APPENDIX H : ON-SITE PLAN EXAMPLE B

APPENDIX H : EXAMPLE OF

ON-SITE PLAN
Example B (Owner of many Consequence Class A1 dams)

ON-SITE PLAN

FOR CASCADE OF RESERVOIRS ON

RIVER RHUN (SOUTH BRANCH)

Preface

This example plan, although based on a real cascade, has been edited in respect of names and key features of the reservoirs to preserve the anonyminity of the reservoirs

Change log for plan

Rev	Date	Details of nature of change	By	Ckd	Approved		Accepted by EA
					Owner	Panel AR[1]	
A01.01	17/06/2005	Issued to Environment Agency for examination and acceptance	FJBS	AJB	EHG	JDG	Na
A01.02	15/11/2005	Accepted by Environment Agency	-	-	-	-	ABC
A1.03	2/8/2006	Update contacts	RTS	SEG	Na	Na	Na

Notes

1. Documented in signed off separate statement by Qualified Civil Engineer

Contents

Tables

Figures

1 OBJECTIVES, SCOPE AND ADMINISTRATION OF THE ON-SITE PLAN

1.1 Objectives

This plan forms part of the risk management of the reservoirs listed in Table 2, comprising the measures that would be taken on site in the event of a serious problem with the structural stability of the dam. It also satisfies the requirements for Element II of a Flood Plan under Section 12A of the Reservoirs Act 1975 (added through Section 77 of the Water Act 2003).

1.2 Scope

The reservoirs on the cascade on River Rhun (South) are summarised in Table 2 and shown on Figure 1.1, with this plan covering those reservoirs owned by Krypton plc.

There is a separate reservoir on a downstream tributary of the River Rhun, termed River Rhun (West), also owned by Krypton plc. However this is covered by a separate on-site plan, as failure of the dams on one tributary would not affect the safety of the reservoir(s) on the other tributary

This element of the Flood Plan under the Water Act 2003 should be read in conjunction with the schedule of other documents listed in Attachment F.2.

1.3 Administration of the plan

The status of this document is as shown on the cover of this document and it is issued to those shown in Table 1. The electronic copy of the plan is password protected, with the password issued by the Reservoir Safety Manager.

In addition it is available on the company intranet, with password protected access (password given to Duty Managers and Supervising Engineers).

Table 1 : Distribution list for copies of this document

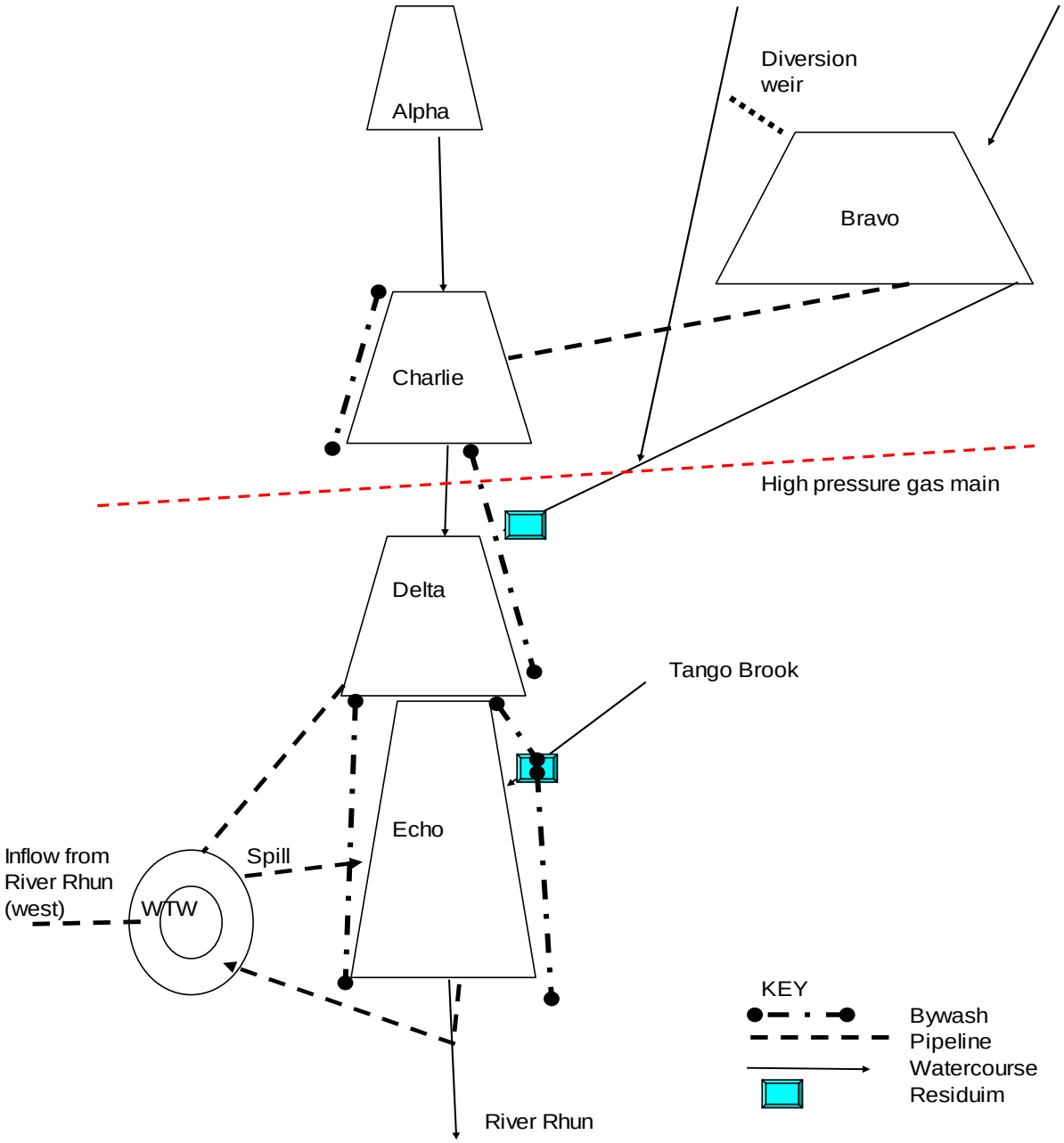
Position	Name	Postal Address	Phone (working hours)	Format
Internal – Krypton plc				
Reservoir Safety Manager	A N Other	xxxxx	xxxx	Electronic notification of changes; plan on company intranet
Emergency Planning Officer	C Smith	xxxxx	xxxx	
Duty Managers File	xxxxx	xxxxx	xxxx	
Supervising Engineer (s)	A. Mann	xxxxx	xxxx	
Operations Manager	xxxxx	xxxxx	xxxx	
Enforcement Authority (Environment Agency)				
a) Technical Manager-Reservoir Safety	xxxxx	Reservoir Safety - Technical Manager, The Environment Agency, Manley House, Kestrel Way, Sowton Industrial Estate, EXETER, EX2 7LQ		Electronic + Hard
b) Regional office.-Operations Manager	xxxxx	xxxxx	xxxx	Hard

Table 2 : Reservoirs and dams in cascade

Reservoir			Dams				Personnel with a knowledge of the dam's behaviour		
Name	Capacity at spillway crest m^3	Surface area m^2	No	Name	Grid Ref[1]	Reservoir that would receive breach	Name	Position	Contact details
Covered by this plan							*Undertaker's Staff*		
Bravo	440,000	70,000	1	Bravo	(AA) 1234 5678	Delta	A Mann	Sup Eng (current)	As Table 1
Charlie	250,000	40,000	1	Charlie	(AA) 1234 5678	Delta	A Other	Sup Eng (prior to 1998)	Event Management Plan
Delta	410,000	50,000	1	Delta	(AA) 1234 5678	Echo	A N Other	Res Safety Manager	As Table 1
Echo	1,300,000	110,000	1	Echo	(AA) 1234 5678	None			
In cascade, but not covered by this plan							*External to Undertaker*		
Alpha	75,000	25,000	1	Alpha		Bravo	John Smith		Appendix F.1

1. Shown on Landranger (1:50,000 scale) Map No xxx and Explorer (1:25,000 scale) Map No xxx
2. The dams and reservoirs covered by this plan are all Consequence Class A1
3. All reservoirs have surveillance visits three times a week.

Figure 1.1 Schematic of reservoirs and dams in cascade



2 MANAGEMENT OF EMERGENCY BY UNDERTAKER

2.1 Undertaker's procedures and authorised personnel

The companies "Event Management Plan" (EMP) applies. This includes

- Standard company procedures for managing emergencies
- Lists of staff positions authorised to take action and manage the emergency
- Contact lists for individuals filling each position
- Escalation sequence for incident, related to severity

2.2 External communication

As for all Krypton plc reservoirs there is a sign board at the reservoir site with the company's name, the name of the dam (and reservoir) and a 24 hour emergency contact number, so members of the public can ring in if they notice any problems.

External notification of an incident will be made once it has reached Advisory, or greater, as defined in Table 4.4 of the Engineering Guide. This will by the Duty Manager, after Director level authorisation. Notification will be to the Local Resilience Forum and use the form in Element III of the Flood plan. Where a Director is not available then the Duty Manager shall issue the external notification, to avoid any delay in off-site actions.

2.3 Checklist for those attending emergency

The individual in charge at the dam site should arrange to take, or have delivered to site, the information listed in Table 3. Clearly the priority should be to get to the dam as soon as possible, so it would often be appropriate to go straight to the dam and arrange for any missing items to be delivered to site from elsewhere.

