RESOURCE SCHEME COSTINGS
Supplementary Report No 6
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WATER RESOURCES DEVELOPMENT STRATEGY
SUPPLEMENTARY REPORT NO 6

RESOURCE SCHEME COSTINGS

Contents List

TABLES

1 INTRODUCTION

This report is the sixth in a series of nine supplementary reports which provide supporting information for the National Rivers Authority Water Resources Development Strategy document:

"An Environmentally Sustainable Water Resources Development Strategy for England and Wales".

The other reports in the series are as follows:

1 Methodology and Assumptions for Demand Scenarios;
2 Review of Public Water Supply Yields;
3 Marginal Demands;
4 'Other' Options;
5 Hydrological Modelling;
7 RESPLAN Modelling;
8 Comparative Environmental Appraisal of Strategic Options;
9 National Strategy Overview.

This report describes the methodology and results of a review of capital and operating costs for a variety of individual schemes under consideration for development within the National Water Resources Strategy.

The objective of the review is to ensure that a consistent set of scheme costs is produced for input to the RESPLAN modelling work. RESPLAN will be used to help to identify, according to present value (PV) cost, alternative scheme combinations, or strategies, to respond to forecast water supply deficits in England and Wales. The results from RESPLAN form an important part of the information required for the formulation of an environmentally sustainable strategy, and the quality of the input information needs to be assured.

The schemes considered in this review are listed in Table 1 (see end of report) which also shows, for each:

- the level of detail to which the scheme has been studied;
- the date of the most recent study, and the name of the organisation which carried it out;
- titles of reports in which previous study results and cost information are presented.

The review has focused upon ensuring cost estimates are related to a common base date, as well as being prepared to a consistent methodology. As can be seen from Table 1, some cost estimates relate to scheme studies carried out many years ago.

2 REVIEW METHODOLOGY

The types of schemes investigated during this exercise include:

- reservoirs;
- groundwater augmentation;
- effluent reuse;
- river to river transfers;
- pipeline transfers; and
- canal transfers.

When producing a set of consistent costing data it is important to decide upon the component elements for each scheme and the manner of source or link operation. As discussed in Section 3.1.3, all water treatment and local distribution costs have been excluded from scheme costs. In addition, the cost of uprating existing downstream abstraction points (if necessary) has been excluded from regulating reservoir, groundwater augmentation and river to river transfer schemes. Scheme operation and operating costs are discussed in Section 3.1.5.

Once the boundaries of the source and link schemes were defined, it was necessary to classify the level of detail to which the scheme's costs had been previously estimated. In reviewing the various reports, three distinct levels of cost estimate were identified. These were:

(i) Detailed engineering feasibility studies, in which costs had been determined from unit costs and bills of quantities. This level of study was associated in the main with the large reservoir schemes, such as Craig Goch, Great Bradley and the SW Oxfordshire Reservoir development.

(ii) Engineering Studies, in which costs had been determined in general using the Water Research Centre Publication TR61, but with certain schemes costed to a greater level of detail using a combination of recent tender prices, database unit rates and manufacturers' budget costs.

(iii) Preliminary Engineering desk studies where costs have been estimated solely on the basis of TR61 cost functions, eg Halcrow 'Other Options'.

The basis of previous cost estimates for each scheme was studied. To equate these different levels it was decided that the level of contingency applied to the estimates should reflect the amount of work undertaken. The contingency levels adopted are as follows:

- Detailed engineering feasibility studies: 10 to 15%
- Engineering studies: 20%
- Preliminary engineering desk studies: 30%

Following the initial categorisation, the cost estimates were reviewed again to develop a consistent approach to the Water Research Centre's TR61 costing methodology. The TR61 methodology has been used by W S Atkins in all their river transfer studies and by Halcrow in the National Water Resources Strategy 'Other Options' Report (see Table 1). The methodology used in the various W S Atkins reports is fairly consistent, with only minor differences between studies. A full description is given in Table 2. The Halcrow 'Other Options' schemes which include the Kielder transfer and the National Grid have been re-costed using the W S Atkins method.

