Cornwall
Population & Household Forecasts
Assumptions, Methodology & Scenario Results

March 2015

For the attention of:

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Acknowledgements

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# Table of Contents

- Contact Details ........................................................................................................... i
- Acknowledgements .................................................................................................. i
- Table of Contents ..................................................................................................... ii
  1. Introduction ............................................................................................................. 3
  2. Cornwall: Area Profile .......................................................................................... 6
  3. Scenario Development .......................................................................................... 13
  4. Scenario Outcomes ............................................................................................... 16
  5. Summary ................................................................................................................ 19
  Appendix A  Scenario Outcomes (2010–2035) ......................................................... 22
  Appendix B  POPGROUP Methodology ................................................................. 23
  Appendix C  Data Inputs & Assumptions ................................................................. 26
1. Introduction

Context

1.1 Cornwall Council, in conjunction with Plymouth City Council, South Hams District Council and West Devon Borough Council commissioned GVA to prepare a Strategic Housing Market Needs Assessment (SHMNA)\(^1\) in November 2012, using demographic analysis and forecasts provided by Edge Analytics. The final SHMNA document was published in July 2013.

1.2 Since the SHMNA was produced, new demographic statistics have become available. In March 2013, the Office for National Statistics (ONS) released its revised mid-year population estimates (MYEs) for the 2002–2010 historical period. In May 2014, the ONS released its 2012-based sub-national population projections (SNPP) for local authorities in England. This provides a new ‘official’ starting point for the development of demographic scenarios, replacing the 2011-based interim SNPP and the earlier 2010-based SNPP. Government Planning Practice Guidance (PPG) has also been finalised, providing guidelines on the approach to assessing housing need.

1.3 In February/March 2015, the Department for Communities and Local Government (DCLG) released the 2012-based household projection model, superseding the 2011-based interim model.

1.4 A further recent change is the release of the latest version of POPGROUP, the population projection modelling software used in this study. For POPGROUP v.4, changes have been made to the way in which migration is handled. For further information on POPGROUP and its methodology, refer to Appendix B.

Requirements

1.5 Cornwall Council has commissioned Edge Analytics to provide an updated suite of population and household forecasts, using the latest demographic data and assumptions. In particular, Cornwall

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\(^1\) http://www.cornwall.gov.uk/media/5830826/SHMNA-revised-2014.pdf
Council requires the assessment of the household growth implications of a range of scenarios using the recently released 2012-based household projection model and the earlier 2008-based model.

**Approach**

**Official Guidelines**

1.6 The National Planning Policy Framework (NPPF)\(^2\) and PPG\(^3\) provide guidance on the appropriate approach to the objective assessment of housing need. The PPG states that the DCLG household projections should provide the “starting point estimate of overall housing need” (PPG paragraph 2a-015). Local circumstances, alternative assumptions and the most recent demographic evidence, including ONS population estimates, should also be considered (PPG paragraph 2a-017).

1.7 The use of demographic models, which enable a range of growth scenarios to be evaluated, is now a key component of the objective assessment process. The POPGROUP suite of demographic models, which is widely used by local authorities and planners across the UK, provides a robust and appropriate forecasting methodology (for further information on POPGROUP, refer to Appendix B).

1.8 The choice of assumptions used within POPGROUP has an important bearing on scenario outcomes. This is particularly the case when trend projections are considered alongside population and household forecasts. The scrutiny of demographic assumptions is now a critical component of the public inspection process, providing much of the debate around the appropriateness of a particular objective assessment of housing need.

**Edge Analytics’ Approach**

1.9 In accordance with the PPG, Edge Analytics has considered the most recent population and household projections for Cornwall. The 2012-based SNPP for Cornwall is presented, with an analysis of the ‘components of change’ underlying this new projection; these statistics are

\(^2\) http://planningguidance.planningportal.gov.uk/blog/policy/

\(^3\) http://planningguidance.planningportal.gov.uk/blog/guidance/
compared to previous estimates and to the historical data on births, deaths and migration. The most recent 2012-based household projection model from DCLG is also considered, with commentary provided on the differences between this and the earlier household projection models.

1.10 In line with the PPG, Edge Analytics has developed a range of demographic scenarios for Cornwall using POPGROUP v.4 technology. The 2012-based SNPP is presented as the official ‘benchmark’ scenario and two alternative scenarios have been developed for comparison with this. In these alternative ‘trend’ scenarios, the migration assumptions are altered.

1.11 The household growth implications of each scenario have been assessed using assumptions from both the new 2012-based and the earlier 2008-based household projection models from DCLG.

1.12 The three scenarios have been run to a 2035 horizon. Historical data are included for the 2001–2013 period. Scenario results are presented for the 2012–2035 plan period. Results are also presented for the 2010–2035 plan period (see Appendix A).