Table 3 : Checklist of information and ancillary equipment required on site

		Available from
1	Mobile phone (and charger)	Use personal.
2	Copy of this plan	Electronic - Tough box laptop held by Headworks Operator Hard copy – files at head office
3	Copy of drawings/ reservoir record	
4	Keys for gate (or bolt croppers)	Local depot
5	Screwdrivers (to lift flooring?)	
6	Confined space equipment	Not required to operate valves

3 DESCRIPTION OF THE RESERVOIRS AND RETAINING DAMS

3.1 Situation

The reservoirs are in open country upstream of the urban area of Lima, which fills the valley floor. The three upper reservoirs are in a National Park.

There is a public highway along the right hand side of the valley, and public footpaths across the valley at several locations.

The Consequence category of the dams is given in Table 2.

3.2 Detailed Records

All data is held electronically on the company computer system, with no hard copy system (other than archived records). The various databases are summarised in Table 4.

Table 4 : Location of information on reservoirs

Information	Electronic Database		Other
	Company network	Other	
Reservoir Record under Statutory Instrument No 1985 No 177	Electronic data management system (EDMS)[1]	Copy on Headworks Operator "Tough box"[2]	
Drawings			
Last Inspection report			
Supervising Engineers statements			
Draw off facilities, schedule of valves	Asset Inventory system[1]	-	Copy in Attachment D
Diversion capacity		-	Tabulated in Attachment B
Monitoring data	Reservoir Safety Section Hard drive	-	
Reservoirs - reservoir volume are area versus elevation		-	Copy in Attachment C
Supplementary to above	-	-	Attachment E

1. Access from any company computer, password protected (Duty managers and internal Supervising Engineers have password). However, currently data on reservoirs in not partitioned from other asset data e.g. for WTW
2. Access to laptop computer is password protected, data is read only

3.3 Physical dimensions and features

This plan includes summarises key dimensions and other information which would be of value to have to hand in an emergency, as follows

Element	
Reservoirs - reservoir level versus elevation	Attachment B
Dam	• Table 5 • Additional information in Attachment E
Appurtenant works	In Reservoir Record
Draw off capacity	Attachment C
Schedule of valves	Attachment D

Table 5 : Summary of key dimensions of dams in cascade covered by this plan (ordered upstream to downstream)

Name	Date built	Height of crest above river bed m	Spillway crest Level mOD	Dam Crest			Crest wall height m	Type of watertight element
				Level mOD	Length m	Width m		
Bravo	1870	15	301.7	303. 59	600	4	none	Puddle clay core
Charlie	1870	21	261.70	263.26`	164	12	0.9	Puddle clay core
Delta	1890	23	233.0	236.75	120	3	0.7	Puddle clay core
Echo	1940	30	219.76	221.26	228	3	1.3	Puddle clay core

3.4 Other features relevant to on-site operations

There is a regional high pressure gas main that runs across the valley, downstream of Charlie and upstream of Delta.

3.5 Access to reservoirs

The dams are 12km SSE of Lima, on a two lane A road, the Axxx, which runs up the valley and provides the main regional access. This and other access routes are summarised in Table 6; whilst vehicular access to the various parts of the dams are summarised in Table 7. Maps are included in Attachment A.

Arrangements for access onto Krypton plc land are covered in the Event Management Plan

Table 6 : Alternative access routes to reservoirs from nearest A road

	Description		Weight/ height restriction within 10km of dam
		Risks of being blocked	
1	Axxxx from the Mx junction xx (14 km) via Lima to Echo	Flooding in 100 year flood	None
2	Axxxx, cross county from the Mx junction xx (18 km) to Echo	Flooding in 100 year flood	None
3	Axxxx, over the moors to Bravo (22 km to Zulu)	Road occasionally closed due to snow in winter	None

3.6 Communications at reservoir site

Mobile phone coverage at the dam site is as follows

Network	Reception at dam	Nearest reception (if none at dam site)
Vodaphone	None	At top of hill at Grid Ref XY 9999 9999, 1.2km from dam
O2	None	
Orange	None, apart from intermittent poor reception at Bravo spillway	
Other	None	

The nearest landlines are

	Location	OS Grid Ref	Distance from dam (by road)	Remarks
Company WTW	Right abutment of Echo.	XY 9999 9999	Right abutment of Echo	Normally unmanned, key from Area Control. One public phone, one company network
Public telephone	By church in Edoras	XY 9999 9999	0. 6 km from Echo	Vulnerable to flooding
	By pub in Rhun village		2 km on 4WD from Bravo	Hill above dams
Private lines	2 The Warren, Edoras	XY 9999 9999	0.3 km from Echo	Within Environment Agency extreme flood outline
	4, The Warren, Edoras	XY 9999 9999		

Krypton plc has no 2 way radios (they have been superseded by mobile phones).

3.7 Welfare facilities

Although there are no facilities at the dams, the adjacent WTW on the right abutment of Echo has

- One unisex toilet
- Control room
- First aid equipment

3.8 Normal Operation

The various functions relevant to operation of the reservoir in an emergency are listed in the distribution list for this document, shown in Table 1.

There are surveillance visits to all the reservoirs at the frequency shown in the note to Table 2.

Table 7 : Vehicular access to elements of dams

	Bravo	Charlie	Delta	Echo
Public access	None	Road over crest	Footpath along berm on ds face	Footpath along berm on d/s face
Undertaker's Personnel	4WD to dam toe, on public highway	C onto crest, on public highway	C to end of crest, on public highway	C to end of crest, on public highway
Access for operation of valves				
Upstream valves	FB	FB + valve cover. Gate in crest wall	FB + valve cover. Climb over crest wall	FB + gate to tower. Gate in crest wall
Downstream chamber	P	P	FB	FB over spillway
Access for works				
Upstream face	No crest wall, 1.5 m high local steepening of pitching	Obstructed by crest wall	Obstructed by crest wall	Obstructed by crest wall
Crest	4WD - 5t along grass crest (weight limit due to stability of upstream wall)	C- Public road, gravel	4WD along grass crest	4WD along grass crest
Downstream toe	4WD (far side of stone toe wall) on gravel public highway	P (tracks come to within 50m, but blocked by stone walls)	P (Water level in Echo reservoir 1m deep)	4WD via WTW
Spillway weir crest	4WD	Dam crest, set back 6m	Dam crest , set back 6m	Dam crest, set back 6m and 4WD down abutment behind crest

Key

Access (in decreasing ease)	
C	Ordinary car
4WD	4 wheel drive (and truck)
TRACK	Tracked vehicle
P	Pedestrian

FB	Footbridge
5t	5 tonne weight limit

4 ACTIONS BY UNDERTAKER ON SITE

4.1 Situation assessment

The first step on arrival of an engineer at the dam is assessment of the situation, to assess

- Likely mode of failure, and estimated time to failure if no action were taken
- Candidate options for actions that could be taken to delay or avert failure
- Availability of resources, both on site and at short notice from off-site
- Risk assessment of candidate options, in terms of all of likely effectiveness in averting failure, health and safety issues for personnel on site and environmental impacts

The same process will be used where the incident has arisen because of an incident at Alpha dam, upstream of the reservoirs covered by this plan, although the candidate options will be different.

The checklist in table 4.8 of the Engineering Guide may be used to assist in this process. The action(s) to be taken will be determined by the Site Lead.

This plan has identified the candidate options described in the following sections. Other options may become apparent in the event of an emergency. The effectiveness of the adopted option should be reviewed continually, and where appropriate modified.

4.2 Undertaker's Resources relevant to on-site activities

4.2.1 Equipment at dam site

There is no equipment at any of the reservoirs or dams.

4.2.2 Resources which could be brought to site

The reservoirs are part of a group of 8 reservoirs, which are managed by four Headworks Operators, who are committed full time to the Headworks.

The arrangements for assistance from framework contractors is given in the Event Management Plan.

4.3 Reservoir drawdown

4.3.1 Capacity of Permanent installations

Attachment C includes data on the reservoir volume and drawoff capacity at different elevations, and the drawdown vs. time for varying inflows.

There are no indirect inflows, other than the releases made within the cascade

4.3.2 Operation of Permanent installations

Information relevant to operation is attached as follows

Information	Given in
Details of valve arrangements	Attachment D
Tables of the installed drawdown capacity vs. reservoir level	Attachment C
Valve testing procedure	Krypton procedures manual
Emergency Drawdown	Krypton procedures manual

4.3.3 Provision for installing and operating additional pumps

There is no special provision for the installation of additional pumps. Each reservoir has only one drawoff, so if the emergency occurred along the line of the drawoff, then reservoir drawdown would have to be with pumps brought to site.

4.4 Other measures

Consideration of the potential failure modes as part of the periodic safety review of the reservoir, and preparation of this plan, have identified contingency measures which may be appropriate to avert failure which are summarised in Tables 8 to 11.

4.5 Off-site impacts of site activities

The maximum outflow from the permanent installations is $3.4m^3/s$, which is significantly less than the 100 year flood (approx $30m^3/s$). There are no weirs or other flow control structures in the first 15km downstream of the reservoirs. Direct off-site impacts on third parties should therefore be small.

The water treatment works which are fed by the reservoirs covered by this plan are also fed from reservoirs on the River Rhun (west). The impact of an emergency at one of the reservoirs covered by this plan would depend on which reservoir was affected, and could result in loss of up to 50% of capacity. The other risk is that failure of the dams could sever the supply main from the water treatment works to Edoras. Reference should be made to a separate water supply emergency plan.