To compare the various costing approaches, a sensitivity analysis has been undertaken on the cost of large diameter ductile iron pipelines. The results are discussed in Section 3.2.

Insufficient engineering and costing data were available for other schemes, such as Birmingham groundwater, Chelmsford reuse and Vyrnwy alternative sources, to enable a similar re-costing exercise to be undertaken. These cost estimates were instead reviewed and adjusted, where necessary, to ensure that the base date, and proportional allowances for contingency, design and supervision and operating costs were derived in a manner consistent with other schemes.

3 REVIEW FINDINGS

3.1 Assumptions

3.1.1 Base Date

The base date for all schemes has been taken to be Q3 1992. Scheme costs have been updated using three different approaches, depending upon the level of information available. These were:

- Method 1: where previous cost estimates have been based on bills of quantity, costs have been updated using the Output Price Index for Public Works.
- Method 2: where previous cost estimates have been calculated using TR61 cost functions but the cost elements are unknown, costs have been updated using the Construction Materials Wholesale Purchase Price Index. This Index is recommended for transfer schemes where the pipeline cost is the largest single component.
- Method 3: where costings have been re-calculated using TR61 cost functions and the breakdown of the scheme into cost elements is known, then the indices most appropriate to each component have been used in line with TR61 methodology.

For several transfer schemes, W S Atkins have used a slightly different approach from Method 3. The component indices were combined and adjusted by doing a regression analysis of published indices until Q1 1991 and projected forward to Q3 1992.

3.1.2 Contingency

As described in Section 2, a varying of contingency allowance has been added to schemes, depending on the level of detail of the original cost estimate. An exception to the categorisation rules outlined in Section 2 is the Craig Goch reservoir costs which appear low even after updating. Therefore, an additional 20% contingency has been applied, reflecting the risk of updating costings undertaken in the seventies.

3.1.3 Water Treatment and Local Distribution

The capital and operating costs associated with clean water treatment, where they have been identified, have been excluded. Waste water treatment costs have been included where applicable to effluent reuse schemes. River transfer and reservoir regulation scheme costings do not include the cost of uprating existing downstream abstraction pumping stations (if necessary) or the associated operating costs.

The cost of treated water distribution has also been excluded.

3.1.4 Design and Supervision

The exact proportion of design and supervision cost as a percentage of the out-turn cost of a scheme will vary depending on the nature of the scheme. A scheme involving a single contract of repetitive work, eg a pipeline, will have a lower proportion of design and supervision costs compared with a more complex contract such as a pumping station which has many engineering elements.

A variation has been accepted of between 8-12% of scheme out-turn cost for design and supervision, according to perceived scheme complexity.

3.1.5 Operating Costs

In order to simplify the RESPLAN calculations, only the power cost element of the operating costs has been taken into account.

A tariff value of 7p/kWh has been selected and applied to all schemes, for comparison, since this figure has been used in many of the W S Atkins reports although it is considered that a tariff of 7p/kWh is rather on the high side.

The operating costs are given in Table 3 in terms of the power cost to pump a Ml per day, for a year. Any adjustment to the operating costs to reflect the annual average pumping time is undertaken at the RESPLAN modelling stage (see Section 4.3).

3.2 Capital Cost Sensitivity to Method of Pipeline Costing

To assess the sensitivity of transfer scheme cost estimates to the various costing methodologies, Halcrow has undertaken a simple comparison. Only the pipeline cost component was considered, since this is the single largest element of a transfer scheme, generally representing 60% of its total cost.

The following methods were compared:

(i) TR61 (November 1976) cost functions for construction of a watermain, with the total cost updated to current values using the Construction Materials Wholesale Purchase Price Index.

(ii) As above, but updated to current values by using the W S Atkins inflation factor of 2.88, calculated from a regression analysis of published indices until Q1 '91 and projecting forward.

