

Scottish Water Carbon Footprint Report 2008-2009



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Water**
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Scottish Water Operational Carbon Footprint 2008/09

0.0 EXECUTIVE SUMMARY

This report sets out Scottish Water's operational carbon footprint (CFP) for the financial year 2008/09 as 475,265 tonnes of carbon dioxide equivalent (tCO₂e). This is the third such report and we commit to continuing to report our footprint annually. Wastewater and sludge activities produce the majority of our CO₂e emissions. Grid electricity is the main source of our CO₂e emissions, with process emissions from sludge also making a significant contribution.

Owing to ongoing improvements in the quality and understanding of our data, there are a number of changes in the components that make up the overall footprint; the main one being the consumption of electricity, which has levelled out from 2007/08 to 2008/09. This equated to a reduction in the CFP of 3,023 tCO₂e from 2007/08 to 2008/09 and appears to be largely due to our leakage reduction programme, which reduced the volume of drinking water supplied by 122 megalitres per day.

We have benchmarked our CFP against the rest of the UK water industry using the Water UK sustainability indicators¹. Scottish Water has the lowest CO₂e for drinking water, due to the generally high quality of the raw water and the extensive use of gravity systems resulting in reduced treatment and pumping. We have the highest CO₂e for wastewater, due to the demography of Scotland where more, and often smaller, wastewater treatment facilities are required to serve smaller populations.

Although reliable year on year comparisons are difficult owing to data changes, it would appear that the 2008/9 footprint represents a marginal reduction in GHG emissions. A real decrease of ~9,800tCO₂e from 2007/08 to 2008/09 is implied, however it is difficult to draw meaningful conclusions from any 'bottom line' change in the CFP from one year to the next because a consistent data collection process is still being established and three years of CFP calculation does not give a long enough trend.

We will continue to improve our data and reporting in order to stabilise our baseline and to identify trends with more confidence. However, we are not waiting for a stable baseline before we start reducing our GHG emissions. We have developed the first version of our carbon plan, used to identify and track the various activities across the business that can help to reduce our GHG emissions. Later in 2010 our carbon plan will also be available on our website at www.scottishwater.co.uk/climatechange

1.0 INTRODUCTION

This report sets out Scottish Water's operational carbon footprint for the financial year 2008/09. This is our third operational carbon footprint (the greenhouse gas emissions associated with operating our water and wastewater services on a daily basis). We measure our carbon footprint (CFP) to understand how much greenhouse gas (GHG) is emitted by different parts of the business and by different processes in order to efficiently manage carbon emissions.

¹ Water UK [Sustainability Indicators](#) 2008/09

Scottish Water is committed to acting responsibly in the delivery of its services and to making the right choices in terms of service, cost and carbon. Our climate change strategy is to proactively address the climate challenges on behalf of customers, seeking to achieve a low carbon service that is resilient to climate change.

With respect to mitigating our contribution to Scotland's carbon emissions, our strategy is based on:

- measuring and managing carbon in our business;
- reducing energy demand;
- becoming more efficient and
- developing renewable power.

We are putting in place a detailed carbon plan to identify and execute actions across the business to implement our mitigation strategy and thereby reduce our carbon emissions.

Scottish Water has been measuring its operational carbon annually since 2007/8, and we commit to continuing to make this information available to customers. The production of this report was undertaken internally this year, having previously been outsourced to carbon consultants. This has significantly improved our carbon assessment capabilities, our understanding of the data, and has been produced more efficiently than previously. The report was verified by the carbon consultants, who commented that the data collection and resolution of the CFP had improved on the previous two years².

Scottish Water also undertakes a large capital investment programme. Our capital carbon footprint (the footprint associated with building new assets) is not calculated on a regular basis. An estimate of the embodied carbon within the current 2006-2010 programme was made in 2008 as part of a project to begin to understand the issue. We are currently developing a whole life costing tool to include carbon. This will build on the work to estimate embodied carbon, enabling the business to understand the carbon impact of the investment decisions we make across the life of an asset. This is important because many of the assets we build have operational lives measured in decades and we need to understand how we can evolve to a more sustainable asset base in the future.

The Climate Change (Scotland) Act 2009 sets GHG reduction targets for Scotland of 30% by 2020 (with the option of 42% dependent upon commitments of other countries after CP.15 at Copenhagen) and 80% by 2050 (from 1990 baseline). Scottish Water falls under Part 4 of the Act, which places climate change duties upon public bodies to contribute to the delivery of these targets and to help deliver Government programmes to adapt to climate change.

