
Appendix:

YKY38_Net Zero Enhancement Case

YKY38_Net Zero Enhancement Case



YorkshireWater

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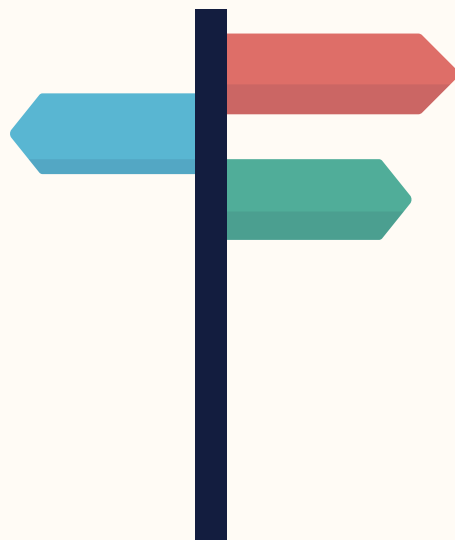
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More detail on this subject can be found in [Chapter 8 Part 2: What our plan will deliver](#)



Contents

1.	Enhancement Case for Net Zero	5
1.1	Driver:	5
1.1.1	Requested Investment:	5
1.1.2	Associated Reporting lines in Data Tables and APR:	6
1.2	High Level Driver description:	6
1.3	Need	9
1.3.1	The Scale and Timing of the Investment	9
1.3.2	Interactions with Base Expenditure	11
1.3.3	Activities Funded in Previous Price Reviews	11
1.3.4	Long-term Delivery Strategy (LTDS) Alignment	11
1.3.5	Customer and Stakeholder Support	12
1.3.6	Factors Outside of Management Control	13
1.4	Best Option for Customers	13
1.4.1	Options Considered	13
1.4.2	Cost-Benefit Appraisal	22
1.4.3	Best Value Analysis (Six Capitals)	22
1.4.4	Impact Quantification	22
1.4.5	Cost and Benefit Uncertainties	22
1.4.6	Third Party Funding	22
1.4.7	Customer Views	22
1.4.8	Direct Procurement for Customers (DPC)	23
1.5	Cost Efficiency	23
1.5.1	Option Costs	23
1.5.2	Cost estimate for our preferred option	23
1.5.3	Efficient Cost Estimates	24
1.5.4	Need for enhancement model adjustment	24
1.6	External Assurance	24
1.7	Customer Protection	24
1.7.1	PCD	25
1.7.2	Scheme substitutions	27
1.7.3	Annualised time delivery incentive	27

1.7.4 Third Party Funding or Delivery Arrangements

27

1. Enhancement Case for Net Zero

1.1 Driver:

Greenhouse Gas (GHG) Reduction

1.1.1 Requested Investment:

Table 1.1: Water AMP8 Expenditure for Net Zero

	£m	Table Line Ref.
Enhancement Expenditure Capex	17.057	CW3.127
Enhancement Expenditure Opex	-6.260	CW3.128
Base Expenditure Capex	0.000	
DPC value	0.000	
Total	10.797	

Table 1.2: Wastewater AMP8 Expenditure for Net Zero

Expenditure	£m	Table Line Ref.
Enhancement Expenditure Capex	44.042	CWW3.177
Enhancement Expenditure Opex	-3.579	CWW3.178
Base Expenditure Capex	0.000	
DPC value	0.000	
Total	40.463	

Table 1.3: Investment Requirements in Net Zero as Shown in Other Reporting Tables

	£m	Table Line Ref.
Enhancement Expenditure Capex	61.098	CW21.1 and CWW22.1-3
Enhancement Expenditure Opex	5.871	CW21.1 and CWW22.1-3
Base Expenditure Capex	0.000	n/a
DPC value	0.000	n/a
Total	66.969	

We are aware there is a discrepancy regarding greenhouse gas expenditure values between tables CW21, CWW22, CW3, CWW3. The values in CW3 and CWW3 include the negative adjustments (opex savings) as a result of deploying the renewable energy schemes, however these have not been applied in CW21 and CWW22. These savings have not been applied in the

base maintenance opex costs, and therefore no double counting has occurred i.e., the opex effect of capex has been contained within the enhancement expenditure lines.

1.1.2 Associated Reporting lines in Data Tables and APR:

Table 1.4 CW3/CWW3 Reporting Lines

Reporting line	Line Description
CW3.127	Greenhouse gas reduction (net zero); enhancement water capex
CW3.128	Greenhouse gas reduction (net zero); enhancement water opex
CW3.129	Greenhouse gas reduction (net zero); enhancement water totex
CWW3.177	Greenhouse gas reduction (net zero); enhancement wastewater capex
CWW3.178	Greenhouse gas reduction (net zero); enhancement wastewater opex
CWW3.179	Greenhouse gas reduction (net zero); enhancement wastewater totex

Other related tables:

- PR24 Tables OUT4.24, OUT5.27, OUT7.7, OUT7.8, and OUT8.32
- CW21 and CWW22
- APR Table 11a for operational carbon emissions reporting in AMP7, including the historical emissions updated to include new reporting categories (Scope 3 - chemicals and fuel and energy (well to tank) emissions) and establish the baseline year emissions (2021/22) against which a percentage reduction for the common performance commitments for AMP8 will be measured.

1.2 High Level Driver description:

Our enhancement case is aimed at supporting the delivery of reductions in GHG emissions aligned to the UK Government’s glide path to net zero emissions. In AMP8, our commitment to tackle operational GHG emissions (Scopes 1 and 2) is impacted by the scale of additional GHG arising from wider compliance programmes (particularly WINEP (Water Industry National Environment Programme)) and there is consequently a need for additional enhancement investment to tackle increasing emissions due to increased energy use and increased process emissions as a result of this. Investment that will reduce emissions from other sources such as fleet vehicles, and equipment with high energy use or which use high carbon fuels, is covered by base maintenance investment.

The intent is to deliver measurable reductions in key emissions sources including those related to process emissions for wastewater and expand our self-generation of electricity through investment in renewables (solar, both rooftop and ground-mounted).

Whilst we have been working in AMP7 and previously to reduce operational GHG emissions and wider embedded GHG emissions, these remain at a level significantly above the level targeted by 2030 for operational emissions and 2050 for all emission sources. Additional enhancement investment is essential to bring our emissions back towards a glide path aligned to the 2050 net zero goal, and our investment is set out below:

For water (see also CW21):

- Solar renewables: We have proposed a Capex investment of **£17.05m** to enable the deployment of roof-mounted and ground-mounted solar arrays on our water sites. This will deliver a net carbon benefit of c. 3,000 tCO2e/year on full deployment, close to 2.5% of our water baseline emissions.