(iii) The formula quoted in Table C1 of Halcrow's 1991 Water Resource Planning - Strategic Options Report, taken from WRc Report No ER 72E and updated using the Output Price Public Works Index.

(iv) WRc's revised TR61 document, May 1993 edition, which gives a unit price per metre.

(v) Working up a cost using CESMM 3 Price Database 1992.

The relative costs for a 50 km long, 900 mm diameter ductile iron pipe are given below:

Method	(i)	£12.2m
	(ii)	£10.6m
	(iii)	£16.9m
	(iv)	£17.7m
	(v)	£12.2m

The studies of the transfer schemes have generally been costed using methods (i), (ii) and (v), and it is interesting to note that, while these are reasonably consistent with each other, they are considerably lower than costs obtained from methods (iii) and (iv), both of which are related to recent contract out-turn costs. All methods include for contractor's charges, material costs and reinstatement.

Unfortunately, the information is not available to apply techniques (iii) and (iv) across the board to bring cost estimates into line. To determine whether an additional contingency needs to be applied to estimates based on the 1976 TR61 cost functions, would require further investigation (see Section 4.2).

3.3 Adjustments to Previous Cost Estimates

The original and adjusted capital and operating cost estimates for all schemes examined are shown in Table 3. It can be seen that most costs have been adjusted. The following is a review of the scheme types, indicating how previous estimates have been adjusted.

(i) Reservoirs

If the previous estimates were of sufficient detail they were reviewed in order to remove water treatment and local distribution cost components.

The level of contingency varied in previous estimates and it was, therefore, adjusted according to the scheme categorisation (see Section 2).

Some of the reservoir cost estimates had engineering costs below the standard 8-10%. These costs were not adjusted since, due to the scale of the schemes, high engineering costs may not be warranted.

It has been assumed that river regulating and direct supply reservoirs have no operating costs. Great Bradley reservoir is augmented from the Ely-Ouse transfer which has been costed separately.

(ii) Groundwater Augmentation Schemes

The Shropshire groundwater scheme has been costed by NRA Severn-Trent region based upon output prices from completed scheme phases. It was felt that, because of the region's detailed knowledge of the scheme, no adjustment to the contingency and engineering costs was necessary. The operating costs were re-calculated for over a twelve month period and the maintenance, monitoring and water supply subsidies were removed. It should be noted that the electricity tariffs used to calculate the power costs are unknown to Halcrow.

No previous costing had been undertaken for the Birmingham groundwater scheme, therefore an estimate was obtained from a pro-rata calculation using Shropshire groundwater scheme data.

(iii) Effluent Reuse

The Deephams reuse scheme involves the tertiary treatment of domestic sewage to a standard suitable for human consumption. The treated water is then to be passed directly to the Lee Valley reservoirs. The previous estimates presented in the NRA Thames Region Water Resources Development Options Report are not broken down and therefore no adjustments could be made. From other costings in the same report, it is believed that the level of contingency is 25%, the engineering costs 12.5% and final treatment and distribution costs are excluded.

Operating costs will include not only power costs but also maintenance, consumables and staffing costs of the tertiary treatment. For this type of scheme this is believed to be appropriate.

The capital costs for the Chelmsford reuse scheme were obtained from Essex Water Company via NRA Anglian Region, with no breakdown, therefore no adjustments could be made. Operating costs are based upon those calculated for the Deephams reuse scheme.

(iv) River and Piped Transfers

The majority of these costings were carried out by W S Atkins using a reasonably consistent approach, with only small adjustments being necessary.

Previous cost estimates for other transfer schemes undertaken by Halcrow, notably the Kielder transfer and the National Grid, have been re-costed to the W S Atkins methodology. Because of the preliminary nature of the Halcrow studies, a 30% contingency and 10% engineering costs allowance has been applied to these calculations. All the operating costs have been adjusted to an annual rate per Ml/d pumped, based on a maximum pipeline

elevation and the friction headloss if the velocity is restricted to between 1.5 m/s to 2.0 m/s. The adjusted cost estimates for the National Grid are shown separately in Table 5, since the National Grid is not currently included within the RESPLAN modelling.

