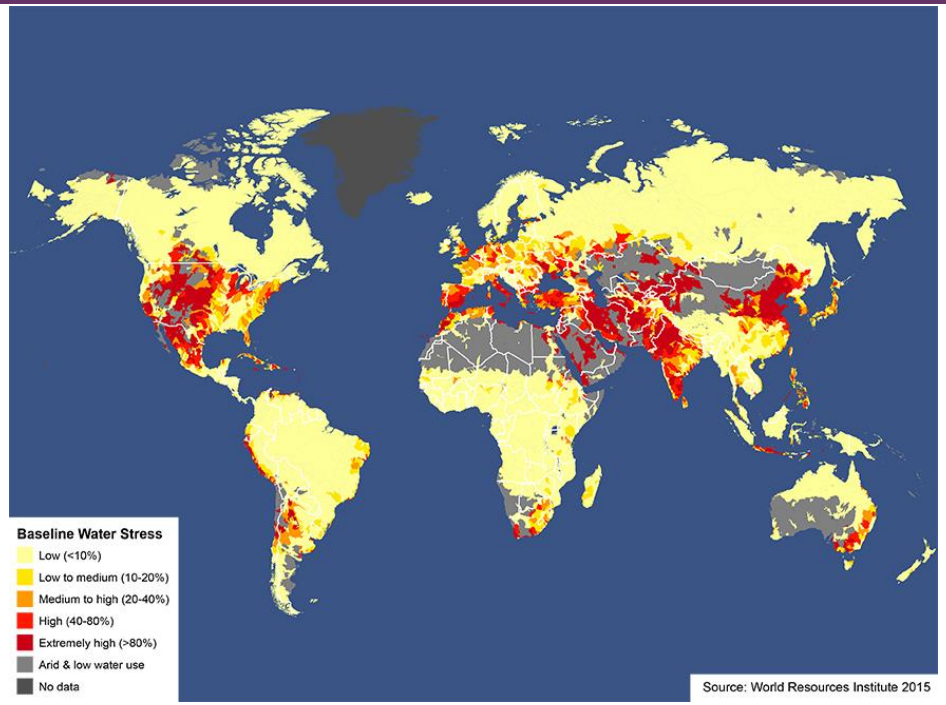
Multi-functionality of the water supply chain: implications for integrated resource management

Prof. Louise Bracken
Executive Director, Institute of Hazard, Risk and Resilience, Durham University

Pammi Sinha and Rebecca Smith
Department of Geography, Durham University

Durham University



Water security and sustainability is a major global concern: socially, economically and environmentally.

Key Challenges

1) Understanding competing uses of water (flooding, supply, treatment, use)

2) Embracing that water is a flux

3) Determining practices for integration

Need to tackle these challenges to meet Sustainable Development Goals

Durham University

Case studies

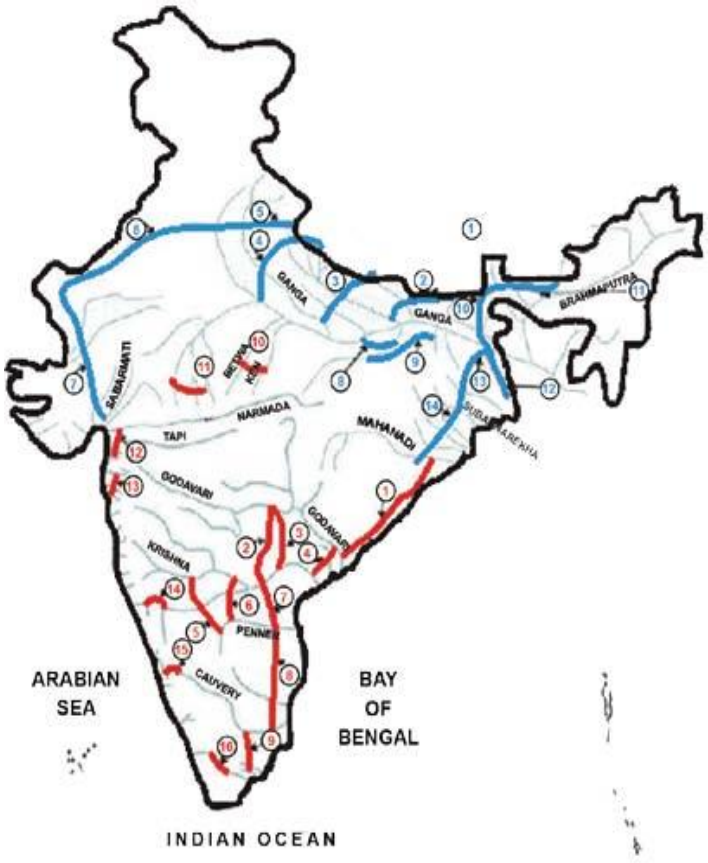
1) Inter-basin water transfer in India

2) Multiple uses of catchments in the UK

Durham University

IBWT in India

- Inter-basin water transfer (IBWT) moves excess water in water-surplus basin to water-deficit basin using engineering structures.
- The Inter Linking Rivers project in India has 30 IBWT links at the inter-state level and 32 IBWT links at the intra-state level.
- Research explores the Sankh-South Koel and South Koel-Subarnarekha links that will function together using existing river channels.



