Dŵr Cymru
Welsh Water

Enhanced Investment Case: WSH71-PE10 - Enhancing the Environment through WINEP and NEP Investigations and Programmes

Contents

Executive Summary

This investment will allow the environmental improvements required to meet a range of new statutory obligations that are part of the National Environmental Programme (NEP) and Water Industry Environmental Programme (WINEP) but are not detailed in other separate enhancement cases. The NEP and WINEP have been built up in collaboration with Natural Resources Wales (NRW) and the Environment Agency (EA).

We have structured this document using the enhancement assessment criteria set out in Ofwat's PR24 Final Methodology, Appendix 9 (Setting Expenditure Allowances), Section A1. The enhancement assessment criteria are divided into four criteria groupings:

- Need for enhancement investment (5 sections).
- Best option for customers (4 sections).
- Cost efficiency (2 sections).
- Customer protection.

The drivers for the investment plans included in this case are as below:

- Bathing waters - NEP
- Shellfish waters - NEP and WINEP
- Barriers to fish passage – NEP and WINEP.
- Marine Water Quality - NEP
- SSSI, Biodiversity, NERC and INNS – NEP and WINEP.
- Appropriate Treatment (septic tanks discharging to surface water) – NEP and WINEP
- Chemical and microplastics investigations – NEP and WINEP
- Nitrogen TAL investigations – NEP
- Urban Wastewater Treatment Regulations (UWWTR) sensitive areas (Merlins Bridge) – NEP
- MCERT monitoring – NEP and WINEP
- Removal of discharges to ground – NEP
- NEP permit applications and variations – NEP
- Eel and fish screen improvements – NEP
- Water Resources Investigations NEP and WINEP

Need: The NEP and WINEP programmes detail a number of areas where investment is needed to meet new environmental obligations that will be delivered by installing or upgrading infrastructure. The programme involves investigations to improve our understanding of the impact of our assets on the environment and provides evidence for environmental investment needed in AMP9 and beyond. It also includes new regulatory monitoring requirements to support compliance to NRW and the EA.

It is necessary to carry out actions identified in these programmes to fulfil statutory obligations or meet targets that go beyond the minimum statutory requirements where that is supported by customers or through the direction of the PR24 Forum e.g., supporting potential new bathing water designations, including inland sites, and working in partnership to achieve good or excellent bathing water classifications at existing sites.

Welsh Water have a number of long-term ambitions which are associated with enhancing the environment. These include outputs related to enhancing biodiversity, river and coastal water quality. The NEP and WINEP programmes of work are central to achieving Welsh Waters long term outputs and have formed the basis for the core pathway in the Long-Term Delivery Strategy. Further details can be seen in Welsh Water's WSH01 Long Term Delivery Strategy.

Options: For each of the packages of work, a number of options to address the identified needs/drivers have been long listed. Considering a range of options including performance data, insights from process scientists, site issues and future growth, a short list of potentially viable options were then developed. Costing and risk and value exercises were then applied to the shortlisted solutions, allowing the best solution to be determined for each asset.

What We Will Deliver: This Enhancement Case will deliver 45 drivers under wastewater specified by the NRW and the EA. This includes:

- 17 investments improving water quality in various water courses in England and Wales (including conventional storm water storage systems),
- 7 monitoring investments improving flow monitoring either at works or CSOs,
- 21 investigation investments will either be part of a national investigation programme (CIP4) or will form the basis of improvement investments in AMP8/9.

Under the water drivers we will deliver:

- The installation of eel screens at 3 individual assets.
- Measures to achieve our WFD obligations.
- 16 investigations (some with multiple surveys) to establish whether further investment is required in AMP9 or later.
- The continuation of our Catchment Management programme in Wales under Drinking Water Protected Areas for NEP where we will continue to work with stakeholders.

Efficient Costing: We will invest £126M of TotEx (post efficiency, 22/23 price base) To undertake the NRW and EA requirements as set out in the NEP and WINEP.

In developing the solutions for the various drivers outlined in these papers, we have looked at multiple interventions where possible. Note - many of the items included in this investment case rely on the completion of an investigation which will be used to determine the best response. Where we have developed scopes for such interventions our best estimates (based on economic assessment of similar schemes in previous AMPs) have been given, as no further information is available until the relevant investigation has been completed.

Customer Protection: This enhancement has oversight from NRW and the EA through requirements set out in the NEP and the WINEP. Progress will be monitored and reported to NRW and the EA as appropriate to the investment.

Benefits: The investment will ensure that Welsh Water can comply with new or ongoing programmes of regulatory obligations. It will help protect and enhance river and coastal water quality, respond to the nature and climate emergency in Wales, support ecosystem resilience and enable our local communities to enjoy our inland and coastal waters. The overall benefit of these individual schemes and investment programmes is to protect and improve the environment for future generations.

Our approach has been independently assessed by Jacobs (Engineering and Costs) and Economic Insight (CBA).

1 Introduction

This Enhancement Case is for works associated with environmental improvements required to meet new or newly arisen statutory obligations as part of the National Environmental Programme (NEP) and the Water Industry Environmental Programme (WINEP) that are not detailed in other separate enhancement cases. The NEP and WINEP have been built up collaboratively with Natural Resources Wales (NRW) and the Environment Agency (EA).

The activities within this Enhancement Case are driven from several statutory obligations, these include:

- Bathing waters - NEP
- Shellfish waters - NEP and WINEP
- Barriers to fish passage – NEP and WINEP.
- Marine Water Quality - NEP
- SSSI, Biodiversity, NERC and INNS – NEP and WINEP.
- Appropriate Treatment (septic tanks discharging to surface water) – NEP and WINEP
- Chemical and microplastics investigations – NEP and WINEP
- Nitrogen TAL investigations – NEP
- Urban Wastewater Treatment Regulations (UWWTR) sensitive areas (Merlins Bridge) – NEP
- MCERT monitoring – NEP and WINEP
- Removal of discharges to ground – NEP.
- NEP permit applications and variations - NEP
- Eel/fish entrainment screens – NEP
- Water Framework Directive – NEP and WINEP
- Water Resources Investigations NEP and WINEP

Figure 1 below details where this Enhancement Case fits into the overall WINEP and NEP enhancement cases (indicated in light green).

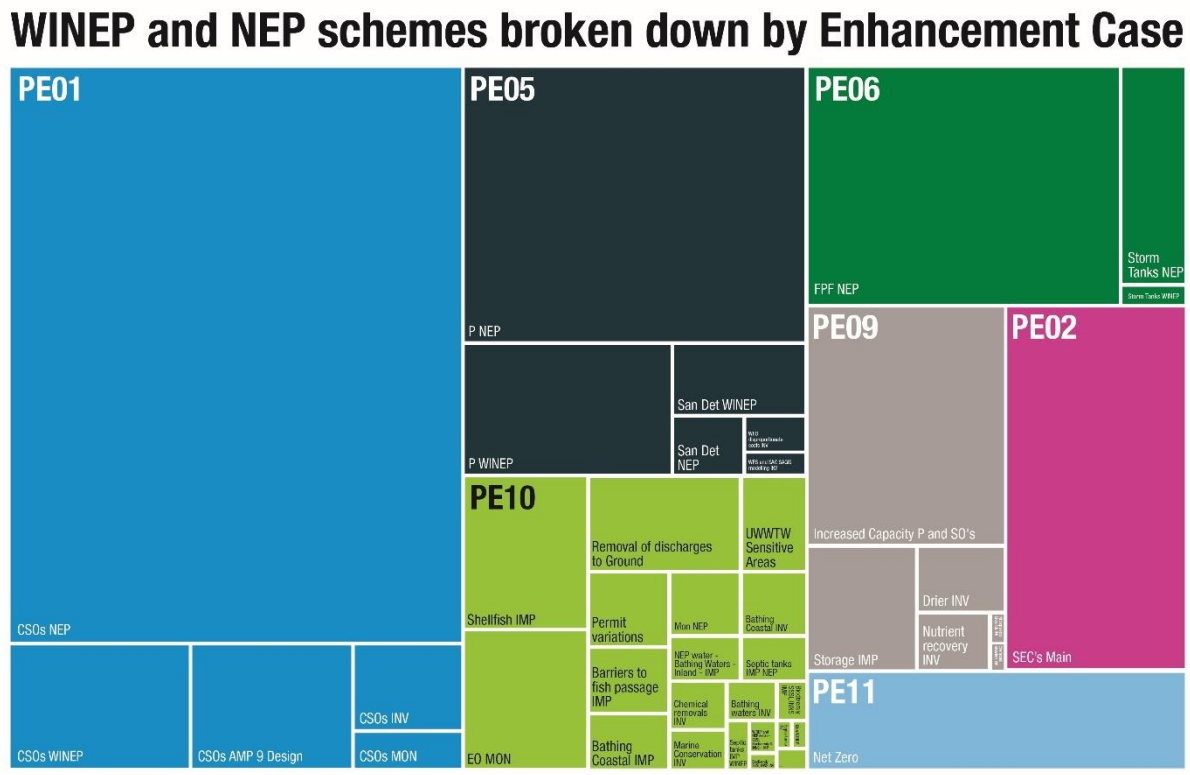

Figure 1: Relative scale of WINEP and NEP schemes broken down by enhancement case based on percentage enhancement Capex..

