

## Wessex Water Services Ltd Response to Ofwat's PR19 Draft Determination – August 2019

**Representation reference: Cost Assessment C6**

**Representation title: WINEP: Investigations**

### Summary of issue

Our response to the IAP proposed £15.0m of investigations, as detailed in Appendix 4 – Protecting and enhancing the environment: Response to IAP. In addition, we note that Ofwat reallocated the £3.2m funding from the WINEP for the 54 investigations of frequently spilling overflows, detailed in the same document. We have reallocated this from Network Storage, Table WWS2 Line 11, to the WINEP investigations, Table WWS2 Line 16.

WINEP: Investigations (Wastewater)	£m
PR19 business plan	18.213
Draft determination	14.571
Representation request	18.213

Ofwat's draft determination deep dive of the wastewater investigations programme gave a pass for the need and fails for two gates: best option for customers and robustness and efficiency of costs. Therefore a 20% efficiency challenge was applied. A further 8.6% efficiency was also assumed by Ofwat on the WINEP programme efficiency challenge. We challenge these arbitrary efficiencies.

We have a large programme of investigations, which will help us innovate future sustainable catchment wide solutions as well as building detailed cases for delivering efficient schemes in the future (or if appropriate avoiding the need for investment).

In this response, we provide some more evidence to the scope of the investigations that have been agreed with the Environment Agency and cost efficiency.

We noted your comment that detail of the investigations programme were distributed throughout our submissions Appendix 4 – Protecting and enhancing the environment (September 2018) and Supporting document 5.1 – Protecting and enhancing the environment: Response to IAP (April 2019). We agree, so this document collates the WINEP investigations programme into one document. It contains more detailed scopes, as agreed with the Environment Agency, and cost breakdown, as further evidence. Through a series of meetings and agreement of these scopes, the EA has already agreed that these are the most appropriate processes for these investigations.

For most of these investigations, detailed cost estimate spreadsheets have been calculated using a bottom up approach. For others, such as the frequent spilling overflow investigations, unit rates of similar historical projects have been used. The approach is detailed in the relevant sections below.

## Change requested

We request that the full allowance in our IAP submission is given, so we can undertake these WINEP investigations, as agreed and required by the Environment Agency.

## Rationale (including any new evidence)

These wastewater investigations have WINEP regulatory outputs and will be scrutinised by the Environment Agency.

Table 1 below shows a breakdown of costs for our investigations. The following sections then provides more detailed scopes, showing our basis for deriving the costs to deliver this investigation programme, along with an example of one of our bottom up estimates showing the level of detail included.

**Table 1: Summary of PR19 wastewater investigations costs**

Scheme name	WINEP ID	Where documented in Sept 2018 submission	Cost (£m)
<b>Bathing and Shellfish waters</b>		<b>Tables 7-4 and 7-8</b>	<b>4.94</b>
Bathing Water Investigations			
- Berrow North of Unity Farm	7WW300032		
- Blue Anchor West	7WW300041		
- Bournemouth Boscombe Pier	7WW300033		
- Burnham Jetty North	7WW300042		
- Clevedon Beach	7WW300035	Page 171	1.58
- Dunster North West	7WW300036		
- Minehead Terminus	7WW300039		
- Weston Main	7WW300043		
- Weston-super-Mare Sand Bay	7WW300040		
- Weston-super-Mare Uphill Slipway	7WW300044		
Poole Harbour SFW North catchment investigation	7WW200689		0.63
Poole Harbour SFW South catchment investigation	7WW200690	Page 177	0.80
Poole Harbour SFW West catchment investigation	7WW200691		1.93
<b>Frequent spilling overflows</b>		<b>Table 4-3</b>	<b>3.17</b>
FSO Investigations (various)	multi	Page 123	3.17 (See note 1)

Scheme name	WINEP ID	Where documented in Sept 2018 submission	Cost (£m)
<b>Nutrient (phosphorus and nitrogen) investigations</b>		<b>Table 3-32</b>	<b>10.09</b>
Post construction monitoring of Cromhall constructed wetlands	7WW300299	Page 45	0.41
Hindon STW - Groundwater Investigation	7WW300200	Page 50	0.67
Sixpenny Handley STW - Groundwater Investigation	7WW300213	Page 59	0.60
Tilshead STW - Groundwater Investigation	7WW300216	Page 50	0.78
Collingbourne Ducis STW - Groundwater Investigation	7WW200233	(See Note 2)	0.26
Maiden Bradley STW - Groundwater Investigation	7WW200550	(See Note 2)	0.26
Nitrate offsetting trials - Hindon - Sixpenny Handley - Tilshead	7WW300201 7WW300212 7WW300217	Page 50 Page 59 Page 50	0.66
Nitrate offsetting trials - Collingbourne Ducis - Maiden Bradley	7WW300300 7WW300301	(See Note 2)	0.44
Bristol Avon Catchment Permitting Trial - Post implementation environmental assessment	7WW300290	Page 42	0.19
Hampshire Avon WQ rCSMG investigation	7WW200439	Page 50	1.26
Moors River (River Crane) SSSI WQ rCSMG investigation	7WW200834	Page 59	0.48
Moors River and Uddens Water SSSI - Further investigation	7WW300205	Page 59	0.30
Dorset Frome SSSI WQ rCSMG investigation	7WW200833	Page 64	0.75
Dorchester STW - SSSI Seasonal P performance investigation	7WW300196	Page 64	0.87
Poole STW (and other assets) investigation N and P to Holes Bay	7WW200438	Page 64	0.65
Poole Harbour catchment STWs - N and P monitoring investigation	7WW300207	Page 65	0.36
North Petherton STW - Phosphorus Removal Investigation	7WW200642	Page 77	0.24
Durleigh Reservoir investigation - Options to reduce phosphorus and nitrogen inputs from the River Tone u/s Firepool Locks	7WW200319	Page 77	0.91
			<b>18.21</b>

**Notes**

1. Costs for FSO investigations originally included in WWn4 Line 11.
2. Subsequent to the publishing of our business plan in September 2018, we agreed with the EA to defer potential asset improvements at Collingbourne Ducis and Maiden Bradley STWs in place of groundwater investigations and nitrate offsetting trials. Amendments to our plan are detailed in pages 23-25 of Appendix 4 – Protecting and enhancing the environment: Response to IAP.

The following sections explains the aims and the detailed scopes that we have agreed to undertake. These have been agreed with the Environment Agency.

---

## Bathing waters

### Aims

The WINEP identifies 10 bathing water ambition investigations to be completed in AMP7. All ten of the bathing waters are currently failing to meet the 'Excellent' classification. The aim of the investigations as stated in the WINEP are as follows: For Bathing Waters not classed as 'Good': Investigation part 1. Catchment investigation to understand what water company action would be needed to achieve a robust classification of Good (less than 20% risk of failing planning class of Good). Investigation part 2. Catchment investigation to understand what water company action would be needed to achieve a robust classification of Excellent (less than 20% risk of failing planning class of Excellent). For Bathing Waters classed as 'Good': Catchment investigation to understand what water company action would be needed to achieve a robust classification of Excellent (less than 20% risk of failing planning class of Excellent). Although not currently stated in the WINEP description, it is understood that Defra require the investigations to report indicative improvement costs (where relevant).

### Scope

These will be managed and delivered by Wessex Water as one project and for ease of delivery, one scope has been produced to cover all ten investigations. The Environment Agency has produced a document compiling all available information sources that they are aware of (ref: 20190104\_BW\_Inv\_Form\_Wessex). This includes some site-specific considerations. The project will be overseen through a project steering group (PSG) comprising the Environment Agency and Wessex Water.

The project will be delivered in four phases:

- 1) Scoping: A project scope will be produced.
- 2) Desk study: A desktop study will be carried out and a report produced. This will:
  - a) Collate existing information on relevant assets and the bathing water. This may include data from the EA, Wessex Water or third parties (including the information in the document from the Environment Agency referenced above).
  - b) Consider any site specific issues identified by the Environment Agency in the document referenced above .
  - c) Identify those bathing water where Wessex Water assets are not a causal factor in the Bathing Water not achieving robust 'Good' or 'Excellent' status (and not taken forward into Phase 3).
  - d) Identify those bathing waters that require further analysis and identify a monitoring and delivery plan to collect that additional information. This may include the requirement for additional sampling and modelling of the performance of Wessex Water's sewerage assets, coastal modelling or misconnection investigations.

The mechanism for determining whether further information is required will be discussed and agreed with the Environment Agency at the PSG. The desk study report will be circulated to the PSG and its findings and recommendations agreed prior to proceeding with Phase 3.

- 3) Monitoring: Additional monitoring at Bathing Waters identified in Phase 2.
- 4) Analysis and reporting: Analysis of monitoring data collected in Phase 3. Where improvements are required at Wessex Water assets, indicative costs will be provided.

The findings will then be presented in a draft report in summer 2021 for comment, followed by production of a final report in by the end of September 2021.

### Costs

The costs from our bottom up estimate are summarised below:

Scheme name	Where documented in Sept 2018 submission	Cost (£m)
Bathing Water Investigations	Page 171 & Table 7-4	1.58

## **Shellfish Waters**

### **Aims**

An 18 month monitoring programme to;

- a) Assess all Wessex Water (WxW) discharges in the Poole Harbour catchment in order to identify how the water company assets impact on the shellfish water (SFW).
- b) Apportion WxW assets load in the context of other sources in order to understand the water company contribution to the failure to achieve the microbial standard.
- c) Understand how the contribution of bacteria from water company discharges may be affected by climate change.
- d) Identify any improvements required to WxW assets to inform PR24.

