20th Century Problems, 21st Century Solutions: Groundwater in the north-west of England

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Presentation Objectives

- UU supply system
- Groundwater issues in the NW - 20th Century problems
- dWRMP - Supply/demand; an uncertain future?
- Back to the future… - 21st Century solutions
UU supply system

- 7 million people, 2.9 million households, 0.2 million businesses
- 1900 ML/d (average) into supply, 4 resource zones
UU supply system

- 7 million people, 2.9 million households, 0.2 million businesses
- 1900 ML/d average into supply, 4 resource zones
- 2000 km of aqueducts/large diameter trunk mains
- £4.5 billion on drinking water improvements since privatisation
Regional Resources

- Carlisle Resource Zone
- North Eden Resource Zone
- West Cumbria Resource Zone
- Integrated Resource Zone

Cities:
- Carlisle
- Workington
- Whitehaven
- Penrith
- Lancaster
- Blackpool
- Preston
- Blackburn
- Burnley
- Southport
- Wigan
- Bolton
- Crewe
- Oswestry

- Morecambe Bay

- Liverpool
- Birkenhead
- Manchester
- Oldham
- Rochdale
- Macclesfield

Other cities:
- Barrow
- Macclesfield
- Manchester
- Oldham
- Rochdale
- Birkenhead
- Liverpool

Map by United Utilities
Welcome to the NW of England.

Groundwater Resources

- West Cumbria
- Eden Valley
- Pennine sources
- Fylde LCUS
- Wirral
- Cheshire, Merseyside

15% of total supply
What does groundwater abstraction look like?

- Over 150 licensed sources
- Important input to UU’s supply especially in IRZ
- Peak Demands
- Low risk – geology, high S, high T
- Apart from….  
- Water quality
- AMP3 – process solutions – “let’s treat it” – financial issues
- AMP4 – do we have to treat?
More NO$_3$

Eden Valley, Cumbria
Eden Valley – conceptual model

THIN GLACIAL DRIFT COVER

Proposed new borehole
5.25m deep

Existing Pumping Station

Maintain existing bores and blend
with low nitrate water from new borehole

PENRITH SANDSTONE
EXPOSED AT OUTCROP

High Nitrate water
abstracted

LIMITED RECHARGE THROUGH DRIFT

HIGH NITRATE RECHARGE WATER

Nitrate concentrations in
Penrith Sandstone
decrease with depth in aquifer
(<10mg/l as NO₃ @ -100 mOD)

Borehole cased to
preclude high
nitrate water

LOW NITRATE WATER AT DEPTH
Eden Valley - Simplified radial flow model
‘scavenger’ type multiwell system
Long record of abstraction

Why?
Integration...?

- Large transfer systems
- 70% of customers receive water via LDTM
A finite resource…?
UU dWRMP aims

- Water supply/demand forecasts over the period to 2035
- To identify the best possible water resources and demand strategy
- To adapt to meet the challenge of climate change
- To ensure that abstraction from our water resources is sustainable
- To ensure our plans deliver the needs and priorities of our customers and other stakeholders
Key Challenges for dWRMP

- **Water Availability**

- Source Yield: 2024 ML/d (2007/08) to 1947 ML/d (2034/35)

- Sustainability reductions (HD, RSA): $-46$ ML/d at 2014/15

- Huge range in predictions (+130 to -516 ML/d)

- Central estimate predicts $-31$ ML/d by 2034/35

- Total: 77 ML/d

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Key Challenges for dWRMP

- **Supply/demand balance**
- **Demand** → Metering, water efficiency, non-household
- **Leakage**
- **Water source yield > dry weather demand**
- **Why do anything?**
- **Uncertainty** (aka headroom) - what we can’t predict (national approach)

- ▲ >200 ML/d by 2034/35
- -41 ML/d (2014/15); -97 ML/d (2019/20) - IRZ
- -89 ML/d (2024/25); -52 ML/d (2034/35) - IRZ
<table>
<thead>
<tr>
<th>Project/Action</th>
<th>ML/d</th>
</tr>
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<tbody>
<tr>
<td>Groundwater</td>
<td>&gt;50</td>
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<td>New water</td>
<td></td>
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<tr>
<td>Leaks reduction</td>
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<td>Water efficiency</td>
<td>5</td>
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<tr>
<td>Metering</td>
<td>8%</td>
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</table>

Can groundwater meet this challenge?
Is there enough water available?

1992
Is there enough water available?

1997
Is there enough water available?

2007
Certainty in yields?

1970's

2000's

PWL data from 1970s considered to
Climate change effects?
New sources in AMP4

New GW sources in (AMP5/AMP6)

Rationalisation and development AMP5/AMP6
Back to the Future?...Implementing the WRMP

- Detailed appraisal of options
- Combined strategy – demand reduction + enhancements
- Magnitude of climate change scenarios
- Robust and reliable long-term solutions
- Groundwater development – historical legacies – GWQ
- WFD – uncertainty?
- Water resources management
- Sustainability, sustainability, sustainability!

Thank you for listening!