new developments which pass certain criteria receive financial assistance to ensure they remain competitive and the requirement for additional capacity is met. The criteria for this does not cover small schemes or schemes which are looking to provide potable water to the market.

To ensure small schemes, which are beneficial to the market and the environment, get considered, the same level of support should be offered. A mechanism to allow small schemes to compete with larger schemes would further improve the market and competition. Small schemes could delay the requirement of large schemes such as reservoirs being built or reduce the required capacity which in turn could benefit the environmental impact.

As this pilot is the first of its kind it is providing us the ability to highlight these barriers and open a discussion around how things could be approached differently. With that in mind we commissioned a report from Frontier Economics to review network access pricing and the different approaches used in the water market and other markets when it comes to considering other aspects such as social and environmental benefits and not just cost.

5.3.5 Water Quality Compliance

To properly enable flexible abstraction and trading, a water quality perspective must be accounted for. The "source-to-tap" approach must be taken, especially when a trade is desired between non-water and water companies. To be established as a "new supply" for public consumption, the Drinking Water Inspectorate (DWI) Water Supply (Water Quality) Regulations 2016 must be adhered to especially, and beginning with, 'Regulation 15 – Sampling: New Sources' which specifies the sampling requirements for:

(a) Sources that have never previously been used for public water supply purposes; and
(b) Sources which have previously been used for public supply purposes, but not for a period of six months or more.

The DWI enforce these regulations with a framework based on the Drinking Water Safety Plan (DWSP) process established by the World Health Organisation (WHO) in their Guidelines for drinking water quality:

- The purpose of the Scheme is to verify that the risk-based drinking water safety plan process (WSP), as advocated by the World Health Organisation, has been implemented, and is consistent with the requirements of the Water Industry Specification document (WIS) (WIS 04-01-04), together with the BSI standard for Security of Drinking Water Supply – Guidelines for Risk and Crisis Management – BS EN 15975-2, and the Guidance document to the Scheme.[20]

For assessing a new water source, Regulations 27-28 cover risk assessment and procedures to be followed if a water source is of potential risk to public health. There are 39 different parameters to assess, as well as "everything else", under Regulation 4, which may be difficult to achieve unless you are already a water company. Water companies have rigorous testing, treatment, and monitoring processes in place already in line with ongoing Drinking Water Safety Planning (DWSP), which can facilitate trading from their side, but it is difficult to imagine that other licence holders can afford to maintain such facility against the theoretical prospect of water trades.

5.3.6 Technical Risk Mitigation

Binnies design feasibility report, provided within Appendix G, for the Ofwat Water Breakthrough Challenge (WBC) – Flexible Local Water Supply Schemes covers the concept process, civil, mechanical, and electrical design for a 1-20 Ml/d Water Treatment Plant at the RWE Didcot Power Station, Oxfordshire.

The proposed treatment process has been selected to satisfy the following criteria:

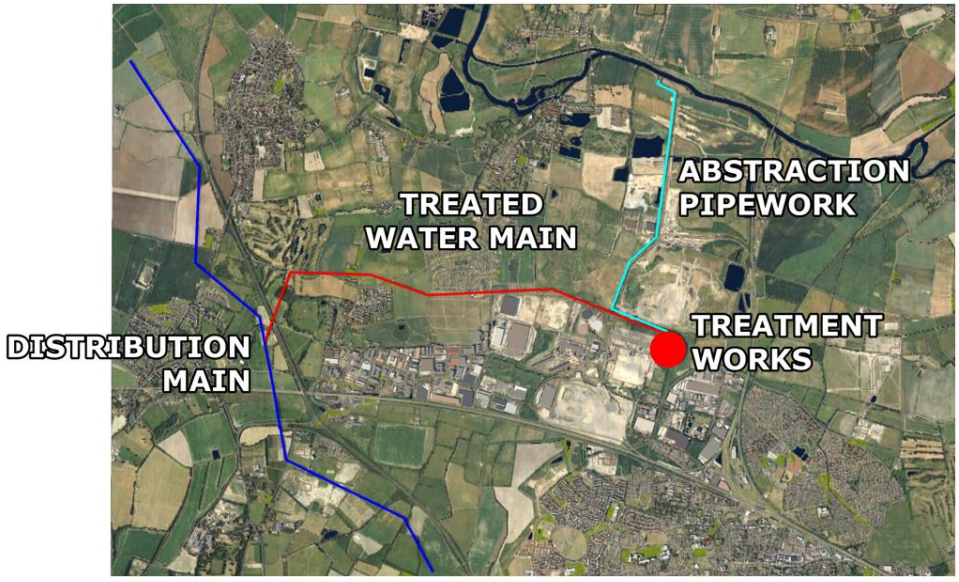
- Treat the estimated design raw water envelope.
- Produce treated water quality that complies with the requirements set out in the Water Supply (Water Quality) (Amendment) Regulations 2018 for England and Wales.
- Provide a modular design, comprising of prefabricated process units to maximise off-site fabrication; minimise concrete construction and allow flexibility to scale up (or down) for other similar applications.

[20] https://www.dwi.gov.uk/water-companies/water-safety-plans/

- Select a process that can be applied at multiple locations with different treatment objectives with minimal variation to the basic process train.
- Provide a low-carbon solution.
- Able to operate over a large turndown of raw water flow.
- Fit the available site footprint at the Didcot power station site (approx. 225m x 75m).

The process selected comprises a robust scalable conventional treatment process of sand ballasted clarification, sand filtration, granular activated carbon, UV plus associated chemical dosing and sludge handling. The plant has been designed along industry standard principles of plant loading and redundancy and offers a turndown to an output of 1 Ml/d to align with the tiered abstraction limits of the licence held by RWE..

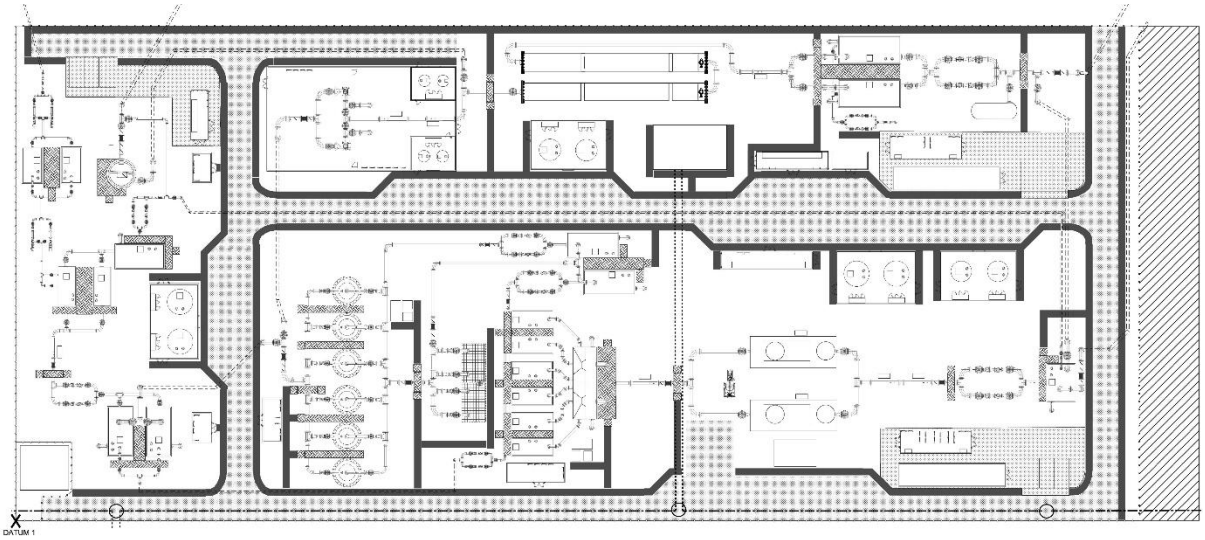
The design of the network from abstraction to connection to the main was considered as a whole, and the costs and risks understood as part of the commercial model development. The design and location was indicative and was subject to further stages of assessment.