In addition, Scottish Water is also part of the CRC Energy Efficiency Scheme (formerly known as the Carbon Reduction Commitment). This is a 'cap and trade' mechanism, providing a financial incentive to large public and private sector organisations to reduce their energy use by putting a price on carbon emissions from energy use.

2.0 METHODOLOGY

Our CFP was calculated using the UKWIR (UK Water Industry Research) Carbon Accounting Workbook (CAW) v3.0, which is based on Defra reporting guidelines. The UKWIR methodology (which was last updated in April 2009) was developed, with input from the

² Enviro Carbon Footprint Verif Report, 2009

Carbon Trust, with the aim of ensuring consistency in the reporting of GHG emissions across the UK water industry.

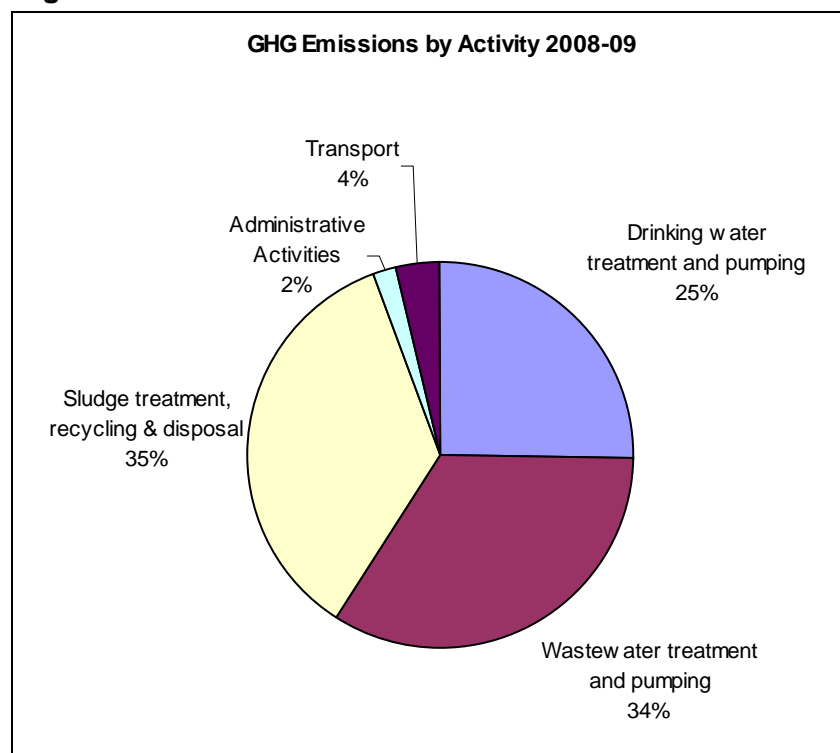
As a result, we are able to benchmark our performance against the rest of the water industry with some confidence. A more detailed description of the CAW methodology is included in Chapter 4 of our 2007/08 CFP report.

3.0 RESULTS

Our operational CFP for 2008/09 was 475,265 tonnes of carbon dioxide equivalent (tCO₂e). This is very close to our operational CFP for 2007/08, although the component parts have altered as we have improved our data and understanding of the sources of emissions. Section 3.0 provides an explanation of the component parts that make up Scottish Water's total CFP.

