Covid-19 impact on household consumption

South Staffordshire and Cambridge Water

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Contents

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1.0 Introduction

In January 2023, South Staffordshire Water Plc[1] (SSC) asked Skewb Ltd to evaluate the impact of Covid-19 on household water consumption in their network area.

A predictive AI Machine Learning Model was built to assess and quantify the impact of the pandemic. The model uses internal data from South Staffordshire Water (SST) and Cambridge Water (CAM), and external data from verified sources, to calculate the impact of Covid and forecast household consumption. The model also accounted for external factors such as travel, weather, and seasonality.

Skewb undertook an 8 week piece of analysis which was presented to SSC Board in March 2023. Further SSC internal data was added to the analysis in August 2023.

This report shares the results of our analysis on Per Household Consumption (PHC) levels alongside our conclusions and recommended next steps.

It does not include any analysis of non household (NHH) consumption levels or unmeasured consumption levels. Data for both (NHH and unmeasured consumption) has been included but not interrogated, meaning:

- We have included NHH data in the model in order to isolate HH consumption – the focus of our analysis.
- We have included unmeasured consumption data to be able to make assumptions on monthly trends – but formal water balance assurance or auditing has not taken place.

Our analysis also does not replace regulatory reported figures from either South Staffs Water or Cambridge Water in relation to PHC.

[1] South Staffordshire Water Plc refers to the Group that operates both South Staffordshire Water and Cambridge Water

2.0 About Skewb

Skewb is a company passionate about transforming water and energy businesses.

Founded in 2018, we knew there was a better way to provide simple and effective solutions to complex problems across the sector. We are a team of industry experts from across utility firms, so we understand and appreciate our clients' challenges. We have lived and breathed their world, and learnt a lot of lessons along the way, enabling us to develop and implement practical solutions to deliver what they need.

We aim to realise the full potential of technology to transform our water clients' capabilities, enabling them to proactively address the challenges that increasing regulation, customer expectation and climate change presents.

As a team, we offer deeper and more technical insights into the relevant drivers of Demand Management activity than any other consultancy in the country.

- **'On the ground' experience** – we have experts that have delivered activities aimed at reducing Per Capita Consumption (PCC) in UK water companies during AMP7. We benefit from current insight into how to run a PCC offering in a post Covid environment.
- **Outcome focussed approach** – we have achieved audited and APR reportable savings of over 20 Mld from household reduction activities in a single regulatory year, the largest of any water demand reduction programme.
- **Latest data analysis and modelling techniques** – our team includes ex water industry data scientists. They have developed industry leading AI and modelling approaches to understand the water industry's largest behavioural change shift since privatisation.
- **Inclusion of open data sources** – we have incorporated unique and novel open data sources to determine and quantify weather based assumptions on our models.

We are also actively engaged in the industry stakeholder groups, policy forums and governmental programmes for demand more broadly. A current Waterwise Board member is a Skewb employee. We are registered members of CIWEM and have been invited to present at national conferences and events on the topic of PCC, demand management and the developing regulatory landscape.

Based on our sector knowledge and range of subject matter experts, we are confident we are able to provide SSC with industry leading technical expertise to bolster their understanding of the impact of Covid-19 on household demand.

3.0 Background and context

3.1 Water industry context

The Covid-19 pandemic, national lockdowns, and the ensuing public travel restrictions had a profound impact on lifestyles and customers' water use behaviours. Work from home mandates, school closures and travel restrictions in 2020 and 2021, and longer lasting hybrid working patterns in 2022 and beyond have meant household (HH) customers are spending more time in their homes and are therefore using more domestic water overall.

The Ofwat commissioned report on the 'Economic impacts of Covid 19 on the water sector'[2] in December 2020 identifies a clear set of industry-wide material impacts, including those driven by shifting consumption from non-household (NHH) customers to household customers as a result of increased working from home, furlough, school closures etc.

As a result of widespread changes to how we use water at home, water companies across the industry underperformed on their AMP7 performance commitment for PCC in Years 1 and 2. In response, Ofwat have consulted on changes to the financial adjustments and have suggested an end of AMP reconciliation. Ofwat have also set out a number of proposed considerations when determining the ODI payment at the end of the AMP. A key evidence requirement is for companies to understand the impact of Covid-19 on their network areas and to demonstrate that specific actions have been taken to close the gap and recover any shortfall. In addition, Defra, the Environment Agency and Ofwat have explicitly outlined their expectations for companies to significantly step-up efforts to reduce demand (and therefore reduce the supply / demand gap) and ensure that companies deliver on their WRMP19 forecast commitments and PR19 performance targets.

3.2 South Staffordshire and Cambridge Water context

In 2019/20 at the end of AMP6, SSC were achieving industry leading[3] levels of outturn performance on their PCC performance commitment. Their reported end of year PCC figure[4] was 125.1 l/p/d in SST and 133.1 l/p/d in CAM (later restated as 126.5 in SST and 127.0 in CAM). For this assessment period, only six companies had delivered reductions in PCC since 2012-13, and South Staffordshire Water were one of them, having reduced PCC levels by just under 1%[5]. As a company, their planned activities and allocated levels of meter

[2] https://www.water.org.uk/wp-content/uploads/2020/12/Impact-of-COVID-19-on-the-water-sector_FINAL-REPORT-STC-141220.pdf

[3] South Staffs Water were industry leading, with Cambridge Water 2nd place

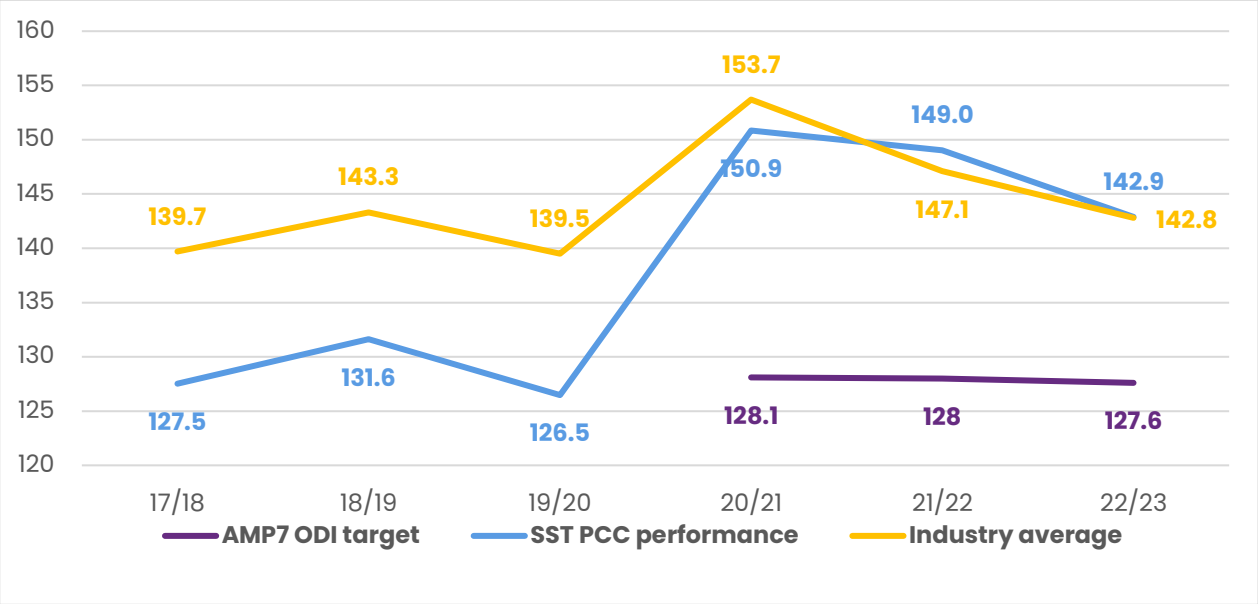
[4] Spot value

[5] https://www.ofwat.gov.uk/wp-content/uploads/2020/12/Service-delivery-2020-final-1-Dec.pdf

installs and reading for AMP7 were based on a PR19 final determination of 1% reduction in PCC levels for AMP7.

The Covid-19 pandemic manifested globally very quickly and had a substantial impact on industry wide PCC levels. Currently, SSC is behind the AMP7 targets for PCC for both SST and CAM. The 2022/23 outturn value in South Staffordshire was 142.9 l/p/d against a target of 127.6 l/p/d[6] and without notable improvements, the company is facing significant end of AMP penalties.

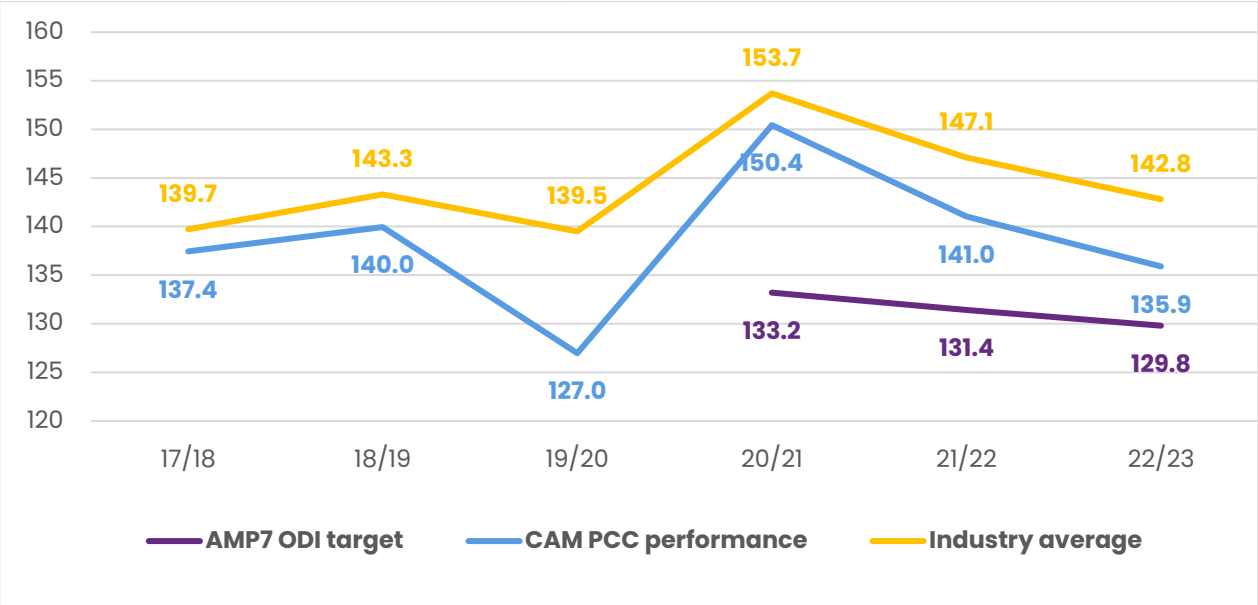
Figure 1: South Staffs: AMP7 PCC target and performance (l/p/d)



[6] PCC performance scores are based on three year rolling averages.

Cambridge Water are also behind the target but to a lesser extent. The 2022/23 PCC was 135.9 l/p/d against a target of 129.8 l/p/d.

Figure 2: Cambridge AMP7 PCC target and performance



At the start of the Covid-19 pandemic, government rules required all customer facing activity to cease. As a result in March 2020, SSC paused their meter reading services in line with most other UK water companies. Field teams were stood down to assess the situation. In order to resume customer services as quickly as possible whilst maintaining essential levels of health and safety, customer teams resumed services after only a few days. Teams engaged in external meter reading activities and did not enter any properties to take internal meter reads. This led to an overall increase in skipped meter reads. This impact lasted until July 2020, when restrictions eased, and SSC were able to return to a normal meter reading schedule. In comparison with industry peers, services were remobilised rapidly and returned to normal in a swift turnaround.

To counter the additional number of skipped reads, SSC introduced SMS campaigns to customers with known internal meters, asking them to provide their own meter reading online. The results of this campaign were positive. SSC saw a bigger response overall in the Cambridge region, where there is a higher proportion of internal meters compared to South Staffordshire.

In order to understand the overall impact of the pandemic and to be able to address Ofwat's evidence requirements, SSC asked Skewb to evaluate the impact of Covid-19 on HH water consumption in their network area using a robust modelling approach. Skewb originally completed a review in February 2023. This was updated in June 2023 when additional meter reads and Year 3 performance figures were available to enhance the analysis.