(v) Canal Transfers

The British Waterways Board capital cost for a proposed transfer from the end of the Severn to Trent pipeline to the River Thames was amended to include for a 20% contingency and 10% engineering costs.

Operating costs were revised, removing the maintenance component and producing an annual cost.

4 FURTHER WORK

4.1 Cost Functions

Costs can only be input into the RESPLAN model for a single-sized scheme; the model will not accept scheme costs expressed as a cost function which would allow any sized scheme to be examined. If time and budget are available, it is proposed that cost functions be developed independently for the major schemes. The results can be input into the model in an iterative process to define the 'suitable' size.

4.2 Sensitivity Analysis

The sensitivity analysis on the cost of a large ductile iron pipe indicated that estimates based on unit costs from a published database and cost functions from the revised 1993 TR61 document are up to 45% greater than costs calculated from the 1976 TR61 document. Further work would be necessary to discover whether similar cost difference exist for other scheme components and to decide if a correcting factor need be applied to 1976 TR61 estimates.

4.3 Pipeline Cost Optimisation

All the transfer scheme cost estimates assume a flow velocity within the pipeline suitable for continuous use (1.5 m/s increasing to 2.0 m/s in pipe diameters above 1200 mm diameter).

An exception is the Severn-Thames Transfer Feasibility Study undertaken by W S Atkins and dated June 1993. In this report the assumption is made that the transfer pipeline will only operate on average for about 30 days per year. A least cost optimisation for the pipeline diameter, using NPV analysis, indicated that use of much higher flow velocities, in the region of 3.5 m/s, would be more economic than the assumed 2.0 m/s. The effect is to reduce significantly the capital cost of the project and increase the operating cost. The transfer pipe diameter was reduced from 2 x 1400 mm diameter to 1 x 1300 mm and this was the largest single factor in reducing the capital cost of £155m given in the NRA Thames region Water Resources Development Options Report, to £75m in the W S Atkins report quoted above. These capital cost sums refer to a pipeline transfer from the Severn at Deerhurst to the Thames near Buscot.

It has since been found from hydrological modelling studies that the average number of pumping days per year for the Severn to Thames transfer would be greater than thirty. The costs given in the W S Atkins report are therefore inappropriate, and the scheme has been revalued based upon a pipeline velocity of 2.0 m/s. However, W S Atkins costings do indicate the potential reduction in the estimated costs which can be achieved by carrying out a cost optimisation study.

4.4 Operating Costs

The cost methodology assumes that power costs represent a good percentage of the total operating costs, and that, for comparison purposes, maintenance and staffing costs may be omitted. However, where transfer pipelines are to be used for only a small proportion of the year (say 50 to 100 days) the relative size of the standing and maintenance costs become significant.

The Wixoe and Kennett pumping stations on the Ely-Ouse Transfer operate for approximately 50 to 60 days per year. The operating costs comprise approximately 50% power costs and 50% standing charges. A significant element of the standing charges is the amount levied by the electricity supply companies to make available a large current, whether it is used or not.

In view of the above, consideration should be given to recalculating transfer operating costs with an annual fixed cost component.

Consideration should also be given to the average annual pumping time required, over and above the hydrological requirements to meet demand, to keep the water in the pipeline sweet. It is suggested that an allowance of 10 days per year could be assumed.