4.6 Assistance from external organisations with on-site measures

Assistance may be required with

a) closing the public footpaths across the three lower dams
b) limiting public access up the single road access to the dam (which is narrow, being single track in places)

Table 8 : Bravo reservoir: Contingency measures considered in drawing up plan

Omitted for brevity

Table 9 : Charlie reservoir: Contingency measures considered in drawing up plan

Omitted for brevity

Table 10 : Delta reservoir: Contingency measures considered in drawing up plan

Measure	Description	Constraints	Equipment and Resources available on site	Possible consequential risk to dam that may be created[1]	Assessment of risk to personnel operating equipment[1]
1	Lower reservoir by decanting to other reservoirs/ elsewhere	30tcm day to WTW	Valves see Appendix D	*Omitted for brevity*	
2	Divert inflows e.g. Using bywash channel	Capacity of bywash given in Appendix B	Valves see Appendix D		
3	Controlled breach of dam on an abutment/ side valley to lower reservoir	Not geometrically suitable	-		
4	Dump fill upstream	4WD onto crest from public road	-		
5	Dump fill downstream to form filter	No vehicular access	-		
6	Dump fill downstream as toe weight	No vehicular access	-		
7	Remove debris from partially blocked spillway during flood	Spillway upstream of crest wall by 5m	None		

Note 1: Risks to be assessed by consideration of hazard and likelihood priori to implementation, using standard company risk assessment forms

Table 11 : Echo reservoir: Contingency measures considered in drawing up plan

Omitted for brevity

5 MEASURES AT OTHER INSTALLATIONS

5.1 Upstream reservoirs

The upstream reservoir, Alpha, is not linked to the other reservoirs in any way other than through the watercourse. Being used for fishing it is normally kept full and there would be little opportunity to block off inflows from this reservoir into the lower reservoirs in the cascade.

5.2 Downstream reservoirs

In the event of an incident at a dam in the cascade, above the bottom (Echo) reservoir of the cascade, as well as measures at the dam, priority would be put into emptying Echo reservoir such that if the upstream dam failed the dam-break flood (including any consequential failures of intermediate reservoirs) would be absorbed in Echo reservoir. Emptying Echo reservoir would be achieved by

- Diverting flows form higher up the cascade around Echo in the bywash channels
- Emergency drawdown of Echo reservoir

The potential volume which would enter Echo reservoir is summarised in Table 12.

Table 12 : Potential volume entering Echo reservoir, in the event of a failure of an upstream reservoir

Consequential failure of	Tributary					
	Alpha/ Charlie			Bravo		
	Volume of individual Reservoir	Cumulative reservoir volume	Additional volume in freeboard to dam crest	Volume of individual Reservoir	Cumulative reservoir volume	Additional volume in freeboard to dam crest
Alpha	75,000		30,000	Not app.		
Bravo	Not app			440,000	440,000	130,000
Charlie	250,000	325,000	62,000	Different tributary		
Delta	410,000	735,000	188,000	410,000	850,000	188,000
Cumulative with flood volume in freeboard		1,015,000	280,000		1,168,000	318,000

5.3 Other installations

The water treatment works would be used to avert failure, by maximising drawoff from Delta dam into the treatment works (and thus into supply).

Other than this there are no other installations that could be used to avert failure, or mitigate the effects downstream.

6 MAINTENANCE OF THE PLAN

6.1 Training of staff

The Reservoir Safety Manager, or other Krypton plc nominee, shall maintain a list of individuals who would be involved in implementing this plan, together with the training which those individuals have received. As well as the seminar below it should list

- Confined space training
- Any other training relevant to the management of emergencies

A company wide one day seminar or workshop shall be held at the frequency shown in Table 13, where the various elements of emergency planning for reservoirs are discussed. Attendees shall include, as a minimum, the following

- Krypton plc Reservoir Safety manager
- Krypton plc Emergency Planning Officer
- At least one of the Duty (Operations Room) Managers
- Supervising Engineers (at least one from the reservoirs covered by this plan)
- Headworks Operators (at least one from the reservoirs covered by this plan)
- At least one Inspecting Engineer used by Krypton
- Invited representative of the Local Resilience Forum

This seminar would normally cover both

a) generic planning for all reservoirs owned by Krypton plc, and
b) the flood plan for one of the cascades of reservoirs owned by Krypton plc (not necessarily those covered by this plan).

6.2 Periodic testing of equipment

All valves shall be operated as follows, with the timing and sequence of releases planned to minimise environmental impact. Reference should be made to the separate notification sheet to the Environment Agency for releases from the reservoirs in this cascade, given in Attachment H.

a) Reservoir safety valves - six monthly
b) Other valves - annually

6.3 Exercising of On-site plan

Exercising shall be carried out as shown in Table 13.

Table 13: Frequency of exercising of on-site plan for this group of reservoirs

Level of Exercise		Frequency	Application
-	Contact verification	Quarterly	Every reservoir
O1	Call out simulation	Annual	One reservoir in this group
T	Seminar	Annual (Note 1)	One member of staff for this group
O2	Tabletop	Included as part of seminar	
O3	Control post/ Operations Room	Not required, as already covered through real incidents in other areas of the companies operations (non reservoirs)	
S1	Site attendance	2 years	One reservoir in this group
S2	Emergency measures	5 years	

Notes

1. Details of exercise defined in Section 4.1 of this plan; otherwise as described in Guide to Emergency planning
2. The company will hold one of these exercise annually, but this group need only attend every two years

This group of reservoirs shall be considered as part of a group of 15 reservoirs covered by the same Headworks group as follows:

- Four reservoirs in the plan covered by this cascade
- One reservoir on River Rhun (north branch)
- Five reservoirs in cascade on River India
- Two reservoirs in cascade on River Juliet
- One Non-impounding and two service reservoirs north of India village

Every exercise should include a formal debriefing and lessons learnt report, with changes to this plan where appropriate, as part of a continuous improvement process.

6.4 Review and updating of plan

The list of contacts in Attachment F should be checked quarterly, with a checklist of dates and times phone numbers were checked given in the format in Attachment G.2 in the Supervising Engineer's annual statements.

This plan should be reviewed (and updated or modified as appropriate)

- following every exercise of this plan
- annually by the Supervising Engineer
- on a reservoir by reservoir basis, as part of a periodic Section 10 Inspection

ATTACHMENT A : MAPS SHOWING ACCESS TO DAM SITE

	Item	Size	No of sheets	Scale
	Regional access	Note 1	1	100,000
	Local access routes and constraints to cascade	Note 1		10,000
	Extent of fluvial flooding in 100 and 1000 year floods (from Environment Agency website)			20,000

Note :
1. Original at A3, reduced to A4 in plan

These maps are omitted from the Guide in the interests of maintaining the anonymity of the reservoirs covered by the plan

ATTACHMENT B : HYDROMETRIC DATA AND DIVERSION CAPACITY

B.1 Gauged Flows

Flow records at the nearest gauging stations included in the Hydrometric register are summarised in Table B.1. 50 and 10 percentile daily inflows to each of the reservoirs in the cascade are given in Table B.2.

Table B.1 : Flows at nearest gauging station

Station No	xxxxxx		
River	Rhun		
Station name	Rhum Mill		
Grid Ref	(AA) 1234 5678		
Catchment area	97.4	km^2	
Years of record	1979-2003		Runoff expressed as mm/day/ km^2
Structure full discharge**	6.5	m^3/s	5.8
Mean rainfall	1290	mm	
Mean annual runoff	705	mm	1.9
Mean flow	2.18	m^3/s	1.9
Median annual flood (QMED)	Not given	m^3/s	
10 percentile (high flow)	4.8	m^3/s	4.3
50 percentile (median)**	1.17	m^3/s	1.0
95 percentile (low flow)	.45	m^3/s	0.4

** from Hydrometric statistics section, rather than Gauging Station Register

B.2 Flood Estimates

A flood routing study for the group of reservoirs (July 1996) showed

		Alpha	Bravo	Charlie	Delta	Echo
PMF						
Inflow						
Duration	Hours		3.75	4.25	4.25	
Summer PMF flood surcharge	m		1.09	1.41	1.98	2.34
Winter PMF surcharge	m		1.04	1.36	1.91	2.29
Weir length			11.5	13.0	24.38	22.86
'c' factor			1.5	1.8	1.65	1.88
Inflow			28	42	118	179
Peak routed outflow (Summer)	m^3/s		20	39	112	154
Prorata to Gauged flows						
QMED	m^3/s	0.4	0.4	0.8	2.3	3.5
Interpolated on log-log paper						
10 year – Q	m^3/s					8
Volume[1]						100,000

Notes

1. Assuming storm duration = 1.5 times that of PMF

B.3 Diversion and bypass capacity

Table B.2 : Inflows, Diversion and By-pass capacity for Reservoirs in cascade

Reservoir name	Catchment area	SAAR	Daily inflow[2]		Median annual flood	Capacity of Bywash around reservoir		Diversion into/ away from watercourse	
			Median 50%	Wet 10%	(2.33 year return period)[3]	Left abutment	Right abutment	Maximum capacity	Destination
	km^2	mm/yr	m^3/day	m^3/day	m^3/sec	m^3/day	m^3/day	m^3/day	
Alpha	1.1	1660	2,000	7,000	0.4	None	None	None	
Bravo	1.2	1602	2,000	7,000	0.4	None	None	None	
Charlie	2.3	1567	3,500	14,000	0.8	None	8,000	None	
Delta	6.6	1580	10,000	40,000	2.3	10,000	None	30,000	To water treatment works
Echo	9.7	1523	15,000	60,000	3.5	4,000	12,000	None	
Gauging station	81.9[1]								