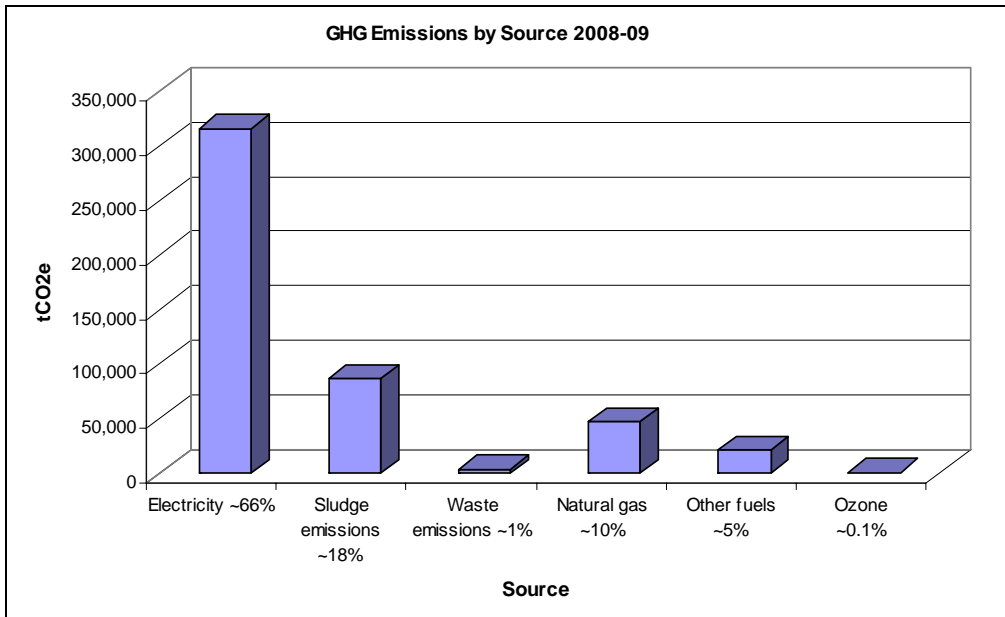
Figure 1 shows the CFP broken down by 'activity type'. These are the core activities we undertake in operating our service. It can be seen that wastewater and sludge activities (treatment & pumping of wastewater and treatment, recycling & disposal of sludge) produce the majority of our CO₂e emissions. Despite our fleet of 1,500 vehicles and the wide geographical area we cover, transport activities account for only 3.8% of the CFP.

Figure 1



If we break down the CFP another way, to show the 'sources' of emissions as in Figure 2, we see that grid electricity is the main source of our CO₂e emissions, with process emissions from sludge (methane and nitrous oxide) also making a significant contribution.

Figure 2



4.0 ANALYSIS

This section outlines our analysis of the 2008/09 CFP including an interpretation of the changes since last year, a comparison to the rest of the UK CFP and an estimate of the customer CFP. Appendix C shows the organisational and operational boundaries of the assets that are included within the CFP. As this is an operational CFP, only the operation of these assets during the year is included, not the building of them.

4.1 Differences from 2007/08

It is difficult to make reliable year-on-year comparisons and to identify underlying trends, due to changes in accounting methods and data sources as we work to improve data quality and reporting. This means that we have yet to establish a reliable stable ‘baseline’ for our CFP. However, there are some differences that can be highlighted.

Table 1 shows the CFP from 2006/07 to 2008/09. The overall CFP did not change significantly (an increase of 0.3%) from 2007/08 to 2008/09. This is well within the confidence range of our operational CFP for 2007/08. However, there are a number of changes from one year to the next in the components that make up the overall footprint. This is either due to genuine changes in CO₂e (i.e. from operational changes) or improvements in the coverage of the data collected (that is, inclusion of sources of data that were not available in previous years).

Table 1 – Operational Carbon Footprints

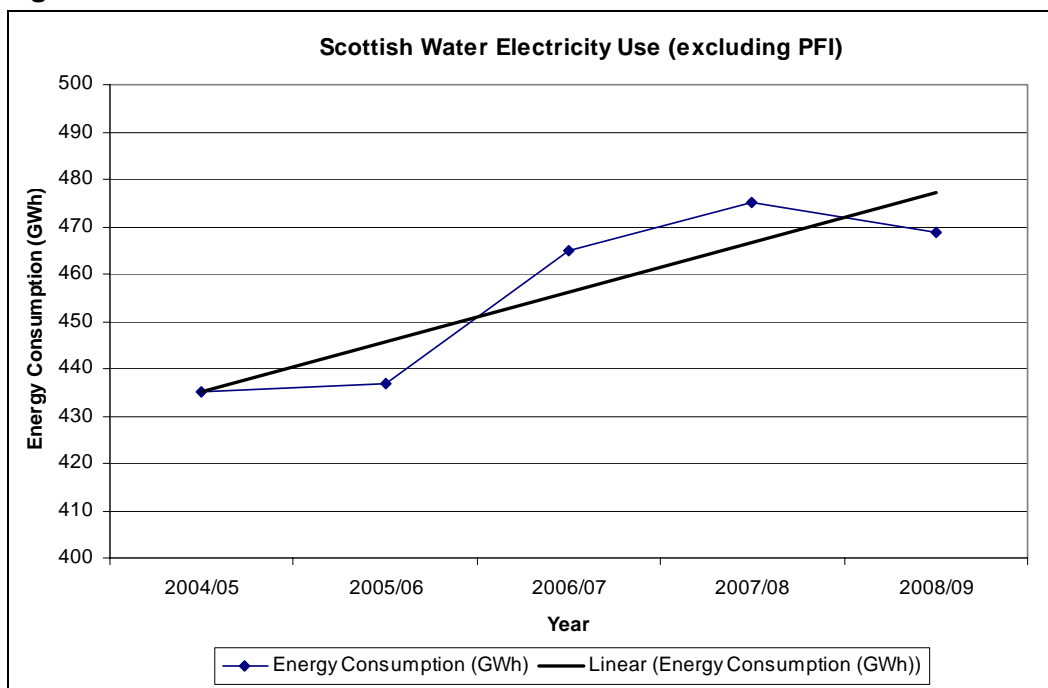
Year	2006/07	2007/08	2008/09
CFP (tCO ₂ e)	468,662	475,142	475,265
Confidence range	+/-11.0%	+/-5.5%	+/-5.2%

