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
Unit	tCO_2e	tCO_2e	tCO2e
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 tCO2e reduction per annum	Lifetime Cost Benefit (tCO2e)
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 tCO2e reduction per annum	Lifetime Cost Benefit (tCO2e)
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**	**134[1]**

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	✓		✓	✓	✓	✓	✓	✓		✓