For wastewater (see also CWW22):

- Solar renewables: We have proposed a Capex investment of **£17.05m** to enable the deployment of roof-mounted and ground-mounted solar arrays on our wastewater network + sites. This will deliver a net carbon benefit/reduction of c. 3,000 tCO₂e/year on full deployment, close to 2% of our wastewater baseline emissions.
- Process emission reduction (methane (CH₄)): We have put forward a Capex **£18.44m** investment to upgrade our anaerobic digesters, install vacuum degassing for post digestion and undertake additional monitoring and leak detection to reduce our methane emissions. This will deliver a net benefit/reduction of 18,183 tCO₂e/year, c. 12% of our wastewater baseline emissions.
- Process emission reduction (nitrous oxide (N₂O)): We have put forward a Capex **£8.54m** investment to upgrade the control systems associated with aeration control of a number of our Activated Sludge Process (ASP) lanes to Real Time Control and provide additional liquor buffering at two sites. This will deliver a net benefit/reduction of 5,371 tCO₂e/year, c. 3.5% of our wastewater baseline emissions.

Ofwat's net zero enhancement challenge calls for emission reduction to be demonstrated at an efficient cost (£/tCO₂e reduction). We have evaluated a range of emission reduction options and selected those that offered the most efficient cost (£/tCO₂e) considering the whole life cost and carbon emissions.

The process emission investments will enable the wastewater emissions of both nitrous oxide and methane to be reduced through a combination of monitoring, control and process plant upgrade. Across the industry, process emissions are thought to be underestimated partly because of the limitations of current modelling and limited measurement of actual emissions, so investment is required to better quantify the scale of the emissions and to put in place solutions (including enhanced process control capabilities) to mitigate them. Should there be any changes to emission factors for process emissions (or in other areas) this will require a re-baselining of emissions to enable on-going like for like comparisons. For now, process emissions remain a challenging area to model, particularly for emissions related to nitrous oxide.

At an industry level there has been limited work undertaken to measure actual emissions and the industry Carbon Accounting Workbook has been used to effectively model emissions. It is increasingly understood that nitrous oxide emissions are understated in this model due to use of a low emission factor. Whilst there is uncertainty regarding the accuracy of the emission factors, we have modelled reductions and cost/tCO₂e efficiency based on the current values, which allows us to make meaningful comparisons between technologies and sites, and the current baseline emissions.

Part of the investment required in this enhancement case is to fund necessary investment in monitoring to enable a true picture of nitrous oxide emissions to be reported across our sites. We see process emission reduction as an essential element of our 2030 commitment and seek funding support (outside of the efficient cost model for other comparators at face value) taking into consideration that these emissions are potentially four times higher than currently understood and the high likelihood that there will be an uplift in the associated emission factor.

As highlighted above the impact of the wider compliance programmes (WINEP) on our wastewater emissions will be significant. We forecast across the remainder of AMP7 and through AMP8 that wastewater emissions arising from WINEP will add close to 70,000 tCO₂e/year, and that despite our investment in base and net zero enhancement our emissions for wastewater will increase during AMP8 rather than reduce. These increases place a strong need for enhancement investment particularly for wastewater as set out in the next section. The WINEP uplift in emissions represents a c. 40% increase in wastewater emissions (20% of overall emissions)

Table 1.6 below shows the AMP8 WINEP impact to provide an example of the operational carbon increases. The AMP7 increase was similar in scale, c. 30,000tCO₂e/year, which will impact emissions post the baseline year. It should be further noted that the scale of these emissions is tied to the final WINEP programme, and it will be necessary to review the final programme plans prior to final determination and make consequential adjustments to numbers.

Table 1.5: Impact of AMP8 WINEP Programme on Operational Carbon (in tCO2)

Category	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Energy	16.56	681.51	3952.80	7337.17	8572.52	9046.39	9046.39	9046.39	9046.39	9046.39	9046.39
Maintenance	13.01	413.57	1522.17	2564.89	2938.76	2990.98	2990.98	2990.98	2990.98	2990.98	2990.98
Sludge	0.00	164.61	637.85	948.18	994.53	1039.16	1039.16	1039.16	1039.16	1039.16	1039.16
Chemicals	0.00	1307.25	5865.38	15063.17	21011.12	21012.16	21012.16	21012.16	21012.16	21012.16	21012.16
Unassigned	3082.67	3257.82	4558.33	5405.08	5437.75	4440.51	4463.52	4463.52	4463.52	4463.52	4482.78
Total	3112.25	5824.77	16536.52	31318.49	38954.68	38529.18	38552.20	38552.20	38552.20	38552.20	38571.46
% Unassigned	99%	56%	28%	17%	14%	12%	12%	12%	12%	12%	12%

* This shows the increased energy and chemical use, sludge arising and consequential transport and maintenance emissions.

1.3 Need

The scale of GHG emission reduction required out to 2050 is significant and the proposed investment is required to ensure we can continue to make emission reductions despite the significant new emissions arising from the wider compliance programmes that our business must deliver. Process emissions have been identified as a priority area and in anticipation that the scale of these emissions will increase, we have a clear need for investment to effect tangible emission reduction.

We also need wider investment to deliver on the expectations of our customers and operate a business in the manner aligned to the UK Government net zero glide path out to 2050 and its associated interim targets. Ofwat has encouraged companies to take a science-based approach to emission reduction out to 2050 and this implicitly requires a reduction of operational emissions at minimum at the scale we propose by 2030 with significant further investment out to 2050.

Aligning with science-based targets requires focused reduction out to 2030 on Scope 1 and 2 emissions, hence the focus of our enhancement investment for AMP8 to address Scope 1 process emissions and reduce Scope 2 purchased electricity through increased renewable self-generation.

The wider scale of emissions (all scopes) is significant, and our focus has been to defer as much investment as possible to future AMPs while maintaining a focus on the short-term reduction required with the emphasis on scope 1 and 2 emissions. Without investment in AMP8 it will be impossible to deliver emission reductions aligned to the UK Government glide path to net zero by 2050 and the interim targets set for 2035. This remains a challenge even with the level of enhancement investment proposed, in no small part due to the scale of our WINEP quality programme and the additional emissions it places on top of our baseline emissions. As can be seen in Table 1.6 above there is significant increases in chemicals, energy, transport, sludge and emissions associated with repair and maintenance.

Our long-term delivery strategy highlights the wider scale of investment required across future AMPs, and the need to spread this over time to avoid compressing bill impact and creating intergenerational inequity.

1.3.1 The Scale and Timing of the Investment

We have quantified our baseline emissions for AMP8 as required using historic emissions in 2021/22 including additional reporting categories. Our gross (location-based) emissions in 2021/22 are as shown in Table 1.7 below:

Table 1.67: Annual Operational Carbon Emissions Including New Reporting Categories in 2021/22 (total and split clean and wastewater).

Line description	2021-22 Operational emissions		
	Water	Wastewater	Total
	tCO ₂ e	tCO ₂ e	tCO ₂ e
Unit	tCO ₂ e	tCO ₂ e	tCO ₂ e
DPs	3	3	3
Net annual emissions (location-based)	117,589.883	164,147.107	281,736.990

Note: the emissions in are those related to our operational GHG emissions. Our wider emissions across all scopes are significantly higher c. 750ktCO₂e/year (excluding customer use/heating of water).

