



Emerging plan for consultation

Appendix 2: Data input
assumptions & commentary

January 2022

Appendix 2. Data input assumptions & commentary

Arguably the most critical element of the August 2021 reconciliation inputs was the bringing together of data for the supply-demand balance (SDB) position and the regional supply / transfer options in line with Environment Agency 'SDB data guide' and 'tables' template prior to the reconciliation process. Throughout autumn 2021, this has enabled exploration of water resource resilience at a national and regional level, including water transfers within and between different regions. The technical methods underpinning water resources planning are complex; given that the current publication is a milestone towards the final Regional Plan and water company WRMP24s, at this stage there are some key assumptions in the data inputs. This section aims to provide a concise commentary to the data inputs, focussed on the following key aspects, as appropriate:

- Brief explanation of the updated data and new methods used where relevant; statement to confirm and explain position linked to the Environment Agency data guide.
- Context in terms of key assumptions, such as data profiling through the planning period, use of previous studies in interim, where new data expected by later stages etc., as required.
- Explanation of alignment or key differences (as appropriate) between regional datasets across different resource zones.

The commentary is provided by major data components, in line with the Environment Agency data guide.

Data component	Jan-22 supporting data position	WReN commentary
Base year	Start year is 2019/20, but base not specified	Our base year is 2019/20 across the region. The start year is 2019/20 for all demand components. However, the demand data has either been uplifted to reflect the impact of Covid on future demand or the forecast from 2019/20 or for some water resource zones the forecast has been rebased to 2020/21 which includes the impact of Covid and lockdown. Either way all water resource zones include the impact of Covid in the demand forecasts from 2020/21.
Planning period	2020 to 2080, with 2080 to 2100 optional	We have provided a forecast to 2085 (i.e., over a 60-year horizon). The core focus of the reconciliation is on the period 2025 to 2050, in line with the standard minimum 25-year planning horizon for the Statutory WRMP24s.
Supply forecast and options	Implement supply options in baseline scenario that are either delivered by 2025, or and those planning for implementing after 2025 with PR19 funding.	The only WReN resource zone with existing planned supply options is the Yorkshire Grid. The WRMP19 final planning solution for this zone included delivery of two supply side schemes by 2025. A 2MI/d deployable output benefit is currently included in the Yorkshire Grid to represent one of the schemes, which is currently being investigated ahead of a licence application being submitted. The benefit of the scheme is based

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		<p>on the licence volume and will be updated once modelling is carried out to identify the true benefit in the Yorkshire Grid conjunctive system under the 1:500-year DO.</p> <p>A second borehole was planned for delivery by 2025 with a 6MI/d benefit from 2025/26 onwards, but this has been removed from the Yorkshire Water capital programme and therefore also removed from the relevant data input. This scheme would relocate an existing groundwater abstraction point for resilience purposes and is not essential for closing the WRMP19 deficit. The existing abstraction is listed on the Environment Agency's pre-WRMP licence information data and, although a sustainability reduction is not anticipated, we will review its status with the Environment Agency before proceeding with the relocation.</p>
<p>Drought resilience and measures</p>	<p>Deployable output under 1 in 500-year scenario without the use of level 4 restrictions</p>	<p>Since the publication of the PR19 tables the Kielder WRZ and the Industrial WRZ have been merged, PR19 tables for the Kielder WRZ included the potable demand for the Industrial customers and the Industrial WRZ was the non-potable water used in the various processes by these same customers. Merging the two zones does not change the DO of the Kielder WRZ as the non-potable and potable demand is separate.</p> <p>All water companies have followed the latest guidance to determine the drought resilience of their WRZs, with appropriate methods applied based on the complexity and nature of the zones. For the two strategic conjunctive-use WRZs (Grid and Kielder) system response modelling has been carried out using stochastic datasets for the first time. These are also the two WReN zones that could be most impacted by future water trading.</p> <p>For the East SWZ the stochastic time series have been analysed using a simple threshold exceedance spreadsheet model. In the smaller groundwater dominated WRZs (Hartlepool and Berwick & Fowberry) a drought library approach has been used. In all cases the hydrological inputs to the models have been based on stochastic data sets for rainfall and PET, for the first time in the region.</p> <p>Where system response modelling has been carried out, the 1 in 500 Deployable Output has been calculated based on the frequency of combined demand and storage trigger-based failures as defining Level 4 restrictions in the analysis. For the</p>