Table 1

SCHEMES FOR WHICH COSTINGS HAVE BEEN REVIEWED

SCHEME	SOURCE OF COST INFORMATION		
	REPORT TITLE	DATE	AUTHOR
Craig Goch Reservoir	Craig Goch Project - Feasibility Study and Promotion Documentation Report	March 1973 December 1980	Halcrow
R Wye to R Severn	Water Resources Strategy - 'Other' Options Report	April 1993	Halcrow
South West Oxfordshire Reservoir Development	NRA Thames Region - Water Resources Development Options plus letter from NRA Thames Region	April 1992 September 1992	Howard Humphreys Brian Arkell
Vyrnwy Redeployment (development of alternative sources)	NRA Northwest Region - *Proforma for Reporting of* Modelling associated with Inter-regional Transfers	May 1993	NRA Northwest
Great Bradley Reservoir	NRA Anglian Region - Strategic Options Study Options for Transfer of Water from the River Trent and Reservoir Storage at Great Bradley plus memo from NRA Anglian Region	January 1993 December 1993	W S Atkins Graham Wilson
Broad Oak Reservoir	Letter from NRA Southern Region	August 1993	Geoff Burrow
Shropshire Groundwater	Extract from appraisal report on options for River Severn Augmentation	1993	NRA Severn Trent Region
Birmingham Groundwater	Notes of meeting at Solihull-Gordon Davies, Paul Crockett and Chris Page	23/6/93	
Deephams effluent reuse - London	NRA Thames Region - Water Resources Development Options	April 1992	Howard Humphreys
Chelmsford effluent reuse - South Essex	Water Resources Strategy - 'Other' Options Report and NRA Anglian Region	April 1993 July 1993	Halcrow David Evans
Kielder-R Swale transfer	Water Resources Strategy - 'Other' Options Report	April 1993	Halcrow
Yorkshire Ouse to R Witham	Water Resources Strategy - 'Other' Options Report	April 1993	Halcrow
Witham to Ely Ouse	NRA Anglian Region - Strategic Options Study Options for Transfer of Water from the River Trent and Reservoir Storage at Great Bradley	January 1993	W S Atkins
Witham to Grafham and Rutland	NRA Anglian Region - Strategic Options Study Options for Transfer of Water from the River Trent and Reservoir Storage at Great Bradley	January 1993	W S Atkins
Ely Ouse to Essex	Memo from NRA Anglian Region to Chris Page	15.6.93	Bob Hillier
R Pant (Blackwater) to R Chelmer to R Roding	NRA Anglian Region - Strategic Options Study Options for Transfer of Water from the River Trent and Reservoir Storage at Great Bradley	January 1993	W S Atkins

Table 1 (Continued)

SCHEME	SOURCE OF COST INFORMATION		
	REPORT TITLE	DATE	AUTHOR
R Roding to R Stort	NRA Anglian Region - Strategic Options Study Options for Transfer of Water from the River Trent and Reservoir Storage at Great Bradley	January 1993	W S Atkins
R Severn to R Trent	Severn to Trent Transfer Options - Feasibility and Outline Engineering Appraisal Study	June 1993	W S Atkins
R Trent to Rutland	NRA Anglian Region - Regional Strategic Options Study - Component 7 - River Trent to Rutland Water Transfer	April 1993	W S Atkins
R Trent to R Witham	NRA Anglian Region - Strategic Options Study Options for Transfer for Water from the River Trent and Reservoir Storage at Great Bradley	January 1993	W S Atkins
R Severn to R Thames	Severn - Thames Transfer Feasibility Study	June 1993	W S Atkins
Canal transfer - from end of the Severn to Trent pipeline to the River Thames	British Waterways - Water Transfer: Feasibility Study	June 1993	Binnie & Partners
London to Canterbury pipeline	Water Resources Strategy - 'Other' Options Report	April 1993	Halcrow
Derwent Valley Redeployment	No previous estimates	-	-