This Enhancement Case details the monitoring, investigations, permit variations and other categories in the NEP and WINEP programme that have been mandated to be undertaken by the NRW and EA. These will all aim to improve water quality and biodiversity throughout the Welsh Water asset base and land holdings.

There are seven categories in this programme of works for wastewater as shown in Table 1. Our cost estimate for these programmes in AMP8 is TotEx value of £107M (post efficiency 2022/23 price base). The categories of work for water are shown in Table 2 and have a total cost of £19M (post efficiency 2022/23 price base)

Table 1: Enhancing the environment through WINEP/NEP driven activities, categories of works, wastewater.

Category	CapEx Cost of Category	OpEx Cost of Category	TotEx
Bathing/shellfish waters	£25.573M	£0.525M	£26.098M
Investigations (INV)	£13.602M	£0.000M	£13.602M
Monitoring	£24.184M	£2.399M	£26.583M
WwTWs improvements	£26.199M	£0.523M	£26.722M
Barriers to fish passage	£5.812M	£0.000M	£5.812M
NRW permit variations	£6.574M	£0.000M	£6.574M
Biodiversity & Conservation	£1.223M	£0.000M	£1.223M
Grand Total – Wastewater WINEP	**£103.167M**	**£3.447M**	**£106.614M**

Table 2: Enhancing the environment through WINEP/NEP driven activities, categories of works, water.

Category	CapEx Cost of Category £M	OpEx Cost of Category	TotEx
Inland bathing waters	£3.346M	£0.000M	£3.346M
Biodiversity & Conservation	£0.844M	£0.000M	£0.844M
Investigations	£4.958M	£0.000M	£4.958M
Eels/fish entrainment screens	£5.692M	£0.000M	£5.692M
Water Framework Directive	£4.611M	£0.000M	£4.611M
Grand Total – Water WINEP / NEP General	**£19.451M**	**£0.000M**	**£19.451M**

1.1 Structure of this Document

We have structured this document using the enhancement assessment criteria set out in Ofwat's PR24 Final Methodology, Appendix 9 (Setting Expenditure Allowances), Section A1.1:

ID from Appendix 9		Abbreviated Assessment Criterion	Addressed in
A1.1.1 Need for enhancement investment	a	Is there evidence that the proposed investment is required?	Section 2.1
	b	Is the scale and timing of the investment fully justified?	Section 2.1
	c	Does the proposed investment overlap with base activities?	Section 2.2
	d	Does the need and/or proposed investment overlap/duplicate with previously funded activities or service levels?	Section 2.3
	e	Does the need clearly align to a robust long term delivery strategy within a defined core adaptive pathway?	Section 2.4
	f	Do customers support the need for investment?	Section 2.1.4
	g	Have steps been taken to control costs, including potential cost savings?	Section 2.5
A1.1.2 Best option for customers	a	Have a variety of options with a range of intervention types been explored?	Section 3.1
	b	Has a robust cost-benefit appraisal been undertaken to select the proposed option?	Section 3.1
	c	Has the carbon impact, natural capital and other benefits that the options can deliver been assessed?	Section 3.2
	d	Has the impact of the proposed option on the identified need been quantified?	Section 3.2
	e	Have the uncertainties relating to costs and benefit delivery been explored and mitigated?	Section 3.3
	f	Where required, has any forecast third party funding been shown to be reliable and appropriate?	Section 3.4
	g	Has Direct Procurement for Customers (DPC) delivery been considered?	Please refer to WSH50-IP00 Our Approach to Investment Planning (Section 3.4.1)
	h	Have customer views informed the selection of the proposed solution?	Please refer to Stepping up to the Challenge: Business Plan 2025-30 (Section 2.2)
A1.1.3 Cost efficiency	a	Is it clear how the company has arrived at its option costs?	Section 4.1
	b	Is there evidence that the cost estimates are efficient?	Section 4.2
	c	Does the company provide third party assurance for the robustness of the cost estimates?	Section 4.1
A1.1.4 Customer protection	a	Are customers protected if the investment is cancelled, delayed or reduced in scope?	Section 5.1
	b	Does the protection cover all the benefits proposed to be delivered and funded?	Section 5.1
	c	Does the company provide an explanation for how third-party funding or delivery arrangements will work for relevant investments?	Not applicable for this case

2 Need for Enhancement Investment

This section will set out the drivers behind this Enhancement Case and describe the context within which it has arisen.

The NEP and WINEP programmes detail a number of areas where investment is needed to install/upgrade infrastructure to improve the environment. The programme also enables a multi-AMP planning approach by supporting investments to scope risks and needs in greater detail and inform work for AMP9 and beyond.

Due to the large number of drivers and resulting investments included in this programme the questions below have been answered with an overview including key example excerpts.

2.1 Evidence that Enhancement is Needed

> ***Is there evidence that the proposed enhancement investment is required?***
> ***Is the scale and timing of the investment justified?***
> ***Where appropriate, is there evidence that customers support the need for investment?***
> *– Ofwat's final methodology for PR24, Appendix 9, A1.1.1a, A1.1.1b and A1.1.1f*

The actions identified in these programmes are necessary to fulfil statutory obligations and/or meet targets that go beyond the minimum statutory requirements (as directed by the PR24 Forum) or where there is customer support for the actions (e.g., working in partnership to reach good or excellent bathing water classification and undertaking investigations to support the designation of inland bathing waters).

It is noted that there are three distinct categories in these enhancement cases: improvements (IMP), investigations (INV) and monitoring (MON).

- IMP: these are investments that will install/upgrade infrastructure within AMP8 to meet the NEP/WINEP requirements identified in previous investment cycles, new regulatory drivers or by recent modelling and investigations.
- INV: these are investigations, included in the NEP/WINEP. Some of these inform investment requirements in AMP9 and beyond and some refine improvement needs in AMP8. This is to ensure Welsh Water plays its part in meeting legal standards for the environment or policy directions from Welsh Ministers and the PR24 Forum.
- MON: these are new monitoring requirements to enable statutory reporting of compliance.

In addition, there are various improvement cases where the NRW are varying the permit to improve river water quality. In an agreement with the Welsh government in 2022, the NRW significantly increased the costs of varying these permits. This decision was too late in our programme for us to include in each individual scheme cost and they are not integrated into our unit cost database for costing solutions. Therefore, they are presented here as an additional enhancement cost as part of, and as a direct consequence of, the NEP requirements. However, there is no individual action listed in the NEP.

All of the other improvement, investigation or monitoring investments align with the NEP/WINEP requirements.

2.1.1 Wastewater drivers

Bathing waters and Shellfish waters

Bathing waters NEP drivers cover measures to ensure designated bathing waters are protected under Bathing Waters Regulations 2013, particularly where they fail (or are at risk of failing) minimum

standards or where there is deterioration from a 2017 baseline. In addition to this statutory requirement, the PR24 forum's strategic steer directs us to investigate and work to achieve more "Good" and "Excellent" bathing waters. Finally, we have included investment to support the designation of a number of inland bathing waters.

Shellfish waters water quality requirements are incorporated into the Water Framework Regulations and the Shellfish Water Protected Areas Directions 2016. The objective for shellfish water protected areas is to protect or improve water quality to support shellfish life and growth and to contribute to the high quality of shellfish products suitable for human consumption.

Table 3: Shellfish and bathing waters

Parent NEP/WINEP Driver Code	Package/Scheme Name
W_BW_IMP	Bathing Waters – Coastal – IMP [NEP]
W_BW_IMP	Bathing Waters – Inland – IMP [NEP]
W_WFD_SHELL_IMP	Shellfish Waters – IMP [NEP]

Investigations

This category covers all the investigation works that need to be carried out to enable increased understanding of the impact of our assets, relative to the local aquatic environmental or terrestrial ecological needs and confirms the needs/risks that are to progress to future NEP/WINEP Improvement schemes.

The works are comprised of investigations into:

Marine conservation zones: These investigations come under multiple water-quality obligations including the Conservation of Habitat and Species Regulations 2017 (Habs Regs), The Water Environment (Water Framework Directive) Regulations 2017 (WFD), Marine and Coastal Access Act 2009 (MCAA) and the UK Marine Strategy Regulations 2010.

Chemical and microplastics investigations: These investigations are driven by a combination of The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 (WFD), Environmental Quality Standards (EQS) Directive (EQSD), The Water Framework Directive (Standards and Classification) Directions (England and Wales) 2015.

