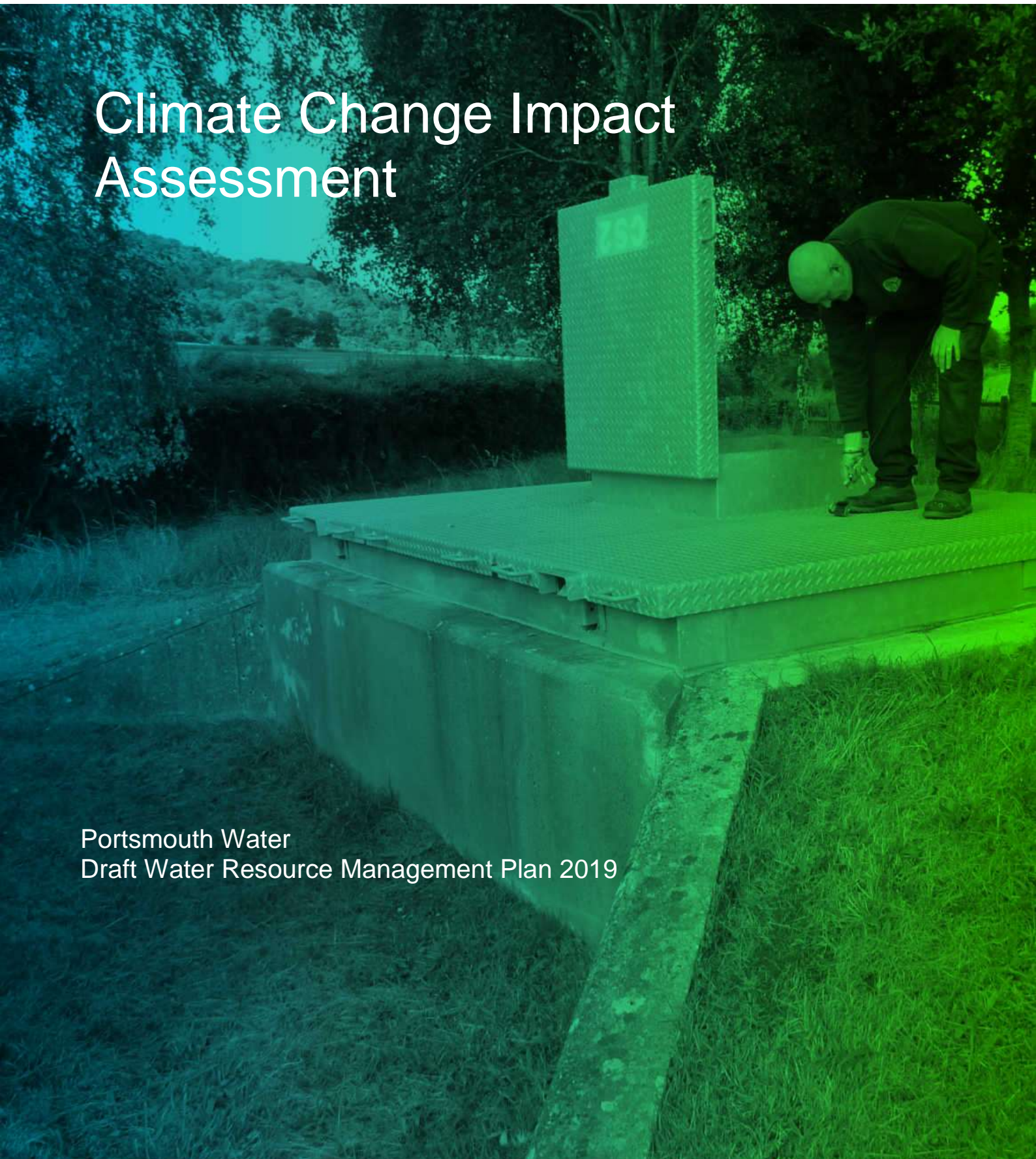


Climate Change Impact Assessment

Portsmouth Water
Draft Water Resource Management Plan 2019



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Executive Summary

AECOM has undertaken the supply calculations on behalf of Portsmouth Water, referred to as a Deployable Output (DO) assessment; the reliable supply over the course of a year is known as Average DO (ADO) and the reliable supply during the summer is known as Peak DO (PDO). Both ADO and PDO are presented in the units of 'millions of litres per day' (or 'Ml/d'). The DO values are representative of reliable outputs that could have been achieved in a historic drought. However the DOs that might be available in a current or future drought may vary in response to a changing climate.

The purpose of this report is to present the methodology and results of the climate change impact assessment, in compliance with the Environment Agency's *Water Resource Planning Guideline (WRPG)* (April 2017), *Estimating impacts of climate change on water supply* (April 2017) and *Climate change approaches in water resources planning – overview of new methods* (2013). The outputs will be considered within Portsmouth Water's decision making tool for the dWRMP19.

A basic climate change vulnerability assessment was completed and this suggests a 'Low Vulnerability' for Portsmouth Water's supply area. This is different from the 'Medium Vulnerability' assessed at WRMP14; the WRMP14 approach was a simple qualitative assessment and the dWRMP19 approach is more sophisticated (it uses a magnitude versus sensitivity plot).