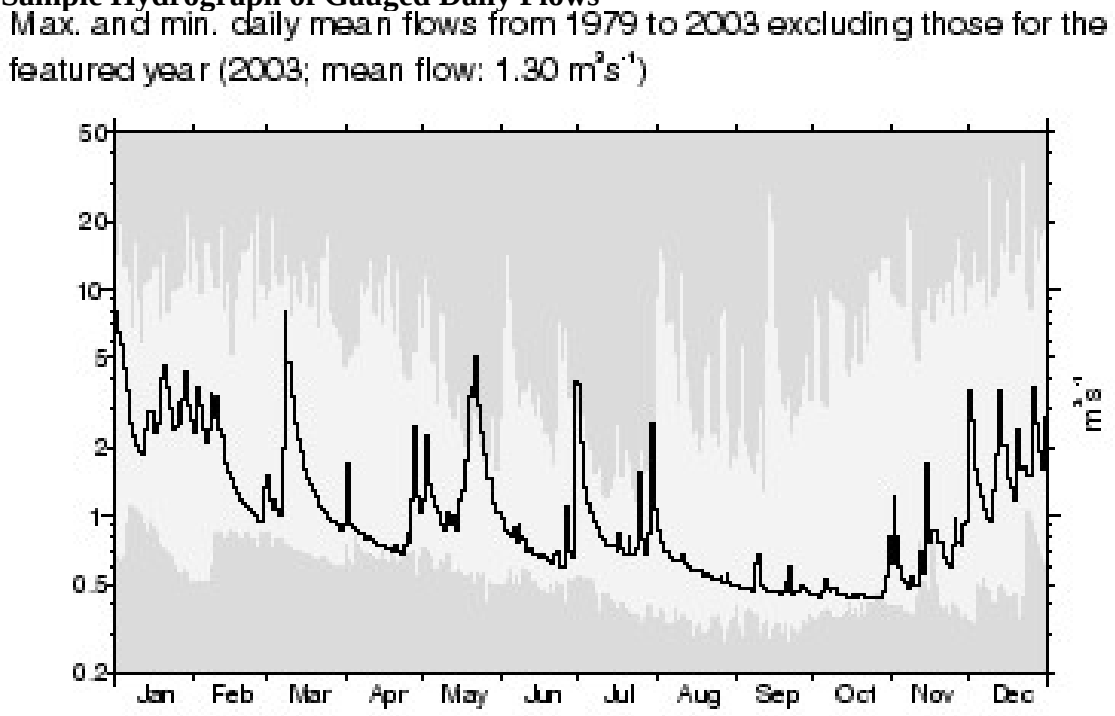
1. Effective for daily runoff i.e. reduced to allow for abstractions from the reservoirs in the upper catchment
2. Daily inflow prorata on the ratio of effective catchment area (i.e. actual catchment area is reduced to allow for abstractions), rainfall to gauged flows at stations in Attachment B, neglects any regulation or storage by upstream reservoirs
3. Prorata to actual catchment area

B.4 Gauging Station data downloaded from Internet

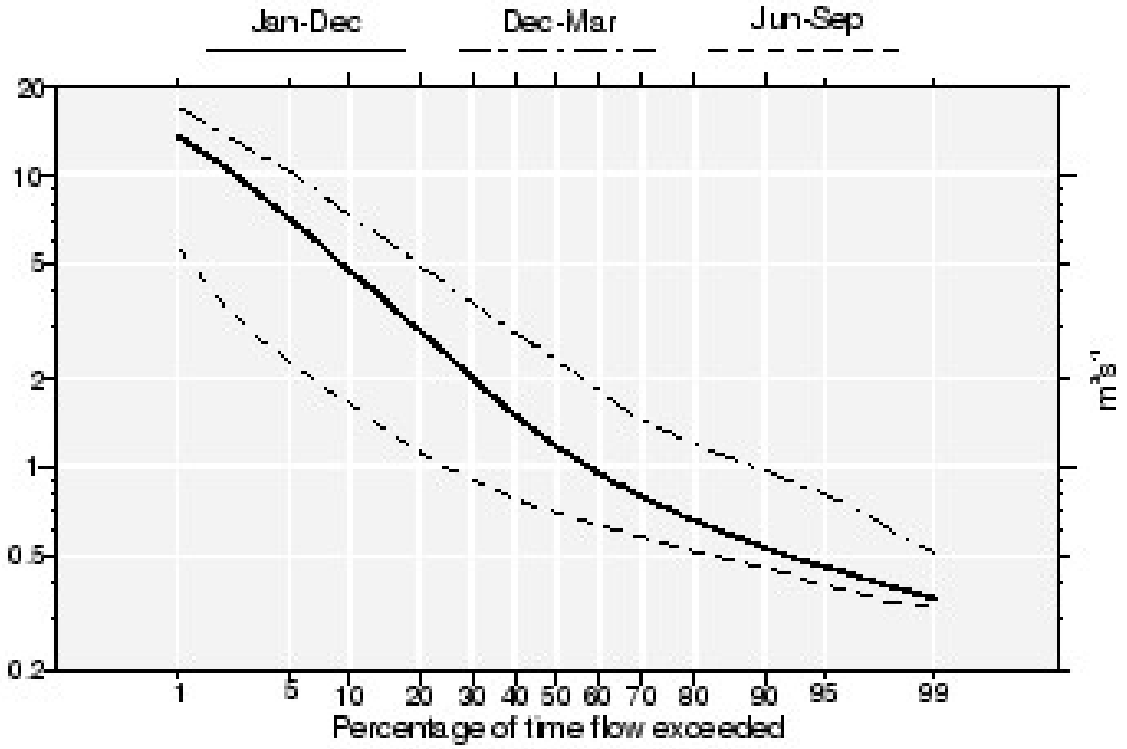
xxxxx- RHUN at RHUM Mill

Grid Reference:	Xx(AB) XXXX XXXX
Operator:	EA
Local number:	
Catchment Area:	97.4 km^2
Level of Station:	68.1 mOD
Max. Altitude:	582.0 mOD
Mean flow:	2.17 m^3s^{-1}
95% exceedance (Q95):	0.457 m^3s^{-1}
10% exceedance (Q10):	4.842 m^3s^{-1}
61-90 Av. Ann. Rainfall:	1231 mm

Sample Hydrograph of Gauged Daily Flows



Flow Duration Curve for Gauged Daily Flows



Station Description

Flat V weir, 11m wide, 1:10 cross-slope. Full range. Reservoirs in headwaters - compensation releases from Rhun Bridge group affects flow pattern. Net export of water from the catchment.

Catchment Description

Predominantly xxxxxxxxx. Moorland headwaters; urban and industrial development in the lower catchment.

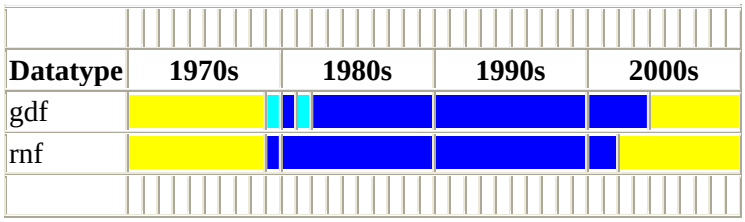
Factors Affecting Runoff

- Reservoir(s) in catchment affect runoff.
- Regulation from surface water and/or ground water.
- Runoff reduced by industrial/agricultural abstraction.

River Flow and Catchment Rainfall on the National River Flow Archive

Gauged Daily Flows (gdf): 1979 to 2003

Monthly Catchment Rainfall (rnf): 1979 to 2001



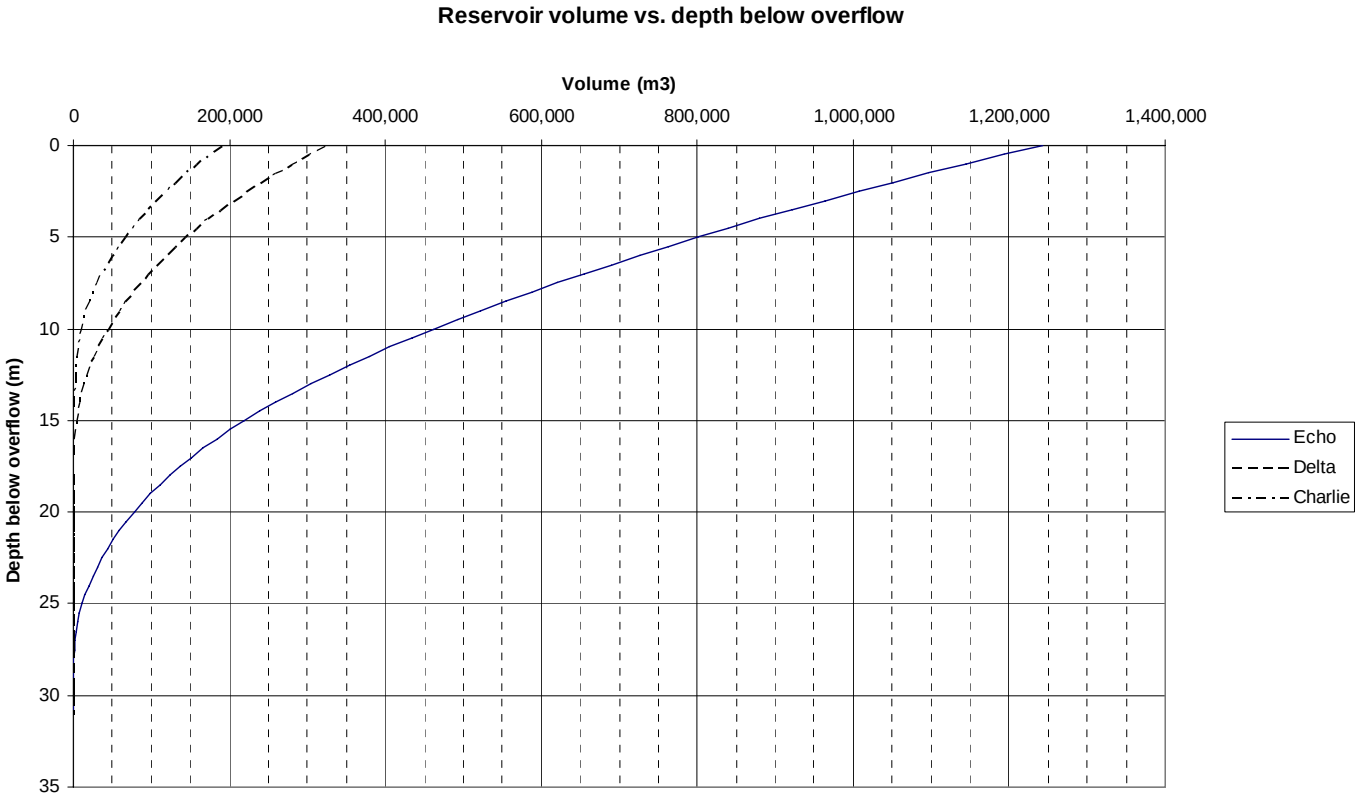
For many stations monthly peak flows are also archived. When daily flow data are not available monthly mean flows may be held on the National River Flow Archive. See Data Holdings for further information.

