Raw water transfer using navigable or formerly navigable waterways

From [1]	To [1]	Waterway (N/P/U)	Date [2]	Distance miles (km) [3]	Type [4]	Operator/water user	Description
Existing water transfer arrangements							
Shincliffe (+=NZ287410)	Fulling Mill Weir Durham (NZ272420)	River Wear (N)	1982	2.4 (3.9)	IC	Northumbrian Water/ Northumbrian Water	Kielder Scheme transfers from the River Tyne at Riding Mill PS (NZ027617) (up to 500 Ml/d) provide support to the River Wear at Frosterley (NZ012372) (upstream of the navigable section) for abstraction at Lumley PS (NZ286502) and WTW (downstream of the navigable section) for public potable water supply.
Farndean Side Ford (NZ373094)	Low Worsall PS (NZ395102)	River Tees (N)	1971 and 1982	3.0 (4.8)	IC	Northumbrian Water/ Teesside industry	Cow Green Reservoir (NY813290) and Kielder Scheme inputs at Eggleston (NZ002226) provide support flows in the River Tees for abstraction at various points upstream of the navigable section, as well as Low Worsall PS (up to 260 Ml/d) (within the navigable section) for industrial water supply.
Sutton Lock (SE474704)	Loftsome Bridge PS (SE702297)	River Derwent (N)	1975	14 (22.5)	C	EA/Yorkshire Water	Barmby Barrage was built to exclude the tide and allow fresh water to be transferred down the river from Sutton Lock for abstraction of up to 150 Ml/d at Loftsome Bridge PS and WTW for pubic potable water supply.
Louth (TF338879) Outfen Lock (TF) Tetney (TA343023)	Covenham (TF354967) Covenham (TF354967) Covenham (TF354967)	Louth Canal (U)	1972	6.7 (10.7) Included above 4.2 (7.4)	C IC C	Anglian Water & EA/ Anglian Water	Abstraction from River Lud at Louth for transfer via Louth Canal to Covenham PS, Reservoir and WTW for public potable water supply. Abstraction at Cloves Bridge PS (TF905468) on Great Eau through 11 km of 914 mm pipeline to Outfen Lock, then via Louth Canal to Covenham Reservoir and WTW for public potable water supply. Backflow in canal from Waithe Beck inputs above the weir downstream of the former Tetney Lock site to Covenham Reservoir and WTW for public potable water supply.
Torksey (SK835781) Bishopbridge (TF031910) Bishopbridge (TF031910)	Short Ferry PS (TF094715) Cadney Bridge PS (SE001029) Appleby Carrs PS (SE980127))	Fossdyke and River Witham (N) River Ancholme (N)	1974	19.0 (30.6) Included below 14.0 (22.5)	IC IC IC	EA/ Anglian Water, British Steel	*Trent-Witham-Ancholme Transfer Scheme* EA pumping station at Torksey can transfer up to 180 Ml/d from the River Trent via the Fossdyke to the River Witham to support abstractions, including EA abstraction at Short Ferry on Barlings Eau via a 18 km pipeline to Toft Newton Reservoir, which feeds the River Ancholme at TF032875 (upstream of navigable section) to support abstraction at: • Cadney Bridge PS (up to 85 Ml/d) (AWS Central Lincs WRZ), via Cadney Carrs Reservoir to Elsham WTW, for public potable water supply; • Appleby Carrs PS (up to 3.75 Ml/d) (British Steel, Scunthorpe) for industrial water supply; • various other abstractions on Rivers Witham and Ancholme.