To address our operational emissions during AMP8, we have proposed an enhancement investment of c. £67m Totex to address a portion of process emissions and increase our use of renewable energy. Interventions include:

1. Install solar renewable systems delivering c. 32MW of electric power generation,
2. Methane emission to atmosphere reductions via investments in more advanced methods of anaerobic digestion, specifically; moving digesters in series, vacuum degassing, and additional leak detection, and
3. Nitrous oxide emission to atmosphere reductions via installation of real time controls (RTC) at large wastewater sites.

For both methane and nitrous oxide, we have included costs for monitoring as without this it would be impossible to validate reductions in emissions. These investments will be supported by other base and standard enhancement investment (bioresources upgrade of digesters at our Knostrop, Hull and Huddersfield sites with a primary driver of increasing digester capacity) to deliver further emission reduction.

Our planned scheme for methane reduction by digester upgrade uses the same technology as proposed in the bioresources enhancement investment case for which there is a primary driver to expand digester capacity at 3 sites. The net zero enhancement scheme will use the same technology at 3 additional sites where digester capacity is not a primary driver, but where the methane reduction it delivers is beneficial and deemed to be at an efficient cost in terms of cost/tCO₂e reduction compared to other interventions we have evaluated (see below for further detail of options considered).

The process emission reductions will be entirely related to the wastewater emissions, while the investment in solar will be split 50:50 across the water and wastewater estate.

As set out in CW21 and CWW22 we have phased investments such that they fall early in the AMP, such that we can realise the reductions in emissions by the end of the AMP.

The required investment is set out in Table 1.8 for water and Table 1.9 for wastewater. The tables also detail the split of capex, opex and totex for each scheme and the benefit in terms of tCO₂e reduction on full implementation at year 5, net of embedded emissions (so lower than that shown in other tables where the gross benefit is shown). The tables also show the cost/benefit (£/tCO₂e) of the investment over the lifetime of the interventions (25 years for solar and 20 years for process emissions).

Table 1.87: Net zero enhancement scheme for water showing costs and carbon benefit

	AMP8 Total Capex £m	AMP8 Total Opex £m	AMP8 Total Totex £m	Net benefit tCO ₂ e reduction per annum	Lifetime Cost Benefit (tCO ₂ e)
Solar Renewables (Water Resources 50% and WN+ 50%)	17.055	0.524	17.579	3,000	234
Totals	17.055	0.524	17.579	3,000	234

Table 1.98: Net zero enhancement schemes for wastewater and bioresources showing costs and net carbon benefit (excluding embedded emissions)

	AMP8 Total Capex £m	AMP8 Total Opex £m	AMP8 Total Totex £m	Net benefit tCO ₂ e reduction per annum	Lifetime Cost Benefit (tCO ₂ e)
Solar Renewables (Water Resources 50% and WN+ 50%)	17.055	0.524	17.579	3,000	234
Methane reduction (100% bioresources)	18.448	0.790	19.238	18,183	53

Nitrous oxide reduction (100% WWN+)	8.541	4.037	12.577	5,371	117
Totals	44.04	5.35	49.39	26,554	134¹

1.3.2 Interactions with Base Expenditure

There are no interactions with base expenditure.

1.3.3 Activities Funded in Previous Price Reviews

Our work on emission reduction in previous AMPs has been through base funding or as a secondary benefit of other enhancement funding and has been taken account of within the baseline that we have set, as described above.

This has included process upgrades (to move to anaerobic digestion), energy efficiency, and the additional operational expenditure for purchasing green energy (both green electricity and gas backed by REGOs and RGGOs). There is no overlap or duplication with those investments or expenditure.

1.3.4 Long-term Delivery Strategy (LTDS) Alignment

Net zero is a core element of the long-term delivery strategy. The need for enhancement investment is clear in the context of our long-term delivery strategy and long-term targets to 2050.

The key difference in focus for the AMP8 net zero enhancement case and the LTDS is driven by the differing context for the AMP8 common performance commitments, which are defined using location-based emissions for a sub-set of total GHG emissions, whereas the LTDS will require emission reductions to be calculated on a market-basis and addressing all scope 1, 2 and 3 emissions which includes significant emissions associated with purchased goods and services beyond chemicals and embedded carbon in capital goods such as concrete, steel etc.

Our approach is aligned to science-based target setting, which calls for priority action on scope 1 and 2 emissions out to 2030 and our highest emitting locations. Addressing scope 3 emissions is a longer-term action, with a target of delivering a 90% reduction by 2050 against baseline (likely our 2019/20 year for science-based target setting), with the residual 10% of emissions to be net off through carbon insets and offsets.

As highlighted above the scale of our wider scope 3 emissions is significant, increasing emissions to over 750ktCO2e/year, but there will also be indirect benefits in terms of reduction arising from a combination of decarbonisation effort by our supply chain and the decarbonisation of purchased electricity (grid decarbonisation through increased mix of renewables and reduced use of fossil fuels).

A key challenge is the increasing scale of our capital programme driven by our wider compliance programme and replacement of end-of-life assets. We anticipate increased emissions associated with our capital programme (both embedded emissions in capital goods and those that impact our operational emissions) over the next two decades, which will offset gains made in emission reduction before other decarbonisation efforts in the supply chain bring reduction at scale to rebalance our emissions. The scale and nature of the long-term quality programme remains a key area of uncertainty in terms of emission growth running against our reduction plans.

¹ Average Value

Overall given the scale of emissions reduction, taking a progressive approach ensures that costs in any single AMP will not become excessive and that these costs are not deferred in such a way that they become a burden to future generations.

Our AMP8 investment is part of a progressive investment in decarbonisation out to 2050 and inclusive of our AMP8 enhancement case, we anticipate a need to invest upwards of £580m (in 2023 pricing) to deliver decarbonisation at the required scale. In setting this out we have had to make assumptions about the scale of future additional emissions arising from WINEP quality programmes and the tailwind benefits of decarbonisation of the electricity grid and our supply chain.



Read more about this at [Long-Term Delivery Strategy](#)

1.3.5 Customer and Stakeholder Support

We know, from the [Ofwat/CCWater customer preferences research](#) that reduction in carbon is of lower importance to customers, when considering it within a wider list of performance commitment areas. This was also triangulated with our [Valuing Water](#) customer priorities research]. However, this was tested within a wider group of service areas and provided qualitative insight into net zero at a more granular level.



Read more about our wider engagement in [Chapter 6: Customer and Stakeholder Engagement](#)

In October 2022, we engaged with our customers through our online community to understand their views on climate change and [net zero, following indications that the cost-of-living crisis](#) may be impacting customer priorities, particularly around sustainability. The study found that, while affordability is of the greatest concern, their view on climate change and net zero remained a high priority, with 82% of customers saying climate change remains important to them and 1 in 3 agreeing that the 2030 net zero target should remain a top priority when asked directly. When asked to comment on the performance of Yorkshire Water in this area, 47% said that we should be doing more.

In addition to the above study, in November 2021 we tested our [customers views on our climate change strategy](#), through focus group sessions and surveys with our online community. The research aimed to understand customer views on climate change and their feelings on our climate change strategy. The importance of climate change was consistent with the results we saw almost 12 months later in the above research, with 89% of customers sharing that they felt it was important.