The model uses internal data from South Staffordshire Water and Cambridge Water, and external data from verified sources, to calculate the impact and forecast HH consumption. Specifically, the model was used to predict what the expected PHC water consumption would have been from late March 2020 onwards if Covid-19 had not impacted overall demand. The model also accounted for other external factors such as weather and seasonality and used national travel data as a proxy for UK wide commuting patterns. Actual data is then compared to forecasted 'non-Covid' usage, resulting in an isolated Covid-19 impact figure for the South Staffordshire and Cambridge regions.

4.0 Headline observations

Skewb were asked to evaluate the impact of Covid-19 on household water consumption across SST and CAM. We used a predictive AI Machine Learning Model to assess and quantify the impact of the pandemic. Although these predictive learning models are relatively new as evidence bases, they can be viewed in parallel with traditional econometric methods, and publicly available models (including those used by other companies and Ofwat). This report should be read in conjunction with SSC's analysis of the impact of Covid-19. The results of our Covid-19 impact model are provided below. These estimates are based on robust sampling and are representative of predictive trends. However they may differ from the values calculated as part of SSC's water balance reporting.

Table 1: Total average increases in household consumption for South Staffordshire and Cambridge Water supply areas

AREA	FISCAL YEAR	OBSERVED (PER PROPERTY PER DAY CONSUMPTION)	ANNUAL AVERAGE IMPACTED CONSUMPTION	AVERAGE CONSUMPTION IMPACT OVER PERIOD	PEAK CONSUMPTION IMPACTED MONTH
South Staffordshire	2020/21	270.95 l/p/d	+7.71%	+13.94%	March 2021 18.92%
	2021/22	290.85 l/p/d	+17.54%		Jan 2022 24.10%
	2022/23	281.12 l/p/d	+15.55%		April 2023 21.81%
Cambridge	2020/21	271.62 l/p/d	+9.21%	+10.99%	Feb 2021 14.09%
	2021/22	293.33 l/p/d	+12.51%		Jan 2022 16.30%
	2022/23	281.82 l/p/d	+9.58%		April 2022 13.18%

- Our analysis shows an estimated average increase in HH consumption of +13.94% in the SST region between 2020 – 2023 due to Covid-19, and an estimated average increase of +10.99% in the CAM region.
- Across both networks, the likely range of impact from Covid-19 is predicted as being between +7.78% and +18.16%.
    - This is a slightly broader range than experienced in the wider industry as increases during the same period have been reported by Water UK as being between +9% and +13%[7].
- The model estimates a lasting effect from the pandemic continuing until the end of the recorded period (April 2023) for SST with HH consumption levels returning to a pre Covid baseline in CAM.
- There are considerable localised differences of predicted impact within the regions, with key areas within the Birmingham commuter region such as B74, B43, B71 seeing the highest average levels of impacts per year of +38.42%, +40.58%, +36.43%, respectively.

Please note: our analysis does not replace regulatory reported figures from either South Staffs Water or Cambridge Water in relation to PHC.

[7] https://artesia.shinyapps.io/Artesia-Reports/

5.0 Methodology

5.1 Why did we select an AI Machine Learning Model method?

Using modelling as an approach provides an evidence based assessment of the impact of Covid-19 on customer demand in SST and CAM. An Artificial Intelligence (AI) approach has been selected to measure the impacts of Covid-19 on HH consumption. We selected this approach as:

- **AI is able to process and analyse large volumes of data**. SSC supply 1.75 million customers across 705,000 homes and 43,000 business properties. Our analysis required evaluation of millions of data points.
- **Complete data sets are not required**. SSC read meters on an annual basis. Skipped meter reads during the pandemic and low levels of meter penetration overall (particularly in SST) mean traditional analysis would not have been able to determine an impact at a sufficiently granular level.
- **Differing data formats do not prohibit analysis**. AI is capable of analysing a wider range of structured and unstructured data sources than human processing. This allowed us to bring together disparate data sources (incl. external data) and enabled central visualisation and single source of insight for future data analysis.
- **It provides robust evidence**. An AI approach provides a robust, repeatable and auditable process for impact assessments.

Machine Learning is a subset of AI. It uses algorithms to automatically learn insights and recognise patterns from data. The use of machine learning enabled:

- **Accurate prediction of future patterns in data**. The technology is able to identify learnings from previous data through statistical analysis, and apply these past learnings to predict future trends. In this analysis, the Machine Learning systems have analysed HH consumption pre-pandemic (using data from 2017 to 2020) and its relationship with variables such as weather, seasonality and travel to predict post-pandemic HH consumption (from 2020 onwards).
- **Integration of complex data sets**. The use of machine learning allowed us to map internal and external data sources to validate assumptions.

5.2 How does the model work?

The AI machine learning model has the following key features:

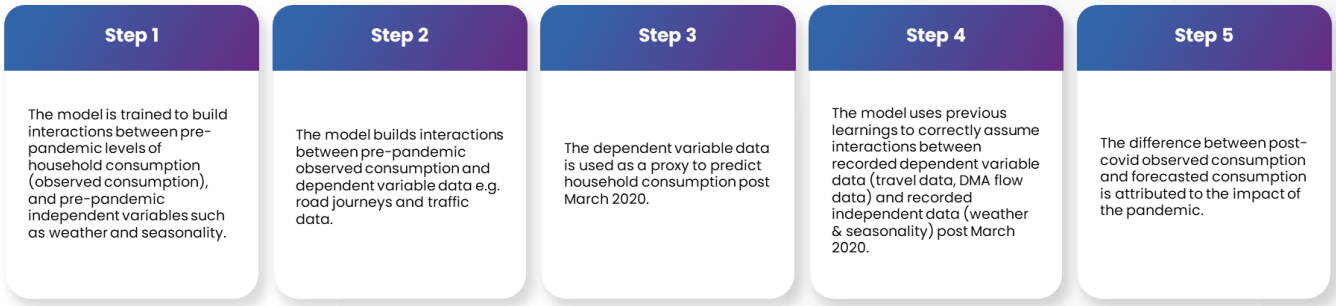
- The model performs at a District Meter Area (DMA) level[8] and analyses the per household consumption (PHC) response for any selected set of DMAs.

[8] A water supply sub area

- The model uses DMA flow and characteristics to calculate PHC in the DMA.
- All DMAs are modelled individually so that they can be amalgamated to assess the impacts of Covid-19 on those with very little NHH usage, compared to those with a larger amount of NHH demand.
- The AI model uses Temetra HH meter reads, DMA fast-logging data, weather, seasonality, and travel data to clean, time-window homogenise, distribute, infer and remove distortions from the HH / NHH, measured / unmeasured consumptions for all the connected properties.
- Additionally, the model takes into account the impacts of Covid-19, weather and seasonality by creating flexible what-if scenarios enabling measurement and comparative analysis of customers pre and post Covid-19 consumption in an unbiased manner.

The predictive model training period is from April 2017 to March 2023. In order to forecast what HH consumption would have been free from the impacts of Covid-19, the following steps were completed:

Figure 3: AI machine learning model approach to analysis



5.3 What data sets does the model incorporate?

SSC provided consumption, customer and property data to support the modelling analysis. This includes WaterNet 15 minute flow reads, Temetra HH meter reads, Acorn postcode level customer categories and SSC's GIS database. A full list of data sources has been provided in Appendix A.

In addition, Skewb have incorporated a number of external data sources into the model. These sources include open data sets provided by UK Government for traffic and rail impacts, weather and seasonality data. They have been vital to ensuring quality model outputs. Proportionally, SSC internal data on consumption was the most representative data source used in the analysis. The SCC data therefore had a stronger impact on the modelling outputs than external data sets.

External data sources contributed either dependent or independent variables to the algorithms, as shown in Table 2**Error! Reference source not found.**.

Table 2: Dependent and independent variables incorporated within the model

DEPENDENT VARIABLES	INDEPENDENT VARIABLES
Railway data	Weather data
Traffic data	Seasonality data
HH and NHH meter reads	
DMA Flow data	

5.4 Use of sampling in the model

To provide a robust and accurate understanding of the impact of Covid-19, a number of checks and exclusions were applied to the sample data prior to modelling:

1. Severe water consumption outliers were excluded including extremely high demand HH (over 100 m^3/month in any time period).
2. Negative meter reads were excluded.
3. Customers without at least 3 years of history before and 2 years after Covid-19[9] were excluded in order to contain the study to reliable samples over time.
4. Meter read samples come only from available and validated district meter areas logged flow.

Of the 373,619 properties in SST and CAM supply areas that have meter read data, 107,993 properties fulfil the data cleansing criteria and were included in the modelling. This is significantly higher than the minimum number of properties required to generate 'high' confidence levels in the accuracy of the results (which would be 5,000). This includes a total of 46,023 properties in South Staffordshire and 61,970 properties in Cambridge[10]. The total sample size included in the analysis therefore provides high levels of confidence in the results.

5.5 Modelling assumptions

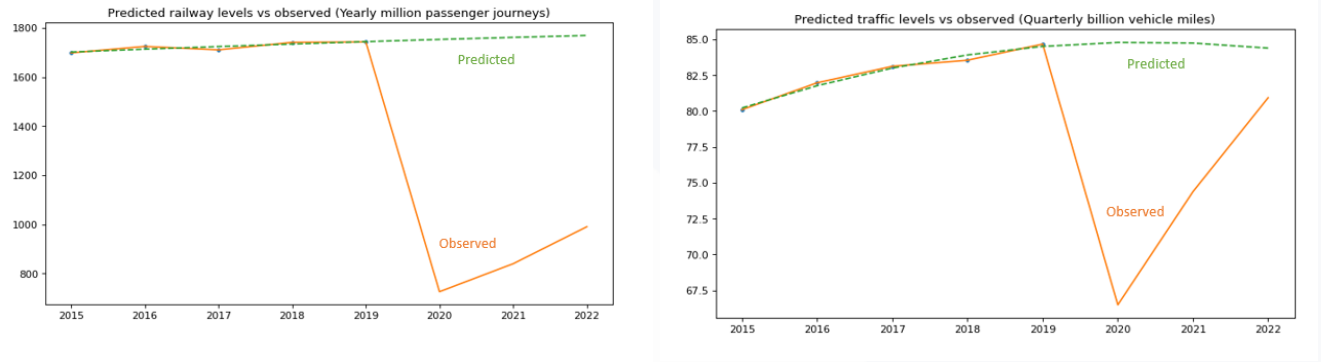
Two key assumptions have been applied in order to accurately assess the Covid impact:

1. HH consumption monthly distribution throughout the year roughly matches the DMAs logged flow.
2. For key input data affected by Covid-19, assumptions have been made on the predicted trend in the absence of Covid-19. This includes the analysis of proxy data sources such as transportation, which has a high correlation with water usage patterns. **Error! Reference source not found.** demonstrates the observed reduction i n public transportation during the pandemic, against the predicted values used in the model.

[9] Study dates for analysis were 01 April 2017 – 01 April 2023, inclusive.

[10] Sample sizes for the regions are reflective of a higher meter penetration in Cambridge than in South Staffordshire.

Figure 4: Observed and predicted transportation usage (rail and traffic)



As a result, the analysis provides a reliable and comprehensive view of water consumption powered by state-of-the-art machine learning technology, which is fully automated, API-based[11] and provides the most up-to-date insights to the business.

[11] Application programming interface

6.0 Overall results

The model estimated an average overall increase in HH consumption of 13.94% in the South Staffordshire region between 2020 – 2023, and an increase of 10.99% in the Cambridge region due to Covid-19.

Specifically, water consumption increased by the greatest amount in SST and in CAM in the year 2021/22.

Our summary results are reproduced below (see also section 4 Table 1).

AREA	FISCAL YEAR	OBSERVED (PER PROPERTY PER DAY CONSUMPTION)	ANNUAL AVERAGE IMPACTED CONSUMPTION	AVERAGE CONSUMPTION IMPACT OVER PERIOD	PEAK CONSUMPTION IMPACTED MONTH
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Cambridge	2020/21	271.62 l/p/d	+9.21%	+10.99%	Feb 2021 14.09%
	2021/22	293.33 l/p/d	+12.51%		Jan 2022 16.30%
	2022/23	281.82 l/p/d	+9.58%		April 2022 13.18%

Please note: our analysis does not replace regulatory reported figures from either South Staffs Water or Cambridge Water in relation to PHC.