Nitrogen TAL: This covers investigations to review the technically achievable limits for total N on WWTWs as a UK wide collaborative project. The legal drivers for this come under The Habitats Regulations 2017, Urban Wastewater Regulations 1994 (UWWTR) and the Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 (WFD).

Bathing Water: These cover investigations into the reasons bathing waters are failing or at risk of failure, investigations at non-designated bathing waters with a view to designation, investigations leading to improving bathing waters to Good or Excellent or investigations to understand why a bathing water may be deteriorating against the 2017 baseline. Investigations under this driver may provide the evidence for improvements in AMP9, or earlier if required.

Barriers to fish passage: This covers the investigation element for AMP9 investment. In Wales this covers investigations into the impact of our assets on migratory fish passages and assesses options for fisheries mitigation obligations and / or their success and achieving outcomes required and actions to implement fisheries mitigation obligations in relevant catchments. In England this comes under obligations set out under the Salmon and Freshwater Fisheries Act 1975.

SSSI, biodiversity, INNS and NERC: This covers the investigation element for AMP9 or earlier investment. These investigations are required to ensure that we comply with our statutory obligations for Biodiversity and Invasive Non-Native Species (INNS), under Section 6 of the Environment (Wales) Act 2016, our obligations under the Wildlife and Countryside Act 1981 and the Natural Environment

and Rural Communities (NERC) Act 2016. These legal requirements are also underpinned in the PR24 Strategic Steers that expect Welsh Water to be ambitious in our proposals to improve Biodiversity by supporting national targets of at least 30% improvement of protected sites and habitats by 2030, 30% improvement of condition of SSSI, SAC and RAMSAR sites, and 10% improvement of woodland from unfavourable to favourable condition by 2030.

Septic tanks: This is the investigation element for potential AMP9 improvements. The driver for these investigations comes from the legislative requirement to meet appropriate treatment standards for all WwTW surface water discharges. This driver requires appropriate treatment as defined by the UWWTR, incorporated into WFD, to be achieved for all discharges to surface water. Appropriate Treatment is defined under the Regulations as "the relevant quality objectives of the receiving water are met". These investigations will identify river needs, impact of the discharge on the receiving water, and suitable improvements for those Welsh Water assets that do meet this investment requirement.

The investigations and drivers are listed in Table 4 below:

Table 4: Investigations and driver codes

WINEP/NEP Driver Code	Package/Scheme Name
W_FISH_INV	Barriers to Fish Passage Schemes – INV [NEP]
W_BW_INV1	Bathing Waters – failing or at risk of failure – INV [NEP]
W_BW_INV3	Bathing Waters – improving to good or excellent - INV [NEP]
W_BW_INV4	Bathing Waters – new bathing waters Inland or coastal - INV [NEP]
BW_INV5	Bathing Waters – Inland- INV [WINEP]
W_WFD_CHEM_INV1	Chemicals removed at WWTWs – INV [NEP]
WFD_INV_CHEM	Chemicals removed at WWTWs – INV [WINEP]
W_HR_MWQ	Marine Conservation Zones – INV [NEP]
W_WFD_MP_INV	Microplastics – INV [NEP]
W_WFD_NTAL	Nitrogen TAL – INV [NEP]
W_U_IMP7	Septic Tanks – INV [NEP]
W_WFD_SHELL_INV1	Shellfish Waters – INV [NEP]
SW_INV	Shellfish Waters – INV [WINEP]
W_SSSI_INV1 & NDINV1	SSSI – INV [NEP]
SSSI_INV[1]	SSSI – INV [WINEP]
W_INNS_INV1	Invasive species investigations (NEP)
W_BIOD_INV1 & 2	Biodiversity investigations (NEP)
INNS_INV	Invasive non-native species (WINEP)
NERC_INV	Enhancement work on non-designated sites (WINEP)

[1] Note this investment includes one output included in the WINEP with a primary driver of HD_INV but with SSSI_INV as a secondary driver.

Scheme output dependent on investigations (INV)

The improvement schemes listed below, relating to areas of biodiversity and conversation drivers, are highly dependent on the outcome of the initial investigations. As such, the detail of the actual interventions required to be delivered in AMP8 are less certain. More detailed development of the required improvement work will be necessary following the investigation phases and we have used our understanding of previous work to estimate the scope and scale of interventions.

Table 5: Scheme output dependent on INV

WINEP/NEP Driver Code	Package/Scheme Name
W_SSSI_IMP	SSSI IMP [NEP]
SSSI_IMP[2]	SSSI IMP [WINEP]
NERC_IMP	Enhancement work on non-designated sites (WINEP)
INNS_IMP	Invasive non-native species (WINEP)
W_BIOD_IMP1	Enhancement of non-designated sites and woodland management (NEP).
W_BIOD_IMP2	Peatland restoration and seed banks (NRW)
W_INNS_IMP	Invasive non-native species (NEP)

Monitoring

These cover our requirement to enhance the level of monitoring of our discharges to the environment as required under drivers within the NEP and WINEP. The main areas of focus for monitoring to be enhanced is on our Emergency Overflows on sewage pumping stations (SPS) and Flow Pass Forward for Treatment (FPF) and monitoring of discharges to storm tanks.

Under these drivers our monitoring schemes are shown below in Table *6*:

Table 6: Monitoring

WINEP/NEP Driver Code	Package/Scheme Name
W_U_MON6	Emergency Overflow Mcert Monitors – MON [NEP]
U_MON6	Emergency Overflow Mcert Monitors – MON [WINEP]
W_U_MON3/4	Monitors – WWTW Flow – MON [NEP]
U_MON3/4	Monitors – WWTW Flow – MON [WINEP]

WwTWs Improvements

Septic tanks: The driver for these investigations comes from the legislative requirement to meet appropriate treatment standards for all WwTW surface water discharges. This driver

[2] Note this investment includes one output included in the WINEP with a primary driver of HD_IMP but with SSSI_IMP as a secondary driver. One other HD_IMP driver, included as a holding line in the WINEP is assumed to be covered by this driver too.

requires appropriate treatment as defined by the UWWTR, incorporated into WFD, to be achieved for all discharges to surface water. Appropriate Treatment is defined under the Regulations as “the relevant quality objectives of the receiving water are met”. These improvements, based on the results of our investigations, will ensure these sites meet the required standard based on identified river needs.

Removal of discharges to ground: The two identified works (Pendine WwTW and Ludchurch WwTW) currently discharge effluent to groundwater sources (ponds). These schemes are to comply with NRW requirements to move these discharges elsewhere.

UWWTW Sensitive areas: These requirements of the Urban Wastewater Treatment (England and Wales) Regulations (UWWTR) 1994 are set out in the W_U_IMP2 driver. WwTW’s serving a population equivalent of 10,000 or more and discharging to water bodies designated as sensitive under the UWWTR may have to reduce phosphorus and / or total nitrogen levels in qualifying discharges. A specific improvement has been identified as a legal requirement for AMP8 at Merlin’s Bridge WwTW, resulting from recent designation of Milford Haven estuary as a sensitive area under the regulations. The WwTW will be required to meet a new 2mg/l phosphorus limit. This investment addresses the implementation of this enhanced treatment.

A summary of the NEP and WINEP drivers under this part of the investment case are summarised in Table 7 below:

Table 7: Permit Variations

WINEP/NEP Driver Code	Package/Scheme Name
W_WFD_GW_NDIMP1	Removal of Discharges to Ground - IMP [NEP]
W_U_IMP7	Septic tanks - IMP [NEP]
U_IMP7	Septic tanks - IMP [WINEP]
W_U_IMP2	UWWTD - Sensitive Areas – IMP (Merlins Bridge) [NEP]

Barriers to fish passage:

This driver requires the implementation of actions to prevent or mitigate causes of entrainment or impediment to fish passage both up and downstream. Interventions include the removal of assets or construction of new solutions, at sites where water company infrastructure has been identified as impeding the passage of fish. This includes sites where the assets are the barrier in their entirety, or where the asset forms part of the barrier preventing or restricting fish passage.

Table 8: Bathing Waters

WINEP/NEP Driver Code	Package/Scheme Name
W_FISH_IMP	Barriers to Fish Passage Schemes - IMP [NEP]
WFD_IMP_PHYSHAB	Barriers to Fish Passage Schemes - IMP [WINEP]

NRW Permit variations:

As part of its commitment to continually assess its service delivery, review its charges for regulatory activities, and to ensure its processes are as efficient and effective as possible, NRW commissioned a Strategic Review of Charging (SRoC) programme: a root-and-branch review of the permitting services provided to customers, such as Welsh Water.