Report Structure

1.13 The report is structured in the following way:

- In Section 2, a demographic profile of Cornwall is presented. This includes a historical perspective on population change since the 2001 Census, analysis of the ‘components of change’ from the 2012-based SNPP and commentary on the new 2012-based household projection model from DCLG.
- In Section 3, the scenarios are detailed, with growth outcomes presented in Section 4.
- Section 5 concludes with a summary of the analysis, scenario outcomes and issues for the Council to consider in local plan development.
- Appendix A presents scenario results for the 2010–2035 plan period.
- Appendix B presents an overview of the POPGROUP methodology.
- Appendix C provides detail on the data inputs and assumptions used in the development of the POPGROUP scenarios.
2. Cornwall: Area Profile

2.1 The development of local housing plans is made considerably more challenging by the dynamic nature of key data inputs. Economic and demographic factors, coupled with the continuous release of new statistics, often undermine the robustness of underpinning evidence. This has been a particular issue since 2012, with the release of 2011 Census statistics, revisions to historical population estimates and updated population and household projections.

2.2 This section provides an overview of population change in Cornwall since 2001 and the recent revisions to the mid-year population estimates. Also presented is the most recent population projection from ONS, the 2012-based SNPP and its constituent ‘components of change’. Commentary is also provided on the most recent household projections, the 2012-based household projection model from DCLG.

Population Change 2001–2011

Mid-Year Population Estimates

2.3 Between successive Censuses, population estimation is necessary. These mid-year population estimates (MYEs) are derived by applying the ‘components of change’ (i.e. counts of births and deaths and estimates of internal and international migration) to the previous year’s MYE. Following the 2011 Census, the 2002–2010 MYEs were ‘rebased’ to align them with the 2011 MYE\(^4\) and to ensure the correct transition of the age profile of the population over the 2001–2011 decade.

2.4 At the 2011 Census, the resident population of Cornwall was 532,273, a 6.5% increase over the 2001–2011 decade. The 2011 Census population total proved to be lower than that suggested by the trajectory of growth from the previous MYEs. For this reason, the revised final MYEs are lower than the previous MYEs (Figure 1).

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http://www.ons.gov.uk/ons/dcp171778_345500.pdf

March 2015
Components of Change

2.5 The rebasing of the MYEs involved the recalibration of the components of change for 2001/02–2010/11. Between Censuses, births and deaths are accurately recorded in vital statistics registers and provide a robust measure of ‘natural change’ (the difference between births and deaths) in a geographical area. Given that births and deaths are robustly recorded, and assuming that the 2001 Census provided a robust population count, the ‘error’ in the MYEs is due to the difficulties associated with the estimation of migration.

2.6 Internal migration (i.e. migration flows to and from other areas in the UK) is adequately measured using data from the Patient Register (PR), the National Health Service Central Register (NHSCR) and Higher Education Statistics Agency (HESA), although data robustness may be lower where there is under-registration in certain age-groups (young males in particular). It is therefore most likely that the ‘error’ in the previous MYEs is associated with the mis-estimation of international migration, i.e. the balance between immigration and emigration flows to and from Cornwall.

2.7 However, ONS has not explicitly assigned the MYE adjustment to international migration. Instead it has identified an additional ‘unattributable population change’ (UPC) component, suggesting it has not been able to accurately identify the source of the 2001–2011 over-count (Figure 2). The effect of the UPC adjustment depends upon the scale of population recalibration that has been required following the 2011 Census results. For Cornwall, the population estimates have been subject to a consistent annual decrease due to the over-count over the 2001–2011 decade.

March 2015
For demographic analysis, the classification of UPC is unhelpful, but given the robustness of births, deaths and internal migration statistics compared to international migration estimates, it is assumed that it is most likely to be associated with the latter. With the assumption that the UPC element is assigned to international migration (for estimates up to 2011), and with the inclusion of statistics from the 2012 and 2013 MYEs from ONS, a twelve-year profile of the ‘components of change’ is presented for Cornwall (Figure 3).
For Cornwall, the population change over the 2001/02–2012/13 period was predominantly driven by net internal migration. Natural change has been largely negative throughout the historical period as the number of deaths exceeds the number of births. Net international migration (with the inclusion of the UPC element) has also been largely negative over the historical period. In the latter part of the decade (2011/12–2013), the net international migration has been positive.

Official Population Projections

In the development and analysis of population forecasts, it is important to benchmark any growth alternatives against the latest ‘official’ population projection. The most recent official subnational population projection is the ONS 2012-based SNPP, released in May 2014.

Under the 2012-based SNPP, the population of Cornwall shows a higher rate of growth than under the previous 2010-based official projection (Figure 4). Under the 2012-based SNPP, the population of Cornwall is projected to increase by 102,296 over the 2012–2037 projection period, a 19.0% increase. Under the 2010-based SNPP, the population was projected to increase by 17.8% over the 2010–2035 period. Excluding the 2010-based SNPP, population growth under the SNPP-2012 is lower than earlier ONS projections.

