BIRMINGHAM CANAL NAVIGATIONS (Ref. No. 20c, Plate Nos. 16 & 16a)

WALSALL SECTION (See Fig. 15.1)

F. Wednesbury Oak Loop

Length

1) 3.1 km. navigable.
2) 0.3 km. unnavigable.

Present Function

1) Feeder to cruising length, water sales, land drainage, access to BWB Bradley Workshops, cruising.
2) Leased to industry.

Development

None

Proposals

None.

Most Economical Treatment

1) & 2) Water channel.

Elimination

1) & 2) Not feasible.

G. Wyrley & Essington Canal

Length

1) Main Line (Horseley Fields – Anglesey Basin) 28.5 km. navigable.
2) Sneyd Branch 0.2 km. navigable.
3) Cannock Extension 2.5 km. navigable.
4) Former Main Line at Huddlesford Junction 0.8 km. and two short arms 0.5 km., part navigable.
5) Bentley Canal 2.6 km. unnavigable (0.8 km. eliminated).
6) Two Basins 0.6 km. unnavigable.

Present Function

1) Land drainage, cruising, feeder to cruising system, amenity, water sales, access to Walsall Section Depot.
2) Land drainage, amenity, access to Walsall Section Depot.
3) Land drainage, cruising, amenity.
4) Land drainage, amenity, moorings.
5) Water sales.

Development

5) Back pumping by L.A.

Proposals

None.

Most Economical Treatment

1)-6) Water channel.

Elimination

1)&2) Not feasible.

3)-6) Feasible, but probably not cheapest solution.

H. Daw End Branch and Rushall Canal

Length

Catshill Junction to Rushall Junction 13.1 km. (navigable) and 0.2 km. branch.

Present Function

Land drainage, water sales, cruising, amenity.

Development

Severe past subsidence (up to 7 m).

Proposals

None.

Most Economical Treatment

Water channel.

Elimination

Feasible, but not cheapest solution.

J. Walsall Canal (part)

Length

1) Doe Bank – Birchills 10.8 km. navigable.
2) Ocker Hill Arm 0.7 km. navigable.
3) Bradley Locks 0.8 km. part navigable.
4) Walsall Arm 0.5 km. navigable.
5) Toll End Locks 1.3 km. filled in.
6) Anson Branch 2.2 km. water channel.
7) 3 Arms totalling 0.8 km. water channel.

Present Function

1)-4) Water sales, land drainage, cruising, some amenity.
2) Power station feed.
5) Leased to industry.
6) Power station feed, land drainage.

Development

6) Closed to traffic to save bank protection costs.

Proposals

4) Amenity development.
3) & 7) Lease for disposal.

Most Economical Treatment

1)-4)
6) & 7) Water channel.

Elimination

1)-4)
6)&7) Feasible, but not cheapest solution.

ANNUAL ACCOUNTS		1974 £000		Most Economical Treatment Future Accounts £000		Most Economical Treatment Arrears Total £000	Total Cost of Elimination £000
Receipts	Water	24.0		29			
	Amenity	3.3		3			
	Other	1.5	28.8	7	39		
Expenditure	Engineering	58.2		84		558	7,950+†
	Development	2.0		–			
	Overheads	29.2	89.4	29	113		
	Deficit		60.6		74	558	7,950
NET PRESENT COSTS (paragraph 15.10.1)		£000			703	419	
					1,122		6,600
Net Present Value of Land Drainage Function at £1,510,000+ p.a. (paragraph 15.10.7)		£000			14,300 +		

\+ Drainage values and elimination costs based on B.C.N. Working Party Report (see paragraph 15.10.5)
† Where feasible.

BRIDGWATER & TAUNTON CANAL (Ref. No. 13, Plate 12)

Length
23.0 km. water channel (including 1.2 km. River Tone Navigation).

Present Function
Water sales, land drainage, boating, amenity.

Development
L.A. restoration for light boating in process – Agreement under negotiation.

Proposals
Completion of development.

Most Economical Treatment
Intermediate standard (see paragraph 15.9.5).

Elimination
Not feasible.

ANNUAL ACCOUNTS		1974 £000		Most Economical Treatment: Future Accounts £000		Most Economical Treatment: Arrears Total £000	Total Cost of Elimination £000
Receipts	Water	20.6		21			
	Amenity	0.2		–			
	Other	1.0	21.8	1	22	85	Not applicable
Expenditure	Engineering	17.7		22			
	Development	–		–			
	Overheads	9.4	27.1	9	31		
	Deficit		5.3		9	85	
NET PRESENT COSTS (paragraph 15.10.1)			£000		86	64	
					150		
Net Present Value of Land Drainage Function at £23,500 p.a. (paragraph 15.10.7)			£000		230		

CALDON CANAL (Ref. No. 42, Plate 36)

Length
1) Main Line 28.2 km. navigable under L.A. Agreement.
2) Leek Branch 4.6 km. navigable.

Present Function
1) Land drainage, cruising, amenity also western half feeder to Trent & Mersey Canal. Some commercial traffic
2) Feeder to Trent & Mersey Canal.

Development
1) Restored to navigation in 1974 under L.A. Agreement.

Proposals
1) BWB have applied for upgrading.
2) Restoration has been suggested.

Most Economical Treatment
1) Cruising standard in accordance with L.A. Agreement.
2) Water channel.

Elimination
1) & 2) Not feasible.

ANNUAL ACCOUNTS		1974 £000		Most Economical Treatment: Future Accounts £000		Most Economical Treatment: Arrears Total £000	Total Cost of Elimination £000
Receipts	Water	4.9		5			
	Amenity	3.1		3			
	Other	1.8	9.8	1	9	359	Not Applicable
Expenditure	Engineering	63.8		29			
	Development	8.9		–			
	Overheads	18.6	91.3	9	38		
	Deficit		81.5		29	359	
NET PRESENT COSTS (paragraph 15.10.1)			£000		276	269	
					545		
Net Present Value of Land Drainage Function at £29,000 p.a. (paragraph 15.10.7)			£000		280		

CHESTERFIELD CANAL (Ref. No. 31, Plate 30)

Length

1) Chesterfield to Staveley 8.0 km. isolated water channel.
2) Staveley to Killamarsh 8.0 km. dewatered.
3) Norwood Tunnel (East End) to Worksop 8.8 km. water channel.

Present Function

1) & 3) Water sales, land drainage, amenity, also
3) Feed to cruising length.

Development

2) Partly eliminated and in process of disposal.
3) All except 4 locks cascaded.

Proposals

1) Affected by proposals for road by-pass.
2) Complete disposal.
3) Amenity development in conjunction with L.A.

Most Economical Treatment

1) & 3) Water channel.
2) Elimination by controlled decay.

Elimination

1) Feasible, but not cheapest solution.
2) In process.
3) Not feasible.

Special Item

Norwood Tunnel, 2.7 km. closed since 1908 collapse. N.C.B. have opened up 0.25 km, BWB have residual responsibility for the rest. Infilling would cost over £200,000 (See Table 15.2).

ANNUAL ACCOUNTS		1974 £000		Most Economical Treatment Future Accounts £000		Most Economical Treatment Arrears Total £000	Total Cost of Elimination £000
Receipts	Water	7.9		8			
	Amenity	0.2		–			
	Other	0.6	8.7	1	9		
Expenditure	Engineering	40.6		20		61	255*
	Development	13.3		2			
	Overheads	16.1	70.0	16	38		
	Deficit		61.3		29	61	255
NET PRESENT COSTS (paragraph 15.10.1)		£000			276	46	
					322		210
Net Present Value of Land Drainage Function at £21,000 p.a. (paragraph 15.10.7)		£000			200		

* For lengths (1) & (2) only, excluding compensation for loss of water supply and special item.

CROMFORD CANAL (Ref. No. 24, Plate 25).

Length

1) Main Line 4.6 km. water channel.
2) Pinxton Branch 3.4 km. eliminated.

Present Function

1) Land drainage, amenity.

Development

1) Locks weired.
2) In process of disposal.

Proposals

1) Disposal to L.A. for amenity.

Most Economical Treatment

1) Water channel.

Elimination

1) Feasible, but disposal for L.A. development probably cheaper.

Special Item

Butterley Tunnel, closed since collapse in 1900. Reservoir (disused) and some development on land over, cost of infilling estimated to be in excess of £200,000 (See Table 15.2).

ANNUAL ACCOUNTS		1974 £000		Most Economical Treatment Future Accounts £000		Most Economical Treatment Arrears Total £000	Total Cost of Elimination £000
Receipts	Water	0.1		–			
	Amenity	0.3		–			
	Other	0.4	0.8	1	1		
Expenditure	Engineering	10.9		6		12*	46+
	Development	–		3			
	Overheads	10.3	21.2	7	16		
	Deficit		20.4		15	12	46
NET PRESENT COSTS (paragraph 15.10.1)		£000			143	9	
					152		38
Net Present Value of Land Drainage Function at £2,300 p.a. (paragraph 15.10.7)		£000			20		

*Excluding special item. + For length 1) only; disposal probably cheaper.

GRAND UNION CANAL – EREWASH CANAL (Ref. No. 26, Plate 25)

Length
17 km. navigable under L.A. Agreement.

Present Function
Feeder to Cruising length, water sales, land drainage, cruising, amenity.

