

Thames Water
Revised Draft Water Resources
Management Plan 2019

Technical Appendices

Appendix Q: Scheme rejection register



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Appendix Q.

Scheme rejection register

A. Introduction

- Q.1 Appendix Q summarises the rejection register for our resource scheme options (Section B) and demand scheme options (Section C).
- Q.2 The resource option rejection register lists the generic option types that have been rejected as well as the specific resource elements on the unconstrained list that have been rejected. Reasons for rejection are provided in each case, taken from:
- Feasibility reports that identify the unconstrained options list then assess the options to identify the Feasible List. Not accounting for size variants, 157 options were rejected at the feasibility stage.
 - The fine screening report that compares the feasible options to generate a Constrained List. Not accounting for size variants, eight options were rejected at fine screening.
- Q.3 The demand scheme rejection register consists of two tables: demand options rejected through primary screening (Table Q-13) and demand options rejected through secondary screening (Table Q-14).
- Primary screening removes demand options considered non-feasible with regard to technological, financial, environmental, risk and resilience and legal constraints. Forty-four demand options were rejected through primary screening (Table Q-13).
 - Secondary screening removes demand options considered non-feasible with regard to qualitative criteria (Section 0). Forty-four demand options were rejected through secondary screening (Table Q-14).

B. Resource scheme rejection register

- Q.4 This is a rejection register taken from the Fine Screening report¹ completed by Mott MacDonald as part of the revised draft Water Resources Management Plan 2019 (draft WRMP19) resource option appraisal process. This rejection register provides a summary and reasoning behind the rejection of potential resource options for the revised draft WRMP19 options appraisal process.

¹ Fine Screening Report, Mott Macdonald, (September 2018)

Generic option rejection

- Q.5 This section provides information on those generic options which have been rejected and therefore have not been taken forward to the feasibility stage.

Tankering of water

- Q.6 In response to the Official Journal of the European Union (OJEU) notice for water resources issued by Thames Water during preparation of its Water Resources Management Plan 2014 (WRMP14) a number of options were put forward by third parties for tankering of water by sea from Scotland, Iceland, Norway and the Netherlands. An assessment of these proposals was carried out and they were rejected due to excessive costs, additional infrastructure requirements and concerns around dependability. In preparation for draft WRMP19 Albion Water further refined its proposals for tankering from sources in Norway and the Netherlands. Assessment of these refined proposals concluded that while technically feasible, at full utilisation (one tanker per day) it would be excessively costly; and at low utilisation (one tanker per week) the option remains uncompetitive with other options of a similar size. Tankering has therefore not been developed as a water resources option, but we are considering this option as a potential emergency drought plan option to avoid Level 4 restrictions.

Icebergs

- Q.7 The option to import icebergs has been rejected on the basis that the techniques involved are not sufficiently advanced for commercial use and because there is a high level of uncertainty that the scheme would provide significant yield.

Rain cloud seeding

- Q.8 Rain cloud seeding has been rejected on the basis that the techniques involved are not sufficiently advanced for commercial use and because there is a high level of uncertainty that the scheme would provide significant yield.

Tidal barrage

- Q.9 The option for the use of the Thames Barrage to impound fresh water has been rejected as this option would limit the navigation of the River Thames to both private and commercial traffic resulting in disproportionate social and economic costs. It would also limit the passage of aquatic life which would cause significant ecological damage. The option could also result in raising the groundwater levels in the surrounding areas which could increase the incidence of flooding and cause damage to services and historic buildings in London.

Rainwater harvesting

- Q.10 Rainwater harvesting was rejected on the basis of poor drought resilience.

Specific option rejection – London Water Resources Zone (WRZ)

- Q.11 For generic option types that passed the generic screening stage, specific options have been identified and assessed both at the feasibility and fine screening stages.

Table Q-1: London rejection summary

Type	Option	Rejection Stage			
		Stage 1	Stage 2	Stage 3	Fine screening
Raw Water Transfer (RWT)					
<i>Although RWT options are found in the London rejection summary, some of these options also serve Swindon and Oxfordshire water resource zone (SWOX) and Slough, Wycombe and Aylesbury water resource zone (SWA)</i>					
	Craig Goch Reservoir expansion	X			
	CRT Bradley groundwater abstraction	X			
	Use of a new Thames Reservoir (if successfully promoted) to support River Severn abstraction	X			
	Use of Farmoor Reservoir to enable benefit from a River Severn transfer	X			
	Great Spring	X			
	Minworth Sewage Treatment Works (STW) effluent transfer through existing canal network	X			
	Longdon Marsh reservoir to support River Severn transfer		X		
	Kielder Reservoir		X		
	Conveyance - Pipeline from Kielder Reservoir		X		
	Conveyance - Canals from Kielder Reservoir		X		
	Conveyance - Deerhurst to Culham 100		X		
	Conveyance - Deerhurst to Radcot 300		X		
	Conveyance - Deerhurst to Radcot 600		X		
	Conveyance - Deerhurst to Culham 600			X	
	Conveyance - Cotswold Canal 100			X	
	Conveyance - Cotswold Canal 300			X	
	River Severn (unsupported)			X*	
	Conveyance - Deerhurst to Lechlade 100			X*	
Reuse					
	Abbey Mills Pumping Station (PS) Sewer Mining (Luxborough Lane)		X		
	Greenwich PS Sewer Mining (Lower Hall)		X		
	Greenwich PS Sewer Mining (Hogsmill)		X		
	Long Reach STW Final Effluent Reuse (adjacent to site)		X		



Type	Option	Rejection Stage			
		Stage 1	Stage 2	Stage 3	Fine screening
	Riverside STW Final Effluent Reuse (adjacent to site)		×		
	Abbey Mills PS Sewer Mining (Lower Hall)			×	
	Millbrook Road PS Sewer Mining (Hogsmill)			×	
	Wandle Valley PS Sewer Mining (Hogsmill)			×	
	Deephams STW Final Effluent Reuse 25 MI/d			×	
	Mogden Final Effluent Reuse (Mogden STW)			×	
	Beckton Final Effluent Reuse 50 MI/d				×
	Mogden Final Effluent Reuse (Hydes Field)				×
	Crossness Final Effluent Reuse				×
Direct River Abstraction (DRA)					
	Beckton effluent transfer to Teddington and increase of existing river abstraction	×			
	Mogden effluent transfer to Teddington and increase of existing river abstraction upstream at Surbiton	×			
	Mogden effluent transfer to Teddington and new river abstraction at Teddington with transfer to Queen Mother Reservoir			×	
	Mogden effluent transfer to Teddington and new river abstraction and treatment at Teddington for direct supply		×		
	Mogden effluent transfer to Teddington and new river abstraction at Teddington with direct transfer to Thames Lee Tunnel (TLT).			×	*
	New river abstraction on River Roding	×			
	New river abstraction on River Mardyke	×			
	New river abstraction on River Rom/ Beam	×			
	New river abstraction on River Ingrebourne	×			
	River Lee abstraction at Three Mills Lock, transfer to North Woolwich Road site for treatment to potable quality, followed by transfer to service reservoir		×		
	New river abstraction from River Lee at Three Mills Lock and transfer to Lee Valley Reservoirs				×
Desalination					
	River Lee, Coppermills Water Treatment Works (WTW) (blended)		×		
	Manor Road, Erith, Honor Oak, (blended)		×		
	Tripcock Ness, Thamesmead Coppermills WTW (blended)		×		



Type	Option	Rejection Stage			
		Stage 1	Stage 2	Stage 3	Fine screening
	Crossness (Erith Southern Grazing Marshes)			X	
	Crossness (unblended) Northumberland Heath				X
Reservoir					
	Site 3 Cricklade	X			
	Site 4 Swindon	X			
	Site 9 Lechade	X			
	Site 13 Uffington	X			
	Site 20 West Hanney	X			
	Site 24 Kidlington	X			
	Site 27 Beckley	X			
	Site 28 Brightwell Cum Sotwell	X			
	Site 29 Ambrosden	X			
	Site 31 Wheatley	X			
	Site 32 Benson	X			
	Site 34 - Bicester	X			
	Site 44 Stone	X			
	Site 45 Whitchurch	X			
	Site 46 Stewkley	X			
	Site 47 Bierton	X			
	Site 48 Wingrave	X			
	Site 51 Burghfield	X			
	Site 53 Wokingham	X			
	Site 55 Maidenhead	X			
	Site 1 Minety		X		
	Site 2 Leigh		X		
	Site 5 Broad Blunsdon		X		
	Site 6 Highworth		X		
	Site 8 Bishopstone		X		
	Site 10 Shriveham		X		
	Site 11 Clanfield		X		
	Site 12 Faringdon		X		
	Site 14 Brize Norton		X		



Type	Option	Rejection Stage			
		Stage 1	Stage 2	Stage 3	Fine screening
	Site 15 Brampton		×		
	Site 16 Witney		×		
	Site 17 Stanford in the Vale		×		
	Site 18 Longworth		×		
	Site 19 South Leigh		×		
	Site 21 Stanton Harcourt		×		
	Site 23 Wantage		×		
	Site 25 Oxford		×		
	Site 26 Didcot		×		
	Site 30 Drayton St Leonard		×		
	Site 33 Chalgrove		×		
	Site 35 Chalgrove Airport		×		
	Site 38 Great Haseley		×		
	Site 39 Quainton		×		
	Site 49 Cheddington		×		
	Site 50 Kintbury		×		
	Site 52 Beech Hill		×		
	Site 7 Wanborough			×	
	Site 37 Ludgershall			×	
	Site 40 Postcombe			×	
	Site 42 Haddenham			×	
	Site 43 Aylesbury			×	
	Site 54 Bracknell			×	
	Site 22 Abingdon (30Mm ³ and 50Mm ³)				×
	Site 36 Marsh Gibbon				×
	Site 41 Chinnor				×
Groundwater					
	GW – Epsom	×			
	North London Licence Trading/ Transfer	×			
	Shortlands		×		
	London confined Chalk (north-east)		×		
Catchment Management					
	Bean Wellfield (Groundwater)			×	
	Brantwood Rd (Groundwater)			×	



Type	Option	Rejection Stage			
		Stage 1	Stage 2	Stage 3	Fine screening
	Nonsuch (Groundwater)			X	
	Wilmington (Groundwater)			X	
	Southfleet (Groundwater)			X	
	Green Street Green (Groundwater)			X	
	North Orpington (Groundwater)			X	
	Lower River Thames			X	
	Lower River Lee			X	

* Rejected at Stage 4 Validation



Table Q-2: London rejection reasoning

Option Type/Name	Rejection Reasoning
Raw Water Transfer²	
Craig Goch Reservoir expansion	Rejected due the presence of nationally / internationally designated nature conservation sites. Site contained within Elenydd - Mallaen Special Protection Area (SPA), Coetiroedd Cwm Elan / Elan Valley Woodlands Special Area of Conservation (SAC) and Elenydd Site of Special Scientific Interest (SSSI). Raising of the reservoir would directly result in loss of designated land and is considered unlikely to be acceptable from Habitats Directive perspective since other alternative options are available that do not impact Natura 2000 sites. Demonstrating over-riding Public Interest is unlikely to be successful.
CRT Bradley groundwater abstraction	This option was brought forward from WRMP14. Recent work by Canal and River Trust (CRT) has resulted in a new offer from CRT to provide water from the canal network to the River Cherwell. Therefore, Bradley groundwater is rejected on the grounds that it is superseded by the new offer (new option name CRT Birmingham Canal Navigation (BCN) Surplus).
Use of a new Thames Reservoir (if successfully promoted) to support River Severn abstraction	Water Resources Management System 2 (WARMS2) modelling has shown that there is minimal Deployable Output (DO) benefit in discharging a Severn Thames Transfer (STT) pipeline directly to a new Thames Water reservoir, rather than considering separate STT and reservoir options. Therefore, it is considered appropriate to assess the two options separately at Feasibility / Fine Screening stage and consider the combination of options through the Programme Appraisal process. The option is rejected on the grounds that there is negligible increase in water availability with a combined option compared with separate STT and reservoir options. Modelling has not been conducted to confirm whether a benefit exists if modelled using stochastically generated drought series.
Use of Farmoor Reservoir to enable benefit from a River Severn transfer	<p>Water would be transferred directly to Farmoor, the River Severn and River Thames catchments would not be linked, abstraction would cease at Farmoor and previously abstracted water would remain in the river for abstraction at the London intakes.</p> <p>This option has potential ecological benefits from leaving more water in the upper River Thames during low flows. However, it provides no appreciable DO benefit over discharging straight to the river. Droughts in the lower and upper Thames are not coincident, so when water is most needed for London, Farmoor may be full or nearly full (as in the 1933/34 drought). The benefits would then be, at maximum, the demands on Farmoor (130/140 MI/d) and, depending on the current drought operating regime and natural recession in the Thames, may be much less.</p> <p>The ability to abstract water for London is also impacted by the way the water is sourced. Water input direct to the Thames is available for re-abstraction downstream, whereas water not abstracted at Farmoor is likely to be considered differently and less likely to be available for abstraction at the London intakes under drought conditions.</p>

² Mott MacDonald/Cascade, Raw Water Transfers Feasibility Report prepared for Thames Water, updated September 2018



Option Type/Name	Rejection Reasoning
	<p>This option is failed on the basis of water availability.</p> <p>In the context of potential Water Framework Directive (WFD) compliance concerns around the impact of the existing Farmoor abstractions, discussions with the Environment Agency have been held which have included the possibility of providing a tee to Farmoor on the Deerhurst-Culham pipeline allowing water currently abstracted for Farmoor to continue downstream. This will be considered as part of investigations into the Farmoor abstraction, separately from the WRMP</p>
Great Spring	<p>Rejected as it has no longer been included as part of Welsh Water's offer which includes other resources considered more cost effective by Welsh Water. It has not been offered by Network Rail, who own the abstraction licence, in response to our OJEU notice. Also concerns on water quality including risk of Cryptosporidium.</p>
Minworth STW effluent transfer through existing canal network	<p>Initial assessment of the 75 Ml/d canal transfer proposed by CRT (which would transfer tertiary treated final effluent from Minworth STW through the canal network and River Cherwell to the River Thames at Isis Lock in Oxford) indicates that the River Cherwell would be affected by the full volume of flow in low flow conditions, with an unacceptable impact on the flow regime, water quality and consequently the ecology. It is also assessed that transfer of the full 75 Ml/d to the River Thames at Isis Lock or Duke's Cut would have significant effects on ecology in low flow conditions due to the likely poor water quality and different water chemistry of the canal water / final effluent. Due to the assessed environmental impact and water quality concerns, it is considered unlikely that the Environment Agency would support the option. It is also noted that if the option were to go forward further discussions would be required with Severn Trent Water (SVT) to confirm the availability of water from Minworth STW. The option is rejected on the grounds of Water Rights and Source Water Quality (Treatability).</p>
Longdon Marsh reservoir to support River Severn transfer	<p>Rejected because of comparatively poor performance against other resource / support elements on several criteria. In the RAG assessment, this scored "red" against estimated land acquisition cost, floodplain encroachment, impact on residential dwellings and archaeology and the historic environment. The floodplain encroachment was of particular concern (over 50% of the site sits in Flood zones 2 and 3) and was the only option that scored "red" against this criterion in the RWT feasibility assessment.</p>
Kielder Reservoir	<p>Rejected because it is associated with conveyance elements that fail Stage 2 assessment, the Water UK study concluded that the water from Kielder reservoir is likely to be required by neighbouring areas and there hasn't been a response from Northumbrian Water to our OJEU notice.</p>
Pipeline from Kielder Reservoir	<p>Rejected because of comparatively poor performance against other conveyance elements on several criteria. Total pipeline conveyance length (a proxy for cost) has a red assessment and is significantly longer than other conveyance elements considered in the RWT feasibility study (total length is over 390km). Also performs poorly (with red assessments) against landscape character sensitivity, nature conservation and biodiversity, archaeology and historic environment, impact on recreation, pumping head, construction complexity and operational complexity.</p>
Canals from Kielder Reservoir	<p>Rejected because this would be an excessively long and operationally complex transfer for the DO available. The capacity would be limited by existing canal capacity (to 45 Ml/d) and the total conveyance length (a proxy for cost) has a red assessment and is</p>



Option Type/Name	Rejection Reasoning
	the longest considered in the RWT feasibility study (total length is over 440km, although length of new pipeline is estimated to be 40km). The operational complexity associated with this conveyance would be disproportionate to the DO benefit that could be achieved and the option is likely to require some complex construction around historical canal assets (although the detail of this has not been investigated at Stage 2 of the feasibility assessment).
Deerhurst to Culham 100	Rejected as mutually exclusive and significantly longer (therefore higher in cost) than the Deerhurst to Lechlade 100 MI/d conveyance element.
Deerhurst to Radcot 300	Rejected as mutually exclusive and less promotable on water quality and environmental grounds than the Deerhurst to Culham 300 MI/d element.
Deerhurst to Radcot 600	Rejected at Stage 2 of the feasibility study as it is mutually exclusive and less promotable on water quality and environmental grounds than the Deerhurst to Culham 600 MI/d element. The Deerhurst to Culham element is rejected at Stage 3 against the 'Nature Conservation and Biodiversity' and 'Water Resources and Water Quality' criteria due to the risk of adverse impact on water quality and ecology. The volume of flow would change the flow regime in the river and have an adverse impact on ecology.
Deerhurst to Culham 600	Rejected against the 'Nature Conservation and Biodiversity' and 'Water Resources and Water Quality' criteria due to the risk of adverse impact on water quality and ecology. The volume of flow would change the flow regime in the river and have an adverse impact on ecology. The option is also comparatively higher in normalised cost than other capacity options.
Conveyance- Deerhurst to Lechlade 100	Rejected as being less cost effective than transfers with greater levels of support, particularly when account is taken of stochastic yields that recognise the impact of climate change and other abstractors utilising licensed amounts.
Cotswold Canal 100	<p>The Cotswold Canal STT is rejected by comparison with the Deerhurst Pipeline STT option for the following reasons:</p> <ul style="list-style-type: none"> ▪ Normalised Cost – the necessary restoration of the canal including the Sapperton Tunnel to allow navigation and transfer would be substantially more costly than the Deerhurst pipeline (a fully restored canal option is estimated to be 46 or 61% higher in terms of up-front costs for 300 MI/d and 100 MI/d options respectively and 32% or 55% higher for the 300 MI/d and 100 MI/d options respectively if operating costs are taken into account. If works are excluded that are needed for navigation but not for transfer the costs of the canal option remain significantly higher than for the Deerhurst pipeline (estimated to be 25% and 29% higher in terms of up-front costs for the 300 MI/d and 100 MI/d options respectively and 17% and 30% higher for the 300 MI/d and 100 MI/d options respectively if operating costs are taken into account). Furthermore, additional costs and risks have been identified that are not currently included in the canal costings that can be expected to widen the cost differential between the pipeline and the canal ▪ Greater operational complexity of a canal transfer that is likely to require cooperation of external infrastructure operators (Canal and River Trust for the Gloucester & Sharpness Canal and the operator for the Cotswold Canal), that has more assets in series which would reduce reliability, and that is readily accessible by the public increasing vulnerability to pollution and vandalism. The canal would also be open for navigation during times of transfer, which adds to the complexity of operating the canal transfers. The open nature of the canal means that it is 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 significant risk to water availability during hot, dry periods and could
Cotswold Canal 300	