A further research study we carried out was in February 2023, where we explored [customer views on carbon offsetting](#), acknowledging that alternative options such as purchasing carbon credits may be necessary to hit the net zero 2030 target. When asked about our targets and approaches to delivering net zero carbon and for example whether we should invest in emission reductions or purchase carbon offsets to deliver our targets, customers had a range of opinions. There was a clear preference for us to work to reduce our emissions and act locally to deliver carbon insets through partnerships and our own efforts and use carbon offsetting a last resort.

Finally, our Net Zero enhancement case is supported by the Yorkshire Leaders Board (you can read more about the Yorkshire Leaders Board in [Chapter 6](#) of our main business plan in their letter of endorsement of our plan).

Net Zero

We understand that enhancement investment in reaching Net Zero may be at risk of removal from your business plan by your regulators. We would strongly oppose the wholesale removal of schemes which help reduce the carbon footprint of Yorkshire Water in our region.

It is in the interest of our residents for the carbon footprint of the Yorkshire region to be reduced, and we would therefore wish to see this investment approved. (Yorkshire Leaders Board, [Letter of Support](#), 12th September 2023)

1.3.6 Factors Outside of Management Control

The following are the key factors that are outside of the management control in relation to this enhancement case:

- The baseline year and use of fixed (2022) location-based emission factors for reporting of emissions reductions and associated benefits arising from the enhancement case.
- Constraints on site selection related to solar renewables arising from planning applications.
- Changes to emission factors for process emissions.
- Other regulatory changes that may impact the way we process or treat waste with potential to impact emission reductions.

1.4 Best Option for Customers

1.4.1 Options Considered

Our approach to addressing our GHG emission reductions has been led by our Net Zero Carbon Committee set up in July 2022 and chaired by our CEO. Under the guidance of the committee, we have undertaken detailed reviews of past, current, and forecast emissions, and investigated a range of options. Our starting point was to review previous work from PR19, and ongoing work being implemented during AMP7. We then reviewed the latest information including the guidance set out in Ofwat's Net Zero Principles position paper from January 2022 and the research and findings from work conducted by Jacobs for Ofwat regarding potential net zero technologies.



Read more about this at www.ofwat.gov.uk/publication/net-zero-principles-position-paper/



Read more about this at www.ofwat.gov.uk/wp-content/uploads/2022/08/Net_Zero_Technology_Review.pdf

Optioneering forms a key step in our capital delivery programme and includes consideration of a range of traditional and non-traditional solutions to meet needs and deliver our key service measures. These follow a hierarchy of no- and low-cost base investments and no-build solutions to those wider technologies including renewable energy technologies, process emission control systems, fleet transitions, etc.

Our modernisation programme includes upgrades such as efficient pumps and motors, improved maintenance facilitated by our Above Ground Maintenance (AGM) programme using smart technology and monitoring of equipment health on critical assets. This ensures we optimise operational and maintenance decision making across the business and keep assets performing optimally for longer, to meet the needs and expectations of our customers.

Our Integrated Planning, Scheduling and Logistics (IPSL) programme also supports optimisation of our service delivery including efficient use of field resources to reduce travel and associated emissions (route optimisation and reduced repeat journeys). The wider benefits of our programme will also support leakage reduction and repairs and maintenance works that will also help to reduce our operational carbon emissions.

We have addressed our net zero aspirations in our procurement and capital works programme by inclusion of more specific requirements for sustainability performance including carbon reduction in key documentation associated with our tendering and purchasing activity and our engineering and design processes.

We expect that newer or enhanced technologies may become available in the coming years that will make greater and/or cheaper carbon emission reductions possible. We will amend our plans and deliver emission reductions using alternative solutions where this is in the best interest of our customers and the delivery of our net zero glide path.

We have considered a wide range of options, including but not limited to:

- Fleet transition to electric or other low emission vehicles (e.g., those using HVO (Hydrotreated Vegetable Oil) or other low carbon fuels).
- Renewable energy (including solar, wind, hydroelectricity, heat recovery, district heating and hydrogen).
- Wastewater process emission reduction options including Final Settling Tank (FST) capacity expansion, Return Activated Sludge (RAS) denitrification, addressing mixed liquor suspended solids (MLSS), chemical dosing (various solutions), Real Time Controls (RTC), Expansion of Anoxic capacity, covering ASP lanes, liquor buffering Ferric dosing, and Final Effluent (FE) recirculation.
- Bioresources process emission reduction options, including cooling digestate, modification of digester to plug flow, vacuum degassing, covering post-digestion sludge storage tanks, leak monitoring and control, biogas recovery and gas to grid.
- Increased use of nature-based solutions within our capital programme to deliver reductions in operational carbon from new or replacement assets while meeting wider service needs e.g., reducing sewer flooding.

Evaluation of options was undertaken by key teams of subject matter experts across the business, including fleet, commercial, cost and modelling, wastewater, bioresources and through key stakeholder groups including the Net Zero Carbon Committee, Operational and Capital Carbon Hubs and a specific net zero task force.

Carbon reduction options for fleet, renewable energy generation and process emission reduction were evaluated with key support from external consultants Royal HaskoningDHV and Stantec.

In all instances a full list of options was created and evaluated using the Enterprise Decision Analytics (EDA) tool used by Yorkshire Water as a key evaluation tool for costs and carbon emissions. Tables 1.10, 1.11 and 1.12 below for details of the scope of the options evaluation.

Table 1.9: Methane reduction options and sites considered

SITE NAME	1. COOLING DIGESTED SLUDGE	2. CONNECTING DIGESTERS IN SERIES	3. PUMPING OUT DIGESTED SLUDGE AT HEIGHT	4. CONVERSION OF BUFFER TANK TO POST FERMENTATION	5. VACUUM DEGASSING	6. GAS TO GRID/MODULAR GREEN GAS INSTALLATION	7. LEAK DETECTION OF THE BIOGAS	9. BIOGAS TREATMENT	10. IMPROVE DIGESTER MIXING	11. PERIODIC LITHIUM TESTING
Knostrop STF	✓	✓	✓	✓	✓		✓			✓
Blackburn Meadows STF	✓	✓	✓	✓	✓		✓			✓
Esholt STF	✓	✓	✓	✓	✓		✓	✓		✓
Huddersfield STF (Lower Brighouse)	✓	✓	✓	✓	✓	✓	✓			✓
Dewsbury STF	✓	✓	✓	✓	✓	✓	✓			✓
Woodhouse Mill STF	✓		✓	✓	✓	✓	✓	✓		✓
Calder Vale STF	✓		✓		✓	✓	✓	✓		✓
Old Whittington STF	✓		✓	✓	✓	✓	✓	✓	✓	✓
Aldwarke STF	✓		✓		✓	✓	✓	✓		✓
Hull STF	✓	✓	✓	✓	✓		✓			✓
Lundwood STF	✓		✓	✓	✓	✓	✓	✓		✓
Sandall STF	✓		✓	✓	✓	✓	✓	✓		✓