The design has not allowed for any treated water storage, and the treated water is intended to pump directly into GATOX/SWOX distribution network. Additionally, no bankside raw water storage has been included.

The design has allowed for maximum use of existing infrastructure by reusing the existing abstraction point and raw water main, plus selected parts of the existing electrical infrastructure. The plant is predominantly constructed above ground with the minimum of buried structures, thereby promoting modularity and the use of off-site construction of process units where possible.

As part of the project dissemination workshop, a virtual tour of the site design was produced which is available as part of the project outputs. The site footprint was scalable with the use of process units as shown below:



We discussed both the proposed position and shutdown with Thames Water to verify the viability of the scheme. They confirmed that the GATOX/SWOX distribution network does have the flexibility to be shutdown to allow the connection to be made. Thames Water advised that once the Combined Supply Application is submitted, they would need to carry out network modelling to confirm network capacity.

As part of the technical risk mitigation, we completed work in the following areas which are provided as separate reports within the Appendices:

- An environmental desk top study to provide a preliminary appraisal to identify the key environmental constraints that should be considered in developing the proposal, Appendix H.
- A high level the benefits valuation reviewed the impact pathways but was unable to assess the benefits in monetary terms at this point due to the high-level nature of the study. Water quality, modelling. and comparison against other options would feed into the next stage, Appendix I.
- Geotechnical desk study, to identify high level geotechnical and contamination risks that may exist at the site, to allow a baseline price for the works to be established, Appendix J.
- Process equipment scalability assessment summarises the number and size of key process units that would be required for water treatment plants capable of treating a range of raw water flows from 5Mld to 48Ml/d, Appendix K.
- A construction cost estimate, Appendix L, and a construction programme to support the commercial assessment, Appendix M.
- CDM risk register, Appendix N.
- Design risk and issues log explaining assumptions made, Appendix O

5.3.6 Trading & Pricing solution

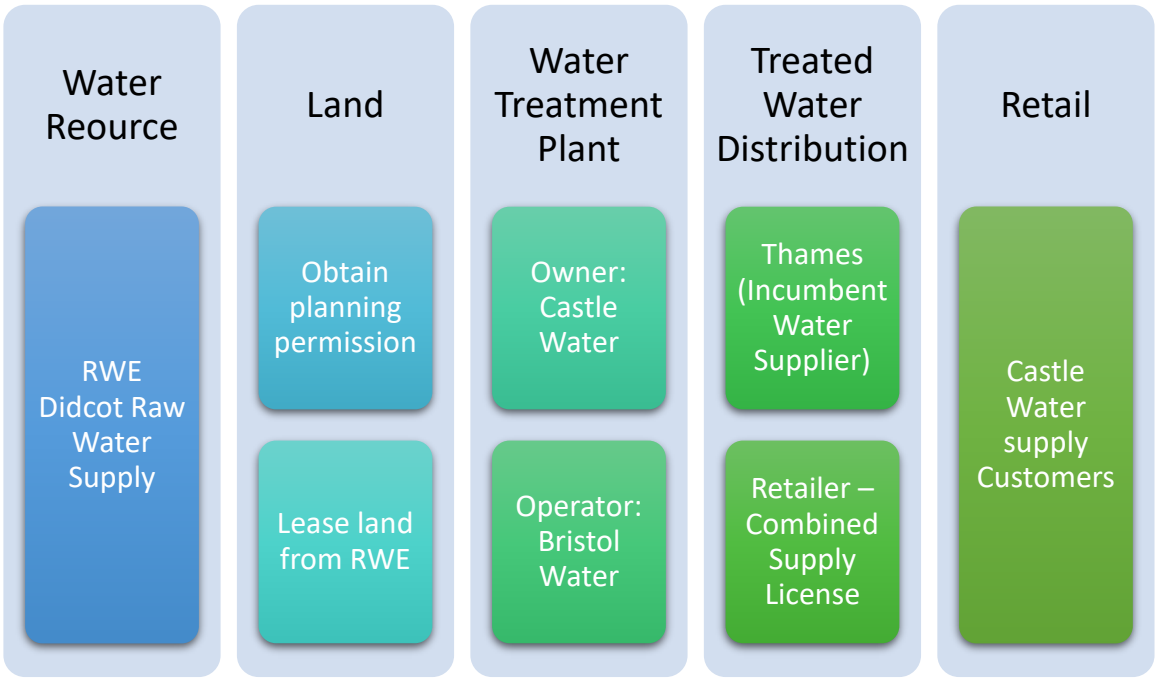
Commercial Operating Structure

The proposed commercial model of our new entrant water resource spans the wholesale supply chain from raw water through to retail supply using an existing treated water distributed network. In the pilot project, RWE will be the raw water supplier, Binnies will design and build the water treatment plant, Castle Water Limited will own the water treatment plant. and Bristol Water will operate the plant. Castle Water Limited will access the Thames Treated water distribution network as the Combined Licence Retailer who will use the treated water to supply customers within the SWOX area.

The contract period will be in line with the Water Treatment Facility expected life, currently estimated at 20 years.

For the commercial model to be successful the target price for production of Treated Water needs to be lower than the wholesale costs charged. This may require additional support to allow for the differential between costs of a new build facility and the sunk costs of existing assets.

Proposed Business Model



The proposed market structure is show above, this model can be rolled out to other schemes.

- Abstraction Licence – the initial requirement is an abstraction licence which can cater for such capacity
    - The Licensee may need to request from the Environment Agency a change of licence to multi use
- Water Treatment Plant "WTP"
    - A new modular WTP is built close to abstraction point
    - Raw water distributed to plant
    - Water Retailer, such as Castle Water Limited – owns WTP
    - Wholesale Water Company, such as Bristol Water Limited – operate WTP
- Treated Water Distribution
    - Retailer uses Combined Supply License to access incumbent network
    - Treated water meets DWI standard and enters the incumbent water distribution network
- Retail
    - Retail Water company supplies large business customers within local area of WTP.

The main costs to consider are:

- Raw water

- Raw water transportation
- WTP build
- WTP operation
- Treated water connection to distribution network
- Potential Network upgrades required
- Combined Supply Access Charge.

Trading and Pricing solutions

Encouraging Water efficiency in the NHH Water retail market has proven to be challenging. This was highlighted in the Economic Insights report published in April 2022: "Options for promoting water efficiency in the NHH water market."

As a retailer it is quite difficult to influence a customer's behaviour to encourage water efficiency measures. Some of the initiatives on offer are, for example, to provide customers with the information on water saving devices, provide the opportunity to speak to third parties regarding their water consumption levels, and encourage AMR installation to allow customers to take control of their own water usage. While most retailers do offer some value-added efficiency services the level of uptake within the market is very low, it is estimated that the savings achieved during 2019-2020 were as low as 0.3%.[21]

The main routes for encouraging water efficiency in the NHH market, must be either Retailer-led or Wholesaler-led. As highlighted above Retailers can provide information to NHH customer on water efficiency measures. However, if the perceived benefit to the customer is less valuable than the time and effort of implementing the measure, then generally customers are not interested. Subsidising these initiatives is currently the best way to incentivise uptake, and this brings the focus back to a wholesaler led approach. In the long term, to encourage customers to take up costly time-consuming incentives, the environmental and social benefit must become the most important factor.

An alternative route to encouraging water efficiency could come from projects like ours. Where a retailer provides a source of water to their customer, changes to tariff structures could be implemented more in line with business tariffs that are commonplace in the energy market.

