BRITISH COAL

NORTH EAST

REPORT ON MINEWATER PUMPING AND WATER PROBLEMS IN THE NORTHUMBERLAND AND DURHAM COALFIELD AREA

SEPTEMBER 1992

BRITISH COAL CORPORATION

NORTH EAST GROUP

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INTRODUCTION

This report has been prepared by British Coal North East Group Technical Support Department on behalf of the National Rivers Authority following a meeting between the respective parties at which the potential effects on minewater discharges following cessation of coal mining within County Durham was discussed.

At present within the traditional Durham Coalfield i.e. South of the River Tyne there are 4 working Collieries and 10 minewater pumping stations. The two Collieries, Easington and Vane Tempest, protected by the outlying pumping stations are at present subject to the Corporations procedure for the review of performance. Should these Collieries close all pumping of minewater will cease save for that internal to the two remaining Collieries, Westoe and Wearmouth, and the minewater will begin to accumulate as it rises to rest level.

In Northumberland there is only one working mine, Ellington, protected by 3 outlying pumping stations. All other minewater pumping ceased in 1986 following the closure of Bates Colliery.

The report reviews the geology of the coalfield, sources and composition of minewater, the history of mining and pumping prior to detailing the present minewater position (Stage 1) and the expected water position on the cessation of coal mining. (Stage 2)

In order to provide continuity with previous internal reports written in 1970 and 1981 the same zones within the three Board Areas existing at that time have been retained, ie:-

(a) North Durham
(b) South Durham
(c) Northumberland

The report should be read in conjunction with the two attached, 1" to 1 mile scale, water plans. The plans show the present water position and the conjectural position as two separate stages,

viz:-

Stage 1 - Present Position - Plan No 1.

Stage 2 - All Collieries closed - Plan No 2.

The plans have been extended to show the position at collieries immediately north of the Stakeford "Dyke" (fault) and inset with the Hauxley, Broomhill area. The report also examines the affect on the water position as each colliery ceases work.

It is acknowledged that this report is limited to the "main coalfield" and does not extend to the coals and collieries within the lower carboniferous rock formations, the majority of which have been closed for many years, and it is expected that all associated minewaters are at their final level. In the time scale it is not possible to give detailed consideration to the potential alteration on minewater flow due to the extraction of coal by opencast methods.

GEOLOGY

The North East Coalfield

General Structure

Coal bearing rocks of the Carboniferous age occupy a great part of Northumberland and County Durham. Formations older than the Carboniferous are confined to the region of the Cheviots.

The major exploitation of Coal Measures of the landward North East Coalfield occupies a triangular area of approximately 2000 square kilometres. The apex is located near the mouth of the River Coquet and the base , along a line running eastwards from the vicinity of Middleton on Tees to Hartlepool. They attain a maximum thickness of approximately 700 metres.

The coal bearing Lower Carboniferous strata, entering at Berwick on Tweed, extends southwards into Yorkshire and westwards into Cumbria covering an area of some 4000 square kilometres.

In the South and East the Coal Measures are overlain unconformably by the Permian rock formation, whose outcrop extends from Caldwell near Scotch Corner, to South Shields, continuing from there out to sea reaching a position some 6km from the shore at Blyth.

The principal structure feature of the coalfield is an irregular syncline whose major axis has an approximately North - West to South -East trend and passes out to sea at Sunderland. Consequently the Eastern limb of the basin is located mainly offshore whilst the Coal Measures are deepest in the Sunderland locality. The differential in dip between the Coal Measures and overlying Permian reduces the cover South and East, where seams incrop successively against the base of Permian.

The coalfield is traversed by a number of important faults. Major faults trend ENE to WSW and have been used as a convenient delineation of Colliery boundaries. Minor faults run NW TO SE and although not so important they still constitute a potential water hazard. The coalfield is also traversed by a number of igneous dykes with the older quartz dolerite dykes, associated with intrusion of the whin sill into the limestone group, correspond in direction with the major faulting.

The general succession of the coalfield is :

Superficial Deposits - The coal Measures are frequently buried beneath a cover of glacial deposits including sands, gravels and clays. Drift thickness is very variable but tends to be greatest along the courses of pre-glacial river valleys (up to 70m)

Permian - Permian cover in County Durham is essentially dolomitic in character, the dominant member being Magnesian Limestone. This formation is notoriously water bearing, the water passing with comparative ease through strongly fissured, honeycombed, and in places brecciated, limestone. The basal yellow sands are able to transmit so much water, that underground they have been known to assume the role of quicksand.