Table 1.10: Nitrous oxide emission reduction options and sites considered

SITE	1. Additional Aeration Capacity	2. Additional FST Capacity	3. RAS Denitrification	4. Methanol Dosing	5. RTC	6. Additional Anoxic Capacity	7. Caustic Dosing	8. Ferric Dosing	9. MLSS Recycle	10. FE Recirc
Knothrop STW			✓	✓	✓	✓	✓		✓	
Blackburn Meadows STW			✓	✓	✓	✓	✓		✓	
Esholt STW			✓	✓	✓	✓	✓		✓	
Huddersfield STW (LB)		✓	✓	✓	✓	✓	✓		✓	
Dewsbury STW			✓	✓	✓	✓	✓		✓	
York Naburn STW			✓	✓	✓	✓	✓		✓	
Halifax Copley STW					✓					
Woodhouse Mill STW		✓	✓		✓		✓		✓	
Calder Vale STW			✓	✓	✓	✓	✓		✓	
Old Whittington STW			✓	✓	✓	✓	✓		✓	
Aldwarke STW			✓	✓	✓	✓	✓		✓	
Hull STW					✓		✓			

Table 1.1211: Renewable options considered

New schemes		Approx capacity (MWp)
Generation	Solar rooftop	15
	Solar 3rd party land	15
	Solar small-scale ground mounted	15
	Wind (Haisthorpe)	0.25
	Wind (Wetherby)	0.85
	Wind Loftsome & Hull repowering	4.8
	Other solar	30
	Other wind	9.6
	Final effluent	n/a
	Hydrogen from biogas with CCS (Carbon Capture and Storage)	n/a

Options were reviewed at high-level, and consideration given as a first step as to how each option aligned with the requirements of the net zero enhancement case as follows:

- a) Were they investments that had been integrated previously into base investments in previous AMPs? If yes, we excluded it and if no, we retained it.
- b) Was carbon a primary or secondary driver? If no, we excluded it and if yes, we retained it.
- c) Were the identified carbon benefits material in the context of our carbon emissions? If no, we excluded it and if yes, we retained it.
- d) Were the options deemed to be at a relative efficient cost in terms of £/tCO₂e reduction and were they deemed to be cost efficient relative to Government Green book costs of carbon and other measures (e.g., efficient cost indicated by the London School of Economics). If no, we excluded it and if yes, we retained it.
- e) Was the scale of investment required at a level not deemed affordable within a single AMP? If no we excluded it and if yes, we retained it, with a view taken if delivered in part in the AMP8 enhancement case (this was the case for renewables where larger investment was identified).

This initial review enabled us to make the following decisions:

- Fleet transition was excluded as it was deemed a base investment.
- Renewable options were pared back to those associated with roof-mounted and ground-mounted solar panels as these offered the lowest £/tCO₂e reduction,

and proven deliverability. Some other options offered potential carbon reduction with reasonable efficiency however were ruled out due to the overall cost of schemes. In the case of wind power there was uncertainty related to the planning conditions and likelihood of approval for onshore wind.

- Process emissions related to methane offered several pathways, however some were ruled out as it was deemed that these would result in emission reductions that would be hard to quantify or at inefficient costs. Three options were selected from the wider set of options considered as set out Figures 1.2, 1.3 and 1.4. These were: a) reconfiguring digesters in series, b) vacuum degassing, and c) leak detection. These options were selected via workshop review with the internal team and the consultants.
- Process emissions related to nitrous oxide similarly offered several reduction pathways, and these are set out in the consultancy report prepared by Stantec and Royal HaskoningDHV and illustrated in the figures below. Options were reviewed via workshops, and options were discounted where they either offered no cost efficiency or the use of chemical dosing replaced emission reduction related to Scope 1 nitrous oxide with Scope 3 chemical emissions.

Figure 1.1: List of options considered for nitrous oxide at Knostrop Wastewater Treatment Works demonstrating the relative cost efficiency used to aid short-listing of options.

yes
 no

KNOSTROP STW 380044

Treatment type ASP

Emission Calculation CAW IPCC

N2O emission 40.2 162 kg N2O/d

CO2-eq 3,888 tonne CO2/y

Time Horizon 20 years

Relative Efficiency of cost taking into account whole life carbon over 20 years

Implemented (y = 1 / n = 0)	Minimal emission reduction	Maximum emission reduction	Leftover emission (average reduction)	Typical reduction	MITIGATION	TOTAL CAPEX £	ANNUAL OPEX £/y	EMBODED CARBON tCO2e	OPERATIONAL CARBON tCO2e/y	Reduced carbon tCO2e/y	Leftover carbon tCO2e/y	tCO2e BENEFIT in time horizon	£/ton CO2 in time horizon
1					0. Monitoring	27,000	54,000	?	?				
1	5%	35%	80%	20%	3. RAS DENITRIFICATION	8,560,790	699,985	2,848	1,313	778	3,111	-13,555	-1,664
1	5%	15%	90%	10%	4. METHANOL DOSING	1,865,918	3,455,079	331	7,160	389	3,500	-135,757	-523
1	20%	50%	65%	35%	5. RTC	614,039	35,700	74	11	1,361	2,527	26,921	49
1	5%	35%	80%	20%	6. ADDITIONAL ANOXIC CAPACITY	12,051,698	581,381	4,845	891	778	3,111	-7,116	-3,328
1	5%	15%	90%	10%	7. CAUSTIC DOSING	1,658,196	1,494,665	279	3,080	389	3,500	-54,095	-583
1	5%	35%	80%	20%	9. MLSS RECYCLE	4,132,284	2,683,954	1,012	6,203	778	3,111	-109,513	-528
1	0%	20%	90%	10%	11. ADDITIONAL LIQUOR BUFFERING	1,196,658	28,480	175	27	389	3,500	7,065	250
Total						30,106,585	9,033,244	9,563	18,685	2,945	943	-324,358	650

Figure 1.2: Example of options and selected options for nitrous oxide emission reduction at Knostrop Wastewater Treatment Works.

Selection of solutions by toggling 1

Setting reduction %

Additional cost for monitoring

Carry through of costs and carbon benefit

Implemented (y = 1 / n = 0)	Minimal emission reduction	Maximum emission reduction	Leftover emission (average reduction)	Typical reduction	MITIGATION	TOTAL CAPEX £	ANNUAL OPEX £/y	EMBODED CARBON tCO2e	OPERATIONAL CARBON tCO2e/y	Reduced carbon tCO2e/y	Leftover carbon tCO2e/y	tCO2e BENEFIT in time horizon	£/ton CO2 in time horizon
1					0. Monitoring	27,000	54,000	?	?				
	5%	35%		20%	3. RAS DENITRIFICATION	8,560,790	699,985	2,848	1,313				
	5%	15%		10%	4. METHANOL DOSING	1,865,918	3,455,079	331	7,160				
1	20%	50%	80%	20%	5. RTC	614,039	35,700	74	11	778	3,111	15,256	87
	5%	35%		20%	6. ADDITIONAL ANOXIC CAPACITY	12,051,698	581,381	4,845	891				
	5%	15%		10%	7. CAUSTIC DOSING	1,658,196	1,494,665	279	3,080				
	5%	35%		20%	9. MLSS RECYCLE	4,132,284	2,683,954	1,012	6,203				
1	0%	20%	90%	5%	11. ADDITIONAL LIQUOR BUFFERING	1,196,658	28,480	175	27	389	3,604	3,177	556
Total						1,817,697	118,180	349	38	953	2,955	17,655	238

Totals for selected solutions

Figure 1.3: List of options considered for methane reduction at Knostrop Wastewater Treatment Works demonstrating the relative cost efficiency used to aid short-listing of options.