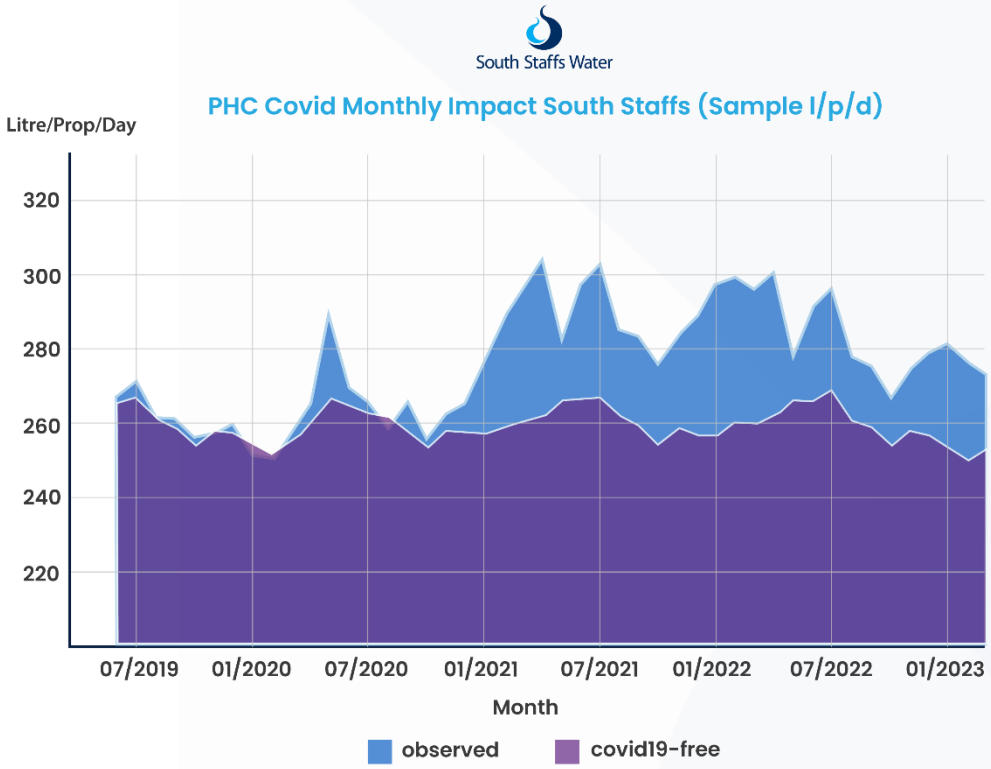
6.1 Impact on the South Staffordshire region

Consumption levels

Our assessment shows the South Staffordshire region has seen a prolonged impact of Covid-19, which continued to increase into mid 2022, and has remained high until the end of the data window[12].

[12] 01 April 2023

Figure 5: Covid-19 impact on per household consumption in the South Staffordshire region



The graph above is populated with the modelled output of measured customers with reads from the overall data sets provided. The blue level estimates PHC on a monthly basis during the data window. The purple level estimates what the PHC consumption at SST would have been had Covid-19 not occurred (accounting for weather and seasonality).

As described in section 5.2, in order to reach these conclusions, the model looks at pre-pandemic levels of household consumption (before March 2020), and combines this with pre-pandemic independent variables such as weather and seasonality. It then forecasts an 'observed consumption' level (blue) based on HH meter reads from Temetra and 15 minute flow reads extracted from the WaterNet database. Finally, the model takes into account the impacts of Covid-19, weather and seasonality (by creating flexible what-if scenarios enabling comparative analysis) and produces the values in the 'Covid-19 free' level (purple). Actual data is compared to forecasted 'non-Covid' usage, resulting in an isolated Covid-19 impact figure for the South Staffordshire region.

In the South Staffordshire region, the month with the highest estimated impact of Covid-19 was January 2022, with a predicted peak impact of 24.10%.

At SSC, annual meter readings are taken. In order to estimate monthly impacts, the model makes statistical assumptions based on consumption data from previous years. This is

why small differences may be observed between 'anecdotal' evidence, or reported figures, and the results depicted in the graph above. The variances are attributable to meter read frequency and subsequent time lag of observed impact, as well as meter read data quality.

We have compared the modelled results to reported figures by the business and can see strong correlation between the two. We have further validated the modelled results by iterating and re running the model frequently, particularly after the introduction of new data sets.

Whilst it is important to note that our analysis does not replace regulatory reported figures from either SST or CAM in relation to PHC, we believe the modelled estimates represent a strong indication of localised impact.

More data, specifically additional years' worth of data from SSC, will strengthen the analysis over the next few years.

Regional variation in the South Staffordshire supply area is shown by year in **Error! R eference source not found.**, **Error! Reference source not found.**, and **Error! Reference source not found.** below. The highest levels of impact were seen in the areas neighbouring the city of Birmingham. Four of the five highest impacted postcodes are surrounding Birmingham (B74, B45, B71, B68), as shown **Error! Reference source not f ound.**[13]. This suggests that customers who, pre-covid, commuted out of their homes and into the city for work, were now working from home due to lockdown restrictions and changing their water consumption patterns. The elevated Covid-19 impact has remained high throughout 2022. In 2021 postcodes outside of these commuter belts also saw an elevated covid impact, however by 2022 the increase was less substantial than the commuter belt.

Postcode heat maps

Heat maps have been developed to show at the district level (first letters and digits of the postcode) the percentage modelled Covid-19 impact and the HH population sample size which the impact is based on. Some districts had small sample sizes meaning that impact analysis in these areas would not provide a representative impact for the postcode area. Therefore, districts with less than 100 properties are shown in the visualisations for reference but are shown as grey in the maps.

[13] See Annex B for the full table of postcodes and impacts

Table 3: South Staffordshire districts with the highest Covid-19 impact

POSTCODE	2021 IMPACT (%)	2022 IMPACT (%)	2023 IMPACT (%)	DIFFERENCE 2021-2022	DIFFERENCE 2022-2023
B74	26.31	38.42	36.82	+12.10%	-1.59%
B43	25.91	38.27	40.57	+12.36%	2.29%
B71	23.42	36.43	36.26	+13.01%	-0.17%
WS15	22.81	27.73	27.23	+4.93%	-0.50%
B68	15.67	28.41	28.46	+12.74%	0.05%

Only two districts saw a reduction in Covid impact from the 2021 fiscal year to the 2022 fiscal year (DE13 and WS1). DE13 is a postcode located between Derby and Birmingham, covers a medium sized town, and experienced a reduction in impact of 2.94% (from 2021: 15.81%, to 2022, 12.87%). WS1 is a small postcode partially covering the town of Walsall, and saw a negligible reduction in impact of 0.03% (from 2021: 24.63%, to 2022: 24.61%).

The area with the highest increase in Covid-19 impact between 2021 and 2022 was B62, a postcode located on the outskirts of Birmingham, which saw a 24.92% increase (2021: 4.50%, 2022: 29.43%).

The full impact across the postcodes assessed has been provided in Appendix B.

Figure 6: South Staffordshire Covid-19 impact heat map in 2021 fiscal year

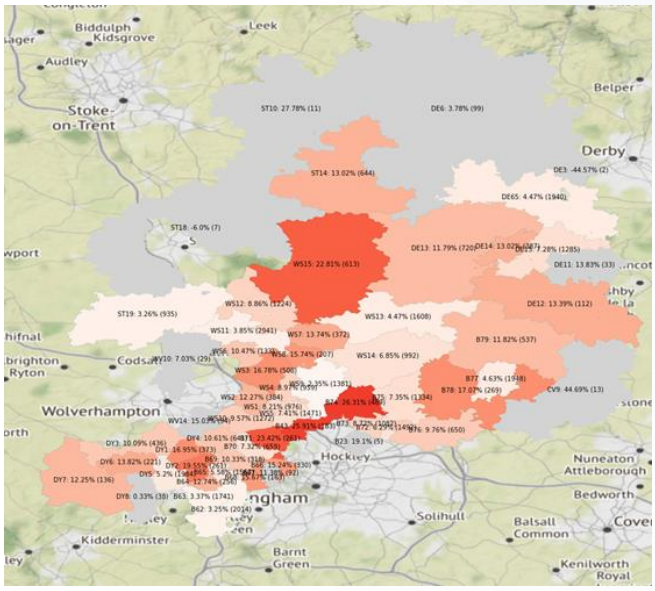


Figure 7: South Staffordshire Covid-19 impact heat map in 2022 fiscal year

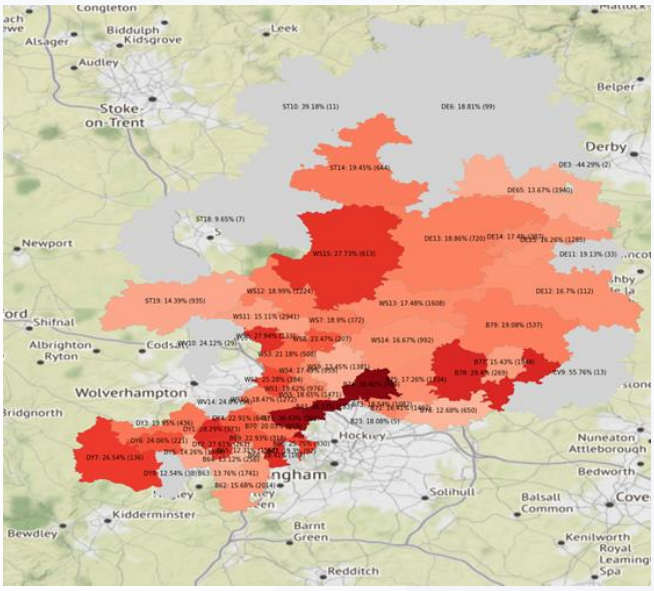
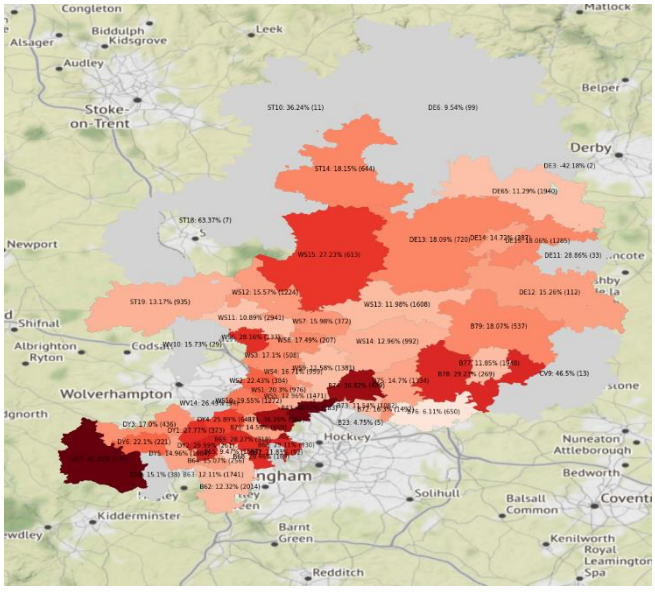


Figure 8: South Staffordshire Covid-19 impact heat map in 2023 fiscal year



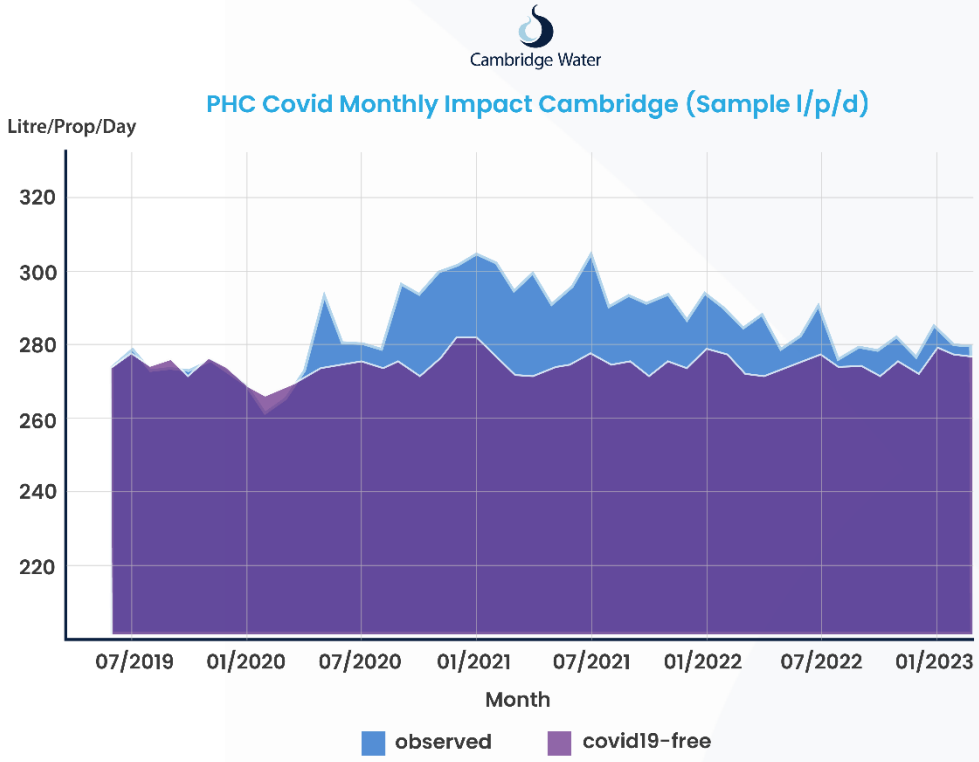
6.2 Impact on the Cambridge region

Consumption levels

The Cambridge region initially saw a comparable Covid-19 impact to that of the South Staffordshire region. However, this correlation subsided in 2022 as the observed consumption has reduced and is now on a downward trajectory towards pre-pandemic levels.