Data component	Jan-22 supporting data position	WReN commentary
		<p>groundwater WRZs analysis of the stochastic timeseries was carried out to select a 1 in 500 hydrological event to model. Further work will be undertaken to build a 'drought library', rather than using a single event, in order to assess the drought resilience of these zones more fully.</p> <p>It should be noted whilst the application of stochastic data for the first time marks a step-change in modelling sophistication for the WReN region, it does flag areas of insight and questions related to the stochastic data itself. We are continuing to analyse this data which could result in changes to the numbers presented in this submission. It is our understanding that as well as WReN, a number of other regions are also either further investigating the basis of the stochastic data to better understand their results or revising aspects of the stochastic data for further modelling later in the regional or WRMP process. This creates the likelihood for shifts in the supply forecasts results in future. We will engage with other regions and regulators as appropriate where the implications and consequences of stochastic data are being explored.</p> <p>We have included the benefit of customer use restrictions in the 'drought measures benefits' planning estimates. However, no benefit has been attributed to DO for drought permits and orders.</p>
Climate change	Appropriate approach within each region, regarding use of UKCP18 products (use of RCM and/or probabilistic projections in line with guidance)	<p>Results of the Regional Climate Models (RCMs), for the 2070's, from the latest UK Climate Projections 2018 (UKCP18) projections, have been used in our assessment of the potential impacts of climate change on water resources for public water supply.</p> <p>All water companies have used the RCP8.5 (high emissions) scenario as the basis for DO modelling, as data is spatially coherent and allows for consistent modelling to be carried out across the region (or between regions) in future.</p> <p>In the two strategic conjunctive-use WRZs (Grid and Kielder), and the East SWZ, all 12 RCM scenarios were applied to a sample of the stochastic data and run through rainfall-runoff models to produce inputs for resource modelling. In the remaining WRZs a sample of the 12 RCM scenarios were applied to the drought scenarios and re-run through the groundwater models.</p>

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		<p>The RCP8.5 scenarios are based on a high climate emissions scenario, and as such the DO impacts produced are often significantly higher than the equivalent (non-regionally coherent) climate products used in WRMP19. As a result, we have scaled down the modelled DO impacts from the high (RCP8.5) to a medium (RCP6) emission scenario, using a method developed by Atkins which uses a temperature-based scaling equation (Atkins - WRSE Climate Data Tools Scaling Report v0.4). This is comparable with the approach taken by some other regions. Climate change impacts have been scaled back to 1990, which therefore assumes that the DO estimated in the start of the planning horizon already includes some climate change impacts.</p>
<p>Confirmed sustainability changes</p>	<p>The DO reduction of any confirmed sustainability changes and consistent with WINEP and WRMP24 figures.</p>	<p>The outcomes from ongoing AMP7 Water Resources WINEP investigations could influence the magnitude of any loss to PWS DO in the regional plan. Until these investigations are completed the outcomes will remain uncertain and for this reason, we have not included any sustainability reductions linked to these investigations in the pre-reconciliation supply-demand balance. Acknowledging that uncertainty with the outcomes from these investigations will remain until they are completed, we will include sensitivity-testing around the potential impact of larger sustainability reductions in the plan, where relevant. See Appendix 6 for further details.</p> <p>The outcomes of the AMP7 investigations are also likely to influence the magnitude of any loss to PWS DO linked to Environmental Destination - see row below and Appendix 6.</p>
<p>Environmental destination</p>	<p>Indicative best estimate of loss to PWS DO, where these can be tangibly defined.</p>	<p>At this stage an indicative best estimate loss to PWS DO cannot be defined. Potential impacts on DO linked to Environmental Destination will be explored through scenario-testing. See Appendix 6 for further details.</p>
<p>Outage allowance and process losses</p>	<p>Outage allowance covering the risk of temporary or short-term losses of supply (both planned and unplanned) and raw water treatment losses</p>	<p>The outage allowances and raw water losses for all WRZs used in WRMP19 have been reviewed and deemed to be appropriate for inclusion. A full reassessment will take place for inclusion in the draft region plan and company WRMPs.</p>