Option Type/Name	Rejection Reasoning
	<p>restrict the supply of water from this route, at a time when the water is likely to be most needed. We commissioned independent experts Centre for Ecology and Hydrology to investigate this aspect and the findings of their report support 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).</p> <ul style="list-style-type: none"> ▪ Greater construction complexity of a canal transfer due to the need to construct assets of which we have little experience, the need to interface those assets with existing historical assets and the need for construction in urban areas ▪ Based upon advice from an independent expert from the University of Cambridge, Dr David Aldridge, it has been concluded that the Cotswold canal option carries a higher risk of spread of non-native invasive species than the pipeline. The pipeline concept includes sand filtration before transfer across the catchment boundary and transfer is affected in a closed pipeline. Whereas the canal concept provides filtration to the transfer flow downstream of the open water canal sections in the Thames catchment to ensure discharge quality at the point of transfer discharge to the River Thames. The canal is likely to provide habitat for invasive non-native species (INNS); there is the potential for ‘jump dispersal’ of invasive species between sections of open water and although the River Severn and River Thames are currently linked through the canal network, a fully restored canal will create a new direct link between the Lower Severn and the Upper Thames. The INNS paper from Dr David Aldridge, which is included in the RWT Feasibility Report, states: <p><i>“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...</i></p> <p><i>...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.”</i></p> <p>There are, however, criteria where the Cotswold Canal option performs better than the Deerhurst Pipeline. In addition to the biodiversity opportunities that restoration of the canal would offer the other main benefits of the Canal transfer relate to the economic and recreational benefits from restoring the canal and potential associated heritage, conservation and landscape/visual amenity benefits. These potential wider economic and social benefits would only be fully achieved, however, if the Cotswold Canal 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 exist, the primary purpose of the transfer is to facilitate a cost effective, resilient and environmentally acceptable water resource for the south-east of England. The issues identified associated with the Cotswold Canal around cost, operational complexity and risk of INNS make it a less suitable water transfer solution than the Deerhurst Pipeline despite the potential benefits of the canal option, and it is for these reasons that Cotswold Canal option is rejected at this stage.</p>
River Severn (unsupported)	Rejected as being less cost effective than larger scale transfers. It also offers less adaptability to address future needs than larger scale alternatives.



Option Type/Name	Rejection Reasoning
Reuse ³	
Abbey Mills PS sewer mining and treatment at Lower Hall	<p>Rejected in preference to Beckton STW option for the following reasons:</p> <ul style="list-style-type: none"> ▪ the Beckton catchment options are mutually exclusive. Option type capacity combinations are possible for flows <200 MI/d ▪ higher treatment cost ▪ Reverse Osmosis (RO) waste stream (75 MI/d) to be returned to Beckton catchment for treatment due to treatment capacity limitation at Deephams and mitigating risk of increasing chloride concentration in the Deephams discharge ▪ planning designations, consents and requirements are likely to more onerous at the Abbey Mills PS site / Lower Hall site than at Beckton STW / Gascoigne Way ▪ effects on heritage assets at the Abbey Mills PS site ▪ restricted land opportunity for expansion at the Abbey Mills PS abstraction site ▪ nature conservation and biodiversity importance affected ▪ greater flood plain encroachment at the Lower Hall site
Abbey Mills PS sewer mining and treatment at Luxborough Lane	<p>Rejected in preference to the Abbey Mills PS (Lower Hall) option for the following reasons:</p> <ul style="list-style-type: none"> ▪ options are mutually exclusive – Option type capacity combinations are possible for flows < 200 MI/d ▪ the land area available at Luxborough Lane offers less scope for expansion / additional treatment processes than at Lower Hall ▪ RO waste stream (75MI/d) to be returned to Beckton catchment for treatment due to treatment capacity limitation at Deephams and mitigating risk of increasing chloride concentration in the Deephams discharge ▪ longer conveyance route (almost twice as long 21km verses 12.8km) ▪ additional major crossing and conveyance route complexity ▪ there is less potential to mitigate non-traffic impacts upon local properties
Greenwich PS Sewer Mining (Lower Hall)	<p>The two Greenwich PS options have been rejected at Stage 2 over retaining the better performing Millbrook Road and Wandle Valley options. The main / differentiating reasons being:</p> <ul style="list-style-type: none"> ▪ The assumed limit for reuse in the Crossness catchment is 190 MI/d ▪ The Crossness catchment options are mutually exclusive ▪ Other options available with shorter conveyance ▪ Visually sensitive viewpoints affected ▪ Heritage assets affected ▪ Lower Hall site is allocated for use as flood compensation storage

³ Mott MacDonald/Cascade, Water Reuse Feasibility Report prepared for Thames Water, updated September 2018



Option Type/Name	Rejection Reasoning
Greenwich PS Sewer Mining (Hogsmill)	<p>All the Crossness catchment options (five sets) are mutually exclusive. The two Greenwich PS options (treatment within Deephams treatment works, previously at Lower Hall or at Hogsmill) have been rejected over retaining the better performing Millbrook Road and Wandle Valley options. The main differentiating reasons being:</p> <ul style="list-style-type: none"> ▪ Greater length of conveyance for the same option type capacity ▪ Visually sensitive viewpoints affected by proposed water reuse treatment works for the Greenwich options ▪ Heritage assets affected ▪ The Greenwich PS options also perform less well than the Crossness STW site option due to higher costs, including the need for larger pre-treatment storage (during night flow)
Millbrook Road PS Sewer Mining (Hogsmill)	<p>The Crossness Millbrook Road PS to Hogsmill STW options have been screened out in preference to the better-performing, mutually exclusive Crossness STW site options for the following reasons:</p> <ul style="list-style-type: none"> ▪ The AIC (average incremental cost) £/m³ for corresponding capacity options is higher <ul style="list-style-type: none"> – Capacity 50 MI/d - Millbrook Road is 10% higher than Crossness STW – Capacity 100 MI/d - Millbrook Road is 13% higher than Crossness STW ▪ More impacts on visual sensitivity particularly at the PS location ▪ Fewer opportunities for biodiversity enhancement at the abstraction site ▪ Potentially restricted land opportunity for expansion at Millbrook Road PS abstraction location ▪ Larger pre-treatment storage (during night flow) required than for the corresponding Crossness STW option at the same capacity ▪ Less potential to mitigate non-traffic impacts upon local properties (site locations and conveyance routes)
Wandle Valley PS Sewer Mining (Hogsmill)	<p>The Crossness Wandle Valley PS option is screened out in preference to the better performing, mutually exclusive Crossness STW site options for the following reasons:</p> <ul style="list-style-type: none"> ▪ The option has similar conveyance length as the Crossness STW option but lower capacity (only 17 MI/d) ▪ No potential to expand the option ▪ Average incremental cost (AIC) £/m³ is higher than similar comparable options e.g. 17 MI/d Wandle Valley PS is 10% higher than 100MI/d Millbrook Road PS
Long Reach STW Final Effluent Reuse (adjacent to site)	<p>The reasons for rejecting the Long Reach and Riverside STW options are as follows:</p>
Riverside STW Final Effluent Reuse	<ul style="list-style-type: none"> ▪ Significant conveyance lengths (>25km) for minimal option capacity: <ul style="list-style-type: none"> – Long Reach option capacity of 90 or 50 MI/d - length of conveyance 31.4km – Riverside option capacity of 38 MI/d - length of conveyance 25.8km



Option Type/Name	Rejection Reasoning
(adjacent to site)	<ul style="list-style-type: none"> Conveyance complexity due to length and number / type of pipeline crossings for the options
Deephams STW Final Effluent Reuse 25 MI/d	<p>For small capacity options, the upper capacity limit provides better value due to economies of scale. For the Deephams Reuse options the lower and upper capacity bands were established through work undertaken in WRMP14.</p>
Mogden Final Effluent Reuse (Mogden STW)	<p>The Mogden STW 212 MI/d option includes redevelopment of part of the existing Mogden STW Works site to accommodate the necessary reuse treatment, followed by conveyance of the reuse water to connect into the existing TLT. The option is screened out in preference to the option with treatment at Hydes Field which discharges the reuse water upstream of Walton. The principal reasons for this decision are as follows:</p> <ul style="list-style-type: none"> the two options are mutually exclusive the option involving redevelopment of part of Mogden STW is expected to be more challenging with regards to: <ul style="list-style-type: none"> space constraints at the site and the need to potentially build upwards could have visual impacts for the sensitive (exclusively residential) surrounding area strict planning policy constraints at the site the lack of opportunity for biodiversity enhancement The option with reuse treatment at Hydes Field offers greater flexibility as it discharges upstream of Walton intake, allowing the reuse water to be abstracted for treatment at several different treatment works in west London or in east London (using the TLT). There is little difference in the Average Incremental Costs (AIC) between the option with treatment at Mogden STW and the option with treatment at Hydes Field. It is further noted that the AICs for Beckton reuse are lower than they are for any of the Mogden reuse variants.
Beckton Final Effluent Reuse 50 MI/d	<p>A single tunnelled conveyance has been selected to serve all Beckton (and Crossness) reuse options. This provides for future growth and limits disruption during construction instead of providing multiple individual pipelines, which would all need to use the same limited construction corridors. This results in strong economies of scale and means that 50 MI/d Beckton reuse option is rejected against the cost sub-dimension at Fine Screening.</p>
Mogden Final Effluent Reuse (treatment at Hydes Field)	<p>Deephams STW has been identified as the optimum potential site for a first water reuse plant for London. The main reason for this is that the other reuse options require substantial water conveyance infrastructure that would be a sunk cost if we were to decide at a later date not to expand water reuse further, for example because innovation in desalination technologies made desalination more competitive, or if a Deephams plant were to demonstrate that direct reuse is acceptable in terms of drinking water safety (which could render obsolete some infrastructure constructed to make sure reuse is indirect).</p> <p>The capacity of reuse at the Deephams site is limited to approximately 45 MI/d and Beckton has been identified as the next best site to follow on for any subsequent large scale development of water reuse. The Beckton reuse option performs better than Mogden reuse against a number of aspects:</p> <ul style="list-style-type: none"> Costs: Deephams STW has been identified as the least cost site for a first water reuse plant for London. Mogden reuse was previously rejected as being mutually exclusive with the Teddington DRA scheme, and so following rejection of the Teddington scheme it has been necessary to update the assessment of the next best site for development of reuse following Deephams.



Option Type/Name	Rejection Reasoning
	<p>The costs of the Mogden reuse scheme have therefore been updated for consistency with the Phase 3 Beckton reuse option costs to ensure that a fair comparison can be made. This comparison found Mogden reuse to be a less favourable option than Beckton reuse against the cost dimension owing to the combined cost of conveyance of the Mogden Effluent to Hydes Field, conveyance of reuse effluent from Hydes Field to Walton, and the costs of waste stream treatment and disposal when compared with the Beckton reuse option with conveyance to King George V Reservoir.</p> <ul style="list-style-type: none"> ▪ Phasing and adaptability: Should further investigation identify that impacts on the Middle Tideway of further reuse is not a constraint then the Beckton reuse option offers the potential to be extended to approximately 380 MI/d (nominal capacity). In contrast reuse at Mogden is constrained to 212 MI/d (nominal capacity) by potential availability of effluent from Mogden under drought conditions. Beckton reuse therefore offers significant benefits over Mogden reuse in terms of adaptability. ▪ Navigational impacts: Mogden reuse would reduce the volume of effluent discharged from Mogden STW at Isleworth Ait. This would have some impact upon water levels in the Upper Tideway which could impact accessibility for the Port of London Authority's Harbour Service launches, other emergency vessels and commercial services. Changes in water level could also potentially impact leakage levels at Richmond lock and lead to sport and recreational vessels being pushed more into the main channel causing potential increased incidents. The impacts on navigation for Beckton reuse, in comparison, are expected to be negligible. <p>With Deephams and Beckton reuse included in the Constrained List, scenario analysis indicates that there are more water reuse options on the Constrained List than could reasonably be required over the planning horizon. The scenario analysis in the Fine Screening Report (Section 5.4.1) does not envisage any circumstances where Deephams, Beckton and Mogden reuse could all be required.</p> <p>A further factor in the assessment is the poor performance of water reuse against the flexibility dimension and, in particular, it offers material dis-benefits against the ramp-up sub-dimension. A ramp-up time of eight weeks is estimated for water reuse using Reverse Osmosis from a 'care and maintenance' state, which would be employed for nine months of the year. The long ramp up time would substantially reduce the benefit of the reuse options if ramp-up were not commenced early enough to make the option available when required, or if ramp-up took longer than expected.</p> <p>Associated with the limitations imposed by ramp-up time and their consequential implications for the availability, or not, of water supply, both desalination and water reuse have been assessed as offering material dis-benefits against the following resilience sub-dimensions:</p> <ul style="list-style-type: none"> ▪ System outage: The ramp up times required for bringing a reuse water supply on-stream mean that when the reuse resource is in a 'care and maintenance' state it can provide limited benefit in dealing with unplanned outage events when they occur. ▪ Other failure modes: Our experience at the Gateway Desalination plant has demonstrated that Reverse Osmosis technology, which is also currently proposed for water reuse, can be unreliable in intermittent operation and also subject to ramp-up delays. <p>On these cumulative grounds the Mogden reuse option has not been carried forward to the Constrained List.</p>



Option Type/Name	Rejection Reasoning
Crossness Final Effluent Reuse	<p>Deephams STW has been identified as the optimum potential site for a first water reuse plant for London. The main reason for this is that the other reuse options require substantial water conveyance infrastructure that would be a sunk cost if we were to decide at a later date either not to expand water reuse further (for example because innovation in desalination technologies made desalination more competitive), or if a Deephams plant were to demonstrate that direct reuse is acceptable in terms of drinking water safety.</p> <p>The capacity of reuse at the Deephams site is limited to approximately 45 Ml/d and Beckton has been identified as the next best site to follow on for any subsequent large scale development of water reuse. It is envisaged that indirect reuse at Beckton would require the construction of a conveyance tunnel from Beckton to Lockwood Shaft on the TLT Extension, while direct reuse would require a tunnel from Beckton to Coppermills WTW for blending. The water conveyance distance, whether to Lockwood Shaft or to Coppermills WTW is greater from Crossness than it is from Beckton.</p> <p>Crossness reuse has been rejected on the basis that there are more water reuse options than could reasonably be required over the planning horizon and it is the least favourable reuse option measured against the cost dimension on the Feasible List. The scenario analysis in section 5.4.1 of the Fine Screening Report does not envisage any circumstances where Deephams, Beckton and Crossness reuse could all be required.</p> <p>Furthermore the cumulative impact of developing multiple water reuse, desalination and DRA schemes could increase salinity in the Thames Tideway, resulting in moderate, probably reversible impacts on potentially sensitive ecological receptors as a result of disruption of communities. To mitigate this the decrease in freshwater inputs to the Tideway should be limited to no more than 275-366 Ml/d, as discussed in Appendix L of the Fine Screening Report. This would limit the total additional capacity of water reuse and desalination options to a maximum of 275 Ml/d without more detailed analysis to confirm that higher levels would be acceptable.</p> <p>A further factor in the assessment is the poor performance of water reuse against the flexibility dimension and, in particular, it offers material dis-benefits against the ramp-up sub-dimension. A ramp-up time of eight weeks is estimated for water reuse using Reverse Osmosis from a 'care and maintenance' state, which would be employed for nine months of the year. The long ramp up time would substantially reduce the benefit of the reuse options if ramp-up were not commenced early enough to make the option available when required, or if ramp-up took longer than expected.</p> <p>Associated with the limitations imposed by ramp-up time and their consequential implications for the availability, or not, of water supply, both desalination and water reuse have been assessed as offering material dis-benefits against the following resilience sub-dimensions:</p> <ul style="list-style-type: none"> ▪ System outage: The ramp up times required for bringing a reuse water supply on-stream mean that when the reuse resource is in a 'care and maintenance' state it can provide limited benefit in dealing with unplanned outage events when they occur. ▪ Other failure modes: Our experience at the Gateway Desalination plant has demonstrated that Reverse Osmosis technology, which is also currently proposed for water reuse, can be unreliable in intermittent operation and also subject to ramp-up delays.



