

## Welsh Housing Conditions Survey 2017-18

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## 1. Introduction

This quality report provides users of the Welsh Housing Conditions Survey (WHCS) 2017-18 with information relating to the quality of the statistical outputs produced. The report sets out how the WHCS adheres to the European Statistical System (ESS) definition of quality (Section 3), and also how it adheres to four additional quality principles originating from the ESS Code of Practice (Section 4).

Throughout the report there is reference to the Welsh Government Statistics and Research [Statement of Compliance](#) which sets out the standards we follow during the production of our statistics for a number of areas relevant to statistical quality. This includes our [Statistical Quality Management Strategy](#).

## 2. Background to the WHCS

The WHCS forms part of the [Housing Conditions Evidence Programme](#) (HCEP), which is a strategic programme of investment in evidence about the condition and energy efficiency/performance of housing in Wales. The HCEP encompasses two work streams:

- The Welsh Housing Conditions Survey 2017-18; and
- The [Housing Stock Analytical Resource Wales](#) (HSAR): A robust anonymised evidence base which will capture a range of data on the characteristics, fabric, condition and energy efficiency of the housing stock in Wales. Where possible it will be at individual property level.

The first Welsh housing conditions survey took place in 1968 and they have been conducted roughly every 5 years since (1973, 1976, 1981, 1986, 1993, 1998, 2004, 2008). The most recent of these prior to the WHCS 2017-18 were the [Living in Wales Property Surveys](#). Initially the focus of these surveys was purely the condition of housing; whether homes had basic amenities: a bath or shower; an indoor WC; a wash hand basin; and hot and cold water at three points. Over time, as housing conditions have improved, the focus has shifted more to energy performance/efficiency and the social context of housing, whilst still closely monitoring conditions.

Fieldwork for the WHCS 2017-18 ran from August 2017 until the end of April 2018. A sample of addresses was drawn from eligible households taking part in the [National Survey for Wales](#) 2017-18. This resulted in physical inspections of 2,549 properties across Wales, which enables national level estimates. The survey covers all tenures but not vacant properties.

Key information gathered in the WHCS allows properties to be assessed for energy efficiency, repair costs, the [Welsh Housing Quality Standard \(WHQS\)](#), [fuel poverty](#) and the [Housing Health and Safety Rating System \(HHSRS\)](#). It will also help improve the Housing domain in the [Welsh Index of Multiple Deprivation](#) 2019 update and underpin two of the Well-being of Future Generations [National Indicators for Wales](#), specifically homes free from hazards and homes with adequate energy efficiency measures. This will contribute to the wider monitoring of our progress as a nation against the Well-being Goals. The WHCS 2017-18 is closely linked to the Welsh Government's [Decarbonisation Programme](#) and is recognised as one of the crucial data sources, especially for the domestic buildings working group. The survey will also be used to provide data for many other housing, environmental and social policy needs.

[Prosperity for All: the national strategy](#) deals with the commitments made in this Administration's [Programme for Government](#), [Taking Wales Forward](#). It places them in a long-term context, and sets out how they'll be delivered by bringing together the efforts of the whole Welsh public sector. Housing is one of the original five cross-cutting priority areas of Prosperity for All, acknowledging the impact housing can have on all aspects of life. [Prosperity for All: the national strategy - Annual Report 2018](#) announced that Decarbonisation has been adopted as the sixth priority area for the Welsh Government. The HCEP and specifically the WHCS is a key data source for these priority areas.

In the early planning stages for the survey, a number of options were considered on how the Welsh Government's housing conditions evidence gap could be filled. These options included the modelling of existing data, a collection of administrative data sources such as HSAR, and a periodic or continuous housing conditions survey. A number of combinations of these options were considered. It was decided that a periodic survey in combination with HSAR would be the most suitable option in terms of effectiveness and cost considerations. Incorporating the data from a periodic survey into HSAR will allow Wales-level estimates from the survey to be modelled down to a lower level of geography. Estimates derived from a periodic survey can be updated using data from HSAR between survey years.

Initial headline results from the WHCS 2017-18 were published in December 2018. More detailed topic specific reports are planned from early 2019.

### 3. Summary of quality

This section covers how the WHCS 2017-18 meets the dimensions of quality set out by the European Statistical System:

- Relevance
- Accuracy and Reliability
- Timeliness and punctuality
- Accessibility and clarity
- Comparability and coherence

Further details of the methods discussed below can be found in the WHCS Technical Report on the [WHCS webpage](#) or the National Survey for Wales 2017-18 Technical Report found on the [National Survey webpage](#).

#### 3.1 Relevance

*The degree to which the statistical product meets user needs in both coverage and content.*

The following summarises the key features of the WHCS.

#### What it measures

The WHCS 2017-18 is very much a standard housing conditions survey and is very similar to those conducted in other nations. Key information gathered in the survey allows measurement of energy efficiency, repair costs, the [Welsh Housing Quality Standard \(WHQS\)](#), [fuel poverty](#) and the [Housing Health and Safety Rating System \(HHSRS\)](#). Data from the WHCS will underpin two of the Well-being of

Future Generations [National Indicators for Wales](#) (specifically homes free from hazards and homes with adequate energy efficiency measures) and will therefore contribute to the wider monitoring of our progress as a nation against the Well-being Goals.

The survey covers all types of housing – houses, bungalows, flats (purpose built/converted), temporary structures, park homes etc. It also covers all tenures, but not vacant properties. The sample allows for national level estimates only. Further work will be conducted to produce lower level estimates in time.

Survey topics include, but are not limited to, general dwelling characteristics, state of repair, disabled accessibility/adaptions, energy efficiency, off grid fuels, water supply/drainage and damp. As well as the usual topics and those related to specific Welsh Government policies (WHQS etc.) the survey collects information on potential future issues, specifically relating to climate change (hotter summers, wetter winters etc.) and the housing stock's ability to cope. For full details of the topics included in the Survey see the Survey Form, available on the [Survey webpage](#).

The sample for the WHCS 2017-18 was taken from the [National Survey for Wales](#) 2017-18. As such it is possible to link the housing condition survey data with data such as health, wellbeing and perceptions of housing and local areas from the National Survey for Wales. A full list of topics contained in the National Survey for Wales 2017-18 can be found on the [Survey webpage](#).

### **Coverage and sample size**

Physical inspections of 2,549 properties across Wales were carried out between August 2017 and April 2018. These enable national level estimates only. The sample is not large enough to allow sub-national estimates. Further work will be conducted to produce modelled lower level estimates in time.