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Population and property forecasts	Local authority population / property numbers as WRMP24 guidance	<p>Updated population and property data sources have led to differences between WRMP19 population and property forecasts and the latest WReN view. Edge Analytics have provided population and property growth for all water resource zones in the WReN region to support a consistent approach. In alignment with WRMP24 Guidance, population and property forecasts have been designed to reflect Local Authority planned growth. For WReN this is the Housing Plan scenario used by all water companies for Baseline forecasts as well as the forecast used to calculate the DMO options. The Housing Plan scenario is a housing-led scenario, with population growth underpinned by each local authority's Local Plan housing growth trajectory. Following the final year of data, projected housing growth in non-London areas returns to the ONS-14 & ONS-16 long-term annual growth average by 2050.</p>
Household consumption	Policy assumption (e.g., 110 l/h/d by 2050) with regional statement	<p>The upward trend in household consumption seen generally across many companies since WRMP19 will result in higher forecasts in the next round of planning compared to WRMP19 projections. The current forecasts have been rebased to 2019 or 2020, and the “new normal” impact of covid and people working from home on demand has been applied to household consumption for all demand scenarios.</p> <p>Work continues to understand the short to medium term impact of Covid on our plans. We continue to participate in collaborative water industry studies and engage with Regulators to understand and discuss covid impacts and how we should consider them in our forecasts. Household projections have been modified to reflect the impact of covid, which has produced a significant increase to household demand, using internal data and analysis from Artesia collaborative project.</p> <p>Where appropriate, water companies have updated their demand management options (metering and water efficiency) which have a direct impact on household consumption. Any adjustments to household consumption take account of behavioural changes and restrictions on movements working from home with the aim to meet the 110 l/h/d target by 2050.</p> <p>The baseline PCC reflects where companies assume no additional enhanced metering or water efficiency activity from AMP8. The ‘policy assumption - reductions to consumption’ will include, where necessary, reductions in consumption to aim to</p>

Data component	Jan-22 supporting data position	WReN commentary
Non-household consumption	Large user forecasts and economic forecasts at a sector level in line with WRMP24 guidance	<p>achieve 110 l/hd/d, by way of water company specific metering and water efficiency strategies. These reductions are not showing a final planning position yet.</p> <p>Non-household demands include the impact of covid. Taking account of the restriction of movements, and closure of schools and workplaces, adjustments have been calculated based on economic predictions where possible. New non-household demand has been included for any new known growth in the region. Non-household demand will not be showing a final WRMP24 planning position yet as work continues to assess these forecasts.</p> <p>For some water resources zones including Kielder, the non-household consumption forecast has been modelled by characterising non-household customers by geographical area and industrial sector. For the Grid zone, the non-household consumption forecast is modelled by industrial sector. Historical regression modelling has been applied to consumption for each sector. Forecasts have then been based upon the appropriate selection of explanatory variables, such as numbers in employment or the level of economic activity (GVA), which most appropriately account for historical trends and variations in demand.</p>
Leakage	Policy assumption (e.g., 50% reduction by 2050) with regional statement	<p>For Northumbrian and Yorkshire, there is a commitment of a 15% reduction in leakage by 2024/25 and this will be achieved in the Kielder and Grid water resource zones. These levels remain static for the Baseline planning period until 2080. For the assumption adjustments to baseline scenario, the reduction in leakage to 50% by 2050 meets the national leakage target set by the National Framework for Water Resources, and as recommended by the NIC. At present, the pace of this reduction varies between companies, although the question of pace also remains a strategic question for all companies as we move forward with the plan.</p> <p>For Hartlepool Water resources zone, leakage has been modelled to reduce by 30% while WRMP24 modelling continues and bearing in mind that the National Framework target of 50% applies nationally. For Hartlepool this would mean that leakage would reduce from 17% of DI down to 12% of DI by 2050. Note that demand management options are currently being reassessed for WRMP24.</p> <p>The policy assumptions for reductions in leakage will not be showing a final planning position yet as all water companies continue to model leakage options.</p>