Option Type/Name	Rejection Reasoning
	<p>We have confirmed that we currently consider that the cumulative effect of exposure to these resilience risks would be unacceptable if all desalination and reuse options at both Beckton and Crossness were developed using Reverse Osmosis technology.</p> <p>On these cumulative grounds the Crossness reuse option has not, therefore, been carried forward to the Constrained List.</p>
DRA⁴	
<p>Beckton effluent transfer to Teddington and increased abstraction upstream</p>	<p>The option for transfer of Beckton treated effluent to Teddington Weir to support additional DRA has been rejected at Stage 1 on the basis of proximity to abstraction points. The option had been considered as the transfer route could have been potentially negotiated within the Thames Tideway Tunnel (TTT). However, it would have impacted on the design of the tunnel, increasing its diameter by approximately 200mm, causing issues with maintenance and potentially adding treatment requirements for the effluent prior to transfer. As construction contracts have been awarded for the TTT in 2016 and funding for WRMP19 will not be approved until 2020 there is a fundamental misalignment of the two programmes and associated funding cycles which means that the option could not be implemented without negatively impacting effectiveness of the Thames Tideway scheme. Without utilisation of the TTT, the transfer tunnel required between Beckton and Teddington Weir is 20km.</p> <p>Alternative options for effluent transfer from Mogden STW have been developed to replace it.</p> <p>The Mogden effluent transfer options have been rejected due to potential ecological impacts arising from water temperature increases associated with the discharge. Further information is provided in the Rejection Register entry for the Mogden DRA option that discharges to the TLT. Similar issues would also prevent the Beckton effluent transfer option from being included on the Feasible List.</p>
<p>Mogden effluent transfer to Teddington and increase of existing river abstraction upstream at Surbiton</p>	<p>This option comprised of increasing an existing river abstraction upstream of Teddington Weir which would require a transfer of effluent from Mogden STW to Teddington Weir to maintain Teddington Target Flows. Increasing the abstraction at Surbiton was deemed to have the least impact on the River Thames as it is closest to Teddington Weir. However, the existing intake could not be rehabilitated to deliver the full potential flow of the option and so duplication would be required. This option has been rejected due to the additional conveyance length in comparison with the Teddington DRA option which transfers flow to the TLT.</p> <p>The Mogden effluent transfer option discharging to the TLT has been rejected due to potential ecological impacts arising from water temperature increases associated with the discharge. Further information is provided in the Rejection Register entry for the Mogden DRA option that discharges to the TLT. Similar issues would also prevent the Mogden effluent transfer option with abstraction at Surbiton from being included on the Feasible List.</p>
<p>Mogden effluent transfer to Teddington and river abstraction to Queen Mother Reservoir</p>	<p>The option comprises transfer of 300 Ml/d from Mogden STW to Teddington Weir, allowing additional abstraction upstream of Teddington Weir with flows transferred to Queen Mother Reservoir. This option has been rejected due to the additional conveyance length and additional associated cost from the transfer to Queen Mother Reservoir, in comparison to the Teddington DRA option which transfers flow to the TLT.</p>

⁴ Mott MacDonald/Cascade, Direct River Abstraction Feasibility Report prepared for Thames Water, updated September 2018



Option Type/Name	Rejection Reasoning
	<p>The Mogden effluent transfer option discharging to the TLT has been rejected due to potential ecological impacts arising from water temperature increases associated with the discharge. Further information is provided in the Rejection Register entry for the Mogden DRA option that discharges to the TLT. Similar issues would also prevent the Mogden effluent transfer option with abstraction and transfer to Queen Mother Reservoir from being included on the Feasible List.</p>
<p>Mogden effluent transfer to Teddington and river abstraction at Teddington for direct supply</p>	<p>The option comprises transfer of 300 MI/d from Mogden STW to Teddington Weir, allowing additional abstraction upstream of Teddington Weir with flows treated and put directly into supply. This option is located upstream of the alternative abstraction location near the YMCA Hawker Centre. It is further away from the transfer location and will cause more detriment to river flows. There are also issues with this location due to the high land costs and the number of lease holders on this site – including one lease valid until the year 2109. In addition, it is anticipated that the Honor Oak to Hampton 42 inch water mains are at capacity and will need significant network reinforcement to utilise the potable water treated at this site. It has therefore been rejected in favour of the Teddington DRA option which transfers flow to the TLT.</p> <p>The Mogden effluent transfer option discharging to the TLT has been rejected due to potential ecological impacts arising from water temperature increases associated with the discharge. Further information is provided in the Rejection Register entry for the Mogden DRA option that discharges to the TLT. Similar issues would also prevent the Mogden effluent transfer option with abstraction, treatment and direct supply from being included on the Feasible List.</p>
<p>Mogden effluent transfer to Teddington and new river abstraction at Teddington with direct transfer to TLT.</p>	<p>River modelling identified that one of the likely impacts of the option would be an increase in water temperature in the freshwater River Thames locally above Teddington Weir and in the Upper Tideway as a consequence of discharging treated effluent at Teddington. The potential temperature effects were identified as a key concern to aquatic ecology in the draft WRMP, and the Environment Agency has advised that mitigation would need to achieve a zero temperature increase.</p> <p>Both operational mitigation, to reduce / temporarily suspend the DRA operation, and engineering solutions, to cool the treated effluent prior to discharge, to achieve a zero temperature increase have been investigated. At present a robust temperature mitigation package to achieve zero temperature uplift has not been identified. Please refer to Appendix F of the DRA Feasibility Report for the statement of Thames Water and Environment Agency common understanding of the water environment effects of the Teddington DRA option.</p> <p>Environment Agency and Natural Resources Wales (2017) Water Resources Planning Guideline Section 6.11 states: <i>“You should confirm that there is no risk of deterioration from a potential new abstraction or from increased abstraction at an existing source before you consider it as a feasible option”.</i></p> <p>The Option 3a Teddington DRA is now, therefore, rejected as a feasible option, whereas previously in the draft WRMP19 it was included in the Preferred Programme, subject to identification of appropriate temperature mitigation targets and the inclusion of necessary mitigation to achieve those targets.</p>
<p>New river abstraction on River Roding</p>	<p>This option combines the flows from the Lower Roding and Seven Kings assessment points, for which it was estimated that the volumes available were 17.3 MI/d and 3.9 MI/d with a reliability of supply of 70% of the year, and transfer to Lee Valley Reservoirs, or full treatment and put into direct supply. From a review of the long-term flow record (1950-2015) at the Environment Agency’s Roding at Redbridge flow gauge, this hands-off flow condition would protect flows less than Q90 and abstraction would not reduce these low flows. At moderately low flows, abstraction would be constrained to less than 3 MI/d to comply with the hands-off flow condition. A further review of the long-term flow record identified that in drought conditions, it is</p>



Option Type/Name	Rejection Reasoning
New river abstraction on River Mardyke	<p>improbable that the scheme would provide any significant DO benefit as there would be very little flow available above the hands-off flow at times when the resource is most needed. In addition, this source is not anticipated to be resilient with climate change.</p> <p>This option comprised of a new intake on the River Mardyke, abstraction at 3.7 MI/d with full treatment and distribution of flows directly into supply. Based on historical data there is insufficient flow at this location for use as a reliable resource. In addition, this source is not anticipated to be resilient with climate change. The Environment Agency has identified that abstraction would not be allowed to reduce flows below 4.41 MI/d, a hands-off flow condition. Abstraction would therefore be constrained to less than 2 MI/d to comply at moderately low flows. From review of the long-term flow record (1950-2015) at the Environment Agency's Mardyke at Stifford flow gauge, this hands-off flow condition would protect flows less than Q90 and abstraction would not reduce these low flows. At moderately low flows, abstraction would be constrained to less than 2 MI/d to comply with the hands-off flow condition. A further review of the long-term flow record identified that in drought conditions it is improbable that the scheme would provide any significant DO benefit in drought conditions as there would be very little flow available above the hands-off flow when the resource is most needed. For example, in the severe 1976 drought, between the months of May to September, abstraction would only have been possible on 65 days with abstraction of 3.7 MI/d on only 26 days (17% of the period). Abstraction over the May to September 1976 period would have only yielded a total of about 160 MI (an average of just over 1 MI/d during the drought critical period driving the DO assessment).</p>
New river abstraction on River Rom/ Beam	<p>This option comprised a new intake on the River Rom/Beam, abstraction at 7.2 MI/d with full treatment and distribution of flows directly into supply. Based on historical data there is insufficient flow at this location for use as a reliable resource. In addition, this source is not anticipated to be resilient with climate change. The top-down review of resource availability included in Appendix A of the Feasibility Report identified a potential new option for abstraction from the River Rom/Beam of up to 7.2 MI/d with a reliability of 70% of the year. A potential option is to abstract flows from the River Rom/Beam, then treat and supply directly, as the Lee Valley Reservoirs (the nearest raw water reservoirs) are over 15km away. The Environment Agency has identified that abstraction would not be allowed to reduce flows below 8.8 MI/d, a hands-off flow condition.</p> <p>From a review of the long-term flow record (1965-2015) at the Environment Agency's Beam at Bretons Farm flow gauge, this hands-off flow condition would protect flows less than about Q85 (the flow of a river which is exceeded on average for 85% of the time). Abstraction would however be constrained at moderately low flows between Q85 and about Q65 to less than 1 MI/d with this hands-off flow condition at moderately low flows. Based on the historical record, it is improbable that the scheme would provide any significant (DO) benefit in drought conditions as there would be very little flow available above the hands off-flow when the resource is most needed. Further review of the long-term flow record identified that during drought conditions, it is improbable that the option would provide any significant DO benefit as there would be very little flow available above the hands-off flow at times when the resource is most needed. For example, in the severe 1976 drought during the months of May to September, abstraction would only have been possible on 25 days (16% of the period) with abstraction of 7.2 MI/d only possible on 19 days. Abstraction over the May to September 1976 period would have yielded only a total of about 629 MI (an average of 4.1 MI/d during the drought critical period driving DO assessment).</p>
New river abstraction on River Ingrebourne	<p>This option comprised of a new intake on the River Ingrebourne, abstraction at 4.2 MI/d with full treatment and distribution of flows directly into supply. Based on historical data there is insufficient flow at this location for use as a reliable resource. In addition, this source is not anticipated to be resilient with climate change. The Environment Agency has identified that abstraction would not be allowed to reduce flows below 11.5 MI/d near to the tidal limit, a hands-off flow condition. Abstraction would be</p>



Option Type/Name	Rejection Reasoning
	<p>constrained to be less than 2 MI/d to comply with this hands-off flow condition at moderately low flows. Based on the historical record, it is improbable that the scheme would provide any significant DO benefit in drought conditions as there would be very little flow available above the hands off-flow when the resource is most needed. From a review of the long-term flow record (1970-2015) at the Environment Agency's Ingrebourne at Gaynes Park flow gauge (located upstream of the hands-off flow point), this hands-off flow condition would protect flows less than about Q90. Abstraction would however be constrained at moderately low flows between Q90 and about Q70 to less than 2 MI/d to comply with the hands-off flow condition. Further review of the long-term flow record identified that during drought conditions, it is improbable that the option would provide any significant DO benefit as there would be very little flow available above the hands-off flow at times when the resource is most needed. For example, in the severe 1976 drought between May and September, abstraction would only have been possible on 45 days (30% of the period) with abstraction of 4. 2MI/d only possible on 16 days. Abstraction over the May to September 1976 period would have yielded only a total of about 206 MI (an average of 1.3 MI/d during the drought critical period driving DO assessment).</p>
<p>New river abstraction from River Lee at Three Mills Lock, transfer to North Woolwich Road site for treatment to potable quality, followed by transfer to service reservoir</p>	<p>This option included abstraction at Three Mills Lock, transfer to seven day bankside storage and treatment location south of North Woolwich Road, followed by conveyance to Woolwich Common Service Reservoir south of the River Thames. Reservoir storage equivalent to seven days throughput has been provided to help manage and mitigate the risks associated with pollution in the River Lee and to allow the abstraction regime to be better controlled. In particular these pollution risks relate to pollution from contaminated land around the Olympic Park area. A number of constraints were found including: construction complexity, pumping head, ownership of site and archaeology and historic environment criteria.</p> <p>This option is mutually exclusive with the indirect option to abstract at Three Mills Lock which involves partially treating flows at the abstraction location and transfer to the Lee Valley reservoirs. The transfer to the existing River Lee reservoirs provides greater dilution and retention time between abstraction and supply allowing more time to respond to a pollution incident and reducing the potential impact. The indirect option is therefore considered to be a lower drinking water safety plan risk to drinking water safety, compared to the direct option. Additionally, in comparison to the indirect option the direct option found more constraints during the assessment. The option for DRA and supply to Woolwich Common Service Reservoir has therefore been rejected in comparison with the indirect option to the Lee Valley Reservoirs.</p>
<p>New river abstraction from River Lee at Three Mills Lock and transfer to Lee Valley Reservoirs</p>	<p>The Lower Lee DRA option has been rejected in comparison with the Deephams reuse option to which it is mutually exclusive. The Deephams option performs better than the Lower Lee option in a number of respects including having a higher DO, lower cost and better operability. The operability concerns for the Lower Lee options arise from the raw water quality risks that arise from contaminated land adjacent to the Lower Lee and the potential for contaminated groundwater to impact on river water quality under certain hydrogeological conditions.</p>
<p>Desalination⁵</p>	
<p>River Lee, Coppermills WTW (blended)</p>	<p>Significant compensation would be required to relocate well developed commercial and industrial businesses as part of land purchase agreements. This option also lies furthest from the River Thames, requiring a longer abstraction pipeline through third party land or public highways, including a number of major transport link crossings, industrial and residential properties. A</p>

⁵ Desalination Feasibility Report prepared for Thames Water by Mott MacDonald/Cascade, updated June 2017



Option Type/Name	Rejection Reasoning
	<p>recognised viewpoint lies within 5km of the proposed site which could be affected by this option. This option also has the most residential properties within 350m of the site boundary, with over 1500 properties identified that would be affected by construction impacts. This option is directly comparable to Estuary North, Beckton which performs better due to its flexibility regarding potential land availability at Beckton STW, has fewer residential properties around the site and offers the potential resilience benefit of improving distribution from the existing Thames Gateway Desalination Plant. Although this option would require a shorter tunnelled conveyance, both treated water tunnel conveyances would be complex but the River Lee conveyance would cross significant infrastructure of the Olympic Park. Estuary North, River Lee is therefore rejected in favour of Estuary North, Beckton which also has the potential to facilitate future expansion of desalination capacity at Crossness.</p>
Manor Road, Erith, Honor Oak, (blended)	<p>There is no Thames Water owned land in the vicinity, with land purchase required and the added risk that a portion of the site is Crown land. This option is also located furthest east, requiring a longer tunnel to convey treated water to Honor Oak or Coppermills for blending into the potable network. The land is un-developed, greenfield land entirely within the zone 2 or 3 floodplain, so some degree of compensatory land may be required. This option has been rejected in favour of Estuary South, Waldrist Way which requires a significantly shorter tunnel, has better existing access to the road network and is not located within a flood zone 2 or 3. Estuary South, Waldrist Way offers the potential resilience benefit of improving distribution from the existing Thames Gateway Desalination Plant.</p>
Tripcock Ness, Thamesmead Coppermills WTW (blended)	<p>The Stage 2 assessment identified that the land that had been chosen for the Thamesmead treatment site is not feasible as it is allocated in the Local Plan as Metropolitan Open Land (MOL) 20+6 hectares, with mixed use land (including 2,000 residential housing and commercial use) 27.5 hectares and a proposed primary school site 1.9 hectares. An alternative site in the vicinity has therefore been identified south of Erith Marshes on Waldrist Way.</p>
Crossness (Erith Southern Grazing Marshes)	<p>The Stage 3 assessment identified marginal difference in the normalised cost of all Crossness blended desalination options. This option lies on greenfield marsh land which is less preferable than comparable options on brownfield sites and is located furthest from the point of distribution, requiring the longest conveyance with the most infrastructure crossings. This option has been rejected in favour of Estuary South, Waldrist Way which is on a mixed greenfield and brownfield site. The normalised costs are similar, however the Estuary South, Waldrist Way option has better scope for biodiversity improvement and is preferable for preservation of water quality. It also offers the potential resilience benefit of improving distribution from the existing Thames Gateway Desalination Plant and would allow desalination capacity to be introduced in a phased approach, with the potential for two 150 MI/d plants to be constructed at Beckton and south of Crossness using the same conveyance.</p>
Crossness (unblended), Northumberland Heath	<p>This option would continuously supply Northumberland Heath service reservoir with desalinated water. It has been rejected due to substantial dis-benefits against the promotability, deliverability and resilience dimensions at fine screening. Outage events would result in changes in water quality as the supply would revert to the conventional sources. Our experience suggests this would lead to a significant increase in customer water quality complaints. The full capacity of the plant may not generally be utilised, as it would be less suitable than conventional water resources for supplying other zones due to the impact of changing water quality. Current average demand means that up to 15 MI/d may be un-utilised in the short-medium term. This option also could not be used to support outage at another works without a change in water quality and the resolution of likely consequential</p>



Option Type/Name	Rejection Reasoning
	customer complaints.
Groundwater⁶	
GW - Epsom	Disaggregation of the licence would allow abstraction to be increased from the Chalk aquifer as it would remove constraints within the existing individual components of the group licence. Only very minor engineering works would be required. The Environment Agency will not support the proposed licence disaggregation due to concerns about the impact of the increased abstraction on flows in the River Hogsmill. This option was therefore rejected due to no realistic prospect of an abstraction licence and concerns about the water availability (CAMS ⁷ status)
North London Licence Trading/ Transfer	Attempts to engage with third party supplier have not been successful. Rejected at Stage 1 on the basis of there not being a realistic prospect of an abstraction licence.
Shortlands	Shortlands is rejected due to uncertainties regarding the impact of the abstraction on groundwater levels in the Chalk aquifer, flows in the River Ravensbourne, reduction in DO at nearby Thames Water abstractions and the stability of the Thanet Sands Formation. This therefore failed due to hydrogeological suitability and water source and availability.
London confined Chalk (north-east)	A review of data from the British Geological Survey BGS, Environment Agency and Essex and Suffolk Water indicate that there is unlikely to be sufficient yield within the identified area to provide any DO benefit for the London WRZ or justify further investigation. This therefore failed due to hydrogeological suitability and water source and availability.
Reservoir⁸	
Site 13 Uffington	These options failed due to insufficient clay thickness of less than 10 metres. Any reservoir site will require a sufficient depth of clay to provide an impermeable base. The depth of this layer would be determined by site-specific factors, however a depth of at least 10m will be required for lining purposes to ensure that there is no leakage into the groundwater and to contribute to the construction of embankments. Sites with insufficient clay thickness are rejected due to significant environmental impacts external to the site to import large volumes of clay.
Site 20 West Hanney	
Site 47 Bierton	
Site 46 Stewkley	
Site 3 Cricklade	These options failed due to statutory heritage designations which include World Heritage Sites, Scheduled Monuments and Grade I Listed Buildings. The National Planning Policy Framework (NPPF) identifies these designations amongst those heritage assets of the highest significance, which should be preserved from development. These constraints are considered to be of such importance, and with respect to Listed Buildings of such a site-specific nature, that their presence within a proposed site area was considered sufficient at Stage 1 of the screening process to render it unsuitable for reservoir development.
Site 9 Lechlade on Thames	
Site 28 Brightwell Cum Sotwell	

⁶ Mott MacDonald/Cascade, Groundwater Feasibility Report prepared for Thames Water, updated September 2018

⁷ Catchment abstraction management strategy

⁸ Mott MacDonald/Cascade, Reservoirs Feasibility Report prepared for Thames Water, updated June 2017



Option Type/Name	Rejection Reasoning
Site 29 Ambrosden Site 24 Kidlington	
Site 27 Beckley Site 46 Stewkley	
Site 24 Kidlington Site 27 Beckley	These options failed due to statutory nature conservation designations due to Ramsar, Special Areas of Conservation (SAC), Special Protection Areas (SPA) and Sites of Special Scientific Interest (SSSI) designated conservation sites. These designations are regarded as the UK's best wildlife habitats and as such should be protected from development. SPA, SAC and Ramsar sites are protected under European Directives. The NPPF identifies all these designations as being of importance when determining planning applications. As part of the screening process the identification of any of these designated sites within a proposed site area was considered sufficient to reject that option.
Site 31 Wheatley	
Site 4 Swindon Site 51 Burghfield	Rejected due to the presence of built development on the site
Site 1 Minety	Site rejected because it contains Grade II Listed Buildings, would cause the loss of over 10 residential dwellings and is distant both from an intake / outfall point and from people who would potentially benefit from access to a recreational resource.
Site 2 Leigh	A disused airfield which covers a large proportion of the Leigh site is now owned and managed as a Wiltshire Wildlife Trust reserve and is a County Wildlife Site, which is open to the public. The majority of this reserve would be lost should the site be selected for reservoir development. The site is also located distant from a potential intake / outfall point and has large topographical variation across the site.
Site 5 Broad Blunsdon	Rejected due to poor performance across many criteria including presence of Ancient Woodland and distance from potential intake / outfall points.
Site 6 Highworth	The site boundary includes two Grade II Listed Buildings and a national recreational resource -Thames Path National Route, plus other public rights of way including local footpaths and a bridleway. It is located distant from potentially suitable intake / outfall points and there is high topographical variation across the site.
Site 7 Wanborough	Rejected due to poor performance in many assessment criteria including planning, cost and flood risk
Site 8 Bishopstone	This site is located near to a national designated landscape, with the North Wessex Downs Area of Outstanding Natural Beauty (AONB) being only 300m away. The site is also distant from a potential intake / outfall location and has a high degree of topographic variation.
Site 10 Shrivenham	The site contains Ancient Woodland, considered to be irreplaceable, as well as Listed Buildings and comprises high value agricultural land. It is close to the North Wessex Downs AONB, is remote from people who could benefit from access to a new recreational facility and access requires use of local roads that passes through built up areas.
Site 11 Clanfield	The site comprises of mainly high value agricultural land and construction access would be via B roads and through Farringdon. There is also a high level of topographic variation (25m difference) and significant difficulties to achieve rail access - 11km from an operational railway line, with requirement for many structures, although can make use of disused railway line for some of the route.