ATTACHMENT C : RESERVOIR LEVEL VS ELEVATION AND DRAWDOWN CAPACITY

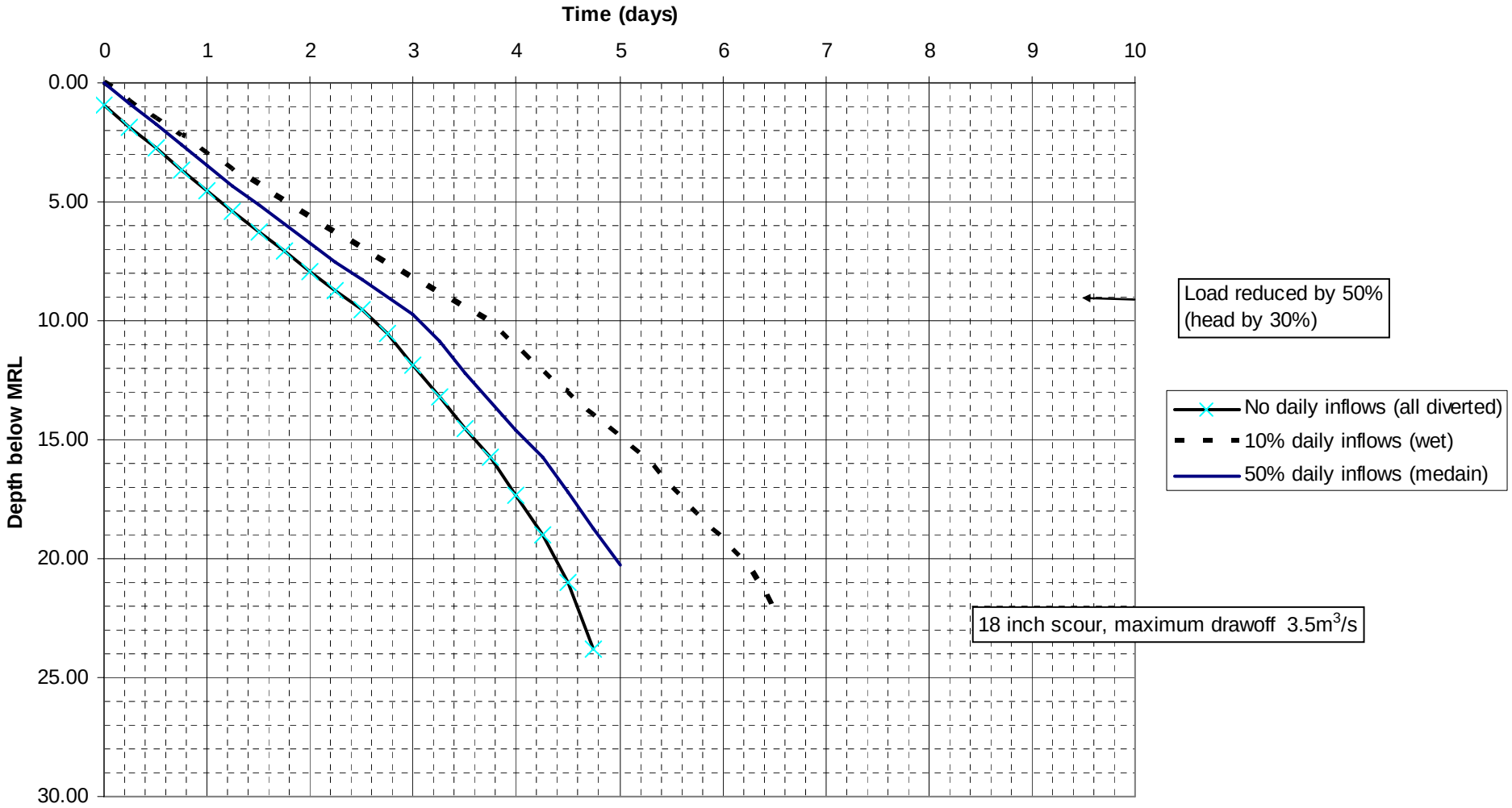
Contents

Item	Title	Size	No sheets	
	Graphs of reservoir volume and area vs. elevation	A4	4*	1/ reservoir
	Tables of drawoff capacity vs. reservoir elevation			
	Graphs of drawdown capacity vs. reservoir elevation	A4	4*	1/ reservoir

Only that for Echo reservoir included as example, for brevity



Echo reservoir: Drawdown vs. time for varying inflows



Echo Reservoir : Drawoff capacity vs. elevation

			Flow rate m^3/day		
Depth m Down	Reservoir capacity	Pipe area (m^2)	Bottom outlet 0.16	Supply 0.07	Total
0.0	1,242,716		201,969	89,764	291,734
0.5	1,193,134		200,334	89,037	289,371
1.0	1,144,823		198,685	88,305	286,990
1.5	1,097,742		197,023	87,566	284,588
2.0	1,051,843		195,346	86,820	282,166
2.5	1,007,120		193,654	86,069	279,723
3.0	963,566		191,948	85,310	277,258
3.5	921,164		190,227	84,545	274,772
4.0	879,892		188,489	83,773	272,262
4.5	839,725		186,736	82,994	269,730
5.0	800,654		184,966	82,207	267,173
5.5	762,660		183,179	81,413	264,591
6.0	725,703		181,374	80,611	261,985
6.5	689,712		179,551	79,800	259,352
7.0	654,616		177,709	78,982	256,691
7.5	620,373		175,849	78,155	254,004
8.0	586,969		173,968	77,319	251,287
8.5	554,453		172,066	76,474	248,540
9.0	522,879		170,144	75,619	245,763
9.5	492,232		168,199	74,755	242,955
10.0	462,459		166,232	73,881	240,113
10.5	433,620		164,241	72,996	237,237
11.0	405,820		162,226	72,100	234,326
11.5	379,056		160,185	71,193	231,379
12.0	353,267		158,118	70,275	228,393
12.5	328,441		156,024	69,344	225,368
13.0	304,600		153,901	68,400	222,301
13.5	281,731		151,748	67,444	219,192
14.0	259,804		149,565	66,473	216,038
14.5	239,076		147,349	65,488	212,837
15.0	219,680		145,099	64,489	209,588
15.5	201,219		142,814	63,473	206,287
16.0	183,447		140,492	62,441	202,932
16.5	166,618		138,130	61,391	199,522
17.0	151,047		135,728	60,323	196,051
17.5	136,763		133,282	59,236	192,519
18.0	123,492		130,791	58,129	188,920
18.5	111,035		128,251	57,000	185,251
19.0	99,362		125,660	55,849	181,508
19.5	88,305		123,014	54,673	177,687
20.0	77,739		120,310	53,471	173,781
20.5	67,992		117,544	52,242	169,785
21.0	59,216		114,711	50,983	165,694
21.5	51,194		111,806	49,692	161,498
22.0	43,895		108,824	48,366	157,191
22.5	37,229		105,758	47,004	152,762
23.0	31,077		102,601	45,600	148,201
23.5	25,361		99,343	44,152	143,495

24.0	20,052	95,974	42,655	138,629
24.5	15,305	92,483	41,104	133,586
25.0	11,280	88,855	39,491	128,346
25.5	7,928	85,072	37,810	122,882
26.0	5,163	81,113	36,050	117,163
26.5	3,172	76,950	34,200	111,151
27.0	1,896	72,550	32,244	104,794
27.5	1,001	67,864	30,162	98,026
28.0	396	62,830	27,924	90,754
28.5	101	57,355	25,491	82,847
29.0	28	51,300	22,800	74,100
29.5	6	44,427	19,745	64,173
30.0	2	36,275	16,122	52,397
30.5	0	25,650	11,400	37,050
31.0	0	0	0	0

ATTACHMENT D : PLANS SHOWING VALVE ARRANGEMENTS

	Item	Size	No of sheets	Scale	Remarks
	For each of four reservoirs • Schedule of valves present • Valve locations and numbering at each reservoir	 A4 A4	 4* 4		 1/ reservoir 1/ reservoir