We are currently investigating some ideas, such as:

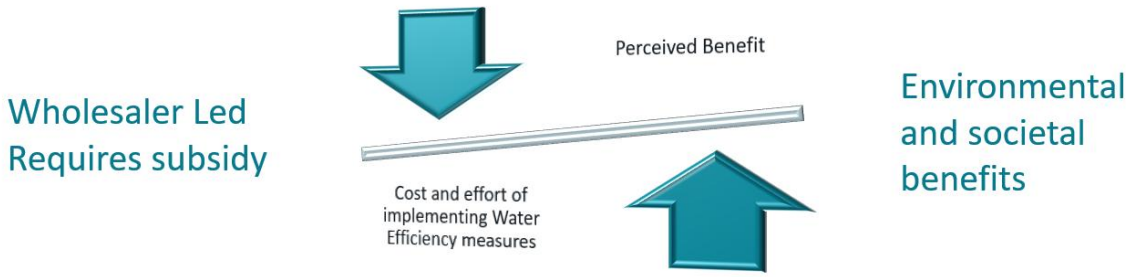
[21] Taken from Economic Insights Report – Options for promoting water efficiency in the NHH water market. Published April 2022.

Interruptible Tariff	Drought Tariff	Baseline Tariff	Seasonal Tariff
•Similar to the power market, Large NHH customers would pay a cheaper tariff if they agree to an interruptible service. •The customers supply system would be set up to limit supply during interruptible periods, such as drought or WTW maintenance periods. •This option would prove costly to set up and would need to be a long term contract, which may not be feasible in the current economic climate.	•During periods of drought, water would be charged at a premium. •Customers would require to have AMR installed. •May be costly to manage. •Costs would decrease depending on the time period flows are monitored i.e., more expensive to monitor daily compared to monthly.	•Agree a baseline water consumption level and any usage above the baseline would be charged at a premium. •To be efficient customers would need to have AMR installed. As per previous tariff, this could be costly to manage. •Longer time period monitoring e.g., monthly could lead to unusual water consumption profiling if customer has spare capacity at the end of a period.	•The water charge is cheaper in the winter months and more expensive during summer months when droughts are more prevalent. •Easier to manage. •Customers could have AMR, monthly readings or bi-annual readings at the start and end of each period.

Without development in the market the possibility of trading the water cannot be fully investigated. It is possible to trade bulk supplies with water being moved between connecting regions. However, for smaller scale trading to take place, the mechanism to trade water needs to be developed. For example, excess water available from the WTW due to a turn down in demand through either interruptible service or demand reduction due to a drought tariff could be sold to the incumbent to help meet their demand needs in periods of reduced supply.

The other approach that could be taken if the market mechanism were updated is to sell the treated water directly to the incumbent and allow them to utilise the water as required. All the trading options require an update to the codes and real time monitoring of flows and pressure to ensure the incumbents system remains in balance.

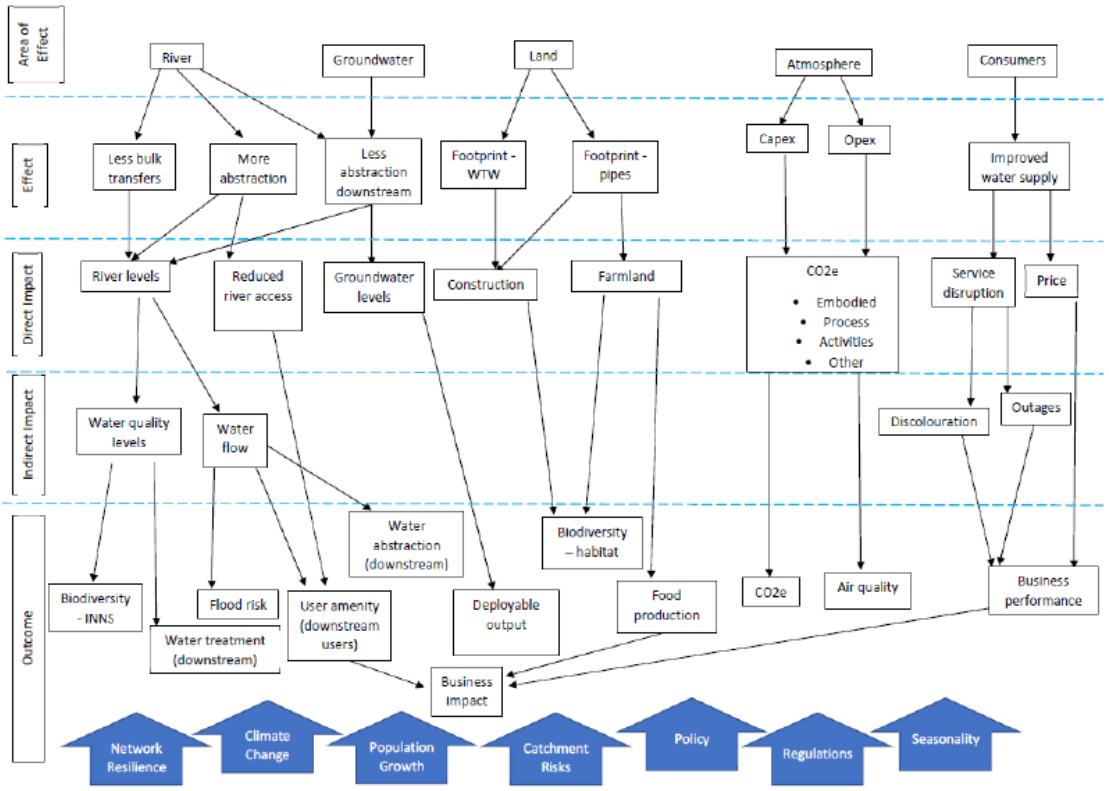
For the business retail market, the expectation is that both retailers and wholesalers encourage water efficiency. If it is retailer-led, then there needs to be sufficient margin to do so flexibly. If wholesaler-led, there needs to be cross subsidy with other consumers. Therefore, if possible, there should be a retailer-led focus that allows environmental and societal benefits to be aligned with the economic value of the business water use. A retailer could have a role to balance this across their business customers, but the margin to do this needs to be created through competitive entry with a source of treated water. This cost should be socialised over wholesale costs as a whole rather than the cost of entry landing on the retailer.



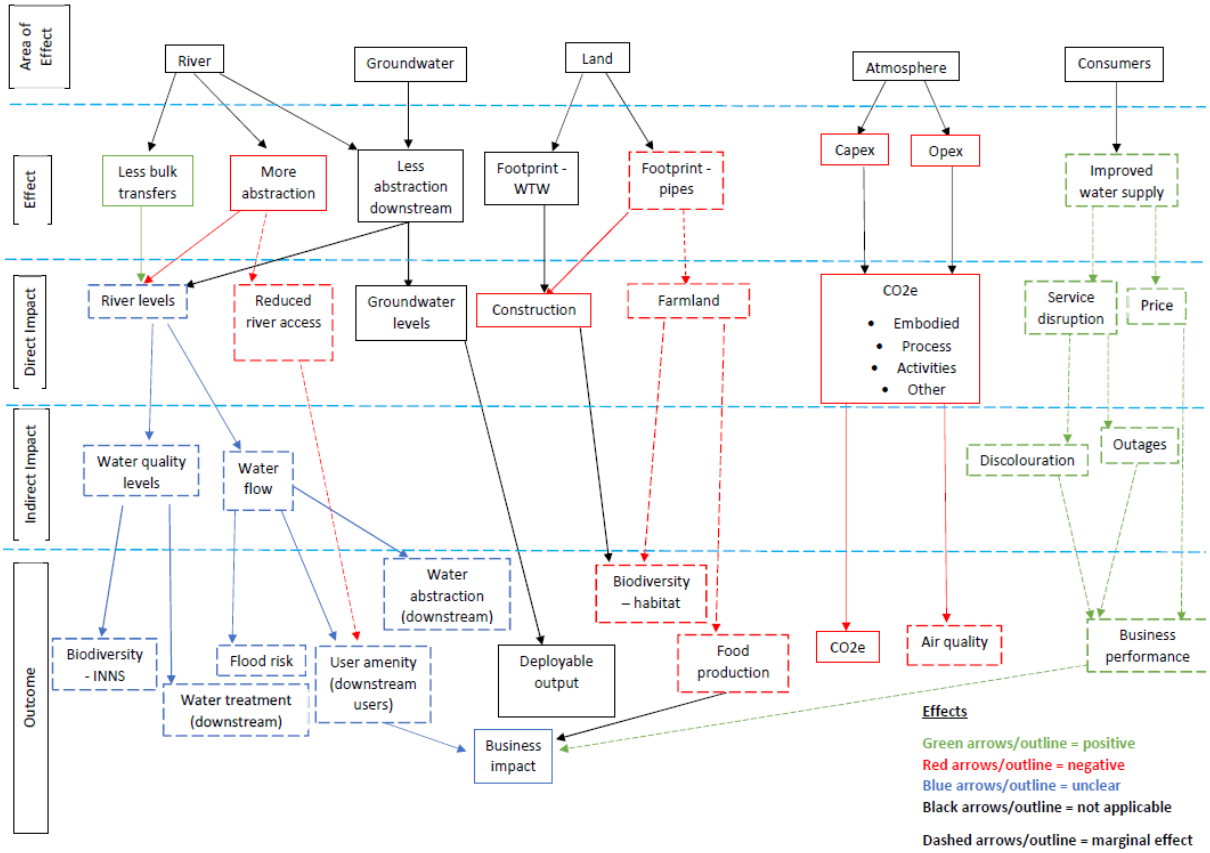
We conclude that there should be a thin access price for wholesale water supply entry, with the impact on the wholesale socialised across wholesale costs as a whole. The cost of entry therefore