Figure 4: Official population projections for Cornwall (source: ONS)
2.12 The 2012-based SNPP components of change are presented in Figure 5, with the historical components of change for 2001/02 to 2011/12 included for comparison. The annual average natural change, net migration (internal and international) and population change for the 2012-based SNPP are compared to the historical 5-year and 10-year averages in Table 1.

![Figure 5: Historical and 2012-based SNPP components of change for Cornwall (source: ONS)](image)

Table 1: 2012-based SNPP components of change for Cornwall (source: ONS)

<table>
<thead>
<tr>
<th>Cornwall Component of Change</th>
<th>Historical</th>
<th>Projected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural Change</td>
<td>-226</td>
<td>-662</td>
</tr>
<tr>
<td>Net Internal Migration</td>
<td>4,104</td>
<td>4,920</td>
</tr>
<tr>
<td>Net International Migration</td>
<td>242</td>
<td>59</td>
</tr>
<tr>
<td>Unattributable Population Change*</td>
<td>-939</td>
<td>-991</td>
</tr>
<tr>
<td>Annual Population Change</td>
<td>3,208</td>
<td>3,333</td>
</tr>
<tr>
<td>Annual Population Change (%)</td>
<td>0.61%</td>
<td>0.66%</td>
</tr>
</tbody>
</table>

* UPC is only applicable to the years 2001/02 - 2010/11

2.13 Historically, over both the 5-year and 10-year periods, net internal migration has been the dominant component of population change. Net internal migration is projected to continue to be the dominant component of change over the 2012–2037 period, averaging at +4,150 persons per year. This is lower than the historical 5-year average but higher than the 10-year average.

March 2015
2.14 The population-growth impact of natural change has remained negative over the historical 5-year and 10-year period (i.e. the number of deaths has exceeded the number of births). This trend is set to continue in the 2012-based population projection, with an average annual reduction of -213 persons through natural change.

2.15 The population-growth impact of net international migration is projected to be small but positive over the 2012–2037 projection period (an average of +154 persons per year), at a lower rate than the historical 10-year average but higher than the historical 5-year average (at +59 and +242 persons per year respectively).

**Official Household Projections**

2.16 In the assessment of housing need, the PPG states that the DCLG household projections should provide the starting point estimate (PPG paragraph 2a-015). The 2012-based household projection model, which is underpinned by the 2012-based SNPP, was released by the DCLG in February/March 2015, superseding the 2011-based interim household projection model.

2.17 The methodological basis of the new 2012-based model is consistent with that employed in the previous 2011-based interim and 2008-based household projections. A ‘two-stage’ methodology has been used by DCLG. ‘Stage One’ produces the national and local projections for the total number of households by age-group and relationship status group over the projection period. ‘Stage Two’ provides the detailed household type breakdown by age. Currently, only Stage One output is available for the 2012-based household projection model (refer to Appendix C for further detail).

2.18 Whilst methodologically similar to previous releases, the 2012-based household projections provide an important update on the 2011-based interim household projections with the inclusion of the following information:

- 2012-based SNPP by sex and age that extend to 2037 (rather than to 2021 as was the case in the 2011-based interim projections).
- Household population by sex, age and relationship-status consistent with the 2011 Census (rather than estimates for 2011, which were derived from 2001 Census data, projections and national trends, as used in the 2011-interim projections).
- Communal population statistics by age and sex consistent with the 2011 Census (rather than the previous estimate, which were calibrated to the total communal population from the 2011 Census).
- Further information on household representatives from the 2011 Census relating to aggregate household representative rates by relationship status and age.
- Aggregate household representative rates at local authority level, controlled to the national rate, based on the total number of households divided by the total adult household population (rather than the total number of households divided to the total household population).
- Adjustments to the projections of the household representative rates in 2012 based on the Labour Force Survey (LFS).

(Source: DCLG Methodology\(^5\), page 5)

2.19 The official 2012-based DCLG household projection model for Cornwall, underpinned by the 2012-based SNPP, suggests that the number of households will increase by 23.2% over the 25-year projection period (2012–2037)\(^6\), equivalent to an additional 54,105 households (approximately 2,164 households per year). With an 18.5% increase in the size of the household population, average household size is projected to fall from 2.27 in 2012 to 2.18 by 2037.

2.20 Under the 2011-based household projection model, underpinned by the 2011-based interim SNPP, household growth was predicted to average 2,424 households per year 2011–2021. Household size was projected to decrease slightly from 2.27 to 2.26, but with a 9.7% increase in the household population.

2.21 Under the earlier 2008-based household projection model, underpinned by the 2008-based SNPP, household growth was predicted to average 2,818 households per year 2008–2033. As in both the 2011-based interim and 2012-based model, average household size was expected to fall, from 2.24 in 2008 to 2.08 by 2033.

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\(^6\) The number of households in England is projected to increase by 23.5% 2012–2037.
3. Scenario Development

Introduction

3.1 There is no single definitive view on the likely level of growth expected in Cornwall; a mix of economic, demographic and national/local policy issues ultimately determines the speed and scale of change. For local planning purposes, it is necessary to evaluate a range of growth alternatives to establish the most ‘appropriate’ basis for determining future housing provision.