Coal Measures

Upper Coal Group - This group is characterised by massive sandstones, but its coals have proved of little general economic importance in the past. The formation has a maximum thickness of 330 metres near the mouth of the River Wear.

Middle or Productive Group - This group attains a thickness of approximately 240 metres, and incorporates over twenty potentially workable coal seams, of which fourteen have been extensively exploited.

Lower Coal Group - This series is from 35 to 90 metres thick and consists mainly of sandstones and ganisters. Only two seams have been worked.

Millstone Grit Series - This series comprises of a sequence of sandstones, grits, shales and ganisters from 35 to 180 metres thick, interbedded with a few impersistent coals. A few basal coals have been worked in Northumberland and South Durham.

Bernician Series

Limestone Group - Comprises a rhythmic series of limestones, shales and sandstones ranging from 600 to 750 metres thick. Although sandstones are the dominant formation, this group is characterised by 15 to 20 marine limestones which are often associated with coal seams. Certain of these coals have proved of considerable economic importance.

Scremerston Group - Comprises of sandstones, shales, fireclays, coals and thin bands of limestone ranging from 90 to 600 metres thick. Some 10 workable seams have been identified and worked at various times over the last 200 years.

Tuedian Series - Comprise of the Fell Sandstone group (180 to 600 metres thick) and the Cementstone Group (150 to 400 metres thick) both of which are devoid of coals.

SOURCES AND COMPOSITION OF MINEWATERS

The main source of minewater in the North East is the percolation through the superficial deposits of either fresh (rainwater, snow melt) or sea water into the sedimentary strata overlying mine workings and then via strata fractures induced by mining into the workings.

The incidence of minewater depends upon the permeability and thickness of the superficial deposits, the permeability of the Coal Measures strata, and the depth beneath the surface or water bearing strata. It is subject to seasonal variations depending upon the source of inflow, the inflow derived from shallow cover and outcrop workings being more variable than that from the deep storage in the Coal Measures rocks.

Water infiltrating into mineworkings is normally free from suspended solids but may become contaminated through contact.

Waters from the most shallow workings may contain sulphates, chlorides, bicarbonates, calcium, magnesium and sodium salts.

Waters from slightly deeper workings are more heavily mineralised with calcium and magnesium salts predominant, these components being replaced by sodium bicarbonate at increasing depths.

Waters from even greater depths contain progressively less bicarbonate, and increasing concentrations of sodium, calcium and magnesium chlorides which have accumulated in the strata and been separated by geochemical forces into well defined quality patterns. At great depths appreciable concentrations of barium, strontium and ammonium chlorides may be found.

The minerals iron pyrite and marcasite are present in all coals and coal measure rocks to an extent varying from fractions of 1% to over 10%. All forms of iron pyrite and marcasite are reactive to atmospheric oxygen, the reaction starting as soon as these minerals are exposed to air, provided that the humidity is greater than 60%.

The initial products of oxidation are ferrous and ferric sulphates, sulphuric acid and hydrated ferric oxide (ochre). These primary reaction products, with the exception of the ferric oxide, are soluble in water and in turn react with clays and carbonate minerals to form aluminium, calcium, magnesium and other sulphates.

Ferruginous drainage waters which flow freely in the presence of air in the mine workings may lose carbon dioxide from solution and absorb oxygen with a consequent oxidation of ferrous compounds. The ochre precipitated by this reaction may be discharged with the minewater at the surface or may settle out and be retained by the workings, depending on the volume of standage through which the water passes on its way out of the mine. The extent of the self purification processes within the mine is much greater than generally realised.

Water flooding abandoned mine workings, in which large quantities of pyrite oxidation products have accumulated over many years, will become seriously contaminated. In many situations pyrite oxidation may not be suspected since either the workings were naturally dry or discrete feeders had not been contaminated.

Provided that contaminated water is effectively contained and not subsequently displaced, problems on discharge will not occur but usually overflows of contaminated water develop. However, flooding has the advantage that oxidation ceases once the pyrite is submerged and the overall problem decreases progressively as the contaminated water is displaced.

Though often of a high suspended solids content, mine water discharged from the working coal mines has generally been of relatively low iron content and has rarely caused major pollution to rivers and streams.