should be limited to the cost to the incumbent of distributing the water, rather than a "thick" entry cost which is the wholesale price less avoided costs by the incumbent. The latter "wholesale minus" approach forecloses competitive water market entry.

A framework for considering the benefits of this project was set out in the benefits valuation framework (Appendix I). This started with the setting out a benefits pathway of the potential economic, social and environmental benefits.



The assessment of the project design then showed the pathways that were more or less likely to be achieved and their magnitudes.



This framework could therefore be applied to the wider case for flexible local water supplies, assuming that they were commercially viable based on the access price that was available.

5.3.7 Trading & Pricing conclusions

This section of the document sets out the final trading and pricing conclusions and the challenges that were encountered in utilising the existing regulatory framework. Ultimately, as we show below, both the application process and the commercial reality of the framework meant that access is unfeasible.

Even if it was feasible, and the water quality characteristics of this site meant they were relatively challenging and expensive as a package treatment plant process, the commercial terms available proved to be uneconomic. Whilst we considered taking this gap between the cost of supply and available access price through Ofwat to try and test whether an acceptable access price was feasible, the gap was such that it was unlikely to be resolved. Any societal or wider economic benefit from using alternative water supplies to those owned and operated by the incumbent network would need the socialisation of network costs to reduce the access price and risk to new entrants.

Under the proposed model, up to 20ML/day of RWE's abstraction licence would be utilised to treat water to potable standards before introducing it into the Thames network within the SWOX region, supplying Castle Water customers with annual consumption exceeding 50ML.

At the start of the project, we established a model to understand the basic economics of water resources and treated water competition. The calculation is shown below.

We used as a starting point the equalisation payment between the incremental and average cost of water resources that Ofwat expected (at the time of the 2019 Price Review – PR19) to form the basis of competition for water resources. We also included the marginal cost of treated water that Thames Water suggested in its Network Access Code. Together these suggested a water resource cost of

23p/m3 as the value of the abstraction licence and raw water. We calculated a range of possibilities though, ranging from marginal cost (low) through to high (specific PR19 water resource management plan schemes), and then a site-specific approach based on the cost of Abingdon (now White Horse) Reservoir which ultimately the competitive entry based on the Didcot licence could theoretically replace.

We considered the other cost components in the value chain – for low this was on a marginal cost (Long Run Marginal Cost basis), medium based on Long Run Average Cost, and high based on Long Run Incremental Cost (LRIC).

When we assumed costs of distributing treatment works through the strategic water distribution system (such as the Thames Swindon Oxford – SWOX main) and the local distribution network costs (using the discounts from wholesale charges for New Appointment and Variations – NAVs), this demonstrated that a negative margin would be available for treating water for a competitive provider (shown as the net margin of water resources which is negative in all three scenarios).

However, the theoretical fourth model shows that once the higher cost of future water resource schemes is taken into account, there is a positive margin available for water treatment of 41p/m3, based on the cost of the pilot plant in this project. This would require an access pricing regime for small flexible local water supplies that allowed socialisation of wholesaler existing average costs so competitive entry is encouraged. The Frontier report reached similar conclusions on this as a potential model looking at the learning from other sectors.

However, the current range of water sector potential pricing approaches show a negative margin which suggests this model will not be commercially viable for Didcot, but it may be viable for other sites. Even for other sites though it requires a water resource and treatment wholesale margin available from incumbents of c100p/m3. Margins for local water distribution to NAVs though suggest this is economically unfeasible without putting the financial resilience of the incumbent water company at risk (or an increase in cost to end consumers with no change in service, which we screened out as an acceptable outcome for individual competitive market entry).

Theoretical Thames Water access status - all figures p/m3				
Assuming 20Ml/d volume	79			
Average water resource costs for Thames (p/m3)	12			
Thames water incremental water resource costs	**Low**	**Medium**	**High**	**Theoretical**
	PR19 apparent	**PR19 2025+**	**Incremental basket**	**Abingdon (long term)**
	9	23	45	106
Equalisation payment	0	11	33	94
Water resource access price into bilateral trade	79	68	46	-15
Treated water provision				
Methodology				
Thames treated water input	**Low**	**Medium**	**High**	
	Marginal costs	**Average costs**	**Replacement**	**Replacement costs**
Water treatment incremental cost (thames)	8	21	45	84
Water resources average discount	12	12	12	12
Equalisation payment discount	0	11	33	94
treatment discount	8	21	45	84
Wholesale charge	79	79	79	79
Total discounts	20	44	90	190
Network access charge (for distribution)	59	**34**	-11	-111
Check - local NAV discount	44.26	Reasonable enough to 51 assumed for local distribution		
	Low	**Medium**	**High**	**Theoretical**
Water resource (assuming no treatment discount)	**PR19 apparent**	**PR19 2025+**		**Abingdon (long term)**
Wholesale margin	79	79	79	79
Less distribution access costs	-34	-34	-34	-34
Water resource payment (average plus equalisation)	12	23	45	106
Available margin	56	68	89	150
water resource cost	-25	-25	-25	-25
Treated water cost	-84	-84	-84	-84
Net margin of supplying treated water	**-53**	**-42**	**-20**	**41**
(at a treatment discount of 25p/m3 vs scheme cost of 62p)				
	LRMC	**LRAC**	**LRIC**	
Water resources	12	23	106	
water treatment	21	30	84	
Bulk distribution	34	35	35	
Local distribution	44	44	51	
	112	**132**	**276**	
Excl. local distribution	68	**88**	225	

As we show in the section below, the actual access price offered by Thames Water was only 10% of the necessary margin. This is based on the combined supply indicative access prices but is such a large gap, and beyond the current water sector framework for possible alternative access price approaches, that it is not economically feasible to test the concept with Ofwat further at this stage.

Commercial Viability

For this pilot project to achieve commercial viability, the cost of abstracting and treating water must be lower than the wholesale purchase price, ideally by a margin of at least **10%**. The owner of the water resources (in this case RWE) would need as part of this a return for the rights to use the water

resource (which we calculated at 23p/m3 based on alternative water resource costs, based on the value chain analysis summarised above).

Thames Water Volumetric Wholesale Charges 2025/26

- Customers consuming **50–250ML per annum**: **185.57p/m³**
- Customers consuming **>250ML per annum**: **148.6p/m³**

To meet the 10% discount target, the cost to supply the potable water would need to be **167.01/m³**. Using the higher wholesale charge as a basis makes the commercial case less challenging.