In the Cambridge region, the month with the predicted highest impact of Covid-19 was January 2022, with a peak impact of 16.30%.

Figure 9: Covid-19 impact on per household consumption in the Cambridge region



The Cambridge region followed a similar regional impact pattern (although to a lesser extent), with elevated Covid impacts seen in areas surrounding the Cambridge city centre. This again suggests changes in commuters' behaviour due to lockdown restrictions imposed by the government, and lasting changes to working patterns. The Cambridge region has seen less of a variance in impact however, with rural areas having a similar level of Covid impact to those of urban areas. In 2022, an increase in impact was recorded across all areas, however this increase was significantly less than that recorded in the South Staffordshire region.

Postcode heat maps

Figure 10: Cambridge Covid-19 impact heat map in 2021 fiscal year

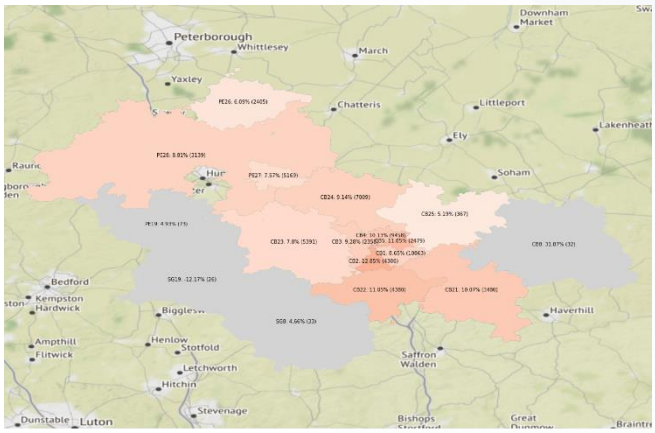


Figure 11: Cambridge Covid-19 impact heat map in 2022 fiscal year

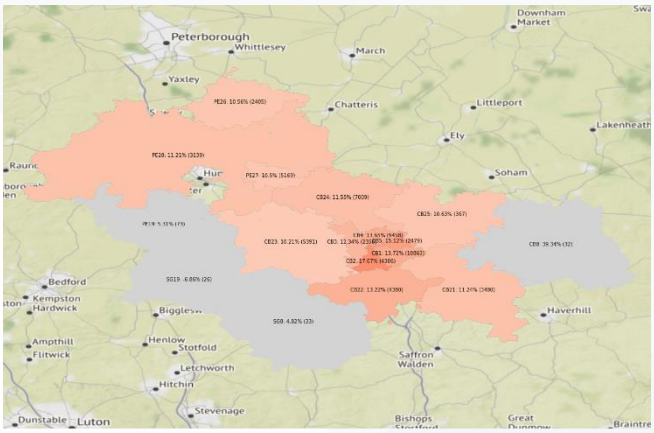
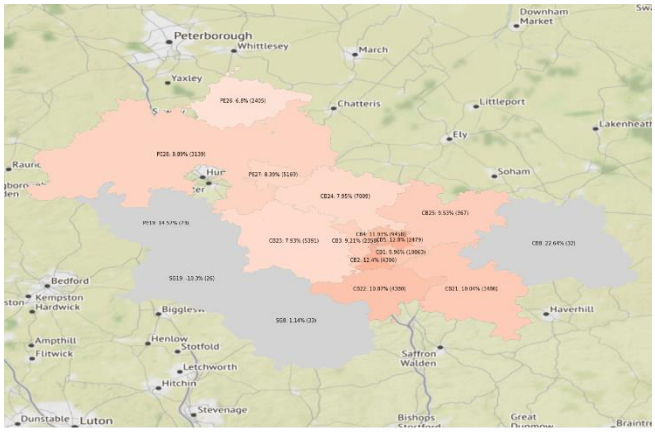


Figure 12: Cambridge Covid-19 impact heat map in 2023 fiscal year



Four of the five districts with highest impact are located in the central Cambridge City centre (**Error! Reference source not found.**). The district with the highest increase in Covid i mpact between 2021 and 2022 was CB25, a rural area to the North East of Cambridge City Centre, which saw a 7.60% increase (from 2021: 9.95%, to 2022: 17.55%).

Table 4: Cambridge districts with the highest Covid-19 impact

POSTCODE	2021 IMPACT (%)	2022 IMPACT (%)	2023 IMPACT (%)	DIFFERENCE 2021-2022	DIFFERENCE 2022-2023
CB1	8.65	13.72	9.96	+5.07%	-3.76%
CB2	12.85	17.07	12.40	+4.22%	-4.67%
CB22	11.05	13.22	10.87	+2.17%	-2.34%
CB4	10.13	13.65	11.03	+3.52%	-2.62%
CB5	11.85	15.12	12.80	+3.27%	-2.32%

6.3 Overall impact

Travel data and commuting pattern analysis

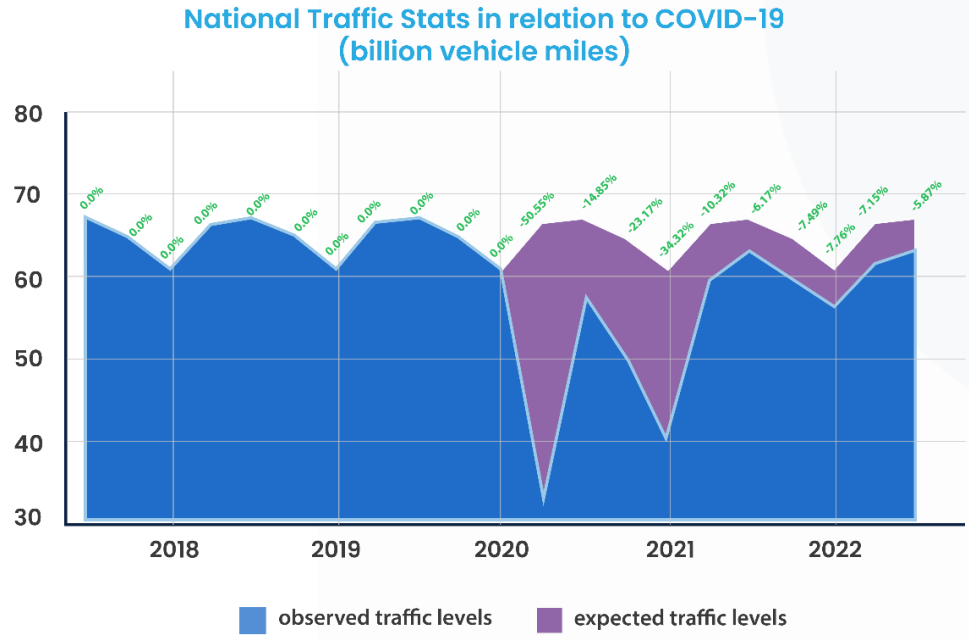
As described above, across the two geographic regions of South Staffordshire and Cambridge we saw more substantial increases and more sustained impact from Covid-19 in the South Staffordshire region. One of our assumptions about why this could be true was SST's geographic position on the outskirts of Birmingham.

Birmingham is the second largest city in the UK. The 2021 mid-year estimate produced by the ONS[14] in December 2022 puts London's population at 8.8 million. The same survey states there are 1.14 million people living in Birmingham. This is an increase of 6.7% (71,900) compared with the 2011 Census. Birmingham is also twice as big as the next largest UK city (Glasgow at 0.63 million).

Given the size of the city, the surrounding region can be described as the second largest commuter belt in the country. The impact of customer behaviour change from the pandemic had a strong influence on commuter belt regions. As part of our analysis we attempted to quantify the impact of migratory patterns of customers (spending more time at home as opposed to offices in central Birmingham).

However, availability of data to support statistical conclusions was limited. Open data from the Department for Transport (DfT) on gov.uk allowed us to estimate the predicted reduction in road use across the country.

Figure 13: National traffic levels during the Covid-19 pandemic



[14] https://www.ons.gov.uk/visualisations/censuspopulationchange/E08000025/

Expected traffic levels diminished throughout 2021 and 2022 in the UK. At the peak of the pandemic and lockdown restrictions in 2020, national traffic statistics measured a reduction in overall road users of 50.55%.

Additional, more granular commuting analysis has been included in the model in order to understand migratory patterns of usage across SSC's regions. UK Government traffic statistics (road users) for the South Staffordshire and Cambridge region have been assessed for Covid impact. Traffic levels in the region pre-pandemic (2017-2020) have been compared to traffic levels post pandemic (2020-2022) for both major and minor roads. Major roads include motorways and main A roads, and minor roads include residential streets. The difference in levels of traffic between the two time periods is shown in

From the available data, it therefore appears as though there was a more profound impact in the Cambridge region than in South Staffordshire. However, these results relate to road use data and do not include other modes of transport such as trains, bicycles or walking. We suspect the overall migratory commuting impact to be higher in the South Staffordshire region as households paused travel patterns in and out of Central Birmingham for work. However there were a lack of external data sets we could use to verify this conclusion. Instead, the traffic statistics have been used by the model in its analysis to build interactions between pre-pandemic observed consumption and dependent variables (see 'Step 2' of How the model works in section 5.2).

below, with South Staffordshire seeing a decrease of over a quarter (26.45%) on the major roads, and a 12.49% decrease on minor roads. Cambridge saw a slightly higher decrease in traffic levels, with a 28.73% reduction on major roads, and a 16.74% reduction on minor roads.

Table 5: Changes in regional traffic levels pre and post Covid-19 pandemic

AREA	MAJOR ROAD IMPACT (% CHANGE)	MINOR ROAD IMPACT (% CHANGE)
SOUTH STAFFORDSHIRE	-26.45%	-12.49%
CAMBRIDGE	-28.73%	-16.74%

From the available data, it therefore appears as though there was a more profound impact in the Cambridge region than in South Staffordshire. However, these results relate to road use data and do not include other modes of transport such as trains, bicycles or walking. We suspect the overall migratory commuting impact to be higher in the South

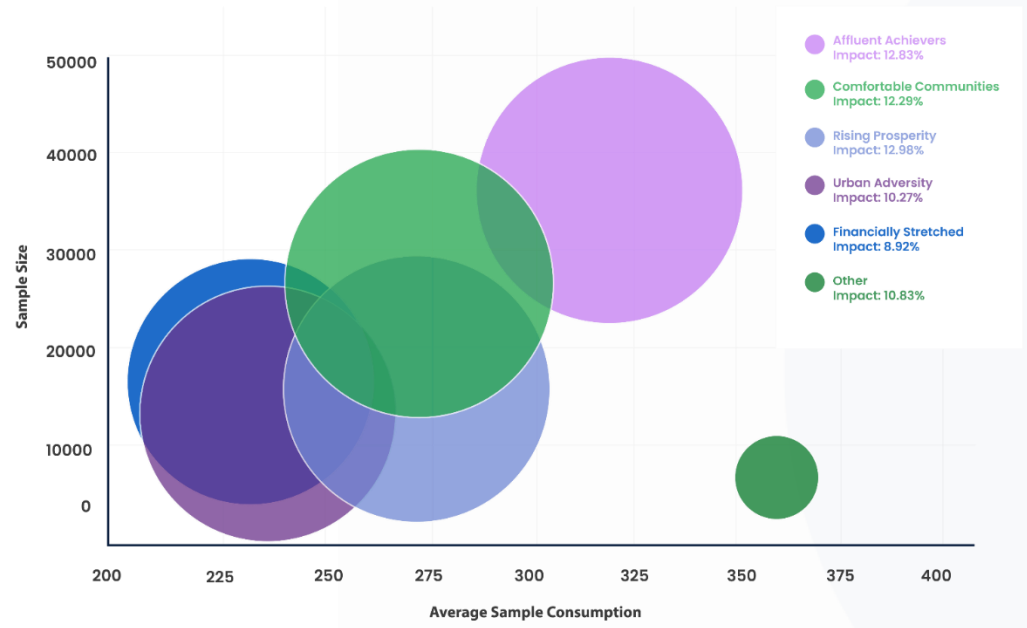
Staffordshire region as households paused travel patterns in and out of Central Birmingham for work. However there were a lack of external data sets we could use to verify this conclusion. Instead, the traffic statistics have been used by the model in its analysis to build interactions between pre-pandemic observed consumption and dependent variables (see 'Step 2' of How the model works in section 5.2).