Table 2 W S ATKINS COSTING METHODOLOGY

Cost Element	Basic Formula to Drive Cost in £k	Units and Definitions	Inflation Factor and Index (Q1 93)	Multipliers and Comment	References
Pipeline Capital Cost (CC)	$0.0702 \times (LEN)^{0.73} \times DIA^{0.91\,(DIA/(1000+DIA))}$ Plus additional easement compensation cost (LEN x .012 in £K)	LEN = Length measured from map x 1.1 for additional design length (m) DIA = pipe diameter (mm)	x 191/58 Construction Materials Wholesale Purchase Price	x 1.1 Design and Supervision x 1.2 Contingencies x 1.1 Road and rail crossings and excavation in rock (factor used only for Halcrow Costing's Atkins method separately costs road and rail crossings and uses an additional rate for excavation in rock)	• TR61 • Atkin's Severn-Trent Transfer report
Calculation of friction headloss in metres	$H_L = \frac{2.775 \times Q^{1.85} \times LEN}{D^{4.87} \times C^{1.85}}$	Q = Discharge (Ml/d) LEN = Measured length x 1.1 (km) D = Diameter (m) C = Coefficient Assumed at 135		Hazen-Willams Headloss Formula	• Fluid Mechanics by Weber • Atkin's Severn-Trent Report for C= 135
Pumping Station Structure Civil CC	$PS\ civil = 4 \times (Q \times 1.25)^{0.79}$	Q = Discharge (Ml/d)	x 118/53.2 Public Sector Building Tender Price	x 1.1 Design and Supervision x 1.2 Contingencies	• TR 61 • Atkin's Severn-Trent Report
Pumping Plant - Mechanical and Electrical CC.	$PS_{M\&E} = 0.0229 \times [(Q \times 41.6) \times 1.25]^{0.91} \times H_T^{0.43}$	Q = Discharge (Ml/d) H_T = Total Pumping Head (m) (H_L + H_s) Hs= static head (m)	x 185/60.5 Metal Goods Engineering and Vehicle Producers Price Output Index		• TR 61 • Atkin's Severn-Trent Report
CC of Intake = C_I CC of Outfall = Co	C_I = 25% of Pumping Station Civil Cost = 0.25 x PS civil Co = 10% of Pumping Station Civil Cost = 0.1 x PS civil	PS Civil = Pumping Station Structure Civil CC	x 118/53.2 Public Sector Building Tender Price	x 1.1 Design and Supervision x 1.2 Contingencies	• TR 61 • Atkin's Severn-Trent Report
CC of Break Pressure Tank	$C_{BPT} = 40.7 \times CAP^{.7}$	CAP = Tank Capacity $m^3 \times 10^3$ = Q (Ml/d) x 0.5/24 for 1/2 hr storage	x 131/55 Public Works Output Price	x 1.1 Design and Supervision x 1.2 Contingencies	• TR 61 • Atkin's Severn-Trent Report
Pumping Station Power Supply CC	£ 50k for Pumping Station Q< 100 Ml/d £ 100k for Pumping Station Q> 100 Ml/d	Q = Discharge in Ml/d	At Q1 93 Price	x 1.1 Design and Supervision x 1.2 Contingencies	• Atkin's Severn-Trent Report
Annual Operating Cost of Energy for Pumping	$0.1829 \times H_T \times Q \times AHOURS \times PCOST/1000$	H_T = Total Pumping Head (m) Q = Discharge (Ml/d) AHOURS = No of hours pumped per year PCOST = Cost of Electricity in £/KWh	At Q1 93 Price	Includes: 0.73 Efficiency Factor 0.85 Power Factor Electricity tariff assumed at £0.07/KWh	• Atkin's Severn-Thames Report

Table 3

ORIGINAL AND ADJUSTED COST ESTIMATES

SCHEME	ORIGINAL COST ESTIMATES (see Table 1 for sources)		ADJUSTED COST ESTIMATES (for input to RESPLAN		BASIS AND DATES FOR ORIGINAL COST ESTIMATES	COMMENTS
	Capital Costs £M	Operating Costs £K/Ml/d per annum	Capital Costs £M	Operating Costs £K/Ml/d per annum		
Craig Goch Reservoir 366 m TWL	12.5 (including tunnels to River Severn and River Wye - see below)	0.0	60.5	0.0	Bill of quantities Q2 1972	The original costs were revised to also include for work identified to be necessary at the promotion report stage in 1980
Craig Goch to River Severn, 400 Ml/d	See above	0.0	44.5	0.0	Bill of quantities Q2 1972	
Craig Goch to River Wye, 400 Ml/d	See above	0.0	11.5	0.0	Bill of quantities Q2 1972	
River Wye to River Severn, 400 Ml/d	42.4	10.3	47.5	15.0	TR61 Q4 1992	
South West Oxfordshire Reservoir Development	330.0	1.7	400.0	23.5	Bill of quantities 1992	Original cost estimate for a 100 Mm^3 scheme comprising two reservoirs. However, adjusted costs for a 150 Mm^3 single reservoir scheme.