NRW’s charging schemes are based on the principle of full cost recovery in line with Managing Welsh Public Money, HM Treasury rules and obligations under the Natural Resources Body for Wales (Establishment) Order 2012. Their aim is to develop a charging scheme that applies the right charges

to their activities and that the cost of their permitting and compliance work is recovered from those they regulate, avoiding subsidy through the public purse (Grant in Aid). By fully cost recovering, this helps ensure NRW is better able to regulate and protect the environment of Wales, contributing to the Sustainable Management of Natural Resources.

The cost associated with the application for a new permit, or a variation to an existing permit have increased significantly. Previously, costs for a regulator-initiated variation (for example, inclusion on the National Environmental Programme) were waived. Under the review of charges this is no longer the case. The new charging structure came into effect in 1st July 2023. [3]

Table 9: Number. of NRW permit variations expected in AMP8

Type of permit variation	Expected number of variations
Emergency Overflow	769
Continuous Discharge (WwTW)	166
Intermittent Discharge Improvement	78
Habitat Regulations Assessment Add on Charge for SAC P Schemes	107
Intermittent Discharge Investigation (Storm Overflows)	684
TOTAL	**1804**

2.1.2 Water drivers

Implementation of Eels Actions

The driver W_EEL_IMP1 requires the implementation of actions to improve abstractions and outfalls to prevent the entrainment of eels and to address barriers to the passage of eels.

The UK Government has established the Eels (England and Wales) Regulations 2009, setting measures for the recovery of the stock of European eel. Part 4 of the Regulations provides the Environment Agency and Natural Resources Wales powers in relation to securing safe passage for eels.
From 1 January 2015, it is an offence to not have an eel screen on any diversion structure capable of abstracting at least 20m^3 per day. The responsible person must, at their own cost, ensure eel screening and any associated by-wash is maintained in an efficient state.

Best practice eel passage and screening mitigation measures are therefore required at the below abstraction points to ensure compliance with our statutory requirements, remove the risk of financial penalties/reputational damage, and prevent deterioration of eel population due to abstraction points. In AMP8 we will be delivering enhanced screening at two sites, namely Bryn Aled and the Fathew.

Drinking Water Protected Areas

Investment included in this driver is associated with the NEP component of our Catchment Management programme. More details of this programme can be found in Enhancement Case WSH53-CW01.

Water Resources preventing deterioration in WFD status

[3] https://naturalresources.wales/about-us/what-we-do/what-we-regulate/our-charges/strategic-review-of-charging/?lang=en

The driver W_WFD_WRFlow_NDINV1 requires us to undertake investigations to determine the likelihood that future abstraction will cause deterioration in any element affecting the ecological status of a water body and identify effective solutions.

These investigations in AMP8 will look to determine if our abstractions are impacting upon the achievement of good ecological status of the relevant surface water body. This will include an assessment of existing mitigation measures and whether or not these are sufficient to support the achievement of Good Ecological Status/Good Ecological Potential (for a HMWB). Where an abstraction is found to impact the waterbody status and/or suitable mitigation measures are not in place, then the study will move into options appraisal to identify the most beneficial solutions.

The sites we will be investigating in AMP8 are listed below, together with their associated waterbody:

- Llyn Llygad Rheidol – waterbody ID GB31037641.
- Afon Lwyd reservoirs Nant-y-Mailor, Cwysychan – waterbody ID GB109056032912.
- Penderyn Reservoir and associated abstractions – waterbody ID GB31040990.
- Upper Llieidi and Cwm Lliedi reservoirs – waterbody ID GB110059032090.
- Llyn Craigypistyll – waterbody ID GB31037690.

Llanerch Park No Deterioration Investigation

The W_WFD_GW_NDINV1 driver requires us to undertake an assessment of the aquifer quality/quantity and the sustainability of the groundwater abstraction at Llannerch park taking into account future demands and climate change.

HMWB Water Resources Investigation

This NEP driver (W_WFD_WRHMWB_INV1) requires that we undertake investigation and appraisal of options to determine the impact of abstraction on achievement of good ecological potential (GEP) in an Artificial or Heavily Modified Water Body (for water resources uses).

These investigations will assess the impacts of the impounding reservoirs upon the downstream flow regime, sediment supply and transport, river channel morphology, river temperature and water quality at the following sites:

- Syfynwy (waterbody ID's - GB31040087, GB31039942, GB110061038300).
- Tywi (waterbody ID's - GB31039020, GB110060036250, GB110060036350).
- Castell Nos, Lluest Wen reservoirs (waterbody ID's - GB30941377, GB30941303, GB109057027210).
- Lliw (waterbody ID's - GB31041050, GB31041177).
- Llyn Alaw (waterbody ID's - GB31032538, GB110102058981).
- Llyn Fawr (waterbody ID - GB31041219).

HWMB Implementation of Mitigation Measures

The driver W_WFD_WRHMWB_IMP1 requires us to implement measures to mitigate impacts of abstraction and achieve GEP in Artificial or Heavily Modified Water Bodies at the following sites:

- Elan Valley Reservoirs; Craig Goch; Pen-y-garreg; Claerwen; Caban Coch (waterbody ID - GB30938419).
- Crai (waterbody ID - GB109056033080).
- Cynon Nant Hir (Nant Hir Reservoir) (waterbody ID - GB30940987).
- Grwyne Fawr (waterbody ID - GB30939891).
- Taff Fawr (waterbody ID - GB109057033170).
- Talybont (waterbody ID - GB109056033000).
- Llyn Llygad Rheidol (waterbody ID - GB31037641).

Habitat Regulations Investigations

The driver W_HR_INV1 asks that we undertake investigation and appraisal of options to determine the impact of abstraction on fish habitat under the Habitats Regulations. These will determine the costs and technical feasibility of meeting targets. This work will cover HM, WR and site and species requirements at the following sites:

- Llyn Brenig (waterbody ID - GB41102G200200)
- Alwen Reservoir (waterbody ID - GB41102G200200)

Reservoir construction order flow measurement – Fisheries mitigation

The Reservoir Construction Orders put legal obligations on water companies in perpetuity, which includes fisheries to be mitigated for the loss of spawning habitat arising from the construction of impounding reservoirs.

As an alternative to stocking fish, delivery of the mitigation obligation should be based on habitat improvements to the relevant catchments including restoration of compacted spawning grounds and fish passage improvements at partial natural barriers to fish migration 'in river'.
Mitigation is therefore required at the reservoirs below to ensure compliance with our statutory requirements, remove the risk of financial penalties/reputational damage and prevent deterioration of spawning habitats and fisheries below reservoirs.

- Llys y Fran
- Brianne
- Elan
- Celyn

Table 10: WINEP/NEP Driver Codes Fisheries Mitigation

WINEP/NEP Driver Code
W_FISHMIT_IMP1

Achievement of long-term Sustainable Abstraction

The NEP does not identify specific sites as this investigation is intended to provide a framework that will allow us to ensure that all our raw water sources of supply can be operated sustainability long term, particularly when the impacts of climate change are accounted for upon the river flows and ecology of the catchment in which we operate. It is likely that we will focus initially on our most sensitive sites where the ecology is likely to be the most impacted by climate change.

The driver W_BIOD_INV1 requires us to undertake investigations and/or options appraisal for changes to permits or licenses, and/or other action that contributes towards Welsh biodiversity duties, requirements, and priorities.

Nature Based Solutions for water resources

Although our NEP does not formally identify any sites to be investigated under this driver, we are proposing the following sites for this driver:

- Alaw reservoir
- Alwen reservoir
- Ystradfellte reservoir
- Pontsticill Reservoir

These sites have been selected to provide us with a good geographical spread across our supply area so we can investigate a variety of catchments to understand which nature-based solutions work best. These are also key reservoirs for supply within their respective areas. We will liaise further externally with NRW and internally with other teams, such as our Catchment Team, to understand if there may be more suitable sites than those stated above.

The driver W_NRP_INV1 requires us to undertake investigations and / or options appraisal for nature-based solutions for a water resource or water quality benefit.

These investigations are intended to provide an evidence base to develop Nature Based Solutions as feasible options that can be considered within our 2029 Water Resource Management Plan (WRMP29).

Biodiversity Nature Based Solutions

Biodiversity drivers are included under various policies including the UK Biodiversity Framework and the Wales Biodiversity Partnership Framework. This places a biodiversity and ecosystems resilience duty onto Welsh Water through the sustainable management of our natural resources. Assessment and implementation of mitigations are therefore required at the below reservoirs to ensure compliance with our statutory requirements, remove the risk of financial penalties/reputational damage and prevent deterioration of Biodiversity status of waterbodies.

- Afon Lwyd
- Pant yr Eos/Ynys y Fro
- Cwmtillery
- Blaenycwm

Table 11: WINEP/NEP Driver Codes Biodiversity

WINEP/NEP Driver Code
W_BIOD_INV1
W_NBS_IMP1

2.1.3 Scale and timing of investment

Under the wastewater drivers we will deliver:

- 17 investments improving water quality in various water courses in England and Wales (including conventional storm water storage systems),
- 7 monitoring investments improving flow monitoring either at works or CSOs,
- 21 investigation investments will either be part of a national investigation programme (CIP4) or will form the basis of improvement investments in AMP8/9.