### **Scope**

This investigation will assess the impact of WxW assets in the Poole Harbour catchment on SFW compliance. The desk study will inform final locations and numbers of samples. The project will involve monitoring of 21 STW, 35 freshwater locations and 2 intermittent discharges in the Poole Harbour catchment and will entail:

- a) Production and agreement of scope of works with the Environment Agency/ Natural England
- b) Production of desk study and detailed monitoring plan (this may result in changes to the monitoring outlined in this scope)
- c) Implementation of plan, anticipated to include:
  - i) STW, intermittents and other discharges (to characterise feeder streams)
  - ii) Sewer network modelling to understand source apportionment and impact of climate change on assets
  - iii) Quantification of travel time and bacterial decay from assets to SFW
- d) Options appraisal. Options will include technical feasibility as well as cost and sustainability. This phase will identify and factor in AMP7 STW improvements.
- e) Climate change - high level assessment of how rainfall patterns and growth may change and how this will affect performance of STW and CSOs.
- f) Liaison with Environment Agency/ Natural England and other stakeholders over outcomes.

### **Costs**

The costs from our bottom up estimate are summarised below:

<b>Scheme name</b>	<b>Where documented in Sept 2018 submission</b>	<b>Cost (£m)</b>
Poole Harbour SFW North catchment investigation	Page 177 & Table 7-8	0.63
Poole Harbour SFW South catchment investigation		0.80
Poole Harbour SFW West catchment investigation		1.93

## **Frequent spilling overflows**

### **Aims**

Combined sewer overflows are designed to discharge untreated storm sewage into watercourses during heavy rainfall, in order to prevent adjacent properties from flooding. There is an understandable perception amongst a section of public that our sewers should not spill any untreated sewage into the environment. These storm overflows are consented (permitted) by the Environment Agency because they are there to protect properties from flooding.

The national Storm overflow assessment framework (SOAF) was outlined on page 124 of Supporting document 5.1 – Protecting and enhancing the environment as part of our business plan submission in September 2018. In this framework, a storm overflow is considered to be a frequent spilling overflow (FSO) if it spills more than 40 times a year on averaged over three years (or 50 times averaged over two years, or 60 times in one year).

At the time of writing the PR19 plan, we had identified 54 storm overflows that were deemed to be frequent spilling overflows (FSO) according to the criteria in the SOAF, using available Event duration monitoring (EDM) data and thought to be caused by hydraulic overload. These excluded FSO that were primarily caused by infiltration.

We agreed with the EA to only include FSOs on the WINEP that were thought to be caused by hydraulic overload (capacity) issues.

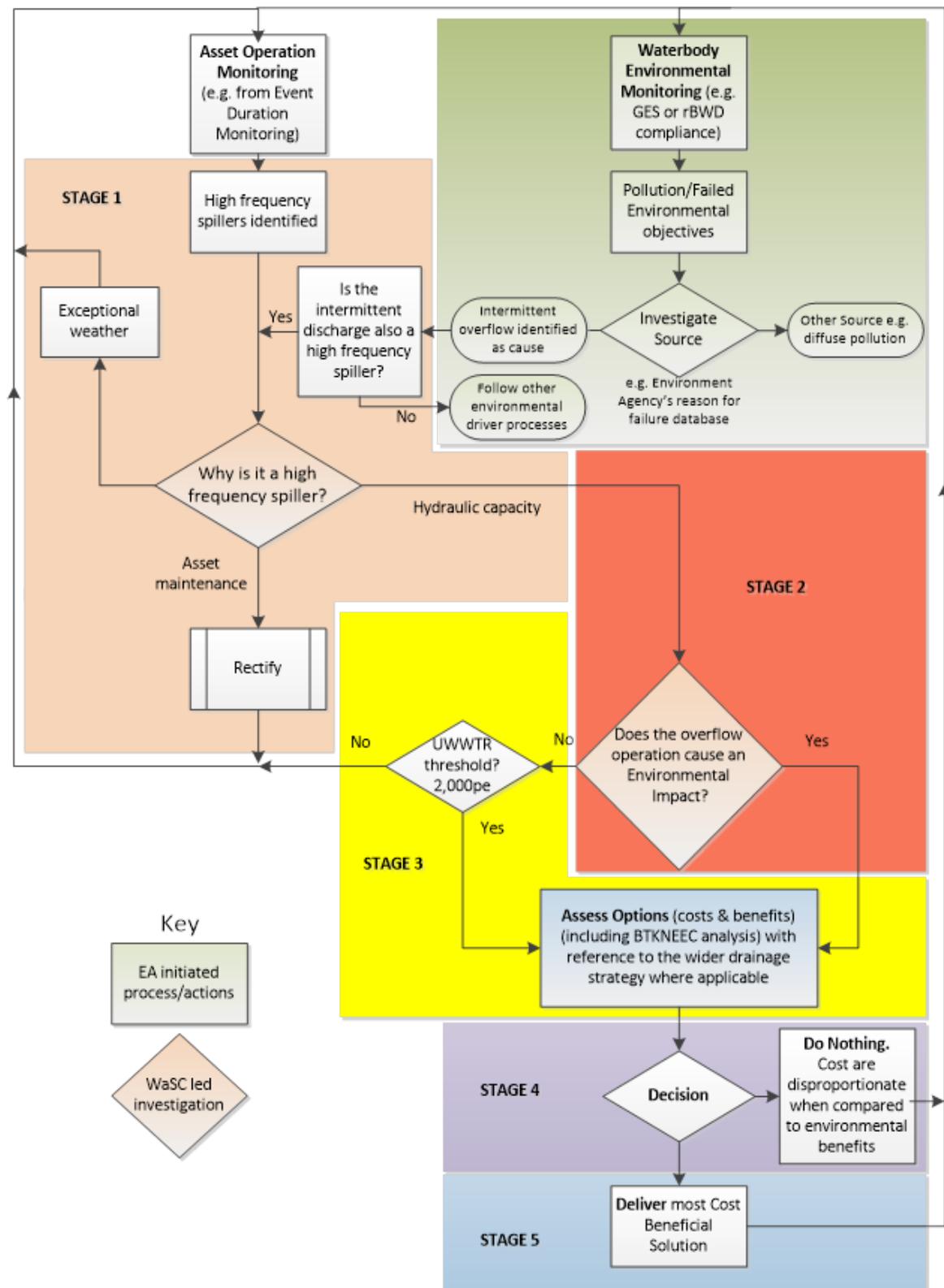
### **Scope**

The scope of the investigations required for FSOs is defined in the SOAF. This includes sampling/analysis requirements and a cost benefit analysis of the hydraulic options to determine the optimum solutions. As well as having investigations drivers, 13 of the 54 storm overflows were also given a secondary driver for improvement in AMP7, in addition to the investigations drivers.

Last year (2018) our new EDM equipment identified over 30 additional FSOs. If investigations of the 54 originally identified WINEP FSOs show that some are caused by operational, rather than hydraulic issues then authorisation will be sought to swap them out and replace them with newly identified hydraulic capacity deficient frequent spilling storm overflows. A similar swapping approach will be taken with the 13 FSO improvements, if needed.

An extract of the SOAF investigation process is provided below.

Figure – Storm overflow assessment framework process



### Stage 1c – Hydraulic assessment

If a verified hydraulic model of the overflow is already available, this should be used to assess whether the high spill frequency is a genuine reflection of the permitted hydraulic design of the asset, and the amount of connected area contributing rainfall runoff. Alongside asset inspections carried out under stage 1b (above), models may have already been used to determine that the high spill frequency is not due to maintenance issues.

Where a verified hydraulic model is not already available, a new model will be required to predict the performance of the overflow. A verified model is also likely to be required in order to quantify the environmental impact of the overflow under stage 2. In order to have confidence in model predictions, models should be verified in accordance with the [CIWEM Urban Drainage Group Code of Practice for the Hydraulic Modelling of Urban Drainage Systems](#) (CIWEM UDG, 2017). The EDM datasets will assist with verification.

Each Investigation requires hydraulic computer modelling. If we do not have a fit for purpose model we will need to re-verify the model using new flow monitoring equipment near the overflow that is being investigated. This may require to install local short term flow surveys to verify the storm overflow performance, which costs at least £10k each.

The next stage of the investigation is shown below (extracted for the SOAF):

### 3. Stage 2 – Does the storm overflow cause an environmental impact?

The following impact assessment will be used to quantify the environmental impact of the storm overflow. The assessment is divided into three main components:

- Aesthetic impact including amenity and public complaint
- Invertebrate (biological) impact
- Water quality impact

Each of these components is scored and classified separately depending on the information available, and will link to the cost and benefits analysis for overflow improvements under stage 3. The process is illustrated in Figure 2. It is hierarchical and gives preference to invertebrate impact data over modelled water quality assessments. The process is summarised as follows:

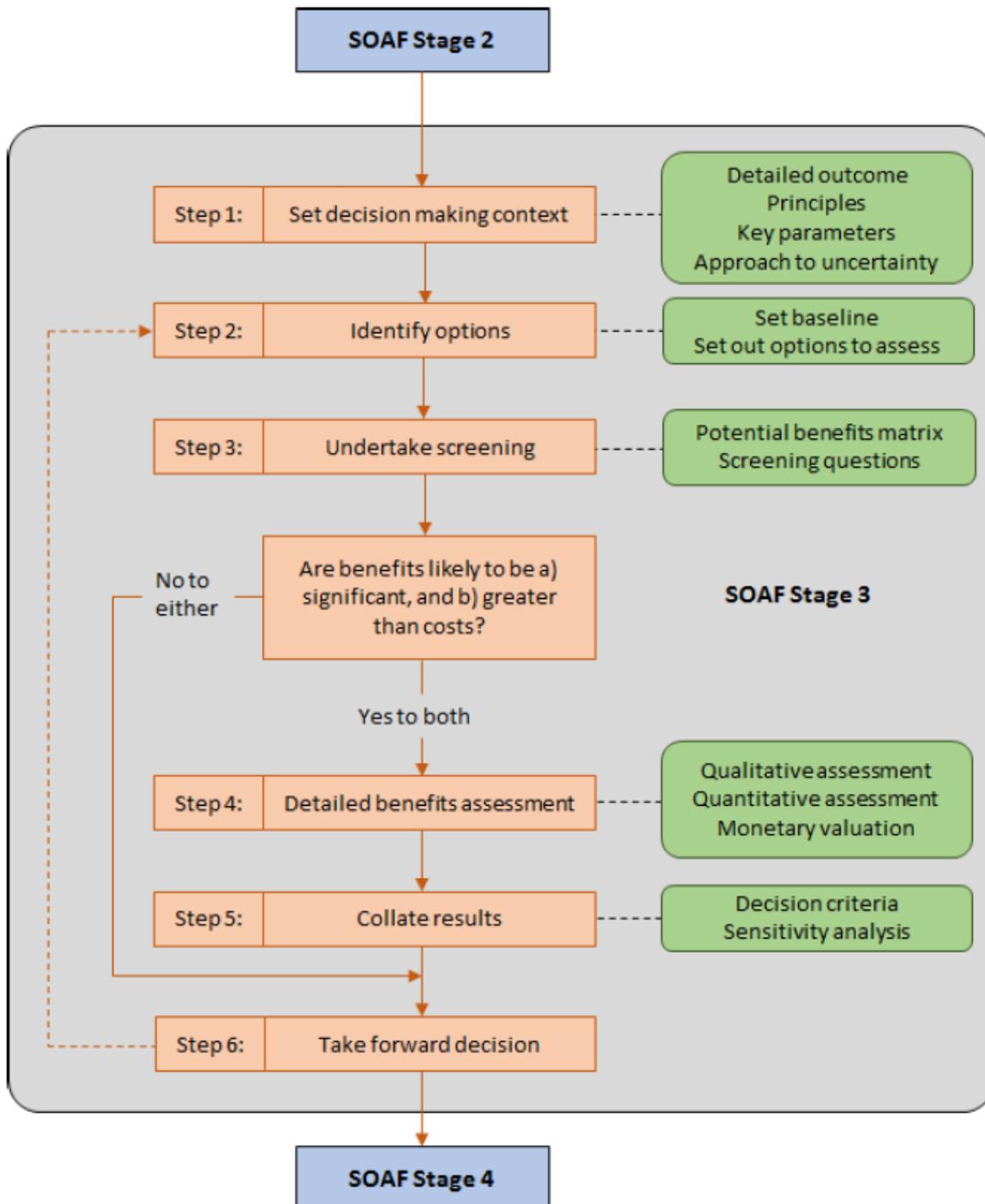
**Stage 2a:** the process begins with an aesthetics assessment. A score and classification ranging from no impact to severe impact is assigned to the overflow.

**Stage 2b:** where it is possible to collect representative invertebrate samples upstream and downstream of the overflow, an invertebrate impact classification will be assigned, ranging from no impact to extremely severe. Where the invertebrate assessment is possible, an assessment of water quality impact based on levels of dilution or modelling is not needed. The invertebrate samples provide evidence of the degree of impact.

**Stage 2c:** an assessment of water quality impact is required where it is not possible to collect representative invertebrate samples upstream and downstream of the outfall. The water quality impact assessment involves an initial assessment based on dilution. If the dilution criteria are not met, a modelled impact assessment is required. The overflow is then assigned a water quality impact classification ranging from no impact to severe impact.

This will require site surveys to seek evidence of aesthetic debris. Invertebrate samples will often be required (kick sampling) and in the complex cases water quality sampling will be required.

A cost benefit analysis is then required for each investigation:



The SOAF stage 2 step 2 is to identify options to the FSO to reduce the spill frequency and impact on the receiving watercourse. Optioneering will consider all feasible options, including traditional solutions and sustainable solutions (as stated in Section 3.2.2 of Appendix 4 – Protecting and enhancing the environment).

We will be following the SOAF process for the FSO investigations and the improvements that are included on the WINEP and also for those being delivered under the Non-WINEP

performance commitment (see Section 8.9 of Appendix 3 – Updated Performance Commitment detail document (update from business plan)).

### Costs

We have applied a unit rate approach to the FSO investigations costs estimate. See summary table below and the following detail.

Scheme name	Where documented in Sept 2018 submission	Cost (£m)
FSO Investigations	Page 123 & Table 4-3	3.17

We assumed that these 54 investigations will be a mix of: investigations using existing verified models, new short term flow surveys / verification required, and three new complex Urban Pollution Management<sup>1</sup> (UPM) studies required.

The Environment Agency has agreed the level of detail that each investigation is likely to require. Level 1 is the simplest (but these still required computer modelling and normally invertebrate samples). Level 2 is more complex and may require mass balance water quality modelling. Level 3 is complex and requires dynamic water quality modelling.

The table below give details of each investigation type. We have applied unit rates for the investigation and modelling was based on carrying out these investigations using our in-house computer modelling team, which has been proven to be very cost efficient compared against consultants (See page 34 of Supporting document 5.4 – Minimising sewer flooding).

The UPM costs have been based on the Bristol UPM study that cost £0.88m almost a decade ago. We have applied efficiencies to this cost, when applying the unit rates, as shown in Table below.

**Table – FSO investigation type and costs**

FSO Name	Anticipated type of investigation	Investigation Cost (£m)
17684 Willsbridge CSO	Level 1 Invertebrate	0.05
13172 Kinson New Road Northbourne STW SSO	Level 1 Invertebrate	0.05
13258 Salisbury Petersfinger -Southampton Road STW SSO	Level 1 Invertebrate	0.05
13308 Thingley Coppershell Lane STW SSO	Level 1 Invertebrate	0.05
13330 Wellington Tone STW SSO	Level 1 Invertebrate	0.05
14058 Horton Farm SPS	Level 1 Invertebrate	0.05
16470 Bristol Hanham Polly Barnes Hill CSO	Level 1 Invertebrate	0.05
19821 Pitminster Weir SPS	Level 1 Invertebrate	0.05

<sup>1</sup> Urban Pollution Management Manual, Foundation for Water Research, 2012 (<http://www.fwr.org/UPM3/>)

FSO Name	Anticipated type of investigation	Investigation Cost (£m)
14152 Broads Green SPS	Level 1 Invertebrate	0.05
16790 Monkton Combe Mill Lane CSO	Level 1 Invertebrate	0.05
16673 Ilminster Brewery Lane CSO	Level 1 Invertebrate	0.05
15084 Verwood Potterne Way SPS	Level 1 Invertebrate	0.05
15450 Norton Fitzwarren Langford Lane SPS	Level 1 Invertebrate	0.05
13132 Gillingham Common Mead Lane STW SSO	Level 1 Invertebrate	0.05
15435 Bathpool Hyde Lane SPS	Level 1 Invertebrate	0.05
13256 Rode STW SSO	Level 1 Invertebrate	0.05
13244 Potterne STW SSO	Level 1 Model	0.03
13275 Shrewton STW SSO	Level 1 Model	0.03
14179 Biddestone Manor Cottages SPS	Level 1 Model	0.03
19975 Filton Stoke Brook CSO	Level 1 Model	0.03
16693 Long Sutton Back Street CSO	Level 1 Model	0.03
13043 Butleigh STW SSO	Level 1 Model	0.03
13223 North Petherton STW SSO	Level 1 Model	0.03
14431 Bishop Sutton SPS	Level 1 Model	0.03
13044 Calne STW CSO	Level 1 Model	0.03
16899 Bradford-On-Avon Market Street Junction With Church Street CSO	Level 2 Water quality	0.20
16897 Bradford-On-Avon Culver Street Recreation Park Off Pound CSO	Level 2 Water quality	
19308 Bristol Glenwood Road Side Of No 2 Westbury On Trym CSO	Level 2 Water quality	0.20
16407 Bristol Wellington Hill West / Bishopthorpe Road CSO	Level 2 Water quality	
16950 Winterbourne Harcombe Farm Hicks Common In Field CSO	Level 2 Water quality	0.25
16556 Frampton Cotterell St Peters Church (Nw) Church Road CSO	Level 2 Water quality	
16561 Winterbourne Watleys End In Field Off Factory Road CSO	Level 2 Water quality	
17543 Bath Lambridge Rugby Ground Carpark CSO	Level 2/3 Water quality	0.60
16115 Bath Westmoreland Road / Cheltenham Street Junction CSO	Level 2/3 Water quality	
16016 Bath Moorland Road Near No 49 CSO	Level 2/3 Water quality	
16772 Batheaston Garden CSO	Level 2/3 Water quality	
16068 Bath Walcot River Bank End Of Chatham Row CSO	Level 2/3 Water quality	
16073 Bath Cleveland Bridge To The West CSO	Level 2/3 Water quality	
16088 Bath Parade Gardens CSO	Level 2/3 Water quality	
16759 Bathford Ostling Lane CSO	Level 2/3 Water quality	
17166 Bath Bewdley Road CSO	Level 2/3 Water quality	
17541 Bath Larkhall Terrace Field To Rear CSO	Level 2/3 Water quality	