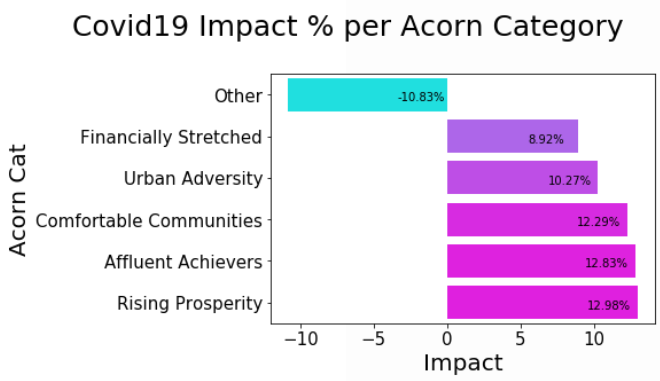
Customer segmentation

The impact of Covid-19 has been mapped across South Staffordshire and Cambridge Water's demographic customer base using ACORN data sets. The ACORN data is accurate up to 2022, and maps customers into demographic segments to a postcode level. ACORN data is available at 3 levels of granularity: 6 Categories (least granular), 18 Groups, and 62 Types (most granular). The impact of Covid-19 on these segments is shown in **Error! R eference source not found.**, **Error! Reference source not found.** and **Error! Reference source not found.** below, with the full dataset available in Appendix C in table format.

All ACORN categories saw an increase in consumption due to Covid-19, with the largest of the segments, 'Rising Prosperity' being the most heavily impacted by Covid, with an increase of +12.98%. 'Affluent Achievers' and 'Comfortable Communities' saw an increase of +12.83% and +12.29% respectively.

Figure 14: ACORN customer segmentation analysis by Category



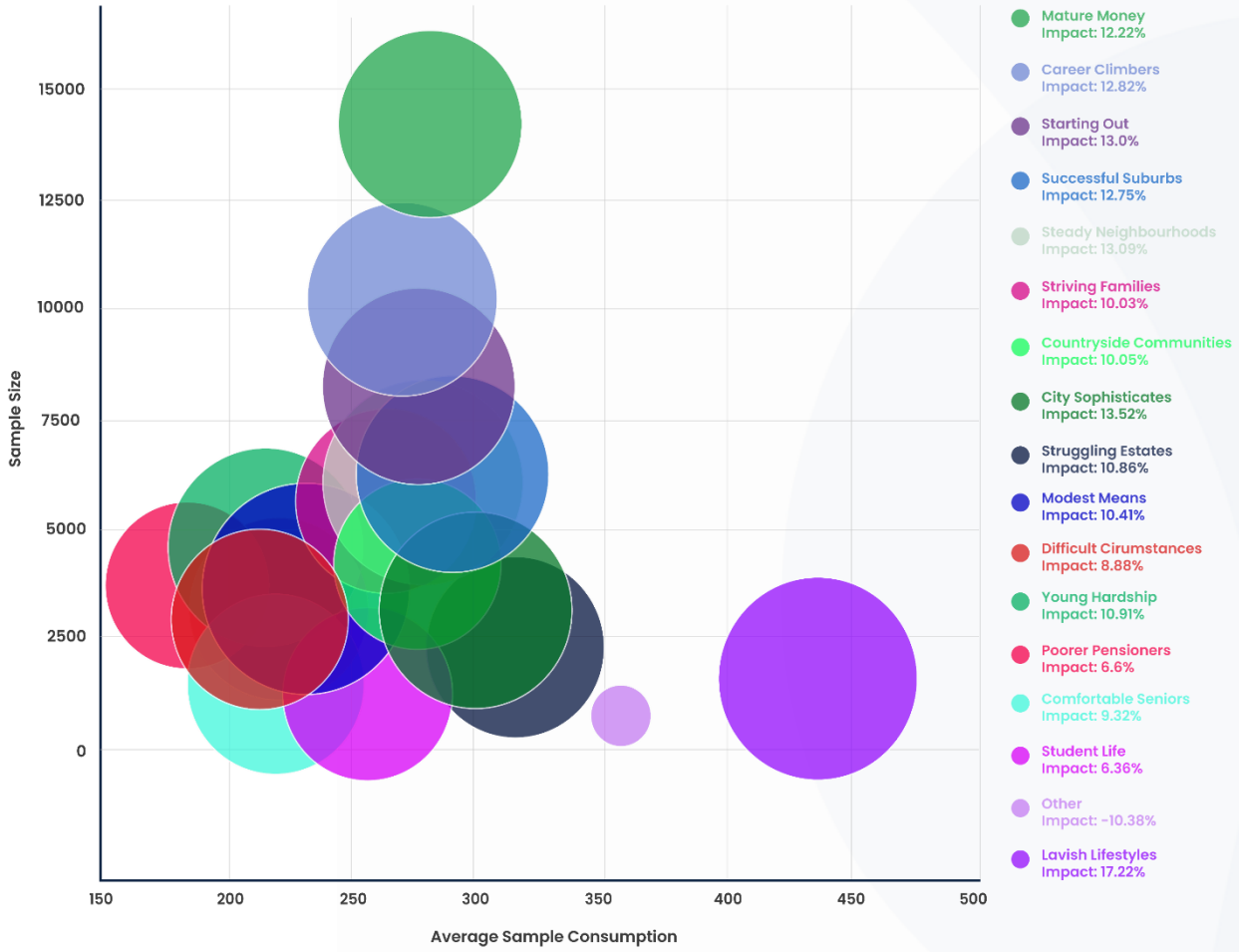


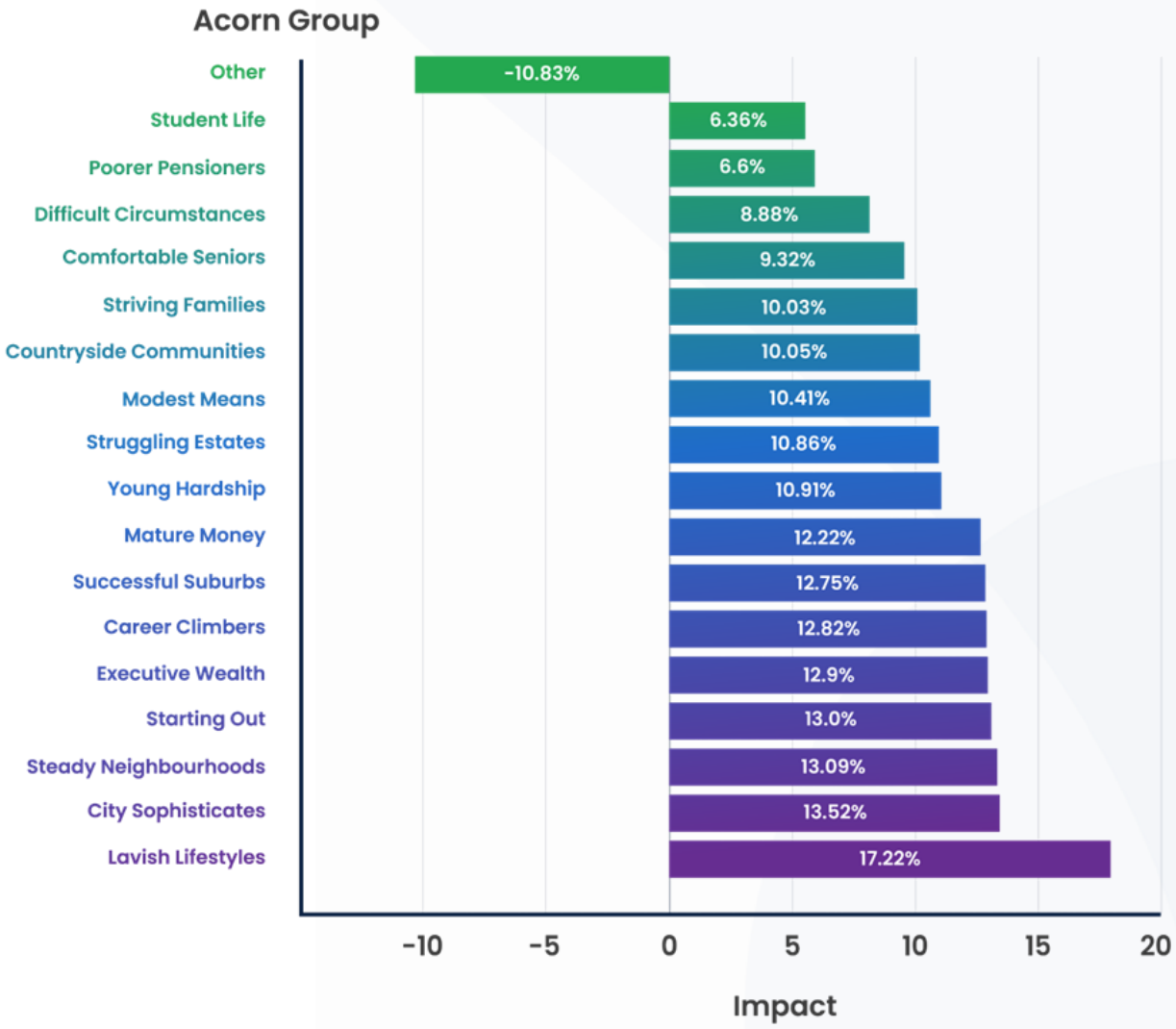
All ACORN groups saw an increase in consumption due to Covid-19, ranging from 6.36% (Student Life) to 17.22% (Lavish Lifestyles).