Alongside the WHCS, we are developing the [Housing Stock Analytical Resource for Wales \(HSAR\)](#). The aim of HSAR is to bring together a range of data on the characteristics, fabric, condition and energy efficiency/performance of the housing stock in Wales. It will provide a continuous and robust anonymised evidence base, where possible at the individual property level. HSAR will link administrative, survey and modelled data. It will be used alongside the WHCS to provide improved modelling of data at low levels of geography. In addition it will provide more up-to-date data than that available from periodic housing conditions surveys.

A periodic housing survey in combination with HSAR was deemed the most effective and cost efficient option when considering the best approach to the HCEP.

### **Frequency**

Ad-hoc. The first Welsh survey of housing conditions took place in 1968 and they have been conducted roughly every 5 years since (1973, 1976, 1981, 1986, 1993, 1998, 2004, 2008). The most recent housing conditions prior to the WHCS 2017-18 were the [Living in Wales Property Surveys](#) in 2004 and 2008. Fieldwork for the WHCS 2017-18 ran from August 2017 until the end of April 2018.

### **Sample frame and design**

The sample for the WHCS 2017-18 was taken from the [National Survey for Wales](#) 2017-18. The National Survey is a face-to-face survey of over 11,000 people across Wales each year. The survey covers a

range of topics with a focus on well-being and people's views on public services. Each year a sample of addresses is selected at random from the Postcode Address File, the Royal Mail's list of addresses, stratified by local authority. When interviewers make first contact with a household they select a random individual aged 16 or over to take part. Full details of the National Survey sampling strategy can be found in the sampling chapter of the National Survey for Wales 2017-18 Technical Report available on the [Survey webpage](#).

Between July 2017 and March 2018, on their first visit to an address, the interviewer made a basic assessment of the condition of the walls, windows and doors and the roof (if visible). They rated each as having no, moderate or major signs of disrepair. This information was then used to determine if the property was in good repair, moderate disrepair or major disrepair. Early in the National Survey the tenure of the property was also established.

All properties determined to be in moderate disrepair, major disrepair and all rented properties (regardless of whether this was privately or through a social landlord), were deemed suitable for an inspection. A proportion (60%) of properties that were owner occupied and in no disrepair were also deemed **suitable**. Where the selected individual, i.e. the respondent to the National Survey, was the Household Reference Person (HRP)<sup>1</sup> or their Spouse/Partner, the property was deemed **eligible** for an inspection and so the respondent was asked to take part in the WHCS. Full details of the WHCS sampling strategy can be found in the sampling chapter of the Technical report which can be found on the [WHCS webpage](#).

## Mode

Property inspections were carried out by qualified surveyors, employed by the [Building Research Establishment](#) (BRE), who performed a visual assessment of the interior and exterior of the property. The inspections lasted around 40-50 minutes, with around 20 minutes spent inside on a room by room inspection. The surveyor also inspected the plot of the property and made an assessment of the local neighbourhood. An electronic data capture system (digital pens) was used to collect the survey data.

## Weighting

The survey results are weighted to take account of unequal selection probabilities and for differential non-response, i.e. to ensure that the number of households in each local authority, the household composition and estimates of tenure of the responding sample matches that of the housing stock in Wales.

## Imputation

No imputation

## Outliers

Outliers are first examined during the digital pen validations checks, where a pen error or a genuine mistake can be rectified. They can also be picked up during the modelling process if they produce

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<sup>1</sup> The Household Reference Person is the person in whose name the property is owned or rented. If jointly owned or rented it is the person who earns the most. If incomes are equal it is the eldest.

unexpected derived values, well outside the expected range, despite not standing out in the raw data. In this case, estimates for the raw data are made to make the derived output more sensible.

In addition, Welsh Government check for outliers during their data validation process. Some were highlighted whilst checking the interim data set but were also identified during BRE's modelling process and dealt with before submission of the final data set.

More detail on the survey design and methodology is set out in the WHCS 2017-18 Technical Report<sup>2</sup> available on the [WHCS webpage](#).

### **Why was the survey commissioned?**

There was a critical gap in the Welsh Government's knowledge about housing conditions in Wales. The last comprehensive collection of data on housing conditions in Wales, prior to the WHCS 2017-18 was the Living in Wales Property Survey in 2008. In 2014-15, as this data no longer represented a current view, a Welsh Government Task and Finish Group considered both internal and external evidence needs to feed into a Business Case for a new [Housing Conditions Evidence Programme \(HCEP\)](#). As part of this programme, the Welsh Housing Conditions Survey 2017-18 was commissioned. The Programme is managed by Knowledge and Analytical Services (KAS) within the Welsh Government.

### **Who are the users of the WHCS?**

The survey is used for policy making purposes by the Welsh Government mainly for housing and environmental areas, but also social policy needs. There are a wide range of other users of the survey, including: Welsh Government Sponsored Bodies; local authorities across Wales; Public Health Wales; Third Sector Organisations; other UK government departments and local government organisations; other public sector organisations; academics; private companies; the media; and members of the public. Datasets will be deposited at the [UK Data Archive](#) to ensure that the results are widely accessible for research purposes.

### **How do we ensure that WHCS statistics meet the needs of users?**

#### **Survey topic consultations**

Topics of interest for the survey were initially examined as part of the scoping work in the early development stage of the Housing Conditions Evidence Programme. This work was revisited in early 2017 as part of the survey topic development. An internal (within the Welsh Government) intranet article was published to promote the work and seek feedback on which topics would be of interest to potential users of the survey. Key policy contacts in the Welsh Government were contacted directly for their input, along with organisations such as Public Health Wales and a number of user networks such as the [Welsh Statistical Liaison Committee](#).

#### **Actively identifying potential new users**

Although there is already a wide range of users of housing conditions survey data from Wales, the HCEP team enthusiastically looks for potential new users for the survey and pursues these links. The team is

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<sup>2</sup> A bilingual executive summary was published alongside the first headline results. The full technical report will be available soon after this.

very active in promoting the survey's uses, potential uses and future design, as well as other elements of the HCEP and HSAR. The team have spoken to a number of stakeholder groups, such as Welsh Government's [Housing Information Group](#), the Wales Housing Expert's Panel, the [Welsh Statistical Liaison Committee](#), the [Welsh Health Analysts Network](#) and the [Third Sector Statistics User Panel for Wales](#). These groups contain representatives from Welsh Government, local government, other public services, registered social landlords, academia and the third sector. As a result of this engagement, follow up conversations have taken place with interested parties e.g. colleagues within Public Health Wales who are interested in the impact of housing on health outcomes, and colleagues developing the National Development Framework for Wales, which will plan land use in Wales for the next 20 years.

