

Thames Water
Draft Water Resources
Management Plan 2019

Statement of Response

Technical Appendices

**Appendix H: Severn Thames Transfer -
Cotswold Canal**



Table of contents

A.	Introduction	1
	Response to consultation	1
	Summary of WRMP19 STT water resources options process	1
B.	CCSTT: Assessment of benefits	2
C.	CCSTT: Assessment of costs	4
	Support from volunteers and partnership funding	4
	Cost estimates	5
	Energy efficiency	5
D.	CCSTT: Comparison with the Deerhurst to Culham pipeline	6



Appendix H.

Severn Thames Transfer- Cotswold Canal

A. Introduction

Response to consultation

- H.1 Thames Water received around 230 responses from individuals and organisations in support of the Cotswold Canals Severn Thames Transfer water supply option. Many of the responses follow similar themes and this appendix provides information in response to the comments received. Key issues addressed in this note include:
- How the Severn Thames Transfer (STT) conveyance options have been evaluated and how feedback from the Cotswold Canals Trust (CCT) has been taken into account in the evaluation
 - How wider economic and social benefits have been taken into account in the assessment of STT options
 - How support from volunteers and partnership funding affect the comparison between STT canal and pipeline alternatives
 - How the relative costs of the pipeline and canal alternatives have been compared
 - How the pipeline and canal alternatives compare in terms of energy efficiency

Summary of WRMP19 STT water resources options process

- H.2 In developing the draft WRMP we have undertaken detailed work to review and assess a large number of potential water resource options, to both manage demand for water and to provide additional water supply, in order that we can continue to provide a secure and reliable supply of drinking water to customers over the 80 year plan period. One of the options examined in great detail was the transfer of water from other regions of the country via the River Severn to the River Thames. For this option we considered conveyance of water from the River Severn into the Thames catchment via a new pipeline from Deerhurst to Culham or via the restored Cotswold Canals.
- H.3 The WRMP19 supply options have been developed and assessed through an objective process of feasibility assessments, fine screening of options and conceptual design reports. A staged approach to feasibility assessment was adopted across all option types and consistently applied using standardised criteria. This methodology assumes that option information is developed as an option progresses through the assessment Stages 1-3 to enable more detailed analysis as the assessment progresses. In some cases, additional work was undertaken to reduce uncertainty and better evaluate the option under examination. The Cotswold Canal Severn Thames Transfer (CCSTT) design concept was identified as an area



of uncertainty early in the WRMP19 planning process and, therefore, a specific engineering feasibility study was undertaken to reduce the uncertainty concerning the option and to inform the Raw Water Transfer (RWT) feasibility assessment. Option assessments were reviewed through regular back-checking as the WRMP planning process moved forward and new information became available; for example, the CCT's queries and comments on the pumping requirements for the CCSTT option led to it being reviewed and resulted in a change being made to the definition of the option and a review of its initial feasibility assessment.

- H.4 We engaged extensively with the CCT as we undertook this additional work and, in the process, took into account and applied relevant information provided by CCT in the feasibility assessment of the option. In addition, we completed further investigatory work in response to issues raised by CCT in relation to the Trust's assessment of the design, economic (costs), recreational, environmental and social benefits that could be delivered by the option.
- H.5 We also engaged with other supporters of the CCSTT.
- H.6 For example, we had regard to those consultation responses that have highlighted that there is an existing canal transfer in Llangollen, North Wales and note that information on the 50 MI/d Llangollen Canal Transfer was provided by Canal and River Trust (CRT) and informed our development of the CCSTT feasibility study.