The top 3 most heavily impacted groups were:

- 'Lavish Lifestyles' at +17.22%
- 'City Sophisticates' at +13.52%
- 'Steady Neighbourhoods' at +13.09%

Figure 15: ACORN customer segmentation analysis by Group



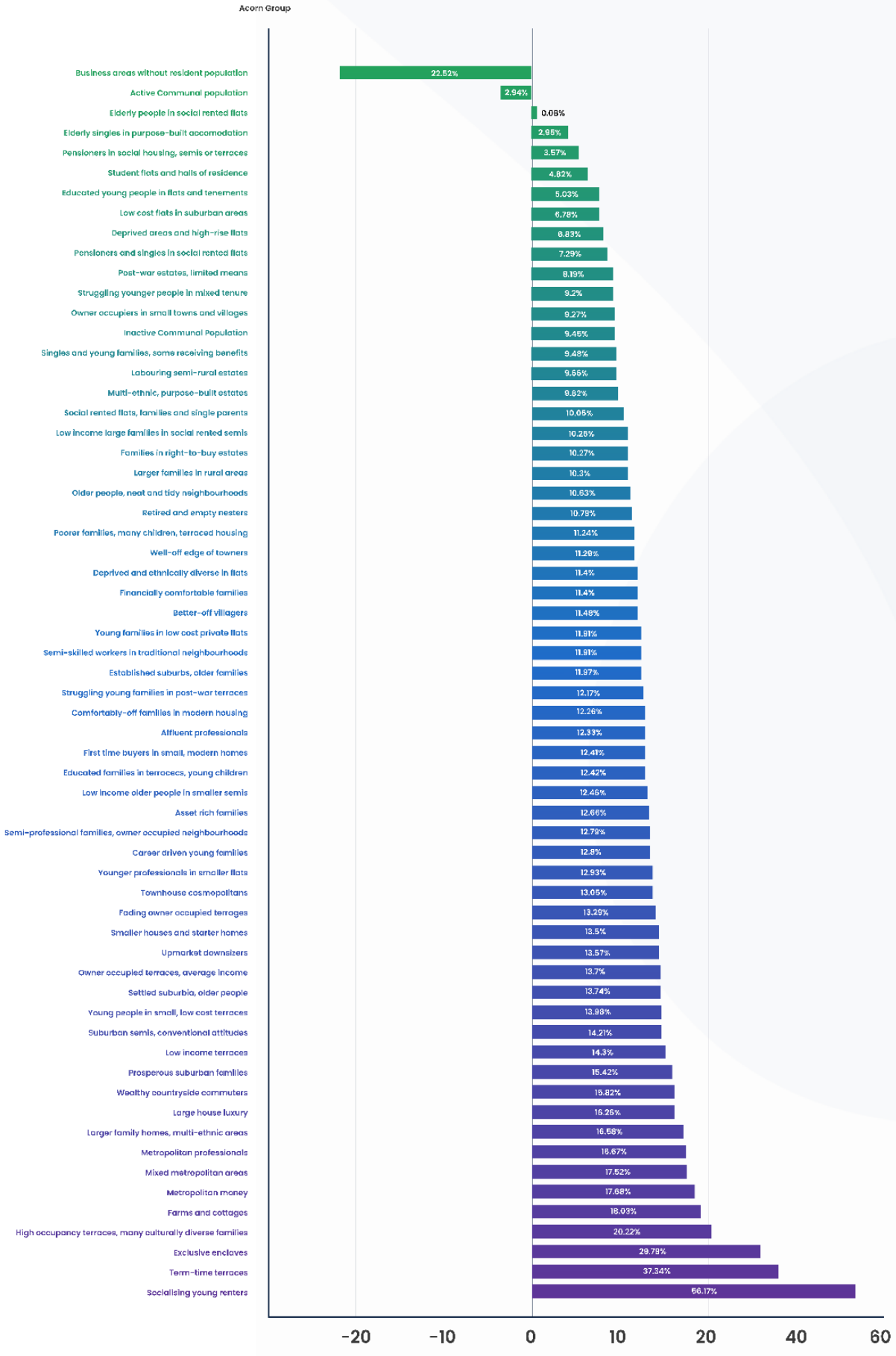


The majority of ACORN Types saw an increase in consumption, however a limited number of ACORN Types saw a decrease in consumption, the largest of which was 'Business areas without resident population' at -22.52% reduction. The 3 ACORN Types most heavily impacted by Covid-19 were:

- 'Socialising young renters' at 56.17%
- 'Term-time terraces' at 37.34%
- 'Exclusive enclaves' at 29.79%

Please note the below graph is available in text format in

Figure 16: ACORN customer segmentation analysis by Type



Consumption monitor data

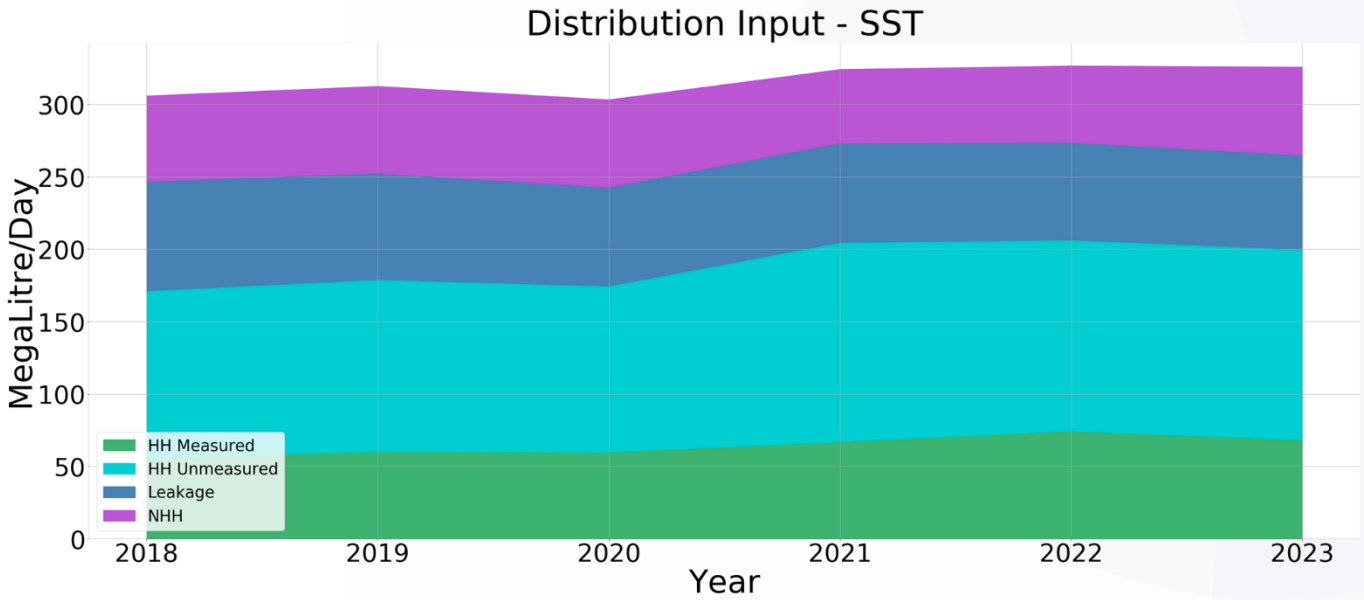
As part of monitoring their customer base for overall trends and impact analysis, South Staffordshire Water Plc have a 'Consumption Monitor data' group. This is a subset of the household customer base which is monitored and can be used as a control group for reporting purposes or measuring a defined impact.

The consumption monitor data was provided as part of the household meter reads and is included in the overall analysis, supporting better meter read data. The group itself was not deemed representative enough of the overall customer base (by type or geography) to be able to derive applicable insights across the total population.

Distribution input

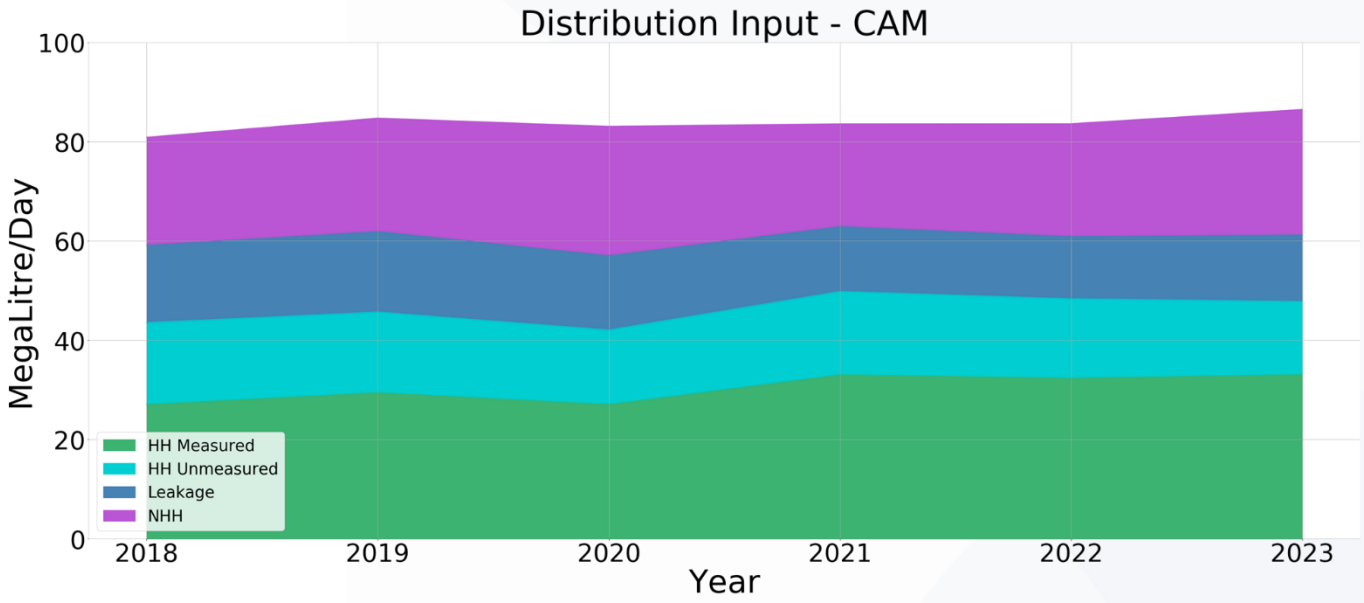
As our analysis showed that household consumption had increased across the two regions, we also reviewed overall Distribution Input (DI) during the period, in order to determine where the additional impact may be coming from. We completed the analysis across South Staffordshire and Cambridge, mapping the DI based on DMA fast-logging data.

Figure 17: Distribution input in South Staffordshire



As shown in **Error! Not a valid bookmark self-reference.**, there was an immediate impact on overall DI in SST in 2020. The model's estimates began increasing at the start of 2020 and in the years since predictions have maintained at a significantly higher level than pre pandemic. This means that the total level of water being consumed in the South Staffordshire region is significantly higher post pandemic than before.

Figure 18: Distribution input in Cambridge



In contrast, **Error! Reference source not found.** shows that in the CAM region, the level of o verall water use remained fairly constant across the years of the pandemic. We suspect this is due to the fact that there is less commuting between the area and neighbouring areas. However we are not able to confirm this conclusion (see earlier travel analysis).

Please note: our analysis also does not replace regulatory reported figures from either South Staffs Water or Cambridge Water in relation to DI.

6.3 Enduring impact

As can be demonstrated from the analysis above, the enduring impact of Covid-19 has been felt more prominently in the SST region. The increases in HH consumption were greater in this region overall and have remained high since.

The AI model we created performs better the more data sets are included. The less training data that is available, the more approximate the results will be.

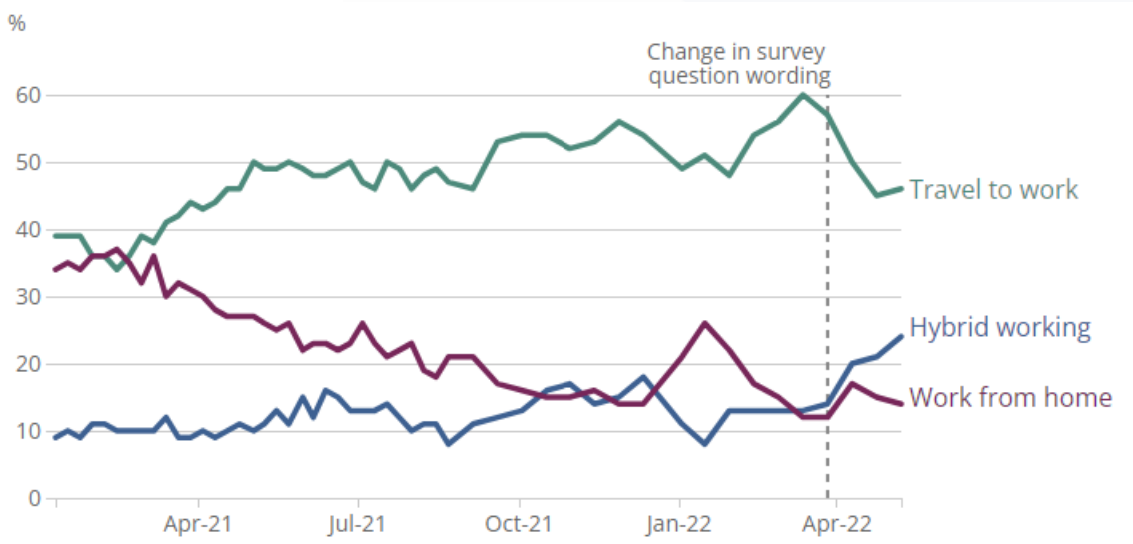
In order to understand the enduring impact of Covid-19 across both regions, more data, specifically additional years' worth of data from SSC, will be needed to strengthen the analysis over the next few years.