## **Stakeholder updates**

The HCEP team send out a stakeholder update every quarter. These include information on developments with the survey and updates on the timetable. The bulletin is sent to the HCEP stakeholder list, which currently has around 300 users<sup>3</sup> who have either previously noted interest in the HCEP/WHCS and have signed up to be kept updated, or those who have been/are directly involved with work on the WHCS. The stakeholder updates are published on the [WHCS webpage](#).

## **Engaging with and updating users - workshops, events, presentations, update papers and questionnaires**

The HCEP team regularly promote the survey and engage with users, and potential users, of the survey at various groups, seminars and events, such as:

- [Housing Information Group](#)
- [Third Sector Statistics User Panel for Wales](#)
- [Welsh Statistical Liaison Committee](#)
- [Welsh Health Analysts Network](#)
- [Wales Housing Research Network \(WISERD\)](#)
- [NEA Fuel Poverty Forum](#)
- [CHC annual Conference](#)
- [Care and Repair annual conference](#)

Workshops are carried out with users to promote the survey and to seek feedback. For example in July 2018, a workshop was held with key users of the WHCS (and those who had previously made a request for information on the survey) to discuss outputs and analysis plans for the WHCS 2017-18.

Occasionally, stakeholders are asked to provide feedback on general or specific elements of the survey. For example, in February 2018 an online survey was carried out, consulting with users on their preferences on output options for the 2017-18 WHCS. A summary report of this user engagement survey was published in August 2018 and is available on the [WHCS webpage](#)..

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<sup>3</sup> As at December 2018

## Governance

A number of governance groups have been established to ensure that we are engaging with key users of the WHCS and that they play an active part in its progress/direction. The Programme Board and Project Board were set up to consider the Housing Conditions Evidence Programme as a whole, of which the WHCS plays a key part.

<b>Group Name</b>	<b>Role</b>	<b>Members</b>	<b>Frequency of meetings</b>
Housing Conditions Evidence Programme Board	<p>To ensure that the Housing Conditions Evidence Programme remains in line with meeting its overall objectives;</p> <p>To ensure that key users are kept informed of progress with the WHCS, and are able to provide challenge if needed;</p> <p>To engage Ministers as appropriate in light of their wider responsibilities;</p> <p>To sign-off at critical points in the Programme.</p>	<p>Chief Statistician;</p> <p>Directors of key policy departments within the Welsh Government;</p> <p>Chief Environmental Health Officer;</p> <p>Senior representatives from the Welsh Revenue Authority (Project Assurance), Welsh Local Government Association, Community Housing Cymru, Public Health Wales.</p>	<p>Meet 3-4 times a year to coincide with key decision/milestones, supplemented by regular progress updates.</p>
Housing Conditions Evidence Project Board	<p>To consider strategic and cross-cutting issues and risks that impact on the programme;</p> <p>To ensure effective communication and collaborative development with HCEP/WHCS users;</p> <p>Management of finances and resources;</p> <p>To ensure adequacy and integrity of governance arrangements;</p> <p>Delivery of outcomes and benefits.</p>	<p>Key survey users within policy departments of the Welsh Government;</p> <p>Analysts and researchers from Welsh Government Knowledge and Analytical Services;</p> <p>Representatives from the Welsh Local Government Association, Community Housing Cymru, Public Health Wales.</p>	<p>Meet every other month, and monthly at peak times of project.</p>

<p>WHCS Technical Group</p>	<p>To present impartial expert advice on technical and operational issues throughout the survey contract and any future survey development work;</p> <p>To provide advice and guidance on dissemination in terms of quality measurement and robustness issues in the reporting of results.</p>	<p>Head of the National Survey for Wales Team;</p> <p>Welsh Government Architect;</p> <p>Welsh Government Public Health Statistician;</p> <p>Representatives from the English Housing Survey, Cardiff University, CADW, Cardiff Metropolitan University.</p> <p>Other relevant experts as and when required, sourced from survey stakeholders/users.</p>	<p>As and when required. Advice usually sought via email / conference call.</p>
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A similar technical group exists for HSAR.

### **Meeting user needs in the future**

The HCEP team will continue to identify new users of the WHCS. Those needs that are not able to be met by the 2017-18 survey have been, and will continue to be, noted and reviewed as part of the planning for any future housing conditions surveys the Welsh Government may commission. The team intend to take a similar approach to meeting users' needs for any future WHCS. Quarterly Stakeholder Updates will continue to be issued throughout the duration of the HCEP. The HCEP team will invite users to provide feedback on outputs and analysis for the WHCS 2017-18 as they are published, with a view to addressing any issues in future publications.

## Strengths and limitations

The **strengths** of the WHCS include:

- The sample is based on the National Survey for Wales (random sample stratified by local authority), which ensures that the results are as representative as possible of people in Wales. Details of the National Survey sampling strategy can be found in Chapter 2 of the technical report available on the [National Survey webpage](#). The WHCS itself is weighted to adjust for non-consent, which also helps make the results as representative as possible.
- Basing the WHCS sample on the National Survey for Wales allows for linking of the physical inspections data from the WHCS with results on the wide range of topics covered by the National Survey for Wales, such as health and well-being.
- The National Survey for Wales also provided the associated household information needed to model fuel poverty and respondents' views on a number of housing-related topics that will add social context to the inspections data from the WHCS.
- Property inspections are carried out by experienced, qualified surveyors, employed by the Building Research Establishment (BRE), who undertake intensive briefing prior to fieldwork. This ensures that the inspections are carried out to a high standard, and that survey forms are filled in consistently.
- The WHCS data collection form is a very detailed 20+ page digital form involving a great deal of instant validation, which reduces the potential for error at the point of input.
- Each surveyor was appointed to one of four regional managers who provided direct feedback of any validation error messages. The regional manager could correct the outstanding validation errors (using access to photos of the property if necessary) and then submit the form to BRE or if necessary return it to the surveyor with queries for them to answer. When these validation queries were resolved, the data was passed to BRE who carried out further intensive data checking which continued throughout the data modelling process. The Welsh Government also quality assured the raw data and derived variables before they were signed off. This process ensured that the WHCS data was of a high quality.
- The WHCS is very much standard in terms of housing conditions surveys, similar to those carried out by other UK Nations and previous housing conditions surveys in Wales. This means that many of the data items collected have been tried and tested, some results can be tracked over time and some results can be compared with other UK countries.
- As well as the usual topics and those related to specific Welsh Government policies, the survey collects information on potential future issues, specifically relating to climate change (hotter summers, wetter winters etc.) and the housing stock's likely ability to cope. For full details of the topics included in the Survey see the Survey Form, available on the [WHCS webpages](#).