B. CCSTT: Assessment of benefits

- H.7 In the preparation of the WRMP19 Thames Water reviewed the potential benefits of options to partially and fully restore the Cotswold Canals to enable conveyance of water from the River Severn to the River Thames. The RWT Feasibility Report¹ included an assessment of the potential benefits of CCSTT as part of the feasibility assessment methodology. We acknowledged the recreational benefits of the canal conveyance option in Stage 2 of the assessment and, in Stage 3, we concluded that the canal option had greater benefits than the alternative Deerhurst to Culham STT pipeline conveyance route in respect of:
- Opportunities for biodiversity improvements
 - Recreational benefits
- H.8 Assessment against these two criteria took into account the access improvements that would arise from canal restoration (e.g. public rights of way or permissive footpaths). Account was also taken of beneficial effects when assessing the option against the other Stage 3 assessment criteria as set out below:
- Landscape character sensitivity criterion: Although it was recognised that a restored canal might offer some opportunities for landscape improvements, the necessary civil engineering works would have to be undertaken within the Cotswold AONB. Mitigation measures to reduce the adverse impacts arising from civil engineering works in and around the canal and the construction of new pumping stations along the route would be required and, accordingly, assessment of the CCSTT against this landscape character sensitivity criterion attracted an overall amber rating;

¹ Raw Water Transfer Feasibility Report, Mott MacDonald & Cascade, Revision 3, August 2018

- Archaeology and historic environment criterion: It was recognised that the canal itself is a heritage asset and that its restoration would deliver heritage benefits (regard to the benefit from a tourist perspective is considered more as part of the recreational benefit). However, it was considered that works in restoring the canal and in the development of new pumping stations would also likely adversely impact designated heritage assets and their settings (not all of which are associated with the canal). These adverse impacts were considered capable of being mitigated to an extent through sensitive design and a considerate approach to the construction works. In consequence, an overall amber rating was assigned to the option against this criterion.
- H.9 The Cotswold Canal Feasibility Report identified four options for the transfer. The RWT feasibility assessment subsequently focussed on the ‘Do Maximum’ and Do Minimum’ canal transfer options as summarised below:
- Option A - Do Maximum: Provide pipeline under Sapperton tunnel invert to enable vessel navigation through the tunnel to be maintained during transfer, and to rehabilitate all pounds and locks to facilitate vessel navigation along the full canal (no provision of facilities to keep the canal in water);
 - Option D – Do Minimum: Use the open water channel for water transfer through Sapperton tunnel and thereby restrict navigation through tunnel during transfer. No rehabilitation of canal pounds and locks not required for water transfer, on the assumption that these would be funded and carried out by others (i.e. CCT) at a later date.
- H.10 The ‘Do Min’ option provides all the infrastructure required for the raw water transfer to the River Thames. It would have the least construction impact but would deliver the least benefit in terms of recreation and opportunity for biodiversity improvement. In general, the option feasibility assessment is unaffected by a choice being made between the two options, and in the case of the two beneficial criteria (biodiversity and recreation), the “Green” assessment (the highest rating available for assessment against these criteria) would apply equally to both options as they both provide some benefit, although the benefit is greater with the ‘Do Max’ option due to the increased number of pounds that would be restored.
- H.11 The RWT Feasibility Report indicates that the partially restored canal option compared more favourably overall in respect of beneficial effects relative to the pipeline option but less favourably overall in respect of its adverse effects and costs (see Sections B and C of this appendix for more information about costs).
- H.12 In summary, there are criteria against which the CCSTT performed better than the pipeline option. In addition to the biodiversity opportunities that restoration of the canal would offer, the other main benefits of the CCSTT reported in the RWT Feasibility Report relate to the local economic and recreational benefits from restoring the canal and potential associated heritage, conservation and landscape/visual amenity benefits. These potential wider economic, social and environmental benefits would only be fully achieved, however, if the Cotswold Canals, including the Sapperton Tunnel, were restored to allow navigation from end to end; but this would attract substantial additional costs. Whilst it is recognised that these benefits may be obtainable, the primary purpose of a STT water transfer option is to facilitate a cost effective, resilient and environmentally acceptable water resource for the south-east of England. The issues identified associated with the CCSTT around cost, operational complexity and risk of



INNS (see Section C of this appendix and the RWT Feasibility Report) significantly outweighed its potential benefits making it a less suitable water transfer option than the Deerhurst Pipeline, having regard to the primary statutory purpose to be served, namely, the development and maintenance of a best value, efficient and economical system of water supply to the Thames Water area; and it is for these reasons that the CCSTT was rejected at the Feasibility Assessment stage.