Table 3 (continued)

SCHEME	ORIGINAL COST ESTIMATES (see Table 1 for sources)		ADJUSTED COST ESTIMATES (for input to RESPLAN		BASIS AND DATES FOR ORIGINAL COST ESTIMATES	COMMENTS
	Capital Costs £M	Operating Costs £K/Ml/d per annum	Capital Costs £M	Operating Costs £K/Ml/d per annum		
Vyrnwy Redeployment (development costs of alternative sources)	68.9+16.1	5.7+0.4	36.9 (R Dee at Huntington 27.9 (R Ribble at Samlesbury)	25.9 (R Dee at Huntington) 40.4 (R Ribble at Samlesbury)	Recent tender prices uprated using TR61 Q4 1992	
Great Bradley Reservoir	73.0	0.0	69.4	0.0	Bill of quantities Q3 1992	Original cost estimate for a 106 Mm^3 reservoir. However, adjusted costs for a smaller 46 Mm^3 reservoir
Broad Oak Reservoir	-	-	47.5	25.0	-	No previous estimates available
Shropshire Groundwater	13.14	5.46	13.14 (assuming a yield of 155 Ml/d)	5.95	Tender prices and operational experience 1992	
Birmingham Groundwater	-	-	4.4 (assuming a yield of 50 Ml/d)	5.95	-	No previous estimates available
Deephams Effluent Reuse London	39.1	10.5	37.0	1.05 M (assuming a yield of 100 Ml/d)	TR61 and Database unit rates 1991	

Table 3 (continued)

SCHEME	ORIGINAL COST ESTIMATES (see Table 1 for sources)		ADJUSTED COST ESTIMATES (for input to RESPLAN		BASIS AND DATES FOR ORIGINAL COST ESTIMATES	COMMENTS
	Capital Costs £M	Operating Costs £K/Ml/d per annum	Capital Costs £M	Operating Costs £K/Ml/d per annum		
Chelmsford Effluent Reuse - South Essex	-	-	13.5	0.28 M (assuming a yield of 40 Ml/d)	-	No previous estimates available
Kielder to River Swale, 325 Ml/d	28.19	21.1	48.0	30.5	TR61 Q4 1992	
Yorkshire Ouse to River Witham, 325 Ml/d	71.13	7.14	107.0	16.5	TR61 Q4 1992	
Witham to Ely Ouse, 400 and 200 Ml/d	8.5 (200) 24.5 (400)	18.0 (200) 13.0 (400)	100 (200) 149 (400)	14.4 (200) 10.4 (400)	TR61 Q3 1992	Original operating costs included a 25% allowance for maintenance. Operating costs include increases to Kennett (£13.3M) and Wixoe (£1.3M) capacities
Witham to Grafham and Rutland, 150 Ml/d	37.0	24.5	37.0	19.6	TR61 Q3 1992	Original operating costs included a 25% allowance for maintenance
Ely Ouse to Essex	0.0	15.4	0.0	11.18	Operational experience 1992/93	Pipeline capacity already exists

Table 3 (continued)