The **limitations** include:

- Although the response rate is reasonably good, there is still a substantial proportion of sampled households who do not take part. This is likely to affect the accuracy of the estimates produced. Non-response can occur at various stages: refusal to participate in the WHCS during the National Survey interview; refusal to book a WHCS appointment with the surveyor; refusal to participate in the WHCS when the surveyor calls at the door. The overall response rate, taking into account non-consent and consent followed by decline, was 45%.
- The survey does not cover vacant properties.
- Although surveyors undertook intensive briefing prior to their inspections, and there was considerable validation built into processes, there is still a possibility of some inconsistencies across surveyors in the way results are reported on the data collection form.
- The sample size isn't large enough to allow robust analysis below national (Wales) level.
- A significant period of time is needed to process and validate the survey data after fieldwork and prepare the statistical outputs, which can affect the timeliness of results.
- In order to estimate levels of Fuel Poverty in Wales, detailed income information needed to be collected about the households living in the inspected properties. Questions on income can be sensitive and difficult to measure, therefore the HCEP team approached NatCen to carry out a desk review and cognitive testing of the income questions to ensure that as many people as possible were content to provide this potentially sensitive information and that the information collected covered all of the main income sources in an accurate manner. A cognitive testing report was published with details of the process available on the [Survey webpage](#).

Several of the strengths and limitations mentioned above relate to the accuracy of the results. Accuracy is discussed in more detail in the following section.

### **3.2 Accuracy and reliability**

Accuracy is the closeness between an estimated result and the (unknown) true value.

Reliability is the closeness of early estimates to subsequent estimated values.

The Welsh Government Chief Statistician has overall responsibility for the production of Welsh Government Statistics. Should any inappropriate use of WHCS statistics occur which would compromise the accuracy and reliability of the statistics, the Chief Statistician, in line with the [Code of Practice for Statistics](#), will challenge this and will reflect upon how further misuse can be prevented.

A total of 2,549 full WHCS surveys were achieved across the 22 local authorities of Wales. A response (consent rate) of 58% was achieved by the National Survey for Wales interviewers, and a conversion rate of 78% was achieved by the BRE surveyors.

Non-response can occur at various stages: refusal to participate in the WHCS during the National Survey interview; refusal to book a WHCS appointment with the surveyor; refusal to participate in the WHCS when the surveyor calls at the door. The overall response rate, taking into account non-consent and consent followed by decline, was 45%.

It should be noted that because the WHCS is based on the National Survey for Wales, that any sources of error associated with the National Survey could also have an impact on the WHCS. The National Survey for Wales has its own Quality Report, on the [Survey webpage](#), with a section on Accuracy and Reliability, and it is advised that it is read in conjunction with this chapter.

### **Introduction of conditional incentive**

Consent rates from the National Survey for Wales for WHCS inspections were lower than expected to begin with, and despite employing a number of mitigating actions, remained well below target after the first two thirds of fieldwork. As a result a £10 conditional incentive was introduced from 1 January 2018, and this initiative proved successful. Consent rates reached target level by the time fieldwork was complete.

### **Sampling error**

Sampling error arises because the estimates are based on a random sample of the population rather than the whole population. The results obtained for any simple random sample are likely to vary by chance from the results that would be obtained if the whole population was surveyed (i.e. a census), and this variation is referred to as the sampling error. In general, the smaller the sample size the larger the potential error.

For a random sample, sampling error can be estimated statistically based on the data collected, using the standard error for each variable. Standard errors are affected by the survey design; and can be used to calculate confidence intervals in order to give a more intuitive idea of the size of sampling error for a particular variable. These issues are discussed in the following subsections.

### **Effect of survey design on standard errors**

The sample for the WHCS 2017-18 was provided by the [National Survey for Wales 2017-18](#). The National Survey is stratified at local authority level, with different probabilities of selection for people living in different local authorities. In addition, the probability of subsequently being selected for the WHCS depends on some characteristics of the property and its household (state of disrepair, tenure and the selected person in the National Survey being the household reference person or their spouse). Weighting is used to correct for these different selection probabilities, as well as to ensure the results reflect the population characteristics of each local authority. One of the effects of this complex design and applying survey weights is that standard errors for the survey estimates are generally higher than the standard errors that would be derived from a simple random sample of the same size.

The ratio of the *standard error* of a complex sample to the standard error of a simple random sample (SRS) of the same size is known as the design factor, or “deft”. If the standard error of an estimate in a complex survey is calculated as though it has come from a SRS survey, multiplying that standard error by the deft gives the true standard error of the estimate, which takes into account the complex design.

The ratio of the sampling variance of the complex sample to that of a simple random sample of the same size is the design effect, or “deff” (which is equal to the deft squared). Dividing the actual sample size of a complex survey by the deff gives the “effective sample size”. This is the size of a SRS that would have given the same level of precision as the complex survey.

Standard errors, adjusted for the survey design and design effects and design factors, for a selection of key WHCS variables are set out in the Technical Report, available on the [WHCS webpage](#).

## Confidence intervals

Standard errors can be used to calculate confidence intervals for each survey estimate. The confidence intervals for each estimate give a range within which the 'true' value for the population is likely to fall (that is, the figure we would get if the survey covered the entire population). The most commonly-used confidence interval is a 95% interval. In 95% of survey samples, the 95% confidence interval for each sample will contain the 'true' figure for the whole population. The larger the confidence interval, the less precise the estimate is.

95% confidence intervals have been calculated for key WHCS variables and are included in the analysis and supporting tables. These intervals have been adjusted to take into account the design of the survey and are larger than they would be if the survey had been based on a simple random sample of the same size. They equal the point estimate plus or minus approximately  $1.96 * \text{the standard error of the estimate}$ <sup>4</sup>.