3.2 Edge Analytics has used POPGROUP (v.4) technology to develop a range of growth scenarios for Cornwall (for detail on the POPGROUP methodology, refer to Appendix B).

3.3 Three scenarios have been produced: the most recent official population projection from ONS, the 2012-based SNPP, and two alternative trend-based scenarios, based on short-term and long-term migration histories.

3.4 In the following sections, the scenarios are described and the broad assumptions specified. For further detail on the data inputs and assumptions, please refer to Appendix C.

Official Projections

3.5 In accordance with the PPG, the alternative scenarios are ‘benchmarked’ against the most recent official population projections from the ONS, the ONS 2012-based SNPP. The SNPP-2012 scenario replicates this official population projection.

Alternative Trend Scenarios

3.6 Given the unprecedented economic changes that have occurred since 2008, and the differences between the historical migration data and the 2012-based SNPP projection assumptions (see Figure 5 and Table 1 on page 10), it is important to consider an extended historical time period for
migration ‘trend’ scenarios. Two alternative trend scenarios have been developed, based on the latest demographic evidence:

- **PG-5Yr**: internal migration rates and international migration flow assumptions are based on the last 5 years of historical evidence (2008/09–2012/13), with the UPC adjustment included within the international migration assumptions.
- **PG-17Yr**: internal migration rates are based on the last 17 years of historical evidence (1996/97–2012/13). The 17-year profile of net internal migration is presented in Figure 6. International migration flow assumptions are based on the last 10 years of historical evidence (2003/04–2012/13).

![Figure 6: Net internal migration for Cornwall 1996/97–2012/13 (source: ONS)](image)

**Household Growth**

3.7 In each scenario, household growth has been assessed through the application of household headship rates from both the 2012-based and the 2008-based DCLG household projection models, producing two alternative household-growth trajectories:

- In the **HH-12** outcome, the 2012-based DCLG headship rates are applied;
- In the **HH-08** outcome, the 2008-based DCLG headship rates are applied, scaled to be consistent with the 2011 DCLG household total but following the original trend thereafter.

3.8 For further detail on the household-growth assumptions used, please refer to Appendix C.

March 2015
**Scenario Summary**

3.9 Three scenarios have been produced (Table 2) under two scenario types; official projections and alternative trend-based scenarios.

<table>
<thead>
<tr>
<th>Scenario Type</th>
<th>Scenario Name</th>
<th>Scenario Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Official Projections</strong></td>
<td>SNPP-2012</td>
<td>This scenario mirrors the 2012-based SNPP from ONS for Cornwall. This is the official ‘benchmark’ scenario.</td>
</tr>
<tr>
<td><strong>Alternative Trend-based Scenarios</strong></td>
<td>PG-5Yr</td>
<td>Internal and international migration assumptions are based on the last 5 years of historical evidence (2008/09–2012/13), with the UPC adjustment included within the international migration assumptions.</td>
</tr>
<tr>
<td></td>
<td>PG-17Yr</td>
<td>Internal migration assumptions are based on the last 17 years of historical evidence (1996/97–2012/13). International migration assumptions are based on the last 10 years of historical evidence (with the UPC adjustment included within the international migration assumptions).</td>
</tr>
</tbody>
</table>

Note: Refer to Appendix C for further information on the scenario data inputs and assumptions.
4. Scenario Outcomes

Introduction

4.1 Three scenarios have been produced for Cornwall using POPGROUP (v.4) technology. In this section, the scenario outcomes are presented in the form of a chart and two tables.

4.2 The chart illustrates the trajectory of population change resulting from each scenario. The tables are presented under an HH-12 and HH-08 alternatives:

- In HH-12, the DCLG 2012-based headship rates have been applied
- In HH-08, the DCLG 2008-based headship rates have been applied, scaled to be consistent with the 2011 DCLG household total but following the original trend thereafter.

4.3 The tables summarise the changes in population and household numbers that result from each scenario for the 2012–2035 period. The scenarios are ranked (high to low) according to the expected population growth over the forecast period. The tables also show the average annual net migration (internal and international migration) for each scenario.