Under the water drivers we will deliver:

- The installation of eel screens at 3 individual assets.
- Measures to achieve our WFD obligations.
- 16 investigations (some with multiple surveys) to establish whether further investment is required in AMP9 or later.
- The continuation of our Catchment Management programme in Wales under Drinking Water Protected Areas for NEP where we will continue to work with stakeholders.

Dates for compliance have been confirmed in the latest published versions of the NEP and WINEP. These compliance dates mean that Welsh Water is required to identify appropriate solutions (including operational changes), create detailed designs and construct or adapt assets to meet these obligations within the stipulated timeframes.

2.1.4 Customer support for Investment

Our approach to customer engagement is set out in Stepping up to the Challenge: Business Plan 2025-30 (Section 2.2).

2.2 Overlap with Activities to be Delivered through Base

> ***Does the proposed enhancement investment overlap with activities to be delivered through base?***
>
> *– Ofwat's final methodology for PR24, Appendix 9, A1.1.1c*

We have a standard approach for assessing overlap between base and enhancement, this is set out in WSH50-IP00 Our Approach to Investment Planning.

The cost estimates included within this business case only include scope for new assets, monitoring or investigations. Any costs associated with refurbishing our existing assets are not included within this investment case and will be addressed under Base allowance. This investment is not being used to address any existing maintenance needs at these assets.

The CapEx costs for the enhanced assets in this business case are therefore separate from any base maintenance drivers. The OpEx costs only apply to new OpEx arising from the construction of the new assets. There are therefore no overlaps within the business case with any activities to be delivered through base maintenance allowances.

2.3 Overlap with Funding from Previous Price Reviews

> ***Does the need and/or proposed enhancement investment overlap with activities or service levels already funded at previous price reviews?***
>
> *– Ofwat's final methodology for PR24, Appendix 9, A1.1.1d*

As outlined in Section 2.1.3: Scale and Timing of Investment, there is a link between when investigations are funded and when the subsequent improvement is then implemented. These are separate activities with no funding overlap.

Merlin's Bridge WwTW was the subject of funding in relation to sludge treatment in AMP6. There is no overlap with the AMP8 funding requirement at the WwTW.

Table 12 shows the drivers detailed in this paper and where they have received investment in previous AMPs for the investigation and have now transitioned to implementation in the following AMP.

There are investigations in AMP8 that will transition to be improvements in AMP9, or as in the example of 'Biodiversity, SSSI, NERC and INNS', it is a requirement in the NEP that both the investigation and the improvements will be conducted within the same AMP.

Table 12: Improvements and investigations by AMP

Scheme	Detail	Investigation under AMP	Improvements under AMP
Barriers to fish passage	Investigation	AMP8	AMP9
Barriers to fish passage	Improvement	AMP7	AMP8
Bathing waters	Investigation	AMP8	AMP9
Bathing waters	Improvement	AMP7	AMP8
Shellfish waters	Investigation	AMP8	AMP9
Shellfish waters	Improvement	AMP7	AMP8
Septic tanks	Investigation	AMP8	AMP9
Septic tanks	Improvement	N/A	AMP8
Biodiversity, SSSI, NERC and INNS	Investigation	AMP8	AMP8
Biodiversity, SSSI, NERC and INNS	Improvement	AMP8	AMP8
UWWTD sensitive areas	Merlin's Bridge WwTW	N/A	AMP8
Chemicals and microplastics	Investigation	AMP8	AMP9
Removal of discharges to ground	Improvement	N/A	AMP8
Marine conservation zones	Investigation	AMP8	AMP9
Nitrogen TAL	Investigation	AMP8	AMP9

We have profiled AMP8 improvements that followed on from AMP7 investigations, to commence early in the AMP (March 2025 through to March 2027). This will enable maximum time for the benefits of delivery of the improvement to provide benefit as the Environmental need and the most suitable response are already at a higher confidence level.

Investigations that are scheduled to form part of an AMP9 improvement plan are profiled to occur towards the beginning of AMP8 so they can inform decisions for the PR29 submission in 2027/28.

The Water Resources Implementation drivers for Fisheries Mitigation, Eel Regulations and WFD HMWB all build on investigative work undertaken during AMP7 that has demonstrated the need for these interventions to be delivered in order to meet the ecological requirements. The remaining drivers all deliver investigations that will likely lead to further implementation of schemes in AMP9 and beyond.

2.4 Alignment with the Long Term Delivery Strategy

Is the need clearly identified in the context of a robust long term delivery strategy within a defined core adaptive pathway?

– Ofwat's final methodology for PR24, Appendix 9, A1.1.1e

Welsh Water have a number of long-term ambitions which are associated with the environment and biodiversity. These include outputs related to river and coastal water quality and pollution incidents. The WINEP and NEP programmes of work are central to achieving Welsh Waters long term outputs and have formed the basis for the core pathway in the Long Term Delivery Strategy. Further details can be seen in Welsh Water's WSH01 Long Term Delivery Strategy.

The schemes detailed in this Enhancement Case align with our aim to meet all funded statutory requirements as set out by the NRW and EA.

2.5 Management Control of Costs

Is the investment driven by factors outside of management control? Is it clear that steps been taken to control costs and have potential cost savings been accounted for?

– Ofwat's final methodology for PR24, Appendix 9, A1.1.1g

All these cases have NEP and WINEP drivers associated with them, with these statutory requirements being required by the NRW and the EA to deliver environmental improvements. We have looked to control costs across all schemes. For the assets that require an investigation to be completed prior to an improvement being implemented, our routine process of developing schemes will look at all options and choose the one that is most cost beneficial.

Within this investment case, an example of where cost-efficient integrated solutions have been identified and proposed for implementation is the solution proposed for Pendine WwTW. We are proposing to combine the delivery of this scheme, where the proposed solution is to pump all flows away to Laugharne WwTW, with an additional scheme, described in WSH72-PE07 - Avoiding a High-Consequence Event at Laugharne Wastewater Treatment Works to pump Laugharne WwTW to St Clears WwTW. The amalgamation of these schemes will enable efficiencies in delivery and be more cost-effective than if they been dealt with independently.

3 Best Option for Customer

In this section, we will describe how we have developed options for addressing the need identified above.

We have identified the investments to achieve the improvement (IMP) and investigation (INV) drivers identified in the WINEP and NEP, and accordingly enhance the environment.

The four sub-sections below correspond to the eight criteria set out in Ofwat's PR24 Final Methodology, Appendix 9 (Setting Expenditure Allowances), Section A.1.1.2.

Due to the large number of investments contained within this Enhancement Case we will detail the optioneering of an example case to demonstrate the process we have employed, which is also described in WSH50-IP00 Our Approach to Investment Planning.

3.1 Identification of Solution Options

> ***Has the company considered an appropriate number of options over a range of intervention types to meet the identified need?***
> ***Is there evidence that the proposed solution represents best value for customers, communities, and the environment over the long term?***
> *– Ofwat's final methodology for PR24, Appendix 9, A1.1.2a and A1.1.2b*

We have considered a range of options to address each of the identified needs/drivers for the improvement cases. Where the investment was based on a WwTW our approach took a range of aspects into consideration including site performance data, insights from Process Scientists on site issues and future growth projections, environmental monitoring data and information from stakeholder engagement. Where an investment was an improvement requiring an investigation first, costs have been based on previous similar scheme costs.

The options followed the following hierarchy:

1. Eliminating, reducing or delaying the need for change (e.g., manage demand).
2. Maintaining the effective risk controls already in place (e.g., maintain, replace the existing asset like-for-like, or mothball/dispose of the existing asset or service).
3. Enhancing existing or adding new resources.

The solutions considered for each asset are provided in more detail in the respective options development reports. A typical example, implementing improvements to Llannant WwTW Inlet and Treborth WwTW, under a Shellfish Water driver, has been selected and used below to illustrate the process undertaken.

A longlist of options initially considered, are detailed in Table 14 below. These were evaluated for viability, considering if each option would be able to achieve the required outcomes: in this example a reduction in storm overflow operation.

Table 13: Longlist of options considered.