Confidence intervals can also be used to help tell whether there is a real difference between two groups (one that is not just due to sampling error, i.e. the particular characteristics of the household that took part in the survey). As a rough guide to interpretation: when comparing two groups, if the confidence intervals around the estimates overlap then it can be assumed that the estimates are not statistically significantly different. This approach is not as rigorous as doing a formal statistical test, but is straightforward, widely used and reasonably robust.

Note that checking to see whether two confidence intervals overlap is less likely than a formal statistical test to lead to conclusions that there are real differences between groups. That is, it is more likely than a formal test to lead to "false negatives": incorrect conclusions that there is no real difference when in fact there is a difference. It is also less likely than a formal test to lead to "false positives": incorrect conclusions that there is a difference when there is in fact none. However, carrying out many comparisons increases the chance of finding false positives.

Therefore, when many comparisons are made the conservative nature of the test is an advantage because it reduces (but does not eliminate) this chance.

## Non sampling error

'Non-sampling error' means all differences between the survey estimates and true population values except those arising because of sampling error. Unlike sampling error, non-sampling error is present in censuses as well as sample surveys.

It is not possible to eliminate non-sampling error altogether, and it is not possible to produce statistical estimates of the size of non-sampling error. Substantial efforts have been made to reduce non-sampling error in the WHCS. Some of the key steps taken are discussed in the following subsections.

## Weighting and grossing

Weighting and grossing is the process whereby the information gathered by means of a sample survey is translated into figures that reflect the real world. The process has a number of stages reflecting the

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<sup>4</sup> The value of 1.96 varies slightly according to the sample size for each particular estimate.

separate stages of the sampling process and the survey process itself. The weighting and grossing for the WHCS was carried out by the Office for National Statistics in collaboration with the Welsh Government, and the process is broadly outlined below:

- A weighted logistic regression model was included to correct for non-consent to the WHCS. The variables included in the model were: local authority; tenure; dwelling type; state of repair of walls and roof; highest educational qualification; number of people in the household.
- Consent followed by decline was not corrected for using logistic regression as the model fit was poor. Instead, any non-response arising from this scenario was addressed by the calibration.
- Household weights were calibrated to the number of households in each local authority, the household composition (the number of adults and children within a household) and estimates of tenure proportions from the National Survey.
- Person weights for individuals within each WHCS household were calibrated to the total number of individuals in Wales in the same age-sex groups from local authorities as the National Survey.

More details can be found in the Technical Report on the [WHCS webpage](#).

## **Measurement error**

Issues with the way data are collected can lead to measurement error. This can be caused by inaccuracies with how an individual surveyor gathers data, or with problems in the form which can lead to incorrect data being recorded. The WHCS team minimises measurement error in the following ways:

**Form development and surveyor training:** To reduce measurement error, well-established questions are used on the physical inspection survey form wherever possible, such as those used in previous Welsh Housing Surveys and also those used in the housing surveys of other UK countries. This means that the questions are tried and tested, which increases the likelihood that the questions are consistently understood as intended by the surveyor and that observations are recorded as accurately as possible.

Property inspections were carried out by qualified surveyors, employed by the Building Research Establishment (BRE). The majority had either worked on the Living in Wales Property Survey 2008 or were working on the English Housing Survey. Any surveyors new to the WHCS completed additional selection exercise and basic training prior to undertaking the standard intensive five day briefing on the WHCS before starting fieldwork. They were also provided with detailed guidance manuals to aid them with their property inspections. This ensured that the inspections were carried out to a high standard, and that survey forms were filled in consistently. An electronic data capture system (digital pens) was used to collect the survey data. This method uses a digital pen in conjunction with a paper form printed using 'Anoto' technology. This enabled instant validation to be carried out in field, which reduced the time taken by supervisors carrying out further validation on the survey forms. Surveyors were provided with additional training on how to use the digital pen technology. Each surveyor was appointed to one of four regional managers, who accompanied surveyors to their initial property inspections and provided guidance on how to interpret the inspection form. Regional managers also supervised the data collection process and checked and approved every completed survey form before it was sent to BRE.

**Surveyor website:** The purpose of the WHCS surveyor website was to host the case management system the surveyors used to view case data, arrange appointments, upload survey data, validate the survey data, attach photographs, add mileage and generate invoices. Regional managers used the website to check on the survey data sent to them by their surveyors and to help manage their surveying team.

BRE project management staff also used the website for allocation of case data to surveyors, carried out acceptance checks on the data by viewing survey forms and associated photos, checked on the progress of the survey against targets and to help with the rearrangement of survey appointments. Welsh Government staff had access to the website to enable them to monitor survey progress throughout the fieldwork period.

The website also hosted important documents that were useful to the surveyor over the course of the fieldwork period. These include the surveyor manual, [Housing Health and Safety Rating System \(HHSRS\)](#) benchmarking examples, briefing presentations, BRE model answers for the briefing properties, the WHCS software and associated instructions.

**Validation system:** BRE developed a validation system which sat behind the WHCS surveyor website and which ran for all surveys uploaded to it. It was designed to improve the quality of the collected data and to give the surveyors greater ownership over their surveys and the information they collected. The validation consisted of a number of database checks and logic statements which were run on the data when it was first uploaded and subsequently every time a surveyor moved between pages, saving any changes they made to the data. These checks included:

- range checks – where the entered answer falls outside a valid range of responses;
- logic checks – where a combination of responses to certain questions is not logically consistent;
- consistency checks – to determine whether linked responses in different parts of the form are consistent with each other (e.g. that detailed room data is only entered where a room is coded as existing); and
- plausibility checks – to determine whether a response is reasonable given that there is not a well-defined range of possible answers (e.g. ceiling height of a room entered as 24 metres instead of 2.4 metres).

Surveyors could also visually check all pages of their paper form against those on the website to ensure that the digital pen entries mirrored those on the paper form i.e. that handwritten numbers had not been misinterpreted by the software. Surveyors received direct feedback from their regional managers of any remaining validation error messages which needed to be attended to before the survey was accepted.

The regional manager could correct any outstanding validation errors (using access to the photos if necessary) and then submit the form to BRE or if necessary return it to the surveyor with queries for them to answer.

The BRE project manager performed spot checks on the data and was able to change the data if a mistake was identified. They also had the option to return the form to the regional manager if the remedy was not clear-cut.

**Manuals and guidance:** The surveyor manual encompasses all the information a surveyor needs in order to complete, upload and validate a survey form. It provides benchmark examples for reference when making their judgements and contains details of how to survey unusual homes, such as non-residential buildings which contain some residential accommodation and houses in multiple occupation.