FSO Name	Anticipated type of investigation	Investigation Cost (£m)
16072 Bath St Johns Road Scouts Site CSO	Level 2/3 Water quality	
16043 Bath Recreation Ground By North Stand CSO	Level 2/3 Water quality	
17532 Bath Avon Street O/S Bath Technical College CSO	Level 2/3 Water quality	
17236 Maiden Bradley Drive To STW CSO	Level 2 Groundwater	0.10
15486 West Bexington SPS	Level 2 Reedbed	0.10
13056 Charmouth Headworks/Sea Outfall STW CSO	Level 2 Coastal	0.10
13334 Bridport West Bay SPS	Level 2 Coastal	0.10
15648 Portland Bill SPS	Level 2 Coastal	0.10
13013 Avonmouth Kingsweston Lane STW SSO	Level 2 Coastal	0.10
16290 Bristol Alma Road O/S No 87 CSO	Level 2 Coastal	0.10
16848 Weymouth Chickerell Road CSO	Level 2 Coastal	0.10
14016 Bristol Ashton Avenue SPS	Level 2 Coastal	0.10
<b>Total</b>		<b>3.2</b>

## **Cromhall constructed wetland monitoring**

### **Aims**

In place of a new phosphorus permit at Cromhall Water STW in AMP6, we are trialling the use of a constructed wetland for the reduction of phosphorus to compare with 'traditional' hard engineering and chemical tertiary treatments. The site currently has a dry weather flow of 520m<sup>3</sup> per day and a population equivalent of 1994 with no trade waste. The wetland is due for construction by the end of AMP6. The design consists of three common lagoons (through which all flow will pass), followed by a 50:50 flow split to two sets of three lagoons.

The wetland is intended to reduce both suspended solids and phosphorus levels in the final effluent, whilst providing natural capital benefits that would not be realised if a 'traditional' approach were implemented. It is recognised that wetlands may remove other contaminants present in final effluent and three PhD studentships have been secured to investigate the fate of nutrients, bacteria and pharmaceuticals within the wetland and the processes they undergo (although these will report outside the timescales of the WINEP investigation).

The aim of this investigation is to assess the water quality improvements and biodiversity benefits of the newly created wetland tertiary treatment system, and inform how the site should be managed in the future to achieve the best balance between water treatment performance and biodiversity value.

### **Scope**

The investigation will assess the efficacy of nutrient, organic pollutant and pharmaceutical removal from final effluent using a wetland, and the wider biodiversity benefits of this type of approach. To help identify these wider benefits and to understand the processes delivering them a detailed and diverse monitoring plan is required. As part of the construction phase, a pre-construction and construction monitoring programme is currently being delivered to capture the existing ecological structure and ecosystem services present at the wetland site, whilst a post construction monitoring plan has also been developed (details available on request).

The first phase of this project will include a desk study to review all data collected during the pre-construction and construction monitoring phases and, if necessary, amend the post-construction monitoring programme in light of this information. Some modifications to the monitoring programme may be required to accommodate the experimental design of the PhD investigations.

The second phase of the investigation will see the implementation of the post construction monitoring programme and will consist primarily of sampling and survey work. Interim investigation summaries will report on progress. The post construction monitoring programme is likely to include;

- Water quality - nutrients, bacteria, pharmaceuticals
- Ecology - terrestrial and freshwater
- Flow - STW effluent and receiving water course

The final phase will consist of detailed analysis of results and reporting with the aim of understanding the net gain to the natural capital of the area, the overall performance of the wetland on final effluent water quality and inform how the site should be managed going forward to afford the best balance between water quality removal performance and biodiversity value. Annual progress reports will be prepared during project delivery.

### Costs

The costs from our bottom up estimate are summarised below:

Scheme name	Where documented in Sept 2018 submission	Cost (£m)
Post construction monitoring of Cromhall constructed wetlands	Page 45 & Table 3-32	0.41

---

## **Groundwater nitrogen investigations and catchment offsetting**

### **Aims**

In the development of the WINEP, five sewage treatment works (STW) that discharge to soakaways were identified as requiring improvements to mitigate the impact of sewage effluent discharges on nitrate concentrations in groundwater. To control nitrogen (nitrate) concentrations in chalk aquifers (WFD groundwater bodies) the Environment Agency were set to apply nitrogen (N) limits to the effluent discharge of 8.4 mg/l (as N). We felt there was significant uncertainty at each of these sites as to both the extent of, and mechanisms involved in, potential nitrate groundwater contamination. We also felt that the capital and ongoing costs were disproportionate to the size of the works. We proposed to the EA to undertake investigation work during PR19, reviewing available evidence, undertaking targeted monitoring and, where appropriate, trialling new technologies to assess the impacts of these discharges and allowing evidence-based decision making to inform works required for PR24. Alongside this investigation work, it was proposed to undertake catchment management in the surrounding area to offset the impact whilst the investigation is completed.

It has been agreed with the EA for us to undertake investigation work at all five sites:

- Hindon STW
- Sixpenny Handley STW
- Tilshead STW
- Collingbourne Ducis STW
- Maiden Bradley STW

The aim is to review available evidence, undertake targeted monitoring (to define existing impact) and, where appropriate, trial potential nitrogen reduction technologies to assess the impacts of these discharges on the receiving groundwater. Collated findings, alongside a costed options appraisal exercise, will be used to inform works required for PR24 to control the concentration of nitrogen reaching the aquifer (if required). Alongside this investigation work, it is proposed to undertake catchment management in the relevant catchments (River Till (Tilshead), Fonthill Brook (Hindon), River Allen (Sixpenny Handley), Bourne (Collingbourne Ducis) and Upper Wylve (Maiden Bradley)) to offset the impact whilst the investigation is undertaken (subject of a separate AMP7 scope document).

### **Scope**

A single investigation will be undertaken covering all five sites and comprising three key phases:

- 1) Scoping, to be completed September 2018;
- 2) Desk study, to be completed by end of September 2019 which will:
  - Review and document EA decision making process to identify these sites for N permits;
  - Collate and review available relevant information relating to each discharge including previous investigations, discharge quality, flow, groundwater quality, conceptual understanding of hydrogeology;
  - Identify a monitoring programme that will fill any gaps identified through the above;

- Quantification of nitrogen load from each STW to determine target reduction for catchment management;
  - Review potential options for reducing N at each site; including existing and emerging technologies and catchment management offsetting; and
  - Install observation boreholes (autumn/winter 2019/20).
- 3) Implementation, from April 2020 including:
- Delivery of the monitoring programme;
  - Technology trial, to be run in parallel with monitoring from September 2020 to September 2021.
  - Assessment of impact of discharge using information gathered through the study in relation to other nitrogen sources.
  - Delivery of final report including options appraisal and recommendations for each site for PR24 by March 2022.

In parallel to the groundwater investigations and technology trials, we will be implementing catchment management to offset an agreed proportion of the nitrogen discharges for the duration of AMP7, until March 2024.

### Costs

The costs from our bottom up estimate are summarised below:

Scheme name	Where documented in Sept 2018 submission	Cost (£m)
Hindon STW - Groundwater Investigation	Page 50	0.67
Sixpenny Handley STW - Groundwater Investigation	Page 59	0.60
Tilshead STW - Groundwater Investigation	Page 50	0.78
Collingbourne Ducis STW - Groundwater Investigation	*	0.26
Maiden Bradley STW - Groundwater Investigation	*	0.26
Nitrate offsetting trials - Hindon - Sixpenny Handley - Tilshead	Page 50 Page 59 Page 50	0.66
Nitrate offsetting trials - Collingbourne Ducis - Maiden Bradley	*	0.44

\* Subsequent to the publishing of our business plan in September 2018, we agreed with the EA to defer potential asset improvements at Collingbourne Ducis and Maiden Bradley STWs in place of groundwater investigations and nitrate offsetting trials. Amendments to our plan are detailed in pages 23-25 of Appendix 4 – Protecting and enhancing the environment: Response to IAP.

## **Bristol Avon Catchment Permitting environmental assessment**

### **Aims**

Post implementation three year monitoring starting in April 2019 to assess the water quality and ecological benefits from the phosphorus reduction delivered by the Bristol Avon catchment permitting trial. To include;

- a) Monitoring of river water phosphorus levels upstream and downstream of all the STWs with stretch targets (23 STWs)
- b) Diatom and macrophyte surveys where site conditions are suitable.
- c) Comparison against available historical data, including data from the AMP6 managing uncertainty investigation for the Bristol Avon.

### **Scope**

This investigation will assess the impact of the catchment permitting trial on river water quality, diatom abundance and macrophytes. There are 23 STW that have stretch targets to achieve a target tonnes of phosphorus removed as part of the Bristol Avon catchment permitting trial. This investigation will include a three year monitoring programme for upstream and downstream river water quality sampling of all 23 STW with stretch targets to start when the final STW permit applies (01/04/2019) and a number of diatom and macrophyte surveys, locations to be established during the summer season 2019. Diatom sample location and macrophyte survey location is dependent on suitable environmental conditions such as vegetation cover, water depth and shade. Diatom surveys will be carried out where alkalinity <200 mg/l as sensitivity to nutrients reduces as alkalinity increases. Leafpac macrophyte surveys will be carried out in the higher alkalinity areas where environmental conditions permit.