Option	Type of Option		Brief Description of Option and Comments	Potentially Viable, i.e., progress to shortlisting?
1	**Enhance existing resources or add new resources**	-	Option 1 – 'Grey' Construction (see section 3.1)	✓
2	**Enhance existing resources or add new resources**	-	Option 2 – 'Green/Grey' Construction (see section 3.3)	✓
3	**Eliminate, reduce or delay the need for change.**	-	Managing the demand will not be able to meet the requirements of the NRW driver.	✗
4	**Maintain the effective risk controls already in place.**	-	The new level of performance expected is beyond the capacity of the existing network. The capacity of the existing network will not be affected by changing our ways of working.	✗
5	**Maintain the effective risk controls already in place.**	-	Not viable. The new level of performance expected is beyond the capacity of the existing network– even if that asset were in an as-new condition.	✗
6	**Maintain the effective risk controls already in place.**	-	Not viable. The existing infrastructure is currently under-sized to meet demand	✗
7	**Enhance existing resources or add new resources**	-	Not viable. The quantity of resource required to upgrade the existing network is much higher than other potential options	✗
8	**Maintain the effective risk controls already in place.**	-	Not viable. Providing this service is a statutory requirement.	✗

The two selected options were developed by our Solutions Development Team:

1. 'Grey' Option – a conventional stormwater storage system comprising off-line storage, flow control, mechanically raked screens and a system for returning stormwater flows.
2. 'Green/Grey' Option – based on Welsh Waters previous experience, these options comprise 30% of the spill reduction being achieved using a 'Rainscape'[4] approach. The remaining 70% would be achieved using 'grey' construction.

Option 1 would be considered a more 'traditional' option providing all the storage at the end of the network. Option 2 is a less 'traditional' approach of incorporating a range of smaller solutions throughout the network as well as storage at the end of the network.

[4] Rainscape is a combination of surface water removal, infiltration reduction and retrofitting Sustainable drainage systems (SuDS)

The advantages and disadvantages of both solutions were evaluated along with identifying buildability issues and any residual risks after implementation. A preferred solution was then established and included within our Business Plan.

Where the only activity in the Business Plan is an investigation, these have been costed on the estimated degree of sampling, surveying, data analysis, and report writing that would typically need to be undertaken and using historical costs of similar types of work. In some cases, certain investigations will require external laboratory analysis (e.g., WFD_NTAL) and these have been estimated using established laboratory costs.

3.1.1 Assessment and Selection of Solution Options

Our approach to cost benefit appraisal and its role in decision making is set out in WSH50-IP00 Our Approach to Investment Planning. This includes a cost benefit analysis (CBA) tool, which comprises of a detailed analysis of benefit to costs for all proposed options. The proposed solutions include quantification of risk and benefit over the long term via service measure framework (SMF) values, including valuation of the following criteria: natural capital; social capital; human and intellectual properties.

The CBA tool was applied to all the solutions investigated within this investment case.

To continue the illustrative example above, examples of the CBA tool are presented in table 14 for the Burry Inlet (Llannant WwTW CSO), and table 15 for Treborth WwTW. These tables list the progressed options and compares the benefit to cost ratios based on net present value (NPV) and total costs and whole life benefits values (All monetary values are expressed in 2022/23 prices and are prior to portfolio adjustments for corporate overheads and efficiency challenge. Welsh Water ref: SMF version 5).

In both examples it can be seen that the grey solution, which is the preferred solution demonstrates the best Benefit/Cost Ratio. This is primarily due to the considerably higher CAPEX costs for the Grey-Green Solution.

Table 14: Burry Inlet (Llannant WwTW CSO) example

Solution Option	Option Name	CapEx	Present Value Whole Life Costs (WLC)	Present Value Whole Life Benefits (WLB)	Benefit/ Cost Ratio	Net Present Value (=WLB – WLC)
Option S1	Grey Solution	£8.377M	£8.686M	£2.998M	0.345	-£5.688M
Option S2	Grey-green Solution	£22.546M	£21.002M	£2.056M	0.098	-£18.946M

Table 15: Treborth example

Solution Option	Option Name	CapEx	Present Value Whole Life Costs (WLC)	Present Value Whole Life Benefits (WLB)	Benefit/ Cost Ratio	Net Present Value (=WLB – WLC)
Option S1	Grey Solution	£11.067M	£12.276M	£1.475M	0.120	-£10.800M
Option S2	Grey-green Solution	£31.130M	£31.715M	£0.560M	0.018	-£31.155M

Although in this example CBA is low, this work is mandated and therefore we still need to progress with a solution. Greater understanding of the costs will be gained in the detailed design phase and applied to ensure the best benefit versus cost is reviewed and thus the best option for the customer is delivered.

Third-party technical assurance of cost–benefit appraisal has been completed by Economic Insight who have confirmed that our approach is robust and in line with Ofwat expectations. Full details are given in WSH50-IP00 Our Approach to Investment Planning (Section 6).

3.2 Quantification of Benefits

> ***Has the company fully considered the carbon impact, natural capital and other benefits that the options can deliver?***
> ***Has the impact (incremental improvement) of the proposed option on the identified need been quantified, including the impact on performance commitments where applicable?***
> *– Ofwat's final methodology for PR24, Appendix 9, A1.1.2c and A1.1.2d*

In the analysis of option cost benefit Welsh Water has considered the impact of carbon, natural capital and other capital benefits. Carbon impact is calculated over the life of an asset and includes both the operational impact and embedded impact of carbon. Whole Life Carbon (WLC) estimation is an important input to inform decision making and programme development by Welsh Water. In our development of programme options, we have developed appraisals of the carbon impact of shortlisted options using carbon unit cost database models. Carbon referred to as Green House Gas Emissions (GGE) have been used as a direct input to calculate the benefit or disbenefit of scheme options to inform Cost Benefit Assessment (CBA). The monetised natural capital impact of carbon forming an overall 'benefit' or 'disbenefit' position alongside other service measure impacts.

Natural capitals and wider societal capitals have also been considered through application of Welsh Water's Multi Capital Approach (MCA) valuation of service measure impacts. Like GGE impacts these are considered as part of the CBA. The benefits of a scheme have been calculated by our asset planning and engineering teams based on the best available information available and have been used forecast the impact a scheme will have on service measures in comparison to the pre-investment position/"do nothing" position. Benefits are quantified against the Welsh Water service measure framework meaning they are well understood and trackable through regular business activity.

Throughout the development of the cases, it was agreed that it would not be beneficial to quantify the benefits of the investigations themselves as this would be inherent in the schemes which follow.

3.2.1 Quantifying the Impact on Need and Performance Commitments

Within our cost benefit process the impacts of each option on the need have been quantified. Our methodology is set out in WSH50-IP00 Our Approach to Investment Planning (Section 4.3). Our Service Measure Framework (SMF) quantifies a wide range of aspects including Carbon and impacts on performance within the cost benefit assessment.

The case is driven by the requirements set out in the WINEP and NEP and is targeted at meeting those obligations. The investment is linked to the service delivered under four of the common performance commitments: Discharge permit compliance, bathing water compliance, biodiversity and river water quality. The actions will allow the company to maintain its performances in the light of changing regulatory and environmental conditions rather than create a measurable improvement against the measure.

Discharge permit compliance will be maintained against the new standards through these investments. River water quality will be improved in drivers such as removal of discharges to ground and Merlin's Bridge, by the WwTW discharges either meeting a tighter consent standard or not discharging to a static water source. In addition, the septic tank driver will improve discharge quality from 8 sites in England and Wales and the barriers to fish passage drivers will improve river quality through increased fish diversity from any Welsh Water assets that were previously preventing fish migrations.

The case for coastal bathing water is based on preventing deterioration of the Barry bathing waters against the 2017 baseline. Investigations in AMP7 have shown that growth in the catchment has contributed to the deterioration and our plan is to deliver the protective measures through a wider catchment solution in the local area over the course several AMPs given the scale of improvement needed. This investment is unlikely to create an improvement in the bathing water performance commitment in AMP8 but will prevent further deterioration.

This investment case contributes to the local aquatic biodiversity as the permit limits or new water quality improvements that these schemes are targeting are all directly relative to the river's need and sensitivity. Despite this, this investment case will not be directly contributing to the Biodiversity performance commitment as currently defined. The biodiversity benefit from schemes in this investment case will be surveyed (baseline pre-investment and post scheme delivery) at a programme level, to improve our understanding of how all our work links to and could in future AMPs feed into additional Performance Commitments, based on the chosen solution and pre-existing habitat. This is likely to be in the form of adoption of secondary drivers and shadow performance commitment for AMP9.

3.3 Uncertainties relating to cost and benefit delivery

> ***Have the uncertainties relating to costs and benefit delivery been explored and mitigated? Have flexible, lower risk and modular solutions been assessed – including where forecast option utilisation will be low?***
>
> *– Ofwat's final methodology for PR24, Appendix 9, A1.1.2e*

Our methodology is set out in WSH50-IP00 Our Approach to Investment Planning (Sections 4.10 and 4.3). This includes commentary on our approach to optioneering, costing and cost benefit analysis.

For this Enhancement Case we have evaluated a wide range of options in line with our TotEx hierarchy approach, these are set out in table 17 below.

We have highlighted areas in which the calculation of costs or benefits are unusual or uncertain and how we have mitigated for this in our evaluation. Innovation and new approaches such as nature-based work is inherently more uncertain than tried and tested engineering approaches.