From [1]	To [1]	Waterway (N/P/U)	Date [2]	Distance miles (km) [3]	Type [4]	Operator/water user	Description
Horseshoe Falls, Llantisilio (SJ197432)	Hurleston WTW (SJ623552)	'Llangollen' Canal (N)	1955	45.8 (73.7)	IC	CRT/ United Utilities, Severn Trent Water, Hafren Dyfrdwy, Dŵr Cymru-Welsh Water	Bala Lake (Llyn Tegid) (1956), Llyn Celyn (1965) and Llyn Brenig (1976) support River Dee flows to support abstractions at: • Horseshoe Falls, with transfer via the canal for abstraction by gravity via a feeder above Hurleston Top Lock of 30-40 Ml/d to Hurleston Reservoir and WTW (UU) for public potable water supply; • Bangor-on-Dee (Bangor-is-y-Coed) PS (SJ387464) (upstream of navigable section of River Dee), via Packsaddle WTW (45.5 Ml/d) (HD), for public potable water supply; • Poulton PS (within navigable section of River Dee), via Bretton WTW (DC-WW), for public potable water supply; • Huntington PS (up to 400 Ml/d) (within navigable section of River Dee), via Huntington WTW (UU), for public potable water supply; • Heronbridge PS (within navigable section of River Dee), supplies industrial users and Sutton Hall WTW (UU) (for public potable water supply).; • Boughton intake (within navigable section of River Dee), via Boughton PS and WTW (Severn Trent Water), for public potable water supply; • Chester Weir PS (within navigable section of River Dee), supplies industrial users and Sutton Hall WTW (UU) (for public potable water supply).
Farndon (SJ413542)	Poulton PS (SJ407592)	River Dee (N)		Included below	C		
Farndon (SJ413542)	Huntington PS (SJ414633)			Included below	C		
Farndon (SJ413542)	Heronbridge PS (SJ412643)			Included below	C		
Farndon (SJ413542)	Boughton intake (SJ418663)			Included below	C		
Farndon (SJ413542)	Chester Weir PS (SJ407658)			12.3 (19.8)	C		
Sudbury (TL873408)	Wormingford PS (TL919331)	River Stour (Suffolk) (P)	1972 and 2013	Included below	IC	EA/ Essex & Suffolk Water (NWL)	*Ely Ouse to Essex Transfer Scheme* EA abstraction at Blackdyke on the Cut Off Channel (TL692882), via a tunnel, Kennett PS, pipelines and an open channel to the River Stour at Great Bradley and a pipeline to the River Stour at Wixoe, to support abstractions at: • Wixoe (TL708431) (upstream of navigable section of River Stour) for transfer to River Pant at Great Sampford (TL644353), to support the River Pant/Blackwater for subsequent abstraction at Langford to Hanningfield Reservoir and WTW, for public potable water supply; • Wormingford PS (within formerly navigable section), for transfer to Abberton Reservoir, which supplies Layer de la Haye WTW, for public potable water supply; • Langham PS (up to 55 ML/d) (within formerly navigable section) to Langham WTW, for public potable water supply; • Stratford St Mary PS and Brantham PS (up to 50 Ml/d together) (within navigable section), for transfer to Abberton Reservoir, which supplies Layer de la Haye WTW, for public potable water supply.
Sudbury (TL873408)	Langham PS (TM025344)			Included below			
Sudbury (TL873408)	Stratford St Mary (TM042342)			Included below			
Sudbury (TL873408)	Brantham (TM101331)			23.4 (37.7)			
Ulting (TL803086)	Langford WTW (TL834086)	Chelmer & Blackwater Navigation (N)	2003	2.3 (3.7)	C	Essex & Suffolk Water (NWL)	Langford re-use scheme. Up to 40 Ml/d of treated sewage from Chelmsford Brookend WWTW can be subjected to additional treatment and discharged to the River Chelmer at Scotch Marsh, Ulting, for abstraction at Langford PS to supply Langford WTW or Hanningfield Reservoir and WTW, for public potable water supply. Used only as drought support, as the scheme is expensive to operate.