Option Type/Name	Rejection Reasoning
Site 12 Faringdon	The site contains several woodlands designated as Ancient Woodland as well as Listed Buildings. It also contains a high number of residential properties that would be lost and has a large variation in topography.
Site 14 Brize Norton	The site contains Ancient Woodland and predominately high value agricultural land. There is a high level of topographical change across the site and access requires use of local roads through built up areas. It would also involve the loss of a high number of residential dwellings.
Site 15 Brampton	The site contains sites of archaeological interest, including Grade II Listed Buildings and comprises mainly high value agricultural land. In addition, more than 50% of the site sits within flood zones 2 or 3.
Site 16 Witney	The site contains Grade I and Grade II Listed Buildings, and comprises mostly high value agricultural land. The site contains 25-50% in flood zones, and contains a high number of residential dwellings which would be lost.
Site 17 Stanford in the Vale	The site does contain Grade I and Grade II Listed Buildings and a high number of residential properties would be lost. Access to the site also requires use of local roads that pass through built up areas.
Site 18 Longworth	This site contains Ancient Woodland which is considered to be irreplaceable and would be difficult to avoid through boundary revisions. Furthermore, part of the site is included within/abuts the Conservation Area of Longworth and is remote from suitable rail access.
Site 19 South Leigh	This site contains Ancient Woodland which would not be possible to replace and Listed Buildings which would be lost through reservoir construction. Significant difficulties to achieve rail access – more than 5km from an operational railway line, with requirement for upgrade of many structures, although potential to use disused railway line South of Eynsham and Cassington.
Site 21 Stanton Harcourt	Over 50% of the site sits within flood zones 2 and 3, presenting a high risk of flooding to the site. Furthermore, recreational resource of national importance would be affected - Thames Path National Trail, plus public rights of way including two footpaths, and a bridleway.
Site 22 Abingdon (30Mm ³ and 50Mm ³)	<p>The “What If” scenario analysis in the Fine Screening Report indicates that there are potential future scenarios where a large reservoir option might be required, if other options are prevented from progressing. However, development of a small reservoir on the site would potentially “sterilise” the site preventing a large reservoir from being constructed at a later date. It is therefore recommended that if small reservoirs are required then they should be designed so as to allow future expansion.</p> <p>The following small single-phase reservoir sizes have been screened out on the grounds that their development would prevent a large reservoir from being developed on the site.</p> <ul style="list-style-type: none"> ▪ Abingdon Reservoir single phase 30Mm³ ▪ Abingdon Reservoir single phase 50Mm³ <p>Should a small reservoir be required (e.g. to supply the SWOX WRZ) then the first 30 Mm³ phase of the two phase 30Mm³ + 100 Mm³ would be more appropriate as it would not preclude subsequent expansion to supply London WRZ.</p>
Site 23 Wantage	This site performed poorly against many of the performance measures and contains Ancient Woodland, considered to be irreplaceable, a Grade II Listed Building and is within 100m of an AONB. Land use is mainly high grade agricultural land, topographic variations are high and a high number of residential dwellings would be lost as a result of development.



Option Type/Name	Rejection Reasoning
Site 25 Oxford	The site contains a number of nationally designated assets including Ancient Woodland, two Grade II listed buildings, part of a Registered Park and Garden and a national trail. Also performs poorly in terms of flood risk.
Site 26 Didcot	The site lies within an Area of Outstanding Natural Beauty, comprises mostly high value agricultural land and construction traffic would make use of local roads that pass through built up areas.
Site 30 Drayton St Leonard	This site is distant from an operational railway, contains predominately high value agricultural land and performs poorly in terms of the high number of people that would likely be affected by construction.
Site 33 Chalgrove	Rejected due to poor performance across many criteria including construction traffic and topographical variation.
Site 35 Chalgrove Airport	The site performs poorly against many of the performance measures. It contains Grade II Listed Buildings, part of a Registered Historic Battlefield, recreational resources of national/regional importance and high value agricultural land. Land acquisition costs are likely to be high. A large number of residents are likely to be impacted by construction activities and construction traffic would pass through built up areas.
Site 36 Marsh Gibbon	See site 41
Site 37 Ludgershall	Rejected due to poor performance across many of the criteria, including the likely need for off-site compensation storage for flood plain encroachment, landscape impacts and cost. Additionally, for Ludgershall 50Mm ³ the site also had complex construction requirements.
Site 38 Great Haseley	The site contains Ancient Woodland which is considered to be irreplaceable. It is distant from an operational railway line, has high topographical variation and construction traffic would need to pass through a built-up area.
Site 39 Quainton	The site does contain Ancient Woodland and a number of Listed Buildings, which would be lost as a result of development. There is also high topographical variation across the site.
Site 40 Postcombe	Rejected due to insufficient storage capacity
Site 54 Bracknell	
Site 41 Chinnor and Site 36 Marsh Gibbon	<p>Three sites for new reservoir development were included on the Feasible List at Abingdon (up to 150 Mm³), Chinnor (up to 50 Mm³) and Marsh Gibbon (up to 75 Mm³). The fine screening assessment of these options has found that the Marsh Gibbon and Chinnor sites perform less well than the Abingdon site across the environment & social, cost and deliverability dimensions.</p> <p>The Marsh Gibbon and Chinnor sites (up to 50 Mm³) and the Marsh Gibbon site (up to 75 Mm³) perform less well than the Abingdon site in respect of their comparative environmental performance. The Marsh Gibbon site performs less well than both of the other two sites in landscape terms due to the loss of characteristic ridge and furrow field patterns. The Chinnor site performs less well than both of the other sites in respect of its impact on visual amenity. Lastly, both the Chinnor and the Marsh Gibbon sites perform less well than the Abingdon site in respect of significant adverse effects on recreational facilities with both sites adversely impacting on national trails.</p> <p>The main reasons for the higher costs associated with the Chinnor and Marsh Gibbon sites compared with the equivalent Abingdon options are:</p> <ul style="list-style-type: none"> ▪ The requirement for substantially longer water intake pipelines to the reservoirs (3km, 19km and 32km for Abingdon, Chinnor



Option Type/Name	Rejection Reasoning
	<p>and Marsh Gibbon respectively);</p> <ul style="list-style-type: none"> ▪ More costly and extensive infrastructure to convey flows from emergency drawdowns to the River Thames from Chinnor and Marsh Gibbon compared with Abingdon. By reason of the much greater distance of Chinnor and Marsh Gibbon from the River Thames, the water must either be conveyed in new pipelines / channels or be first attenuated in a flood storage basin prior to discharge into existing small local watercourses. ▪ Lower earthworks quantities for Abingdon than for the Chinnor and Marsh Gibbon sites due to the Chinnor site and, more particularly, the Marsh Gibbon site, being more physically constrained. In addition, the Chinnor site is more steeply sloping than the other two sites. <p>An assessment has also been conducted to compare the costs of phased reservoir development at the Abingdon site against development of an equivalent volume of storage at multiple sites. The following combinations were considered:</p> <ul style="list-style-type: none"> ▪ 50 Mm³ at Abingdon, 50 Mm³ at Chinnor and 30 Mm³ at Marsh Gibbon ▪ 50 Mm³ at Abingdon, 50 Mm³ at Marsh Gibbon and 30 Mm³ at Chinnor ▪ Abingdon first phase of 80 Mm³ followed by second phase of 42 Mm³ <p>The assessment concluded that phased development on multiple sites would be approximately 50% more costly than phased development on an individual site. The costs for phased development at Abingdon are substantially lower as not only are the costs for development at the other sites more costly (as set out above) but also there is a significant amount of infrastructure that need not be duplicated in successive phases where development is undertaken on a single site including intake, river-reservoir conveyance (tunnel and PS) and material handling facilities such as railway sidings, work sites and stockpiling areas. Furthermore, some infrastructure such as floodzone reprovisioning, service and watercourse diversions and habitat creation can be more effectively completed within Phase 1 of a dual phase site, compared to completion on numerous occasions or sites. Once the potential for reservoir development at Abingdon site had been fully utilised, consideration could then be given to further reservoir development at the Chinnor and Marsh Gibbon sites. However, the “what-if” analysis conducted in this report suggests that other resource types (notably desalination and reuse) are expected to be more cost effective than further reservoir development at Chinnor and/or Marsh Gibbon.</p> <p>The Marsh Gibbon and Chinnor reservoir sites also perform less well than Abingdon as regards Deliverability against the constructability sub-dimension. Additional enabling infrastructure would be required for Marsh Gibbon and / or Chinnor due to their respective locations remote from the abstraction location and remote from a suitable watercourse for the discharge of water during emergency drawdown.</p>
Site 42 Haddenham	Rejected due to poor performance across many of the criteria, including landscape and visual impacts as well as complex construction requirements.
Site 43 Aylesbury	Aylesbury was also rejected due to the proximity of new housing developments immediately to the south of the site and potential for impacts on visual amenity and construction complexity. Additionally, for Aylesbury 50Mm ³ the site also had complex construction requirements.
Site 49 Cheddington	Acquisition costs are likely to be moderate due to the presence of a golf course within the site boundaries and there is a moderate variation in topographic levels across the site. The site contains Listed Buildings and includes part of a registered Park



Option Type/Name	Rejection Reasoning
	and Garden. Furthermore the site is located distant from potential intake / outfall point which would impact its cost and its carbon emissions.
Site 50 Kintbury	This site performs poorly against a number of measures. The site is situated within an AONB, contains Ancient Woodland and Listed Buildings. It is also a significant distance from an intake/outfall, and has high topographic variation. In addition, construction traffic would need to pass through small settlements and a high number of residential dwellings would be lost.
Site 52 Beech Hill	The site contains Ancient Woodland, which is considered to be irreplaceable. It also contains a number of Listed Buildings, numerous public rights of way including a national cycle trail. Additionally, it has high topographic variation, a high number of residential dwellings would be lost and acquisition costs are likely to be high.
Catchment Management	
Bean Wellfield (Groundwater) Brantwood Rd (Groundwater) Nonsuch (Groundwater) Wilmington (Groundwater) Southfleet (Groundwater) Green Street Green (Groundwater) North Orpington (Groundwater) Lower River Thames Lower River Lee	The feasibility report concluded that there were no catchment management options to be taken forward to the fine screening stage, primarily because there are significant uncertainties surrounding achievement of the estimated DO benefits. We will however be progressing catchment management schemes in other water source catchments as it extends its current catchment management work to address priority drinking water quality risks which will contribute to increasing the resilience of water sources and reduce the risk of reductions to DO and/or an increase in outage due to water quality deterioration (for example due to increased nitrate or pesticide application on water source catchments).

Specific option rejection – SWOX WRZ

Table Q-3: SWOX rejection summary

Type	Option	Rejection Stage			
		Stage 1	Stage 2	Stage 3	Fine screening
Groundwater					
	Woods Farm licence	×			
	GW - South Stoke 2 (with treatment)	×			
	GW - Moulsoford 2 (with treatment)	×			
	Cotswold Edge	×			
	River Marden		×		
	South Stoke 1			×	*
Aquifer Recharge					
	AR-Cricklade		×		
Removal of DO Constraints					
	Witheridge Hill borehole pumps		×		
Inter-Zonal					
	Transfer from Hambleton WTW to Long Crendon SR to an existing pipeline at Milton	×			
	Transfer from Hambleton WTW to Long Crendon SR to an existing service reservoir at Shotover.	×			
	Transfer from Hambleton WTW to Long Crendon SR to an existing pipeline at Marston	×			
	Transfer from Hambleton WTW to Nettlebed service reservoir to Beggarsbush service reservoir at South Oxford area.	×			
Inter-Company Transfer					
	RES-ICT-WSX-BLU- Charlton WTW to Minety SR to Blusdon SR in South Swindon		×		
	RES-ICT-WSX-ASH- Charlton WTW to Minety SR to Asthon Keynes WTW in South Swindon			×	
Catchment Management					
	Blockley (Groundwater)			×	
	Childrey Warren (Groundwater)			×	
	Dovedale (Groundwater)			×	
	Gatehampton (Groundwater)			×	
	Lower Swell (Groundwater)			×	
	Manor Road (Groundwater)			×	



Type	Option	Rejection Stage			
		Stage 1	Stage 2	Stage 3	Fine screening
	Ashdown Park (Groundwater)			×	
	Upper Swell (Groundwater)			×	
	Marlborough (Groundwater)			×	
DRA					
	New DRA from River Thames at Days Weir and transfer to Farmoor – supported by increased effluent returns from SWOX STWs	×			
	Recommission existing DRA at Culham and transfer to Farmoor Reservoir	×			
	Recommission existing DRA and treatment at Culham and directly supply to SWOX				×

* Rejected at Stage 4 Validation

Table Q-4: SWOX rejection reasoning

Option Type/Name	Rejection Reasoning
Groundwater⁹	
Woods Farm licence	An increase in abstraction licence and construction of a new abstraction borehole in the unconfined Chalk, 1.4 km east of the existing Woods Farm Boreholes, would enable an increase in abstraction from 5 to 8 Ml/d (average) and from 5.5 to 9 Ml/d (peak). The option also includes upgrades to WTW treatment and a new 1.4 km raw water pipeline from the new satellite borehole to Woods Farm WTW. The Environment Agency will not support an increase in abstraction licence at this location due to concerns over the impact of the abstraction on groundwater and on flows in the River Thames. This therefore failed due to no realistic prospect of an abstraction licence and concerns about the water availability (CAMS status).
GW - South Stoke 2 (with treatment)	Construction of four new abstraction boreholes on private land in the unconfined Chalk north of Goring. Water abstracted from the boreholes will be treated at a new on-site WTW, with 1.8 km run to waste pipeline for clearance pumping of the boreholes to the River Thames; 1.6 km waste run from the WTW to the existing local sewage works; and 1.4 km treated water pipeline to supply. The Environment Agency will not support a new licence in this location, without a corresponding reduction in upstream licence or hands-off flow condition, due to concerns over the impacts on flows in the River Thames and deterioration of the Chiltern Scarp groundwater body. This therefore failed due to no realistic prospect of an abstraction licence being granted and concerns about the water availability (CAMS status).
GW - Moulsoford 2 (with treatment)	Three new unconfined Chalk boreholes, treated at a new WTW which is partially on private land. Includes short lengths of raw, treated and washout pipelines and reservoir demolition on site. The Environment Agency will not support a new licence in this location, without a

⁹ Mott MacDonald/Cascade, Groundwater Feasibility Report prepared for Thames Water, updated September 2018



Option Type/Name	Rejection Reasoning
	corresponding reduction in upstream licence or hands-off flow condition, due to concerns over the potential impacts on flows in the River Thames and subsequent potential deterioration of the Chiltern Scarp groundwater body. This therefore failed due to no realistic prospect of an abstraction licence and concerns about the water availability (CAMS status).
Cotswold Edge	New borehole in the Cotswold Edge GWMU, abstracting from the Jurassic limestone aquifer. The Environment Agency has concerns regarding the potential impacts of a groundwater abstraction on surface water flows. Any new abstraction licence would be subject to a hands-off flow condition or may not be supported. There is also concern about the resilience of the aquifer to drought. Uncertain thickness and structurally complex geology means that the potential yield and success of a groundwater or AR/ASR option is considered to be high risk. This therefore failed due to no realistic prospect of an abstraction licence and drought resilience.
River Marden	New and unproven groundwater development in the headwaters of the River Marden. Two or more boreholes to be drilled in the Corallian Group aquifer. This option failed due to the low potential yield of the proposed boreholes, the cost to investigate yield and water quality. This therefore failed due to hydrogeological suitability and water source and availability.
South Stoke 1	The option comprises drilling of a new borehole in the Chalk and transfer of the Childrey Warren licence to the new site. This option is mutually exclusive of the Moulsoford 1 option, which has been carried forward to the fine screening stage. The Moulsoford option performs better on cost and there is also a risk of the South Stoke option derogating existing Thames Water groundwater sources. Therefore, the South Stoke 1 option was rejected at the validation stage.
Aquifer Recharge	
AR-Cricklade	Construction of three new recharge boreholes in the confined Great Oolite Limestone aquifer on-site at the existing Cricklade STW. Recharge water provided by abstraction from the River Thames at the Farmoor WTW, with recovery by abstraction from the existing Latton borehole source. The option also includes: the construction of a new 11 Ml/d WTW adjacent to the existing Latton WTW; a short length of main to one of the recharge boreholes; and run-to-waste pipeline for clearance pumping of the boreholes to the River Thames. The option has been rejected due to concerns of increased groundwater flooding at Latton, requirements for high recharge pressures and impacts on the Ampney Brook, River Churn and the River Coln during abstraction periods. This therefore failed due to hydrogeological suitability and water source and availability.
Removal of DO Constraints	
Witheridge Hill borehole pumps	This option involves lowering of the pumps in a single unconfined Chalk borehole. This option has been rejected due to high costs to complete the investigation compared with the potential DO benefit and low resilience of the source. This therefore failed due to resilience and cost benefit to investigate potential yield.
Inter-Zonal¹⁰	
Inter-zonal transfers from SWA to SWOX (BS-IZTI-01)	Transfer water from Hambleton WTW to Long Crendon Service Reservoir (SR) and from there to an existing pipeline at Milton, identified at WRMP14. Rejected on the basis SWA is forecast to be in deficit throughout the planning horizon