(*Source: Gaur and Amerasinghe 2011)*

Durham University

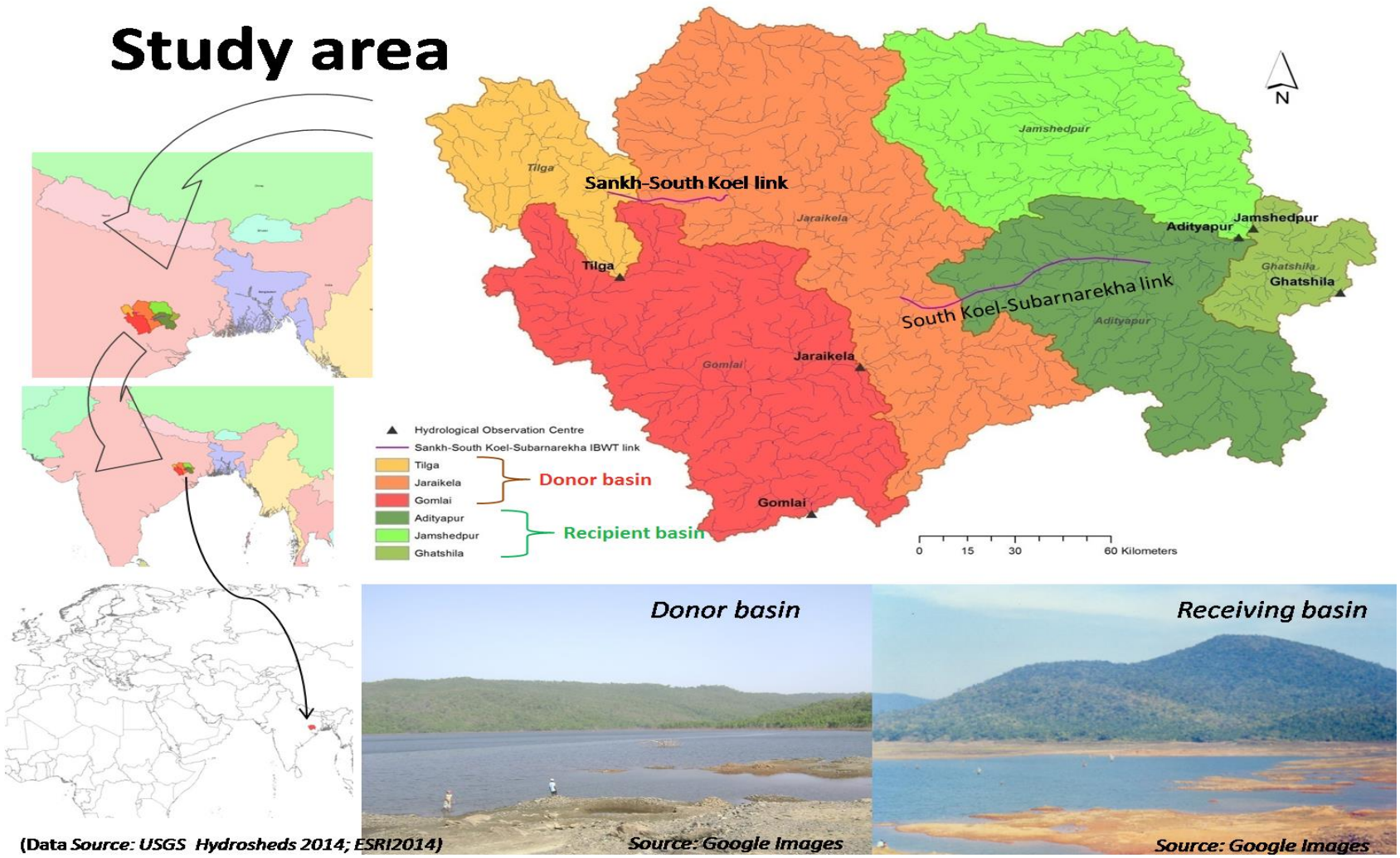


Figure 1: Sankh-South Koel and South Koel-Subarnarekha ILR links with their catchments and their location in India.