This may be due to prevailing hydrological and hydrogeological conditions resulting in the inflowing groundwater tending to be concentrated into limited zones and isolating the majority of pyrite oxidation sites within non flooded workings and free from flowing water. Consequently, a dramatic increase in the iron content and mineralisation of the mine drainage occurs when the workings are flooded, as the accumulated oxidation products of many years are flushed from the workings.

A feature of the vertical profile of minewater composition in a disused shaft is the presence of fresh groundwater and aerobic, low iron and mineralisation drainage from upper non flooded seams lying on top of the anoxic, ferruginous and highly mineralised drainage from flooded coal seams due to the incomplete mixing of drainage flowing in at different levels. Following the cessation of pumping, the compositional depth profile may change as a consequence of the changing flow conditions.

Knowledge of the rate of pyrite oxidation product removal is extremely limited. It has been suggested that the concentration of iron in the drainage from a constant volume of flooded workings decreases exponentially with respect to time.

Though most of the drainage from the coalfield results, and will result, in transient pollution, the pollution arising from the discharge of drainage from localised workings will be more persistent. Such drainage is of a relatively high and seasonally variable iron and sulphate content and these levels will persist for an indefinite period. This is due to the permeable overburden which permits "breathing", the oxidation of pyrite not submerged by groundwater or minewater and the removal of the oxidation products by percolating groundwater during, and after, periods of winter precipitation.

HISTORY OF MINING

GENERAL

Coal has been mined in Great Britain for many hundreds of years. Archaeological evidence indicates coal being consumed during the Roman occupation.

There is little evidence of coal mining, including the Domesday book, from that period up to the 13th century. However, in the 13th century there is documentary evidence as to the mining, marketing and consumption of coal.

In early times coal was mined from surface outcrops by driving drifts or tunnels into the hillside. Alternatively "bell pits" were formed by the sinking of shafts about 1.3 metres in diameter to reach shallow coal seams below the surface. Depths rarely exceeded 12 metres and coal was extracted around a shaft until it became impossible to support the roof at which point another shaft would be sunk adjacent. Thus eventually a series of bell pits was produced.

In Northumberland, the Alnwick Moor Bell Pits, have been included in the County list of scheduled ancient monuments by English Heritage, likewise Cockfield Fell in County Durham.

The demand for coal, allied to a reduction in available timber and the increasing production of iron and other processes, in Elizabethan times could not be satisfied by "bell pit" mining and lead to the development of "bord and pillar" mining. This entails heading out into the seam leaving pillars of coal to support the roof. The pattern of such workings varied from district to district although in general the pillars were usually strong enough to hold up the roof without the need for additional support.

The use of supports at a later date allowed for the "complete extraction" of coal by first advancing from the mine shafts with bord and pillar mining (working in the "whole") with the subsequent extraction of pillars (working in the "brokens"). Thus developed a "longwall" method of coal extraction which has been further developed into that system used in the mines of today.

The bord and pillar system of mining, particularly in Northumberland and Durham, continued to be the usual system of coal extraction until after the nationalisation of the coal industry in 1946 and is still practiced today at Ellington, the last remaining British Coal Colliery in Northumberland.

NORTH EAST

The administrative area of the North East Group covers some 9,200 square kilometres and includes part or all of 6 County Authorities and 22 Local Authorities. Of the area some 3,500 square kilometres (plus approximately 330 square kilometres undersea) are associated with known, unrecorded and suspected coal workings of which 54% (1870 square kilometres) are thought to contain workings less than 30 metres from the surface. At present there are in excess of 20,000 recorded mine entries within this area.

Coal has been associated with the region since Roman times especially at military sites along the Roman Wall and where coal seams outcropped on cliffs, washed by the sea was gathered on the beaches. The first licence to work coal was granted by King Henry III in 1239 but it was the medieval coal merchants and shippers of Newcastle who founded the coal trade which paved the way for Tyneside's rise to industrial fame and fortune.

Shipments from the Tyne date from approximately 1325 but the majority of coal was still burned in households near the outcrops. The great expansion of the coal industry in the region began about 1550. Demand for coal for domestic hearths soared as the nations timber supplies were becoming rapidly depleted. Collieries in Northumberland and Durham developed a virtual monopoly of the London market and because the coal was transported by sea was called sea coal. By 1770 the regions coal output exceeded 1 million tonnes per year and by the nineteenth century, coal gained further impetus. New sources of good quality household coal were tapped, the most significant achievement being the first sinking, in 1821, through magnesian limestone at Hetton which reversed opinion that valuable coal did not exist beneath the limestone.