Alternative Supply Option

- An option considered was supplying any customer within the region rather than limiting supply to specific customers. The higher wholesale purchase costs, as detailed below, would assist in the commercial viability. However, current Wholesale Authorisation requirements restrict supply to customers consuming **over 50ML per annum**. Consequently, the model uses the wholesale charge applicable to customers in the **50–250ML range** as its basis.

Charges for Smaller Customers

- **<20ML per annum**: **247.43/m³**
- **20–50ML per annum**: **226.4p/m³**

Cost Estimates

Binnies has provided comprehensive cost estimates for both the construction and ongoing operation of the proposed water treatment facility. Due to the quality of water abstracted from the river and the stringent standards set by Thames Water, the projected cost of the treatment plant exceeds that of a standard build.

Capital Expenditure

- The estimated cost incorporated into the financial model is approximately **£60 million**, reflecting a **20% uplift** on the base case of **£49.5 million**. The overall cost range is projected between **£34.6 million and £74.3 million**, with feasibility-stage assumptions allowing for up to a **50% increase** or a **30% reduction**.

Operational Expenditure

- Annual operating costs are estimated at **£2.4 million**:
  - **Power costs:** £600,000
  - **Chemical costs:** £564,000
  - **Ground rent:** £400,000 per annum, based on **£100,000 per acre** for an approximate site size of **four acres**
  - **Business Rates**
  - **Insurance**
  - **Staff costs**

- **Additional Costs**
    - **Raw water:** Indicative cost of **£0.23 per m³**

At a high level these costs would equate to approximately £1.52/m^3.

Pricing Methodologies

The current pricing methodology for Combined Supply Access is insufficient to ensure the financial viability of the Didcot project. To address this, the project team engaged Frontier Economics to examine alternative approaches for structuring access charges applied by incumbent wholesalers. Ofwat has previously considered charging principles; however, outside of large-scale water resource schemes under Direct Procurement for Customers (DPC), third-party water provision via incumbent networks remains rare. A key barrier to market entry is the lack of clarity on access pricing, which inhibits effective market signalling.

Experience from other infrastructure sectors demonstrates significant variation in access pricing approaches. Costing methodologies typically fall into two categories:

- **Shallow charges**, which focus on incremental costs associated with new connections.
- **Deep charges**, which incorporate broader network reinforcement costs.

Given the limited market entry context, this pilot adopted the following parameters:

- Review cross-sector case studies where connection and ongoing network costs were calculated using shallow charging principles.
- Summarise the rationale behind shallow versus deep charging structures, highlighting the market objectives regulators sought to achieve in each case.
- Assess the suitability of these approaches for achieving water market-specific objectives.

The purpose of this work is to provide Ofwat with an evidence base to inform future charging principles by presenting the trade-offs associated with different pricing options.

Case Studies

Frontier Economics identified six case studies where regulators implemented shallow charging structures. These examples were drawn from sectors where, similar to water, duplication of network infrastructure is costly, and users typically seek access to incumbent networks. The review focused on European and Australian markets, as their regulatory frameworks exhibit the greatest similarity to the UK context.

Frontier identified six case studies where regulators proposed to put in place shallower charges. The focus was on markets and sectors where, like the water sector, duplication of network infrastructure is expensive, and network users are typically seeking access to existing incumbent network. There was also a focus on case studies from Europe and Australia as access charging in these geographies are most likely to have similarities to the UK.

Table – Charging Case Studies Identified For This Review

CASE STUDY	SECTOR AND JURISDICTION	OVERVIEW
Ofgem electricity connections	UK energy sector (2021)	In a 2021 review, Ofgem proposed to reduce the access charges directly borne by customers connecting to the electricity distribution network
UK/EU Rail access charges	Rail sector in the UK and EU (2012-present)	Legislation issued by the EU in 2012 provides that rail infrastructure managers, as the default, can only recover those costs from access seekers that are directly incurred as a result of the service
Ofcom cost principles	UK telecommunications sector	To assess whether pricing arrangements are fair and reasonable, and only recover the 'right' level of costs, Ofcom has established a framework based on six principles of cost recovery
IPART review of recycled water pricing arrangements	Australian water sector (2018)	The water regulator in Australia reviewed existing pricing arrangements for recycled water schemes and concluded that the costs and benefits must be assessed from a broader perspective
ACCC's Review of access charges for fixed telecommunications services	Australian telecommunications sector (2005)	The competition commission in Australia reviewed, and subsequently rejected, a proposal by the incumbent network owner to charge a geographically averaged access price
UREGNI Profile adjustment for Gas Distribution	Northern Irish Gas Distribution	The Utility Regulatory in Northern Ireland (UREGNI) applied an adjustment such that the distribution charges paid by customers in the early years of natural gas network development were more affordable

Relevance of Case Studies

All six case studies reviewed offer insights applicable to the water sector in England and Wales. Of particular significance are the Ofgem electricity connections decision (2021) and the IPART review of recycled water pricing (2018). These examples are recent and address contemporary challenges in the utilities sector, including climate change and population growth. Key findings from all six case studies are summarised below.

Key Findings

Six overarching themes emerged from the analysis, reflecting the rationale for adopting shallower access charging structures:

1. **Environmental Externalities**

   Regulators have recognised that market entry can deliver positive environmental outcomes. Charging regimes were therefore designed to incentivise such entry, often through cost socialisation where there is willingness to pay for environmental benefits across the wider customer base.

2. **Distribution of Benefits Across the Network**

   In some cases, benefits extend beyond the entrant to other network users. Regulatory reforms have redistributed cost recovery across all beneficiaries, reducing the burden on new entrants and ensuring socially beneficial projects are not discouraged. Broader consideration of avoided costs has also been incorporated.

3. **Promoting Effective Competition**

   Shallow charging has been used to encourage new entrants and enhance market competition; for example, reducing access charges for rail freight operators improved competitiveness against road freight, delivering wider market benefits.

4. **Efficient Resource Use and Network Resilience**

   Favourable pricing arrangements for entrants contributing additional resources have been implemented to strengthen network resilience, particularly in markets where resources are scarce or limited.

5. **Accounting for Cumulative Benefits**

   Regulators have addressed bias against smaller schemes by recognising that, while individual projects may show limited avoided costs, aggregated benefits across multiple schemes can be significant. Reforms ensure fair allocation of these cumulative benefits.

6. **Location-Based Pricing**

   Cost-reflective pricing has been prioritised to maintain economic efficiency. Where service provision costs vary geographically, aligning prices with underlying costs prevents inefficiencies and supports competitiveness.

Summary

Across these themes, the regulators have sought to capture a broad spectrum of costs and benefits – environmental, resilience-related, and operational. The adoption of shallower charging structures is consistently underpinned by the objective of promoting activities that deliver net social benefits.

Regulatory Process: Combined Supply Access Price

One of the final inputs required for the financial model was the **Combined Supply Access Price** from Thames Water. As is discussed above, the outcome of the Combined Supply Access price is unlikely to provide a cost which makes the project viable; however this is the current process so was one we had to see through, prior to further in depth discussions on pricing methodologies. Under the Water Regulations, wholesalers must publish an indicative price; however, obtaining a refined figure requires a formal application. This process proved complex, as it was the first request of its kind. Thames Water

stipulated that Castle Water must hold a **Wholesale Authorisation (WA)** before providing access pricing.

Castle Water initially engaged with Thames Water on an informal basis, aiming to complete all preparatory steps for the Combined Supply Access application prior to WA approval. However, the Wholesale Authorisation process took significantly longer than anticipated – over **18 months** – and by the time approval was granted, changes within Thames Water's teams necessitated restarting the process.

The Wholesale Authorisation was eventually granted on **8 October 2024**, following extensive engagement with Ofwat, the Environment Agency, and the Drinking Water Inspectorate. This was the first-ever WA application, testing the interpretation of the Water Codes. A key challenge arose because the application process requires full project details, yet feasibility studies depend on access pricing, which in turn requires WA approval. This circular dependency created delays and repeated scrutiny.