4.4 Note that under the HH-12 and HH-08 alternatives, population growth and net migration are the same. Only the household numbers differ, reflecting the two alternative approaches to assessing household growth.
Cornwall: Scenario Outcomes

Figure 7: Cornwall scenario outcomes: population growth 2001–2035

Table 3: Cornwall HH-12 scenario outcomes 2012–2035

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Change 2012–2035</th>
<th>Average Annual Net Migration</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Population Change</td>
<td>Population Change %</td>
</tr>
<tr>
<td>SNPP-2012</td>
<td>96,160</td>
<td>17.9%</td>
</tr>
<tr>
<td>PG-17Yr</td>
<td>95,005</td>
<td>17.7%</td>
</tr>
<tr>
<td>PG-5Yr</td>
<td>79,342</td>
<td>14.7%</td>
</tr>
</tbody>
</table>

Table 4: Cornwall HH-08 scenario outcomes 2012–2035

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Change 2012–2035</th>
<th>Average Annual Net Migration</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Population Change</td>
<td>Population Change %</td>
</tr>
<tr>
<td>SNPP-2012</td>
<td>96,160</td>
<td>17.9%</td>
</tr>
<tr>
<td>PG-17Yr</td>
<td>95,005</td>
<td>17.7%</td>
</tr>
<tr>
<td>PG-5Yr</td>
<td>79,342</td>
<td>14.7%</td>
</tr>
</tbody>
</table>
Scenario Results

4.5 The SNPP-2012 scenario replicates the official population projections from the ONS. The ‘PG’ scenarios provide the alternative trend scenarios. These incorporate fertility and mortality assumptions that are consistent with the SNPP-2012 scenario but differ in their calibration of future migration assumptions. In addition, the ‘PG’ scenarios use the latest, 2013 MYE in the calibration process, providing an additional year of historical evidence compared to the SNPP-2012.

4.6 For internal migration, a five-year (PG-5Yr) and a seventeen-year (PG-17Yr) history is used to calibrate future migration assumptions. For international migration, the PG-5Yr scenario considers a five year historical time period whereas the PG-17Yr considers a ten year period. Both ‘PG’ scenarios incorporate the UPC adjustment to the international migration estimates.

4.7 Population growth is highest under the SNPP-2012 scenario, at 17.9% between 2012 and 2035. Under the HH-12 alternative, this results in a growth of 50,471 households over the forecast period. Under the HH-08 alternative, household growth is higher, with an additional 52,905 by 2035.

4.8 Of the two alternative ‘trend’ scenarios, population growth is highest under the PG-17Yr scenario, at 17.7% between 2012 and 2035. This equates to an additional 54,473 households under the HH-12 alternative, and an additional 57,081 households under the HH-08 alternative. Household growth is higher under the PG-17Yr scenario than under the SNPP-2012 scenario due to the different age structures that are implied by the annual average migration assumptions applicable to each scenario.

4.9 Under the PG-5yr scenario, population growth is lower, at 14.7% over the plan period, equivalent to an additional 45,319 households under HH-12 and 47,639 households under HH-08.
5. Summary

Requirements Summary & Approach

5.1 Cornwall Council has commissioned Edge Analytics to provide a range of scenarios for Cornwall, using the latest population and household projections and demographic assumptions.

5.2 Edge Analytics has produced three scenarios using POPGROUP v.4 technology: the 2012-based as the official benchmark scenario, and alternative trend-based scenarios based on short-term and long-term migration histories.

5.3 In each scenario, household growth has been assessed using household formation rates from the 2012-based and 2008-based DCLG household projection models. Output for each scenario has been presented under an HH-12 and HH-08 alternative, using the 2012-based and 2008-based headship rates respectively.

Scenario Outcomes

5.4 A summary of the average annual household growth for each of the scenarios is presented in Table 5 and Figure 8. The average annual household change ranges from 1,970–2,368 under the most recent 2012-based headship rates (HH-12). Under the 2008-based headship rates (HH-08) the average annual dwelling growth is higher, ranging from 2,071–2,482.

Table 5: Cornwall scenario average annual household growth (2012–2035)

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Average Annual Household Growth</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>HH-12</td>
</tr>
<tr>
<td>PG-17Yr</td>
<td>2,368</td>
</tr>
<tr>
<td>SNPP-2012</td>
<td>2,194</td>
</tr>
<tr>
<td>PG-5Yr</td>
<td>1,970</td>
</tr>
</tbody>
</table>
5.5 The general pattern resulting from the HH-12 outcomes is for a lower rate of household growth compared to the HH-08 scenarios (Figure 8)

![Figure 8: Average Annual Household Growth (2012–2035) HH-12 and HH-08 comparison](image)

### Issues for Consideration

5.6 This report provides demographic growth scenarios for Cornwall Council, presenting household growth and change under both the 2012-based and 2008-based projections (HH-12 and HH-08 respectively).

5.7 The DCLG 2012-based household projections replace the previous 2011-based interim projections, providing new assumptions on future rates of household formation, incorporating more detail from the 2011 Census.

5.8 The 2012-based household projections, in conjunction with the 2012-based SNPP, provide a new ‘benchmark’ for local housing requirements evidence. In line with the PPG, these projections should form the ‘starting point’ for the assessment of future housing requirements. However, the PPG also states that:

> “Wherever possible, local needs assessments should be informed by the latest available information. The National Planning Policy Framework is clear that Local Plans should be kept up-to-date. A meaningful change in the housing situation should be considered
in this context, but this does not automatically mean that housing assessments are rendered outdated every time new projections are issued.”