SCHEME	ORIGINAL COST ESTIMATES (see Table 1 for sources)		ADJUSTED COST ESTIMATES (for input to RESPLAN		BASIS AND DATES FOR ORIGINAL COST ESTIMATES	COMMENTS
	Capital Costs £M	Operating Costs £K/Ml/d per annum	Capital Costs £M	Operating Costs £K/Ml/d per annum		
River Pant (Black Water) to River Chelmer to River Roding, 200 and 100 Ml/d	13.0 (100) 21.0 (200)	6.2 (100) 7.2 (200)	24.0 (100) 39.0 (200)	10.3 (100) 11.1 (200)	TR61 Q3 1992	Original operating costs included a 25% allownace for maintenance
River Roding to River Stort, 100 Ml/d	11.0	1.8	11.0	2.9	TR61 Q3 1992	Original operating costs included a 25% allowance for maintenance
River Severn to River Trent, 300 and 100 Ml/d	26.0 (100) 70.0 (300)	13.4 (100) 14.9 (300)	26.0 (100) 70.0 (300)	16.3 (100) 20.2 (300)	TR61 Q1 1993	100 Ml/d transfer delivered to the River Penk and 300 Ml/d transfer delivered to the River Trent
River Trent to Rutland, 200 and 100 Ml/d	32.0 (100) 46.0 (200)	7.1 (100) 13.7 (200)	32.0 (100) 46.0 (200)	20.8 (100) 20.0 (200)	TR61 Q3 1992	Original operating costs included a 25% allowance for maintenance
River Trent to River Witham, 400 and 200 Ml/d	8.0 (200) 18.0 (400)	0.71 (200) 1.37 (400)	8.0 (200) 18.0 (400)	1.0 (200) 1.0 (400)	TR61 Q3 1992	Original operating costs included a 25% allowance for maintenance
River Severn to River Thames, 400 and 200 Ml/d	50.0 (200) 75.0 (400)	37.0 (200) 37.0 (400)	57.0 (200) 92.0 (400)	31.5 (200) 31.5 (400)	TR61 and Database unit rates Q4 1992	Additional capital cost of a pipeline all the way to London (Staines reservoirs) from Lechlade = £120M for a 400 Ml/d transfer and £60M for a 200 Ml/d transfer

Table 3 (continued)

SCHEME	ORIGINAL COST ESTIMATES (see Table 1 for sources)		ADJUSTED COST ESTIMATES (for input to RESPLAN		BASIS AND DATES FOR ORIGINAL COST ESTIMATES	COMMENTS
	Capital Costs £M	Operating Costs £K/Ml/d per annum	Capital Costs £M	Operating Costs £K/Ml/d per annum		
Derwent Valley Redeployment High/Med/Low Demand Scenarios	-	-	31.7 (High) 14.7 (Med/ Low)	71.0 (High) 25.0 (Med/ Low)	-	No previous estimates available. Involves 2 components: (a) Under the low and medium demand scenario's there are sufficient surplus resources available within Yorkshire area to facilitate redeployment of Ladybower Reservoir from direct supply (to Sheffield) to regulation of the Derbyshire River Derwent. The direct supply is replaced by transferring water from Barmby on the Yorkshire River Derwent via a new pipeline to Sheffield. (b) Under the high demand scenario however, additional water needs to be transferred into the Yorkshire area from Kielder in order to replace the Ladybower direct supply. The transfer has been costed from Kielder to Barmby and then added to the Barmby to Sheffield pipeline cost.

Table 3 (continued)

SCHEME	ORIGINAL COST ESTIMATES (see Table 1 for sources)		ADJUSTED COST ESTIMATES (for input to RESPLAN		BASIS AND DATES FOR ORIGINAL COST ESTIMATES	COMMENTS
	Capital Costs £M	Operating Costs £K/Ml/d per annum	Capital Costs £M	Operating Costs £K/Ml/d per annum		
Canal transfer from Trent end of the Severn to Trent pipeline to the River Thames, 100 Ml/d	26.7	11.14	23.14	4.0	TR61, Tender prices and Database unit rates Q4 1992	
London to Canterbury pipeline, 50 Ml/d	70.1	22.0	67.2	21.6	TR61 Q4 1992	