The main component changes from last year's CFP figures are explained here. Other, smaller, changes are included in Appendix A. The main assumptions made when calculating the CFP are provided in Appendix B.

Genuine changes in the CO₂e baseline

1. Grid electricity is the biggest source of our GHG emissions. Figure 3 illustrates the trend in grid electricity consumption from 2004/05 to 2008/09. It shows that there was an increasing trend from 2004/05 to 2007/08. The consumption then starts to level out from 2007/08 to 2008/09. This reduction in electricity consumption equated to a reduction in the CFP of 3,023 tCO₂e from 2007/08 to 2008/09 and appears to be largely due to our leakage reduction programme, which reduced the volume of drinking water supplied by 122 megalitres per day. The decrease in energy represents a real decline in emissions associated with water production and distribution. However, it remains to be seen whether this is a trend that will continue and we will investigate further.
2. The volume of water treated by ozonation reduced. This was due to changes in water treatment processes and contributed to a decrease in the CFP of 697 tCO₂e from 2007/08 to 2008/09.

Figure 3



Main data improvements – amendments to 'baseline'

1. Natural gas used in CHP increased by 10,854 tCO₂e from 2007/08 to 2008/09. This was due to the omission of PFI data for this input last year. A similar amount of PFI gas would have been used in 2007/08; therefore this is a change that affects the baseline of the CFP.
2. Biogas volume increased by 3,711 tCO₂e because it was not calculated last year. This is a change that affects the baseline of the CFP.
3. The passenger transport emissions were calculated differently this year. Firstly, this year we used mileage rather than fuel figures. Secondly, the sources of data this year were

more reliable. Consequently, the allocation of fuels was improved. This led to an apparent increase in freight fuels and decrease in passenger fuels, but was in effect a misallocation last year. The slight overall increase of 1,263 tCO₂e was due to the inclusion of more data sources this year; which is a change that affects the baseline of the CFP.

As can be seen from Table A1 in Appendix 1, there have been a number of increases and decreases in the CO₂e for different components compared to the 2007/08 CFP. These have been colour coded according to whether they are:

- a reallocation of data from one category to another (reallocation);
- the inclusion of new data that was not gathered last year (baseline);
- a genuine increase or decrease of data (real change);
- those that are not colour coded are small numbers of negligible effect.

When examining these changes we can make some assumptions to help us with basic high level calculations. The baseline changes to 2008/09 give a net increase in CO₂e of ~9,900tCO₂e. If we assume that operations were exactly the same in 2007/08 and 2008/09 (this is unlikely because of variations in operational practice) an 'uplift' could be applied to the 2007/08 CFP to enable a high level comparison of the two years without data improvement interference. This allows us to compare what the real change in the CFP bottom line could have been.

Once this ~9,900tCO₂e uplift has been applied to the 2007/08 CFP, a real decrease of ~9,800tCO₂e from 2007/08 to 2008/09 is implied. As explained at the beginning of this section, although reliable year on year comparisons are difficult, it would appear that the 2008/9 footprint represents a marginal reduction in GHG emissions.