¹⁰ Mott MacDonald/Cascade, Inter Zonal Feasibility Report prepared for Thames Water, updated June 2017



Option Type/Name	Rejection Reasoning
Inter-zonal transfers from SWA to SWOX (BS-IZTI-02)	Transfer water from Hambleden WTW to Long Crendon SR (SWA) and from there to an existing service reservoir at Shotover, identified at WRMP14. Rejected on the basis SWA is forecast to be in deficit throughout the planning horizon
Inter-zonal transfers from SWA to SWOX (BS-IZTI-03)	Transfer water from Hambleden WTW to Long Crendon SR (SWA) and from there to an existing pipeline at Marston, identified at WRMP14. Rejected on the basis SWA is forecast to be in deficit throughout the planning horizon
Inter-zonal transfers from SWA to SWOX (BS-IZTI-04)	Transfer water from Hambleden WTW to Nettlebed SR (SWA) and from there to Beggarsbush service reservoir at South Oxford area, identified at WRMP14. Rejected on the basis SWA is forecast to be in deficit throughout the planning horizon
Inter Company Transfers¹¹	
Inter-company transfer from Wessex to SWOX (RES-ICT-WSX-BLU)	Wessex Water to transfer 2.9 Ml/d from Charlton WTW to Minety SR and then to Blunsdon SR in South Swindon. Option mutually exclusive with RES-ICT-WSX-FLX and RES-ICT-WSX-ASH. Option rejected due to the large conveyance length.
Inter-company transfer from Wessex to SWOX (RES-ICT-WSX-ASH)	Option mutually exclusive with RES-ICT-WSX-SWOX-FLX, which is the preferred one on the basis that RES-ICT-WSX-SWOX-ASH presents bigger construction complexity and bigger needs for network reinforcements downstream.
Catchment Management	
Blockley (Groundwater) Childrey Warren (Groundwater) Dovedale (Groundwater) Gatehampton (Groundwater) Lower Swell (Groundwater) Manor Road (Groundwater) Ashdown Park (Groundwater) Upper Swell (Groundwater) Marlborough (Groundwater)	No catchment management options have been taken forward to the fine screening stage. The feasibility report concluded that there were no options to be taken forward to the fine screening stage, primarily because there are significant uncertainties surrounding achievement of the estimated DO benefits. We will however be progressing catchment management schemes in other water source catchments as it extends its current catchment management work to address priority drinking water quality risks which will contribute to increasing the resilience of water sources and reduce the risk of reductions to DO and/or an increase in outage due to water quality deterioration (for example due to increased nitrate or pesticide application on water source catchments).
Direct River Abstraction¹²	
New DRA from River Thames at Days Weir and transfer to Farmoor – supported by increased effluent returns from SWOX STWs	This option was proposed by Group Against Reservoir Development (GARD) based upon work previously done by Entec for the Environment Agency (report entitled “Assessment of the Potential Benefit of Effluent Reuse in SWOX WRZ - November 2009”). The option proposed by GARD included abstraction at Days Weir in Oxfordshire with transfer to either Farmoor intake, reservoir or treatment works. However, the Environment Agency’s 2014 Catchment Abstraction Licensing Strategy designates the River Thames at Days Weir as having no water available at low flows and specifies hands off flow of between Q21 (7209 Ml/d) and Q50 (1780 Ml/d) while between May and September 1976, the critical drought for determining the DO of SWOX supplies, flow at Days weir never rose above the 1450 Ml/d. On this basis the option would not therefore provide a DO benefit. New non-consumptive licences may be granted irrespective of the resource availability status where a high proportion (>95%) of the abstracted volume is returned to the river upstream or immediately downstream of the point of

¹¹ Mott MacDonald/Cascade, Inter Zonal Feasibility Report prepared for Thames Water, updated June 2017

¹² Mott MacDonald/Cascade, Direct River Abstraction Feasibility Report prepared for Thames Water, updated September 2018



Option Type/Name	Rejection Reasoning
	<p>abstraction. However, our assessment is that typically 20-27% of the volume of water abstracted is consumed and so a non-consumptive licence would not be applicable. It remains unclear how the Environment Agency would treat a licence application that is linked to increased abstraction associated with increased effluent discharges due to growth in demand in SWOX and whether it would be necessary for such growth to be realised before a licence could be granted. Without clarification on abstraction licencing policy in this regard this option has been rejected due to water availability and impacts on downstream abstractors.</p>
<p>Recommission existing DRA at Culham and transfer to Farmoor Reservoir</p>	<p>We have an existing abstraction license for 4.5 MI/d at Culham. The existing abstraction is disused and so the resource benefits the London WRZ DO. This option involved transferring the 4.5 MI/d of abstracted flows approximately 13km to Farmoor Reservoir via a new raw water pumping main. The flows would then enter supply into the Swindon and Oxford Water Resource Zone (SWOX WRZ) through the existing Farmoor WTW.</p> <p>We completed modelling using WARMS2 to understand the potential DO. It was found that when abstracting 4.5 MI/d at Culham and transferring to Farmoor Reservoir, the benefit to SWOX would be fully offset by the loss of DO to London. Therefore, this option was rejected based on the impact on existing abstractions downstream.</p>
<p>Recommission existing DRA and treatment at Culham and directly supply to SWOX</p>	<p>This option involves reinstating the existing 4.5 MI/d WTW at Culham with supply to the SWOX WRZ via the nearby Culham service reservoir. We completed WARMS2 modelling to understand the potential DO of this option. It was found that the net DO benefit to SWOX would only be 2 MI/d, once the reduction in benefit to the London WRZ is taken into account. Due to the relatively low resource benefit and high treatment costs the option was assessed as excessively costly at feasibility stage 3 and therefore this option was rejected.</p>

Specific option rejection – SWA WRZ

Table Q-5: SWA rejection summary

Type	Option	Rejection Stage			
		Stage 1	Stage 2	Stage 3	Fine screening
Aquifer storage and recovery					
	Hampden Bottom-Wendover		X		
Groundwater					
	Bourne End (East Marlow)	X			
	Medmenham	X			
	Taplow	X			
	Remenham	X			
	GW – West Marlow	X			
Removal of DO Constraints					
	RC – Hampden disinfection upgrade	X			
	RC - Datchet Main Replacement				
	Eton removal of constraints to DO				
Inter-zonal Transfer					
	Export from SWOX to SWA	X			

Table Q-6: SWA rejection reasoning

Zone and type	Rejection reasoning
Aquifer storage and recovery	
Hampden Bottom-Wendover	Hampden Bottom-Wendover Five operational Aquifer Storage and Recovery (ASR) boreholes in the Lower Greensand aquifer (LGS), with recharge from the treated water network during the winter months and abstraction and treatment at the existing Hampden Bottom WTW (after upgrade) during the summer, is required. New long distance pipelines will be required. The option has failed due to uncertainty regarding the presence and thickness of the LGS aquifer in this location. Therefore, the site may not be hydrogeological suitable for the proposed ASR option. This therefore failed due to hydrogeological suitability.
Groundwater¹³	
Bourne End (East Marlow)	Construction of a new abstraction borehole in the unconfined Chalk aquifer near an existing abstraction borehole site. The nearby WTW would be expanded to treat the water. The option also includes 1km of network enhancement to connect into supply. An increase in the peak daily licence will also be required. The Environment Agency will not support an increase in the abstraction licence at this location as the abstraction is from the South West Chilterns groundwater body, which has a Poor status and abstraction would be at the expense of flows in the River Thames (which is non-compliant for flow under full licence conditions). This therefore failed due to no realistic prospect of an abstraction licence and concerns

¹³ Mott MacDonald/Cascade, Groundwater Feasibility Report prepared for Thames Water, September 2018

Zone and type	Rejection reasoning
	about the water availability (CAMS status).
Medmenham	An annual average abstraction licence increase at a group of existing abstraction boreholes in the Chalk aquifer. Water abstracted from the boreholes would be treated at an existing WTW. The Environment Agency will not support an increase in abstraction licence at this location as the abstraction is from the South West Chilterns groundwater body, which has a Poor status and abstraction would be at the expense of flows in the River Thames (which is non-compliant for flow under full licence conditions). This therefore failed due to no realistic prospect of an abstraction licence and concerns about the water availability (CAMS status)
Taplow	The proposed option comprises of the construction of two new boreholes at the Taplow site, new borehole pumps and enhanced RWT main to the existing Dorney WTW. The option also includes expansion of the Dorney WTW to treat the additional flow. A licence increase at Taplow to 55 Ml/d (annual average and daily peak) will be required to allow increased abstraction from the new boreholes. This is an increase of 15.9 Ml/d in the annual average licensed quantity and an increase of 5 Ml/d in the daily peak licensed quantity. The Environment Agency will not support an increase in abstraction licence at this location due to concerns about the impacts on the Maidenhead Chalk groundwater body and flows in the River Thames (which is non-compliant for flow under full licence conditions). This therefore failed due to no realistic prospect of an abstraction licence and concerns about the water availability (CAMS status).
Remenham	Commissioning of the abandoned Remenham boreholes to bring the source into supply, test pumping and considerable network enhancements would be required. The Environment Agency will not support an abstraction licence as it is located in a Poor status groundwater body. This therefore failed due to no realistic prospect of an abstraction licence and concerns about the water availability (CAMS status).
GW – West Marlow	This option involves the refurbishment of three existing unlicensed abstraction boreholes in the unconfined Chalk aquifer located on land southwest of Marlow, currently leased to Thames Water. Water abstracted from the boreholes will be treated at a new WTW located on land adjacent to the existing Marlow WTW. The Environment Agency will not support an abstraction licence at this location, which is in the South West Chilterns groundwater body, which has a poor status and due to impacts of the abstraction on the River Thames. This therefore failed due to no realistic prospect of an abstraction licence and concerns about the water availability (CAMS status).
Removal of DO Constraints	
RC - Datchet Main Replacement	The proposed option was delivered in AMP6 and the DO incorporated into baseline. It is therefore no longer available.
Eton removal of constraints to DO	The proposed option was delivered in AMP6 and the DO incorporated into baseline. It is therefore no longer available.
RC – Hampden disinfection upgrade	Upgrade of existing WTW disinfection capability is required to remove constraint on peak DO. It is not considered to be cost-effective to deliver the potential volume benefit without an increase in licence. However, the Environment Agency will not support an increase in licence at this location due to concerns about the impacts of the abstraction on headwater flows in the River Misbourne. This therefore failed due to no realistic prospect of an abstraction licence.
Inter-zonal Transfer¹⁴	
BS-IZTI-05-SWOX to SWA	Rejected on the basis that SWOX is forecasted to be in deficit throughout the whole planning horizon.

¹⁴ Mott MacDonald/Cascade, Inter-Zonal Feasibility Report prepared for Thames Water, June 2017

Specific option rejection – Kennet Valley WRZ

Table Q-7: Kennet Valley rejection summary

Type	Option	Rejection Stage			
		Stage 1	Stage 2	Stage 3	Fine screening
Groundwater					
	GW - Purley	×			
	GW - Mapledurham	×			
	GW – Hungerford	×			
	GW – Playhatch (increased licence)	×			
	GW-Mortimer (transfer peak licence from Arborfired)		×		
Inter Zonal Transfer					
	SWA to Kennet Valley	×			
	Sheeplands WTW to Early SR		×		
Catchment Management					
	Fognam Down (Groundwater)			×	
	Speen (Groundwater)			×	
	Playhatch (Groundwater)			×	

Table Q-8: Kennet Valley rejection reasoning

Zone and type	Rejection reasoning
Groundwater¹⁵	
GW - Purley	Construction of three new abstraction boreholes in the unconfined Chalk north-west of Reading on the south bank of the River Thames, and a new on-site WTW. Option includes: test pumping to support the application for a new abstraction licence for 10 MI/d average and 15 MI/d peak; a 6.5 km treated water main from the new WTW to the Tilehurst service reservoir; and new raw water and run to waste pipelines. The Environment Agency would not support an abstraction licence at this location due to concerns about impacts on the South West Chilterns groundwater body, which has Poor status. Any abstraction licence would have a hands-off flow condition applied. Consequently, the DO benefit of the option would be 0 MI/d. This therefore failed due to no realistic prospect of an abstraction licence and concerns about the water availability (CAMS status).
GW - Mapledurham	Construction of three new abstraction boreholes in the unconfined Chalk north-west of Reading on the north bank of the River Thames, and a new on-site WTW. Option includes: test pumping to support the application for a new abstraction licence for 10 MI/d average and 15 MI/d peak; an 11 km treated water main from the new WTW to the Tilehurst service reservoir, with a crossing under the River Thames; and new raw water and run to waste pipelines. The Environment Agency have stated that they

¹⁵ Mott MacDonald/Cascade, Groundwater Feasibility Report prepared for Thames Water, September 2018

Zone and type	Rejection reasoning
	would not support an abstraction licence at this location due to concerns about impacts on the South West Chilterns groundwater body, which has Poor status. Any abstraction licence would have a hands-off flow condition applied. Consequently, the DO benefit of the option would be 0 MI/d. This therefore failed due to no realistic prospect of an abstraction licence and concerns about the water availability (CAMS status).
GW – Hungerford	Rehabilitation of one existing abstraction borehole at the Hungerford unconfined Chalk groundwater source and upgrading the pump capacity in two operational boreholes. The option also includes upgrading the existing treatment on site and test pumping the source to support an application to increase the abstraction licence to 4.55 MI/d. The Environment Agency will not support the proposed increase in abstraction licence as the abstraction would be from a Poor status groundwater body and there are concerns about the impact on flows in the River Kennet (which is currently non-compliant for flow). This therefore failed due to no realistic prospect of an abstraction licence and concerns about the water availability (CAMS status).
GW - Playhatch (increased licence)	Construction of a new abstraction borehole at the Playhatch unconfined Chalk borehole source located on the site of the existing WTW. Option also includes: upgrade of one operational borehole pump and existing booster pumps; test pumping to support an application for abstraction licence increase to 9.5 MI/d (average and peak); and upgrade of the WTW to treat the additional supply. The Environment Agency would not support an abstraction licence at this location due to concerns about the impact of the abstraction on flows in the River Thames, which are currently non-compliant for flow, and because the site is within the South West Chilterns, Poor status groundwater body. This therefore failed due to no realistic prospect of an abstraction licence and concerns about the water availability (CAMS status).
GW-Mortimer (transfer peak licence from Arborfield)	Transfer of the peak licence from the disused Arborfield source to the existing Mortimer borehole source. This option includes refurbishment of two issued confined Chalk abstraction boreholes located on-site at the existing, but disused Mortimer WTW. Water abstracted from the boreholes will be treated at the disused WTW which will be upgraded for ammonia and iron removal and recommissioned. A reassessment of the source DO diagram indicates that it will not be possible to achieve a DO of more than 5.0 MI/d, which is less than the licence transfer quantity. Therefore, the option fails as the site may not be hydrogeologically suitable for the proposed option.
Inter Zonal Transfer¹⁶	
SWA to Kennet Valley	Rejected on the basis that SWA is forecasted to be throughout the planning horizon.
Sheeplands WTW to Early SR	Transfer 2.37 MI/d from Sheeplands WTW to Early SR. Kennet Valley is in surplus throughout the planning horizon. The option is only for increasing the export potential and is mutually exclusive to RES-IZT-HEN-SWA-HAM and RES-IZT-HEN-SWOX-NET. Given the large deficit in SWOX and SWA along with the high construction complexity it was rejected.
Catchment Management	
Fognam Down (Groundwater) Speen (Groundwater) Playhatch (Groundwater)	No options have been taken forward to the fine screening stage. The feasibility report concluded that these options should not be taken forward to the fine screening stage, primarily because there are significant uncertainties surrounding achievement of the estimated DO benefits. We will however be progressing catchment management schemes in other water source catchments as it extends its current catchment management work to address priority drinking water quality risks which will contribute to increasing the resilience of water sources and reduce the risk of reductions to DO and/or an increase in outage due to water quality deterioration (for example due to increased nitrate or pesticide application on water source catchments).