When surveyors had technical queries in the field, for which there was not an answer in their manual, they sought assistance from their regional managers in the first instance. If the problem was not resolved, surveyors were able to use the IT support helpline provided by BRE's IT department. Its purpose was to help with any enquiries relating to the use of the digital pen, accompanying software or use of the surveyor website. Surveyors were given the helpline number in their surveyor manual.

**Validation by Welsh Government and BRE:** In addition to the initial data checks performed during fieldwork using the digital pen technology and online validation system, BRE and the Welsh Government also undertook intensive validation checks on the data to ensure that the level of data quality is high. Data validation was an iterative process, carried out firstly on test data (the first 500 cases), then on the interim data (the first two quarters of fieldwork), and finally repeated for the complete dataset.

Once all WHCS physical surveys were submitted to BRE by the surveyors, the data were converted into a series of raw physical survey SPSS files. BRE undertook consistency and plausibility checks on the raw physical survey data. The purpose of these checks was firstly to detect and eliminate certain logical inconsistencies that would cause problems for modelling based on a more complex set of logic rules, and secondly to identify highly implausible answers, which if it was deemed necessary after investigation, were corrected.

Derived variables were created by BRE either by simply recoding a particular survey question or by combining the information collected from a number of questions, which can involve complex modelling. One example of a derived variable is the assessment against the [Housing Health and Safety Rating System \(HHSRS\)](#).

Once BRE had performed internal validation on the raw survey data and derived variables, the data were submitted to the Welsh Government who carried out further comprehensive data checking before the dataset was signed off.

Annex 1 of this report includes a Process Map showing our quality assurance process.

The Welsh Government Statistics and Research [Quality Management Strategy](#) sets out our approach to data checking and data validation in Annex 1 and 2.

### **3.3 Timeliness and punctuality**

Timeliness refers to the lapse of time between the period to which the data refer and publication of the estimate.

Punctuality refers to the time lag between the actual and planned dates of publication.

Fieldwork for the WHCS 2017-18 ran from August 2017 until the end of April 2018. A Statistical First Release for the WHCS 2017-18 was published on 6 December 2018. Therefore the time lapse between end of fieldwork and publication of the results was around six months. This was a balance between the time estimated to comprehensively check and sign off the data, the time taken to carry out initial

analysis, QA and publish a headline Statistical First Release that met user need, whilst not delaying the publication extensively thus allowing users access to the data, and accounting for the National Assembly for Wales recess periods over the later part of 2018. Further analysis of the survey in the form of detailed topic specific bulletins will follow from early 2019, as will the publication of fuel poverty estimates.

All WHCS outputs will be pre-announced on the Welsh Government Statistics and Research [Upcoming calendar](#) web pages, in line with the [Code of Practice for Statistics](#) and the Welsh Government Statistics and Research [Release Practices Protocol](#).

Should the need arise to change the pre-announced release schedule, the Welsh Government Statistics and Research [Revisions, Errors and Postponements](#) process is followed, and a full explanation of the reasons for the change is made available.

A number of checks and processes are in place to ensure the timeliness and punctuality of WHCS statistics:

- At the beginning of the survey process, a detailed timetable was set for each element of the survey. This timetable was used to keep track of key milestones and deliverables in the project.
- A pilot survey for the WHCS was undertaken by BRE in May 2017 and a report was produced for the Welsh Government which can be found on the [WHCS webpage](#). The pilot enabled the testing of all the WHCS processes and procedures, replicating main fieldwork practices as much as possible. A number of recommendations arose from the pilot which were then implemented as part of the main WHCS. This ensured that the main survey ran smoothly and to schedule, as potential issues had been identified and rectified early on.
- In order to estimate levels of Fuel Poverty in Wales, detailed income information needed to be collected about the households living in the inspected properties. Information on the income of the head of household, their partner and other adult household members were collected through the National Survey. Questions were included from July 2017 to the end of March 2018. The HCEP team approached NatCen to carry out a desk review and cognitive testing of the income questions to ensure that as many people as possible were content to provide this potentially sensitive information and that the information collected covered all of the main income sources in an accurate manner. A [cognitive testing report](#) was published with details of the process. The WHCS consent question on the National Survey for Wales also underwent [cognitive testing](#) beforehand, to ensure that as many respondents as possible agreed to participate in the WHCS survey.
- The HCEP team regularly updates the WHCS Programme and Project Boards with progress updates against milestones.
- Throughout the survey the progress of surveyors and fieldwork was monitored by BRE and the HCEP team and any issues that could impact on timeliness and punctuality were addressed.
- The WHCS implements time saving measures where possible, for example an electronic data capture system (digital pens) was used to collect the survey data. This method uses a digital pen in conjunction with a paper form printed using 'Anoto' technology. This enabled instant validation to be carried out in field, which reduced the time taken by supervisors carrying out further validation on the survey forms. It also removed the time taken, and risks to accuracy, of using 'normal' paper forms and data entry clerks as was done on previous surveys in Wales.

- The HCEP team produced a detailed data specification document which was used to ensure that all data items collected on the finalised survey form were allocated to each of the individual data files expected. It also allowed the HCEP team to specify the naming, titling, measures, value labels etc. of the variables and agree these with BRE prior to the first data delivery.
- After a few months of fieldwork, BRE provided the HCEP team with a test dataset containing the first 500 cases. This enabled the team to check that all of the data items expected were being captured, that any filtering within the form was working as expected (base checks) and that the variables produced were formatted etc. as expected and agreed in final data specification document. This was an iterative process between the HCEP team and BRE.
- In March 2018 the HCEP team received the intermediate dataset consisting of the first two quarters of fieldwork. The team checked the frequencies for each variable and looked for any logical inconsistencies in the data, ensuring the routing of the questions was working correctly (base checks). This interim stage of data validation reduced the tasks needed on the final dataset. This was an iterative process between the HCEP team and BRE.
- When the final files were received after the end of fieldwork, the HCEP team re-ran the checks done during the interim stage of validation, ensuring previously raised issues had been fully resolved. Extensive validation checks were also carried out on the derived variables, making sure each variable was constructed correctly from the raw data and according to specification.
- As noted above, some data required for modelling and derivations was obtained from the National Survey (income, some WHQS elements etc.). The National Survey team follow a similar high quality process for data collection and processing. Please see section 2.2 of the National Survey for Wales Quality Report, and section 5.10 of the Technical Report, both of which can be found on the [Survey webpage](#).
- The HCEP team met with users to discuss their analysis requirements and confirm their main priorities before drafting the Statistical First Release, ensuring as many as possible could be met straight off and thus minimising time spent dealing with queries. This meant the team could start work on detailed topic reports following publication of the first release.
- A methodical approach was taken in the production of the Statistical First Release with each member of the HCEP team having specific tasks to complete within a set time frame. These tasks were then rotated to enable a different member of the team to replicate the analysis and hence check the results.