4.2 UK Comparison

The UK water industry reports annually on a number of sustainable development indicators, two of which can be used as a guide to the level of service provision. As such, we have benchmarked our footprint in terms of the indicators in Table 2.

Table 2 – Benchmark against Water UK sustainability indicators

SD Indicator	UK Average	Scottish Water
Greenhouse gas emissions from supplying water (tonnes CO ₂ e per MI of water supplied)	0.30	0.15
Greenhouse gas emissions from wastewater treatment (tonnes CO ₂ e per MI of wastewater treated)	0.75	0.95

Scottish Water performs well against the sustainability indicator for supplying drinking water. This is indicative of the generally high quality of the raw water and the extensive use of gravity systems resulting in reduced treatment and pumping requirements in comparison to other areas of the UK.

However, the result for wastewater treatment is higher than average. This reflects the demography of Scotland where more, and often smaller, wastewater treatment facilities are required to serve smaller populations, thereby losing the benefits associated with economies of scale found elsewhere in the UK.

4.3 Customer footprinting

This section enables customers to estimate their own water and wastewater related carbon footprint, in terms of CO₂e in grams per litre or tonnes per mega litre.

Table 3 – Customer footprinting

Emission Sources	Total emissions for 2007/08 (tCO ₂ e)	CO ₂ e emissions grams per litre or tonnes per MI
Clean water supply – includes extraction, treatment & pumping of clean water supply	132,878	0.17
Wastewater services – includes pumping & treatment of wastewater, transport & treatment of sludges	342,387	0.99

The figures supplied are indicative and based on the best available information. They are likely to change over time as data improvements are made and customers should ensure they are using the latest figures if calculating their emissions associated with the consumption of water and wastewater services.

Note that the figures in Table 3 are different to those given in Table 2, where Scottish Water's emissions are compared to the Water UK average. This is because the Water UK sustainability indicator methodology includes only emissions directly associated with water and wastewater treatment & pumping and with sludge treatment & disposal; Scottish Water's figures are therefore calculated accordingly. However, for customer footprinting (Table 3, above) the figures also include those emissions associated with administration and transport, because these activities are an integral part of the service provision. They have been split evenly between clean water supply and wastewater services.

5.0 NEXT STEPS

With each carbon footprint we calculate, we strive to improve our data quality and reporting. Although we have attempted, in section 4.1, to indicate how Scottish Water is performing in general, it is difficult to draw meaningful conclusions from any 'bottom line' change in the CFP from one year to the next because a consistent data collection process is still being established and three years of CFP calculation does not give a long enough trend. We have tasked ourselves with identifying the remaining shortfalls in data and making all major data improvements over the next two years. We should then be in a position to stabilise our baseline and to identify trends with more confidence.

There are two areas of particular focus for improvement:

- Confidence Grades – this is about improving the 'reliability' and 'accuracy' of data we already collect. For example, capturing on-site fuel use data in a corporate system.
- Coverage of Data – this is about identifying and collecting data that we don't currently include in the CFP. For example, sludge data from the islands; more complete CHP data.

The UKWIR Carbon Accounting Workbook that we (along with the rest of the UK water industry) use for calculating our CFP is in the process of being updated again. Part of this will be to distinguish between Defra/DECC scopes 1, 2 & 3. We will then be able to report our emissions on this basis. There are expected to be limits to the amount of scope 3 (supply chain, raw materials) data the water industry can include at this stage. This is a

common problem across all sectors and the water industry and Scottish Water are committed to working with supply chains to identify and include relevant carbon sources.

As discussed, the absence of a stable baseline makes identifying trends difficult. However, we are not waiting for a stable baseline before we start reducing our GHG emissions. We have developed the first version of our carbon plan used to identify and track the various activities across the business that can help to reduce our GHG emissions. Producing it is an iterative process and we will add to it as we learn more about our CFP, as actions become established and new activities are identified and developed. Our carbon plan will also be available in due course on our website at www.scottishwater.co.uk/climatechange

Appendix A – Other component changes from 2007/08 to 2008/09

Drinking water:

1. Grid electricity usage for drinking water pumping and treatment decreased by 11 GWh. This was largely due to our leakage reduction programme, which reduced the volume of drinking water supplied by 122 megalitres per day. This contributes to a genuine reduction in CFP of 2,736 tCO₂e.
2. On-site generated renewable electricity reduced by almost 6.5 GWh. This is due to an input error last year. In fact on-site generated renewable electricity was similar last year. This is a change that affects the baseline of the CFP (decrease of 1,251tCO₂e).
3. Diesel usage increased and gas oil usage increased considerably. Both were due to an improvement in the processing of the data. Using the same methodology for 2007/08 gives figures of the same order of magnitude as those for 2008/09, with differences that can be explained by the numbers of journal entries in the raw data. These are changes that affect the baseline of the CFP (increase of 393tCO₂e).
4. The mass of water treatment works waste sent to landfill reduced by 7,616 tonnes (50%). This was due to calculation errors last year. This is a change that affects the baseline of the CFP (decrease of 801tCO₂e). (For both years, data for the Western Isles, Orkney and Shetland are not available.)

Wastewater:

5. Grid electricity usage for both wastewater treatment and wastewater pumping increased by a total of 53GWh. This is due to an improvement in data processing. Last year all PFI electricity usage was allocated to the sludge treatment, recycling and disposal category; this year a split has been made between the sludge and wastewater categories. This is a redistribution of data and does not affect the overall CFP. See Appendix B point 1 for detail of how this was done.
6. Gas oil used for wastewater treatment and pumping increased considerably. This was due to calculation errors last year. This is a change that affects the baseline of the CFP (increase of 33 tCO₂e).
7. Diesel used for wastewater treatment and pumping reduced considerably. This was due to an improvement in the processing of the data. Using the same methodology for 2007/08 gives a figure of the same order of magnitude as that for 2008/09, with a difference that can be explained by the number of journal entries in the raw data. This is a change that affects the baseline of the CFP (decrease of 523 tCO₂e).
8. The population served by secondary (and higher) sewage treatment reduced slightly. This was because all treatment types were inappropriately included last year. This population figure is used in calculations of process emissions, therefore this is a change that affects the baseline of the CFP.
9. The mass of screenings and grit sent to landfill decreased slightly. This is due to an improvement in data processing. This is a change that affects the baseline of the CFP (decrease of 131tCO₂e).

Wastewater Sludge:

10. Grid electricity usage for treatment, recycling and disposal of sludge decreased by 58GWh. This is largely due to an improvement in data processing in line with point 5, above. This is a redistribution of data and does not affect the overall CFP.
11. Natural gas usage for treatment, recycling and disposal of sludge increased by 11GWh. This is due to an incomplete data set last year, which has been improved upon this year. However, due to a reduction in the fuel emission factor for natural gas, the GHG emissions in this category have reduced slightly. This is a change that affects the baseline of the CFP (decrease of 1,561tCO₂e).

12. There were slight changes to the sludge categories this year. Although the weight of sludge increased, due to different emissions factors for different sludge outlets, the overall CO₂e emissions for sludge decreased.
 - (a) Digested sludge applied to land reduced by 12k tonnes. This is due to a misallocation in 2007/08. This is a redistribution of data and does not affect the overall CFP.
 - (b) Limed raw sludge applied to land increased by 13k tonnes. This is due to a misallocation in 2007/08. This is a redistribution of data and does not affect the overall CFP.
 - (c) Composted sludge applied to land increased by 2k tonnes. This is a genuine increase in sludge production at one site.

Administration and minor gases:

13. Grid electricity usage for admin decreased by over 5 GWh. This is due to a change in the processing of the data. Previously the electricity in the 'unknown' category had been attributed entirely to admin; this year it was divided equally between categories. This is a redistribution of data and does not affect the overall CFP.
14. Natural gas usage for admin increased by over 2 GWh. This was due to the inclusion of 4 sites for the first time. These are existing sites and would have been using a similar amount of gas last year. The reason for their past omission is unknown and their inclusion this year is put down to data improvement. This is a change that affects the baseline of the CFP (increase of 320tCO₂e).