Implemented by 1/ (n=9)	Minimal emission reduction	Maximum emission reduction	Leftover emission (average reduction)	Average reduction	MITIGATION	TOTAL CAPEX £	ANNUAL OPEX £/y	EMBEDDED CARBON tCO2e	OPERATIONAL CARBON tCO2e/y	Reduced carbon tCO2e/y	Leftover carbon tCO2e/y	tCO2e BENEFIT in time horizon	£/ton CO2 in time horizon
1	50%	80%	50%	50%	1. COOLING DOWN DIGESTED SLUDGE	858,642	30,158	106	70	4,580	4,580	90,696	18
1	20%	50%	80%	29%	2. CONNECTING DIGESTERS IN SERIES	3,520,600	-787,787	426	-1,842	-1,832	7,328	73,655	-157
1	1%	10%	99%	1%	3. PUMPING OUT DIGESTED SLUDGE AT A HEIGHT (INSTEAD OF USING OVERFLOW)	280,717	14,608	35	31	92	9,069	1,177	487
1	80%	99%	20%	80%	4. CONVERTING BUFFER TO POST FERMENTATION	3,880,107	2,420	478	1	7,328	1,832	146,666	27
1	50%	80%	60%	49%	5. VACUUM DEGASSING	1,641,899	29,175	313	14	3,664	5,496	72,689	31
1	20%	50%	85%	15%	7. LEAK DETECTION OF THE BIOGAS (opex only)	0	20,000	0	0	1,374	7,786	27,481	15
1	10%	20%	90%	19%	11. PERIODIC LITHIUM TESTING (opex only)	0	601,744	0	0	916	8,244	18,320	657
Total					96%	10,181,950	-80,642	1,356	-1,726	8,827	333	209,707	41

We have selected a range of options that offer efficient costs (£/tCO2e reduction), and material emission reductions annually and over the life of the investment to ensure an affordable cost and best return on investment for our customers from this enhancement case.

We considered the whole life cost and carbon impact of the schemes proposed. This included a significant amount of operational cost savings e.g., avoided purchased electricity cost, value from increased biogas production and reduced cost associated with purchased chemicals. Note that these opex savings are captured in the wider business plan and not in the totex associated with our enhancement case.

As demonstrated in the figures above, the £/tonne of CO2e reduction in the time horizon was a key element in determining the inclusion of the schemes in our enhancement case.

As a result of our assessments, we are proposing to deliver the following schemes at sites across the business:

- Solar – 32MW (via a combination of ground- and roof-mounted installations)
- 9 Methane reduction schemes at 9 sites
- 13 Nitrous oxide reduction schemes at 13 sites

Details of the methane reduction schemes selected showing the intervention as each site and carbon benefit are included in Table 1.13 and the solutions for nitrous oxide reduction in Table 1.14 below. We have a large set of options for solar sites including available land and rooftop space on both clean and wastewater sites, spread across Yorkshire. We are currently working with the combined authorities and Local Authorities to understand how the geographical spread of this investment best contributes to the Local Area Energy Plans.

Table 1.1312: Selected Methane Reduction Interventions and Gross Carbon Annual Reduction by Site

Site	Methane reduction Interventions	tCO2e reduction/year	Capex £m
Knostrop	5 - Vacuum degassing and 7 - Leak detection	4489	1.72
BBM (Blackburn Meadows)	2 - Digester in series, 5 - Vacuum degassing and 7 - Leak detection	2564	4.52

Esholt	2 - Digester in series, 5 - Vacuum degassing and 7 - Leak detection	3819	4.33
Huddersfield	5 - Vacuum degassing and 7 - Leak detection	2160	0.89
Hull	5 - Vacuum degassing and 7 - Leak detection	2300	1.53
Dewsbury	2 - Digester in series, 5 - Vacuum degassing and 7 - Leak detection	1221	3.56
Woodhouse Mill	5 - Vacuum degassing and 7 - Leak detection	577	0.62
Old Whittington	5 - Vacuum degassing and 7 - Leak detection	506	0.66
Sandall	5 - Vacuum degassing and 7 - Leak detection	686	0.62
Totals		18322	18.45

Table 1.1413: Selected Nitrous Oxide Reduction Interventions and Carbon Annual Reduction by Site

Site	N2O reduction Interventions	tCO2e reduction/year	Capex £m
Knostrop	0 - Monitoring, 5 - RTC and 11 - Additional liquor buffering	933	1.93
Blackburn Meadows	0 - Monitoring, 5 - RTC	562	0.64
Esholt	0 - Monitoring, 5 - RTC	397	0.58
Dewsbury	0 - Monitoring, 5 - RTC	474	0.51
Hull	0 - Monitoring, 5 - RTC and 11 - Additional liquor buffering	840	0.86
York	0 - Monitoring, 5 - RTC	262	0.48
Huddersfield Lower Brighouse	0 - Monitoring, 5 - RTC	207	0.49
Halifax Copley	0 - Monitoring, 5 - RTC	339	0.6
Woodhouse Mill	0 - Monitoring, 5 - RTC	366	0.49
Calder Vale	0 - Monitoring, 5 - RTC	317	0.47
Old Whittington	0 - Monitoring, 5 - RTC	297	0.49
Aldwarke	0 - Monitoring, 5 - RTC	245	0.5
Sandall	0 - Monitoring, 5 - RTC	179	0.49
Totals		5418	8.54

The carbon reductions indicated above are only achievable with the investment set out in this enhancement case. If the additional investment is not allowed, then the overall emissions forecast for our performance commitments will need modification to reflect this. We also need to remove the associated operational cost savings from the wider business plan.

As mentioned above, it is possible that new or lower cost technologies may become available in the future that will make greater and/or cheaper emission reduction possible. We will amend our

plans and deliver planned or greater reductions using alternative solutions where this is in the best interest of our customers and the delivery of our net zero glide path.

1.4.2 Cost-Benefit Appraisal

As the enhancement case is fundamentally anchored to a £/tCO₂e carbon emission reduction as the basis of an efficient case, there is clear focus throughout this case in delivering emissions reduction at the lowest cost and thereby providing value to our customers while meeting the carbon reduction levels required to align to a glide path to net zero emissions by 2050 requiring a 90% emission reduction against baseline. As indicated in table CW15 and CWW15 the benefit of the enhancement case extends into future AMPs and our cost benefit appraisal has therefore considered both the life of the asset and the whole life carbon and costs to determine the cost benefit. We have referenced in the case both the gross and net benefit of carbon and while the former will be used for annual reduction forecasting the latter has been applied for the cost benefit.