* only that for Echo reservoir included, for brevity

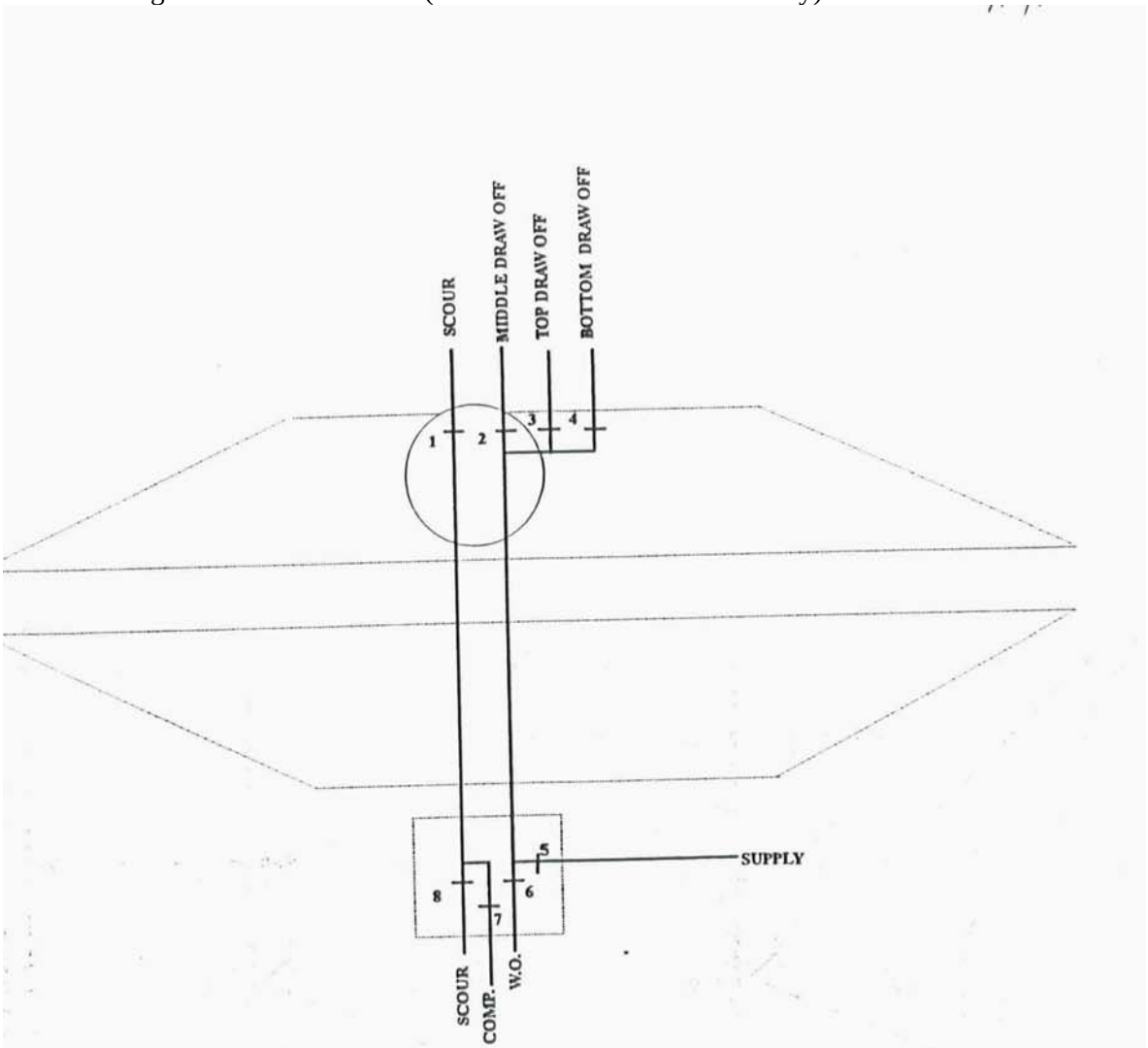
Table D.1 : Schedule of valves present at reservoir

Reservoir Name	Valve ID/ Number[1]	Location of operating position	Function	Reservoir safty[2]	Type	Size	Method of operation;	Number of turns to fully open	Direction to open (CW/ACW)	Normal position
Echo	28/1	Valve tower	Top Draw Off,		Sluice	18"	Manual	295	Clockwise	Varies, partially open
	28/2		Middle Draw Off,		Sluice	18"	Manual	304	Clockwise	
	28/3		Bottom Draw Off,	Y	Sluice	18"	Manual	303	Clockwise	
	28/4		Bottom outlet Guard,	Y	Sluice	18"	Manual	306	Clockwise	Fully Closed
	28/5	Bottom valve house	Supply Isolator,		Sluice	12"	Manual	50	Clockwise	Fully Open
	28/6		Supply Main Washout,	Y	Sluice	12"	Manual	52	Clockwise	Fully Closed
	28/7		Compensation Guard,		Sluice	12"	Manual	51	Clockwise	Fully Open
	28/8		Bottom outlet Duty,	Y	Sluice	12"	Manual	51	Clockwise	Fully Closed
	28/9	External	Compensation Duty by compensation chamber		Sluice		Manual		Clockwise	Partially Open
	28/10		Compensation Chamber Washout		Sluice		Manual		Clockwise	
	28/11		Stilling Basin Washout	Y	Sluice		Manual		Clockwise	Fully Closed
	28/12	Bottom of valve tower	Level Tube Isolator,		Sluice	1.5"	Manual		Clockwise	Fully Open
	28/13		Level Tube Washout		Sluice	2"	Manual		Anticlockwise	Fully Closed
	28/14	Take Dike intake residuum	Tango Brook to Res. Bypass Control,	Y	Penstock	5'	Manual		Anticlockwise	Fully Closed
	28/15		Tango Brook to Res. Bypass Control,	Y	Penstock	5'	Manual		Anticlockwise	Fully Closed
	28/16		Tango Brook to Res. Bypass Control,	Y	Penstock	5'	Manual		Anticlockwise	Fully Closed
	28/17		Drain		Standard tap		Manual		Anticlockwise	Fully Closed

Notes

1. Reservoir number(each reservoir in portfolio owned by Krypton plc has unique number)/ valve number
2. Reservoir safety valves exercised more frequently, as shown in Section 6.2 of plan

Echo : Arrangement of valves 1 to 8 (Valves 9 to 17 omitted for clarity)



VALVE	SIZE	TYPE	POSITION	REMARKS
1	18"	S.V.	OPEN	TESTED OK.
2	18"	S.V.	SHUT	TESTED OK.
3	18"	S.V.	OPEN	TESTED OK.
4	18"	S.V.	SHUT	NOT TESTED
5	12"	S.V.	OPEN	TESTED OK.
6	12"	S.V.	SHUT	NOT TESTED
7	12"	S.V.	OPEN	TESTED OK.
8	12"	S.V.	SHUT	"JUMPED" WHEN CLOSING OTHERWISE OK.

ATTACHMENT E : INFORMATION SUPPLEMENTARY TO RESERVOIR RECORD

Delta Reservoir
The inflows on the right abutment mitre, on the upstream face, are from a spring encountered during construction, taking water over the puddle clay cut-off extension (approximately 100m along) along the right hand side of the reservoir

Services
The high pressure gas main shown on the schematic plan (running across the valley immediately downstream of Charlie), owned by Shell, is 400mm diameter and 60 bar pressure.

ATTACHMENT F : INFORMATION DUE TO BE UPDATED FREQUENTLY

Details of checks/ updates since last major revision of plan

Date	Updated by	Comments
5th Dec 2005	A Mann	No change
5th March 2006	A Mann	Keeper of Alpha lake changed

F.1 Contact details (supplementary to those in Event Management Plan)

Position	Name	Postal address	Phone		
			(working hours)	Out of hours (24hour contact)	Mobile
Owner of Alpha Lake	Mineral Angling Society	Co the Secretary 5 Hill View Rhun Village	xxxxx	xxxxx	Xxxxx
Keeper for Alpha lake	A Smith	8 The Close, Rhun Village	xxxxx	xxxxx	Xxxxx

F.2 Schedule of associated documents to be read with this plan

Type	Title	Plan		Latest Revision			Remarks
		Originator	Owned by	Rev No	Date	Custodian/ Contact	
In-house procedure	Event Management Plan	Krypton plc	Krypton plc	05	Jan 2003	Emergency Planning Officer C Smith	
In-house procedure	Event Procedures Manual for Echo reservoir	Krypton plc	Krypton plc	05	Jan 2003	Res. Safety Manager A.N.Other	
Inundation analysis and consequence assessment for	River Rhun (South Branch)	Consultant 1	Krypton plc	02.01	Feb 1999	D Brown	
On-site plan	Alpha lake	Consultant 2	Mineral angling society	01.01	Mar. 2001	F Smith	Another Reservoir in this cascade
Method statement for routine releases	Reservoirs on River Rhun (South Branch) owned by Krypton plc	Krypton plc	Krypton plc	02	Jan 2005	A N Smith	
	Alpha lake	Consultant 2	Mineral angling society	01	Jan 2001	F Smith	Another Reservoir in this cascade
Interface with off-site organisations	River Rhun (South Branch)	Krypton plc	Krypton plc	02.02	Feb 1999	A N Smith	
	Alpha lake	Consultant 2	Mineral angling society	01.01	Mar 2001	F Smith	Another Reservoir in this cascade

ATTACHMENT G : MAINTENANCE LOG

G.1 Exercising since On-site plan issued

Details of entry		Details of exercise			Details of debriefing/ lessons learnt			Actions taken/ remarks
Date	Name	Date	Level (as Table 4.14 of Guide)	Lead individual	Date	Lead individual	Location of report	

G.2 Contact verification and callout simulation

Details of entry		Details of verification				Result of call	Any Actions taken/ remarks
Date	Name	Date	Time	Type	Lead individual		

ATTACHMENT H : EXTRACTS FROM "KRYPTON PLC EVENT MANAGEMENT PLAN" (SEPARATE DOCUMENT)

Note: This would not normally be part of an individual plan, but is included to illustrate the kind of content that might be in a company's Emergency Management Manual and standard procedures. It is noted that most water companies have these regularly audited internally and externally as part of their ISO9001 accreditation.