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Uncertainty	Target headroom - supply, demand, options uncertainty	<p>All water companies are following the UKWIR 2002 methodology to calculate target headroom allowances for each Water Resource Zone (WRZ). This is based on the use of Monte Carlo simulation to combine probability distributions defining uncertainty ranges for key supply and demand components. A review of component assumptions has been undertaken and for most components, the type of probability distribution adopted is unchanged from WRMP19.</p> <p>However, the data and assumptions used to define the distribution parameters (minimum, most likely and maximum etc) have been updated for key components of the Grid and Kielder WRZ headroom assessments, namely S6, S8, D1, D2 and D3. The aim was to incorporate the dominant uncertainty factors with significant influence on the companies' WRMP24 supply-demand balances for their larger WRZs, for this submission. Updated WRMP24 input data for the target headroom models includes deployable output and demand forecasts, and the latest assessments of climate change impacts on supply and demand based on UKCP18 scenarios (using probability distribution assumptions aligned between companies, although this will be subject to further review). Provisional updated target headroom profiles are therefore provided for the Grid and Kielder WRZs, which are the zones that have most materiality when it comes to regional planning and strategic choices. For the smaller zones the target headroom values have either been retained from WRMP19 submissions (Berwick and East WRZs) or calculated based on a fixed percentage of distribution input in line with WRMP19 assumptions (Hartlepool WRZ). For all WRZs, target headroom allowances are held at fixed values in MI/d from 2050 to the end of the planning period.</p> <p>The target headroom allowances provided in this submission should all be regarded as provisional, as this element of the supply-demand balance is still in development. The target headroom models for the three smaller resource zones (Hartlepool, Berwick and Yorkshire East) will need to be updated with WRMP24 data, and the Monte Carlo simulations carried out, whilst further minor amendments to some components within the Grid and Kielder target headroom models may also be required. There may be scope for increased alignment of approach in the</p>

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		<p>assumptions adopted for S6, D1 and D2 which will be reviewed as part of finalising the target headroom models for WRMP24.</p> <p>Further work to finalise the WRMP24 headroom components for both the WReN regional plan and individual company plans may also include a review of headroom percentile glidepaths, to determine whether it may be feasible for the WReN companies to align to a set of benchmarked risk profiles (glidepaths). The final risk profiles adopted are likely to depend on several factors, including the level of resilience of each WRZ to uncertainties within the supply-demand balance, and the views of individual companies and their customers and stakeholders on the balance between future risks and investment choices.</p>
Regional plan supply options	As WRMP24 guidance	<p>We have provided more detail on options in Appendix 5</p> <p>The cost / impacts and availability of the regional transfer options is dependent on WReN's in-region needs. The autumn 2021 reconciliation process did not result in a request from another region for a transfer from WReN. If another region was to request a transfer from WReN in the future, we would need to consider if there was an in-region need for the resource and assess the alternatives using our best value plan options appraisal process.</p> <p>The regional transfer options include exports to United Utilities (UU) from the Kielder Zone. It should be noted that when planning for a 1 in 500 year level of drought resilience and the latest CP18 climate change projections, the supply surplus in the Kielder WRZ is significantly less than that published in NW's WRMP19. Additionally, modelled reservoir storage in Kielder reservoir has reduced from ~75% in a 1 in 200 year drought resilience scenario in its WRMP19 to ~40% in a 1 in 500 year drought resilience scenario in its latest draft WRMP24 forecasts. A 100MI/d export from Kielder reservoir to UU would reduce storage in extreme droughts further. There are also significant cost and environmental implications surrounding the options, including an INNS risk that would need to be mitigated by significant treatment at source. If UU was to request a transfer in the future these risks would need to be considered further.</p>

Data component	Jan-22 supporting data position	WReN commentary
Regional Plan strategic options		<p>The autumn 2021 reconciliation process resulted in strategic cross regional options being selected by some regions. These are listed in the 'regional plan strategic options' table presented in Appendix 9 (Regional reconciliation process). None of the WReN cross regional export options are included as they were not selected by the other regions.</p> <p>Water Resources West (WRW) has an option to reduce or stop an existing import to Yorkshire Water from the Derwent valley reservoirs. The reconciliation outputs from WRW indicated that this option is frequently selected in its optimisation runs, but the transfer could be retained if a strategic regional option to increase the Derwent valley reservoirs could be implemented. The strategic regional options selected in the reconciliation process include an option to reduce/stop the transfer and an alternative to retain the transfer with investment to increase the Derwent Valley reservoirs. The Derwent Valley reservoir increase requires further development through the gated process before it can be considered feasible. As the future of the transfer is uncertain both options have been listed.</p>
Non-PWS regional demand	<p>Based on EA National Framework abstraction data.</p> <p>(Recent actual abstraction data is reflective of the period 2010-2015 and future abstraction data is based on 2050 growth factor)</p>	<p>The data input for non-PWS regional abstraction is for information only to help us work together with representatives of other sectors in our region, to better understand environmental needs and how they may impact on abstraction in order that our plan can adequately reflect likely future water needs across all sectors.</p> <p>Non-PWS abstraction is summarised by WRZ to be consistent with other components and broken down by primary sectors (agriculture, industry, private water</p>