Below is a timetable outlining the key stages in the WHCS process from the start of fieldwork to publication of the First Results in December 2018. Some of the stages run in parallel, or overlap with each other.

<b>Task</b>	<b>Timing</b>
<a href="#">Cognitive testing of income questions</a>	January 2017
<a href="#">Cognitive testing of WHCS consent question</a>	January 2017
Pilot survey (see section 3.3 above).	May 2017 (fieldwork took place between 2 May and 12 May).
Surveyor briefing and preparation for the survey (section 3.2).	June – July 2017.
Data collection and supervisor validation (section 3.2).	August 2017 - April 2018.
<a href="#">User engagement survey</a> on statistical output options (section 3.1).	February 2018.
Validation, quality assurance and data modelling by BRE (section 3.2).	Ongoing throughout fieldwork up to delivery of final dataset to Welsh Government in October 2018.
Data validation by the WHCS team in Welsh Government (section 3.2).	March – April 2018 (interim data). June - October 2018 (final data).
Weighting and grossing (section 3.2).	January – October 2018
Drafting the Statistical First Release and associated documents.	August – December 2018.
Publication of Statistical First Release (National Headline Results)	6 December 2018.

### **3.4 Accessibility and clarity**

Accessibility is the ease with which users are able to access the data, also reflecting the format in which the data are available and the availability of supporting information.

Clarity refers to the quality and sufficiency of the metadata, illustrations and accompanying advice.

#### **Publications**

All statistical reports are published on the [WHCS webpage](#).

Statistics from the WHCS are pre-announced, and are published on the Welsh Government website at 9.30am on the day of publication in line with the Welsh Government Statistics and Research [Release Practices Protocol](#). All releases are available to download without charge. Outputs are announced and shared on the [Statistics for Wales Twitter feed](#), and a link to results is also sent to members of the WHCS stakeholder database.

The main statistical releases are published in PDF format, and tables and charts associated with the release are also provided in Excel, allowing re-use of the tables/charts by users. An easy to use Results Viewer was created in Excel, allowing users to explore results on a range of topics.

Annex 2 includes a process map which shows the stages of production of the Statistical First Release.

In February 2018 an online survey consulting with users on their preferences on output options for the WHCS 2017-18 was conducted. A summary report of this user engagement survey was published in August 2018 which can be found on the [WHCS webpage](#). Users indicated that their main preference was receiving the headline results as a short Statistical First Release, access to the datasets for their own use and topic specific analysis presented as a series of short bulletins. The HCEP team will invite users to provide feedback on our outputs and analysis for the WHCS 2017-18 as they are published, with a view to addressing any issues in future publications.

#### **Disclosure control**

Outputs are designed to ensure that individuals and individual properties are not identifiable from the published results. We follow the requirements for confidentiality and data access set out in the [Code of Practice for Statistics](#).

#### **Language requirements**

Welsh Language surveyors were recruited to ensure that inspections could be carried out through the medium of Welsh whenever a respondent selected this to be their preference. Supporting materials such as the respondent information and thank you leaflets were produced bilingually.

The Welsh Government's Knowledge and Analytical Services (KAS) comply with the [Welsh Language Standards](#) for all outputs. The HCEP webpages, Statistical First Release and topic bulletins are published in both Welsh and English using plain English or 'Cymraeg Clir' as appropriate.

## UK Data Archive

An anonymised version of the WHCS dataset (from which some information is removed to ensure confidentiality is preserved), together with supporting documentation, will be deposited with the [UK Data Archive](#) as soon as is practicable after the publication of the Statistical First Release. The dataset may be accessed by registered users for specific research projects.

From time to time, researchers may wish to analyse more detailed data than is available through the Data Archive. Requests for such data can be made to the WHCS team at [stats.housingconditions@gov.wales](mailto:stats.housingconditions@gov.wales). Requests are considered on a case by case basis, and procedures are in place to ensure that confidentiality and data security are maintained e.g. Data Access Agreements.

## Methods and definitions

The WHCS technical report contains more detailed information on how the survey was undertaken such as sampling, fieldwork procedures and weighting. A detailed glossary with descriptions of more general terms used in outputs and the survey in general has been produced. Each survey publication contains a key quality information section. A copy of the survey form is available on the [WHCS webpage](#).

### 3.5 Comparability and coherence

Comparability is the degree to which data can be compared over time and domain.

Coherence is the degree to which data that are derived from different sources or methods, but refer to the same topic, are similar.

### Comparisons with other UK countries

Since 1967, all four UK nations have moved into a cycle of measuring housing conditions through sample surveys and developing policies in response to the findings. 2017-18 is significant in that all four UK nations will have been in the field at a similar time and will be able to produce a number of comparative statistics.

The HCEP team in the Welsh Government work with BRE and the other UK nations to ensure that the WHCS uses broadly the same survey questions and methodology as the other UK Nations - with the exception of questions or circumstances that are specific to Wales, for example the [Welsh Housing Quality Standard \(WHQS\)](#), [fuel poverty](#) definitions and looking at potential future issues. This allows for some direct comparison across UK nations to be made and some more caveated comparisons to be made. There are also some areas that should not be compared at all. All Caveats around UK comparisons are clearly stated in outputs. The four UK housing conditions teams intend to publish a summary of where the surveys can be compared directly, where they can be compared with caveats and where they should not be compared at all.

WHCS surveyors receive similar training to that provided to surveyors working on housing surveys for other UK countries, indeed a number of them work on these other surveys. This reduces surveyor variability and helps to ensure comparability with other UK countries.

The Statistical First Release includes some key WHCS statistics compared with other UK Nations, caveated as necessary.

## **Comparisons over time**

Although the WHCS survey form is updated and amended for each survey, many questions remain similar to those used in previous housing conditions surveys in Wales. This allows for some comparison across time to be made.