From [1]	To [1]	Waterway (N/P/U)	Date [2]	Distance miles (km) [3]	Type [4]	Operator/water user	Description
Hay-on-Wye (SO228426)	Lydbrook (SO602176)	River Wye (P)	1952	63.4 (102)	C	Dŵr Cymru-Welsh Water/ Sever Trent Water	Elan Valley reservoirs are used to support River Wye flows when flow at Redbrook Gauging Station is less than 1900 M/d. This supports public water supply and commercial abstractions, specifically that at Wyelands PS (Lydbrook) (Severn Trent Water), which supplies Mitcheldean WTW, for public potable water supply.
Pool Quay (SJ259115)	Gloucester (SO822182)	River Severn (P)	1967	126.5 (203.5)	C	Severn Trent Water/ South Staffs Water Co Severn Trent Water Bristol Waterworks Co	Llyn Clywedog river regulating reservoir transfers water down River Severn to support abstractions at Hampton Loade WTW (South Staffs Water) and Shelton, Trimpley and Mythe WTWs (Severn Trent Water) and Purton WTW (Bristol Waterworks Co, via Gloucester & Sharpness Canal), all for public potable water supply. River support to the River Seven is also available from Vyrnwy Reservoir and the Shropshire Groundwater Scheme
Gloucester Docks (SO826183)	Purton WTW (SO696038)	Gloucester & Sharpness Canal (N)	1973	14.0 (22.5)	C	CRT/ Bristol Waterworks Co	Abstraction from R Severn to Gloucester Docks, then transfer along the canal to abstraction at Purton WTW for public potable water supply. Abstraction at Gloucester introduces silt into the canal, especially on the 50% of high tides that overtop Llanthony Weir, and Bristol Waterworks Co contributes to the cost of dredging the canal.
Aberdulais (SS774993)	Port Tennant (SS682932)	Tennant Canal (U)	?	8.5 (13.7)	IC	Port Tennant Co	Canal not currently navigable but used to supply water abstracted from the River Neath at Aberdulais to Swansea Docks and industrial users.
Firepool Lock (ST231253)	Northfield, Bridgwater (ST295365)	Bridgwater & Taunton Canal (N)	1962	13.3 (21.3)	C	CRT/ Wessex Water	Abstraction from River Tone at Taunton, then transfer by canal to abstraction of up to 18 Ml/d at Bridgwater to supply Durleigh Reservoir and WTW for public potable water supply.
Tavistock (SX480742)	Morwellham (SX446697))	Tavistock Canal (U)	1933	4.4 (0.71)	IC	South West Water	Canal no longer navigable but used to supply up to 106 Ml/d of water abstracted from the River Tavy at Tavistock to a hydroelectric power station at Morwellham.
Proposed and potential water transfers under discussion (in 2020)							
Vyrnwy Aqueduct	SE England	Various narrow canals (N)		Approx. 170 (274)	IC	CRT/ Various	Various studies have been undertaken by Binnie & Partners for British Waterways (1993), Black & Veatch for Anglian Water (2012) and Black & Veatch for CRT and five water companies (2016) to examine use of the narrow canal system for transfer of surplus water from the north-west/north Wales (for example from Manchester area or from the Vyrnwy to Liverpool Aqueduct near Middlewich) to south east England. Studies concluded that 50 Ml/d could be transferred without enlarging the canal cross-section but with some bank raising, 100 M/d would require towpath narrowing or installation of cantilevered towpaths under bridges, 200 Ml/d would require significant channel works and bridge replacement, while 300 Ml/d would conflict with other canal uses.
Birmingham groundwater sources	Cropredy	Oxford Canal and others (N)		Approx. 60 (97	IC	CRT/ Thames Water	Transfer of up to 11 Ml/d via the Oxford Canal to support abstractions for public potable water supply is included as an option to be investigated further in the Thames Water Resources Plan 2020-2100