The project will entail;

- 1) Production and agreement of scope of works with the Environment Agency & Natural England
- 2) Development and production of monitoring plan
- 3) Implementation of three year monitoring plan (1st April 2019 to 31st March 2022) anticipated to include:
  - a) river water quality sampling and analysis
  - b) diatom surveys
  - c) macrophyte surveys
- 4) Final reporting by 31st December 2022

### **Costs**

The costs from our bottom up estimate are summarised below:

<b>Scheme name</b>	<b>Where documented in Sept 2018 submission</b>	<b>Cost (£m)</b>
Bristol Avon Catchment Permitting Trial - Post implementation environmental assessment	Page 74	0.19

## **Hampshire Avon CSMG investigation**

### **Aims**

This investigation will assess the contribution Wessex Water infrastructure and activities (STWs, CSOs, water resources and catchment management) have on the compliance of phosphorus, ammonia, biochemical oxygen demand and dissolved oxygen water quality along the section of Hampshire Avon designated as a Special Area of Conservation (SAC): Avon, Upavon to Christchurch Harbour and designated reaches of the Bourne, Ebble, Nadder, Till and Wylye. Hereafter, collectively referred as the Hampshire Avon SAC.

Hampshire Avon SAC is assessed by NE in terms of its compliance with rCSMG (revised Common Standards Monitoring Guidance) targets, who consider achieving the target riverine concentrations as a pre-requisite for favourable condition. This investigation will explore and assess options for achieving the phosphorus rCSMG targets and established targets for ammonia, biochemical oxygen demand and dissolved oxygen in the designated area that are feasible and effective. Going further, this investigation will additionally investigate the resilience the options have in achieving the phosphorus rCSMG by assessing the risk of deterioration to non-compliance due to population growth.

It will therefore be necessary to undertake this investigation in two parts. Part one, a desk study, will pull together all available relevant information and use a risk-based approach to prioritise further monitoring. In conjunction with this, a SAGIS-SIMCAT model will need to be agreed to use as part of this investigation. This will be done through consultation with the Wessex SAGIS Group. This will involve checking that the river network contains the features and representative data to sufficiently represent the Hampshire Avon SAC. It may be necessary to alter the model to include features (river stretches, fish farms etc) previously unrepresented. It may also be necessary to update the data period and represent the natural background phosphorus concentrations within the model. Any changes will be agreed with the Wessex SAGIS group to ensure that the model can be used for PR24 purposes as well as for this investigation. Details of any required changes to the model will be detailed in the desk study. The desk study will culminate in the production of a monitoring plan designed to address the aims of this investigation.

Part two will involve the implementation of the monitoring, update of the SAGIS-SIMCAT model if necessary and the interpretation of the monitoring data. It will be important to utilise the monitoring data to confirm Wessex Water's contribution to non-compliance with the rCSMG targets of phosphorus, ammonia, biochemical oxygen demand and dissolved oxygen in relation to other sources. Part two will also involve utilising the SAGIS-SIMCAT model to:

- i) Ensure that proposed options will achieve their desired outcome;
- ii) Ensure that proposed options are technically feasible; and
- iii) Determine the resilience of the EA options by assessing the risk of deterioration and future non-compliance due to population growth.

Where possible, targeted monitoring may be undertaken at locations where elevated levels of P are identified or suspected, such as downstream of watercress beds and fish farms.

## Scope

The project will entail:

- 1) Production and agreement of scope in 2018/19
- 2) Desk study and production of monitoring plan in 2018/19
  - a) Establishment of current level of data and evidence showing the contribution of Wessex Water activities (in relation to other sources) upon non-compliance of the rCSMG favourable condition targets for phosphorus, ammonia, BOD and DO along the section of river designated as Hampshire Avon SAC.
  - b) Assess whether update of the SAGIS model is required.
- 3) Implementation of monitoring plan April 2020 to March 2021
  - a) Twice monthly effluent samples at all STW within or upstream of the section of river designated as Hampshire Avon SAC
  - b) Twice monthly river samples within or upstream of the section of river designated as Hampshire Avon SAC, locations to be defined in desk study.
  - c) Twice monthly spot flow monitoring within or upstream of the section of river designated as Hampshire Avon SAC, probably one location on each tributary, to be finalised as part of the desk study.
- 4) Sewer network modelling to identify the impact combined sewer overflows (CSO) on rCSMG favourable condition targets for phosphorus, ammonia, BOD and DO along the section of river designated as Hampshire Avon SAC.
- 5) Farmscoper will be used to inform the benefit catchment management measures may have in achieving the phosphorus rCSMG target and rCSMG favourable condition targets for ammonia, BOD and DO
- 6) Analysis, modelling and final reporting April 2021 to April 2022
  - a) Comparison of model outputs with monitoring data.
  - b) Scenarios will be modelled using SAGIS-Simcat that investigate what measures related to Wessex Water's infrastructure and activities can technically achieve the rCSMG target for phosphorus and rCSMG targets for ammonia, BOD and DO in the designated area. Scenarios may include: load reductions of phosphorus and ammonia from catchment management measures informed by Farmscoper modelling; changes to river flow conditions as a result of changes in Wessex Water's water resources activities, informed by the Wessex Basin Model and; measures involving reducing the impact of CSO, informed by sewer catchment modelling.
  - c) Water quality monitoring data will be used to check the model performance of SAGIS-Simcat used to establish rCSMG phosphorus targets and for options appraisal.
- 7) Liaison with EA/NE and other stakeholders over outcomes.

## Costs

The costs from our bottom up estimate are summarised below:

Scheme name	Where documented in Sept 2018 submission	Cost (£m)
Hampshire Avon WQ rCSMG investigation	Page 50	1.26

## **Crane and Moors River Commons Standards Monitoring Guidance (CSMG)**

### **Aims**

This investigation will assess the contribution Wessex Water infrastructure and activities (STWs, CSOs, water resources and catchment management) has to the compliance of phosphorus, ammonia, biochemical oxygen demand and dissolved oxygen water quality along the section of the River Crane designated as SSSI between Cranborne and its confluence with the Ebblake Stream (referred to hereafter as the Crane SSSI)

The Crane SSSI designated area is assessed by NE in terms of its compliance with rCSMG (revised Common Standards Monitoring Guidance) targets, who consider achieving the target riverine concentrations as a pre-requisite for favourable condition. Whereas the rCSMG targets for ammonia, biochemical oxygen demand and dissolved oxygen have already been established for the Crane SSSI, phosphorus standards have not. As part of this investigation, it will be necessary to establish and agree the rCSMG phosphorus water quality target against which Wessex Water's contribution will be assessed. Thus part of this investigation will involve establishing whether the rCSMG target is 'near-natural' or 'maximum'. Near-natural rCSMG targets are the most stringent and represent the phosphorus concentration of a river with little anthropogenic impact. The maximum target is less stringent and represents the maximum concentration expected to support good condition. The rCSMG target used is dependent upon whether current concentrations are already very low and near-natural, or if it is technically feasible to reduce concentrations.

Once the rCSMG targets have been established, this investigation will explore and assess options for achieving the calculated phosphorus rCSMG targets and established targets for ammonia, biochemical oxygen demand and dissolved oxygen in the designated area that are feasible and effective. The investigation will also investigate the resilience the options have in achieving the phosphorus rCSMG by assessing the risk of deterioration to non-compliance due to growth.

It will therefore be necessary to undertake this investigation in two parts. Part one, a desk study, will pull together all available relevant information and use a risk-based approach to prioritise further monitoring. In conjunction with this, a SAGIS-SIMCAT model will need to be agreed to use as part of this investigation. This will be done through consultation with the Wessex SAGIS Group. This will involve checking that the river network contains the features and representative data to sufficiently represent the Crane SSSI. It may be necessary to alter the model to include features (river stretches, fish farms etc) previously unrepresented. It may also be necessary to update the data period and represent the natural background phosphorus concentrations within the model. Any changes will be agreed with the Wessex SAGIS group to ensure that the model can be used for PR24 purposes as well as for this investigation. Details of any required changes to the model will be detailed in the desk study. The desk study will culminate in the production of a monitoring plan designed to address the aims of this investigation.

Part two will involve the implementation of the monitoring, update of the SAGIS-SIMCAT model if necessary and the interpretation of the monitoring data. It will be important to utilise the monitoring data to confirm Wessex Water's contribution to non-compliance with the

rCSMG targets of phosphorus, ammonia, biochemical oxygen demand and dissolved oxygen in relation to other sources. Part two will also involve utilising the SAGIS-SIMCAT model to:

- 1) Calculate rCSMG targets for phosphorus using SAGIS-SIMCAT
- 2) Ensure that proposed options will achieve the desired outcome
- 3) Ensure that proposed options are technically feasible
- 4) Determine the resilience of the options by assessing the risk of deterioration and future non-compliance due to growth.

### **Scope**

The project will entail:

- 1) Production and agreement of scope in 2018/19
- 2) Desk study and production of monitoring plan in 2018/19
  - a) This will involve establishing the current level of data and evidence showing the contribution of Wessex Water activities (in relation to other sources) upon non-compliance of the phosphorus rCSMG favourable condition targets for ammonia, biochemical oxygen demand and dissolved oxygen along the River Crane SSSI.
  - b) The SAGIS model to be used as part of this investigation will be assessed to determine update is required to address the aims of this investigation.
- 3) Implementation of monitoring plan April 2020 to March 2021
  - a) Twice monthly effluent samples at all STW within or upstream of the section of river designated as the River Crane SSSI
  - b) Twice monthly river samples within or upstream of the section of river designated as the River Crane SSSI; locations to be defined as part of the desk study
  - c) Twice monthly spot flow monitoring within or upstream of the section of river designated as the River Crane SSSI ; locations to be defined as part of the desk study
- 4) Sewer network modelling to identify the phosphorus, ammonia, BOD and DO impact combined sewer overflows (CSO) have upon non-compliance of the phosphorus rCSMG target and rCSMG favourable condition targets for ammonia, biochemical oxygen demand and dissolved oxygen along the section of river designated as the River Crane SSSI
- 5) Farmscoper will be used to inform the benefit catchment management measures may have contributing to achieving the phosphorus rCSMG target and rCSMG favourable condition targets for ammonia, biochemical oxygen demand and dissolved oxygen
- 6) Analysis, modelling and final reporting April 2021 to April 2022
  - a) Modelling to establish the rCSMG target for phosphorus by comparing model outputs with monitoring data gathered during the investigation
  - b) This will involve comparison of model outputs with monitoring data gathered during the investigation
  - c) Scenarios will be modelled using SAGIS-Simcat that investigate what measures related to Wessex Water's infrastructure and activities can technically achieve the rCSMG target for phosphorus and rCSMG targets for ammonia, biochemical oxygen demand, dissolved oxygen and flow in the designated area. Scenarios may include: load reductions of phosphorus and

ammonia from catchment management measures informed by Farmscoper modelling; changes to flow conditions as a result of changes in Wessex Water's water resources activities, informed by the Wessex Basin Model and; measures involving reducing the impact of CSO, informed by sewer catchment modelling.