- H.13 In response to comments received from CCT on the Feasibility Assessment relating to the Trust's view of how the option would have been assessed under the WRMP19 SEA methodology, Thames Water commissioned a "shadow" SEA of the partially restored canal option in August 2017. The "shadow" SEA assessed the potential benefits of water transfer via the canals using the same benefits assessment approach and criteria as used for the pipeline option and all other WRMP19 options that were included in the Constrained List. The "shadow" SEA confirmed the original Feasibility Report assessment findings that there are material specific beneficial effects of the CCSTT option and these are greater than those that would be delivered with the pipeline option. As stated above, however, the reasons for rejecting the CCSTT were related to the cost of the option relative to the pipeline option and its potential adverse effects associated with operational complexity and greater risk of the transfer of INNS.

C. CCSTT: Assessment of costs

Support from volunteers and partnership funding

- H.14 TW acknowledge that there is support for the restoration of the Cotswold Canals and that parties are willing to volunteer time and effort to seek to make the restoration a reality. The civil engineering scheme required for water transfer using the canals would include the laying of large capacity pipelines (1.4m diameter for the 300MI/d option), the construction of pumping stations and lock bypasses capable of transferring 3.5m³/s, restoration and the lining of the partially collapsed Sapperton Tunnel, as well as other canal restoration works. Much of this work would involve complex engineering, requiring specialist skills that voluntary organisations would be unlikely to be able to deliver. Whilst volunteer organisations could take on some elements of the project, these are likely to be best focussed on aspects that are not essential for the transfer (such as restoration of pounds that are not required for transfer). We have included a 'Do Minimum' scenario in the assessment of the CCSTT option, which only includes works required for transfer and excludes further canal restoration. The 'Do Minimum' cost has been used in cost comparisons with the Deerhurst to Culham Pipeline option (which includes a pumping station and treatment works near the River Severn and an underground pipeline to the River Thames), and the comparisons demonstrates the significant additional cost of the CCSTT. It is also unlikely that volunteer organisations could provide a significant contribution to the works required for the water transfer without substantially lengthening the works programme and commensurately deferring the time when the option could be expected to deliver the benefits attributed to it.
- H.15 Partnership and lottery funding has previously contributed to canal restoration work and we understand that further funding could be available for the Cotswold Canals restoration in the



future. However, to date funding applications have focussed on the western section of the canal. The CCSTT option would bypass much of the canal to the west of the watershed with pumped pipelines and the 'Do Minimum' scenario would not restore the sections that would not be required for water transfer. For these reasons, the funding currently secured has minimal impact on the cost estimates used for comparison of the alternative conveyance methods that would enable the Severn Thames Transfer.

Cost estimates

- H.16 Option costs were compared by first ensuring that the costs took into account the whole life cycle of a project. This means that the cost of construction (capital cost), the operating cost (assumed to be fully utilised to allow for consistency) and the cost of carbon emitted were calculated for each option. These costs were discounted and then divided by the estimated yield of the scheme in order to 'normalise' them and allow for direct comparison between options. Recurring capital costs were not included in the whole life cost assessment at feasibility stage as a simplified normalised cost calculation was used, but were included at fine screening. These normalised costs were used to assess options at Stage 3 of the feasibility process against the cost criteria and to review the cost of STT combinations during validation. Costs were determined using a standard methodology and Thames Water cost models were used where these were appropriate. The whole life costing approach allowed options that have a very different balance between capital and operating costs to be compared on an equitable basis.
- H.17 At feasibility stage, option costs were developed to support Stage 3 assessments and an allowance for optimism bias was included based on assessment of confidence against standardised criteria. Costed risk is included in cost estimates of options for program appraisal but is not applied to options that are rejected at feasibility stage. However, costed risk was developed for the CCSTT option to enable a more detailed comparison with the Deerhurst to Culham pipeline. The risk costs were developed from the work reported in the Cotswold Canal Feasibility Study which is an appendix to the RWT Feasibility Report.
- H.18 A number of CCSTT supporters have raised concerns over cost transparency in the WRMP process. Please refer to Statement of Response Appendix I – Assessment of Option Costs for more information.