Development of railways revolutionised the transport system and together with improved shipping facilities, contributed further to the mining industry's expansion. In the present century, output rose from 46 million tonnes per annum in 1900 to a peak of 56 million in 1941 falling in 1946, the last year prior to Nationalisation, to 33 million tonnes. At that time 186 collieries in the Counties of Northumberland and Durham vested into the National Coal Board. At present the coalfield produces 8 million tonnes annually from only 5 working mines.

PUMPING

Initially there were many shallow drift mines along the western edge of the exposed coalfield each pumping its own make of mine water to the surface. The majority of these were connected to drifts alongside or to the newer shallow Collieries to the East. Many of the connections were unrecorded with numerous barriers being robbed and trespass workings common.

In addition many interconnections were made during the second world war to provide alternative means of egress in the event of bomb damage. Upon Nationalisation in 1947 many of these shallow drift mines and collieries were still operational, each dealing with only its own minewater or plus some small feeder from a nearby abandoned mine. As the shallow part of the coalfield was the first to be worked it also became the first to be exhausted and abandoned. Mines in turn closed and their abandoned workings filled with water before overflowing to the next working Colliery to the East. (Appendix 1).

As more and more mines closed, migrating feeders became larger and larger as they combined and passed down the line to the next working Colliery.

Working Collieries on the Western edge of the coalfield thus became "Buffer Pits" ie pumping not only their own mine water but also the large migrating feeders. As a result of this situation, a policy decision was made to protect all working Collieries from migrating feeders by a barrier of pumping stations (Appendix 2) leaving each working mine to deal only with its own minewater feeders.

CURRENT PUMPING SITUATION

As a result of the above policy there are now 14 pumping stations, 11 in Durham and 3 in Northumberland plus Steetley a commercial abstraction station, pumping for the protection of 3 of the 5 working Collieries. The two exceptions being Westoe and Wearmouth which have no external connections and are divorced from migrating feeders.

The Pumping Stations are sited at strategic points along the water migration routes, picking up local feeders to prevent overflows, and currently dealing with 2/3 of all minewater pumped in the Group. (Appendix 3).

They are designed, where possible, to pump all water during the night and at weekends, in periods of cheap electricity in an attempt to minimise costs. (Appendix 4)

In Durham, the route of the mine waters to the coastal collieries is through numerous connections to both Murton and Horden and from there direct to the interconnected working collieries, Seaham/Vane Tempest and Easington.

In Northumberland, following the closure of Bates Colliery all pumping in the South of the County ceased and all workings are now being allowed to flood with the rising waters being monitored.

To the North of the Stakeford Dyke, mine water without control would migrate via Woodhorn to the Lynemouth/Ellington Combine and to prevent this, 3 pumping stations are currently operating.

Both the Durham and Northumberland pumping station barriers are constantly being reviewed and revised as Collieries close and requirements change. In the last six years 11 pumping stations have been shut down and three established following the closure of Ashington, Bates, Sacriston Horden, Dawdon and Murton Collieries.

CONSENTS

No discharge can be made from any Pumping Station without the consent of the National Rivers Authority and all such consents are subject to conditions. (Appendix 5)
These conditions may be amended by the National Rivers Authority, should they believe it necessary.

GRAVITY DISCHARGES

In addition to the pumped discharges there are some 80 recorded abandoned shafts and drifts within the coalfield discharging minewater of their own accord, "gravity discharges", ranging in quantity from a trickle to 2000 gpm and in quality from poor to extremely good. (Appendix 6)

MONITORING

Within the coalfield there are also 13 monitoring stations, 6 in Durham and 7 in Northumberland. (Again Appendix 2)

The majority of the Durham monitoring Stations are used for keeping check on a settled water regime with known outlets and overflows. The purpose of these stations is to detect changes in the system ie. collapse of an underground flow route leading to a build up in a particular area which may have to be dealt with. The only exception is Dawdon, which is being used to monitor the flooding of the abandoned Dawdon mine.

The majority of the Northumberland stations are used for monitoring the rise in the "South Northumberland Pond", a large body of underground workings previously kept dry by pumping for the protection of Bates but now being allowed to flood. The exception here being Ashington, which is being used to monitor flooding of the Ashington mine.