Development
Restored in 1974 with L.A. contribution.

Proposals
BWB have applied for upgrading.

Most Economical Treatment
Cruising standard in accordance with Agreement.

Elimination
Not feasible.

ANNUAL ACCOUNTS		1974 £000		Most Economical Treatment Future Accounts £000		Most Economical Treatment Arrears Total £000	Total Cost of Elimination £000
Receipts	Water	101.7*		5			
	Amenity	0.3		1			
	Other	0.3	102.3	–	6		
Expenditure	Engineering	21.6		24		209	Not Applicable
	Development	(15.7)		–			
	Overheads	9.7	15.6	10	34		
	Deficit		(86.7)		28	209	
NET PRESENT COSTS (paragraph 15.10.1)			£000		266	157	
					423		
Net Present Value of Land Drainage Function at £31,000 p.a. (paragraph 15.10.7)			£000		290		

*Exceptional income, compensation from Stanton Iron Works for termination of water supply agreement.

GRAND UNION CANAL (Ref. Nos. 2 to 6)

Length

1) City Road Basin 0.3 km. navigable (Ref. No. 2a, Plate 2).
2) Paddington Basin 0.7 km. in water (Ref. No. 2c, Plate 2).
3) Slough Arm 7.9 km. navigable under Agreement (Ref. No. 4a, Plate 2).
4) Wendover Arm 11.2 km. including 2.9 km. navigable, 2.3 km. piped 6.9 km. water channel. (Ref. No. 3, Plate 3).
5) Old Stratford Arm 2.0 km. mainly dewatered (Ref. No. 3, Plate 4).
6) Saltisford Arm 0.8 km. water channel part navigable. ref. No. 6, Plate 6).
7) Welford Arm 2.9 km. navigable (Ref. No. 5, Plate 5).

Present Function

1) Water sales, land drainage, moorings.
2) Water sales, land drainage.
3) Water sales, land drainage, cruising, amenity.
4) Feeder to Main Line, land drainage, moorings.
5) & 6) Land drainage, moorings.
7) Land drainage, cruising, amenity feeder to Main Line.

Development

3) Restoration in progress with contribution from local authorities.
7) Restored to navigation in 1969 by BWB and local authority.

Proposals

1) Redevelopment for power station and amenity.
2) Redevelopment for hospital and amenity, dependent on Planning Enquiry.
3) Completion of restoration.
5) & 6) Partial elimination.

Most Economical Treatment

1) & 2) Water channel.
3) Cruising standard in accordance with Agreement.
4)-7) Water channel.

Elimination

1) & 2) Feasible, not cheapest solution but would produce valuable development land.
3), 4) &7 Not feasible.
5) & 6) Feasible, and cheapest solution.

ANNUAL ACCOUNTS		1974 £000		Most Economical Treatment: Future Accounts £000		Most Economical Treatment: Arrears Total £000	Total Cost of Elimination £000
Receipts	Water	0.4		1			
	Amenity	2.4		2			
	Other	2.0		2			
Expenditure	Engineering	7.3	4.8	26	5	165	85*
	Development	–		–			
	Overheads	8.3	15.6	8	34		
	Deficit		10.8		29	165	85
NET PRESENT COSTS (paragraph 15.10.1)			£000		276	124	
					400		70
Net Present Value of Land Drainage Function at £15,000 p.a. (paragraph 15.10.7)			£000		140		

* Lengths 1), 2), 5) and 6) only.

GRANTHAM CANAL (Ref. No. 29, Plate 28)

Length
52.4 km. unnavigable water channel, including 3.4 km. dry length.

Present Function
Water sales, land drainage, amenity, 600 mm. water depth required under LNER Act 1936.

Development
Locks weired, water level lowered, bridges culverted etc.

Proposals
Restoration to amenity use.

Most Economical Treatment
Water channel.

Elimination
Not feasible.

ANNUAL ACCOUNTS		1974 £000		Most Economical Treatment Future Accounts £000		Most Economical Treatment Arrears Total £000	Total Cost of Elimination £000
Receipts	Water	5.5		5			
	Amenity	–		–			
	Other	0.4	5.9	1	6		
Expenditure	Engineering	16.6		32		317*	Not Applicable
	Development	8.0		–			
	Overheads	24.7	49.3	25	57		
	Deficit		43.4		51	317	
NET PRESENT COSTS (paragraph 15.10.1)		£000			485	238	
					723		
Net Present Value of Land Drainage Function at £26,200 p.a. (paragraph 15.10.7)		£000			250		

* Including £150,000 BWB estimate for restoring dry length (3.4 km).

HUDDERSFIELD NARROW CANAL (Ref. No. 38, Plate 34)

Length
26.8 km. discontinuous unnavigable water channel.

Present Function
Water feed to adjacent canals, water sales, land drainage, amenity.

Development
All but 5 locks cascaded, some bridges culverted.

Proposals
Amenity development.

Most Economical Treatment
Water channel.

Elimination
Not feasible.

Special Items

a) *Standedge Tunnel* – clear falls and reline; underpin brick arch ribs to make safe (Estimated cost £86,000).

b) *Tunnel End Reservoir* – Inspecting Engineer's estimate for works required to outfall £300,000. (See Table 15.2).

ANNUAL ACCOUNTS		1974 £000		Most Economical Treatment Future Accounts £000		Most Economical Treatment Arrears Total £000	Total Cost of Elimination £000
Receipts	Water	20.4		20			
	Amenity	0.2					
	Other	1.0	21.6	1	21		
Expenditure	Engineering	30.2		24		145*	Not Applicable
	Development	0.4		2			
	Overheads	15.8	46.4	16	42		
	Deficit		24.8		21	145	
NET PRESENT COSTS (paragraph 15.10.1)		£000			200	109	
					309		
Net Present Value of Land Drainage Function at £13,500 p.a. (paragraph 15.10.7).		£000			130		

* Including special item a) but excluding b).

KENNET & AVON CANAL (Ref. No. 12, Plates 10 & 11)

Length

1) 84.9 km. Bath to Hamstead Lock comprising 51.5 km. navigable waterway (4 lengths), 25.4 km. water channel and 8.0 km. dewatered (3 lengths).
2) 14.6 km. Bulls Lock, Newbury, to Tyle Mill Lock comprising 2.0 km. navigable waterway and 12.6 km. water channel.

Present Function

1) Land drainage (eastern end), cruising/boating, amenity.
2) Land drainage, water sales, amenity, cruising/boating.

Development

1) & 2) Some lengths restored, including locks.

Proposals

1) & 2) Restoration throughout.

Most Economical Treatment

1) & 2) Water channel.

Elimination

1) Feasible, and cheapest solution.
2) Feasible (except 2 km. of river lengths), but probably not cheapest solution.

ANNUAL ACCOUNTS		1974 £000		Most Economical Treatment: Future Accounts £000		Most Economical Treatment: Arrears Total £000	Total Cost of Elimination £000
Receipts	Water	2.5		3			
	Amenity	1.5		1			
	Other	6.3	10.3	6	10	300	1,090
Expenditure	Engineering	101.2		102			
	Development	6.8		–			
	Overheads	37.7	145.7	38	140		
	Deficit		135.4		130	300	1,090
NET PRESENT COSTS (paragraph 15.10.1)		£000			1,235	225	
					1,460		900
Net Present Value of Land Drainage Function at £ 46,500 p.a. (paragraph 15.10.7)		£000			440		

LANCASTER CANAL (Ref. No. 46, Plate 42)

Length

14.0 km. unnavigable water channel (north of Tewitfield), also Hincaster Tunnel (0.35 km.) dewatered.

Present Function

Feeder to Cruising length, land drainage, amenity.

Development

Locks weired, water level lowered, culverted under motorway crossings.

Proposals

Amenity development in conjunction with L.A.'s.

Most Economical Treatment

Water channel.

Elimination

Not feasible.

Special Item

Repairs to *Hincaster Tunnel*. Estimated Cost £20,000.

ANNUAL ACCOUNTS		1974 £000		Most Economical Treatment: Future Accounts £000		Most Economical Treatment: Arrears Total £000	Total Cost of Elimination £000
Receipts	Water	–		–			
	Amenity	0.5		1			
	Other	0.5	1.0	–	1	67*	Not applicable
Expenditure	Engineering	10.7		14			
	Development	10.0		–			
	Overheads	9.4	30.1	9	23		
	Deficit		29.1		22	67	
NET PRESENT COSTS (paragraph 15.10.1)		£000			209	50	
					259		
Net Present Value of Land Drainage Function at £7,000 p.a. (paragraph 15.10.7)		£000			65		

* Including special item.

LEEDS & LIVERPOOL CANAL (Ref. No. 45, Plates 38 to 41)

Length

1) 12.6 km. Main Line (Stanley Dock-Aintree) navigable.
2) 3.4 km. Walton Summit Branch, 0.3 km. in water, 3.1 km. dewatered.
3) 0.6 km. Springs Branch navigable.

Present Function

1) Water sales, land drainage, C.E.G.B. pylon route, cruising, some commercial traffic.
2) Moorings (0.3 km. adjacent to Main Line).
3) Cruising, moorings, amenity.

Development

1) Safety provisions, landscaping etc. following joint Working Party report.
3) Surroundings improved by L.A.