(PPG Paragraph 2a-016-20150227)

5.9 This latest DCLG 2012-based household projection data has provided national and local authority projections and assumptions for the total number of households by age-group and relationship-status group (i.e. Stage One). DCLG intends to release additional data (Stage Two) which enables disaggregation of these projections by each of seventeen household types, although a date for future release of this information has not been set. Whilst this new data will provide further detail to the household outputs, it is not expected that they will change the household growth assumptions implied by the Stage One, which will continue to provide the controlling totals for each local authority district.

5.10 Whilst the SNPP-2012 scenario provides the suggested starting point for the objective assessment of housing need, the alternative ‘trend-based’ outcomes presented by the PG-5Yr and PG-17Yr scenarios should be given due consideration, given the likely impact of the recession upon recent migration flows and given the continuing uncertainty with regard to future international migration impacts.

5.11 It is also recommended that the Council considers further analysis of the links between future demographic change and forecasts of economic growth, as recommended by the PPG.
Appendix A

Scenario Outcomes (2010–2035)

A.1 The population change and annual average net migration for the 2010–2035 plan period are presented for Cornwall (Table 6).

A.2 Scenarios are ranked (high to low) according to the expected population growth over the 2010–2035 plan period. The tables also show the estimated average annual net migration (internal and international).

Table 6: Cornwall scenario outcomes 2010–2035

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Change 2010–2035</th>
<th>Average Annual Net Migration</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Population Change</td>
<td>Population Change %</td>
</tr>
<tr>
<td>SNPP-2012</td>
<td>104,280</td>
<td>19.7%</td>
</tr>
<tr>
<td>PG-17Yr</td>
<td>103,125</td>
<td>19.5%</td>
</tr>
<tr>
<td>PG-5Yr</td>
<td>87,462</td>
<td>16.5%</td>
</tr>
</tbody>
</table>
Appendix B

POPGROUP Methodology

Forecasting Methodology

B.1 Evidence is often challenged on the basis of the appropriateness of the methodology that has been employed to develop growth forecasts. The use of a recognised forecasting product which incorporates an industry-standard methodology (a cohort component model) removes this obstacle and enables a focus on assumptions and output, rather than methods.

B.2 Demographic forecasts have been developed using the POPGROUP suite of products. POPGROUP is a family of demographic models that enables forecasts to be derived for population, households and the labour force, for areas and social groups. The main POPGROUP model (Figure 9) is a cohort component model, which enables the development of population forecasts based on births, deaths and migration inputs and assumptions.

B.3 The Derived Forecast (DF) model (Figure 10) sits alongside the population model, providing a headship rate model for household projections and an economic activity rate model for labour-force projections.

B.4 The latest development in the POPGROUP suite of demographic models is POPGROUP v.4, which was released in January 2014. A number of changes have been made to the POPGROUP model to improve its operation and to ensure greater consistency with ONS forecasting methods.

B.5 The most significant methodological change relates to the handling of internal migration in the POPGROUP forecasting model. The level of internal in-migration to an area is now calculated as a rate of migration relative to a defined ‘reference population’ (by default the UK population), rather than as a rate of migration relative to the population of the area itself (as in POPGROUP v3.1). This approach ensures a closer alignment with the ‘multi-regional’ approach to modelling migration that is used by ONS.

B.6 For detail on the POPGROUP methodology, please refer to the POPGROUP v.4 user manual, which can be found at the POPGROUP website: http://www.ccsr.ac.uk/popgroup/index.html
Figure 9: POPGROUP population projection methodology.
Figure 10: Derived Forecast (DF) methodology

\[
D_{a,s,u,y,d,g} = \frac{P_{a,s,u,y,g} \cdot R_{a,s,u,y,d,g}}{100}
\]

- \(D\): Derived Category Forecast
- \(P\): Population ‘at risk’ Forecast
- \(R\): Derived Category Rates
- \(a\): Age-group
- \(s\): Sex
- \(u\): Sub-population
- \(y\): Year
- \(d\): Derived category
- \(g\): Group (usually an area, but can be an ethnic group or social group)
Appendix C
Data Inputs & Assumptions

Introduction

C.1 Edge Analytics has developed a suite of demographic scenarios for Cornwall using POPGROUP.

C.2 The POPGROUP model draws data from a number of sources, building an historical picture of population, households, fertility, mortality and migration on which to base its scenario forecasts. Using the historical data evidence for 2001–2013, in conjunction with information from ONS sub-national projections, a series of assumptions have been derived which drive the scenario forecasts.

C.3 In the following sections, a narrative on the data inputs and assumptions underpinning the scenarios is presented.

Population, Births & Deaths

Population

C.4 In each scenario, historical population statistics are provided by the mid-year population estimates for 2001–2013, with all data recorded by single-year of age and sex. These data include the revised mid-year population estimates for 2002–2010, which were released by the ONS in May 2013. The revised mid-year population estimates provide consistency in the measurement of the components of change (i.e. births, deaths, internal migration and international migration) between the 2001 and 2011 Censuses.