This is illustrated for two identified options in Table 16 below.

Table 16: Options considered for Llannant CSO and Treborth WwTW

Option	Description	Risks associated with costing this option or valuing its benefits	Mitigation (of the risk associated with costing)
Option 1 – 'Grey' Option	'Grey' Option – a conventional stormwater storage system comprising off-line storage, flow control, mechanically raked screens and a system for returning stormwater flows.	Low risk- Conventional solution	Incorporation of adequate design factors within preliminary concept selection.

Option	Description	Risks associated with costing this option or valuing its benefits	Mitigation (of the risk associated with costing)
		increased rainfall and intensity could affect the potential sizing/scope with allowance for climate change due at detailed design.	
Option 2 'Grey/Green' Option	'Green/Grey' Option – based on Welsh Waters previous experience, these options comprise 30% of the spill reduction being achieved through the use of a 'Rainscape'1 approach. The remaining 70% would be achieved using 'grey' construction	Increased rainfall and intensity could affect the potential sizing/scope with allowance for climate change due at detailed design.	Incorporation of adequate design factors within preliminary concept selection.

To mitigate the uncertainty relating to the costs used within this Enhancement Case we have used our propriety Unit Cost Database (UCD) containing outturn cost data updated on an annual basis, where applicable. Where this has not been appropriate, either due to lack of comparable data or insufficient sizes, we have used third party consultants and the supply chain to ensure that our costings are accurate, robust and have been challenged effectively. This process allowed us to take forward an estimating tolerance of +/-30% within our estimates which is well within the industry range, as defined by the Association for the Advancement of Cost Engineering (AACE), for estimates at a similar level of definition and design maturity.

With respect to benefit uncertainty, we have explored and mitigated the uncertainty around this by using publicly available data where possible. We have also had our approach and calculations assured by third parties, Jacobs and Economic Insight respectively, who confirm that we are in line with the latest best practice.

Following these steps and processes has allowed us to increase our confidence in the costs and benefits that we have put forward in this Enhancement Case and means that we are confident that the correct schemes and solutions have been selected that represent good value for our customers.

3.4 Third Party Funding

> ***Has the scale of forecast third party funding to be secured (where appropriate) been shown to be reliable and appropriate to the activity and outcomes being proposed?***
> *– Ofwat's final methodology for PR24, Appendix 9, A1.1.2f*

No third-party funding is involved in any of the projects included in this Enhancement Case currently and no 3rd party finances will be used or required to deliver any of Welsh Waters statutory and compliance duties.

We continue to collaborate and share learnings with key catchment stakeholders for each scheme. As we know more about each IMP investment programme, we will explore and maximise collaboration and co-funding opportunities with other sectors, for example, where a Council may have additional WQ aspirations that go beyond Welsh Water's fairshare and permit compliance, we can collaborate to define a wider solution where suitable for both organisations, and where it delivers the best balance for the environment and customer outcomes.

4 Costing Efficiency

In this section we give specific details on our approach to costing and benchmarking. Our overarching approach to developing efficient costs is set out in WSH50-IP00 Our Approach to Investment Planning (Section 7).

The two sub-sections below correspond to the three criteria set out in Ofwat's PR24 Final Methodology, Appendix 9 (Setting Expenditure Allowances), Section A.1.1.3.

4.1 Developing a cost for NEP/WINEP

> ***Is it clear how the company has arrived at its option costs? Is there supporting evidence on the calculations and key assumptions used and why these are appropriate? Does the company provide third party assurance for the robustness of the cost estimates?***
>
> *– Ofwat's final methodology for PR24, Appendix 9, A1.1.3a and A1.1.3c*

Bathing Water & Shellfish Water

The costing of the approach of these projects was using the like-for-like (top down) cost modelling through our Unit Cost Database (UCD) Cost & Carbon Estimating Tool (C&CET) as described in WSH50-IP00 Our Approach to Investment Planning (Section 3.10).

The costing was carried out by the Welsh Water costing team. The governance procedures, as outlined in Section 5 Costing Methodology were adhered to with the appropriate use of cost models being confirmed and all manual allowance verified prior to providing sign offs throughout the different iterations of the costings.

The scope is aligned to our Work breakdown Structure (WBS), which was developed to support our data capture process of historical project cost against delivered assets, into a scope input sheet. Within this, sizing of the assets based on the relevant yardstick, which is dictated by the WBS, is provided following calculation in the previous engineering stages. Our costs models are developed in line with our WBS, and this allows us to input this information into the C&CET and generate a project estimate. WBS details the inclusions and exclusions of works under each cost model and the limitations of the model, so we can ensure all project costs are captured and there is also no overlap of cost estimates.

The estimate identifies the assets from the scope with the relevant drivers to influence costs and the C&CET calculates the costs of each item using the cost models. For instance, pipework with the length and diameter, tanks with their volume, screens with their flow etc. With the workstream selected the C&CET applies the correct models to the direct works and site-specific costs, to cost the contractor indirect and project oncosts, associated with delivering the project.

The Inland Bathing Waters programme has been based on historical expenditure from the previous AMP inflated by CPIH with supported costings from third party quotations. This was the most appropriate approach as the scope of works falls outside the coverage of the cost models included in the C&CET.

Investigations

To price investigation works we used historical cost data for investigations carried out in 2019 and inflated these using CPIH. We then used our expert judgement when reviewing to ensure these costs were representative.

Scheme output dependent on investigations (INV)

We have looked at previous projects and used this as a basis to use expert judgement and estimate the investment that we expect to be required.

Along with our overall costing strategy being reviewed and assured by Jacobs, we have also employed third party consultants to review single enhancement cases to provide confidence that the estimates within them are robust, efficient and deliverable. Please refer to WSH50-IP00 Our Approach to Investment Planning (Section 6) for more information regarding the review and assurance undertaken.

Monitoring

We developed a scope for the works which allowed us to use our UCD C&CET as described in WSH50-IP00 Our Approach to Investment Planning (Section 3.10)**,** which follows a like for like (top-down) approach, built up from Unit Cost models. To monitor costs, we capture historical asset-built cost and asset information accurately. This allows us to develop accurate cost models based on the most appropriate cost drivers for each asset and ensures we can input this scope into the C&CET and generate a project cost.

WwTW Improvements

The costing of the approach of these projects was using the like-for-like (top down) cost modelling through our Unit Cost Database (UCD) Cost & Carbon Estimating Tool (C&CET) as described in WSH50-IP00 Our Approach to Investment Planning (Section 3.10).

The costing was carried out by the Welsh Water costing team. The governance procedures, as outlined in WSH50-IP00 Our Approach to Investment Planning, were adhered to with the appropriate use of cost models being confirmed and all manual allowance verified prior to providing sign offs throughout the different iterations of the costings.

The scope is aligned to our Work breakdown Structure (WBS), which was developed to support our data capture process of historical project cost against delivered assets, into a scope input sheet. Within this, sizing of the assets based on the relevant yardstick, which is dictated by the WBS, is provided following calculation in the previous engineering stages. Our costs models are developed in line with our WBS, and this allows us to input this information into the C&CET and generate a project estimate. WBS details the inclusions and exclusions of works under each cost model and the limitations of the model, so we can ensure all project costs are captured and there is also no overlap of cost estimates.

The estimate identifies the assets from the scope with the relevant drivers to influence costs and the C&CET calculates the costs of each item using the cost models. For instance, pipework with the length and diameter, tanks with their volume, screens with their flow etc. With the workstream selected the C&CET applies the correct models to the direct works and site-specific costs, to cost the contractor indirect and project oncosts, associated with delivering the project.

Assumptions made during the design and costing of the WwTW improvement schemes:

- For pipeline construction that there are no major obstacles that will significantly increase construction costs.
- Growth is as per developer services estimates.
- Any existing assets being reused are in a good and serviceable state.

Permit Variations

These costs are built up from the unit rates supplied by the NRW for each different permit required. We have multiplied these by the estimated numbers of permits we will require to be varied in AMP9.

Table 17: NRW permit variation costs.

Permit variation type	NRW cost per variation
Emergency overflow	£2,637
Continuous discharge (WwTW)	£2,786
Intermittent discharges improvement (storm overflows)	£3,024
Habitat regulations assessment add on charge for P schemes	£2,786
Intermittent discharge investigation (storm overflows	£4,838

Water schemes

Cost estimates for the water resources elements of the NEP were based upon delivery of similar projects during AMP6 and AMP7 with uplifts applied accordingly. Costs for the fish screens required under the Eel Regs driver have been produced through detailed engineering design and use of our UCD.

Assurance

Along with our overall costing strategy being reviewed and assured by Jacobs, we have also employed third party consultants to review single Enhancement Cases to provide confidence that the estimates within them are robust, efficient and deliverable.

Please refer to WSH50-IP00 Our Approach to Investment Planning (Section 6) for more information regarding the review and assurance undertaken.