Incident Management

Incidents shall be reported to the Duty Manager, located in the company Operating Room, manned 24 hours a day. Where the incident is serious he shall set up two teams, as follows

	Critical Incident Management team	Local Incident Management Team (LIMT)	Representative advising LRF
Location	Incident Room[1]	Nearest office[2]	LRF Control room
Position	Strategic Direction, Resources, External Interfaces	Site Operations	Advise to LRF on dam safety management issues
Team leader	Director	Tier 2 Manager	Minimum of one individual
Team members	As required e.g. LIMT plus others	Emergency Planning Officer Press Officer Procurement /Commercial Supervising Engineer Runner (Headworks Controller)	None

1. In headquarters building, adjacent to Control Room, equipped with standby power. Contingency plan for the Control Room includes two alternative equipped rooms on headquarters site, if normal venue unavailable for any reason
2. If no suitable office, then in one of the company's Incident Support Vehicle; a van equipped with satellite phone, fax and radio.

Resources and Response Time

The Company has framework contracts with three contractors. These require under a Priority 0 callout they should be present on site within 2 hours out of hours, and 1 hour for a callout during working hours.

Krypton plc have a control room manned 24 hours a day, and would expect similar response times from their own personnel.

Escalation sequence for an incident at a reservoir

The normal escalation sequence would be

	Lead	Alternative if unavailable	Level of incident when escalate to next level
1	Duty Manager	Whoever is in charge of Control Room	Watch or Alert
2	Reservoir Safety Manager	A Supervising Engineer **	Advisory
3	Group Manager	Alternative Group Manager **	Advisory
4	Director		

** Named list of contact sequence; five names minimum

Surveillance of reservoirs

Routine surveillance and operation is by teams of Headworks Operators, organised in groups covering a defined list of reservoirs. Each team provides 24 hour cover and is familiar with all of the reservoirs within their group. These staff are separate from staff operating water treatment and distribution, and where assistance was required this would be provided by another group of Headworks Operators, who are familiar with reservoir operation.

Management of Valves and padlocks

Valve keys and padlocks are kept in the depot, with control and issue by the Headworks Operators for that Group. One padlock key should operate all padlocks within that group.

Each valve is individually numbered, e.g. 28/4, where the first number is the reservoir number and the second the number of the valve at that reservoir. Each valve is individually labelled on site. A copy of the valve layout schematic and schedule is on site fixed to a structure wall out of sight but accessible, in the vicinity of the valves.

Valves are normally manually operated, from the top of the valve tower (via extension spindles). Where there is no building over the top of the valve tower, then metal covers are installed over the valve spindles, secured by padlocks. Above ground headstocks are normally operated anticlockwise to close (but there are some exceptions).

Where access is over a footbridge, the footbridge is normally designed to take the weight of the largest valve plus 2 men

ATTACHMENT I : EXTRACTS FROM "KRYPTON PLC EVENT PROCEDURES MANUAL FOR ECHO RESERVOIR" (SEPARATE DOCUMENT)

Note: This would not normally be part of an individual plan, but is included to illustrate the kind of content that might be in a company's standard procedures. It is noted that most water companies have these regularly audited internally and externally as part of a ISO9001 accreditation.

Chapter: 319 SITE OPERATION; 319.6 Site Data and AIB Schematics

Issue: 2 Last Date 28/09/2004 No of pages in 3

The Site Schematics for Echo IRE are located in AIB and can be accessed by clicking on the View Schematics button at the top of the screen.

An overall view of the reservoir site is shown below: (Embedded image moved to file: pic07995.pcx)

Echo IRE has a natural catchment area part of which is occupied by Delta IRE, Charlie IRE and Bravo IRE. The reservoir receives discharges from Delta IRE and is fed by Tango Brook, all these sources being controllable. There is very little direct land drainage into the reservoir as there are channels on each side which intercept this drainage and divert it away from the reservoir. In addition washwater from Edoras WTW is fed back into the reservoir a short distance upstream from the reservoir embankment on the east side. Catchment area 8.7 km^2.

Echo IRE receives water from Delta IRE and Tango Brook. Both these sources are controllable. Water drawn off from Delta IRE is discharged directly into the reservoir and overflow discharges from Delta IRE are also fed in, although if required they can be diverted via a tunnel, fed from a drop pit on the overflow channel of Delta IRE. This tunnel leads to the Tango Brook intake residuum at the upstream end of Echo IRE to the west of Delta IRE dam embankment.

The Tango Brook intake residuum is fed by Tango Brook and the outlet of the tunnel leading from Delta IRE. Water flowing into the residuum normally flows over a weir into Echo IRE. If required, three penstock valves can be opened at the side of the residuum which diverts the flow of water into the Echo IRE overflow channel. Thus, water from both Delta IRE overflow (incorporating water turned out from that reservoir) and Tango Brook can be turned out from Echo IRE and fed to the by-channel which runs down the east side of the reservoir and discharges into the reservoir overflow channel. The residuum has a bottom outlet pipe at a low level to allow it to be drained down. This pipe is fitted with a blanking flange with a small tap fitted to it. In practice the small capacity of the tap and its tendency to silt up mean that it is not practical to drain the residuum using the tap, the flange joint has had to be broken in the past to facilitate drain down.

The reservoir is formed by an earth embankment dam with a puddle clay core. The core is connected to a concrete filled cut off trench sunk to a maximum depth of approximately 25 metres. The core trench extends upstream for some 22 metres on its right hand flank and approximately 86 metres on the left hand flank. This is to intercept a fault line running beneath the upstream shoulder of the dam. The upstream face is protected by randomly coursed dressed stone pitching down as far as the level of the top draw-off and stone beaching below this level. The crest is grassed and has a concrete wave wall with masonry faces and copings along its upstream side. The downstream face is also grassed with a single narrow berm a short distance down from crest level which carries a fenced off public path over the dam. Near the east end of the dam crest there is a cabinet containing a flow meter which displays the amount of water being fed to the nearby Edoras WTW through a direct pipe feeding the

works from Delta IRE.

Reservoir overflow is catered for by a sharp edged weir situated at 90 degrees to the dam embankment and at its northern end. Water flowing over the weir is discharged into a tumbling bay which also receives water from the reservoir by-channel. There is also a round section short masonry tunnel alongside the tumbling bay which augments the spillway capacity. The spillway channel downstream of the tumbling bay runs down the left hand mitre of the dam to discharge into a stilling basin at the toe of the embankment. The spillway channel is rectangular in section, has an even slope without steps and is constructed of smooth faced masonry blocks.

There is a valve tower situated near the east end of the dam embankment and accessed via a metal footbridge from the dam crest. The tower contains the valving and pipework which enable water to be drawn off from the reservoir. It is circular in section and is constructed from dressed masonry blocks and internally lined with white glazed brickwork. There is a draw off stack within the tower which has three draw off levels teed off it. There is also a separate bottom outlet main. The bottom outlet main and each draw-off pipe are all equipped with a single manually operated sluice valve. All the draw off and bottom outlet valves are operated from headstocks within the valve house which is constructed on top of the valve tower. Immediately upstream of the valve on the bottom outlet main there is a tee off with an isolating valve and a washout valve fitted. This is connected to a second stack within the valve tower which starts at the first level of staging up from the base of the tower. This is used as a reference of reservoir water level and enables the reservoir depth to be monitored by means of a dip tape from the floor inside the valve house at the top of the tower to water level within the stack.

Downstream of the valve tower the supply and bottom outlet mains are carried in a tunnel which runs through the dam embankment. The tunnel is u-shaped in section and is constructed from concrete. The mains are supported on saddles within the tunnel. At the downstream end of the tunnel there is a valve house which is at the toe of the embankment. Access to the downstream end of the tunnel is via a trap door in the floor of the valve house. The chamber in the base of the house houses several more control valves, all of which are manually operated from headstocks at floor level within the valve house.

The bottom outlet main splits at this point. The continuation of the main is equipped with a single sluice valve which when opened allows the reservoir to be emptied into the stilling basin which lies downstream of the valve house. The branch off the main is fitted with guard and duty sluice valves which are used to regulate the compensation supply from the reservoir which is fed to a compensation chamber outside the valve house which enables the amount of compensation to be monitored. The compensation chamber in turn discharges to the stilling basin and is fitted with a washout valve.

The supply main is fitted with air valves at the upstream and downstream ends of the outlet tunnel. It has a branch off it underneath the valve house. The continuation of the main is equipped with a washout sluice valve which discharges into the stilling basin. The branch is also equipped with a sluice valve which controls supply to a buried pipeline which leads to Edoras Water Treatment Works via Echo Raw Water Pumping Station.

In addition to receiving discharges from the outlet pipework of the reservoir, the stilling basin receives flows from the reservoir bypass and overflow system and from a drainage channel which runs down the east side of the reservoir from the dam embankment of Delta IRE. This is an open channel as far as the dam of Echo IRE, from that point it is piped down the mitre of the dam to discharge into the stilling basin. The stilling basin discharges into a stream leading to the River Rhun a short distance downstream. It is fitted with a washout valve to allow it to be drained down for maintenance purposes.