Tables 1.8 and 1.9 show the £/tCO₂e benefit over the lifetime of the interventions which we deem to be positive.

1.4.3 Best Value Analysis (Six Capitals)

We have considered the carbon impact of the proposed interventions across their life including both the gross and net benefits of the selected options. Selection was based on reduction across the life of the investment and in terms of the cost efficiency in £/tCO₂e. Competing options were not least cost options in comparison but were rather those with alternative reduction outcomes over the whole life. The selected options represent best value over the period in financial, natural capital and balanced bill affordability (social capital) for customers. Use of technology and increase in assets adds to both intellectual and human capital e.g., by stimulating jobs in the green economy and improving understanding and control of process emissions.

1.4.4 Impact Quantification

The impact of the proposed options has been determined both in terms of gross emissions reduction and reduction net of embedded emissions. The options selected in the enhancement case have been quantified and integrated into the pathways set out in the performance commitments for operational greenhouse gas emissions reduction for water and wastewater. These reductions are detailed in tables CW21 and CWW22 and integrated into the performance commitment tables OUT4.24 and OUT5.27. As mentioned above these costs and benefits are subject to enhancement case approval and will be removed from our performance commitments if not supported along with any associated savings.

1.4.5 Cost and Benefit Uncertainties

The selected options use technologies and costs that are relatively well understood. We have been cautious in not overestimating the benefits, by using emission reductions modelled at the lower end of the reduction scale to ensure delivery risks are mitigated. While there remain uncertainties in process emissions it is likely that these emissions are currently understated in carbon accounting, and that measurement and management will demonstrate a) a more realistic level of emissions and b) a higher scale of benefit.

The investment in solar renewables has minimal uncertainty and we are confident in the delivery of emission reductions at the forecast scale.

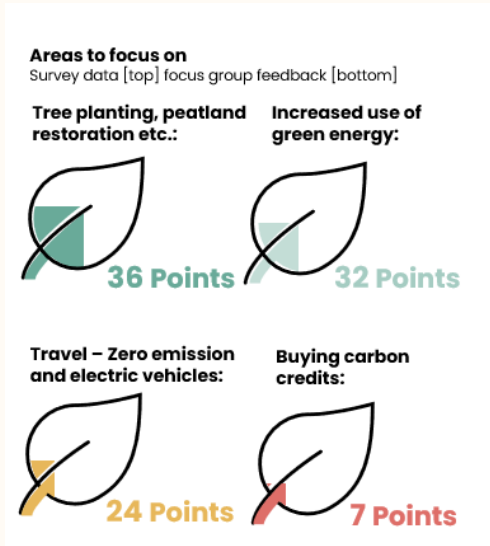
1.4.6 Third Party Funding

There is no third party funding for this case.

1.4.7 Customer Views

As outlined in our customer support section, we have engaged with customers on [alternative solutions for achieving net zero](#), particularly with regards to the use of carbon offsetting. Our customers told us that they have a preference for nature focused actions, rather than the purchasing of carbon credits, as illustrated in Figure 1.5. below.

Figure 1.4: Customer Feedback on Net Zero



While customers have a range of opinions, there was a clear preference for us to work to reduce our emissions and act locally to deliver carbon insets through partnerships and our own efforts and use carbon offsets as a final measure for residual emissions. In addition, customers told us that while carbon reduction is a global issue, any carbon credits delivered should be felt by our customers in our community at a local level.

Read more about this and our wider engagement in [Chapter 6](#) of our main business plan.

1.4.8 Direct Procurement for Customers (DPC)

For more information on the process followed and the cases that were ultimately identified as suitable for DPC, please see [section 6.3](#) in Introduction to Enhancement Cases.



Read more about this at [Introduction to Enhancement Cases](#)

1.5 Cost Efficiency

1.5.1 Option Costs

This section outlines how our overall approach to cost estimation and cost efficiency. Tables 1, 4 and 5 summarise the costs associated with this enhancement case.

1.5.2 Cost estimate for our preferred option

Our cost estimates have been developed using our Unit Cost Database (UCD) and our EDA tool. Further details on how we have applied these tools to develop cost estimates are provided in [section 7.3](#). Key assumptions used to create cost estimates for nitrous oxide emission reduction and methane reduction in this enhancement case are discussed below. Key assumptions used to create cost estimates for nitrous oxide emission reduction and methane reduction in this enhancement case are discussed below.

1.5.2.1 Nitrous Oxide emission reduction and Methane reduction cost estimates

As outlined earlier in this document, our optioneering process considered 11 possible mitigations at 20 Wastewater Treatment Work sites for nitrous oxide emission reductions. This was subsequently narrowed down to 13 sites following a workshop with our planning partners. For methane reduction, 12 sludge treatment facilities were initially considered, before being narrowed down to 9 sites through the same workshop. The work was supported by Royal HaskoningDHV and Stantec to assist in selection of options, review of feasibility against site operating conditions and high-level costing based in their latest commercial modelling.

Scopes of work for each site were developed in conjunction with our Strategic Planning Partner. Our UCD models were typically used to develop cost estimates, utilising historic cost information from previous schemes delivered by Yorkshire Water.

Where proposed measures sat above the upper limit for suitable cost models, best estimates were created after cross checking against information held in the national water industry costing database where applicable (TR61 v14). Some specific cost estimates for bespoke assets or services were developed by our Strategic Planning Partner, with adjustments made to reflect specific on-site requirements.

1.5.2.2 Renewables cost estimates

As described earlier, a range of renewable energy options have been modelled by our commercial team following work undertaken over recent years to review solar, wind, hydro and wider energy options including heat recovery, and hydrogen with options on the long list entered into our EDA tool. This utilised confidential high level cost estimates from suppliers provided by Stantec for bespoke assets or services and there was no external benchmarking.

1.5.3 Efficient Cost Estimates

For our proposed implementation costs, estimates were developed using the expertise of our Strategic Planning Partner to determine scope and using UCD models to create efficient cost estimates. Our UCD approach involves building detailed cost estimates that are developed using historic cost information on individual components of an overall solution.

Further information on the efficiencies embedded within our modelling approach is provided in [section 7.3](#) of the Introduction to Enhancement Cases appendix.

1.5.4 Need for enhancement model adjustment

We note that the Ofwat has not shared its enhancement models for net zero with us ahead of business plan submission, but we understand that it intends to test cost efficiency on a cost per unit of operational GHG emission (£/tCO₂e) abated basis. We do not have any specific reason to believe that an adjustment to these models would be required, but without a view of these models ahead of submission, development of a case for an adjustment is not possible.

We believe that the net zero reduction opportunities available will be company specific and the cost benefit may vary depending on what has been delivered historically and the processes in companies' legacy asset bases.

For example, companies that are less advanced on their emission reduction journey may have the opportunity to reduce carbon emissions by a greater amount and at lower cost than others that have made more progress in their journey of emission reduction, as the more advanced companies may have already deployed solutions with the greatest cost benefit.