C.5 In the SNPP-2012 scenario, future population counts are provided by single-year of age and sex to ensure consistency with the trajectory of the ONS 2012-based SNPP.
**Births & Fertility**

C.6 In each scenario, historical mid-year to mid-year counts of births by sex from 2001/02 to 2012/13 have been sourced from ONS Vital Statistics.

C.7 In the **SNPP-2012** scenario, future counts of births are specified to ensure consistency with the official projections.

C.8 In the **PG-5Yr** and **PG-17Yr** scenarios, a ‘local’ (i.e. area-specific) age-specific fertility rate (ASFR) schedule, which measures the expected fertility rates by age in 2013/14, is included in the POPGROUP model assumptions. This is derived from the ONS 2012-based SNPP.

C.9 Long-term assumptions on changes in age-specific fertility rates are taken from the ONS 2012-based SNPP.

C.10 In combination with the ‘population-at-risk’ (i.e. all women between the ages of 15–49), the area-specific ASFR and future fertility rate assumptions provide the basis for the calculation of births in each year of the forecast period.

**Deaths & Mortality**

C.11 In each scenario, historical mid-year to mid-year counts of deaths by age and sex from 2001/02 to 2012/13 have been sourced from ONS Vital Statistics.

C.12 In the **SNPP-2012** scenario, future counts of deaths are specified to ensure consistency with the official projections.

C.13 In the **PG-5Yr** and **PG-17Yr** scenarios, a ‘local’ (i.e. area-specific) age-specific mortality rate (ASMR) schedule, which measures the expected mortality rates by age and sex in 2013/14 is included in the POPGROUP model assumptions. This is derived from the ONS 2012-based SNPP.

C.14 Long-term assumptions on changes in age-specific mortality rates are taken from the ONS 2012-based SNPP.

C.15 In combination with the ‘population-at-risk’ (i.e. the total population), the area-specific ASMR and future mortality rate assumptions provide the basis for the calculation of deaths in each year of the forecast period.

March 2015
Migration

**Internal Migration**

C.16  In all scenarios, historical mid-year to mid-year estimates of in- and out-migration by five year age group and sex from 2001/02 to 2012/13 have been sourced from the ‘components of population change’ files that underpin the ONS mid-year population estimates. These internal migration flows are estimated using data from the Patient Register (PR), the National Health Service Central Register (NHSCR) and Higher Education Statistics Agency (HESA).

C.17  In the SNPP-2012 scenario, future counts of internal migrants are specified, to ensure consistency with the official projections.

C.18  In the alternative ‘trend’ scenarios, age-specific migration rate (ASMigR) schedules are derived from the area-specific historical migration data. In the PG-5Yr scenario, a five year history is used (2008/09 to 2012/13). In the PG-17Yr scenario, a seventeen year history of net migration is used (1996/97–2012/13) therefore the in- and out-migration rates are the same. This excludes the impact of flows of internal migration prior to Cornwall becoming a Unitary Authority (i.e. flows within what is now Cornwall).

C.19  In the case of internal in-migration, the ASMigR schedule of rates is applied to an external ‘reference’ population (i.e. the population ‘at-risk’ of migrating into the area). This is different to the other components (i.e. births, deaths and international migration), where the schedule of rates is applied to the area-specific population. In the case of Cornwall, the UK population is used as the reference population.

**International Migration**

C.20  Historical mid-year to mid-year counts of total immigration and emigration from 2001/02 to 2012/13 have been sourced from the ‘components of population change’ files that underpin the ONS mid-year population estimates. Any ‘adjustments’ made to the mid-year population estimates to account for asylum cases are included in the international migration balance.

C.21  Implied within the international migration component of change in all scenarios is an ‘unattributable population change’ (UPC) figure, which ONS identified within its latest mid-year
estimate revisions. The POPGROUP model has assigned the UPC to international migration as it is
the component with the greatest uncertainty associated with its estimation.

C.22 In all scenarios, future international migration assumptions are defined as ‘counts’ of migration.
In the SNPP-2012 scenarios, the international in- and out-migration counts are drawn directly
from the official projections.

C.23 In the alternative ‘trend’ scenarios, the international in- and out-migration counts are derived
from the area-specific historical migration data. In the PG-5Yr scenario, a five year history is used
(2008/09–2012/13) and in the PG-17Yr scenario, a ten year history is used (2003/04 to 2012/13).
An ASMigR schedule of rates is derived from the five year (PG-5Yr scenario) and ten year (PG-
17Yr scenario) migration history and is used to distribute future counts by single year of age.

Households

C.24 The 2011 Census defines a household as:

“one person living alone, or a group of people (not necessarily related) living at the same
address who share cooking facilities and share a living room or sitting room or dining
area.”7

C.25 For each scenario, the household-growth implications of the population growth trajectory have
been evaluated through the application of headship rate statistics and communal population
statistics. These data assumptions have been sourced from the 2001 and 2011 Census and the
2012-based and 2008-based household projection models from the DCLG.