From [1]	To [1]	Waterway (N/P/U)	Date [2]	Distance miles (km) [3]	Type [4]	Operator/water user	Description
Stratford	Severn abstraction point	River Avon (Warwickshire) (N) River Severn (N)		45.5 (73.2) to 58.6 (94.3)	IC	CRT/ Thames Water	Transfer of up to 115 Ml/d of treated sewage from Minworth WWTW to the River Avon, thence to the River Severn to support abstraction for Severn-Thames water transfer to support abstractions for public potable water supply in SWOX and London is included as an option in the Thames Water Resources Plan 2020-2100.
Gloucester Docks	Inglesham	Gloucester & Sharpness Canal (N) Cotswold Canals (P)		43.7 (70.3)	IC	CCT/ Thames Water	Transfer of up to 160 Ml/d from the River Severn to the River Thames to support abstractions for public potable water supply is included as an option in the Thames Water Resources Plan 2020-2100. Use of the Cotswold Canals is one option for the transfer.
Birmingham area	Berkhamsted	Grand Union Canal (N)		Approx. 120 (193)	IC	CRT/ Affinity Water	Transfer of up to 50 Ml/d via the GUC from the Midlands, supported by transfer of treated effluent from Minworth Sewage Works, from 2065, to support Affinity Water abstractions in Hertfordshire and west London for public potable water supply.
Boston	Peterborough	Potentially: South Forty Foot (P) River Glen (N) River Welland (P) New waterways		Up to approx. 30 (48.3)	IC	Environment Agency (probably)/ Anglian Water and Affinity Water, also potentially Cambridge Water and Essex & Suffolk Water (NWL)	Options are being examined for the potential contribution to water transfer, in connection with a proposed new South Lincolnshire Reservoir, of the proposed Boston to Peterborough Wetland Corridor (BPWC). The BPWC is an updated version of the Fens Waterways Link scheme and would provide a navigable link from the South Forty Foot drain to the River Nene at Peterborough. Feasibility studies are ongoing for a new South Lincolnshire Reservoir, near Spalding, which would source water from the River Witham, with the output being transferred south towards Peterborough, raising the possibility that the BPWC could contribute to the water transfer route. The feasibility studies involve Water Resources East, one of the five regional water resource planning groups which support the Environment Agency's National Framework for Water Resource Management.

Notes:

The table only includes raw water transfers that make use of navigable or formerly navigable waterways.

The table excludes raw water transfers that take place solely as part of normal waterway operations (such as back-pumping at locks).

Significant transfers of treated water also take place between water undertakers but such transfers do not use waterways, so are not represented at all in the table.

[1] – refers to section(s) of navigable and/or formerly navigable waterway used, not the extent of the whole water transfer scheme

[2] – date water transfer works opened

[3] - distance on navigable or formerly navigable waterway section of water transfer route only, as far as the most downstream abstraction specifically supported by the transfers

[4] – C = within catchment, IC = inter-catchment (refers to the overall raw water transfer scheme)

Abbreviations:

AWS – Anglian Water Services

BPWC - Boston to Peterborough Wetland Corridor

CRT – Canal and River Trust

EA – Environment Agency

HD - Hafren Dyfrdwy

N - navigable by powered craft

NWL – Northumbrian Water Ltd

P - part navigable by powered craft

PS – pumping station

SWOX - Swindon and Oxfordshire water resource zone

U - unnavigable by powered craft

UU - United Utilities

WRZ - water resource zone

WTW – water treatment works (for public water supply)

WWTW – waste water treatment works (sewage treatment works)

Inter-catchment raw water transfer advantages and disadvantages

Advantages	Disadvantages
Water transfer (compared with local measures)	
Potential increased reliability of supply and reduction in the need for water use restrictions during drought in receiving catchment. Potential alleviation of adverse effects of low flows in receiving catchment. Facilitates sharing and more efficient use of water resources of major reservoirs in wetter areas.	High capital costs. Adverse environmental effects of construction. Potential reduction in source catchment of capacity to meet future abstraction demand (can become political, people don't want to lose access to 'their' water). Pumping costs may be high for inter catchment transfers. Potential issues with water quality differences (may affect WFD (retained legislation) compliance, including biological elements, and drinking water standards compliance – need for mitigation may increase costs. Potential adverse effects of low flows in donor catchments (usually addressed by hands-off flow restrictions on use of the transfer scheme). Potential transfer of invasive non-native species. Potential transfer of parasites. May not be the most reliable, cost-effective or environmentally acceptable option for drought mitigation compared with use of local alternative resource (e.g. desalination is a possibility in some cases).
Open channel (compared with pipeline/tunnel)	
Amenity value. Nature conservation value. Potential for multi-use (including navigation). Possible alleviation of low flow problems along transfer route.	Open to ingress of contaminants (from industry, sewage treatment works, septic tanks, combined sewer overflows, agriculture, road drainage, vessels etc), leading to increased water treatment costs and increased waterworks sludge disposal costs, a major problem in relation to pesticides. Head loss where multiple summits involved – leading to higher pumping costs than pipeline.

Note: the alternative of transfer of treated water also needs to be considered in addressing water resource management options.

WFD – Water Framework Directive

John Pomfret, IWA. Updated February 2022