- d) Water quality monitoring data will be used to check the model performance of SAGIS-Simcat used to establish rCSMG phosphorus targets and for options appraisal.

7) Liaison with EA/NE and other stakeholders over outcomes.

Establishing the rCSMG targets for phosphorus would involve modelling the phosphate river concentration within the SSSI if all sectors discharging phosphorus made technically achievable reductions. These technically achievable reductions would include:

- a) Permitting STW within or upstream of the SSSI to the current technical achievable limit (TAL) for phosphorus
- b) All agricultural contributors within or upstream of the SSSI reducing their contribution of phosphorus load by 30%
- c) All industrial discharges such a fish and water-cress farms operating at current best practice.

If the resulting phosphate concentrations within the SSSI are  $\leq$  the 'near-natural' target, then this will become the rCSMG target. Otherwise, the rCSMG target will be the 'maximum' target.

### Costs

The costs from our bottom up estimate are summarised below:

Scheme name	Where documented in Sept 2018 submission	Cost (£m)
Moors River (River Crane) SSSI WQ rCSMG investigation	Page 49	0.48

## **Moors River and Uddens investigation**

### **Aims**

The aim of this investigation is to implement the recommendations of the AMP6 investigation and inform PR24 by further assessing the impact of three Combined Sewer Overflows (CSOs) (West Moors Pennington Copse, Ferndown Ameysford Road and Ferndown Redwood Drive) on water quality and ecology in the Moors River and its tributaries around Tricketts Cross. The previous investigation found evidence of localised ecological impacts in the area, but was unable to determine whether the CSOs were the cause.

### **Scope**

This investigation will assess the effect of the three CSOs named above on water quality and ecology in the Moors River system. A detailed monitoring plan will be produced including a review of previous work however due to the nature of the AMP6 study, a full desk study is not deemed necessary. The investigation will include a one year monitoring period with six months for analysis and reporting.

The investigation has two main elements, the first is to use existing sewer network models covering the CSOs discharging to the Moors River network to determine the likelihood of each CSO spilling and the probable discharge volume. Dependent on the output from this work a basic cost benefit/options appraisal may be done to look at improvement options.

The second element will look at the impact on the river of the three CSOs identified in the recommendations of the AMP6 investigation by means of ecological and water quality monitoring.

The project will entail:

- 1) Production and agreement of scope of works with the Environment Agency & Natural England
- 2) Production of a detailed monitoring plan, identifying locations and parameters for monitoring
- 3) Implementation of plan anticipated to include:
  - a) Water quality monitoring (routine and event driven).
  - b) Targeted invertebrate sampling.
- 4) Sewer network modelling and, where necessary, options appraisal to identify improvements to be included at PR24.

### **Costs**

The costs from our bottom up estimate are summarised below:

<b>Scheme name</b>	<b>Where documented in Sept 2018 submission</b>	<b>Cost (£m)</b>
Moors River and Uddens Water SSSI - Further investigation	Page 59	0.30

## **Dorset Frome CSMG investigation**

### **Aims**

This investigation will assess the contribution Wessex Water infrastructure and activities (STWs, CSOs, water resources and catchment management) have on the compliance of phosphorus, ammonia, biochemical oxygen demand and dissolved oxygen water quality targets along the section of river designated as SSSI between Dorchester and Wareham.

The Dorset Frome SSSI designated area is assessed by NE in terms of its compliance with rCSMG (revised Common Standards Monitoring Guidance) targets, who consider achieving the target riverine concentrations as a pre-requisite for favourable condition. Whereas the rCSMG targets for ammonia, biochemical oxygen demand and dissolved oxygen have already been established for the Dorset Frome SSSI designated area, phosphorus standards have not. As part of this investigation, it will be necessary to establish and agree the rCSMG phosphorus water quality target against which Wessex Water's contribution will be assessed. Thus part of this investigation will involve establishing whether the rCSMG target is 'near-natural' or 'maximum'. Near-natural rCSMG targets are the most stringent and represent the phosphorus concentration of a river with little anthropogenic impact. The maximum target is less stringent and represents the maximum concentration expected to support good condition. The rCSMG target used is dependent upon whether current concentrations are already very low and near-natural, or if it is technically feasible to reduce concentrations.

Once the rCSMG targets have been established, this investigation will explore and assess options for achieving the calculated phosphorus rCSMG targets and established targets for ammonia, biochemical oxygen demand and dissolved oxygen in the designated area that are feasible and effective. The investigation will also investigate the resilience the options have in achieving the phosphorus rCSMG by assessing the risk of deterioration to non-compliance due to growth.

It will therefore be necessary to undertake this investigation in two parts. Part one, a desk study, will pull together all available relevant information and use a risk-based approach to prioritise further monitoring. In conjunction with this, a SAGIS-SIMCAT model will need to be agreed to use as part of this investigation through consultation with the Wessex SAGIS Group. This will involve checking that the river network contains the features and data to sufficiently represent the Poole Harbour Catchment. It may be necessary to alter the model to include features (river stretches, fish farms etc) previously unrepresented. It may also be necessary to update the data period and represent the natural background phosphorus concentrations within the model. Any changes will be agreed with the Wessex SAGIS group to ensure that the model can be used for PR24 purposes as well as for this investigation. Details of any required changes to the model will be set out in the desk study. The desk study will culminate in the production of a monitoring plan designed to address the aims of this investigation.

Part two will involve the implementation of the monitoring, update of the SAGIS-SIMCAT model if necessary and the interpretation of the monitoring data. It will be important to utilise the monitoring data to confirm Wessex Water's contribution to non-compliance with the

rCSMG targets of phosphorus, ammonia, biochemical oxygen demand and dissolved oxygen in relation to other sources. Part two will also involve utilising the SAGIS-SIMCAT model to:

- 1) Calculate rCSMG targets for phosphorus using SAGIS-SIMCAT
- 2) Ensure that proposed options will achieve the desired outcome
- 3) Ensure that proposed options are technically feasible
- 4) Determine the resilience of the options by assessing the risk of deterioration and future non-compliance due to growth.

### Scope

The project will entail:

- 1) Production and agreement of scope in 2018/19
- 2) Desk study and production of monitoring plan in 2018/19
  - a) This will involve establishing the current level of data and evidence showing the contribution of Wessex Water activities (in relation to other sources) upon non-compliance of the rCSMG favourable condition targets for phosphorus, ammonia, BOD and DO along the section of river designated as SSSI.
  - b) The SAGIS model to be used as part of this investigation will be assessed to determine if an update is required to address the aims of this investigation.
- 3) Implementation of the monitoring plan April 2020 to March 2021 (monitoring locations to be finalised in desk study)
  - a) Twice monthly effluent samples at all STW within or upstream of the section of river designated as SSSI
  - b) Twice monthly river samples within or upstream of the section of river designated as SSSI
  - c) Twice monthly spot flow monitoring within or upstream of the section of river designated as SSSI
- 4) Sewer network modelling to identify the impact combined sewer overflows (CSO) on rCSMG favourable condition targets for phosphorus, ammonia, BOD and DO along the section of river designated as SSSI.
- 5) Farmscoper will be used to inform the benefit catchment management measures may have in achieving the phosphorus rCSMG target and rCSMG favourable condition targets for ammonia, BOD and DO
- 6) Analysis, modelling and final reporting April 2021 to April 2022
  - a) Modelling to establish the rCSMG target for phosphorus by comparing model outputs with monitoring data gathered during the investigation
  - b) The Wessex Basin Model will be used to understand the impact Wessex Water's abstractions has on river flow
  - c) Scenarios will be modelled using SAGIS-Simcat to investigate what measures related to Wessex Water's infrastructure and activities can technically achieve the rCSMG target for phosphorus and rCSMG targets for ammonia, BOD & DO in the designated area. Scenarios may include: load reductions of phosphorus and ammonia from catchment management measures informed by Farmscoper modelling; changes to flow conditions as a result of changes in Wessex Water's water resources activities, informed by the Wessex Basin Model and; measures involving reducing the impact of CSO, informed by sewer catchment modelling.

- d) Water quality monitoring data will be used to check the model performance of SAGIS-Simcat used to establish rCSMG phosphorus targets and for options appraisal.
- 7) Liaison with EA/NE and other stakeholders over outcomes.

Establishing the rCSMG targets for phosphorus would involve modelling the phosphate river concentration within the SSSI if all sectors discharging phosphorus made technically achievable reductions. These technically achievable reductions would include:

- a) Permitting STW within or upstream of the SSSI to the current technical achievable limit (TAL) for phosphorus
- b) All agricultural contributors within or upstream of the SSSI reducing their contribution of phosphorus load by 30%
- c) All industrial discharges such as fish and water-cress farms operating at current best practice.