Table A1 – Increases and decreases from 2007/08 to 2008/09

	tCO ₂ e			
	2007/08	2008/09	Decrease	Increase
Water				
Electricity Indirect Emissions - Drinking water treatment and pumping	123,416.4	120,680.6	-2,735.9	
Natural Gas used for pumping or treatment (excludes CHP)	77.9	55.9	-22.0	
Gas Oil used for pumping or treatment	0.7	314.3		313.7
Diesel used for pumping or treatment	13.2	92.9		79.6
Emissions from on-site renewable electricity, attributable to the sale of ROCs	4,429.8	4,340.7	-89.1	
Emissions from exported renewable electricity	-5,764.4	-7,015.5	-1,251.1	
Ozonation	1,297.5	600.1	-697.4	
Water treatment works sludge recycled to land	-	26.1		26.1
Water treatment works sludge sent to landfill	1,621.3	820.8	-800.5	
Sewage				
Electricity Indirect Emissions - Sewage treatment and pumping	90,497.0	121,171.7		30,674.7
Natural Gas used for pumping or treatment	202.5	196.1	-6.4	
Gas Oil used for pumping or treatment	0.1	33.0		32.9
Diesel used for pumping or treatment	579.7	56.9	-522.8	
Natural gas combustion by CHP	341.9	11,196.0		10,854.1
Sewage Treatment (includes methane from mechanical treatment and short term storage of sludge)	27,458.0	26,126.7	-1,331.3	
Sewage screenings and grit sent to landfill	784.6	654.0	-130.7	
Sludge				
Electricity Indirect Emissions - Sludge treatment, recycling and disposal	97,226.3	68,878.3	-28,348.0	
Natural Gas used sludge treatment and disposal	36,020.5	34,459.7	-1,560.8	
Emissions from on-site renewable electricity, attributable to the sale of ROCs	-	401.2		401.2
Sludge disposal	69,795.2	62,540.9	-7,254.3	
Biogas combustion other than CHP	-	3,710.6		3,710.6
Admin				
Electricity Indirect Emissions - Administrative activities	10,073.5	7,460.1	-2,613.4	
Natural Gas used for administration	885.8	1,205.9		320.1
Gas Oil used for administration	0.1	-	-0.1	

(Table A1 continued)

	tCO ₂ e			
	2007/08	2008/09	Decrease	Increase
Diesel used for administration	219.8	-	-219.8	
Minor gases	-	30.8		30.8
Passenger transport				
<i>By fuel consumption</i>				
Petrol used	104.5	-	-104.5	-
Diesel used	8,523.2	-	-8,523.2	-
<i>By mileage</i>				
Small petrol car (max 1.4 litre engine)	-	175.2	-	175.2
Medium petrol car (from 1.4 - 2.1 litres)	-	424.1	-	424.1
Large petrol car (above 2.1 litres)	-	103.5	-	103.5
Small diesel car (1.7 litre and under)	-	547.3	-	547.3
Medium diesel car (1.7 litre to 2.0 litre)	-	551.1	-	551.1
Large diesel car (over 2.0 litres)	-	203.1	-	203.1
Car (unknown fuel)	2,599.2	132.8	-2,466.4	
Public transport (taxi, bus, rail, ferry, air)	148.0	258.6	-	110.6
Freight transport	4,589.5	14,831.4		10,241.9

	2007/08 CFP	2008/09 CFP	Baseline decrease	Baseline increase	Baseline net
TOTALS	475,141	475,265	-5,906	15,853	9,947

Key:

Reallocation	a reallocation of data from one category to another
Baseline	the inclusion of new data that was not gathered last year
Real change	a genuine increase or decrease of data
Negligible	small numbers of negligible effect