Household Headship Rates

C.26 The DCLG household projections are derived through the application of projected household
representative rates (also referred to as headship rates) to a projection of the private household
population. A household headship rate (also known as household representative rate) is the

“probability of anyone in a particular demographic group being classified as being a household representative”.

C.27 In the scenarios presented here, headship rate assumptions have been sourced from the new 2012-based household projection model and from the earlier 2008-based model, producing two alternative outcomes for each scenario:

- In the HH-12 outcome, the 2012-based DCLG headship rates are applied.
- In the HH-08 outcome, the 2008-based DCLG headship rates are applied, scaled to be consistent with the 2011 DCLG household total, but following the original trend thereafter.

2012-based Headship Rates

C.28 The 2012-based headship rates have been sourced from the new 2012-based household projection model from DCLG. The methodology used by DCLG in its household projection models consists of two distinct stages:

- **Stage One** produces the national and local authority projections for the total number of households by sex, age-group and relationship-status group over the projection period. All Stage One output and assumptions for the 2012-based household projection model have been released by DCLG.

- **Stage Two** provides the detailed ‘household-type’ projection by age-group, controlled to the previous Stage One totals. Stage Two assumptions and output for the 2012-based model have yet to be released by DCLG.

C.29 In POPGROUP, the 2012-based headship rates are defined by age, sex and relationship status. These rates therefore determine the likelihood of person of a particular age-group, sex and relationship status being head of a household in a particular year, given the age-sex structure of the population.

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**2008-based Headship Rates**

C.30 The 2008-based headship rates are provided by age-group and household type and therefore define the likelihood of a particular household type being formed in a particular year, given the age-sex profile of the population. Household-types are modelled with a 17-fold classification (Table 7).

Table 7: Household type classification

<table>
<thead>
<tr>
<th>ONS Code</th>
<th>DF Label</th>
<th>Household Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>OPM</td>
<td>OPMAL</td>
<td>One person households: Male</td>
</tr>
<tr>
<td>OPF</td>
<td>OPFEM</td>
<td>One person households: Female</td>
</tr>
<tr>
<td>OCZ2P</td>
<td>FAMC0</td>
<td>One family and no others: Couple: No dependent children</td>
</tr>
<tr>
<td>OC1P</td>
<td>FAMC1</td>
<td>One family and no others: Couple: 1 dependent child</td>
</tr>
<tr>
<td>OC2P</td>
<td>FAMC2</td>
<td>One family and no others: Couple: 2 dependent children</td>
</tr>
<tr>
<td>OC3P</td>
<td>FAMC3</td>
<td>One family and no others: Couple: 3+ dependent children</td>
</tr>
<tr>
<td>OL1P</td>
<td>FAML1</td>
<td>One family and no others: Lone parent: 1 dependent child</td>
</tr>
<tr>
<td>OL2P</td>
<td>FAML2</td>
<td>One family and no others: Lone parent: 2 dependent children</td>
</tr>
<tr>
<td>OL3P</td>
<td>FAML3</td>
<td>One family and no others: Lone parent: 3+ dependent children</td>
</tr>
<tr>
<td>MCZDP</td>
<td>MIX C0</td>
<td>A couple and one or more other adults: No dependent children</td>
</tr>
<tr>
<td>MC1P</td>
<td>MIX C1</td>
<td>A couple and one or more other adults: 1 dependent child</td>
</tr>
<tr>
<td>MC2P</td>
<td>MIX C2</td>
<td>A couple and one or more other adults: 2 dependent children</td>
</tr>
<tr>
<td>MC3P</td>
<td>MIX C3</td>
<td>A couple and one or more other adults: 3+ dependent children</td>
</tr>
<tr>
<td>ML1P</td>
<td>MIX L1</td>
<td>A lone parent and one or more other adults: 1 dependent child</td>
</tr>
<tr>
<td>ML2P</td>
<td>MIX L2</td>
<td>A lone parent and one or more other adults: 2 dependent children</td>
</tr>
<tr>
<td>ML3P</td>
<td>MIX L3</td>
<td>A lone parent and one or more other adults: 3+ dependent children</td>
</tr>
<tr>
<td>OTAP</td>
<td>OTHHH</td>
<td>Other households</td>
</tr>
<tr>
<td>TOT</td>
<td>TOTHH</td>
<td>Total</td>
</tr>
</tbody>
</table>

**Communal Population Statistics**

C.31 Household projections in POPGROUP exclude the population ‘not-in-households’ (i.e. the communal/institutional population). These data are drawn from the DCLG 2012-based household projections, which use statistics from the 2011 Census. Examples of communal establishments include prisons, residential care homes and student halls of residence.
For ages 0–74, the number of people in each age group ‘not-in-households’ is kept fixed throughout the forecast period. For ages 75–85+, the proportion of the population ‘not-in-households’ is recorded. Therefore, the population not-in-households for ages 75–85+ varies across the forecast period depending on the size of the population.