Whilst the longer-term impacts of Covid-19 on PCC, and demand more broadly, are not yet fully understood, the Ofwat funded Frontier Economics research has identified three scenarios that describe the extent to which the increased levels of working from home will be sustained in the long run. The key findings were that working from home is not likely to be a binary decision (e.g. work from home all the time or not at all) but the research

suggests that hybrid patterns of working from home and in the office is most likely. It is therefore appropriate to expect some longer term, sustained impacts on HH consumption.

Currently, publicly available research suggests that hybrid patterns of partial working from home and in the office is most likely[15].

Figure 19: Percentage of working adults travelling to work, Great Britain, January 2021 to May 2022



Source: Office for National Statistics – Opinions and Lifestyle Survey

7.0 Observed data trends

In addition to the modelled outputs of our analysis, we noticed several trends in the data sets we were provided. We were not able to quantify the impact of these statements on the observed household consumption of SST and CAM. However we have included the insights as likely influencers on the overall results.

- SST has a larger commuter belt population. As previously mentioned, Birmingham is the UK's second largest city. Due to the increase in hybrid working arrangements during the pandemic, more customers who used to commute into Birmingham for work could have worked from home or not travelled into the city. This could mean that more people remained in the South Staffordshire region during the government restricted periods of movement and is the likely reason behind the increase in DI in SST.
- Our evidence suggests that occupancy rates per property are higher in SST than in CAM meaning more customers live in a single property. Again, this means that

[15] https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/employmentandemployeetypes/articles/ishybridworkingheretostay/2022-05-23

more customers were remaining in the SST area when asked to stay at home than in CAM.

- The data shows that measured consumption is returning to pre pandemic levels quicker than unmeasured consumption. The CAM region has higher levels of meter penetration overall in comparison with SST (73% vs. 49.4%). This mean that it is likely that the higher levels of meter penetration in CAM gave customers better oversight of their increased usage and they adapted their behaviours to a 'pre-pandemic' level quicker than in SST.
- In terms of geographic influences, the weather data we incorporated into the modelling showed that CAM is subject to higher temperatures overall than SST. There is a recognised link between weather patterns and customer water use behaviour.

Further analysis is required to fully quantify these statements.

8.0 Performance excluding the impact of Covid-19

Our primary outputs for the model are shown in **Error! Reference source not found.** and REF _Ref145344858 \h * MERGEFORMAT **Error! Reference source not found.** above. These graphs show the modelled outputs of measured customers with reads from the overall data sets provided. The 'observed' level (blue) estimates PHC on a monthly basis during the data window. The 'Covid-19 free' level (purple) level estimates what the PHC consumption at SST would have been had Covid-19 not occurred (accounting for weather and seasonality).

This analysis does not replace regulatory reported figures from either South Staffs Water or Cambridge Water in relation to PHC. However, we have compared the estimated values to reported figures by the business to further validate the modelled results.

We have considered reported PCC values from SSC as described in **Error! Reference s ource not found.** and **Error! Reference source not found.** below. Our model does not include occupancy figures and direct comparisons are therefore not possible.

Nevertheless, we compared our analysis of the impact of Covid-19 against demonstrated rates of improvements over AMP6 to understand whether SSC were likely to have met their performance targets had Covid-19 not occurred.

South Staffordshire Water

The reported PCC values from SST are as described in **Error! Reference source not found.** b elow.

Table 6: Reported regulatory outcomes – PCC in South Staffordshire

South Staffs Water	AMP6			AMP7				
Target	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25
PCC target (3 yr. rolling average)				128.1	128.0	127.7	127.6	127.3
% Reduction				-0.4%	-0.5%	-0.7%	-0.8%	-1.0%
Performance								
PCC (l/p/d)	127.53	131.61	126.47	150.85	149.02	142.5		
Difference from target (%)				+17.76%	+16.42%	+11.59%		
Demonstrated rate of improvement		+3.20%	-3.91%					

(AMP6 performance)								

- South Staffordshire is currently significantly behind the AMP7 target for PCC and the impacts of Covid-19 are not diminishing.
- In 2019/20 at the end of AMP6, South Staffordshire Water were achieving industry leading levels of outturn performance. During this assessment period, only six companies had delivered reductions in PCC since 2012-13, of which one was SST, having reduced PCC levels by just under 1%*.
- The difference between their AMP6 Year 4 and 5 performance was a reduction in PCC of -3.5%. Their target % reduction across AMP7 was -1%.
- PCC was only introduced as a measured regulatory outcome in AMP6. Without focused interventions to reduce HH consumption, SST were still in a strong performance position.
- Skewb's analysis of the impact of Covid-19 in 2022/23 was that the overall average increase in PHC was 15.89% for SST.
- We can assume that with appropriate ODIs and given their previous results, SST would have achieved their PCC target.

Our analysis suggests that had Covid-19 not occurred, and SST performance had continued on the same trajectory as its AMP6 outturn performance, their AMP7 reduction commitment of -1% would have been achieved.

Cambridge Water

Table 7: Reported regulatory outcomes – PCC in Cambridge

Cambridge Water	AMP6			AMP7				
Target	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25
PCC target (3 yr. rolling average)				133.2	131.4	129.8	128.1	126.3
% Reduction				-1.3%	-2.5%	-3.8%	-5.0%	-6.3%
Performance								
PCC (l/p/d)	137.43	139.95	126.97	150.43	141.03	135.89		
Difference from target (%)				+12.94%	+7.33%	+4.69%		

Demonstrated rate of improvement (AMP6 performance)		+1.83%	-9.27%					

- Cambridge is currently behind the AMP7 target for PCC, however the PCC spot value from 2022/23 shows that the impact of Covid-19 is diminishing.
- Skewb's analysis of the impact of Covid-19 in 2022/23 was that the overall average increase in PHC was 10.12% for CAM.
- Whilst SST's overall usage has increased since Covid-19 and remained high, in CAM by the end of the data period (01/04/23), impact levels of Covid-19 had begun to reduce and were aligning with pre pandemic levels.

Because of these factors, it is difficult to say with certainty what the performance of CAM would have been had Covid-19 not occurred, as this is subject to more variables including seasonality impacts and customer demographics (higher proportion of wealth across the region).

We are unable to assess whether their AMP7 reduction commitment of -6.3% would have been achieved.

In conclusion, we can say with medium to high levels of confidence that had Covid-19 not occurred, SST would have met their regulatory reduction targets for PCC. In CAM, we are unable to assess whether their Year 3 reduction commitments would have been achieved.

9.0 Conclusions

There has been a sector wide impact on HH consumption due to Covid-19 and the associated consumer behavioural changes.

When faced with an unprecedented increase in HH consumption, South Staffordshire Plc reacted to support their customers and continue to work across the sector to understand the evolving longer term impacts of Covid-19.

SSC will use this analysis to account for the impact of Covid-19 and therefore be able to accurately measure the impact of delivered activity at year end.

Additional analysis has been suggested following the end of the regulatory year 2023/24. Meter reads from 2023/24 and 2024/25 can be incorporated into the model to enhance the analysis and further exploratory analysis can be conducted into the varying impact(s) of DI and unmeasured consumption during the period via the inclusion of additional data sources.

10.0 Next steps

In terms of next steps, Skewb would recommend the following activity which can be used to improve the model outputs, and gain a more comprehensive view of the ongoing impacts of Covid-19:

- Integration of additional data sources into model to increase accuracy. This includes:
  - Unmeasured consumption – the impact of Covid-19 has been recorded at an industry level as having a higher impact on unmeasured customers. The inclusion of unmeasured consumption through the addition of further datasets would give a more comprehensive view of total impact[16].
  - NHH – increased granularity of NHH data is required to understand the full migratory impact on consumption. This can be provided from external sources such as MOSL or Severn Trent. Alternatively additional analysis (with supporting GIS information) can be undertaken on SSC's internal data sources.

- Installation of a small sample of smart meters (loggers) on a balanced portion of the population
  - This will allow for the automation of a real-time view of Covid impacts.

[16] Initial analysis focused on measured consumption to provide greater accuracy and detail.

- Extension of the model to include a 360 degree view of leakage.
  - The model could analyse each DMA uniquely to make DMA logged flow more applicable to calculation of unmeasured consumption.

Appendix A

Data Sources

The data we have received from South Staffordshire Water and external data sets we have incorporated include:

- HH historical meter reads (Temetra)
- NHH meter reads (Temetra)
- 15 minute flow reads (WaterNet)
- Occupancy history data
- Postcode level Acorn data
- Property data (snapshot of all properties in Rapid)
- Water balance by year
- Historic performance data and targets
- Freepack distributions (from GetWaterFit)

We have summarised the frequency and format of data analysed across internal and external sources below.

Table 8: Data types, frequencies and format used in the Covid analysis

DATA SOURCE	TYPE	DESCRIPTION	FREQUENCY	FORMAT
WaterNet	Internal	15 minute flow reads extracted from the WaterNet database.	15 minute	CSV
Temetra	Internal	Household and non-household meter reads.	Yearly	TXT
Acorn data	Internal	Postcode level Acorn data.	2022 Refresh	CSV
ABP	Internal			
GIS database				
Weather data	External	Full weather data coverage, visual crossing weather data. https://www.visualcrossing.com/	30 minute	API / json
Traffic data	External	UK Government Department for Transport (DfT) traffic data. https://roadtraffic.dft.gov.uk/local-authorities/97 https://roadtraffic.dft.gov.uk/local-authorities/117 https://roadtraffic.dft.gov.uk/local-authorities/141	Quarterly	CSV
Rail Journeys	External	Office of Rail and Road (ORR) passenger rail usage data. https://dataportal.orr.gov.uk/statistics/usage/passenger-rail-usage/	Yearly	CSV
ONS data	External	Nationally available population demographic data	Yearly	CSV

Appendix B

South Staffordshire District Covid Impact

Table 9: Impact at a postcode level in the South Staffordshire region

DISTRICT	SAMPLE SIZE	2020/21	2021/22	2022/23	DIFFERENCE 2021 TO 2022	DIFFERENCE 2022 TO 2023
B23	5	19.10%	18.08%	4.75%	-5.31%	-73.75%
B43	183	25.91%	38.27%	40.57%	47.71%	5.99%
B62	2,015	3.25%	15.68%	12.32%	382.88%	-21.46%
B63	1,742	3.37%	13.76%	12.11%	308.36%	-12.02%
B64	256	12.74%	13.12%	15.07%	2.99%	14.90%
B65	1,567	5.58%	12.31%	9.47%	120.65%	-23.05%
B66	330	15.24%	25.75%	29.11%	69.01%	13.07%
B67	92	11.38%	19.30%	21.83%	69.61%	13.14%
B68	163	15.67%	28.41%	28.46%	81.26%	0.19%
B69	318	10.33%	22.93%	28.27%	121.83%	23.33%
B70	660	7.32%	20.03%	14.59%	173.76%	-27.14%
B71	261	23.42%	36.43%	36.26%	55.57%	-0.46%
B72	1,493	6.29%	16.41%	16.30%	161.15%	-0.70%
B73	1,084	8.72%	18.54%	11.54%	112.71%	-37.75%
B74	490	26.31%	38.42%	36.82%	45.99%	-4.14%
B75	1,334	7.35%	17.26%	14.70%	134.95%	-14.84%
B76	650	9.76%	12.68%	6.11%	29.95%	-51.79%
B77	1,948	4.63%	15.43%	11.85%	233.05%	-23.21%
B78	269	17.07%	29.40%	29.23%	72.23%	-0.57%
B79	538	11.82%	19.08%	18.07%	61.32%	-5.26%
CV9	13	44.69%	55.76%	46.50%	24.78%	-16.60%
DE11	33	13.83%	19.13%	28.86%	38.28%	50.88%
DE12	112	13.39%	16.70%	15.26%	24.76%	-8.62%
DE13	722	11.79%	18.86%	18.09%	59.91%	-4.07%
DE14	387	13.02%	17.40%	14.72%	33.68%	-15.43%
DE15	1,285	7.28%	16.26%	18.06%	123.40%	11.12%
DE3	2	-44.57%	-44.29%	-42.18%	-0.63%	-4.77%
DE6	99	3.78%	18.81%	9.54%	397.32%	-49.28%
DE65	1,940	4.47%	13.67%	11.29%	205.56%	-17.38%
DY1	375	16.95%	28.29%	27.77%	66.89%	-1.82%
DY2	262	19.55%	27.61%	29.99%	41.21%	8.63%
DY3	436	10.09%	19.95%	17.00%	97.62%	-14.77%
DY4	641	10.61%	22.91%	25.89%	115.86%	12.99%
DY5	1,984	5.20%	14.26%	14.96%	174.32%	4.88%
DY6	221	13.82%	24.06%	22.10%	74.02%	-8.14%
DY7	136	12.25%	26.54%	41.05%	116.69%	54.67%
DY8	38	0.33%	12.54%	15.10%	3718.31%	20.49%
ST10	11	27.78%	39.18%	36.24%	41.04%	-7.50%
ST14	646	13.02%	19.45%	18.15%	49.40%	-6.71%