4.2 Benchmarking our approach

> ***Is there evidence that the cost estimates are efficient (for example using similar scheme outturn data, industry and/or external cost benchmarking)?***
>
> *– Ofwat's final methodology for PR24, Appendix 9, A1.1.3b*

We engaged our independent consultants to carry out an industry benchmark of the two shellfish schemes at Llannant WwTW and Treborth WwTW. This was a project level benchmark against a like-for-like scope against our pre-efficiency costing.

The combined costs of the 2 scheme totals from the benchmarking exercises suggest that our pre-efficiency costs are within the benchmark range.

5 Providing Customer Protection

There are existing reporting mechanisms in place and clearly defined timeline and output requirements for each element of the diverse work programme contained within this case.

The section below corresponds to the criteria set out in Ofwat's PR24 Final Methodology, Appendix 9 (Setting Expenditure Allowances), Section A.1.1.4. There is no third-party funding associated with this Enhancement Case.

5.1 Proposed Protection

> ***Are customers protected (via a price control deliverable or performance commitment) if the investment is cancelled, delayed or reduced in scope?***
> ***Does the protection cover all the benefits proposed to be delivered and funded (e.g., primary and wider benefits)?***
> *– Ofwat's final methodology for PR24, Appendix 9, A1.1.4a and A1.1.4b*

The outputs for this Enhancement Case are contained within the NEP and WINEP and therefore have existing oversight from NRW and the EA. There are already well-established reporting and tracking mechanisms, with clearly defined timelines, supporting these programmes. Failure to deliver will result in enforcement, and potentially prosecution.

In addition, the outputs from investment will be covered by the discharge permit compliance and the river water quality common performances commitments. Failure to comply with the new standards which are being brought in by the environmental regulators will result in failure against these performances commitments.

The benefits from this work are focused on delivery of the required NEP/WINEP deliverables. No wider benefits have been identified for the chosen solutions.

6 Appendix A

Table 18 below shows the total CapEx and OpEX enhancement costs in AMP8 covered by this enhancement case. The lines in the data tables these map to are as follows:

- CW3b.1 - Biodiversity and conservation; (WINEP/NEP) water capex
- CW3b.4 - Eels/fish entrainment screens; (WINEP/NEP) water capex
- CW3b.16 - Water Framework Directive; (WINEP/NEP) water capex
- CW3b.31 - Investigations; (WINEP/NEP) - survey, monitoring or simple modelling water capex
- CW3b.34 - Investigations; (WINEP/NEP) - multiple surveys, and/or monitoring locations, and/or complex modelling water capex
- CW3b.132 - Additional line 2; Visitor Centre - enhancement water capex
- CWW3b.1 - Event duration monitoring at intermittent discharges (WINEP/NEP) wastewater capex
- CWW3b.4 - Flow monitoring at sewage treatment works; (WINEP/NEP) wastewater capex
- CWW3b.10 -MCERTs monitoring at emergency sewage pumping station overflows (WINEP/NEP) wastewater capex
- CWW3b.11 - MCERTs monitoring at emergency sewage pumping station overflows (WINEP/NEP) wastewater opex
- CWW3b.16 - Increase storm tank capacity at STWs - grey solution; (WINEP/NEP) wastewater capex
- CWW3b.17 - Increase storm tank capacity at STWs - grey solution; (WINEP/NEP) wastewater opex
- CWW3b.19 - Increase storm system attenuation / treatment on a STW - green solution; (WINEP/NEP) wastewater capex
- CWW3b.20 - Increase storm system attenuation / treatment on a STW - green solution; (WINEP/NEP) wastewater opex
- CWW3b.52 - Chemicals and emerging contaminants monitoring, investigations, options appraisals; (WINEP/NEP) wastewater capex
- CWW3b.61 - Nitrogen technically achievable limit monitoring, investigation or options appraisal; (WINEP/NEP) wastewater capex
- CWW3b.64 - Treatment for phosphorus removal (chemical) (WINEP/NEP) wastewater capex
- CWW3b.65 - Treatment for phosphorus removal (chemical) (WINEP/NEP) wastewater opex
- CWW3b.85 - Catchment management - habitat restoration; (WINEP/NEP) wastewater capex
- CWW3b.91 - Septic tank replacements - treatment solution; (WINEP/NEP) wastewater capex
- CWW3b.92 - Septic tank replacements - treatment solution; (WINEP/NEP) wastewater opex
- CWW3b.94 - Septic tank replacements - flow diversion; (WINEP/NEP) wastewater capex
- CWW3b.95 - Septic tank replacements - flow diversion; (WINEP/NEP) wastewater opex
- CWW3b.103 - Investigations, other (WINEP/NEP) - desk-based studies only wastewater capex
- CWW3b.106 - Investigations, other (WINEP/NEP) - survey, monitoring or simple modelling wastewater capex
- CWW3b.109 - Investigations, other (WINEP/NEP) - multiple surveys, and/or monitoring locations, and/or complex modelling wastewater capex
- CWW3b.118 - River connectivity (e.g., for fish passage); (WINEP/NEP) wastewater capex
- CWW3b.189 - Additional Line 5; Other NEP related enhancement that does not match the definitions in lines above and is explained in the commentary - enhancement wastewater/bioresources capex
- CWW3b.190 - Additional Line 5; Other NEP related enhancement that does not match the definitions in lines above and is explained in the commentary - enhancement wastewater/bioresources opex

Table 18: Total CapEx in AMP8 Plan in 2022/23 prices

Driver Ref	Year in AMP8					
	1	2	3	4	5	Grand Total
CW3b.1	£0.171M	£0.168M	£0.165M	£0.167M	£0.173M	£0.844M
CW3b.4	£1.707M	£1.683M	£0.761M	£0.766M	£0.775M	£5.692M
CW3b.16	£0.928M	£0.915M	£0.915M	£0.921M	£0.932M	£4.611M
CW3b.31	£0.088M	£0.086M	£0.000M	£0.000M	£0.000M	£0.174M
CW3b.34	£0.963M	£0.950M	£0.949M	£0.955M	£0.967M	£4.784M
CW3b.132	£1.361M	£0.666M	£0.656M	£0.663M	£0.000M	£3.346M
CWW3b.1	£2.476M	£2.420M	£0.000M	£0.000M	£0.000M	£4.896M
CWW3b.4	£0.192M	£0.187M	£0.000M	£0.000M	£0.000M	£0.379M
CWW3b.10	£3.876M	£5.683M	£5.586M	£3.764M	£0.000M	£18.909M
CWW3b.11	£0.137M	£0.342M	£0.548M	£0.686M	£0.686M	£2.399M
CWW3b.16	£3.175M	£6.207M	£7.119M	£3.083M	£1.069M	£20.653M
CWW3b.17	£0.024M	£0.070M	£0.124M	£0.147M	£0.156M	£0.521M
CWW3b.19	£1.009M	£1.973M	£1.938M	£0.000M	£0.000M	£4.92M
CWW3b.20	£0.000M	£0.001M	£0.001M	£0.001M	£0.001M	£0.004M
CWW3b.52	£1.558M	£1.523M	£0.000M	£0.000M	£0.000M	£3.081M
CWW3b.61	£0.126M	£0.123M	£0.000M	£0.000M	£0.000M	£0.249M
CWW3b.64	£1.409M	£1.378M	£0.677M	£1.711M	£1.778M	£6.953M
CWW3b.65	£0.000M	£0.000M	£0.000M	£0.056M	£0.111M	£0.167M
CWW3b.85	£0.249M	£0.243M	£0.239M	£0.241M	£0.251M	£1.223M
CWW3b.91	£0.316M	£0.309M	£0.759M	£0.767M	£0.957M	£3.108M
CWW3b.92	£0.000M	£0.000M	£0.000M	£0.000M	£0.007M	£0.007M
CWW3b.94	£0.116M	£0.114M	£0.279M	£0.282M	£0.352M	£1.143M
CWW3b.95	£0.000M	£0.000M	£0.000M	£0.000M	£0.003M	£0.003M
CWW3b.103	£0.321M	£0.315M	£0.000M	£0.000M	£0.000M	£0.636M
CWW3b.106	£2.770M	£2.707M	£1.446M	£0.000M	£0.000M	£6.923M
CWW3b.109	£1.372M	£1.341M	£0.000M	£0.000M	£0.000M	£2.713M
CWW3b.118	£1.182M	£1.155M	£1.136M	£1.147M	£1.192M	£5.812M
CWW3b.189	£1.529M	£3.133M	£6.020M	£5.341M	£5.546M	£21.569M
CWW3b.190	£0.000M	£0.000M	£0.000M	£0.000M	£0.346M	£0.346M
Total	**£27.055M**	**£33.692M**	**£29.318M**	**£20.698M**	**£15.302M**	**£126.065M**