There is a risk that basing allowances on the cost of a unit of operational GHG emission may significantly overfund or underfund individual companies. We ask that Ofwat considers carefully the reasons why companies may be outliers in costs in respect of the models rather than automatically attributing these to relative efficiency/inefficiency. We suggest that the modelling approach should be combined with a deep dive of the costs of specific solutions being proposed.

1.6 External Assurance

For information on Assurance please see [section 7.4](#) of the Introduction to Enhancement Cases appendix.

1.7 Customer Protection

We have reviewed our forecast enhancement totex and found that it does not meet the 1% materiality threshold for PCDW18 or PCDWW34. However, we acknowledge there is not regulatory oversight of the implementation of our GHG reduction programme. Accordingly, we

propose to implement a Price Control Deliverable (PCD) to protect customers from non-delivery of our various schemes across our water and wastewater sites.

We also considered whether additional customer protection mechanisms were in existence or should be introduced to complement the PCD.

1.7.1 PCD

For information on the methodology, we have used and the central assumptions we have applied for our PCDs please see [section 8.2](#) in Introduction to Enhancement Cases.

We set out our PCD parameters and payment rate in the following tables.

Table 1.1514: PCD Delivery Expectation

PCD Delivery Expectation	
Description	<p>Reducing greenhouse gas emissions by targeting energy use in the company’s operations and process emissions. Process emissions are gases produced from treating wastewater and sewage sludge and include nitrous oxide and methane. The company is investing in:</p> <ul style="list-style-type: none"> • 32 MW of solar renewables, which will be deployed through roof-mounted and ground-mounted solar arrays on our water and wastewater network and sites to generate electricity. • 9 schemes to reduce methane process emissions, by upgrading our STWs. • 13 schemes to reduce nitrous oxide process emissions, by upgrading our STWs. <p>Methane and nitrous oxide are targeted because these are key GHG emissions with significant global warming potential, associated with wastewater processes and contribute more than 40% of total wastewater emissions. As scope 1 emissions these are under our direct control, and we have a responsibility to address these emissions as a priority.</p>
Output measurement and reporting	<p>Company must deliver the outputs in line with the profile specified in the ‘forecast deliverables’ table.</p> <p>Company should report outputs annually in parallel with the APR (Annual Performance Report). This information should be split by:</p> <ol style="list-style-type: none"> 1. New installed MW capacity of solar renewables on water sites. 2. New installed MW capacity of solar renewables on wastewater sites. 3. Methane reduction schemes completed. 4. Nitrous oxide reduction schemes completed.
Assurance	<p>The company must commission an independent, third-party assurer, with a duty of care to Ofwat, to assure, to our satisfaction, that the conditions below have been met and the outputs of the scheme set out below have been delivered.</p>
Conditions on Scheme	<p>The pace of technological change for emission reduction technologies is rapid. Therefore, the company can substitute scheme solutions where it can achieve equal to or greater GHG emission reduction than the forecast benefits.</p>

We propose a series of deliverables to reflect the differences in activities under our proposed net zero enhancement funding. We have set out our delivery profile based on the phasing of investment and the implementation plan anticipated across the AMP. Work will commence in all areas in year 1, however it is likely that completion will commence from year 2 onwards.

1.7.1.1 Forecast deliverables

Table 1.1615: Forecast Deliverables

Deliverable	Unit	Forecast Deliverables				
		2025/26	2026/27	2027/28	2028/29	2029/30
Solar renewables (Water)	MW installed. (cumul)	0	5	10	14	16
Solar renewables (Wastewater)	MW installed. (cumul)	0	5	10	14	16
Methane reduction	No. Schemes (cumul).	0	3	6	9	9
Nitrous oxide reduction	No. Schemes (cumul).	0	4	8	12	13

We propose the PCD protects all totex in this enhancement case, including the costs for monitoring of the baseline and post scheme installation process emissions. This will be key to ensuring that the reductions can be validated and reported on an on-going basis.

The different PCD rates reflect that solar schemes are relatively similar per MW installed, but there is greater variability across the methane and nitrous oxide investments.

1.7.1.2 Proposed PCD payment rates.

Table 1.1716: PCD Payment Rates

Deliverable		Unit payment (£m)
Solar renewables (Water)	£m per MW	Enhancement totex (water) ÷ total MW capacity installed. = 17.57 ÷ [16MW] = £1.1m
Solar renewables (Wastewater)	£m per MW	Enhancement totex (solar wastewater) ÷ total MW capacity installed. = 17.57 ÷ [16MW] = £1.1m
Methane reduction	£m per scheme	Per Capex cost as indicated in Table 1.13
Nitrous oxide reduction	£m per scheme	Per Capex cost as indicated in Table 1.14

We propose applying the PCD payment per unit to the difference between the forecast and actual outputs delivered for each type of output as at the end of AMP8.

1.7.1.3 Annualised Outcome Delivery Incentives

We identified two common performance commitments that are impacted by this enhancement case. We have forecast the expected improvements from this enhancement case; however, we will report the net GHG reduction for the company annually against these performance commitments. While the benefits of this enhancement case are set out here there will be other changes that impact emissions reported.

Table 1.1817: Forecast benefits

PC	Unit	Forecast Benefits – Gross Carbon Benefit				
		2025/26	2026/27	2027/28	2028/29	2029/30
Operational greenhouse gas emissions (water)	t CO2e (cumul).	0	1000	2000	3000	3500
Operational greenhouse gas emissions (wastewater)	t CO2e (cumul).	0	9500	20500	25418	27240

Ofwat has not yet issued the ODI rate for these two performance commitments. If the ODI rate introduces significant customer protection against the delay and non-delivery of the identified GHG reduction schemes, we propose Ofwat reconsiders the extent that a PCD is required for the investment.

As mentioned above, the impact and potential variability of the WINEP programme needs to be considered in terms of overall emissions and should be revisited and adjustments made prior to final determination as required. Amendments to process emissions factors (or other factors in the carbon accounting workbook) may also require updating and re-baselining to ensure consistent reporting.

1.7.2 Scheme substitutions

We have prepared our forecast solutions and GHG reduction benefits based on the latest available technology, and we believe that this enhancement case offers the best optimised plan. That said, this is an area of rapid technology development and as such, enhanced or lower cost technologies may become available in the future that will make greater and/or cheaper emission reduction possible. We would like to retain flexibility to deliver the best possible solution for Net Zero. We propose that where we can deliver greater GHG reductions using alternative solutions, we should substitute in these schemes where this is in the best interest of our customers and the delivery of our net zero glide path. Should a variation of technology or solution become available to us, we would look to incorporate that through our design process, with associated governance and sign off.

1.7.3 Annualised time delivery incentive

We do not propose a time incentive because this case does not meet the 1% materiality threshold to establish a PCD for water or wastewater activities. We note there is also an ODI incentive to reduce our greenhouse gas emissions year-on-year.

1.7.4 Third Party Funding or Delivery Arrangements

This is not applicable for this case as no third party or DPC delivery is proposed.