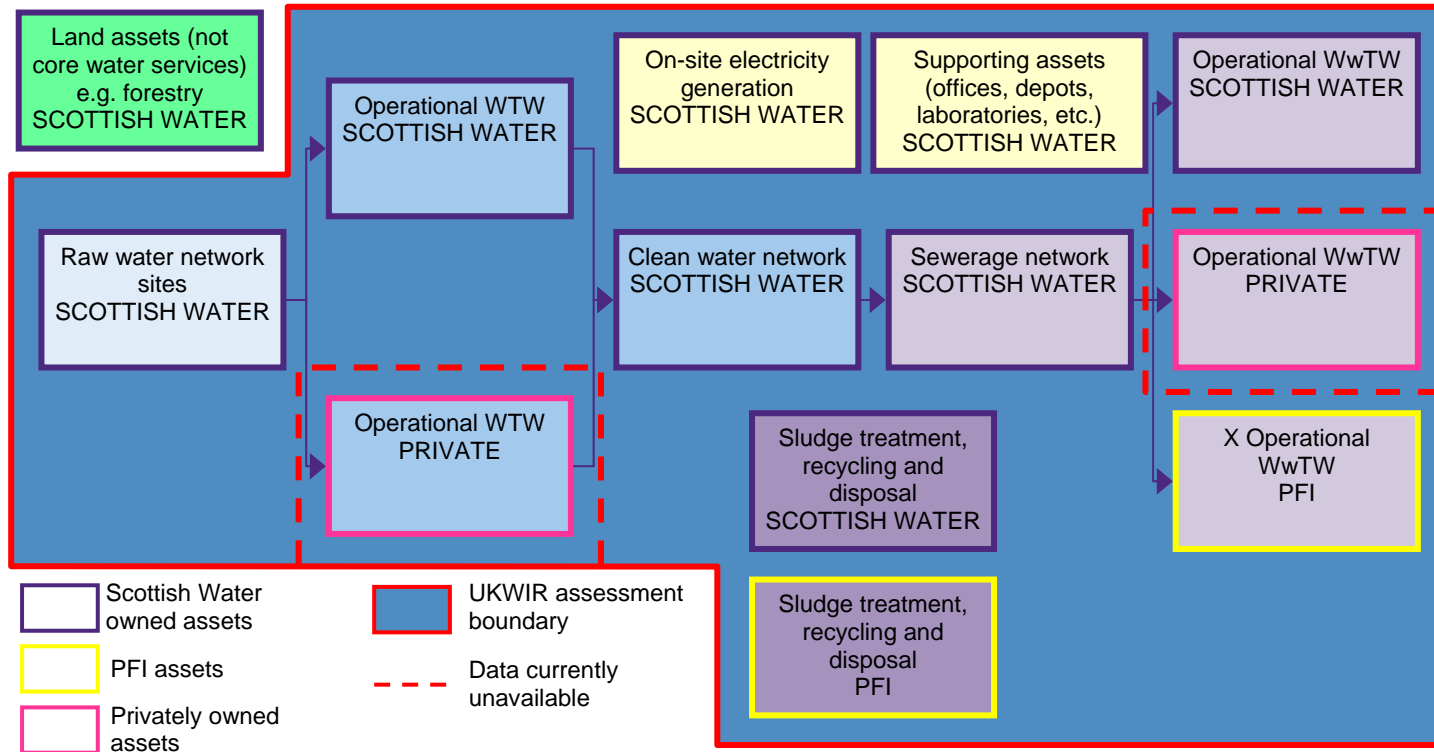
Appendix B – Assumptions

A number of assumptions were made about the data collected, as follows:

1. Electricity usage at PFI WwTW with sludge treatment has been allocated to the sludge category; Electricity usage at those PFI WwTW without sludge treatment has been allocated to the wastewater category. The exceptions to this are two PFI WwTW, which allocated electricity between pumping and treatment on site, where pumping has been allocated wastewater and treatment to sludge. See point 5 Appendix A for details of the change this makes.
2. Sludge categories were allocated using the sludge category matrix in our 2007/08 CFP report.
3. Some on-site fuel figures were only available as costs and had to be calculated on this basis. For this purpose, we used the following £ per litre figures (taken from the AA and the Department for Business, Innovation and Skills websites): £0.56 for gas oil; £1.17 for diesel.
4. Some freight transport figures were calculated from cost data, which then needed to be converted into litres. For this purpose, we used the following £ per litre figure (taken from the AA and the Department for Business, Innovation and Skills websites): £1.03 for petrol
5. Some passenger transport figures were calculated from fares (either booked with a travel provider or claimed through our expenses system), which then needed to be converted into passenger kilometres. Using the UKWIR methodology for estimating the km per £ for the ten most frequent journeys of each transport mode, gave the following average figures: 5.7km/£ for rail; 0.9km/£ for ferry; 3.1km/£ for air. For some modes of transport, average prices were difficult to find, but we used the following: £2.50/mile for taxi (taken from the Visit Britain website); £0.15 for bus/mile and 2km/£ for underground (no source found, based on 'reasonable assumption').

Appendix C – CFP Boundaries: what’s in, what’s out?

Figure C1 – Organisational boundary of assets included in carbon footprint



The 2007/08 organisational boundary diagram showed the privately owned assets as being included in the UKWIR boundary and therefore within the CFP. However, no data was available for them. This year we have clarified this on the diagram.

Figure C2 – Operational boundary for Carbon Footprint (adapted from UK Water Industry Greenhouse Gas Emissions Inventory Vol. 1)