Durham University

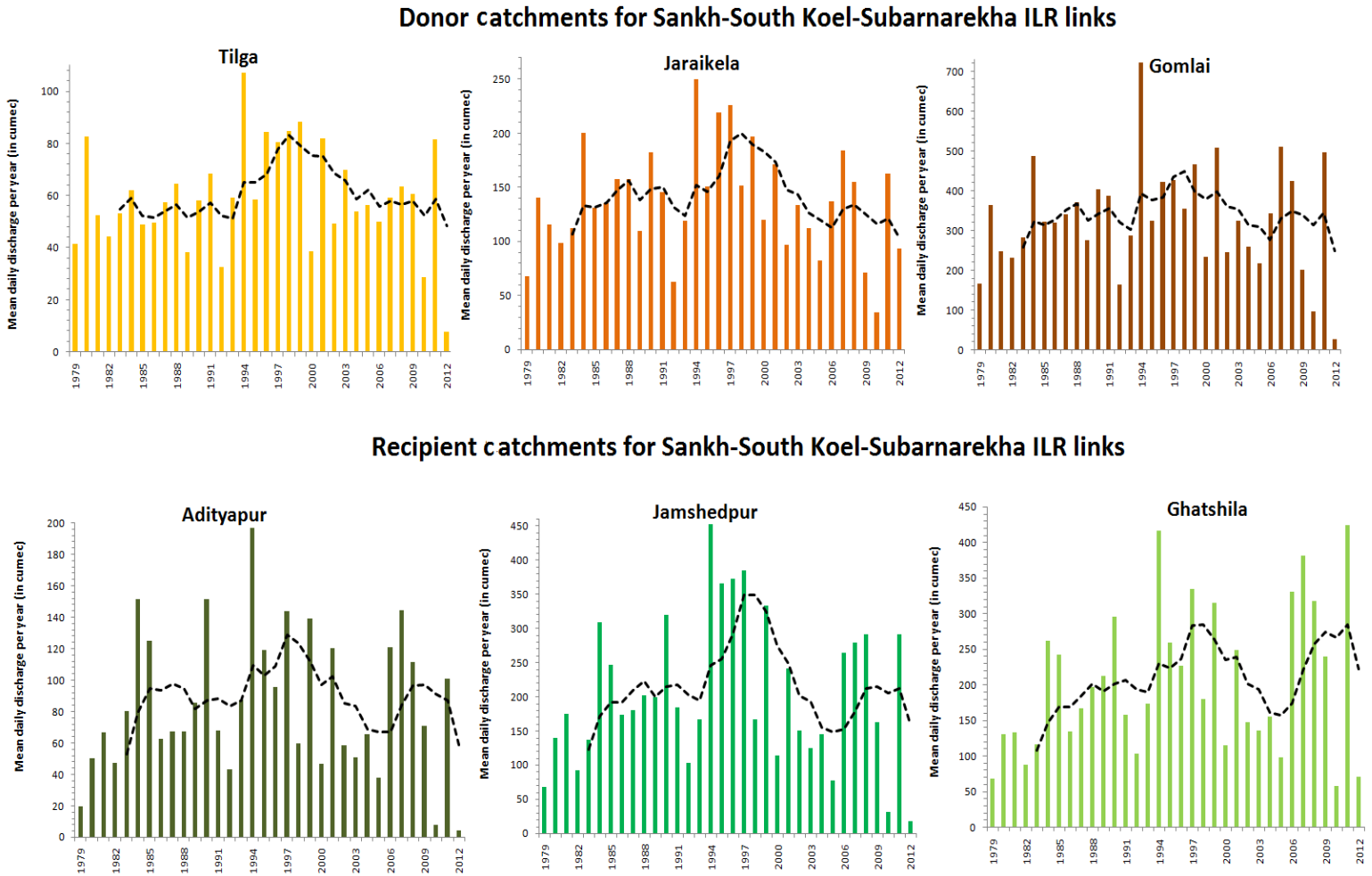


Figure 3: Inter-annual variability in donor and recipient catchments.