Proposals

1) Eventual restoration to cruising standard.
2) Eliminate dewatered length.

Most Economical Treatment

1) Water channel.
2) Elimination by controlled decay.
3) Water channel.

Elimination

1) Feasible but not cheapest solution (costed by 1969 Working Party at £2 M – say £3.5 M at March 1974 prices).

ANNUAL ACCOUNTS		1974 £000		Most Economical Treatment: Future Accounts £000		Most Economical Treatment: Arrears Total £000	Total Cost of Elimination £000
Receipts	Water	1.8		2			
	Amenity	0.9		1			
	Other	3.0	5.7	4	7	98	3,580*
Expenditure	Engineering	30.0		28			
	Development	–		–			
	Overheads	10.3	40.3	10	38		
	Deficit		34.6		31	98	3,580
NET PRESENT COSTS (paragraph 15.10.1)			£000		294	74	2,970
					368		
Net Present Value of Land Drainage Function at £192,000* p.a. (paragraph 15.10.7)			£000		1,825*		

* Cost for length 1) based on 1969 Working Party Report.

MANCHESTER, BOLTON & BURY CANAL (Ref. No. 43, Plate 37)

Length

1) Water channel (totalling 8.6 km) in isolated lengths, plus 0.6 km. piped.
2) Several short isolated lengths (totalling 4.7 km.) in process of disposal to L.A. s.

Present Function

1) Water sales, land drainage, amenity (Elton Reservoir used for sailing).
2) Land drainage, amenity.

Development

1) & 2) Locks eliminated/disposed of, water level lowered.

Proposals

1) & 2) Part disposal to L.A, part amenity development in conjunction with L.A. s.

Most Economical Treatment

1) Water channel.

Elimination

1) Feasible, but not cheapest solution.
2) Feasible and cheapest solution.

Special Item

Elton Feeder in poor condition, BWB estimate for piping £100,000. (See Table 15.2).

ANNUAL ACCOUNTS		1974 £000		Most Economical Treatment: Future Accounts £000		Most Economical Treatment: Arrears Total £00	Total Cost of Elimination £000
Receipts	Water	14.1		14			
	Amenity	0.9		1			
	Other	1.1	16.1	3	18		
Expenditure	Engineering	10.3		10		142*	190
	Development	21.4		–			
	Overheads	9.1	40.8	9	19		
	Deficit		24.7		1	142	190
NET PRESENT COSTS (paragraph 15.10.1)		£000			10	107	155
					117		
Net Present Value of Land Drainage Function at £11,500 p.a. (paragraph 15.10.7)		£000			110		

*Excluding special item.

MONMOUTHSHIRE & BRECON CANAL (Ref. No. 14a, Plate 13)

Length

1) 52.0 km. navigable under L.A. Agreement.
2) 4.0 km. unnavigable water channel.

Present Function

1) Land drainage, cruising, amenity.
2) Water sales, land drainage, amenity.

Development

1) Restored for cruising in 1969 under L.A. Agreement.
2) Bridges culverted.

Proposals

1) BWB have applied for upgrading.
2) Restoration for cruising.

Most Economical Treatment

1) Cruising standard in accordance with Agreement.
2) Water channel.

Elimination

1) Not feasible.
2) Feasible, but water sales justify present maintenance expenditure.

Special Items

a) Llanfoist breach – Consulting Engineers' estimate £40,000 (See Table 15.2).
b) Protective measures to other vulnerable lengths including bed lining and stop gates, estimate £100,000. (See Table 15.2).

ANNUAL ACCOUNTS		1974 £000		Most Economical Treatment Future Accounts £000		Arrears Total £000	Total Cost of Elimination £000
Receipts	Water	5.6		5			
	Amenity	7.6		8			
	Other	1.8	15.0	2	15	340*	220+
Expenditure	Engineering	45.7		46			
	Development	0.2		–			
	Overheads	31.4	77.3	31	77		
	Deficit		62.3		62	340	220
NET PRESENT COSTS (paragraph 15.10.1)		£000			589	255	180
					844		
Net Present Value of Land Drainage Function at £46,000 p.a. (paragraph 15.10.7)		£000			440		

*Excluding special items + Length 2) only.

NOTTINGHAM CANAL (Ref. No. 25, Plate 25)

Length
8.2 km. unnavigable water channel.

Present Function
Land drainage, amenity.

Development
Water level lowered by 550 mm.

Proposals
Negotiations in progress for complete disposal, in water, to L.A. s.

Most Economical Treatment
Water channel.

Elimination
Feasible, but disposal may be cheaper.

ANNUAL ACCOUNTS		1974 £000		Most Economical Treatment: Future Accounts £000		Most Economical Treatment: Arrears Total £000	Total Cost of Elimination £000
Receipts	Water	–		–			
	Amenity	–		–			
	Other	0.6	0.6	1	1	18	98*
Expenditure	Engineering	6.6		8			
	Development	–		–			
	Overheads	7.3	13.9	7	15		
	Deficit		13.3		14	18	98
NET PRESENT COSTS (paragraph 15.10.1)		£000			133	14	82
					147		
Net Present Value of Land Drainage Function at £4,100 p.a. (paragraph 15.10.7)		£000			40		

* Alternatively dispose of to L.A s, say £20,000.

OXFORD CANAL (NORTH) (Ref. No. 10, Plate 7).

Length
7.1 km. in 8 lengths (old loops) of which 6 are in water.

Present Function
Brownsover Arm (2.5 km.) feeder to Cruising length;
Stretton & Rugby Wharf Arms (0.8 km.) moorings.
Remaining 5 arms abandoned.

Development
2 arms dammed off.

Proposals
Retention of 3 arms named above in present roles.
Elimination of remainder.

Most Economical Treatment
Water channel.

Elimination
Feasible for all except Brownsover Arm, and cheapest solution.

ANNUAL ACCOUNTS		1974 £000		Most Economical Treatment: Future Accounts £000		Most Economical Treatment: Arrears Total £000	Total Cost of Elimination £000
Receipts	Water	–		–			
	Amenity	–		–			
	Other	0.1	0.1	–	–	9	23*
Expenditure	Engineering	1.1		2			
	Development	–		–			
	Overheads	1.8	2.9	2	4		
	Deficit		2.8		4	9	23
NET PRESENT COSTS (paragraph 15.10.1)		£000			38	7	19
					45		
Net Present Value of Land Drainage Function at £3,800 p.a. (paragraph 15.10.7)		£000			35		

* All except Brownsover Arm.

PEAK FOREST CANAL (Ref. No. 40, Plate 35)

Length

1) 13.0 km. (Marple Junction – Dukinfield Junction) navigable, under L.A. Agreement.
2) 1.2 km. Buxworth Arm, part dewatered.

Present Function

1) Water sales, land drainage, cruising, amenity.

Development

1) Restored to navigation under L.A. Agreement in 1974.
2) Private restoration for access to former transhipment wharves.

Proposals

1) BWB have applied for upgrading.
2) Completion of restoration and reopening for cruising, moorings, and amenity.

Most Economical Treatment

1) Cruising standard in accordance with Agreement.
2) Water channel.

Elimination

1) Not feasible.
2) Feasible and cheapest solution.

Special Item

Bench construction near Hyde Bank Tunnel requires full investigation (See also paragraph 12.5.6). Remedial works could cost £200,000. (See Table 15.2.).

ANNUAL ACCOUNTS		1974 £000		Most Economical Treatment: Future Accounts £000		Most Economical Treatment: Arrears Total £000	Total Cost of Elimination £000
Receipts	Water	10.2		10			
	Amenity	0.1		–			
	Other	1.0	11.3	1	11	99*	12+
Expenditure	Engineering	37.3		26			
	Development	14.7		–			
	Overheads	7.2	59.2	7	33		
	Deficit		47.9		22	99	12
NET PRESENT COSTS (paragraph 15.10.1)		£000			209	75	10
					284		
Net Present Value of Land Drainage Function at £65,000 p.a. (paragraph 15.10.7)		£000			620		

*Excluding special item. + Applies to Buxworth Arm only.

POCKLINGTON CANAL (Ref. No. 32, Plate 31)

Length

1) 5.2 km. navigable under L.A. Agreement.
2) 10.0 km. water channel.

Function

1) Cruising, amenity.
2) Land drainage, amenity.

Development

1) Restored to cruising under L.A. Agreement.

Proposals

2) Restoration for cruising/amenity under L.A. Agreement.

Most Economical Treatment

1) Cruising standard in accordance with Agreement.
2) Maintain as water channel.

Elimination

1) Not feasible.
2) Feasible, and probably cheapest solution.

ANNUAL ACCOUNTS		1974 £000		Most Economical Treatment: Future Accounts £000		Most Economical Treatment: Arrears Total £000	Total Cost of Elimination £000
Receipts	Water	–		–			
	Amenity	–		–			
	Other	0.1	0.1	–	–	37	50*
Expenditure	Engineering	19.0		19			
	Development	3.1		–			
	Overheads	7.3	29.4	7	26		
	Deficit		29.3		26	37	50
NET PRESENT COSTS (paragraph 15.10.1)		£000			247	27	
					274		42
Net Present Value of Land Drainage Function at £7,600 p.a. (paragraph 15.10.7)		£000			70		

* Length 2) only

ST. HELENS CANAL (Ref. No. 44, Plate 37)

Lengths

1) Main Line, 17.2 km. water channel, 0.6 km. dewatered and 3.3 km. eliminated.
2) Blackbrook Branch 1.1 km. water channel.
3) Pocket Nook Branch 1.3 km. water channel.
4) Carr Mill Reservoir (BWB own water rights only, and have maintenance responsibility).