There is mains electricity supplied to the valve tower, tunnel and bottom valve house. This is used to supply power for lighting and 110 Volt sockets in the tower and the tunnel as well as lighting and the compensation monitoring equipment located in the bottom valve house. The compensation meter is linked to the RTS system.

Water from Echo IRE is fed to Edoras Water Treatment Works. There is also compensation paid out to the River Rhun. Bottom outlet and overflow discharges are also fed to the River Rhun. Compensation meter linked to RTS and located in the bottom valve house.

Chapter: 319 SITE OPERATION; 319.9 Valve Schedule

Issue: 1 Last Date 13/05/2004 No of pages in 1

The site diagram and schematics for this section can be located in 319.6 Site Data and AIB Schematics.

Transferred to Table D.1

Chapter: 335 RESERVOIR; 335.10 Valve Testing Procedure (including Bottom outlet Test)

Issue: 1 Last Date 03/06/2004 No of pages in 3

The testing of the valves should be carried out twice yearly, with one test when the reservoir is at top level or above. The valves are to be tested in the normal operating mode. The Valve Test Procedure for Echo IRE incorporates the Bottom outlet Valve Test for this site. Before commencing procedures ensure all necessary preliminary arrangements for Bottom outlet Valve Testing have been carried out (see 235.2 Bottom outlet Test Notification Procedure in Headworks and Treatment Procedures).

Check that all persons and organisations which need to be informed of the proposed bottom outlet test have been informed at the appropriate time (see 235.2 Bottom outlet Test Notification procedure). Control (Duty Manager) must be notified of proposed test on the morning of the day on which it is to be carried out. They must also be notified of the completion of the test as soon as is practical.
If a full valve and bottom outlet test is to be carried out, it should be ensured that Echo IRE is not being used to supply Edoras Water Treatment Works. The operational positions of the reservoir valves at Echo IRE should then be noted before setting them to the positions in the table below.

Valve No.	Valve Description	Initial Operating Position
28/1	Top Draw Off	Fully Closed
28/2	Middle Draw Off	Fully Closed
28/3	Bottom Draw Off	Fully Closed
28/4	Bottom outlet Guard	Fully Open
28/5	Supply Isolator	Fully Open
28/6	Supply Main Washout	Fully Closed
28/7	Compensation Guard	Fully Open
28/8	Bottom outlet Duty	Fully Closed
28/9	Compensation Duty	Partially Open
28/10	Compensation Chamber Washout	
28/11	Stilling Basin Washout	Fully Closed
28/12	Level Tube Isolator	Fully Open
28/13	Level Tube Washout	Fully Closed
28/14	Rake Dike to Res. Bypass Control	Fully Closed
28/15	Rake Dike to Res. Bypass Control	Fully Closed
28/16	Rake Dike to Res. Bypass Control	Fully Closed

28/17	Rake Dike Intake Residuum Drain	Fully Closed

1. Fully close 28/5. Record number of turns.
2. Fully open 28/6. Record number of turns. Allow main to drain down. Check seals on 28/1, 28/2 and 28/3 by examining washout for discharge.
3. Fully open 28/3. Record number of turns. This is the bottom outlet test for the supply main. Observe flow into stilling basin.
4. Fully close 28/6. Record number of turns. Check seal on this valve by examining washout for discharge.
5. Fully open 28/6. Record number of turns.
6. Fully close 28/3. Record number of turns. Check seals on 28/1, 28/2 and 28/3 by examining washout for discharge.
7. Fully open 28/2. Record number of turns. Observe flow into stilling basin.
8. Fully close 28/2. Record number of turns. Check seals on 28/1, 28/2 and 28/3 by examining washout for discharge.
9. Fully open 28/1. Record number of turns. Observe flow into stilling basin.
10. Fully close 28/1. Record number of turns. Check seals on 28/1, 28/2 and 28/3 by examining washout for discharge.
11. Fully close 28/6. Record number of turns.
12. Crack open slowly the draw off valve previously used for supply. Allow main to charge up then fully open this valve.
13. Fully open 28/5. Record number of turns. If required the reservoir can now be put back on to supply to Edoras Water Treatment Works via Echo Raw Water Pumping Station.
14. Fully open 28/9. Record number of turns to fully open.
15. Fully close 28/7. Record number of turns.
16. Fully open 28/8. Record number of turns. This is the bottom outlet test for the bottom outlet main. Observe flow into stilling basin.
17. Fully close 28/1. Record number of turns. Check seal on this valve by examining bottom outlet pipe for discharge.
18. Fully open 28/1. Record number of turns.
19. Fully close 28/8. Record number of turns. Check seal on this valve by examining bottom outlet pipe for discharge.
20. Fully open 28/7. Record number of turns.
21. Fully close 28/9. Record number of turns.
22. Fully open 28/9. Record number of turns.
23. Reset 28/9 to previous operating position, using the number of turns obtained in step 14 as a guide.
24. Fully open 28/10. Record number of turns. Observe discharge to stilling basin.
25. Fully close 28/10. Record number of turns. Check seal on this valve by examining washout pipe for any discharge.
26. Fully open 28/11. Record number of turns. Observe discharge to river.
27. Fully close 28/11. Record number of turns. Check seal on this valve by examining washout pipe for any discharge.
28. Fully close 28/12. Record number of turns.
29. Fully open 28/12. Record number of turns.
30. Fully open 28/13. Record number of turns.
31. Fully close 28/13. Record number of turns. Check seal on this valve.
32. Check compensation level and adjust setting of 28/9 if necessary.
33. Fully open 28/14. Record number of turns.
34. Fully close 28/14. Record number of turns. Check seal on this valve.
35. Fully open 28/15. Record number of turns.
36. Fully close 28/15. Record number of turns. Check seal on this valve.
37. Fully open 28/16. Record number of turns.
38. Fully close 28/16. Record number of turns. Check seal on this valve.
39. Ensure that 28/1 is fully open.

40. Fully open 28/8. Record number of turns. **This is the bottom outlet test.** Observe discharge to stilling basin.
41. Fully close 28/8. Record number of turns. Check seal on this valve by examining bottom outlet pipe for discharge.
42. Crack open 28/6. Open sufficiently to lift the valve off its seat, but ensure that the supply to Edoras Water Treatment Works is not interrupted or adversely affected.
43. Fully close 28/6. Check seal on this valve by examining washout for discharge.
44. Ensure that 28/1 is fully open.
45. Fully open 28/8. Record number of turns. **This is the bottom outlet test from the bottom outlet main**. Observe discharge to stilling basin.
46. Fully close 28/8. Record number of turns. Check seal on this valve by examining bottom outlet pipe for discharge.
47. Note operational positions of valves 28/1, 28/2, 28/3 and 28/5.
48. Fully close 28/1, 28/2 and 28/5.
49. Fully open 28/3.
50. Fully open 28/6. Record number of turns**. This is the bottom outlet test from the supply main**. Observe discharge to stilling basin.
51. Fully close 28/6. Record number of turns. Check seal on this valve by examining washout for discharge.
52. Return valves to previous operational position.

Chapter: 335 RESERVOIR; 335.90 Draw Down (including Emergency) Procedure

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The drawing down of an IRE can be required for a wide range of reasons, including maintenance purposes or at times of emergency. In order for this to be carried out efficiently, these draw-down procedures shall be followed.

N.B. The Environment Agency has to be consulted before any reservoir can be drawn down and/or kept in a drawn down condition. If applicable appropriate Consents to Discharge have to be obtained from the Environment Agency.

In planned draw down situations, the reservoir level should not be allowed to reduce by more than 150 mm per day without the approval of the asset manager.
Turn out all controllable intakes (see 332.20 Intake Turnout Procedure).
The reservoir level will fall as water is supplied to Edoras Water Treatment Works or supplied as compensation. It may be necessary to alter the draw-off level as the water level falls (see 235.5 Rules for Selecting Appropriate Draw-Off Level in Headworks and Treatment Procedures).
If the reservoir is not falling fast enough, an additional amount can be released from the reservoir by opening bottom outlet duty valve 28/8 by an appropriate amount to discharge additional water to the stilling basin. When the desired level for maintenance purposes has been reached, isolate the reservoir (see 335.38 Isolation Procedure).

In an emergency situation it is important to drop the level of water in the reservoir as quickly as possible.
1. Ensure that 28/1 is fully open.
2. Fully open 28/8. This maximises outflow from the bottom outlet pipe.
3. Fully open 28/6.
4. Fully open draw-off valves 28/1, 28/2 and 28/3. This maximises outflow from the reservoir.
5. Turn out all intakes (see 332.20 IntakeTurnout Procedure).
6. If the reservoir was in use to supply Edoras WTW, arrange for an alternative supply to be set up.

Notification Sheet to Environment Agency of Bottom outlet Valve test

BOTTOM OUTLET VALVE TEST NOTIFICATION SHEET

RESERVOIR	DATE	START TIME	DURATION OF TEST	NGR OF DISCHARGE POINT	NAME OF WATER COURSE AFFECTED	APPROX. VOLUME TO BE DISCHARGED	DRAW-OFF LEVEL	PROPOSED MEASURES TO PROTECT THE WATERCOURSE / LOCAL LANDOWNERS INFORMED	YWS CONTACT NAME, ADDRESS & TELEPHONE NO.
Echo Dam	22/03/2005	10 .00 hrs	45 mins	XX XXXX XXXX	River Rhun	3.2 cubic metres/ second	Bottom outlet pipe at - 28 m	Downstream abstractors and land owners to be informed by A Smith	A Smith. Echo Reservoir, Edoras, A County. Tel xxxxx xxxxxx