Durham University

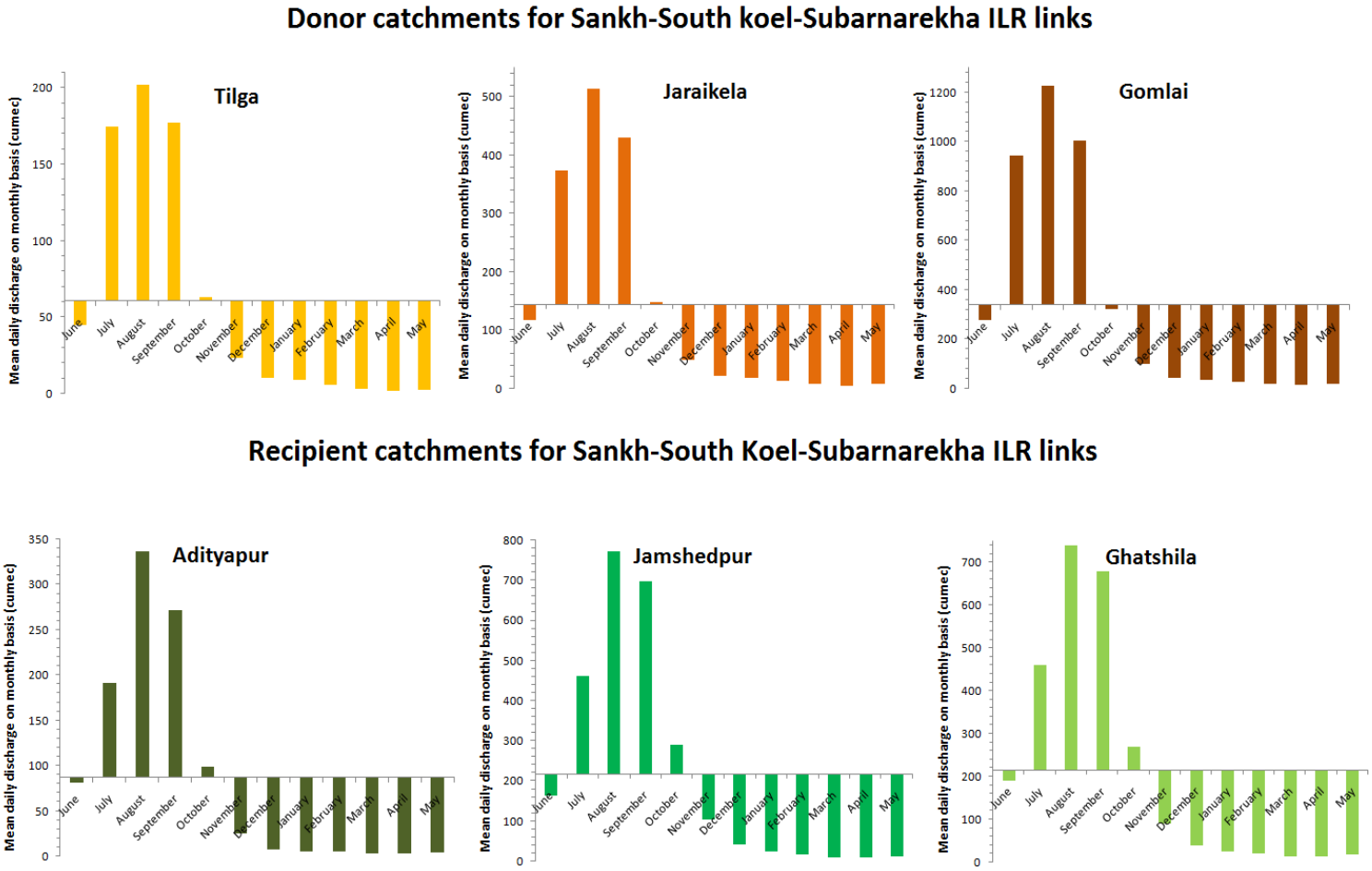
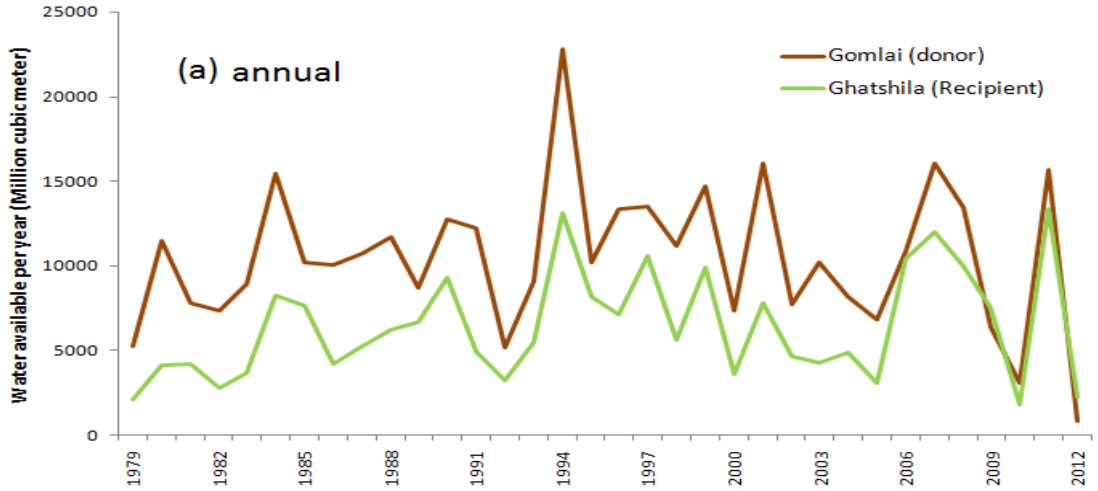