During the review, Ofwat raised legislative uncertainties, particularly regarding whether water could be conveyed without a direct connection to the customer's premises. This issue was repeatedly debated, despite Ofwat's own published guidance[22] providing clarity on the matter.

Wholesale Authorisation Timeline

February 2023

- Castle Water (CWL) informed Ofwat of its intention to apply for Wholesale Authorisation (WA).
- Initial meeting held between CWL and Ofwat to discuss the process.

March 2023

- Meeting with Ofwat and Bristol Water to address legislative questions.
- CWL proposed options such as conditional or time-limited authorisation.

April 2023

- No feedback received from Ofwat.

May 2023

- CWL initiated discussions with the Environment Agency (EA).
- Identified and resolved an error with the online application tool.

June 2023

- CWL submitted its application, including legislative explanation for access and conveyance.

[22] Information notice

- Two weeks later, Ofwat confirmed the application would progress to initial checks.

July 2023

- After 1.5 months and several invoicing discussions, the invoice was prepared and paid by CWL.

August 2023

- Ofwat confirmed the application was complete and opened public consultation.
- Questions from the Drinking Water Inspectorate paused the timetable.
- CWL responded to DWI queries and coordinated a meeting.

September 2023

- CWL and DWI met to review the project and feasibility-stage considerations.
- EA provided comments on the application.

November 2023

- Constructive discussions with DWI and EA concluded; both parties satisfied.
- Ofwat confirmed progression of the application and noted the need to draft a recommendation and sample licence, which would take time as this was the first wholesale licence.

December 2023 – February 2024

- CWL sought timeline clarity.
- Ofwat advised delays due to licence drafting and unresolved legal interpretation regarding water introduction into Thames' network; external counsel advice required.

February 2024

- CWL provided detailed legal analysis.
- Ofwat's response did not address CWL's substantive points.

March 2024

- MOSL indicated Ofwat wanted the WA application to be a separate licence rather than an amendment to the retail licence.
- CWL queried this approach, citing legislation stating that a water supply licence includes both retail and wholesale authorisations.
- Ofwat confirmed a separate licence was now considered necessary, requiring special conditions to meet DWI requirements.
- CWL requested clarification and reiterated alternative options (e.g., derogation or limited authorisation).
- Ofwat acknowledged delays and legal complexity, confirming that a separate licence was considered the best approach for long-term benefits.

- CWL expressed frustration over Ofwat's year-long delay and lack of clarity.

April 2024

- Ofwat confirmed the application would proceed by modifying the existing licence with additional authorisations rather than issuing a separate licence.
- Draft licences sent to DWI for review; statutory 28-day consultation under Section 17G WIA required.
- Consultation expected to run from 15 April to 13 May.
- CWL followed up on consultation timeline and licence conditions; Ofwat apologised for delays and proposed 6 May for public consultation.

May 2024

- CWL requested confirmation of when licence conditions would be reviewed.
- CWL received draft licence conditions one day after the proposed consultation date.
- CWL reviewed and proposed minor clarifications to ensure accuracy and compliance with Section 17D of the Water Industry Act.

June 2024

- Ofwat confirmed wording was under legal review.
- Public consultation postponed until after elections.

July 2024

- Consultation confirmed for 15 July to 12 August.
- DWI indicated undertakings were in progress.

August 2024

- CWL submitted undertakings document to DWI.
- Ofwat confirmed final approval would follow DWI confirmation.

September 2024

- CWL followed up with Ofwat; still awaiting DWI confirmation.
- DWI confirmed receipt of acceptable undertakings.

October 2024

- CWL requested final sign-off date.
- Ofwat confirmed approval date.
- **8 October 2024**: Wholesale Authorisation approved.

Combined Supply Access Application and Pricing Challenges

Following the completion of the Wholesale Authorisation process, Castle Water submitted a Combined Supply Access application to Thames Water in December 2024. The key challenge which was faced with the WA immediately emerged: the application process requires comprehensive project details, yet the project remains at the feasibility stage. Access pricing is essential to determine viability, creating a circular dependency that resulted in further delays.

In January 2025, Thames Water confirmed that the application could not progress formally under the Access Code due to incomplete water quality and treatment specifications. Nevertheless, they explored options to advance the project and provided an initial calculation indicating that supplying 20ML/day into the SWOX network could generate an indicative wholesale discount of approximately £1.06 million annually, subject to revision in April 2025. This assumption was subsequently updated following a review of the proposed Didcot connection point. Ultimately, Thames Water confirmed a **Combined Supply Discount of £0.1231/m³**, equating to a **6.6% reduction** on the wholesale charge for customers consuming 20–50ML annually. This discount falls significantly short of the level required for financial viability and is notably below the published indicative figure of **£0.1461/m³**, rendering the current pricing structure insufficient to support the project's commercial case.

It is clear that the current pricing strategy does not provide a great enough incentive for competition and further discussions focused on the pricing methodology for access charges, referencing alternative approaches outlined in the Frontier Economics report, which examined pricing strategies in other sectors. They confirmed that the Didcot access price was calculated using the avoided cost approach, consistent with Ofwat indicative access price guidelines, and refined to provide a more accurate indicative value than published rates. Thames Water indicated no current scope for alternative pricing options but recommended establishing an industry-wide working group to address broader issues raised by this case.

We do not accept Thames Water's position as incumbents have a responsibility to consider how entry could be enabled and not merely to relay on theoretical indicative access pricing. It relies on an Efficient Component Pricing Rule (ECPR) which only allows new entrants a margin that reflects the cost the incumbent avoids. The actual access price guidance was withdrawn by Ofwat in 2014, and competition case law does not support the use of ECPR unless it is specifically mandated in legislation because of the societal and policy framework. The reliance on Ofwat or industry working groups to develop this rather than consider the alternatives put forward by this project is disappointing, but ultimately for this project did not affect the commercial viability. It could affect the viability of other sites with better quality raw water and cheaper water treatment costs. Therefore, removing this blocker competition with a "thin" access price based on the cost to incumbents of the access and socialising the lost average costs across the value chain (with a budget cap of entry set by regulators) is our view of the best way of encouraging more flexible use of local supply opportunities.

It is clear that companies should be supported with a framework that allows economic competitive market entry. Defra's guidance to Ofwat on charges focuses on encouraging upstream competition, but not deaveraging of network costs (e.g., parallel pipework to serve a development at a lower cost to the existing network). Disputes about Wholesale charges for water supply and common carriage prices in relation to the transportation and/or treatment of water services can be referred to Ofwat

under WIA s. 66EA, which includes whether prices are in accordance with codes produced by Ofwat. In the absence of an Ofwat pricing code, Ofwat would determine whether the indicative access prices guidance was relevant to the case, or whether other pricing principles (such as published by Ofwat under s.40 bulk supplies between licensees should apply).

We raised a number of questions with Thames Water for discussion on these principles, but as we show below Thames only offered a price based on avoided costs, and this was below its indicative access price discount for the SWOX water resource zone as a whole as it only applied to the specific main (GATOX) rather than the wider zone. In addition, the project was aware that Thames had included the RWE abstraction licence within its 2024 Water Resource Management Plan list of options, on the basis of swapping the Didcot abstraction with further abstraction downstream on the Thames.