Data component	Jan-22 supporting data position	WReN commentary
		<p>supply, power and 'other' non-PWS sectors) and then by secondary sectors. The split by WRZ omits some outlier abstractions that are included in the National Frameworks 'North' dataset but do not fall within the particular WRZ applicable to the WReN region.</p> <p>The recent actual abstraction data is reflective of the period 2010 to 2015. The future abstraction data provides a forecast for 2050 and is based on 2050 growth factors for each sector. Water still needs to be available for abstraction regardless of whether it is then returned back to the environment. For this reason, recent actual and future abstraction data is given for both 'consumptive only' and for 'consumptive plus non-consumptive'.</p> <p>There is considerable uncertainty with the data, therefore certain assumptions are made:</p> <ul style="list-style-type: none"> • All abstractions are assumed to take place in same location (e.g., does not represent new / emerging abstraction in locations where it does not already take place) • Abstractions previously exempt from licensing e.g., navigation, mineral extraction • industry and trickle irrigation are not included, therefore non-PWS demand is likely to increase • Growth factors have been applied consistently at a national scale based on the licence point-purpose category – however variation between regions, catchments and individual users are probable but won't be reflected in dataset <p>The limitations with future growth data make it difficult to see trends in abstraction from recent actual up to 2050</p>
Environmental destination	Indicative abstraction reductions	Our regional environmental destination baseline assumes no additional reductions in abstraction to achieve our environmental destination (see Appendix 6)

Progress since August and potential for change between January 2022 submission, and draft and final Regional Plan (and WRMP24)

We completed a significant amount of work to create the information and data required to input to the regional reconciliation process at August 2021 input and through autumn 2021. For the first time, this has included working together across water companies at a regional level to develop and apply new methodologies, taking into account new data, guidance and policy. However, the information and data presented in this emerging plan does not represent a final view for our Regional Plan or for company WRMPs, and over the coming months we will be continuing to update it. This will include refining some of our technical input data (notably regarding the impact of stochastics and climate change on our forward supply forecasts), working with other stakeholders to better understand environmental needs and how they may impact on abstraction, and carrying out further work with representatives of other sectors in our region, in order to ensure that our plan adequately reflects likely future water needs across all sectors. In addition, feedback from customers and stakeholders on our emerging plan through informal consultation and again on our updated Regional Plan and draft WRMPs from August 2022, may also result in changes to our plans.

All of this means that much of the information presented in this submission is subject to change. Particular areas where we anticipate that material changes are likely include:

- Supply forecasts (DO), which will be subject to further refinement particularly around how we use stochastic data and how we scale for climate change impacts.
- Outage and process losses are based on WRMP19 values and will be updated.
- Demand forecasts, and in particular the scale, pace and certainty of demand reduction policies including leakage and PCC reductions, the potential need for adaptive planning to handle uncertainty, and an ongoing refinement of our understanding of possible post-Covid demand patterns. Demand management options for WRMP24 have not been finalised in particular metering and water efficiency, all water companies are working towards finalising these options. Further updates are also expected on Non-household demand forecasts.
- Exports, Water companies have been working with Retailers and Inset Appointees (NAVs), further work is required to finalise these forecasts
- Scale and pace of achieving the 1 in 500-year drought resilience in the Yorkshire Grid.
- Sustainability reductions and environmental destination, in particular as we begin to see the outputs from ongoing AMP7 WINEP investigations as well as further engagement with stakeholders at a catchment scale.
- Target headroom, as we refine and explore uncertainty and risk associated with the new stochastic deployable output methods, the UKCP18 climate scenarios and uncertainty related to PCC and leakage reductions.
- Options require further assessment to finalise the costs and benefits, which will impact on the metrics and environmental assessment, and it is possible additional options may be developed. The Government has recently published revised guidance on carbon costing, and we shall update our cost models to reflect this. These updates impact on optimisation runs and they will need to be re-run for the formal submission.
- Option appraisal outputs are indicative based on the data available at the time of writing. The work to date reflects the process we shall use to produce a final planning scenario and pathways, but all optimisation runs will be re-run once the option costs and benefit data is finalised.
- If there is a change to any of the supply-demand balance components this will impact on the baseline and sensitivity testing scenarios and will need to be incorporated into the option appraisal and decision making. The current outputs are still to be finalised, but it should also be noted that the supply-demand needs may also result in a material change to the emerging plan.
- Water companies may include additional metrics in their WRMPs e.g., Yorkshire Water is considering a resilience metric. This may alter the options put forward in the final solution but will not have a material impact on the regional planning process outcomes.

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