If the resulting phosphate concentrations within the SSSI are  $\leq$  the 'near-natural' target, then this will become the rCSMG target. Otherwise, the rCSMG target will be the 'maximum' target.

### Costs

The costs from our bottom up estimate are summarised below:

Scheme name	Where documented in Sept 2018 submission	Cost (£m)
Dorset Frome SSSI WQ rCSMG investigation	Page 64	0.75

## **Dorchester Seasonal permitting investigation**

### **Aims**

Desk based feasibility study to investigate an innovative seasonal phosphorus permitting approach at Dorchester STW. To include:

- a) Development of an approach to seasonal phosphorus permitting.
- b) Understand technical feasibility and operational opportunities and constraints of implementing seasonal phosphorus permits.
- c) Predict impact of seasonal permit on river water quality.
- d) Investigate opportunities for Catchment Nutrient Balancing (offsetting) phosphorus discharged in winter season by working with farmers.
- e) Assess cost effectiveness of phosphorus offsetting versus removal at STW.

### **Scope**

This investigation will include;

- 1) Production and agreement of scope of works with the Environment Agency and Natural England
- 2) Production of desk based feasibility study to include;
  - Literature review - to establish where seasonal permitting has been trialled or is operational
  - Assessment of historical river water quality
  - Development of seasonal permitting strategy with targets set to minimise phosphorus discharged in growing season and less stringent phosphorus targets in the winter season
  - Assessment of cost effectiveness of working with farmers to deliver phosphorus reduction through Catchment Nutrient Balancing during winter, than to chemical dose for phosphorus removal over the same period.
  - Model / predict potential impact on river water quality of seasonal variations in phosphorus discharged from the STW
  - Consider potential operational impacts of seasonal permitting at the STW; opportunities, risks and constraints
  - Recommendations of where seasonal permitting could be implemented.

An interim/progress report will be prepared at the end of year 1. This investigation is closely linked to the other AMP7 investigations in the Poole Harbour catchment. The outcome of this feasibility assessment may inform the options appraisal stage of 7WW200833 Dorset Frome SSSI WQ rCSMG investigation.

### **Costs**

The costs from our bottom up estimate are summarised below:

<b>Scheme name</b>	<b>Where documented in Sept 2018 submission</b>	<b>Cost (£m)</b>
Dorchester STW - SSSI Seasonal P performance investigation	Page 64	0.87

## **Holes Bay nitrogen and phosphorus investigation**

### **Aims**

Investigation of N & P loads from Wessex Water owned continuous and intermittent discharges to Holes Bay, Poole. To include;

- a) Establish the load discharged of total nitrogen and total phosphorus from WxW assets that discharge to Holes Bay and its landward catchment area
- b) Impact assessment of the contribution from Wessex Water assets in the context of other contributions
- c) Options appraisal to identify most appropriate solution(s) to reduce WxW contribution
- d) Establish N & P load entering and leaving Holes Bay from the outer harbour under different seasonal and tidal conditions

The information collected in this investigation will also be used to inform 7WW300208 (Poole STW - Options appraisal to achieve proposed targets) and for future decisions for PR24 and the Water Protection Zone work.

### **Scope**

This investigation will assess the N and P contributions from our assets to Holes Bay. There is one STW (Poole) discharging into Holes Bay and its landward catchment and 11 intermittent discharges. Sample location, number and frequency to be confirmed during the desk study phase, suggested monitoring only in this scope.

The project will entail:

- 1) Production and agreement of scope of works with the EA and NE
- 2) Production of desk study and monitoring plan
- 3) Implementation of plan anticipated to include:
  - a) Monitoring of load discharged from STW (FE and storm), intermittent discharges and other discharges (culverted water courses, highways, surface waters etc)
  - b) Sewer network modelling/interpretation of event duration monitoring (EDM) data to estimate spill frequency/volumes.
  - c) Investigate surface water outfalls for foul sewer misconnections.
  - d) Monitoring within the bay under different tidal and seasonal regimes (spring/neap tides, high/ low season and seasonal).
- 4) Impact assessment and options appraisal

### **Costs**

The costs from our bottom up estimate are summarised below:

<b>Scheme name</b>	<b>Where documented in Sept 2018 submission</b>	<b>Cost (£m)</b>
Poole STW (and other assets) investigation N and P to Holes Bay	Page 64	0.65

## **Poole Harbour catchment N&P investigation**

### **Aims**

To understand the N and P contributions from WxW STW in the Poole Harbour catchment.  
To include final effluent monitoring of phosphorus and nitrogen concentrations of all the STW in the catchment (21 STW).

Wessex Water will set out a strategy of how nitrogen and phosphorus data will be reported in the catchment in the future, this sampling strategy will be voluntary and subject to agreement and funding.

The information collected in this investigation will be used to inform 7WW300208 (Poole STW - Options appraisal to achieve proposed targets) and for future decisions for PR24 and the Water Protection Zone work.

### **Scope**

This investigation will assess the N and P contributions from STW in the Poole Harbour catchment. There are 21 STW discharging in the catchment. This investigation will include an 18 month monitoring programme of the final effluent at all STW in the catchment. Sample number and frequency to be confirmed during desk study phase, suggested monitoring only in this scope.

The investigation will entail:

- 1) Production and agreement of scope of works with the Environment Agency & Natural England
- 2) Production of desk study and monitoring plan
- 3) Implementation of plan anticipated to include STW monitoring of final effluent
- 4) Final reporting on final effluent N and P concentrations. This will include recommendations for future longer term N & P monitoring of the STW in the Poole Harbour catchment to be delivered outside of this investigation.

### **Costs**

The costs from our bottom up estimate are summarised below:

<b>Scheme name</b>	<b>Where documented in Sept 2018 submission</b>	<b>Cost (£m)</b>
Poole Harbour catchment STWs - N and P monitoring investigation	Page 65	0.36

## **North Petherton STW investigation**

### **Aims**

The aims of this investigation are to;

- 1) Characterise the current flow regime in the Petherton Stream catchment downstream of the M5 motorway including the influence of the penstock structure upstream of North Petherton STW;
- 2) Determine the necessary flow regime to allow North Petherton STW to comply with fair share of WFD Good status, or determine the necessary permit for fair share compliance if this is unfeasible;
- 3) Determine if the desired flow regime is concurrent with planned improvements for fish passage in the catchment;
- 4) Assess the feasibility of relocating the outfall from Petherton Stream to the ditch network;
- 5) Identify other potential opportunities for water quality improvements in the catchment that could be used to offset phosphorus removal commitments at North Petherton STW.

### **Scope**

The project will be delivered as in four phases:

- 1) A project scope will be produced.
- 2) A desktop study will be carried out and a report produced. This will include information on the data required for analysis and the monitoring required to collect this, as well as a methodology for identifying any further areas of investigation that may be prompted by the results of monitoring. This stage will also include desktop investigations into ownership and operation of the penstock structure, and engagement with the owner if identified. A catchment walkover will also be undertaken to understand and confirm the flow arrangements in the watercourses downstream of the Penstock.
- 3) A monitoring phase. This will include the collection of water quality data for river monitoring sites upstream and downstream of the North Petherton STW outfall, and monitoring of effluent quality at this site twice monthly for 12 months to total 24 samples for each monitoring point. High frequency water quality data will also be collected upstream of the treatment works to increase confidence in the baseline concentration identified from these samples. Spot flow monitoring will also be undertaken upstream of the site and the penstock structure to determine the maximum natural flow through the channel that the STW discharges to, which will then be transformed to a daily data set using data from a comparable permanent flow gauge. This data will allow the calculation of effect from the STW in scenarios including various designs of fish passage and flow redistribution.
- 4) Analysis and reporting. During this phase the feasibility assessment of outfall relocation will be carried out in order to determine if it is possible to use final effluent to maintain wet fencing currently provided by the ditch network, should sufficiently flow be needed to be diverted such that it would affect the integrity of the network. The findings will then be presented in a draft report, to be circulated to stakeholders in Spring 2021 for comment, followed by production of a final report in Summer 2021.

**Costs**

The costs from our bottom up estimate are summarised below:

Scheme name	Where documented in Sept 2018 submission	Cost (£m)
North Petherton STW - Phosphorus Removal Investigation	Page 77	0.24

---

## **Durleigh reservoir nutrient investigation**

### **Aims**

The aims are to:

- 1) Investigate load contributions of each STW upstream of Firepool Weir to nutrient levels in Durleigh Reservoir.
- 2) Assess the impact phosphorus reduction measures could have upon water quality in the Tone catchment and Durleigh reservoir.
- 3) To determine whether catchment management measures in combination with permitting at STW could deliver Wessex Water's contribution to non-compliance of WFD good ecological status in the Tone sub-catchment.

The investigation will involve determining the impact the Tone STW have upon nutrient levels in Durleigh Reservoir. To do this, it will be necessary to establish the loading to Durleigh from the reservoir catchment and Durleigh Brook, the canal and any discharges it may receive directly and the Tone catchment upstream of Firepool weir. It will therefore be necessary to undertake this investigation in two parts:

Part one, a desk study, will pull together all available data and use a risk based approach to prioritise where monitoring effort should be focused. The desk study will culminate in the production of a monitoring plan designed to address the aims of this investigation.

Part two will involve the implementation of the monitoring, interpretation of the modelling data and the production of a report designed to address the aims of the investigation. A key uncertainty that this investigation will need to consider is the flow split between the Bridgwater and Taunton canal and the River Tone downstream of Firepool weir.