Despite the down-grading of climate change vulnerability from 'Medium Vulnerability' to 'Low Vulnerability', a similar level and complexity of modelling has been applied for the dWRMP19 compared with that for WRMP14.

One hundred sets of climate change factors for the 2080s have been used to adjust climate data, so that climate change impacts on groundwater levels and river flows can be estimated for the 2080s; consequently the impacts have been translated into climate change impacts on DO for the 2080s. The average impact on DO has been scaled back to 2020 to derive profiles (covering the period 2020 to 2080) for use by Portsmouth Water in further supply and demand balance modelling work. In addition the uncertainty around the impact of climate change on DO (the maximum and minimum estimates) is used within the dWRMP19 headroom assessment.

The estimated impact of climate change on DO is presented in the table below. Scaling of climate change impacts from the 2080s to the 2020s has been undertaken according to the revised equation within the regulators' *WRPG* (April 2017) for the dWRMP19. The impact in the year 2020 is more significant when applying the new equation for dWRMP19 (compared to the equations for WRMP14).

Median impact on ADO (Ml/d) in 2020 (dWRMP19 equation)	Median impact on ADO (Ml/d) in the 2080s	Median impact on PDO (Ml/d) in 2020 (dWRMP19 equation)	Median impact on PDO (Ml/d) in the 2080s
-0.9	-2.2	-2.5	-6.1

The methodology and results of the climate change impact assessment are presented within this report. The outputs will be considered within Portsmouth Water's decision making tool for the dWRMP19. The methods comply with the requirements of the WRPG and related guidance.

1 Introduction

1.1 Background

AECOM (incorporating URS) undertook the reassessment of Portsmouth Water's Deployable Output (DO) and the impact of climate change for the Water Resource Management Plan 2014 (WRMP14) submission (see Portsmouth Water, August 2014). This was completed in accordance with the regulators' *Water Resources Planning Guideline* (WRPG) (October 2012) and the supporting guidance in the UKWIR's *WR27 DO Report* (2012) and *A Unified Methodology for the Determination of Deployable Output from Water Sources* (2000).

AECOM has been commissioned to undertake the reassessment of Portsmouth Water's DO for the draft Water Resource Management Plan 2019 (dWRMP19) submission. This reassessment has been completed taking into account the Environment Agency's updated *WRPG* (April 2017) and the supporting *Drought Plan and WRMP Links* (June 2016), and is reported in AECOM's *Deployable Output Assessment Report* (November 2017). Water Resource Zone (WRZ) DO values have been calculated for a range of return periods (a range of drought severities) and the 'worst historic' drought (see Table 1-1 below).

Table 1-1 Summary of WRZ DO results

Return period of DO (related to drought severity)	ADO (Ml/d)	PDO (Ml/d)	MDO (Ml/d)
1 in 20 year	227	280	252
1 in 40 year	217	270	237
Worst Historic	215	267	242
1 in 83 year	212	263	233
1 in 125 year	203	252	235
1 in 200 year	191	236	222
1 in 500 year	185	238	217

These WRZ DO values are representative of reliable outputs that could have been achieved in a historic drought. However the WRZ DOs that might be available in a current or future drought may vary in response to a changing climate.

1.2 The current report

AECOM has been commissioned by Portsmouth Water to undertake the reassessment of the impact of climate change on DO for the dWRMP19 submission. This reassessment has been completed taking into account the Environment Agency's updated *WRPG* (April 2017) and supporting guidance *Estimating impacts of climate change on water supply* (April 2017) and *Climate change approaches in water resources planning – overview of new methods* (2013).

Section 2 of this report outlines the findings of the Portsmouth Water WRZ climate change vulnerability and impact of climate change assessments. Section 3 provides report conclusions.

2 Climate change impact assessment

2.1 Introduction

This section identifies the vulnerability of the Portsmouth Water WRZ to climate change and assesses the likely impact of climate change on WRZ DO.

2.2 Climate change vulnerability assessment

A basic climate change vulnerability assessment for the Portsmouth Water company area was completed in September 2016 by HR Wallingford and was based on outputs from the WRMP14 DO assessment. The report is provided in Appendix A and concludes that Portsmouth Water's single WRZ has a 'Low Vulnerability' to climate change. This is a change from the WRMP14 assessment, which considered the zone to be of 'Medium Vulnerability'. Unlike the previous assessment, the dWRMP19 assessment involved the construction of a magnitude versus sensitivity plot, rather than relying upon a simple qualitative assessment; this more sophisticated approach led to the down-grading of the vulnerability classification.

2.3 Approach to climate change impact assessment

Despite the down-grading of climate change vulnerability from 'Medium Vulnerability' to 'Low Vulnerability', a similar level and complexity of modelling has been applied for the dWRMP19 compared with that for WRMP14. The dWRMP19 climate change impact assessment has involved identifying a representative sample of 100 climate change scenarios from the UKCP09 10,000 member ensemble for the 2080s under a Medium Emission Scenario. The sampling was undertaken by HR Wallingford and the accompanying report is provided in Appendix B.