¹⁶ Mott MacDonald/Cascade, Inter-Zonal Feasibility Report prepared for Thames Water, June 2017

Specific option rejection – Guildford WRZ

Table Q-9: Guildford rejection summary

Type	Option	Rejection Stage			
		Stage 1	Stage 2	Stage 3	Fine screening
Groundwater					
	Mousehill and Rodborough Rehab	X			
	ASR-Guildford (Abbotswood)		X		
	RC-Sturt Road Spring Capture		X		
Inter-Company Transfer					
	Surrey Hills SR (SEW) to Hogsback SR (TW- Guildford)		X		

Table Q-10: Guildford rejection reasoning

Zone and type	Rejection
Groundwater¹⁷	
Mousehill and Rodborough Rehab	Rehabilitation of eight existing abstraction boreholes in the Lower Greensand aquifer at two existing TWUL sites, in order to support a licence increase to 7 Ml/d (average and peak). Water abstracted from the boreholes would be treated at the existing WTW. The Environment Agency will not support an increase in licence at this location due to concerns over the impact of the abstraction on the River Ock. It is not considered to be cost-effective to deliver the potential volume benefit without an increase in licence. This therefore failed due to no realistic prospect of an abstraction licence.
ASR-Guildford (Abbotswood)	Construction of five new ASR boreholes in the Lower Greensand Aquifer on private land. Recharge would occur during the winter months through high pressure recharge and be provided via a new 750 m main connected to an existing WTW. Water would be abstracted during the summer months from the ASR boreholes and treated at a new on-site WTW. A number of risks have been highlighted concerning the option, primarily due to the purchase of land, impacts on a local nature reserve and the location of the site in the floodplain. This therefore failed due to flood risk and land use.
RC-Sturt Road Spring Capture	The Sturt Road spring source is an existing licensed, natural groundwater discharge from the Lower Greensand aquifer, developed via several headings that transfer flow out of the Hythe Beds into a raw water network that transfers the water to the treatment works. There are several spring overflows that discharge into the River Wey that are neither gauged nor captured. The proposed option involves utilising the currently uncaptured spring flows. The option failed due to the uncertainties in water availability, the low resilience of the potential DO increase and the high cost of further investigation to reduce these uncertainties.
Inter-Company Transfer¹⁸	
Surrey Hills SR (SEW) to Hogsback SR (TW- Guildford)	Transfer 10 Ml/d from Surrey Hills SR (SEW) to Hogsback SR (TW- Guildford). Option mutually exclusive with RES-ICT-SEW-GUI-MNT-10. Option rejected due to the large conveyance length (>20km) and the major construction complexity of this transfer. In addition, there is a high mixing water quality risk identified.

¹⁷ Mott MacDonald/Cascade, Groundwater Feasibility Report prepared for Thames Water, September 2018

¹⁸ Mott MacDonald/Cascade, Inter-Zonal Feasibility Report prepared for Thames Water, June 2017

Specific option rejection – Henley WRZ

Table Q-11: Henley rejection summary

Type	Option	Rejection Stage			
		Stage 1	Stage 2	Stage 3	Fine screening
Groundwater					
	Sheeplands licence disaggregation		:		
Catchment management					
	Sheeplands (Groundwater)				x

Table Q-12: Henley rejection reasoning

Zone and type	Rejection
Groundwater¹⁹	
Sheeplands licence disaggregation	Disaggregation of a group borehole abstraction licence to allow operation of two sources as per their individual licensed amounts. The option also includes a pump capacity upgrade in one borehole to facilitate total peak output of the source, and the upgrade of the Granular Activated Carbon (GAC) and nitrate removal capacity at an existing WTW. The Environment Agency will not support the disaggregation of the licence due to impacts on the River Thames and River Loddon and the Maidenhead Chalk (Good status, at risk) and South West Chilterns (Poor status) groundwater bodies. It may be possible to demonstrate that impacts on surface water are limited due to the discharge of effluent upstream of the groundwater source but this would not mitigate the impacts on groundwater. This therefore failed due to no realistic prospect of an abstraction licence and concerns about the water availability (CAMS status).
Catchment Management	
Sheeplands (Groundwater)	The Sheeplands option has not been taken forward to the fine screening stage. The feasibility report concluded that this option should not be taken forward primarily because there are significant uncertainties surrounding achievement of the estimated DO benefit. We will however be progressing catchment management schemes in other water source catchments as it extends its current catchment management work to address priority drinking water quality risks which will contribute to increasing the resilience of water sources and reduce the risk of reductions to DO and/or an increase in outage due to water quality deterioration (for example due to increased nitrate or pesticide application on water source catchments). Further explanation of the reasons for the rejection of this catchment management option is set out in the relevant Feasibility Report and is summarised in the Option Rejection Register.

¹⁹ Mott MacDonald/Cascade, Groundwater Feasibility Report prepared for Thames Water, September 2018

C. Demand scheme rejection register

- Q.12 The purpose of the demand options screening is to develop a list of feasible demand management options (Section 8: Appraisal of demand options) from the unconstrained demand options list (Appendix P: Options list tables). At each stage of the screening process, options are rejected. These rejected options make up our demand options rejection register which is presented in Table Q-13 and Table Q-14.
- Q.13 The full Demand Management Options Screening process is presented in the report, 'Thames Water WRMP19 Demand Management Options Screening Report', March 2017. This was reviewed by external stakeholders at our technical stakeholder forum on 19 June 2017.
- Q.14 A summary of the demand options screening process is presented in Section 8.B.
- Q.15 There are two predominant stages to create a feasible demand management options list, primary screening and secondary screening. Primary Screening assesses option feasibility at a high level for acceptance or not, having regard to Technological, Financial, Environmental, Risk and Resilience and Legal constraints. Secondary screening further refines the options list that has emerged from the primary screening exercise by reference to qualitative criteria.

Primary Screening Rejection Register

- Q.16 The purpose of Primary Screening is to remove from further consideration any water Demand Options considered non-feasible having regard to Technological, Financial, Environmental, Risk and Resilience and Legal constraints.
- Q.17 Each option in the Unconstrained Options List (Appendix P: Options list tables) is assessed against the following questions:
- Q.18 Technical: Is the option currently technically feasible? (new to draft WRMP19)
- Q.19 Cost: Does the option avoid excessive cost, using available outline cost information?
- Q.20 Environmental: From an initial environmental assessment, are the likely significant effects of the option on the environment considered acceptable?
- Q.21 Risk: Does the option give rise to an acceptable risk of it being implemented? Is there an acceptable risk that the option will not provide a net water resource benefit or not provide sufficient future resilience?
- Q.22 Legal: Does the option comply with current legal requirements? (new to draft WRMP19)
- Q.23 This assessment is conducted at a high level by Thames Water economists, engineers and environmental experts who specialise in each of the Generic Options areas.
- Q.24 To pass through the Primary Screening exercise each Demand Option must score 'yes' to all five questions. If an option is rejected it will not continue to Secondary Screening and be presented in the demand options rejection register (Table Q-13).
- Q.25 Of the 135 Demand Management Options presented in the Unconstrained Options List (Appendix P: Options list tables), 44 specific options have been rejected by Primary Screening (Table Q-13).



Water Efficiency and Non-Potable Rejected options

- Q.26 Table Q-13 lists some options under Water Efficiency and non-potable options as being rejected.
- Q.27 The options listed as Rejection* under Water Efficiency have been rejected as part of the enhanced demand management programme for WRMP19. This does not mean they have been rejected by the business and may still be included in our Water Efficiency Baseline programme.
- Q.28 The Baseline Programme refers to the established programme of activity that we undertake to promote an efficient use of water and ensure we deliver our statutory duty to develop and maintain an efficient and economical system of water supply. The Baseline Programme is a forecast of what would happen if we did not take any new supply or demand actions and did not implement any changes to company policy or existing operations.
- Q.29 The options listed as Rejected under the non-potable options refer to the rejection of that specific component of the non-potable option being rejected. For example, non-potable, rainwater harvesting, individual buildings typology 1 refers to the rejection of conducting rainwater harvesting in individual buildings in typology 1. Rainwater harvesting may still be conducted in different buildings and has not been rejected by the business as a whole.



Demand options primary screening

Table Q-13: Primary screening of demand management options

Generic option	Sub option	Specific option	Technical	Cost	Environment	Risk and resilience	Legal	Overall outcome	Screening reasoning
Leakage	Pressure Management	Pressure Management 4 - further reduction of pressure on existing schemes that are made up of multiple District Metered Areas (DMAs). Requires the installation of additional tall building boosters.	y	y	y	N	y	Rejected	Prior to the implementation of a Pressure Management Scheme, We conduct extensive investigations to determine the viability and benefit of installing Pressure Management across multiple DMAs in a zone. This includes desktop studies involving topographic data, burst and customer complaint history, large users and large blocks of flats information to identify customers that may be impacted by pressure management. Further hydraulic modelling studies and field studies are then undertaken to verify this information and ensure the Pressure Management Scheme is viable. Due to the extensive studies undertaken prior to the implementation of existing large Pressure Management Schemes, there is limited scope for further significant reductions in pressure even with the installation of additional tall building boosters. Consequently, the risk that this demand option will not provide a net benefit is considered unacceptable and therefore this option has not been taken further in the screening process.
Water Efficiency	Advice and Guidance	Benchmark to help drive water efficient behaviours (domestic)	y	y	y	n	y	Rejected*	High risk that this will not achieve behaviour change and therefore save water and produce a yield. Potential for Baseline.
		Call Centre contact to customers giving water efficiency advice	y	y	y	n	y	Rejected*	Medium risk that this will not achieve behaviour change and therefore save water and produce a yield. However, this option will continue to be included in baseline. We will proactively call customers specifically on water efficiency and also integrate more water efficiency information / advice into more customer journeys – call centre and online.
		Develop an Automatic Meter Reading (AMR) interface tool to help drive water efficiency behaviours	y	y	y	n	y	Rejected	We are moving away from procuring / installing AMR devices, in favour of AMI smart meters. These devices will allow customers to see more accurate and frequent consumption information on mobile-responsive web-portals. Consequently, there is a medium risk this option will not provide sufficient future resilience as the online technology will not be compatible with the majority of in



Generic option	Sub option	Specific option	Technical	Cost	Environment	Risk and resilience	Legal	Overall outcome	Screening reasoning
									ground technology.
		Develop water certificates for customer properties	y	n	y	n	y	Rejected	There is a high risk that this will not achieve a water saving as homes which achieve a certificate are already water aware. This is also not a cost-effective option for all households in the supply area. We are however providing bespoke Water Saving Reports to each household following their Smarter Home Visit (SHV).
		Development and promotion of an online water use calculator	y	y	y	n	y	Rejected*	Medium risk that this will not achieve a behaviour change and therefore save water and produce a yield as it targets already water wise customers. However, this option will continue to be included in baseline. We will continue to offer all household customers a free online calculator tool, in the form of the Water Energy Calculator (WEC). The WEC is an Energy Saving Trust software tool that provides personalised water use, water and energy saving advice, which can be downloaded by the customer.
		Development of Smart Phone Applications	y	y	y	n	y	Rejected	Medium risk that this will not achieve a behaviour change and therefore save water and produce a yield as it targets already water wise customers. Instead of a Smart Phone application, We have recently launched our new Thames Water website using a SiteCore platform. This will be far more capable, flexible and cost effective than smartphone apps.
		Distribution of advice and guidance via Water Regs visits	y	y	y	n	y	Rejected*	High risk that this will not achieve a water saving as we will not know if the guidance has been acted upon. However, this option will continue to be included in baseline using the lessons from AMP5 and AMP6 into AMP7 and beyond.
		Distribution of self-audit packs	y	n	y	y	y	Rejected	High risk that this will not achieve water savings as we will not know if the guidance has been acted upon. At present, the distribution of self-audit packs is also not seen as a cost effective water efficiency method. We promote our free online WEC as the preferred method of quantifying personalised water use/savings, and identifying appropriate water savings interventions.
		Distribution of water saving information in customers' bills	y	y	y	n	y	Rejected*	Medium risk as it is unknown whether the information will achieve an actual water saving. However, this option will continue to be included in baseline using the lessons from AMP5 and AMP6 into AMP7 and beyond.
		Distribution of water saving information via leaflet	y	y	y	n	y	Rejected*	Medium risk as it is unknown whether the information will achieve



Generic option	Sub option	Specific option	Technical	Cost	Environment	Risk and resilience	Legal	Overall outcome	Screening reasoning
		distribution							an actual water saving. However, this option will continue to be included in baseline using the lessons from AMP5 and AMP6 into AMP7 and beyond.
		Education in schools and provision of educational material	y	y	y	n	y	Rejected*	Medium risk as it is unknown whether the information will achieve an actual water saving. However, this option will continue to be included in baseline using the lessons from AMP5 and AMP6 into AMP7 and beyond.
		Events and road shows	y	y	y	n	y	Rejected	We have reduced the number of events and road shows, as there is little to no mechanism for quantifying any real water savings attributed to this action
		Promotions via newspapers	y	y	y	n	y	Rejected*	High risk that this will not achieve a water saving as we will not know if the guidance has been acted upon. However, this option will continue to be included in baseline using the lessons from our area specific water saving programmes in AMP5 and AMP6, into programmes for AMP7 and beyond.
		Water efficiency advice via an internet promotion	y	y	y	n	y	Rejected*	High risk that this will not achieve a water saving as we will not know if the guidance has been acted upon. However, this option will continue to be included in baseline using the lessons from AMP5 and AMP6, into programmes for AMP7 and beyond.
	Self Install	Distribution of hose guns for self-installation	y	y	y	n	y	Rejected	We have ceased to offer garden trigger hoses due to lack of measurable water savings evidence. Some anecdotal evidence shows that water consumption increases due to customers' wanting to use the new equipment
		Distribution of water gels to gardeners for self-installation	y	y	y	n	y	Rejected	We have ceased to offer this due to lack of measurable and significant water saving evidence.
		Distribution of water saving devices to businesses via Water Regs visits	y	y	y	n	y	Rejected*	High risk that this will not achieve a water saving if the devices are not installed. However, this option will continue to be included in baseline using the lessons from AMP5 and AMP6, into programmes for AMP7 and beyond.
		Subsidy for water efficient white goods	y	n	y	y	y	Rejected	We do not offer this as there are other more cost effective actions to implement ahead of such rebates. In addition, previous offers have only resulted in a small uptake.
	Non-Domestic Advice and	Benchmark to help drive water efficient behaviours (non-domestic)	y	y	y	n	y	Rejected*	High risk that this will not achieve behaviour change and therefore save water and produce a yield. However, this option will



Generic option	Sub option	Specific option	Technical	Cost	Environment	Risk and resilience	Legal	Overall outcome	Screening reasoning
	Assistance								continue to be included in baseline. We have a number of case studies on our website which outline some benchmark and good practice advice for non-domestic buildings. We will be launching new online tools and advice in early 2017.
		Exploit retail and loan funding opportunities for non-domestic water saving	y	y	y	n	y	Rejected	High risk that this will not achieve water savings following Business customers' transfer to Castle Water in 2017.
		Free water efficiency goods and advice to all newly metered businesses	y	y	y	n	y	Rejected	High risk that this will not achieve water savings or be cost effective for us following Business customers' transfer to Castle Water in 2017.
		Introduce training for non-domestic customers about wise water use	y	y	y	n	y	Rejected	High risk that this will not achieve water savings. We have previously delivered a number of water efficiency training sessions for non-domestic customers. However, much of this role will now move to Castle Water with the transfer of customers in 2017.
		Non-Domestic water saving advice and assistance	y	y	y	n	y	Rejected*	Medium risk that this will not achieve a behaviour change and result in water savings. However, this option will continue to be included in baseline. We have the industry's most comprehensive self-audit tool kit available online (Saving water in your Business). We offer a range of free downloadable water efficiency case studies for businesses.
		Optimising water using processes	y	y	y	n	y	Rejected	High risk that this will not achieve water savings following Business customers' transfer to Castle Water in 2017.
	Regulation	Enforce use of water efficient fittings in new buildings	y	y	y	y	n	Rejected	We are not empowered to enforce such actions. To include this as a discrete additional management option would also be double counting as our demand forecasts do assume the installation of water efficient fittings in new buildings.
		Flow restrictor charging	y	y	y	y	n	Rejected	We are not empowered to enforce a tariff reduction for a restriction in domestic water supply pressure. This would contravene our other regulatory target relating to minimum pressures (DG2).
		Ban high water use devices	y	y	y	y	n	Rejected	We are not empowered to enforce such actions as we are a service provider and must meet the reasonable expectations of customers. This option could only be enforced by the Government.
		Preventing new development	y	y	y	y	n	Rejected	We are not empowered to prevent a growth in demand by



Generic option	Sub option	Specific option	Technical	Cost	Environment	Risk and resilience	Legal	Overall outcome	Screening reasoning
									enacting planning restrictions and preventing new development. We are routinely consulted on planning and development matters and may influence the scale and location of new development. We will continue to liaise with planning authorities into the future but cannot include this as a discrete demand management option.
		Legislate on water use	y	y	y	y	n	Rejected	We are not empowered to enforce such actions as we are a service provider and must meet the reasonable expectations of customers. This option could only be enforced by the Government.
Combined Options	Distribution Mains Replacement (Partial DMA Replacement) + Metering (houses, flats)	Distribution Mains Replacement and metering - replacement of parts of mains within a DMA including the connecting communication pipes, the installation/replacement of boundary boxes and the installation of connection meters to target Customer Side Leakage (CSL). The portion of mains to replace are determined by burst rates.	y	y	y	n	y	Rejected	We no longer assess the suitability of mains replacement by burst rate alone or install a meter to target CSL alone. Consequently, this option has not been taken further in the screening process. Instead, this option has been replaced by the 'Partial DMA Mains Replacement' options which assess distribution mains both on burst rate and assumed levels of leakage.
	Distribution Mains Replacement (Partial DMA Replacement) + Metering (houses, flats) + CSL	Distribution Mains Replacement and metering - replacement of parts of mains within a District Metered Area including the connecting communication pipes, the installation/replacement of boundary boxes and the installation of connection meters to target CSL and the replacement of supply pipes where CSL is detected. The portion of mains to replace are determined by burst rates.	y	y	y	n	y	Rejected	We no longer assess the suitability of mains replacement by burst rate alone or install a meter to target CSL alone. Consequently, this option has not been taken further in the screening process. Instead, this option has been replaced by the 'Partial DMA Mains Replacement' options which assess distribution mains both on burst rate and assumed levels of leakage.
	Mains Replacement (Full DMA Replacement) + Full DMA Replacement Metering (houses, flats)	Full DMA mains replacement including the connecting communication pipes, the installation/replacement of boundary boxes and the installation of connection meters to target CSL. The DMAs to replace are determined by leakage levels.	y	y	y	n	y	Rejected	We no longer assess the suitability of full DMA mains replacement on leakage levels alone or install a meter to target CSL alone. Consequently, this option has not been taken further in the screening process. Instead, this option has been replaced by the 'Full DMA Mains Replacement' option which assess distribution mains both on burst rate and leakage levels.
	Mains Replacement (Full DMA Replacement)	Full DMA mains replacement including the connecting communication pipes, the installation/replacement of boundary boxes, the installation of connection meters and the replacement of supply pipes where CSL age is	y	y	y	n	y	Rejected	We no longer assess the suitability of full DMA mains replacement on leakage levels alone or install a meter to target CSL alone. Consequently, this option has not been taken further in the screening process. Instead, this option has been replaced by the