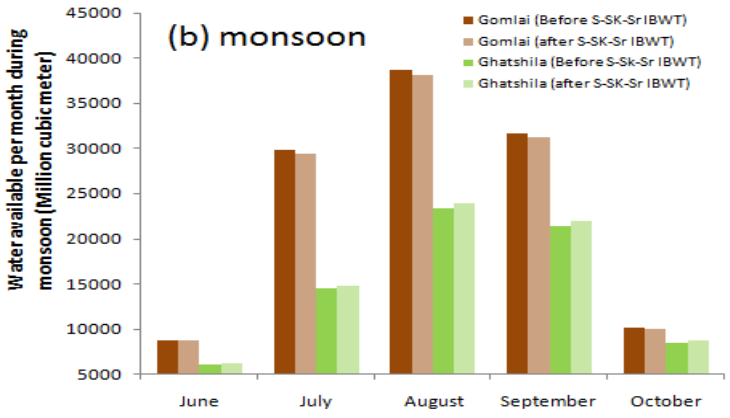
Figure 4: Intra-annual variability in donor and recipient catchments.

Durham University



a. Inter-annual variability

b. Intra-annual variability showing monsoon (June-October) and non-monsoon (November-May) seasonal variation in water availability.



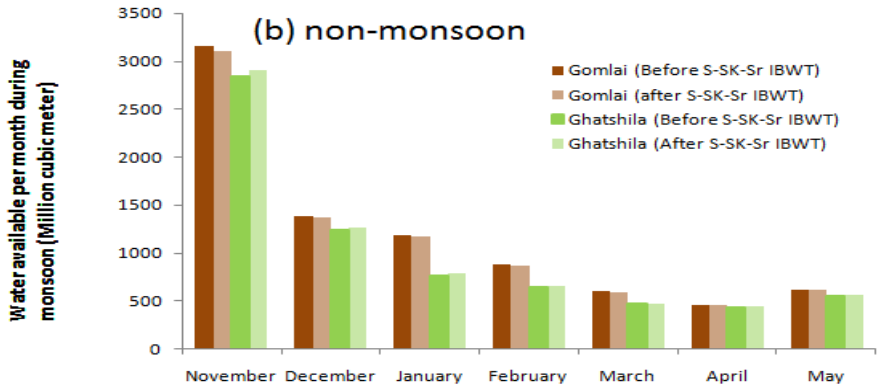


Figure 5: Water availability in donor and recipient catchments

Durham University

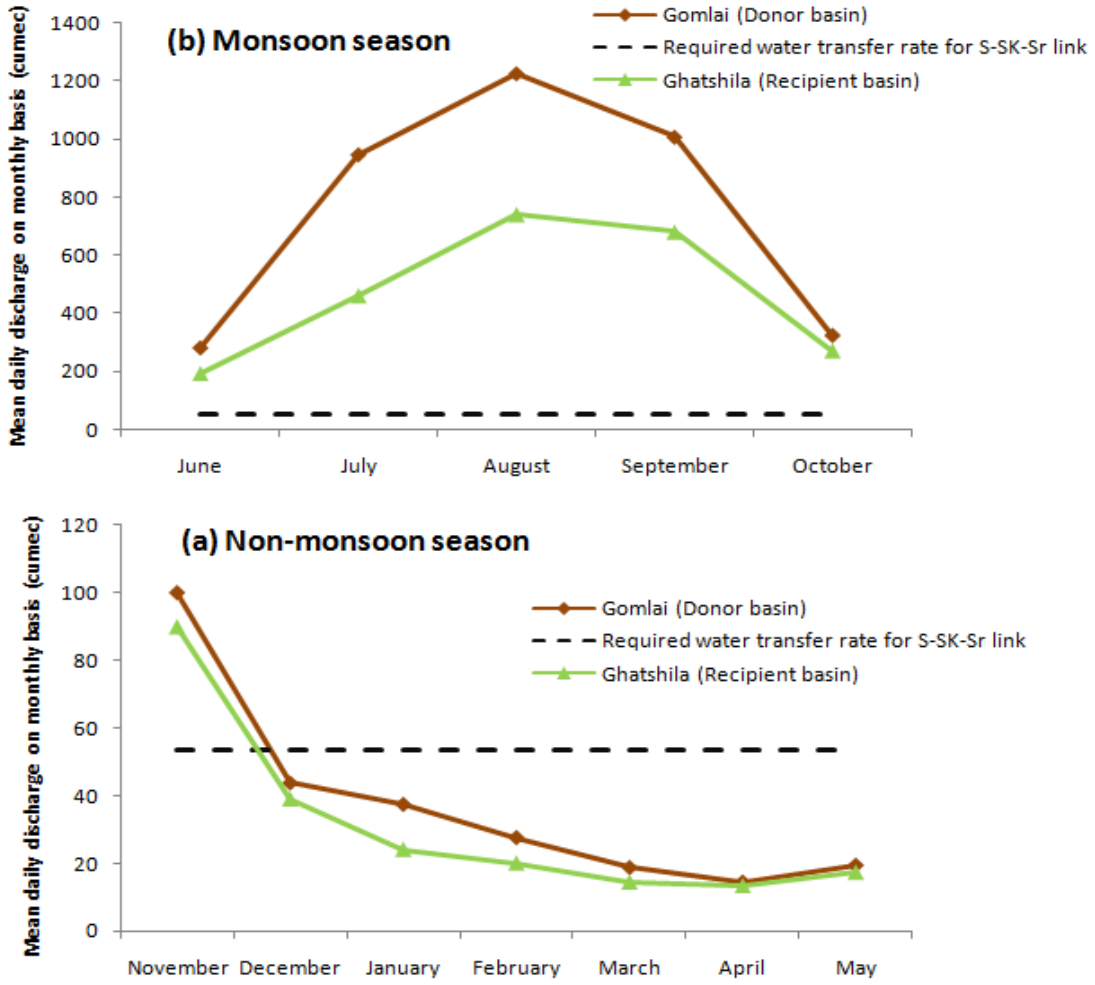


Figure 6: Comparison of mean daily discharge of donor and recipient basins with required water transfer rate by South-koel-Subarnarekha ILR link

Durham University

Note:
Gomlai and Ghatsila represent final outpour points of donor and recipient catchments.

Summary of IBWT in India

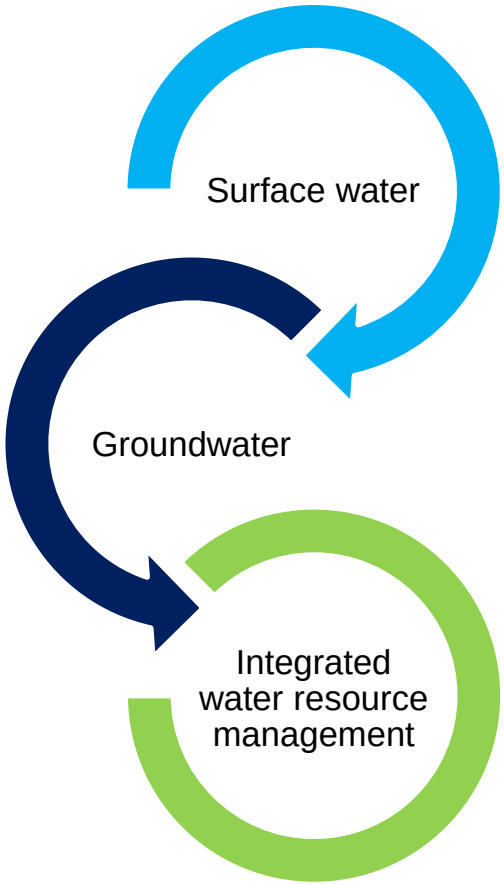
IBWT has been recognized to be a potential panacea for India's water-resource problems.

Socio-hydrological analysis suggests that there are problems:

- On an average 15.7% of water available per annum at Gomlai will be transferred to Subarnarekha basin via S-Sk-Sr link.
- Water transfer will not be viable in non-monsoon season.
- Uncertain climate and water availability
- Spatial understanding of impacts (up- and down-stream, donor and receiver, inundation of land, degradation of river ecosystems, relocation of population)
- Cost-benefit distribution and cost-effectiveness
- Lack of transparency in project and stakeholder engagement