The subsequent rainfall and potential evapotranspiration monthly factors have been applied by AECOM to the stochastic climate data (from the Water Resources in the South East group) to understand climate change impacts on groundwater levels at Idsworth Well and on surface water flows in the River Itchen during a 'dry year' (the event associated with the 1 in 20 year WRZ DO). These impacts have been translated to individual sources (using the DO assessment models), such that climate change impacts for the 2080s can be assessed.

2.4 Results of climate change impact assessment

The outputs from the WRZ model for the 100 climate change scenarios are shown within the graphs in Figure 1. However a summary of the ADO, PDO and MDO results is provided in Table 2-1 and a summary of the climate change impacts is provided in Table 2-2.

The results provide 'lower range' and 'upper range' estimates of climate change impacts, which are to be used within the dWRMP19 headroom assessment. The 'most likely' climate change impact is to be used within Portsmouth Water's decision making tool for testing of the supply and demand balance.

The 2080s impacts have been scaled back to the 2020s (resulting in a set of profiles) using the revised equation presented within the Environment Agency's Climate change river flows supplementary information revised April 2017; this results in a most likely climate change impact of -0.9 MI/d ADO in 2020 and -2.5 MI/d PDO in 2020.

The 2080s impacts have also been scaled back to the 2020s using the equations under the WRMP14 approach, which are designed to avoid a major step change between baseline deployable output and the underlying climate change trend; this results in a most likely climate change impact of -0.5 MI/d ADO in 2020 and -1.4 MI/d PDO in 2020.

For the Portsmouth Water WRZ the most likely climate change impacts are small relative to the baseline DO, such that the impact of the dWRMP19 approach (relative to the WRMP14 approach) on the supply demand balance is expected to be minimal.

Table 2-1 Median, minimum and maximum DOs for the 2080s

Portsmouth Water WRZ	ADO (MI/d)	PDO (MI/d)	MDO (MI/d)
Median	223	274	240

Portsmouth Water WRZ	ADO (MI/d)	PDO (MI/d)	MDO (MI/d)
Minimum	149	184	172
Maximum	242	296	266

Table 2-2 Climate change impacts for the 2080s

Portsmouth Water WRZ	ADO (MI/d)	PDO (MI/d)	MDO (MI/d)
Likely impact	-2.2	-6.1	-6.0
Lower range of impact	-76.9	-95.9	-73.6
Upper range of impact	16.2	16.1	19.9

3 Conclusions

The draft climate change vulnerability assessment for the Portsmouth Water area was based on outputs from the WRMP14 DO assessment and was completed in September 2016. The assessment uses a more sophisticated approach than the WRMP14 vulnerability assessment and concluded that Portsmouth Water's single WRZ has a 'Low Vulnerability' to climate change.

Despite the down-grading of climate change vulnerability from 'Medium Vulnerability' to 'Low Vulnerability', a similar level and complexity of modelling has been applied for the dWRMP19 compared with that for WRMP14. The climate change impact assessment involved identifying a representative sample of 100 climate change scenarios from the UKCP09 10,000 member ensemble for the 2080s under a Medium Emission Scenario. The subsequent rainfall and PET monthly factors have been applied to the stochastic climate data and lumped parameter models to understand climate change impacts on regional groundwater levels during the 1 in 20 year event. These impacts have been translated to individual groundwater sources such that climate change impacts on the output of groundwater sources for the 2080s can be assessed.

The results provide 'lower range' and 'upper range' estimates of climate change impacts, which are to be used within the dWRMP19 headroom assessment. The 'most likely' climate change impact is to be used within Portsmouth Water's decision making tool for testing of the supply and demand balance. The 2080s impacts have been scaled back to the 2020s (resulting in a set of profiles) using the revised equation presented within the Environment Agency's Climate change river flows supplementary information revised April 2017 and also the equations used at WRMP14.

The revised dWRMP19 equation results in a company-wide climate change impact of -0.9 MI/d ADO in 2020 and -2.5 MI/d PDO in 2020. The WRMP14 equation results in a company-wide climate change impact of -0.5 MI/d ADO in 2020 and 1.4 MI/d PDO in 2020. The company-wide impact increases to -2.2 MI/d ADO and -6.1 MI/d PDO by the 2080s.

4 References

AECOM (November 2017), *Deployable Output Assessment Report*

Environment Agency (April, 2017), *Water Resources Planning Guideline*

Environment Agency (April, 2017), *Estimating impacts of climate change on water supply*

Environment Agency (June, 2016), *Drought Plan and WRMP Links*

Environment Agency (2013), *Climate change approaches in water resources planning – overview of new methods*

Environment Agency (October, 2012), *Water Resources Planning Guideline*

Portsmouth Water (August 2014), *Final Water Resources Management Plan 2014*.

UKWIR (2000), *A Unified Methodology for the Determination of Deployable Output from Water Sources*. Reference 00/WR/18/1.

Appendix A. Climate change vulnerability assessment

Appendix B. Climate change assessment

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