Present Function

1) Land drainage, amenity.
2) Overflow from Carr Mill Reservoir, amenity.
3) &4) Water sales.

Development

1)-3) Water level lowered, some locks cascaded or eliminated, 1.8 km. of Main Line in process of transfer to L.A.

Proposals

1) Transfer to L.A. s or R.W.A. except for 0.6 km. to be eliminated.
2) Retain for amenity development with L.A. and R.W.A.
3) Disposal.

Most Economical Treatment

1)-3) Water channel except 3.9 km. of 1).

Elimination

1) & 3) Feasible, but disposal probably cheaper.
2) Feasible, but not cheapest solution.

Special Item

Carr Mill Reservoir: Inspecting Engineer's estimate of remedial works required £150,000. (See Table 15.2).

ANNUAL ACCOUNTS		1974 £000		Most Economical Treatment Future Accounts £000		Most Economical Treatment Arrears Total £000	Total Cost of Elimination £000
Receipts	Water	42.3		42			
	Amenity	0.2		–			
	Other	1.0	43.5	1	43	39*	440+
Expenditure	Engineering	9.2		22			
	Development	10.2		–			
	Overheads	11.8	31.2	12	34		
	Deficit		(12.3)		(9)	39	440
NET PRESENT COSTS (paragraph 15.10.1)		£000			(86)	29	360
					(57)		
Net Present Value of Land Drainage Function at £31,000 p.a. (paragraph 15.10.7)		£000			290		

* Excluding special item. + Transfer of 1) to L.A. and R.W.A. under negotiation and probably cheaper

SHEFFIELD & SOUTH YORKSHIRE NAVIGATION (Ref. No. 34e, Plate 32)

Length
6.3 km. navigable (Tinsley to Sheffield Basin).

Present Function
Water sales, land drainage, cruising.

Development
None.

Proposals
Amenity development (L.A.).

Most Economical Treatment
Water channel, but disposal would produce valuable development land.

Elimination
Feasible.

ANNUAL ACCOUNTS		1974 £000		Most Economical Treatment Future Accounts £000		Arrears Total £000	Total Cost of Elimination £000
Receipts	Water	9.1*		14			
	Amenity	2.1		–			
	Other	1.1	12.3	1	15		
Expenditure	Engineering	9.6		8		72	410
	Development	–		6			
	Overheads	5.1	14.7	5	19		
	Deficit		2.4		4	72	410
NET PRESENT COSTS (paragraph 15.10.1)		£000			38	54	340
					92		
Net Present Value of Land Drainage Function at £32,000 p.a. (paragraph 15.10.7)		£000			300		

* Unusually low

SHROPSHIRE UNION CANAL (Ref. No. 21, Plates 20 & 21)

Length

1) Montgomery Branch (Ref. No. 21e, Plate 21) Main Line 53.3 km., water channel except for 8.8 km. dry/piped.
2) Montgomery Branch – Weston and Guilsfield Arms. 4.8 km. mostly dry.
3) Newport, Trench and Shrewsbury Branches (Ref. No. 21f, Plate 21) 2.2 km. in short isolated dewatered lengths plus 1.5 km. in process of disposal (also Berwick Tunnel 0.9 km).
4) Prees Branch (Ref. No. 21d, Plate 20) comprising a) 2.5 km. navigable, b) 1.2 km water channel, and c) 1.7 km. eliminated.

Present Function

1) & 2) Land drainage and amenity.
3) None except for Trench Pool (water sales and amenity).
4) Land drainage, cruising, amenity, access to marina.

Development

1) 2.4 km. length restored to navigation at Welshpool and work is in progress on a further 11.2 km. with finance provided by Prince of Wales Committee. Elsewhere long lengths are overgrown and some bridges have been culverted or lowered.
3) Long lengths eliminated or disposed of.
4) 2.5 km. restored to navigation for access to marina.

Proposals

1) Joint working party with L.A. s to discuss further amenity development for full restoration.
3) Complete disposal, except for Trench Pool.

Most Economical Treatment

1), 4a) & 4b) Water channel.
2) Continue controlled decay.
3) Continue disposal.

Elimination

1) & 3) Feasible, and probably cheapest solution.
2) Continued elimination by controlled decay.
4a) Feasible, but not cheapest solution.
4b) Feasible, and cheapest solution

Special Item

Berwick Tunnel, partially blocked. Very shallow cover to agricultural land. Estimated cost of infilling £70,000 (See Table 15.2).

ANNUAL ACCOUNTS		1974 £000		Most Economical Treatment: Future Accounts £000		Most Economical Treatment: Arrears Total £000	Total Cost of Elimination £000
Receipts	Water	37.4		37			
	Amenity	0.7		1			
	Other	1.8	39.9	2	40		
Expenditure	Engineering	38.0		52		215*	410
	Development	7.6		–			
	Overheads	42.8	88.4	40	92		
	Deficit		48.5		52	215	410
NET PRESENT COSTS (paragraph 15.10.1)		£000			494	151	340
					645		
Net Present Value of Land Drainage Function at £17,500 p.a. (paragraph 15.10.7)		£000			165		

* Excluding Special Item.

SWANSEA CANAL (Ref. No. 14b, Plate 13)

Length
6.1 km. water channel in isolated lengths.

Function
Water sales, land drainage, some amenity use.

Development
Water level lowered.

Proposals
Retain as water channel, weir locks where required.

Most Economical Treatment
Water channel.

Elimination
Feasible.

ANNUAL ACCOUNTS		1974 £000		Most Economical Treatment Future Accounts £000		Most Economical Treatment Arrears Total £000	Total Cost of Elimination £000
Receipts	Water	14.5		15			
	Amenity	–		–			
	Other	0.3	14.8	–	15		
Expenditure	Engineering	8.6		8		18	335
	Development	–		1			
	Overheads	8.8	17.4	9	18		
	Deficit		2.6		3	18	335
NET PRESENT COSTS (paragraph 15.10.1)		£000			29	14	
					43		280
Net Present Value of Land Drainage Function at £31,000 p.a. (paragraph 15.10.7)		£000			290		

FORTH & CLYDE CANAL (Ref. No. 49a, Plates 25 and 26)

Length
1) 54km. (Falkirk to Bowling) water channel, also lengths totalling 1 km. piped by L.A.s.
2) Glasgow Branch 4.2 km. water channel, also 0.3 km. piped by L.A.

Present Function
1) Water sales, land drainage, boating, amenity and moorings (at Bowling).
2) Water sales, land drainage.

Development
1) Water level lowered, piped at several locations by L.A. bascule bridges fixed.

Proposals
1) Joint Working Party with L.A. recommended amenity development. Scottish I.W.A. pressing for restoration to navigation.

Most Economical Treatment
1)&2)Water channel.

Elimination
1)&2)Feasible, but not cheapest solution in either case.

ANNUAL ACCOUNTS		1974 £000		Most Economical Treatment Future Accounts £000		Most Economical Treatment Arrears Total £000	Total Cost of Elimination £000
Receipts	Water	50.9		51			
	Amenity	4.9		5			
	Other	1.9	57.7	2	58		
Expenditure	Engineering	50.9		58		190	4,090
	Development	–		3			
	Overheads	32.4	83.3	32	93		
	Deficit		25.6		35	190	4,090
NET PRESENT COSTS (paragraph 15.10.1)		£000			333	143	
					476		3,395
Net Present Value of Land Drainage Function at £164,000 p.a. (paragraph 15.10.7).		£000			1,560		

MONKLAND CANAL (Ref. No. 49b, Plate 45)

Length
5.0 km. water channel in two lengths, also 11.4 km. piped by L.A.s.

Present Function
Water sales to Pinkston Power Station and supplies Forth & Clyde Canal (49a) for water sales.

Development
Lengths piped, bridges culverted etc.

Proposals
Further piping under consideration.

Most Economical Treatment
Water channel.

Elimination
Feasible.

ANNUAL ACCOUNTS		1974 £000		Most Economical Treatment: Future Accounts £000		Most Economical Treatment: Arrears Total £000	Total Cost of Elimination £000
Receipts	Water	23.3		23			
	Amenity	–		–			
	Other	0.6	23.9	1	24	15	325
Expenditure	Engineering	17.5*		6			
	Development	–		–			
	Overheads	15.1	32.6	15	21		
	Deficit		8.7		(3)	15	325
NET PRESENT COSTS (paragraph 15.10.1)		£000			(29)	11	270
					(18)		
Net Present Value of Land Drainage Function at £25,000 p.a. (paragraph 15.10.7)		£000			240		

* Including abnormal special maintenance.

UNION CANAL (Ref. No. 50, Plate 46)

Length
48.4 km. water channel, including 1.8 km. piped by L.A.

Present Function
Water sales (mainly at Edinburgh end), land drainage, boating, amenity.