Durham University

Multiple uses of water in the UK

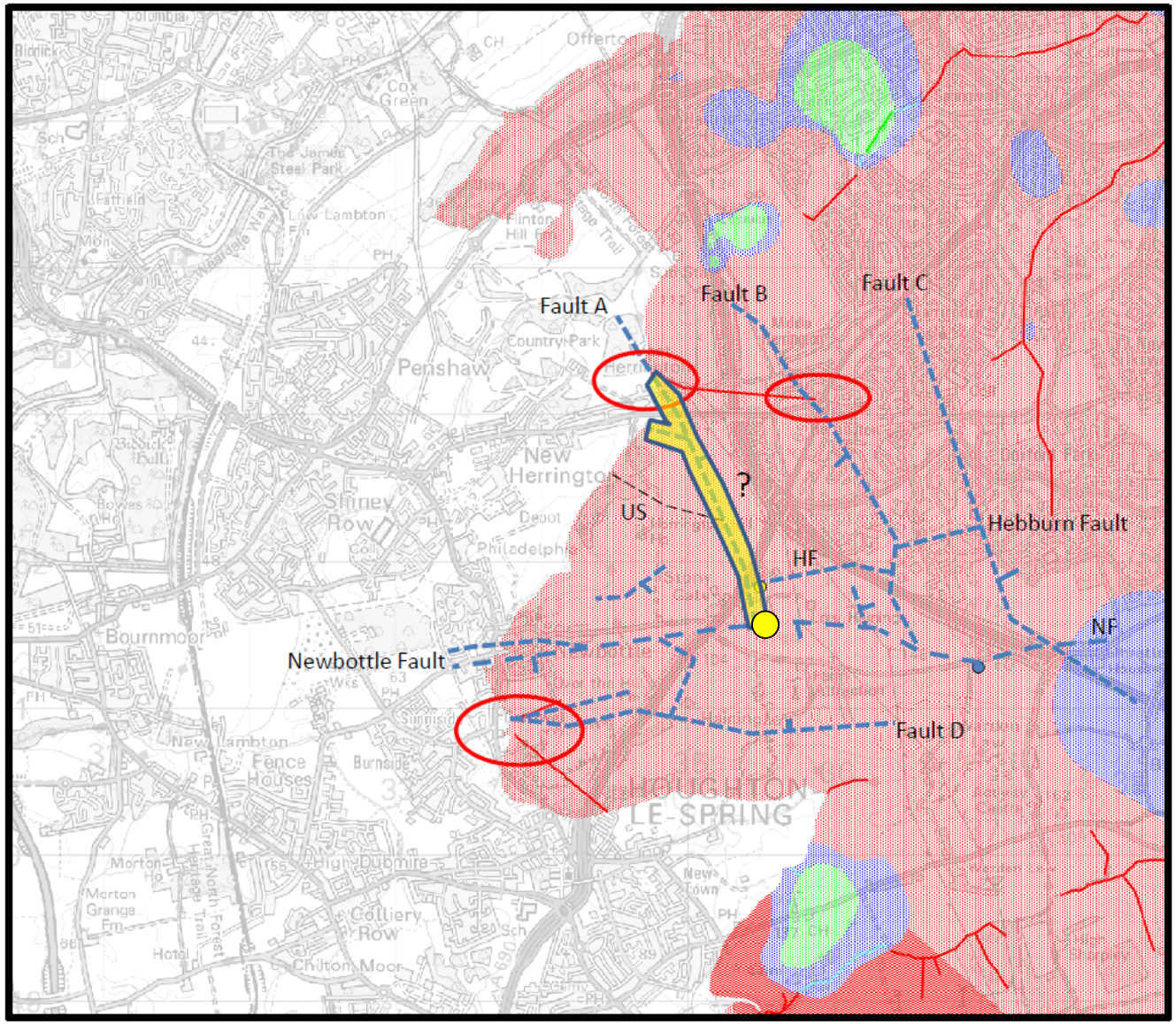


Need to better understand causality and consequence on nature and quality of water fluxes between surface and groundwater to manage the water supply chain effectively.