DISTRICT	SAMPLE SIZE	2020/21	2021/22	2022/23	DIFFERENCE 2021 TO 2022	DIFFERENCE 2022 TO 2023
ST18	7	-6.00%	9.65%	63.37%	-260.96%	556.56%
ST19	936	3.26%	14.39%	13.17%	341.42%	-8.43%
WS1	976	8.21%	19.62%	20.30%	138.93%	3.42%
WS10	1,272	9.57%	18.47%	19.55%	92.95%	5.88%
WS11	2,942	3.85%	15.11%	10.89%	292.68%	-27.97%
WS12	1,224	8.86%	18.99%	15.57%	114.46%	-18.01%
WS13	1,609	4.47%	17.48%	11.98%	291.20%	-31.43%
WS14	992	6.85%	16.67%	12.96%	143.41%	-22.26%
WS15	613	22.81%	27.73%	27.23%	21.62%	-1.81%
WS2	384	12.27%	25.28%	22.43%	105.98%	-11.28%
WS3	508	16.78%	21.18%	17.10%	26.25%	-19.28%
WS4	959	8.97%	17.49%	16.71%	94.98%	-4.43%
WS5	1,471	7.41%	18.65%	12.96%	151.59%	-30.53%
WS6	133	10.47%	27.94%	28.16%	166.71%	0.81%
WS7	372	13.74%	18.90%	15.98%	37.52%	-15.43%
WS8	207	15.74%	23.47%	17.49%	49.11%	-25.47%
WS9	1,382	2.35%	13.45%	11.58%	471.73%	-13.95%
WV10	29	7.03%	24.12%	15.73%	243.08%	-34.76%
WV14	94	15.03%	24.80%	26.49%	65.02%	6.83%

Cambridge District Covid Impact

Table 10: Impact at a postcode level in the Cambridge region

DISTRICT	SAMPLE SIZE	2020/21	2021/22	2022/23	DIFFERENCE 2021 TO 2022	DIFFERENCE 2022 TO 2023
CB1	10,874	8.65%	13.72%	9.96%	58.53%	-27.37%
CB2	4,307	12.85%	17.07%	12.40%	32.85%	-27.38%
CB21	3,484	10.07%	11.24%	10.04%	11.58%	-10.67%
CB22	4,380	11.05%	13.22%	10.87%	19.64%	-17.73%
CB23	5,400	7.80%	10.21%	7.93%	30.87%	-22.34%
CB24	7,013	9.14%	11.55%	7.95%	26.31%	-31.19%
CB25	367	5.19%	10.63%	9.53%	105.01%	-10.35%
CB3	2,367	9.28%	12.34%	9.21%	32.92%	-25.35%
CB4	9,480	10.13%	13.65%	11.03%	34.77%	-19.17%
CB5	2,574	11.85%	15.12%	12.80%	27.60%	-15.37%
CB8	32	31.87%	39.34%	22.64%	23.43%	-42.45%
PE19	73	4.93%	5.31%	14.57%	7.63%	174.67%
PE26	2,410	6.09%	10.56%	6.80%	73.54%	-35.61%
PE27	5,171	7.57%	10.50%	8.39%	38.84%	-20.10%
PE28	3,146	8.81%	11.21%	8.89%	27.23%	-20.70%
SG19	26	-12.17%	-6.86%	-10.30%	-43.62%	50.16%
SG8	33	4.66%	4.82%	1.14%	3.36%	-76.37%

Appendix C

ACORN Category data analysis

Table 11: Impact at ACORN 'Category' level

ACORN CATEGORY	AVERAGE SAMPLE CONSUMPTION (L/PROP/D)	COVID IMPACT	SAMPLE SIZE
AFFLUENT ACHIEVERS	331.56	18.30%	23,615
RISING PROSPERITY	278.24	13.42%	10,357
COMFORTABLE COMMUNITIES	279.01	14.22%	16,270
FINANCIALLY STRETCHED	236.89	8.08%	9,276
URBAN ADVERSITY	243.14	8.30%	6,396
OTHER	307.52	8.81%	201

ACORN Group data analysis

Table 12: Impact at ACORN 'Group' level

ACORN CATEGORY	AVERAGE SAMPLE CONSUMPTION (L/PROP/D)	COVID IMPACT	SAMPLE SIZE
LAVISH LIFESTYLES	438.47	31.24%	1,202
EXECUTIVE WEALTH	349.53	19.03%	13,339
MATURE MONEY	290.97	15.51%	9,074
CITY SOPHISTICATES	301.62	13.48%	2,648
CAREER CLIMBERS	270.21	13.40%	7,709
COUNTRYSIDE COMMUNITIES	270.43	10.43%	2,462
SUCCESSFUL SUBURBS	293.57	15.82%	4,030
STEADY NEIGHBOURHOODS	288.73	14.18%	3,575
COMFORTABLE SENIORS	229.79	7.46%	714
STARTING OUT	272.26	15.64%	5,489
STUDENT LIFE	237.44	10.71%	796
MODEST MEANS	248.66	11.10%	2,131
STRIVING FAMILIES	267.08	10.91%	3,887
POORER PENSIONERS	178.86	0.14%	2,462
YOUNG HARDSHIP	214.79	7.73%	2,906
STRUGGLING ESTATES	333.94	14.54%	1,402
DIFFICULT CIRCUMSTANCES	221.62	4.90%	2,088
OTHER	307.52	8.81%	201

ACORN Type data analysis

Table 13: Impact at ACORN 'Type' level

ACORN TYPE	AVERAGE SAMPLE CONSUMPTION (L/PROP/D)	COVID IMPACT	SAMPLE SIZE
BUSINESS AREAS WITHOUT RESIDENT POPULATION	366.86	-22.52%	456
ACTIVE COMMUNAL POPULATION	392.42	-2.94%	24
ELDERLY PEOPLE IN SOCIAL RENTED FLATS	126.31	0.08%	508
ELDERLY SINGLES IN PURPOSE-BUILT ACCOMMODATION	199.08	2.95%	229
PENSIONERS IN SOCIAL HOUSING, SEMIS AND TERRACES	167.59	3.57%	1,097
STUDENT FLATS AND HALLS OF RESIDENCE	463.29	4.82%	200
EDUCATED YOUNG PEOPLE IN FLATS AND TENEMENTS	202.43	5.03%	892
LOW COST FLATS IN SUBURBAN AREAS	211.15	6.78%	1,493
DEPRIVED AREAS AND HIGH-RISE FLATS	170.48	6.83%	1,043
PENSIONERS AND SINGLES IN SOCIAL RENTED FLATS	185.07	7.29%	1,103
POST-WAR ESTATES, LIMITED MEANS	204.41	8.19%	560
STRUGGLING YOUNGER PEOPLE IN MIXED TENURE	234.19	9.20%	1,995
OWNER OCCUPIERS IN SMALL TOWNS AND VILLAGES	251.71	9.27%	3,061
INACTIVE COMMUNAL POPULATION	336.96	9.45%	264
SINGLES AND YOUNG FAMILIES, SOME RECEIVING BENEFITS	242.65	9.48%	755
LABOURING SEMI-RURAL ESTATES	260.46	9.66%	2,998
MULTI-ETHNIC, PURPOSE-BUILT ESTATES	214.15	9.82%	55
SOCIAL RENTED FLATS, FAMILIES AND SINGLE PARENTS	248.86	10.05%	1,422
LOW INCOME LARGE FAMILIES IN SOCIAL RENTED SEMIS	323.33	10.26%	1,605
FAMILIES IN RIGHT-TO-BUY ESTATES	275.15	10.27%	1,153
LARGER FAMILIES IN RURAL AREAS	306.63	10.30%	930
OLDER PEOPLE, NEAT AND TIDY NEIGHBOURHOODS	224.82	10.63%	1,172
RETIRED AND EMPTY NESTERS	241.06	10.79%	1,546
POORER FAMILIES, MANY CHILDREN, TERRACED HOUSING	254.18	11.24%	343
WELL-OFF EDGE OF TOWNERS	370.03	11.29%	3,475

ACORN TYPE	AVERAGE SAMPLE CONSUMPTION (L/PROP/D)	COVID IMPACT	SAMPLE SIZE
DEPRIVED AND ETHNICALLY DIVERSE IN FLATS	346.36	11.40%	36
FINANCIALLY COMFORTABLE FAMILIES	349.33	11.40%	4,559
BETTER-OFF VILLAGERS	310.18	11.48%	7,414
YOUNG FAMILIES IN LOW COST PRIVATE FLATS	194.28	11.91%	2,413
SEMI-SKILLED WORKERS IN TRADITIONAL NEIGHBOURHOODS	242.03	11.91%	1,286
ESTABLISHED SUBURBS, OLDER FAMILIES	283.38	11.97%	2,896
STRUGGLING YOUNG FAMILIES IN POST-WAR TERRACES	293.60	12.17%	870
COMFORTABLY-OFF FAMILIES IN MODERN HOUSING	300.34	12.26%	3,148
AFFLUENT PROFESSIONALS	307.05	12.33%	2,846
FIRST TIME BUYERS IN SMALL, MODERN HOMES	244.42	12.41%	5,995
EDUCATED FAMILIES IN TERRACES, YOUNG CHILDREN	264.32	12.42%	3,800
LOW INCOME OLDER PEOPLE IN SMALLER SEMIS	230.38	12.46%	1,010
ASSET RICH FAMILIES	320.78	12.66%	4,913
SEMI-PROFESSIONAL FAMILIES, OWNER OCCUPIED NEIGHBOURHOODS	264.86	12.79%	2,787
CAREER DRIVEN YOUNG FAMILIES	310.84	12.80%	3,656
YOUNGER PROFESSIONALS IN SMALLER FLATS	237.85	12.93%	625
TOWNHOUSE COSMOPOLITANS	317.04	13.05%	2,452
FADING OWNER OCCUPIED TERRACES	241.68	13.29%	666
SMALLER HOUSES AND STARTER HOMES	286.99	13.50%	4,364
UPMARKET DOWNSIZERS	199.37	13.57%	1,947
OWNER OCCUPIED TERRACES, AVERAGE INCOME	335.83	13.70%	735
SETTLED SUBURBIA, OLDER PEOPLE	286.25	13.74%	3,328
YOUNG PEOPLE IN SMALL, LOW COST TERRACES	248.50	13.98%	314
SUBURBAN SEMIS, CONVENTIONAL ATTITUDES	258.41	14.21%	2,481
LOW INCOME TERRACES	375.97	14.30%	245
PROSPEROUS SUBURBAN FAMILIES	356.30	15.42%	2,646

ACORN TYPE	AVERAGE SAMPLE CONSUMPTION (L/PROP/D)	COVID IMPACT	SAMPLE SIZE
WEALTHY COUNTRYSIDE COMMUTERS	385.53	15.82%	2,996
LARGE HOUSE LUXURY	422.23	16.26%	1,349
LARGER FAMILY HOMES, MULTI-ETHNIC AREAS	425.36	16.58%	377
METROPOLITAN PROFESSIONALS	275.18	16.67%	69
MIXED METROPOLITAN AREAS	295.05	17.52%	527
METROPOLITAN MONEY	503.75	17.68%	178
FARMS AND COTTAGES	376.21	18.03%	274
HIGH OCCUPANCY TERRACES, MANY CULTURALLY DIVERSE FAMILIES	399.06	20.22%	158
EXCLUSIVE ENCLAVES	501.66	29.79%	95
TERM-TIME TERRACES	424.47	37.34%	48
SOCIALISING YOUNG RENTERS	316.92	56.17%	31