Generic option	Sub option	Specific option	Technical	Cost	Environment	Risk and resilience	Legal	Overall outcome	Screening reasoning
	+ CSL + Full DMA Replacement Metering (houses, flats)	detected. The DMAs to replace are determined by leakage levels.							'Full DMA Mains Replacement' option which assess distribution mains both on burst rate and leakage levels.
Non-potable	Rainwater Harvesting	Individual Buildings (Typology 1) - Commercial Only. Individual commercial Buildings throughout our supply area that are being redeveloped contain a non-potable treatment system.	y	y	y	n	y	Rejected	High risk that this will not achieve water savings as we cannot regulate the maintenance and continued use of non-potable systems on individual private commercial properties located throughout the water supply area.
		Individual Buildings (Typology 1) - Residential Only. Individual residential buildings throughout our supply area that are being redeveloped contain a non-potable treatment system.	y	y	y	n	y	Rejected	High risk that this will not achieve water savings as we cannot regulate the maintenance and continued use of non-potable systems on individual private residential properties located throughout the water supply area.
		Individual Buildings (Typology 1) - Commercial and Residential. Individual commercial and residential buildings throughout our supply area that are being redeveloped contain a non-potable treatment system.	y	y	y	n	y	Rejected	High risk that this will not achieve water savings as we cannot regulate the maintenance and continued use of non-potable systems on individual private properties located throughout the water supply area.
	Storm-water Harvesting	Individual Buildings (Typology 1) - Commercial Only. Individual commercial Buildings throughout our supply area that are being redeveloped contain a non-potable treatment system.	y	y	y	n	y	Rejected	High risk that this will not achieve water savings as we cannot regulate the maintenance and continued use of non-potable systems on individual private commercial properties located throughout the water supply area.
		Individual Buildings (Typology 1) - Residential Only. Individual residential buildings throughout our supply area that are being redeveloped contain a non-potable treatment system.	y	y	y	n	y	Rejected	High risk that this will not achieve water savings as we cannot regulate the maintenance and continued use of non-potable systems on individual private residential properties located throughout the water supply area.
		Individual Buildings (Typology 1) - Commercial and Residential. Individual commercial and residential buildings throughout our supply area that are being redeveloped contain a non-potable treatment system.	y	y	y	n	y	Rejected	High risk that this will not achieve water savings as we cannot regulate the maintenance and continued use of non-potable systems on individual private properties located throughout the water supply area.
	Greywater Recycling	Individual Buildings (Typology 1) - Commercial Only. Individual commercial Buildings throughout our supply area that are being redeveloped contain a non-potable treatment system.	y	y	y	n	y	Rejected	High risk that this will not achieve water savings as we cannot regulate the maintenance and continued use of non-potable systems on individual private commercial properties located throughout the water supply area.
		Individual Buildings (Typology 1) - Residential Only. Individual residential buildings throughout our supply area that are being redeveloped contain a non-potable treatment system.	y	y	y	n	y	Rejected	High risk that this will not achieve water savings as we cannot regulate the maintenance and continued use of non-potable systems on individual private residential properties located throughout the water supply area.



Generic option	Sub option	Specific option	Technical	Cost	Environment	Risk and resilience	Legal	Overall outcome	Screening reasoning
		treatment system.							throughout the water supply area.
		Individual Buildings (Typology 1) - Commercial and Residential. Individual commercial and residential buildings throughout our supply area that are being redeveloped contain a non-potable treatment system.	y	y	y	n	y	Rejected	High risk that this will not achieve water savings as we cannot regulate the maintenance and continued use of non-potable systems on individual private properties located throughout the water supply area.
	Wastewater (Blackwater) Recycling	Blackwater recycling at new developments	y	y	y	n	n	Rejected	Blackwater recycling has been rejected on the grounds of it being more complicated to implement and presenting higher risks. In addition, there is no current guidance on the use of treated effluent (Blackwater) for non-potable purposes in the UK. In the absence of such guidance and due to the potential risk of contamination and impact on public health, Thame Water will not take this option further in the screening process. With further developments in the future, this option could be reconsidered in future planning periods.

Note: Where the table refers to 'Full DMA Replacement' under Combined Options, this was referred to as VMR in WRMP14.

Secondary Screening Rejection Register

- Q.30 The purpose of Secondary Screening is to provide a manageable list of Demand Management Options to input into the IDM model for optimisation, while ensuring that a sufficient range of water management schemes is being assessed.
- Q.31 Each option that passed through the Primary Screening process is assessed against the following questions applied for the purposes of Secondary Screening:
- Does the option avoid excessive cost?
 - Is the option likely to be acceptable in terms of planning and environmental constraints?
 - Is the option likely to help meet **WFD** objectives and prevent deterioration of water body status?
 - Does the option have an acceptable risk of social impact or inequality?
 - Does the option align with company policy objectives?
 - Does the option provide flexibility/adaptability to climate change uncertainty?
 - Does the option provide conjunctive use benefits or other benefits to water resource management?
 - Is the option practical and efficient to implement and maintain? (new to draft WRMP19)
 - Is the option lead time sufficiently flexible to planning or other uncertainties to ensure security of supply is maintained?
 - Are all other risks and uncertainties acceptable?
 - Can costs and benefits of the Demand Option be modelled for comparison with alternatives at DMA level?
- Q.32 This assessment is carried out by internal Thames Water economists, engineers and environmental experts who specialise in each of the Generic Options areas.
- Q.33 To pass Secondary Screening each option must score 'yes' to all eleven questions. If an option is rejected it will not pass to the Feasible Options list and will be presented in the demand options rejection register (Table Q-14). Of the 91 Demand Management Options remaining after Primary Screening, a further 44 specific options have been rejected by Secondary Screening (Table Q-14).
- Q.34 In Table Q-14, the Water Efficiency Options which are notated 'Rejected*' refer to options that will be included in Baseline Water Efficiency activities having not passed through to the Feasible Options list. This means that although these options will not be included in draft WRMP19, they will be included by the business in the Baseline Programme.
- Q.35 **The Baseline Programme** refers to the established programme of activity that **we undertake** to promote an efficient use of water and ensure we deliver our statutory duty to develop and maintain an efficient and economical system of water supply. The Baseline Programme is a



forecast of what would happen if we did not take any new supply or demand actions and did not implement any changes to company policy or existing operations.



Table Q-14: Secondary screening of demand management options

Generic option	Sub option	Specific option	1	2	3	4	5	6	7	8	9	10	11	Overall outcome	Screening reasoning
Leakage	Active Leakage Control	Active Leakage Control (ALC) + 10% - Enhanced levels of 'Find and Fix' over and on top of that already being undertaken to maintain current levels of leakage to achieve a further 10% reduction in leakage.	n	y	y	y	y	y	y	y	y	n	y	Rejected	Given the extensive work on leakage detection and repair activity there is considered to be limited scope to make significant further leakage reductions with current methods of leakage detection and repair alone. As leakage is reduced further, the uncertainty of delivery increases. In addition, as leakage is reduced, much greater time is required to detect multiple, smaller leaks in a DMA. In the absence of other work (i.e. Network Reconfiguration), the cost of this additional leakage detection as an individual demand management option become prohibitive. Consequently, although the risk that 'ALC + 10%' will not provide a leakage reduction is less than the risk associated with 'ALC + 20%', the additional cost and risk of non-delivery is considered unacceptable and therefore this option has not been taken further in the screening process. Rather, it has been replaced by 'Enhanced ALC'.
		ALC + 20% - Enhanced levels of 'Find and Fix' over and on top of that already being undertaken to maintain current levels of leakage to achieve a further 20% reduction in leakage.	n	y	y	y	y	y	y	y	y	n	y	Rejected	Given the extensive work on leakage detection and repair activity, with 60,000 repairs completed on the water supply network per year, there is considered to be limited scope to make significant further leakage reductions with current methods of leakage detection and repair alone. As leakage is reduced further, the uncertainty of delivery increases. The high risk that this demand option will not provide the additional 20% leakage reduction is considered unacceptable and therefore this option has not been taken further in the screening process.
	Mains Replacement	Asset Replacement - replace individual pipes that have high burst rates	y	y	y	y	y	y	y	n	y	y	n	Rejected	Replacing individual pipes as a demand management intervention is not a practical or efficient use of time, resources (human and equipment) or permits (traffic management/dig). It is also difficult to accurately measure and model the demand benefit making it infeasible for realistic modelling against alternative demand options.
		Asset Replacement 100m - replace individual pipes that have high burst rates and must be above 100m in length	y	y	y	y	y	y	y	n	y	y	n	Rejected	Replacing individual pipes as a demand management intervention, even at length of 100m, is not a practical or efficient use of time, resources (human and equipment) or permits (traffic management/dig). It is also difficult to accurately measure and model the demand benefit making it not feasible for realistic modelling against alternative demand options.



Generic option	Sub option	Specific option	1	2	3	4	5	6	7	8	9	10	11	Overall outcome	Screening reasoning
		Comms Only - replace communication pipes only	y	y	y	n	y	y	y	n	y	y	n	Rejected	Replacing individual communication pipes alone as a demand management intervention, is not a practical or efficient use of time, resources (human and equipment) or permits (traffic management/dig). It is unlikely to be considered acceptable by our customers to interrupt their supply to replace their communication pipe without replacing the water main at the same time. It is also difficult to accurately measure and model the demand benefit making it infeasible for realistic modelling against alternative demand options.
Metering	Houses Only	Meter all houses (Dumb technology) and repair CSLs found	y	y	y	n	n	y	n	y	y	n	y	Rejected	For the last three AMP periods, we have used Advanced Metering Infrastructure (AMI), AMR and Dumb meter technology as the company moved towards a full smart metering solution. However, from AMP7 and beyond, we will no longer support the large scale rollout of Dumb meter technology. There are three main factors for this decision; 1. Reduced Customer Benefit and social inequality: Dumb meter technology is not supported by Web and Mobile Apps that allow customers to track their water use in real time. Web and Mobile Apps facilitate a greater reduction in water use and therefore lower bills, and increase customer confidence in meter reading accuracy. This in turn leads to greater customer satisfaction and a reduction in customer calls. 2. Low Reduction in CSL: Due to the requirement for manual meter reads, Dumb meter technology results in a 24% reduction in CSL compared with 56% and 76% from AMR and AMI technology. 3. No Benefit to Mains Replacement Targeting: due to their real time monitoring abilities, AMR and AMI technology provides data to conduct a water balance within a DMA or sub DMA facilitating better mains replacement targeting. Due to the requirement for manual meter reads, Dumb metering technology cannot provide this benefit. To reconfirm this decision, the full Dumb metering option has still been taken forward for modelling, see 'Meter all houses (including CSL repair) and individual flats (internal, no CSL repair) with Dumb technology and bulk metering (including CSL repair) blocks of flats with AMR technology.'
	Houses and Bulks	Meter all houses and bulk meter (external) blocks of flats (Dumb technology) and repair CSLs found	y	y	y	n	n	y	n	y	y	n	y	Rejected	For the last three AMP periods, we have used AMI, AMR and Dumb meter technology as the company moved towards a full smart metering solution. However, from AMP7 and beyond, we will no longer support the large scale rollout of Dumb meter technology. There are three main factors for this decision; 1. Reduced Customer Benefit and social inequality: Dumb meter technology is not supported by Web and Mobile Apps that allow



Generic option	Sub option	Specific option	1	2	3	4	5	6	7	8	9	10	11	Overall outcome	Screening reasoning
															customers to track their water use in real time. Web and Mobile Apps facilitate a greater reduction in water use and therefore lower bills, and increase customer confidence in meter reading accuracy. This in turn leads to greater customer satisfaction and a reduction in customer calls. 2. Low Reduction in CSL: Due to the requirement for manual meter reads, Dumb meter technology results in a 24% reduction in CSL compared with 56% and 76% from ARM and AMI technology. 3. No Benefit to Mains Replacement Targeting: due to their real time monitoring abilities, AMR and AMI technology provides data to conduct a water balance within a DMA or sub DMA facilitating better mains replacement targeting. Due to the requirement for manual meter reads, Dumb metering technology cannot provide this benefit. To reconfirm this decision, the full Dumb metering option has still been taken forward for modelling, see 'Meter all houses (including CSL repair) and individual flats (internal, no CSL repair) with Dumb technology and bulk metering (including CSL repair) blocks of flats with AMR technology.'
	Houses, bulks and individual flats	Meter all houses (including CSL repair), individual flats (internal, no CSL repair) and bulk meter (including CSL repair) blocks of flats (Dumb technology)	y	y	y	n	n	y	n	y	y	n	y	Rejected	For the last three AMP periods, we have used AMI, AMR and Dumb meter technology as we moved towards a full smart metering solution. However, from AMP7 and beyond, we will no longer support the large scale rollout of Dumb meter technology. There are three main factors for this decision; 1. Reduced Customer Benefit and social inequality: Dumb meter technology is not supported by Web and Mobile Apps that allow customers to track their water use in real time. Web and Mobile Apps facilitate a greater reduction in water use and therefore lower bills, and increase customer confidence in meter reading accuracy. This in turn leads to greater customer satisfaction and a reduction in customer calls. 2. Low Reduction in CSL: Due to the requirement for manual meter reads, Dumb meter technology results in a 24% reduction in CSL compared with 56% and 76% from ARM and AMI technology. 3. No Benefit to Mains Replacement Targeting: due to their real time monitoring abilities, AMR and AMI technology provides data to conduct a water balance within a DMA or sub DMA facilitating better mains replacement targeting. Due to the requirement for manual meter reads, Dumb metering technology cannot provide this benefit. To reconfirm this decision, the full Dumb metering option has still been taken forward for modelling, see 'Meter all houses (including CSL repair) and individual flats (internal, no CSL repair) with Dumb technology and bulk metering (including CSL



Generic option	Sub option	Specific option												Overall outcome	Screening reasoning
			1	2	3	4	5	6	7	8	9	10	11		
Water Efficiency	Advice and Guidance	Free water efficiency goods and advice to all newly metered customers	y	y	y	y	y	y	y	y	y	n	n	Rejected	repair) blocks of flats with AMR technology.'
		Offer free water efficiency goods online	y	y	y	y	y	y	y	y	y	n	n	Rejected	This has been rejected as a discrete option as there is a risk that water savings will not be realised if customers do not install and use the devices or implement the advice. Instead it is more effective to promote multiple domestic retrofit activities conjunctively, integrated with other demand management activity such as our SHV.
	Self-Install	Distribution of aerated shower head	n	y	y	y	y	y	n	n	y	y	y	Rejected	This has been rejected as a discrete option owing to the high cost to engage with each customer and gain access to the property. Instead it is more effective to promote multiple domestic retrofit activities conjunctively, integrated with other demand management activity such as our SHV, Smarter Business Visit and Wastage fix programmes.
		Distribution of cistern displacement devices	n	y	y	y	y	y	n	n	y	y	y	Rejected	This has been rejected as a discrete option owing to the high cost to engage with each customer and gain access to the property. Instead it is more effective to promote multiple domestic retrofit activities conjunctively, integrated with other demand management activity such as our SHV, SBV and Wastage fix programmes.
		Distribution of Shower Timers	n	y	y	y	y	y	n	n	y	y	y	Rejected	This has been rejected as a discrete option owing to the high cost to engage with each customer and gain access to the property. Instead it is more effective to promote multiple domestic retrofit activities conjunctively, integrated with other demand management activity such as our SHV, SBV and Wastage fix programmes.
		Distribution of tap inserts for self- installation	n	y	y	y	y	y	n	n	y	y	y	Rejected	This has been rejected as a discrete option owing to the high cost to engage with each customer and gain access to the property. Instead it is more effective to promote multiple domestic retrofit activities conjunctively, integrated with other demand management activity such as our SHV, SBV and Wastage fix programmes.
	Direct Efficient Goods Plumber Installation Direct Efficient	Installation of water butt	n	y	y	y	y	y	n	n	y	y	y	Rejected	This has been rejected as a discrete option owing to the high cost to engage with each customer and gain access to the property. Instead it is more effective to promote multiple domestic retrofit activities conjunctively, integrated with other



Generic option	Sub option	Specific option	1	2	3	4	5	6	7	8	9	10	11	Overall outcome	Screening reasoning
Goods Plumber Installation															demand management activity such as our SHV, SBV and Wastage fix programmes.
		Plumber assisted installation of tap inserts	n	y	y	y	y	y	n	n	y	y	y	Rejected	This has been rejected as a discrete option owing to the high cost to engage with each customer and gain access to the property. Instead it is more effective to promote multiple domestic retrofit activities conjunctively, integrated with other demand management activity such as our SHV, SBV and Wastage fix programmes.
		Replacement - installation of a dual flush toilet	n	y	y	y	y	y	n	n	y	y	y	Rejected	This has been rejected as a discrete option owing to the high cost to engage with each customer and gain access to the property. Instead it is more effective to promote multiple domestic retrofit activities conjunctively, integrated with other demand management activity such as our SHV, SBV and Wastage fix programmes.
		Replacement - installation of a low flush toilet	n	y	y	y	y	y	n	n	y	y	y	Rejected	This has been rejected as a discrete option owing to the high cost to engage with each customer and gain access to the property. Instead it is more effective to promote multiple domestic retrofit activities conjunctively, integrated with other demand management activity such as our SHV, SBV and Wastage fix programmes.
		Retrofit - installation of a duel flush toilet device	n	y	y	y	y	y	n	n	y	y	y	Rejected	This has been rejected as a discrete option owing to the high cost to engage with each customer and gain access to the property. Instead it is more effective to promote multiple domestic retrofit activities conjunctively, integrated with other demand management activity such as our SHV, SBV and Wastage fix programmes.
Partner Efficiency Good and Installation		Partner controlled domestic plumbing installs	y	y	y	y	y	y	y	y	y	n	n	Rejected*	This option has been rejected owing to the high risk that water savings may not be realised or quantified and the inability to model this option at a DMA level until commitment from specific partners. This option is being explored as a benchmark option through small scale pilot projects with social housing providers
		Partnership projects with national organisations	y	y	y	y	y	y	y	y	y	n	n	Rejected	This option has been rejected owing to the high risk that water savings may not be realised or quantified and the inability to model this option at a DMA level until commitment from specific partners.
		Partnership projects with public and third sector organisations	y	y	y	y	y	y	y	y	y	n	n	Rejected	This option has been rejected owing to the high risk that water savings may not be realised or quantified and the inability to model this option at a DMA level until commitment from specific partners.
		Partnership projects with utility	y	y	y	y	y	y	y	y	y	n	n	Rejected*	This option has been rejected owing to the high risk that water