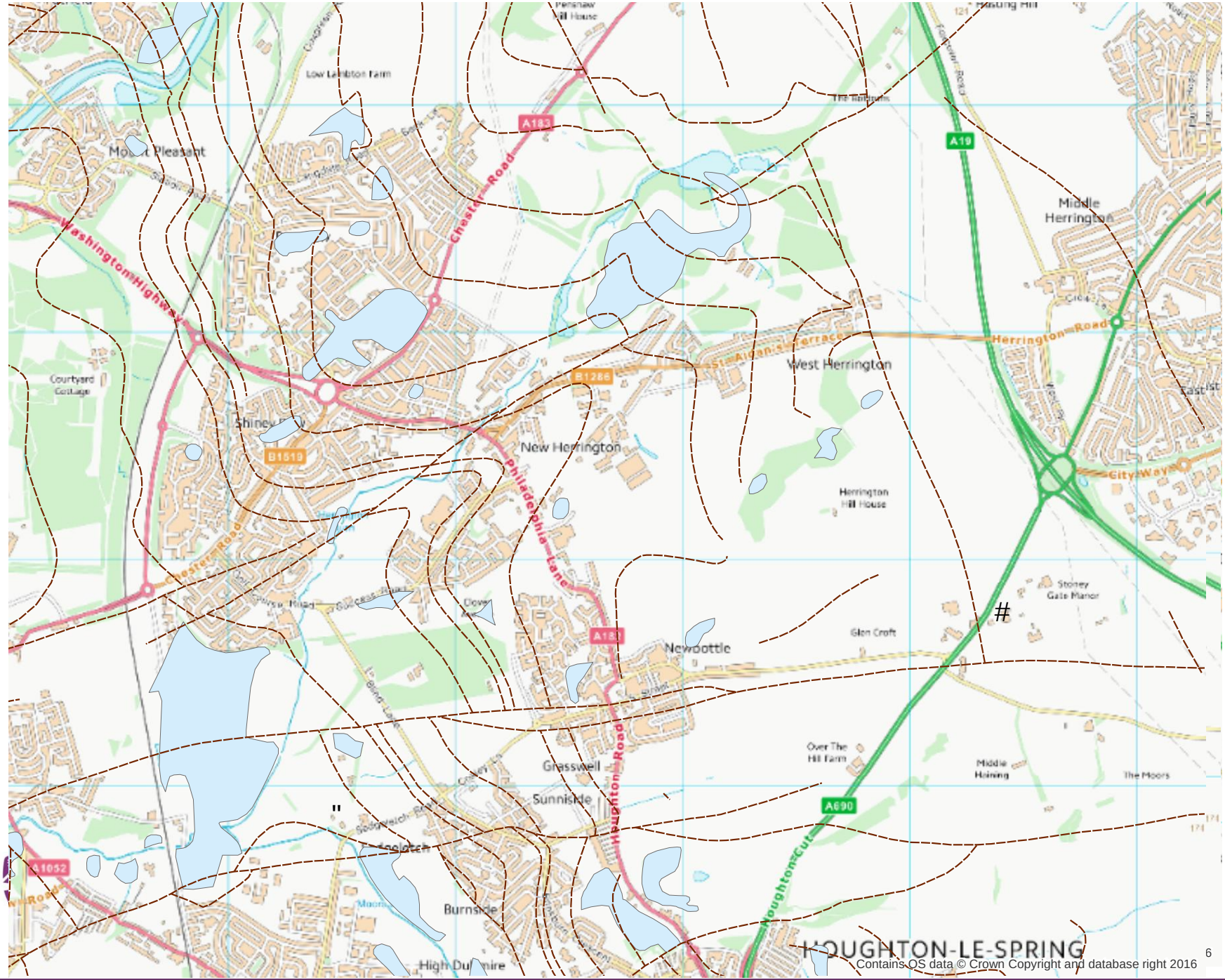
Durham University

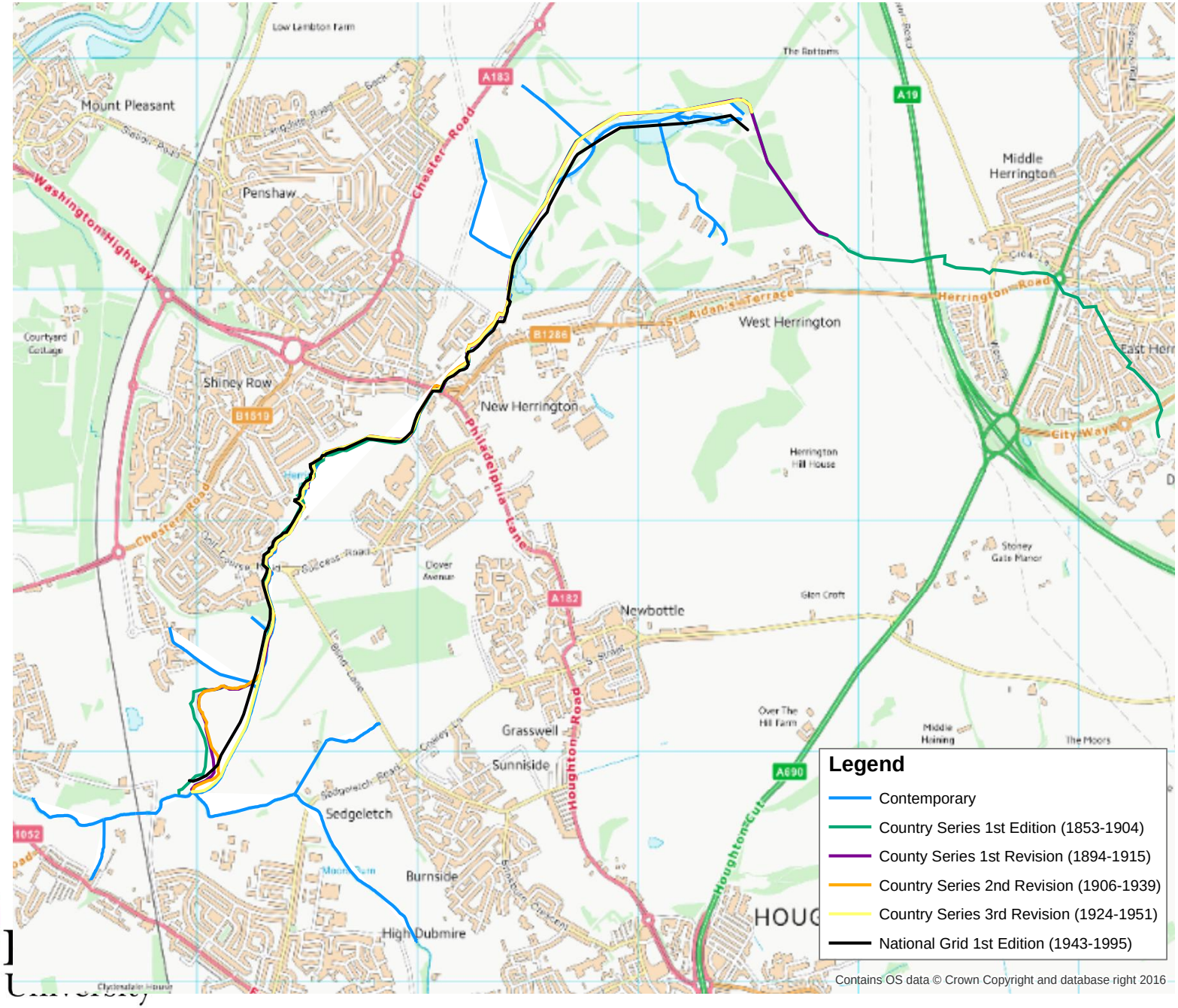
Interreg North Sea Region TOPSOIL

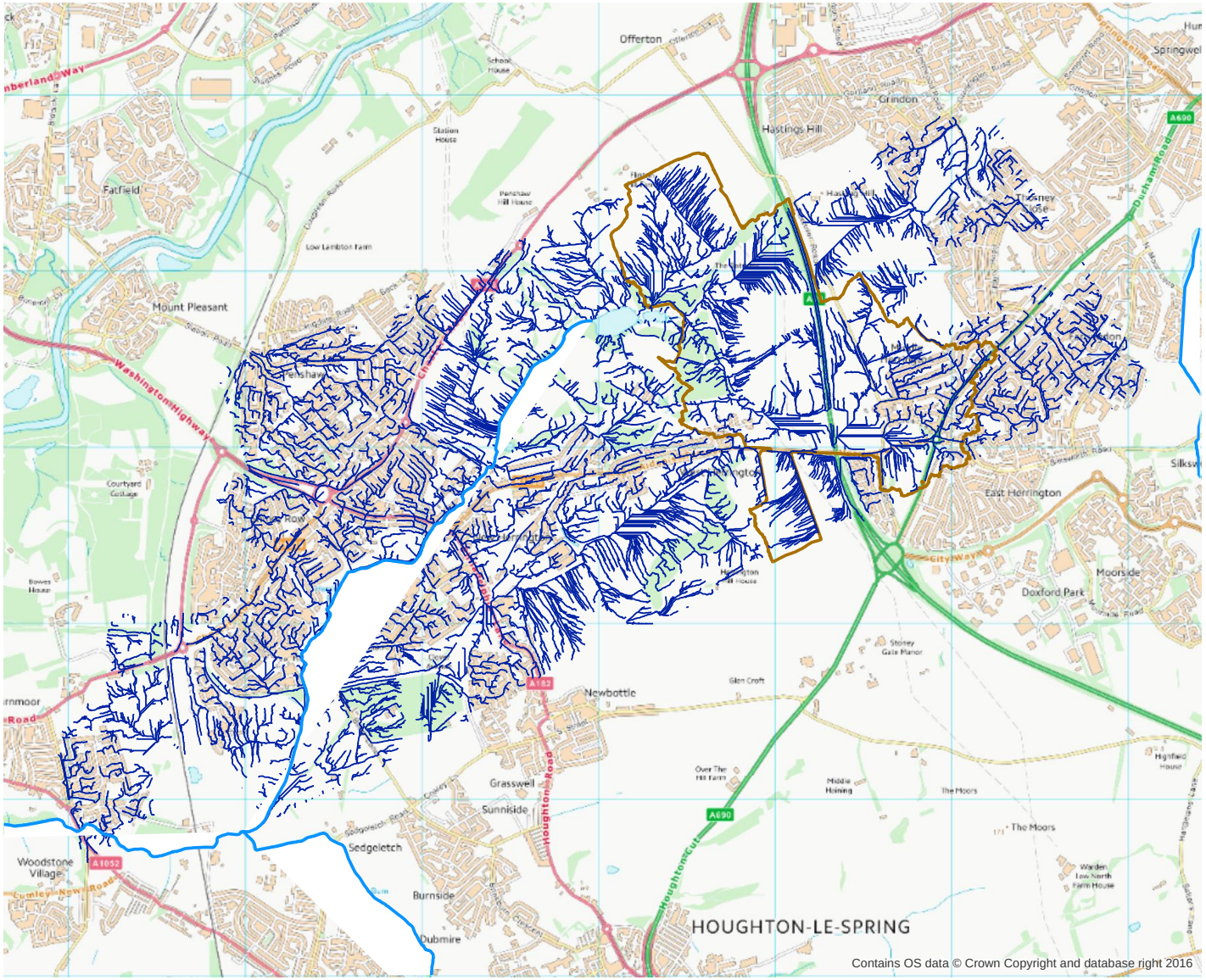
Groundwater Risk Map and Faults in region of Stoneygate Borehole



Durham University




Legend
Contemporary
Country Series 1st Edition (1853-1904)
County Series 1st Revision (1894-1915)
Country Series 2nd Revision (1906-1939)
Country Series 3rd Revision (1924-1951)
National Grid 1st Edition (1943-1995)
Contains OS data © Crown Copyright and database right 2016
Mount Pleasant
Penshaw
Washington Highway
Chester Road
A183
Shiney Row
B1519
B1286
New Herrington
West Herrington
Middle Herrington
Herrington Road
St Aidan's Terrace
City Way
A19
Philadelphia Lane
A182
Newbottle
Houghton Road
Houghton Cut
A690
Grasswell
Sunniside
Sedgeletch
Burnside
High Dubmire
Low Lambton Farm
The Bottoms
Courtyard Cottage
Herrington Hill House
Stoney Gate Manor
Glen Croft
Over The Hill Farm
Middle Hainin
The Moors



Durham University

The water supply chain in the UK

- Uncoordinated catchment development is common.
- Multiple impacts on water resources that are not always recorded.
- Need to think about the interaction of surface water, water infrastructure and ground water.
- Organisations need to work together across the supply chain.
- Detrimental in terms of:
  - In stream water quality (failing WFD)
  - Increased costs of water supply (blending)
  - Biodiversity
  - Complexity of management

Durham University

Summary

1) There are many examples where water resource management is not integrated which produces many detrimental impacts on people and the environment.
2) We need strategic oversight of the water supply chain, that is the ways in which we use water (supply, treatment, abstraction, discharge).
3) Need systemic, integrated approaches for managing the whole water supply chain: across perspectives, organisations and managers.
4) The water supply chain needs to be included in regional development, local planning, flooding, water quality, supply, waste water…..
5) Thinking about the whole water supply chain will help meet our Sustainable Development Goals.

Durham University