Development
Water level lowered by 300 mm, 8 crossings culverted.

Proposals
Subject of Working Party Report. Development for boating and amenity use in conjunction with L.A.s.

Most Economical Treatment
Water channel.

Elimination
Feasible

Special Items
Avon, Almond and Slateford Aqueducts. Repairs as per Consulting Engineers' report £114,000.

ANNUAL ACCOUNTS		1974 £000		Most Economical Treatment: Future Accounts £000		Most Economical Treatment: Arrears Total £000	Total Cost of Elimination £000
Receipts	Water	18.0		22			
	Amenity	0.2		–			
	Other	0.5	18.7	1	23	204*	1,000
Expenditure	Engineering	36.2		36			
	Development	–		–			
	Overheads	24.6	60.8	25	61		
	Deficit		42.1		38	204	1,000
NET PRESENT COSTS (paragraph 15.10.1)		£000			361	153	830
					514		
Net Present Value of Land Drainage Function at £60,000 p.a. (paragraph 15.10.7)		£000			570		

* Including Special Items.

OTHER LENGTHS

A. **Calder & Hebble Navigation: Dewsbury & Halifax Branches.** (Ref. No. 36, Plate 34).

Length
1) Dewsbury Branch 1.0 km. navigable.
2) Halifax Branch 0.6 km. navigable.

Present Function
1) Moorings.
2) Feeder to Main Line.

Development
None.

Proposals
None.

Most Economical Treatment
1) & 2)Water channel.

Elimination
1) Feasible, but probably not cheapest solution.
2) Not feasible.

B. **Gloucester & Sharpness Canal: Stroudwater Canal** (Ref. No. 15, Plate 14).

Length
0.7 km. half navigable.

Present Function
Moorings, feeder to Main Line Gloucester & Sharpness Canal

Development
Part eliminated.

Proposals
None.

Most Economical Treatment
Water channel.

Elimination
Not feasible.

C. **Ripon Canal**
(Ref. No. 33a, Plate 31)

Length
1.6 km, water channel.

Present Function
Feeder to Cruising length, amenity.

Development
Bridges dropped, locks weired.

Proposals
Restoration.

Most Economical Treatment
Water channel.

Elimination
Not feasible.

D. **Sheffield & South Yorkshire Navigation: Dearne & Dove Canal**
(Ref. No. 34a, Plate 33).

Length
0.4 km. navigable.

Present Function
Access to boatyard, navigation rights claimed and serviced.

Development
Back pumping to locks serving boatyard.

Proposals
None.

Most Economical Treatment
Water channel allowing for navigation to boatyard.

Elimination
Feasible, but compensation payable. Otherwise cheapest solution.

E. **Staffordshire & Worcestershire Canal: Hatherton Branch** (Ref. No. 18, Plate 17).

Length
2.3 km. water channel.

Present Function
Feeder to Galley Reservoirs or to main line via length of canal now in private ownership.

Development
Water level lowered, partially disposed of.

Proposals
Various, depending on whether new sewer is routed along canal.

Most Economical Treatment
Water channel.

Elimination
Feasible also for reservoirs but not cheapest solution.

F. **Stourbridge Canal**
(Ref. No. 19, Plate 16)

Length
1) Stourbridge Arm 2.5 km. navigable.
2) Fens Branch 1.1 km. water channel plus Fens Pools.

Present Function
1) Land drainage, cruising, amenity.
2) Land drainage, amenity, feeder (minor).

Development
1) Minor only.
2) Bridge culverted, some drainage diverted from Fens Pools.

Proposals
None.

Most Economical Treatment
1) & 2) Water channel.

Elimination
1) & 2) Feasible, but probably not cheapest solution.

G. **Weaver Navigation: Frodsham Cut**
(Ref. No. 22, Plate 22)

Length
0.8 km. in water.

Function
Disused.

Development
Lock gates fixed.

Proposals
Amenity developments or transfer to L.A.

Most Economical Treatment
Water channel.

Elimination
Feasible, but probably not cheapest solution.

ANNUAL ACCOUNTS		1974 £000		Most Economical Treatment Future Accounts £000		Arrears Total £000	Total Cost of Elimination £000
Receipts	Water	–		–			
	Amenity	0.5		1			
	Other	0.2		–			
Expenditure	Engineering	1.9	0.7	10	1	27	230*
	Development	–		–			
	Overheads	3.5	5.4	5	15		
	Deficit		4.7		14	27	230
NET PRESENT COSTS (paragraph 15.10.1)			£000		133	20	190
					153		
Net Present Value of Land Drainage Function at £21,300 p.a. (paragraph 15.10.7)			£000		200		

* Lengths A1), D, E, F & G only.

CHAPTER 16

SUMMARY AND CONCLUSIONS

Chapter 16

Summary and Conclusions

16.1 *Scope and Purpose of the Study*

16.1.1 The waterways of the BWB system are of three basic types, River Navigations, Canalised Rivers and Artificial Canals, the latter being either wide for barge traffic, or narrow for boats. The BWB are generally responsible only for navigational aspects of and navigational works on the river navigations, but for all aspects of the artificial canals. The navigational obligations are mainly those defined by Section 104 and 105 of the Transport Act 1968, under which the waterways of the BWB system are divided into three categories. The first, Commercial, contains mainly river navigations and canalised rivers but includes some artificial canals, to a total length of 548.5 km. The second category, Cruising waterways, totals 1743 km and includes the bulk of the artificial canals with some canalised rivers. The waterways in the third, Remainder, category total 815 km and include a number that are virtually derelict, though many are still in regular use for cruising.

16.1.2 The prime object of our Study has been to assess the costs of operation and maintenance of all the waterways as required to comply with the Board's Statutory and other obligations. Our Terms of Reference and the scope of the Study are described more fully in Chapter 1 of this Volume. A general account of the development and present state of the system has been given in Chapter 2, while Chapter 3 reviews the Board's legal obligations for their waterways, which extend far beyond the purely navigational obligations defined in the 1968 Act. The individual waterways included in the system are listed in Chapter 4; more detailed descriptions are given in Volume Two and the waterways themselves are illustrated by the series of maps comprised in Volume Three.

16.2 *Maintenance Requirements*

16.2.1 In order to make the required assessments of cost we had first of all to establish what standards of maintenance are implied by the Board's various obligations and to ascertain the extent by which actual conditions fell short. We had to identify any items where the overtaking of arrears of maintenance appeared to be a matter of urgency, and those further items calling for attention under normal continuing maintenance within the 15 year time span contemplated by our Study. We then estimated the cost of dealing with these arrears of maintenance under alternative programmes, and of the continuing maintenance and operating activities.

16.2.2 The various considerations taken into account and the definition of standards of maintenance are discussed in Chapter 10, while Chapter 11 deals with the methods and strategy of future maintenance which we consider appropriate. Details of our assessments are given in Chapter 12, together with an account of the aims and methods of inspection employed in our examination of the works and structures of the BWB waterway system. For the purpose of this chapter we shall first summarise our findings in cost terms, and then refer briefly to the more important features that have emerged.

16.2.3. We find that while the general condition of the Commercial and Cruising waterways is such as to allow of some kind of navigation there are many instances where the present condition of works and structures falls below that indicated by the Board's obligations. At March 1974 price levels the estimated cost of overtaking these arrears of maintenance is £37.6M of which some £3M should be made available immediately in the interests of public safety, and the remainder in accordance with a programme of works carefully planned to avoid undue further deterioration.

16.2.4 Provided that the immediately critical works are given early attention there would be greater freedom in drawing up programmes for the remainder. We have considered various alternatives, as called for in our Terms of Reference, and recommend that urgent works and those appropriate to be let to outside contractors are completed within the first three years, and that the balance of the arrears should be dealt with by direct labour over a further period of twelve years. The rate of direct labour expenditure should build up steadily to a maximum in the first two years of this latter period and after about five years at the maximum rate should be progressively reduced in the last years. For reasons given in Chapter 12 we consider that this programme has advantages in respect of value for expenditure. On completion of the programme the system as a whole will have been brought into a condition in which it can be maintained satisfactorily by a continuing pre-planned annual effort.

16.2.5 The recommended programme would produce, as shown in Fig. 12.5, annual totals of operation and maintenance cost for Commercial and Cruising waterways including the overtaking of arrears as follows (at March 1974 prices):-

Year	£M
1974 (actual)	6.5
1975 (forecast)	7.0
1976	10.9
1977	12.9
1978	13.4
1979	12.6
1980	12.0
1981–86 (each year)	11.3
1987	10.8
1988	10.3
1989	9.3
1990 onwards	8.8

The total expenditure over the 15-year period is £168.7 M, which when discounted at a rate of 10% per annum gives a Net Present Cost of £87.3 M as shown in Table 12.13.

16.2.6 We estimate that the cost of operation and maintenance on a continuing basis (assuming that traffic remains at the 1974 levels) would be £8.8 M per annum, this figure again relating to the Commercial and Cruising waterways only and excluding the docks, estate department and other activities that are outside our Terms of Reference. We recommend as an essential feature of future maintenance that regular and systematic inspections of all works and structures should be made. This would form the basis of the annual programmes ("Programmed Maintenance") so that as far as possible the need for attention is recognised and allowed for in advance, and unnecessary expenditure, e.g. on a purely fixed time interval basis, is avoided.