Generic option	Sub option	Specific option	1	2	3	4	5	6	7	8	9	10	11	Overall outcome	Screening reasoning	
		companies													savings may not be realised or quantified and the inability to model this option at a DMA level until commitment from specific partners. We will continue to work with other utility companies to explore opportunities through our baseline programme.	
		Partnership working benefits	y	y	y	y	y	y	y	y	y	n	n	Rejected*	This option has been rejected owing to the high risk that water savings may not be realised or quantified and the inability to model this option at a DMA level until commitment from specific partners. We have many partnership programmes running to benefit water efficiency, and will continue to enhance these and new projects in the future to explore opportunities through our baseline programme.	
	Research		Continue to support ongoing research projects	y	y	y	y	y	y	y	y	y	n	Rejected*	This option cannot be modelled at DMA level or the benefits accurately quantified for the model framework. Through our baseline programme we will continue to support the Water UK and UKWIR water efficiency research initiatives – a combined water sector initiative. We are also conducting research into Faith / Cultural water efficiency.	
			Ofwat water efficiency research fund	y	y	y	y	y	y	y	y	y	n	Rejected*	This option cannot be modelled at DMA level or the benefits accurately quantified for the model framework. Through our baseline programme we will continue to support the Water UK and UKWIR water efficiency research initiatives – a combined water sector initiative. We are also conducting research into Faith / Cultural water efficiency.	
			Save Water Swindon and other flagship research projects	y	y	y	y	y	y	y	y	y	n	n	Rejected	The Save Water Swindon Project finished in 2014.
			Support the leak toilet valves project phase 2	y	y	y	y	y	y	y	y	y	y	n	Rejected*	This option cannot be modelled at DMA level or the benefits accurately quantified for the model framework. However, this option will continue to be included in baseline. We have been supporting the leaking toilet valves project throughout AMP6 and this will continue into AMP7 and beyond.
			Support the research undertaken by UKWIR	y	y	y	y	y	y	y	y	y	y	n	Rejected*	This option cannot be modelled at DMA level or the benefits accurately quantified for the model framework. Through our baseline programme we will continue to support the Water UK and UKWIR water efficiency research initiatives – a combined water sector initiative. We are also conducting research into Faith / Cultural water efficiency.
			Support the Waterwise evidence base	y	y	y	y	y	y	y	y	y	n	n	Rejected	This option cannot be modelled at DMA level or the benefits accurately quantified for the model framework.
Combined	AMI Meter	Meter all houses (including CSL	y	y	y	y	y	y	y	y	n	y	Rejected	Medium risk that this will not achieve water savings. Although		



Generic option	Sub option	Specific option												Overall outcome	Screening reasoning		
			1	2	3	4	5	6	7	8	9	10	11				
Options	(houses, flats, bulks) + CSL repair + SHV (non LAHA properties) +SBV	repair), individual flats (internal, no CSL repair) and bulk meter (including CSL repair) blocks of flats (AMI technology). Includes SHV and or SBV to a proportion of newly metered non-LAHA properties that take up the SHV offer. Includes Wastage fix to a proportion of newly metered non-LAHA properties that have a wastage issue identified.															we will continue to deliver SBVs to our Business customers, we cannot guarantee the degree of uptake or influence following Business customers' transfer to Castle Water in 2017.
	AMR Meter (houses, flats, bulks) + CSL repair + SHV (non LAHA properties)	Meter all houses (including CSL repair), individual flats (internal, no CSL repair) and bulk meter (including CSL repair) blocks of flats (AMR technology). Includes SHV to a proportion of newly metered non-LAHA properties that take up the SHV offer. Includes Wastage fix to a proportion of newly metered non-LAHA properties that have a wastage issue identified.	y	y	y	y	y	y	y	y	y	y	n	n	Rejected		Given our move towards a full smart metering (AMI) solution, it was considered the 'AMI Meter (houses, flats, bulks) + CSL repair + SHV (non LAHA properties)' had already covered this option in the modelling and this would largely be a repeat of this scenario. This option was more critical in WRMP14 when the potential roll out of AMI meters was still in its infancy.
	AMR Meter (houses, flats, bulks) + CSL repair + SHV (non LAHA properties) +SBV	Meter all houses (including CSL repair), individual flats (internal, no CSL repair) and bulk meter (including CSL repair) blocks of flats (AMR technology). Includes SHV and or SBV to a proportion of newly metered non-LAHA properties that take up the SHV offer. Includes Wastage fix to a proportion of newly metered non-LAHA properties that have a wastage issue identified.	y	y	y	y	y	y	y	y	y	n	n	n	Rejected		Given our move towards a full smart metering (AMI) solution, it was considered the 'AMI Meter (houses, flats, bulks) + CSL repair + SHV (non LAHA properties)' had already covered this option in the modelling and this would largely be a repeat of this scenario. This option was more critical in WRMP14 when the potential roll out of AMI meters was still in its infancy. There is also a medium risk that SBVs will not achieve water savings. Although we will continue to deliver SBV's to our Business customers, we cannot guarantee the degree of uptake or influence following Business customers' transfer to Castle Water in 2017.
	Dumb Meter (houses, flats, bulks) + CSL repair + SHV (non LAHA properties)	Meter all houses (including CSL repair), individual flats (internal, no CSL repair) and bulk meter (including CSL repair) blocks of flats (Dumb technology). Includes SHV to a proportion of	y	y	y	n	n	y	y	y	y	n	y	n	Rejected		For the last three AMP periods, we have used AMI, AMR and Dumb meter technology as the company moved towards a full smart metering solution. However, from AMP7 and beyond, we will no longer support the large scale rollout of Dumb meter technology. There are three main factors for this decision; 1. Reduced Customer Benefit and social inequality: Dumb meter



Generic option	Sub option	Specific option	1	2	3	4	5	6	7	8	9	10	11	Overall outcome	Screening reasoning
		newly metered non-LAHA properties that take up the SHV offer. Includes Wastage fix to a proportion of newly metered non-LAHA properties that have a wastage issue identified.													technology is not supported by Web and Mobile Apps that allow customers to track their water use in real time. Web and Mobile Apps facilitate a greater reduction in water use and therefore lower bills, and increase customer confidence in meter reading accuracy. This in turn leads to greater customer satisfaction and a reduction in customer calls. 2. Low Reduction in CSL: Due to the requirement for manual meter reads, Dumb meter technology results in a 24% reduction in CSL compared with 56% and 76% from ARM and AMI technology. 3. No Benefit to Mains Replacement Targeting: due to their real time monitoring abilities, AMR and AMI technology provides data to conduct a water balance within a DMA or sub DMA facilitating better mains replacement targeting. Due to the requirement for manual meter reads, Dumb metering technology cannot provide this benefit.
	Dumb Meter (houses, flats, bulks) + CSL repair + SHV (non LAHA properties) +SBV	Meter all houses (including CSL repair), individual flats (internal, no CSL repair) and bulk meter (including CSL repair) blocks of flats (Dumb technology). Includes SHV and or SBV to a proportion of newly metered non-LAHA properties that take up the SHV offer. Includes Wastage fix to a proportion of newly metered non-LAHA properties that have a wastage issue identified.	y	y	y	n	n	y	y	y	y	n	y	Rejected	For the last three AMP periods, we have used AMI, AMR and Dumb meter technology as the company moved towards a full smart metering solution. However, from AMP7 and beyond, we will no longer support the large scale rollout of Dumb meter technology. There are three main factors for this decision; 1. Reduced Customer Benefit and social inequality: Dumb meter technology is not supported by Web and Mobile Apps that allow customers to track their water use in real time. Web and Mobile Apps facilitate a greater reduction in water use and therefore lower bills, and increase customer confidence in meter reading accuracy. This in turn leads to greater customer satisfaction and a reduction in customer calls. 2. Low Reduction in CSL: Due to the requirement for manual meter reads, Dumb meter technology results in a 24% reduction in CSL compared with 56% and 76% from ARM and AMI technology. 3. No Benefit to Mains Replacement Targeting: due to their real time monitoring abilities, AMR and AMI technology provides data to conduct a water balance within a DMA or sub DMA facilitating better mains replacement targeting. Due to the requirement for manual meter reads, Dumb metering technology cannot provide this benefit.
	Mains Replacement (Full DMA Replacement) + CSL + AMI Metering (houses, flats)	Full DMA mains replacement with bulk meters, boundary boxes and CSL repairs plus metering all houses and flats with AMI technology.	y	y	y	y	y	y	y	n	y	n	y	Rejected	Following the Full DMA Replacement Project, we are moving away from predetermined full mains replacement together with CSL repair and meter install solutions. Due to the success of the Progressive Metering Programme (PMP) as a discrete option and the benefits in investing in sub-DMA mains renewal rather than full DMA replacement, it has been found to be more efficient to assess the mains renewal and metering programs as discrete options. This allows the Integrated Demand



Generic option	Sub option	Specific option												Overall outcome	Screening reasoning		
			1	2	3	4	5	6	7	8	9	10	11				
																	Management (IDM) model to identify the optimal combined solution for each individual DMA. That is, by assessing these options individually, IDM will identify DMAs where it will be efficient to conduct these mains renewal and metering together and others where it will be more efficient to do these options in isolation.
	Mains Replacement (Full DMA Replacement) + CSL + AMI Metering (houses, flats) + SHV	Full DMA mains replacement with bulk meters, boundary boxes and CSL repairs plus metering all houses and flats with AMI technology followed by a SHV	y	y	y	y	y	y	y	n	y	n	y			Rejected	Following the Full DMA Replacement Project, we are moving away from pre-determined full mains replacement together with CSL repair and meter install solutions. Due to the success of the PMP as a discrete option and the benefits in investing in sub-DMA mains renewal rather than full DMA replacement, it has been found to be more efficient to assess the mains renewal and metering programs as discrete options. This allows the IDM model to identify the optimal combined solution for each individual DMA. That is, by assessing these options individually, IDM will identify DMAs where it will be efficient to conduct these mains renewal and metering together and other's where it will be more efficient to do these options in isolation.
	Mains Replacement (Full DMA Replacement) + CSL + AMI Metering (houses, flats) + SHV + SBV	Full DMA mains replacement with bulk meters, boundary boxes and CSL repairs plus metering all houses and flats with AMI technology followed by a SHV and/or SBV	y	y	y	y	y	y	y	n	y	n	y			Rejected	Following the Full DMA Replacement Project, we are moving away from predetermined full mains replacement together with CSL repair and meter install solutions. Due to the success of the PMP as a discrete option and the benefits in investing in sub-DMA mains renewal rather than full DMA replacement, it has been found to be more efficient to assess the mains renewal and metering programs as discrete options. This allows the IDM model to identify the optimal combined solution for each individual DMA. That is, by assessing these options individually, IDM will identify DMAs where it will be efficient to conduct these mains renewal and metering together and other's where it will be more efficient to do these options in isolation. In addition, there is a medium risk that this will not achieve water savings. Although we will continue to deliver SBVs to our Business customers, we cannot guarantee the degree of uptake or influence following Business customers' transfer to Castle Water in 2017.
	Mains Replacement (Full DMA Replacement) + CSL + AMR Metering (houses, flats)	Full DMA mains replacement with bulk meters, boundary boxes and CSL repairs plus metering all houses and flats with AMR technology.	y	y	y	y	y	y	y	n	y	n	y			Rejected	Following the Full DMA Replacement Project, we are moving away from predetermined full mains replacement together with CSL repair and meter install solutions. Due to the success of the PMP as a discrete option and the benefits in investing in sub-DMA mains renewal rather than full DMA replacement, it has been found to be more efficient to assess the mains renewal and metering programs as discrete options. This allows the IDM



Generic option	Sub option	Specific option												Overall outcome	Screening reasoning		
			1	2	3	4	5	6	7	8	9	10	11				
																	model to identify the optimal combined solution for each individual DMA. That is, by assessing these options individually, IDM will identify DMAs where it will be efficient to conduct these mains renewal and metering together and other's where it will be more efficient to do these options in isolation.
	Mains Replacement (Full DMA Replacement) + CSL + AMR Metering (houses, flats) + SHV	Full DMA mains replacement with bulk meters, boundary boxes and CSL repairs plus metering all houses and flats with AMR technology followed by a SHV	y	y	y	y	y	y	y	n	y	n	y				Following the Full DMA Replacement Project, we are moving away from predetermined full mains replacement together with CSL repair and meter install solutions. Due to the success of the PMP as a discrete option and the benefits in investing in sub-DMA mains renewal rather than full DMA replacement, it has been found to be more efficient to assess the mains renewal and metering programs as discrete options. This allows the IDM model to identify the optimal combined solution for each individual DMA. That is, by assessing these options individually, IDM will identify DMAs where it will be efficient to conduct these mains renewal and metering together and other's where it will be more efficient to do these options in isolation.
	Mains Replacement (Full DMA Replacement) + CSL + AMR Metering (houses, flats) + SHV + SBV	Full DMA mains replacement with bulk meters, boundary boxes and CSL repairs plus metering all houses and flats with AMR technology followed by a SHV and/or SBV	y	y	y	y	y	y	y	n	y	n	y				Following the Full DMA Replacement Project, we are moving away from predetermined full mains replacement together with CSL repair and meter install solutions. Due to the success of the PMP as a discrete option and the benefits in investing in sub-DMA mains renewal rather than full DMA replacement, it has been found to be more efficient to assess the mains renewal and metering programs as discrete options. This allows the IDM model to identify the optimal combined solution for each individual DMA. That is, by assessing these options individually, IDM will identify DMAs where it will be efficient to conduct these mains renewal and metering together and other's where it will be more efficient to do these options in isolation. In addition, there is a medium risk that this will not achieve water savings. Although we will continue to deliver SBVs to our Business customers, we cannot guarantee the degree of uptake or influence following Business customers' transfer to Castle Water in 2017.
	Mains Replacement (Full DMA Replacement) + CSL + Dumb Metering (houses, flats)	Full DMA mains replacement with bulk meters, boundary boxes and CSL repairs plus metering all houses and flats with Dumb technology.	y	y	y	n	n	y	y	n	y	n	y				For the last three AMP periods, we have used AMI, AMR and Dumb meter technology as the company moved towards a full smart metering solution. However, from AMP7 and beyond, we will no longer support the large scale rollout of Dumb meter technology. There are three main factors for this decision; 1. Reduced Customer Benefit and social inequality; Dumb meter technology is not supported by Web and Mobile Apps that allow customers to track their water use in real time. Web and Mobile



Generic option	Sub option	Specific option												Overall outcome	Screening reasoning		
			1	2	3	4	5	6	7	8	9	10	11				
																	Apps facilitate a greater reduction in water use and therefore lower bills, and increase customer confidence in meter reading accuracy. This in turn leads to greater customer satisfaction and a reduction in customer calls. 2. Low reduction in CSL: Due to the requirement for manual meter reads, Dumb meter technology results in a 24% reduction in CSL compared with 56% and 76% from ARM and AMI technology. 3. No Benefit to Mains Replacement Targeting: due to their real time monitoring abilities, AMR and AMI technology provides data to conduct a water balance within a DMA or sub DMA facilitating better mains replacement targeting. Due to the requirement for manual meter reads, Dumb metering technology cannot provide this benefit.
	Mains Replacement (Full DMA Replacement) + CSL + Dumb Metering (houses, flats) + SHV	Full DMA mains replacement with bulk meters, boundary boxes and CSL repairs plus metering all houses and flats with Dumb technology followed by a SHV.	y	y	y	n	n	y	y	n	y	n	y			Rejected	For the last three AMP periods, we have used AMI, AMR and Dumb meter technology as the company moved towards a full smart metering solution. However, from AMP7 and beyond, we will no longer support the large scale rollout of Dumb meter technology. There are three main factors for this decision; 1. Reduced Customer Benefit and social inequality: Dumb meter technology is not supported by Web and Mobile Apps that allow customers to track their water use in real time. Web and Mobile Apps facilitate a greater reduction in water use and therefore lower bills, and increase customer confidence in meter reading accuracy. This in turn leads to greater customer satisfaction and a reduction in customer calls. 2. Low reduction in CSL: Due to the requirement for manual meter reads, Dumb meter technology results in a 24% reduction in CSL compared with 56% and 76% from ARM and AMI technology. 3. No Benefit to Mains Replacement Targeting: due to their real time monitoring abilities, AMR and AMI technology provides data to conduct a water balance within a DMA or sub DMA facilitating better mains replacement targeting. Due to the requirement for manual meter reads, Dumb metering technology cannot provide this benefit.
	Mains Replacement (Full DMA Replacement) + CSL + Dumb Metering (houses, flats) + SHV + SBV	Full DMA mains replacement with bulk meters, boundary boxes and CSL repairs plus metering all houses and flats with Dumb technology followed by a SHV and/or SBV	y	y	y	n	n	y	y	n	y	n	y			Rejected	For the last three AMP periods, we have used AMI, AMR and Dumb meter technology as the company moved towards a full smart metering solution. However, from AMP7 and beyond, we will no longer support the large scale rollout of Dumb meter technology. There are three main factors for this decision; 1. Reduced Customer Benefit and social inequality: Dumb meter technology is not supported by Web and Mobile Apps that allow customers to track their water use in real time. Web and Mobile Apps facilitate a greater reduction in water use and therefore lower bills, and increase customer confidence in meter reading



Generic option	Sub option	Specific option	1	2	3	4	5	6	7	8	9	10	11	Overall outcome	Screening reasoning
															accuracy. This in turn leads to greater customer satisfaction and a reduction in customer calls. 2. Low reduction in CSL: Due to the requirement for manual meter reads, Dumb meter technology results in a 24% reduction in CSL compared with 56% and 76% from ARM and AMI technology. 3. No Benefit to Mains Replacement Targeting: due to their real time monitoring abilities, AMR and AMI technology provides data to conduct a water balance within a DMA or sub DMA facilitating better mains replacement targeting. Due to the requirement for manual meter reads, Dumb metering technology cannot provide this benefit. There is also a medium risk that this will not achieve water savings through the SBVs. Although we will continue to deliver SBV's to our Business customers, we cannot guarantee the degree of uptake or influence following Business customers' transfer to Castle Water in 2017.

Note: Where the table refers to 'Full DMA Replacement' under Combined Options, this was referred to as VMR in WRMP14.