## **Coherence**

Knowledge and Analytical Services (KAS) within the Welsh Government publish an [annual report](#) on the Welsh Housing Quality Standard. This report includes information on the progress made by social landlords (local authorities and registered social landlords) in achieving the WHQS for all their stock. The data is **self reported** by landlords.

Knowledge and Analytical Services also publishes statistics collected from local authorities on their own assessments of dwellings under the Housing Health and Safety Rating System. These are available on the [Welsh Government webpage](#). This information is not comparable with the WHCS as it only covers those residential dwellings which were assessed by local authorities during the reporting year and not all residential dwellings in that year.

## **4. Additional principles**

Producers of official statistics are asked to comment on four additional principles when reporting quality. These principles originate from the European Statistical Code of Practice.

### **4.1 Trade-offs between output quality components**

This is covered in section 3.1 – Relevance.

### **4.2 Assessment of user needs and perceptions**

This is covered in section 3.1 – Relevance.

### **4.3 Balance between performance, cost and respondent burden**

#### **Performance and cost**

Although a significant cost, the WHCS provides statistics for Wales which are not available elsewhere and fill the evidence gap for housing conditions data in Wales. See the background to the survey (section 2) and Relevance (section 3.1) for more information on how the survey will be used.

Much of the methodology and many of the survey questions are similar to those used in the housing conditions surveys of the other UK nations, and in the previous Living in Wales Property Survey (2004 & 2008). This ensures that lessons learned and developments with these surveys have been implemented in the WHCS, ensuring cost effectiveness and timeliness. This also means that some of the questions may be compared across time and with other UK nations – see section 3.5 – Comparability and Coherence.

A pilot survey was conducted (see section 3.3 – Timeliness), which saved time and money by ensuring that any potential issues with the survey were ironed out before the main fieldwork began.

Digital pens were used by the surveyors (see section 3.2 – Accuracy) which enabled some data validation to be carried out at the point of fieldwork, therefore reducing time and cost during the main data validation stage.

WHCS data will be made available in the form of Excel tables and charts alongside outputs, data will be deposited at the [UK Data Archive](#) (see section 3.4 – Accessibility and Clarity) and more detailed datasets will be available under special licence from the [HCEP team](#) directly, allowing re-use of the data by survey users.

## **Respondent burden**

Participation in the WHCS was voluntary and was sought through informed consent during the National Survey for Wales. Information about the WHCS was explained to respondents during the National Survey, and a respondent leaflet, available on the [WHCS webpage](#), was provided to those consenting with more detail, including why participation was important and information about confidentiality. Interviewers collected information on when would be the best time for surveyors to call to conduct an inspection. They also recorded if a household would prefer to have a Welsh speaking surveyor. Surveyors tried to arrange an appointment with the household to conduct the inspection. Where contact was not possible, they visited the property and if no contact was made, they left calling cards with contact details so that respondents could make an appointment at a time that suited them. Everything was done to try and ensure that the surveys were as little inconvenience to respondent households as possible.

During the WHCS, surveyors performed a visual, non-invasive assessment of the interior and exterior of the property. No furnishings or carpets were disturbed, and no testing was undertaken. The inspections lasted around 40-50 minutes, with around 20 minutes spent inside on a room by room inspection. The surveyor also inspected the plot of the property and made an assessment of the local neighbourhood.

A [signposting / thank you leaflet](#) was handed out by the surveyors at the end of each survey. The leaflet thanked the respondents for their time and good will, and also signposted to organisations and websites which could help improve the energy efficiency/performance and condition of their home. Surveyors could point the respondents to particular organisations that would be of benefit to them (e.g. [Care and Repair Cymru](#) for older people).

## 4.4 Confidentiality, transparency and security

### Confidentiality

There are a number of procedures in place to ensure the confidentiality of WHCS statistics:

- We follow the requirements for confidentiality and data access set out in the [Code of Practice for Statistics](#).
- The Welsh Government Statistics and Research website includes a [Confidentiality Statement](#) which we adhere to.
- All staff working on the WHCS are trained in their obligations relating to confidentiality.
- Staff at BRE sign a third party confidentiality agreement (as is the case with any third party who request WHCS data).
- Surveyors were trained on the importance of confidentiality during the surveyor briefings. Surveyors were required to comply with their obligations under the 1998 Data Protection Act. They were instructed to maintain strict confidentiality of all data collected, which was not to be used for any other purpose. They were not to retain records of addresses or persons visited beyond the requirements of completing this work, and were not to disclose such details to any other person or organisation. All survey forms were destroyed at the end of the survey, as directed by BRE.
- Respondents to the WHCS receive a leaflet, available on the [WHCS webpage](#), prior to the property inspection taking place, which explains how their information will be kept confidential.
- Outputs are designed to ensure that individuals and individual properties are not identifiable from the published results.

### Transparency

- The Welsh Government Statistics and Research website includes a [Statement of Compliance](#) which covers a number of statements and protocols that we adhere to when producing and publishing statistics.
- Statistics from the WHCS are pre-announced, and are published on the Welsh Government website at 9.30am on the day of publication in line with the Welsh Government Statistics and Research [Release Practices Protocol](#).
- Any revisions, errors or postponements to the data are carried out in line with the Welsh Government Statistics and Research [Revisions, Errors and Postponements Guidance](#).
- The WHCS statistical releases include a Key Quality Information section which provides background to the definitions and methods used within the release. Releases also include contact details for the lead statistician.

## Security

At the surveyor briefing, each surveyor received their ID cards and lanyards in their pack, and were instructed to show these when the respondent answered the door. They were also instructed to explain to respondents that they could phone the helpline (if they wished) to legitimise the survey.

The digital pens used during fieldwork were able to distinguish between forms by the use of a barcode (which the pen could scan), printed on an adhesive label which was placed on the front of each form. In this way, there was no address information present on the survey form; an important feature for data security.

Surveyors signed a contract to agree that the surveys undertaken in the WHCS were purely for statistical purposes and that any information revealed was not to be acted upon in a professional capacity.

## 5. Feedback or further information

If you would like further information please visit the Welsh Housing Conditions Survey [webpage](#), or contact us on [stats.housingconditions@gov.wales](mailto:stats.housingconditions@gov.wales).

The HCEP team welcome feedback from users of the survey, for example on the content and presentation of our publications.



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Produced by: Knowledge and Analytical Services, Welsh Government

Last Reviewed: December 2018

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## 7. Annex 2: Process map of output production