16.3 *Bank Protection*

16.3.1 By far the largest item in the arrears of maintenance is the need for bank protection; it amounts in total to some £22.4M out of the gross total for all works of £37.6 M (the balance of £15.2 M covers the items detailed in paragraph 16.4.1). If and when such arrears have been overtaken, however, the continuing cost of bank protection maintenance is of the same order (rather less than £1 M p.a.) as for each of the other principal categories (e.g. dredging, structures, etc.) in the system as a whole.

16.3.2 The banks of the waterways serve essentially to contain the water within its intended bounds and to prevent leakage and seepage which, if unchecked, could lead to risk of a breach with consequential flooding and other damage. To avoid erosion and disintegration, mainly but not solely due to the wash-waves of craft, some form of protective revetment is in general necessary. We estimate that some 75% of the towpath side banks and 40% of the offside banks are already provided with some kind of revetment, of which rather more than a quarter is in need of repair and just less than a further quarter requires replacement. In addition nearly all the presently unprotected banks on the towpath side and about half those on the offside will need the provision of revetments within the 15 year period.

16.3.3 These general remarks cover both the Commercial and the Cruising waterways, and the average cost of all protective treatment approaches £8,500 per net km of bank for the former compared with about £6,000 for the latter. The total cost of bank protection on Commercial waterways is estimated at £4.4 M of which 57% relates to waterways in the Castleford Area where the Aire and Calder and the Sheffield and South Yorkshire Navigations each account for about £1 M. The highest unit costs are incurred on river navigations such as the Trent and Severn where the BWB are responsible for the protection of only comparatively short lengths of artificial cut and approaches to locks, but where deeper piling of heavier section is necessary. On the other hand revetments on the Caledonian Canal can be repaired at a comparatively low unit cost.

16.3.4 On the Cruising waterways the total cost of bank protection recommended is some £18 M, 64% of which arises in the Birmingham and Northwich Areas. Costs of all kinds of treatment exceed £1 M for each of the Leeds and Liverpool Canal, Calder and Hebble Navigation, Shropshire Union Canal, Trent and Mersey Canal and the Grand Union Canal. Unit costs will be higher than average on the Grand Union Canal and Oxford Canal (North), in the Birmingham Area and in other places where some protective works need to be carried deeper.

16.3.5 The actual type of protective work required varies considerably from place to place; where deterioration has not gone so far as to necessitate replacement existing revetments may be capable of repair, which is allowed for wherever possible. Substantial lengths of the banks on the Coventry and Trent and Mersey Canals, and the Main Line of the Birmingham Canal Navigations can be repaired at a low unit cost. The short remaining life expected for much of the existing steel trench sheeting can be prolonged by providing a concrete capping for example.

16.3.6 New and replacement works include some lengths of special design where local conditions make them essential, but for the majority of the work we have allowed for a modified form of the steel trench sheeting which the BWB have been using almost exclusively in recent years. This modification, which the BWB are already investigating, consists essentially of galvanising the exposed parts of the sheeting and treating of its anchorages with a view to securing a longer life than the unprotected metal can offer.

16.3.7 It is necessary to emphasise the vital importance of carrying out works of bank protection in order to safeguard the integrity of the waterways and to avoid risk of breaches of the banks developing from leaks and slips. The BWB have an obligation to take every possible precaution against such risks; repair of a major breach is bound to be an expensive item and the damage and loss likely to result from an outrush of water may give rise to very substantial claims by parties affected.

16.4 *Dredging, Structures, Etc.*

16.4.1 Although bank protection works are the largest single element in the total arrears of maintenance, quite substantial costs are estimated to be involved under other headings. The more important, with the respective arrears figures, are:-

	£ M
Dredging	3.5
Locks	2.6
Bridges	2.7
Other structures	1.5

In addition there are items such as reservoirs, feeders, pumping installations, hedges and fences, towing paths, operational property, maintenance plant and equipment, workshops, etc. which account for a further £2.9 M. All these, with £2.0 M for administration charges on the arrears programme, make up the balance of £15.2 M from paragraph 16.3.1.

16.4.2 The need for dredging arises partly from the continued erosion of banks and partly from material brought in by streams, feeders and land drainage. In the river navigations and canalised rivers there is usually a regular demand for dredging to restore navigation depths; occasionally floods may cause rapid siltation that must be dealt with quickly if commercial traffic is not to be impeded. Experience is the only guide to what must be expected and we have made provision in our estimates on the basis of the Board's operations, and their effects, over the past years. The traditional methods are to use floating plant for excavating the silt and debris, loading into floating craft which are then taken to a tip site for deposit on land. More recently some use has been made of land-based appliances which can result in considerable savings where the method is practicable. We have made allowance for economies of this kind wherever we consider that land-based plant could be employed effectively.

16.4.3 An important factor in the maintenance of locks is the need to repair and replace the gates and operating gear at regular intervals. A normal pair of gates, properly maintained, has a life of about forty years. The total number of gates in the system is not so large that replacements cannot be manufactured in BWB workshops as a regular practice, although in certain cases (e.g. the Caledonian Canal) the steel frameworks are best provided by outside contractors as required. We consider that a continuance of these practices is economically justified and have allowed accordingly in our estimates.

16.4.4 Aqueducts provide problems, not least in keeping them watertight and avoiding risk of damage from craft. They may be of cast iron supported on masonry abutments and piers, of masonry with or without cast iron linings, or of brickwork.

Almost every one has had to receive individual consideration. The most notable, Telford's masterpiece at Pontcysyllte on the Llangollen Branch of the Shropshire Union Canal, has recently shown signs of distress, and is now being examined by the Board. In this instance (as in the case of other exceptional items receiving similar attention) we have considered and adopted the Board's assessment of what special maintenance is likely to be required.

16.4.5 Those of the Board's bridges which carry public highways have been the subject of a special exercise "Operation Bridgeguard" – whereby they are being brought up to a condition suitable for carrying modern road traffic, as required by Part VIII of the Transport Act 1968. The costs of the works involved are separately funded and we are not required to take account of them in this Study. We have, however, made provision for subsequent continuing maintenance costs, as these will fall to be borne by the Board. We have also recommended that the Board's accommodation bridges should be dealt with on a similar basis to ensure that they are or will be brought up to a condition adequate for the traffic they have to bear. The costs of the work involved, as well as of subsequent maintenance, will need to be borne by the Board and we have made appropriate provision in our estimates.

16.4.6 The tunnels include several of 2 km and more in length, mostly capable of allowing cruising craft to pass each other but some will accept single line traffic only (there are no tunnels on the Commercial waterways). They are brick or masonry lined, with a few unlined sections, and some have been affected by coal mining subsidence. The Harecastle tunnel on the Trent and Mersey Canal is currently undergoing major repairs and others (including some on Remainder waterways) present special problems. Allowance has been made in each case for the cost of overtaking arrears and the subsequent continuing maintenance costs.

16.5 *Water Supplies*

16.5.1 The maintenance and operation of reservoirs, feeders, pumping stations and other elements of the water supply function, which constitute a substantial part of the Board's annual expenditure, are discussed in detail in Chapter 9. The system is complex; the main problem areas are in the upland regions of the Pennines, the south Midlands and the Chiltern Hills where supplies have to be maintained for the summit levels of artificial canals crossing high watersheds.

16.5.2 There are some ninety reservoirs in the system as a whole, most of which are essential for conserving supplies to meet the fluctuations of rainfall and demand. The Board is obliged to comply with requirements of the Reservoirs (Safety Provisions) Act 1930 and the Reservoirs Act 1975 (when it is brought into force), under which reservoirs are subject to inspection by an engineer on a Government panel, and to carry out any works of repair or alteration that he may stipulate. One consequence has been that the storage capacity of some reservoirs has had to be reduced; in a few cases we consider that it would be justifiable to carry out works, with the approval of the inspecting engineer, to restore or increase the storage capacity. We have not contemplated the construction of entirely new reservoirs, even where an operational need might be established, as any such proposal would involve detailed studies in great depth and prolonged consultation with a number of authorities before any estimate of cost – or indeed feasibility – could be made.

16.5.3 Other sources of supply include streams, wells and boreholes, the exploitation of which is under constant surveillance by the BWB engineers; we consider that it might be advantageous, in making conjunctive use of all water resources, to place somewhat greater reliance on these yields in preference to drawing on reservoirs even though pumping costs would tend to increase. The Board's water engineers have considerable experience in optimising resources and have developed a technique, with the aid of a mathematical model for computer application, which promises to give a useful guide to the most effective way of utilising all available supplies in a given area.

16.5.4 We do however recommend an extension of the use of small pumping units for the purpose of returning water used at locks to the higher levels. This is a relatively cheap and flexible method of conserving supplies and we consider that there is scope for a number of new or enlarged units at specific places; some may not be needed unless cruising traffic expands to double its present volume or more, but when the time comes there should be no difficulty in designing suitable installations. We have made provision accordingly in our estimates for Chapters 12 and 13.