The questions are typical of those an access price case would need to consider and were:

- Given that Castle Water's customers are throughout the SWOX zone and therefore can be served by displacement, should the wider supply rather than the GATOX costs be considered?
- Are there any future water resource schemes to be considered? Given that closing the supply demand deficit will include water efficiency and demand management, leakage and supply options, what account has been taken of the marginal cost of these types of activities? Ofwat's guidance originally considered an adjustment to leakage targets, although this was as part of an Economic Level of Leakage concept where we now have percentage reductions for the long term. What consideration of these marginal costs or avoided schemes could be made?
- You have not assumed any savings in abstraction costs because Thames would need to provide a supply if the Didcot supply was not available. What short term or planned absence of the Didcot supply could affect this?
- In the short run marginal cost calculation, what consideration has been made to future changes in cost (e.g., consistent with PR24, recognising that K factors are 36.46% but the combined supply discount does not change)?
- The Thames network access code (p.54) states that discounts are based on 2024/25 Wholesale Production Budget data. Is there evidence available as to whether this is consistent with the costs included in wholesale tariffs (ie PR24)?
- What assumptions for inflation (or cost links) are proposed for the wholesale access price discount?
- What consideration of the appropriateness of the avoided cost approach as opposed to other pricing concepts (e.g., from Ofwat's NAV guidance, bulk supplies between undertakers, s.40 bulk supply cases, other sectors as outlined in the Frontier Report) has been undertaken?
- Future water resource schemes (e.g., Abingdon reservoir) are now being planned through RAPID and through commercial and competitive market frameworks (e.g., DPC, SIPR etc) that means the future capex and opex investment may not be included within PR24. Does this have an impact on the combined supply calculations?
- Although indicative access prices only look at schemes in the following 5 years, actual schemes can have a longer timeframe? Is this relevant given expected future investment?
- The Thames WRMP24 showed an option for purchase of a "spare" element of the Didcot power station abstraction licence that could then be available downstream. This has peak and average dry period of 22.6Ml/d, broadly consistent with the same water being used for a 20Ml/d treatment water plant output for this project. What are the peak avoided costs in this

zone, recognising that there are no average benefits of this alternative (but with costs of this scheme to update Medmenham WTW, Kempton WTW treatment capacity, network reinforcement, and a new intake)?

- What assumptions have been made on local authority growth plans and any additional pressures that may have emerged with recent Government Policy? Similarly for industry usage, are there indications of Government economic industry strategy and growth plans (e.g. data centres) in the SWOX zone which would change the benefits/avoided cost of this project?

Thames did not answer these questions or agree to a meeting to discuss them, and therefore the project was lost the opportunity of addressing the questions further, before the project partners took the decision to conclude the commercial feasibility stage of the project.

Discussion on NAV charges

Thames NAV access prices (on a wholesale minus basis) are currently £1.4846/m3 compared to a wholesale charge of £2.4743/m3, a discount of £0.9897/m3 or 39%.

Thames calculate this by taking treated water distribution average costs and then apply it, assuming 4.4m of main per property on a NAV site and 110.7m3 usage per property. On this basis, network losses amount to £0.0668/m3, on site costs of £0.2811/m3 and replacement asset costs of £0.6418/m3.

Inserting this water may reduce network losses over a length of pipe, but with a bigger volume. On site, costs are less relevant to large user customers and replacement asset costs on a development site less obviously relevant. However, these calculations assume an annuity rate as a concept for the entrants' assets – the equivalent concept would allow an annuity for water treatment, abstraction, and network connection for this type of competitive entry. This supports our proposal for a thinner access price for flexible local water supplies. A discount of 40% for a new housing estate on wholesale charges compared to only 7% despite having the cost of water resources and water treatment is clearly uneconomic and forecloses competitive market entry.

Discussion on bulk supply pricing

Ofwat's guidance on bulk supply pricing (issued for s.40 rather than s.66 as noted above) focuses on the costs reasonably associated with the provision of relevant services. In this case it could be the provision of network transport, and the marginal cost of any back up supplies (including for network losses in transport). Ofwat's guidance suggests definition the relevant set of services to provided, and the cost of this provision. This cost can be costs already incurred or likely to be incurred in the future.

The key question for this pricing (and in the absence of any specific guidance or cases under combined supply), is whether it is relevant to consider

- The average cost of supply other customers; or

- An assessment of the specific costs associated with a specific customer.

Where a network is involved as with the Didcot example, the provision of services will include joint costs, common costs or network benefits. In this case the cost of the network is averaged, so the cost of making the supply is specific to the scheme, but there are common costs in operations, but in averaging the benefits to the network of the entry should also be considered.

Ofwat also consider that bulk supply prices should facilitate the efficient use of resources and effective competition within the water supply industry, where appropriate. It would be recognised that a price based on short run avoided operating costs would prevent entry, even if efficient in the long run.

In Ofwat's view, bulk supply pricing for combined supply should consider these wider charging principles as an important tool to:

- Secure the efficient use of resources (and is expected within the Cave review establishing business retail competition); and
- Encouraging effective competition within the water supply sector.

Ofwat set out similar information for s.40 bulk supplies to that collected in combined supply applications, such as maximum and certainty of usage, impact on quantities and customers in the area etc.

The Frontier report looks at other sectors and summarises factors that could be considered in water bulk supplies. Factors that are relevant focus (in line with Ofwat's bulk supply principles) on efficiency use of resources and encouraging effective competition.

Benefits that could be considered to wholesalers include:

- Contribution to meeting business demand targets.
- Improved resilience from additional water resource supplies (both use this Thames abstraction and treated water).
- Shallower charges to incentivise entry (along a range from the additional marginal cost of making the supply rather than the marginal cost avoided with the supply being made).
- Network resilience (e.g., to power outages, or avoiding demand hotspots).
- Accounting for cumulative benefits – recognising that measuring the benefits of an individual small scheme entry may underestimate the benefits as a whole compared to a single large scheme.
- Locational pricing where it improves averaging as an approach to efficient entry.

This has a value to wholesalers and therefore thee access price regime should accommodate this.

Summary

The Didcot pilot project, funded by Ofwat's Innovation Fund, aimed to demonstrate the feasibility of small-scale packaged water treatment plants as an alternative to large-scale infrastructure. The consortium—RWE, Pennon Group, Castle Water, and Binnies – proposed using up to 20ML/day of RWE's abstraction licence to supply potable water to the Thames network for customers consuming over 50ML annually.

Commercial viability required treatment costs at least 10% below wholesale rates, but current Thames Water charges and access pricing methodologies presented significant challenges. Estimated capital expenditure is approximately £60 million (range £34.6–£74.3 million), with annual operating costs of £2.4 million plus additional raw water and site costs.

The project highlighted systemic issues in pricing methodologies and regulatory processes. Wholesale Authorisation took over 18 months – the first application of its kind – creating delays and circular dependencies between feasibility assessments and access pricing. Ultimately, Thames Water offered a Combined Supply Discount of £0.1231/m³ (6.6%), far below the required level for viability. Frontier Economics' review of cross-sector case studies suggested that shallow charging principles could improve market entry and competition.

Conclusions

- **Technical feasibility** was demonstrated, but **commercial viability remains unattainable** under current pricing structures.
- **Regulatory complexity and prolonged authorisation timelines** create significant barriers for small-scale projects.
- **Access pricing methodologies** based on avoided costs disadvantage smaller schemes and fail to incentivise innovation.
- Without reforms – such as streamlined authorisation, standardised access pricing, and financial support mechanisms – small-scale water treatment solutions will remain commercially unviable.
- Establishing an **industry-wide working group** to review pricing principles and regulatory frameworks is essential to unlock innovation and resilience in the water sector.

Without reforms to streamline authorisation, standardise access pricing, and support smaller projects through targeted mechanisms, small-scale water treatment solutions will remain commercially unviable. Addressing these issues is essential to unlock innovation, resilience, and environmental benefits in the sector.

5.4 Changes to Intended Outputs

All of the outputs are as originally envisaged and no significant changes were made.

5.5 Intellectual Property Rights

No specific IPR at the end of the project has arisen. Certain elements of the project are commercially confidential to Binnies, RWE, and Castle Water but this does not affect the production of this final report and the pilot scheme outputs from the innovation fund itself. We have carefully described and presented the outputs in the final report sufficiently so as not to reveal the commercially confidential information.

5.6 Outputs, Adoption and Foreground IPR

The IPR position and that set out in the Winners Agreement are reflected in this Final Report. The project is a pilot of taking a market concept through to the point at which the alternatives have been tested and is investible. The process, assessment, and nature of the pilot were shared openly with the water industry, RAPID, regulators and through workshops and publications during and at the end of

the project. We intend to publish the report in full and provide access for interested parties who wish to further exploration of similar commercial opportunities in the future.