### **Scope**

The project will entail:

- 1) Production and agreement of scope in 2018/19
- 2) Desk study and production of monitoring plan in 2019
  - a) This will involve establishing the current level of data and evidence showing the contribution of STW in relation to other sources in the Tone Catchment
  - b) Data and evidence relating to phosphorus loading from sources other than the Tone catchment to the canal will be examined
  - c) Data and evidence relating to phosphorus loading to Durleigh reservoir directly from its catchment
  - d) The SAGIS model for the Tone and for Durleigh reservoir will be examined to determine the level of update required to address the aims of this investigation
  - e) Options will be examined for obtaining flow data from the Tone to the Bridgwater and Taunton canal and finalised during this period
- 3) Implementation of monitoring plan April 2019 to March 2020
  - a) Twice monthly effluent samples at STW in the Tone catchment (locations finalised within the desk study)
  - b) Twice monthly river samples across the Tone Catchment (locations finalised within the desk study)

- c) It may be necessary to sample the canal, Durleigh reservoir and its catchment. This will be finalised in the desk study
  - d) Twice monthly spot flow monitoring across the Tone Catchment (locations finalised within the desk study)
  - e) Flow monitoring of the Canal and Rivers' Trust abstraction from the Tone to the Bridgwater and Taunton canal (details to be finalised within the desk study)
- 4) Farmscoper will be used to inform the benefit catchment management measures may have to Wessex Water's contribution to non-compliance of WFD good ecological status in the Tone sub-catchment and Durleigh Reservoir.
  - 5) Analysis, modelling and final reporting April 2020 to September 2021
    - a) This will involve comparison of model outputs with monitoring data gathered during the investigation
    - b) Scenarios will be modelled using SAGIS-Simcat that investigate the benefit permitting at STW and catchment management measures may have to Wessex Water's contribution to non-compliance of WFD good ecological status in the Tone sub-catchment and Durleigh Reservoir.
  - 6) Liaison with Environment Agency/Natural England and other stakeholders over outcomes.

### Costs

The costs from our bottom up estimate are summarised below:

Scheme name	Where documented in Sept 2018 submission	Cost (£m)
Durleigh Reservoir investigation - Options to reduce phosphorus and nitrogen inputs from the River Tone u/s Firepool Locks	Page 77	0.91

### Efficient Costs

Below is an example of the level of detail our bottom up estimate include.

Work Items	Unit	Rate	2018/2019	2019/2020	2020/2021	2021/2022	2022/2023	2023/2024	2024/2025	Total	Justification/comment
<b>Staff time</b>											
Senior Scientist	Days/yr		15	15	15	20	40			105	includes time for 7777 to interpret and model, assess fairshare
	E/day	400	6000	6000	6000	8000	16000			42,000.00	
Scientist	Days/yr			20	20	20	0			60	Station surveys - allow 1 day per year per location, to include sampling twice, liaison with lab and results interpretation
	E/day	300	0	6000	6000	6000	0	0	0	18,000.00	
WECS Environmental Scientist	Days/yr			0	0	0	0			0	upstream and downstream of 23 STW river water quality samples, monthly for 3 year period. (23*12=276 samples/yr, assume 10 spot samples per day)
	E/day	300	0	0	0	0	0	0	0	0.00	
Sampler	Days/yr			28	28	28				84	Project management and 7777 time
	E/day	250	0	7000	7000	7000	0	0	0	21,000.00	
Project management	Days/yr			10	5	5	15			35	Project management and 7777 time
	E/day	400	0	4000	2000	2000	6000	0	0	14,000.00	
	Days/yr			0	0	0	0			0	
	E/day			0	0	0	0			0	
	Days/yr			0	0	0	0			0	
	E/day			0	0	0	0			0	
	Days/yr			0	0	0	0			0	
	E/day			0	0	0	0			0	
	Days/yr			40	30	0	0			70	
	E/day			0	0	0	0			0	
	E/day			15	113	88	73	55	0	354	
<b>TOTAL (days)</b>											
<b>TOTAL (£)</b>			6,000.00	23,000.00	21,000.00	23,000.00	22,000.00	0.00	0.00	95,000.00	
<b>Consultant support</b>											
Modeling										0.00	
Flow monitoring	E/day	300								0.00	
Ecological monitoring (terrestrial)										0.00	
Catchment management										0.00	
Sampling survey of intermittents inc. analysis										0.00	
Other										0.00	
Other										0.00	
Other										0.00	
<b>TOTAL (£)</b>			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
<b>Construction costs</b>											
Outgoing stations										0.00	
Boreholes										0.00	
Test pumping										0.00	
Other										0.00	
Other										0.00	
Other										0.00	
Other										0.00	
Other										0.00	
<b>TOTAL (£)</b>			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
<b>Water quality analysis</b>											
Water quality analysis	number of samples			276	276	276				828	23 STW u/s and d/s, 276 samples
	E/per sample	50	0	13800	13800	13800	0	0	0	41,400.00	
Specialist analysis	number of samples			0	0	0				0	
	E/per sample			0	0	0				0	
Other	number of samples			0	0	0				0	
	E/per sample			0	0	0				0	
Other	number of samples			0	0	0				0	
	E/per sample			0	0	0				0	
Other	number of samples			0	0	0				0	
	E/per sample			0	0	0				0	
Other	number of samples			0	0	0				0	
	E/per sample			0	0	0				0	
<b>TOTAL (number of samples)</b>				276	276	276	0	0	0	828	
<b>TOTAL (£)</b>			0.00	13,800.00	13,800.00	13,800.00	0.00	0.00	0.00	41,400.00	
<b>Ecological monitoring (Aquatic)</b>											
Invertebrates (family)	number of samples			0	0	0				0	
	E/per sample	100	0	0	0	0				0	
Invertebrates (species)	number of samples			0	0	0				0	
	E/per sample	275	0	0	0	0				0	
Macrophytes	Days/yr			300	0	0				0	
	E/day	300	0	0	0	0				0	
Diatoms	number of samples			40	40	40				120	assume u/s and d/s of 10 STW twice a year, 10*2*2=40
	E/per sample	100	0	4000	4000	4000	0	0	0	12,000.00	
Flow monitoring	Days/yr			300	0	0				0	
	E/day	300	0	0	0	0				0	
Other	number of samples			0	0	0				0	
	E/per sample			0	0	0				0	
Other	number of samples			0	0	0				0	
	E/per sample			0	0	0				0	
Other	number of samples			0	0	0				0	
	E/per sample			0	0	0				0	
Other	number of samples			0	0	0				0	
	E/per sample			0	0	0				0	
<b>TOTAL (days)</b>				40	40	40	0	0	0	120	
<b>TOTAL (£)</b>			0.00	4,000.00	4,000.00	4,000.00	0.00	0.00	0.00	12,000.00	
<b>Monitoring equipment</b>											
Trailer (New)	E/unit	100000								0.00	
Trailer (Existing inc maintenance)	E/unit/yr	10000								0.00	
Autosampler	E/unit	2000								0.00	
Sonde (New)	E/unit	15000								0.00	
Sonde (Existing inc maintenance)	E/unit/yr	200								0.00	
New Esnet telemetry	E/unit	2500								0.00	
Timeview licence	E/unit/yr	150								0.00	
Medcor licence	E/unit/yr	750								0.00	
DBH logger	E/unit	300								0.00	
Online nitrate probes for realtime monitoring	E/unit/yr	25000								0.00	
Acoustic monitors and kiosk	E/unit/yr	40000								0.00	
Sampler equipment	E/unit/yr	1000								1,000.00	
P-pods maintenance	E/unit/yr	5000								0.00	
Other	E/unit/yr									0.00	
<b>TOTAL (£)</b>			0.00	1,000.00	0.00	0.00	0.00	0.00	0.00	1,000.00	
<b>Stakeholder/ Third Party</b>											
Academic (PhD/Masters etc)										0.00	
Other										0.00	
Other										0.00	
Other										0.00	
Other										0.00	
<b>TOTAL (£)</b>			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
<b>Communications/PR</b>											
Other					2000					2,000.00	
Other										0.00	
Other										0.00	
Other										0.00	
<b>TOTAL (£)</b>			0.00	0.00	2,000.00	0.00	0.00	0.00	0.00	2,000.00	
<b>Other</b>											
Other										0.00	
Other										0.00	
Other										0.00	
Other										0.00	
<b>TOTAL (£)</b>			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
<b>GRAND TOTAL (£)</b>			6,000.00	41,800.00	40,800.00	40,800.00	22,000.00	0.00	0.00	151,400.00	

In Appendix 5.1.E of our Business Plan submission in September 2018, we describe the cost assurance process for our PR19 investigations programme. We appointed APEM to provide an independent assessment of the likely tasks and resources required to deliver a representative sample of investigations. APEM is the largest aquatic science consultancy in the UK. Through this process, our investigation costs have been shown to be robust and efficient.

---

### **Why the change is in customers' interests**

The Environment Agency's 25-year environmental plan shows the importance of the environment. Our customers supported our initiatives to these investigations to innovate and try to make schemes more cost effective whilst making sustainable improvements to the environment.

If the investigations show that these innovative techniques (such as catchment management) can prevent the need for large capital investment, then our customers could see a reduction in their bills as well as improved environment.

---

### **Links to relevant evidence already provided or elsewhere in the representation document**

- PR19 business plan submission (September 2018)
  - Supporting document 5.1 – Protecting and enhancing the environment
    - Appendix 5.1.E – APEM – Investigations – cost assurance
  - Supporting document 5.4 – Minimising sewer flooding
- Response to Initial Assessment of Plans (April 2019)
  - Appendix 3 – Updated Performance Commitment detail document (update from business plan)
  - Appendix 4 – Protecting and enhancing the environment: Response to IAP (