16.5.5 We have drawn attention in Chapter 9 to the fact that the operation of locks is not the only reason for requiring supplies of water. Comparable quantities are needed to make good evaporation, percolation and leakage losses, none of which can be returned to the system. Reduction of leakage, etc. to the maximum possible extent is therefore important for this reason as well as to minimise the risk of breaches in the banks and bed of the waterways. At the same time water can be conserved by an effective control of lock operations, supervision of sluices and regulation of pound levels. For this reason we have stressed the importance of having adequate supervisory staff, particularly at busy holiday periods on the Cruising waterways.

16.6 *Standards of Maintenance*

16.6.1 The standards which we have defined in Chapter 10 and the deficiencies revealed by our inspections are of two kinds, quantitative and qualitative. The quantitative standards were defined in relation to the specific navigational obligations laid down by Section 105 of the Transport Act 1968, and their main effect was to identify for each waterway critical dimensions such as width and depth of water, headroom, etc. which have to be observed; if not currently available then these dimensions must be achieved by dredging or other works. In most cases we found that the required dimensions can be obtained without difficulty, some overtaking of dredging arrears being all that is required. In a few cases however we found it necessary to allow for bank revetment works in order that additional dredging may be carried out.

16.6.2 It was however in the qualitative aspect of maintenance works that we found considerable arrears to exist. No specific standards could be derived from a consideration of the Board's statutory obligations and we found it necessary to take account of all the Board's legal obligations, particularly those relating (whether at Common Law or otherwise) to public safety, public health and amenity. In addition to these factors we found it necessary to form our own views as to proper standards of engineering construction for the various components of the waterways and their structures. In doing so we consulted the BWB and ascertained their own views and relevant practices. To a large extent we found ourselves in agreement, but there were some points on which we found it necessary to adopt different criteria as detailed in Chapters 10 and 11.

16.6.3 Our physical examination of the waterways comprised

a thorough inspection of representative lengths totalling 10% of the whole, supplemented by spot checks on more important features, individual structures, etc. over a further 5%. In addition a second survey on a random sampling basis, concentrating on bank protection requirements, was undertaken separately in order to confirm the situation in respect of this very important category of work. Totals of about 20% of the works and structures in the system were thus inspected for the purpose of this Study.

16.6.4 By its nature our survey was not capable of examining every detail of the system, nor was it possible to see the effects of extreme conditions such as exceptional floods or prolonged drought. Examination of many structures was necessarily superficial, and it was possible to make a full examination of underwater structures only in the few cases when waterways had been drained for special attention. Nevertheless we are satisfied that the combined results of our inspections together with the information supplied by BWB officers are sufficient to enable us to form reliable assessments of the existing state of the system and the deficiencies of maintenance calling for inclusion in programmes of works.

16.6.5 In the course of our inspections care was taken to obtain the views of local BWB officers on the existence of maintenance problems which might not have been immediately obvious. This was particularly important as the BWB had themselves undertaken a comprehensive survey of the condition of the waterways and their structures in 1970, on the results of which schedules of maintenance requirements had been prepared. It was one of our objectives to see how far our own survey agreed with the BWB 1970 survey. It was evident from the outset that the largest items of cost would be found in bank protection work, and after initial comparisons had disclosed a lack of sufficient agreement the second survey, specially devoted to this class of work, was undertaken as a check on our first more general survey.

16.6.6 Particular care was taken in compiling estimates of unit costs for the various kinds of works. Where these are peculiar to waterway practice we consulted the BWB and compiled schedules of rates generally applicable to the system as a whole. Where possible prices were confirmed independently and outside contractors' prices checked. All figures were brought to March 1974 price levels as required by the Terms of Reference, and due allowance has been made for such overhead charges as supervisory and administration costs.

16.6.7 In the outcome our estimates of cost for arrears of maintenance as described above and set out in detail in Chapter 12 were close to those of the BWB 1970 survey, after allowing for the rise in prices between that date and March 1974. This correspondence was more clearly seen in the total figures but there was a lack of consistency in some categories of work and also between the various Areas of the Board's administration. Some of these differences could be explained by changes since 1970, i.e. remedial works undertaken at many points and continued deterioration elsewhere, but others were probably due to our application of more uniform and more closely defined standards over the whole system.

16.6.8 We examined the organisation and general administration of the Board's maintenance and operating divisions so far as they would have any significant effect on effectiveness and costs; we did not make a management study as such. We concluded that the BWB have an organisation, under their Chief Engineer, which contains competent professional engineers capable of evaluating requirements and assessing appropriate methods of treatment. It also contains technical, supervisory and wages grade staff able to carry out by direct labour and contract a wide range of maintenance works and operational duties.

16.6.9 In our view, however, there is a need for the present arrangements for periodical inspections of works and structures to be strengthened. In order to ensure that maintenance can be properly directed to meeting the Board's obligations it is considered that a system of Programmed Maintenance, based on a systematic inspection and reporting procedure, should be provided for. At present it is clear that the annual programmes of maintenance works are governed more by the amount of money made available than by considerations of maintenance standards and engineering criteria.

16.7 *Special Constraints*

16.7.1 The BWB are affected by a number of constraints in operating and maintaining their waterways. Some of these are of a general nature, such as the regard which must always be had for public safety; others arise from statutory obligations and are more specific in character. These include such matters as the navigational requirements, the strengthening of public road bridges and the control of reservoirs which have already been mentioned in this Summary.

16.7.2 There are, however, other constraints affecting the Board's operations which have a direct or indirect bearing on the costs it has to bear. Chapter 6 of this Report discusses the way in which current legislation imposes limitations on the manner in which the BWB can deal with those of their structures and works that are classified as Ancient Monuments and Listed Buildings; also their responsibilities in relation to Conservation Areas. It has not been possible to form any reliable estimate of the total cost of complying with these various obligations. What may be more important is the consequent delay in enabling decisions to be made as to how repairs and reconstructions should be carried out, or even as to the feasibility of certain kinds of development.

16.7.3 Chapter 7 of this Report deals with another kind of constraint, that arising from the effects of mining subsidence and mineral workings generally. The largest items of cost are incurred in the protective and remedial measures necessitated by coal mining and brine pumping operations. These are likely to increase in the future as a result of increased development by the National Coal Board, including their new coalfield in the Selby area, and of revision of an agreement between BWB and NCB when it comes up for renewal in 1978.

16.7.4 Constraints – if they may be so termed – of a less onerous kind result from the Board's obligations to make Cruising waterways available for fishing and other recreational purposes and to preserve amenity on Remainder waterways. The effects are detailed in Chapter 8 and include the recognition of Nature Reserves and Sites of Special Scientific Interest under relevant legislation. Although no special maintenance costs are incurred on account of such status there is some obligation to preserve access to the waterways and reservoirs concerned and conceivably a limitation on freedom to undertake works of maintenance in some situations.

16.8 *Use of the Waterways*

16.8.1 The Terms of Reference call for particulars for each waterway of the extent of use under ten separate headings and of the extent and nature of waterway-related private investment.

Full information in these respects is set out in Chapter 5, with discussions of the more important features, and the salient points may be summarised as follows.

16.8.2 The Commercial waterways carried 3.73 million tonnes of freight in 1974; other waterways added only 0.13 million tonnes. The largest craft were tankers of up to 1,000 tonnes on the Gloucester and Sharpness Canal; barges on other waterways did not exceed 500 tonnes capacity. Some 72.5 M tonne-kilometres of freight transport were recorded over the total of 548.5 km of Commercial waterway, the journey distance averaging 25% of the length of the individual waterways.

16.8.3 Cruising has grown rapidly in recent years and is practised on Commercial and Remainder waterways as well as on all the Cruising waterways. In addition to private cruising there is a substantial "commercial" element which includes hire cruisers, trip boats and hotel boats. In 1974 there were over 25,000 boats licensed and registered and a count of craft on one day in August gave a total of 21,200. Over 2,000 craft were recorded on each of the Grand Union and Shropshire Union Canals and over 1,000 craft on each of four other waterways.

16.8.4 The provision of accommodation for craft when not navigating is becoming a matter of some concern. Hire-cruiser operators have their own centres, usually with berthing space off the waterways, and a number of marinas have recently been established for general use. Occupation of linear moorings along the banks of the waterways is a cause of congestion and the BWB are seeking to phase out such moorings and to provide or encourage alternative accommodation. It is estimated that the system as a whole now provides space for not more than about 16,500 berths, so that there is already a need for the development of more marinas off the main channels. A number of sites have been earmarked for consideration by private developers.

16.8.5 The whole system is used for a wide range of amenity activities as described in Chapter 8. There are over 250 Angling Clubs and Associations making use of the Board's waterways and reservoirs and a one-day count in August 1974 recorded 25,126 anglers on the waterways and 1,010 on the reservoirs. Towpath users totalled 9,793 and 411 respectively.

16.8.6 A very important function of the system is the reception of land drainage, surface and storm water, sewage and other effluents. Many of these discharges are firmly established by long-standing custom and usage but the more recent instances are covered by agreements. Determination would often present great physical difficulties and it is evident that the system forms an essential component of the country's drainage network. Where the BWB receive payment under agreement they endeavour to have it assessed on a basis that would recognise the drainage value, but often only the direct costs of dealing with and disposing of the effluents are covered. It would seem to be appropriate, particularly when considering the future of Remainder waterways, to take account of the value to the country of the service provided in this way. We deal with this question for the Remainder waterways in Chapter 15 but have made no attempt to assess the value of the drainage function for the Commercial and Cruising waterways.