6 Outcomes

The overall outcome was to complete this 6-stage project to work through each of the potential barriers and risks to develop a commercially viable investment model based on a real pilot plant. Each stage was completed to the satisfaction of Ofwat, DWI, and EA, who acted as gatekeepers at each stage. Continuous engagement with wider water sector companies, specifically Thames Water for this pilot was also delivered.

This collectively allowed for systematic exploration of the regulatory barriers, network access constraints, drinking water quality risks, and technical risks to the satisfaction of regulators.

We developed a commercial model which would be investable and which can readily be replicated elsewhere. However, the access price did not meet the needs of this commercial model, as we explain in our main report.

The project aimed to provide wider societal benefits through providing a minimum of 500 hours of learning opportunities for at least two university students as part of this project. Three university students at master's and PhD level were involved in the project, supplemented by some additional specific consultancy through UWE because of the difficulties in accessing sufficient open abstraction data to support a university student dissertation project.

6.1 Outcomes for the Partners

The outcome for the partners to complete the project was achieved. However, the partners had a desire for an ongoing commercial relationship based on the commercial model which proved to be unfeasible for Bristol Water, Castle Water, and RWE. The project benefits therefore were achieved, with the exception that the concept proved to be unfeasible based on the current regulatory framework.

6.2 Outcomes for other Direct Beneficiaries

The direct beneficiaries are water companies and regulators and the project conclusions clearly sets out the infeasibility and barriers to this form of competition. An example includes the Frontier report which sets out learning opportunities for other sectors and the GIS tool developed by UWE. The project report as a whole provides a reference point for ongoing development of water resource and supply competition. Ultimately as our project report shows there is a significant impact on economic growth from sufficient sustainable water resources.

6.3 Residual Activities to achieve Outcomes

There are no further residual activities although the project outcomes have fed through already to other projects, such as the commercial modelling for Cheddar 2 reservoir.

6.4 Organisational Innovation Capability

The project built commercial water capability across Binnies, Pennon, Castle Water, and RWE. The commercial model could be revived if the legislative and regulatory barriers allowed this in the future.

7 Impacts

7.1 Impacts and Benefits for the Water Sector

In the short term, the main impact and benefit of this project is to prevent a significant amount of time or effort of resources to be expended on this form of competition. The concept of taking alternative water sources, treating the water, and applying it into the business retail market has been shown to be unfeasible in terms of both the application process itself and its commercial viability. The thought process though has fed into more feasible commercial arrangements such as Direct Procurement for Customer bulk supply approaches.

7.2 Quantifiable Benefits

It is not appropriate to estimate quantifiable benefits for this project.

7.3 Timescales for Realising Benefits

The qualitative benefits of this project have already been realised as water reform is not expanding or relying on this type of competition and Ofwat have avoided development water resources trading until the 2029 price review framework at the earliest. Defra has also announced the creation of a single water sector regulator which will allow the commercial model envisaged in this project to be considered in the future. The timeframe for this will be set out in the Defra water reform transition plan, but we would expect it will be after 2035 for any of the potential barriers to validating the findings of this project to be resolved.

7.4 Sector Innovation Capability

The cultural aspect of commerciality has been developed between the project partners. The unfeasibility of the commercial arrangements and the lack of credible access price from Thames Water means we do not attribute any change in sector innovation capability as a result of this project.

8 Dissemination and knowledge sharing

8.1 Dissemination Activities

An industry dissemination workshop was held in May 2023 which took industry partners through the project phases and indicative outputs, up to the point of the commercial model and investability decision that emerged through the water wholesale authorisation application process. The industry workshop was the intention of the original project proposal. We considered a further workshop at the point of commercial viability but the investor decision not to support further commercial development of water resource trading means this is no longer necessary. Publishing this report conclusion will see the results communicated through LinkedIn articles and further industry conference presentations.

In addition, Pennon has presented at a range of events and conferences on the commercial model for SRO water resource schemes and bulk supply pricing that this project has fed into. We also describe in the project report the submissions made to the Independent Water Commission that used project outputs to inform water sector reform decisions.

8.2 Efficacy and Learnings from Dissemination

Feedback on the industry interim workshop we held was positive. Discussions with RAPID focused on not developing alternative models to DPC and therefore this limited further dissemination of these project findings at this stage.

8.3 Future and On-going Communications

We will communicate the final project report being published on LinkedIn and with a series of articles on the project findings. This is targeted at the regulatory, competition, and commercial contacts on this platform who are interested in this topic.

9 Next Steps for Adoption and Implementation

9.1 Next Steps

The commercial decision has been not to adopt or implement this project further. A change to the regulatory and legislative framework in the future will be needed for further adoption and development.

9.2 Wider Implementation

We address this in the future considerations of the project outputs in section 5 and in the Executive Summary of this final report, which also provides routes for other projects to consider these issues. This suite of information is also ready to inform future regulatory reform of these markets. We are publishing this report, and will use its findings in future industry and cross-sector discussion on the potential for market reform. However, the ultimately conclusion is that this approach as piloted cannot be implemented in an investable way at this current point in time.

10 Outturn Monitoring Data

Project Start Date	04/01/2024
Project Technical Completion Date	31/12/2025
Total Original Project Budget (per Winners Agreement) Total funding awarded + total financial contributions from partners (excluding the financial value of any in-kind contributions).	£622,156
Total Amount of Funding Awarded by Ofwat (per Winners Agreement) Amount of funding initially awarded by Ofwat.	£622,156
Originally Planned Partner Financial Contributions (per Winners Agreement) Financial contributions that were planned from partners at the outset of the project.	£0
Finalised Amount of Funding Awarded by Ofwat Finalised amount of funding awarded by Ofwat, where this has been increased through approved Project Change Requests (note this applies to a minority of projects and only for specific reasons).	£622,156
Total Project Outturn Cost (Actual Cost) at Completion Total expenditure of funding awarded by Ofwat + total expenditure of funding provided by project partners (excluding the financial value of any in-kind contributions)	£411,152
Finalised Amount of Ofwat Funding Used Finalised amount of funding awarded by Ofwat used to cover the project costs, where this has been underspent compared to the total award.	£411,152

Finalised Partner Financial Contributions Finalised amount of financial contributions required from partners to cover the project costs (noting the requirement for 10% minimum contribution)	£0
Difference Between Outturn Costs and Original Budget Difference in expenditure expressed as project outturn cost – total original project budget (i.e. over or underspend)	-£211,004

11 Final Reflections and Concluding Remarks

Although the innovation has proved to be commercially unviable, the project objectives were achieved and the findings set out in the main project report all have subsequent uses. However, the timetable for water sector reform means it may be after 2035 before the principles set out in this report are revisited. In the meantime, large scale water resources rather than flexible local supplies are being developed. A more sustainable margin for the business retail market will also remain elusive without the more flexible use of local water resources. However, the project outputs have already been used in water sector reform discussions and in developing bulk supply pricing arrangements for other more feasible forms of competitive market pressures in the water sector.

12 References and Links

References, links and appendices for the project outputs are shown throughout the report

13 Appendices

Appendix A Project Risk Register

Appendix B Review of Cross-Sector Charging (Frontier Economics)

Appendix C Abstraction Management England & Wales (UWE)

Appendix D Abstraction Management International (UWE)

Appendix E Technical Note 1 - Water Quality Issues Related to Abstraction (UWE)

Appendix F Technical Note 2 - Scalability & Visualisations (UWE)

Appendix G Design Feasibility Report (Binnies)

Appendix H Environmental Desktop Study (Binnies)

Appendix I Benefits Valuation Framework (Binnies)

Appendix J Geotechnical Desk Study (Binnies)

Appendix K Process Treatment Scalability (Binnies)

Appendix L Construction Cost Estimate Summary (Binnies)

Appendix M Construction Programme (Binnies)

Appendix N CDM Risk Register (Binnies)

Appendix O Design Risk and Issues Log (Binnies)

Appendix P Commercial model (Confidential)