Energy efficiency

- H.19 The CCSTT and Deerhurst to Culham Pipeline options would both require power to pump water to the watershed at the boundary of the River Severn and River Thames catchments, and for operating a water treatment works for water quality and ecology mitigation. The level of the watershed is lower for the CCSTT option as it utilises the Sapperton Tunnel and therefore the power required to pump flow over the watershed is lower in this option; however additional pumping stations are needed for the CCSTT to pump water from the end of the canal near Inglesham to the water treatment works, and for the 300MI/d option, to pump on from the treatment works for discharge at Culham. This energy requirement of the option erodes the benefit in energy efficiency gained from its lower watershed. Whilst energy use is estimated to be higher for the Deerhurst to Culham pipeline option compared with that of the

CCSTT, the overall assessment of the two options demonstrates that a new pipeline should be the preferred method of transfer, rather than the use of the restored Cotswold Canals as described in Section D of this appendix.

D. CCSTT: Comparison with the Deerhurst to Culham pipeline

- H.20 Based on the assessments completed (found in the RWT Feasibility Report) we have concluded that a new pipeline from Deerhurst to Culham is the preferred route for STT conveyance of water, rather than the use of the restored Cotswold Canals, for the following reasons:
- H.21 Cost: The restoration of the canal, including the Sapperton Tunnel, to allow for simultaneous navigation and water transfer would be substantially more costly than a pipeline. A comparison between the CCSTT and Deerhurst to Culham Pipeline costs is included in the RWT Feasibility Report and we shared further information on the cost assessment with the Cotswold Canals Trust to allow them to review, challenge and comment on, the assessment.
- H.22 Operational complexity: Conveyance by canal, that is open for navigation, will be significantly more complex on operational grounds and will require extensive cooperation with external non-TW infrastructure operators. The open nature of the canal means that it is much more vulnerable to pollution incidents and also, that it will have a much higher incidence of algal blooms than a pipeline conveyance mechanism. Algal blooms are likely to increase given the forecast impacts of climate change and they pose a risk to water quality/availability by overwhelming treatment during hot, dry periods and could restrict the supply of water from this route, at a time when the water is likely to be most needed. We asked independent experts CEH (Centre for Ecology and Hydrology) to investigate this aspect for us and the findings of their report supports this conclusion reported in the Briefing Note on the Impact of Draft Water Resources Management Plan 2019 (Centre for Ecology and Hydrology (2018), Natural Environment Research Council, Briefing Note on the Impact of Draft Water Resources Management Plan 2019, Dr Mike Bowes and Dr Alex Elliot).
- H.23 Environmental issues including the spread of invasive non-native species (INNS): The CCSTT carries a higher risk of the spread of invasive non-native species than the Deerhurst to Culham pipeline as has been explained by an independent expert from the University of Cambridge and accepted by our environmental regulators, Natural England and the Environment Agency. The INNS paper included in the RWT Feasibility Report states:

“It is considered that the best option for minimising the risk of introducing invasive species during water transfer is to use a pipeline transfer that is subject to filtration. A canal transfer will serve as a reservoir of invasive species that are brought in close proximity to the Thames. As such, the risk of the introduction of INNS to the Thames by canal is relatively high. Any hydrological link between the canal and the Thames would result in a very high risk of introductions as it would be impossible to screen all the water.

Given the range of other possible pathways for introduction of invasive species that already exist between the Severn and Thames, it seems that a well-



designed and managed filtration system would reduce the risk of introductions of invasive species through a pipeline transfer to a negligible level.”

H.24 Further information regarding this issue can be found in the RWT Feasibility Report.