16.8.7 A substantial part of the Board's revenue is derived from the sale of water to industry, for which they have statutory powers, the licensing of the abstractions being specially provided for by the Water Resources Act 1963. In 1974 more than 200,000 Ml of water was abstracted for this purpose, of which some 82% was returned to the system after use. There were 50 customers who each paid more than £5,000 p.a. for the use of water. Although the larger users are found on some river navigations very substantial supplies were taken from the Remainder waterways in the Birmingham area and in Scotland.

16.8.8 Use is made of waterways for bulk transportation of water for use by public water supply undertakings, the principal instances being the Gloucester and Sharpness Canal and the Llangollen Branch of the Shropshire Union Canal. Recently a project has been completed for making use of the Fossdyke and part of the Witham Navigations for a similar purpose. There would not appear to be much prospect of further schemes being developed purely for public water supply purposes but we consider that there may be scope for redeploying resources in some cases for the joint benefit of the BWB and public supply undertakings. Any such proposals would need the approval of the Regional Water Authorities concerned.

16.8.9 Private investment related to the waterways includes commercial and industrial installations, many of which have only a small residual value in present day conditions. Investment in modern freight-carrying craft and cargo handling appliances is probably not less than £10 M and a notional book value of the total currently in operation might be £25 M. Cruising activities certainly account for larger amounts; we estimate that they may be of the order of £9 M for fixed installations and as much as £60 M for craft of all kinds. The average fixed-installation investment per boat licensed, about £370, compares with an estimate given by a firm of hire cruiser operators that new investment is now running at some £500 - £600 per berth. Our survey noted a total of 49 builders of cruising craft and 315 boatyard, marina and service sites actually located on the BWB system.

16.8.10 In addition to dealing with current conditions we were asked to comment on the effects of possible further growth in waterway usage. We consider, as discussed in Chapter 13, that on the Commercial waterways there is scope for dealing with two or three times the present volume of freight traffic, carried in craft capable of using the present locks. A scheme for accommodating larger craft by reconstructing locks, etc. on the Sheffield and South Yorkshire Navigation is not within the scope of our study. A corresponding increase of cruising traffic on Commercial waterways would necessitate a larger degree of control of movements through the locks.

16.8.11 With regard to the Cruising waterways, there are already evident signs of congestion in certain places at peak periods. If the present rate of cruising activity growth continues craft movements could double in seven years and treble within about twelve years. It would not be possible for the peak intensities to double or treble at places already experiencing congestion, so that there would have to be an extension of supervision and control of craft movements, leading to a spreading out over other periods and places, to allow for the total traffic envisaged. Congestion arises at constricting points such as single track tunnels and aqueducts and at narrow locks, particularly those in staircase formation. It would be necessary in some cases to consider the construction of relief lock flights but the widening of tunnels and aqueducts is not generally contemplated. Other factors to be considered are the provision of additional water supplies and the optimum location of moorings, marinas, hire-cruiser centres, etc.

16.8.12 With these considerations in mind we estimated, in Chapter 13, that the cost of providing for a 100% increase in

traffic would be £5.8 M, with a further £7.2 M for a 200% increase. When these figures were applied to the alternative programmes of Chapter 12 it was found that our recommended form of programme (summarised in paragraph 16.2.5) remained the best in terms of value for expenditure. Over the 15-year period the total expenditure under the modified programme would increase by £19.3 M to £188.0 M and the corresponding Net Present Cost by £11.7 M to £99.0 M.

16.8.13 Chapter 14 discusses the costs of operation and maintenance resulting from observing the specific navigational standards defined in the Transport Act 1968 for Commercial and Cruising waterways, with the object of advising on the effect of disregarding the need to provide for "Commercial" and "Cruising" navigation. We consider that, if general navigational use continued to be made of these waterways for the time being to such extent as the reduced standards might permit, the effect of disregarding the specific standards would be to reduce the cost of overtaking their arrears of maintenance by some £4.8 M to £32.8 M. The corresponding reduction in the continuing costs of operation and maintenance would be about £1.2 M to £7.6 M per annum.

16.8.14 In the eventual situation of all navigation ceasing, after an interim period of decreasing navigation, the annual costs would reduce by a further £2.1 M to £5.5 M. If, however, all navigation were to cease immediately, then the 'arrears' costs would be reassessed at £21.6 M and the saving in continuing costs would be increased to some £3.5 M, i.e. the ongoing costs would be £5.3 M per annum.

16.9 *Remainder Waterways*

16.9.1 The Remainder category comprises practically the whole of some sixteen separate waterways and parts (in some cases very small branches, loops etc.) of sixteen others; they are listed in Table 4.3 of Chapter 4. We are required to advise on the annual operating and maintenance costs for the most economical treatment in each case and to take into account the cost of elimination where such a course is possible.

16.9.2 The considerations which govern various possible lines of treatment for Remainder waterways, having regard to the provisions of Section 107 of the Transport Act 1968 and the Board's other obligations, are discussed in Chapter 15. Apart from the specific differences between Remainder waterways and those in the Commercial and Cruising categories introduced by the 1968 Act, one important consideration appears to be that any works involved in a proposed change of user would require planning consent from the appropriate local authority. All protective provisions for the benefit of other parties contained in existing enactments would have to be observed. Firm contractual obligations to local authorities and other bodies must also be taken into account.

16.9.3 Conditions on some Remainder waterways have changed since the 1968 Act was passed. The Board have made considerable progress with disposing of unwanted canals and derelict lengths on the one hand, and on the other with developing sections for amenity purposes by agreement with local authorities. In some cases, e.g. the Ashton, Peak Forest and Caldon Canals, restoration for cruising purposes has been effected. Having regard to these changes the Inland Waterways Amenity Advisory Council have made a number of recommendations (in accordance with their statutory duties) for regrading certain Remainder waterways to Cruising status, but no action has been taken to implement their views.

16.9.4 We have, therefore, given full consideration to possible lines of treatment for all the waterways contained in the Remainder category. Practical courses in most cases are confined to:-

retention for the present function as a navigable waterway or a water channel,
conversion of a navigable waterway into a water channel,
disposal as it stands, or
partial or complete elimination.

The necessity or value of preserving the function of a water channel may depend on the extent to which the waterway in question either provides a water supply to a Cruising or Commercial waterway or acts as a link in a land drainage network.

16.9.5 The results of our examinations of all the individual Remainder waterways are set out in the tabulated statements ("digests") appended to Chapter 15. In each case the estimated annual operating and maintenance costs for the most economical treatment short of elimination are given; costs of elimination are given for comparison in those cases where elimination seems possible. Where appropriate an indication is included of the notional value of the waterway in respect of land drainage.

16.9.6 On the basis of the digests it is clear that retention of a Remainder waterway for navigation would be economical only where the BWB have entered into agreements with local authorities for making contributions towards the cost of maintenance. In some other cases elimination is feasible and economical but in all the rest conversion to or retention as a water channel is the optimum treatment. Of the present total length of 815 km the results of adopting the most economical treatment would be as follows:-

	km
Retain for cruising	142.5
Retain for light boating	23.0
Convert to or retain as a water channel	441.0
Dispose of or eliminate	208.5

16.9.7 It is impossible to make close estimates of cost in all cases as much will depend on terms to be negotiated with local authorities, industry, land owners, etc., and on conditions that may be attached to planning consents. After making such assumptions as now appear to be reasonable we consider that the future net cost of operating and maintaining the Remainder waterways on the lines indicated would amount to some £935,000 per annum, including recommended annual contingency allowances of £175,000.

16.9.8 Although strictly outside our Terms of Reference we have suggested in Chapter 15 that, although it may not be feasible to eliminate or materially alter the present use of certain waterways, there could be merit in the BWB transferring them as they stand to a local authority or another navigation authority. These might include the

Ripon Canal (with the River Ure Navigation)
Pocklington Canal
Manchester, Bolton and Bury Canal
St. Helens Canal
Swansea Canal

It may also be desirable to give special consideration to the Remainder lengths of the Kennet and Avon Canal.

16.10 *Acknowledgements*

16.10.1 During the whole course of this Study we have received every possible assistance from the officers and staff of the British Waterways Board. Our field inspections were facilitated by the engineers and inspectors who gave freely of their local knowledge and made arrangements for access wherever required. The specialist engineers and other officers were very ready at all times to provide data from their respective fields and to discuss their work. We are particularly indebted to the Chief Engineer and his staff at Headquarters, and to the General Manager and other Departmental Heads, who spared neither time nor trouble in answering questions and discussing various aspects of our work. They have in this way made a substantial contribution in the direction of factual accuracy of the descriptive matter, etc., contained in this Report. They have in no way, however, been concerned with or responsible for the opinions expressed, policies advocated or recommendations made; these are entirely our own.

16.10.2 We wish to place on record the help given to us by other authorities and organisations concerned with the waterways; they are mentioned individually in Chapter 1. Their respective interests are diverse and while we have not been able to take into consideration all the points brought to our attention we are grateful for the information and advice made available in every case.

16.10.3 We also acknowledge the advice and guidance received from the representatives of the Department of the Environment, at all stages of our Study, in clarifying issues that emerged during its course and in enabling us to present our conclusions in a form that would best serve the intended purpose.