Because of the possibility of mine gases being dispersed by the rising waters in the Northumberland area, all Northumberland Monitoring Stations have been equipped with ventilation chimneys to allow any dispersed gases to dilute safely in the atmosphere.

APPENDICES

1 Diagrammatic cross section of coalfield

2 Plan of coalfield

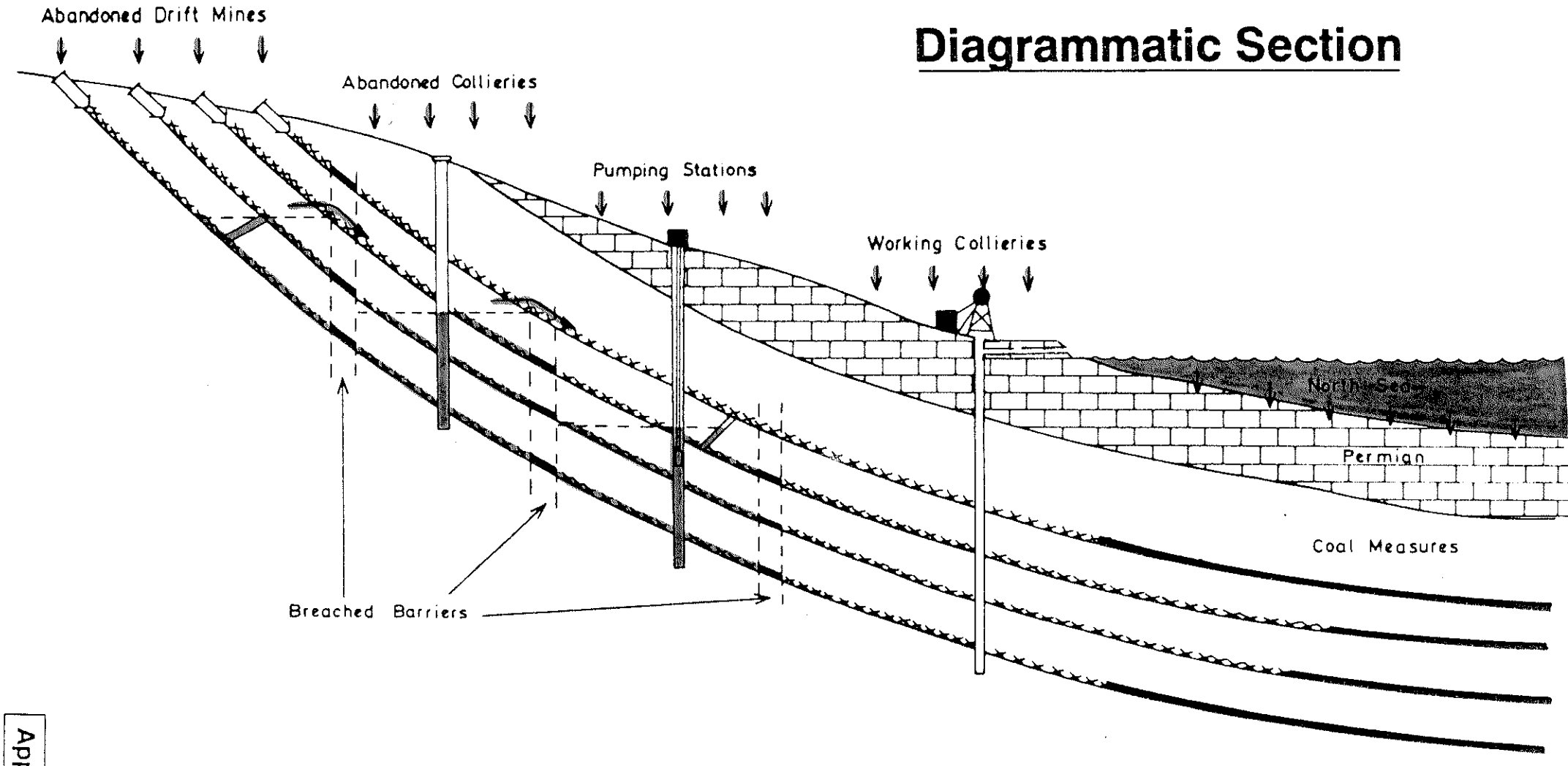
3 Schedule of water pumped (Present & Past)

4 Pumping Stations and running times

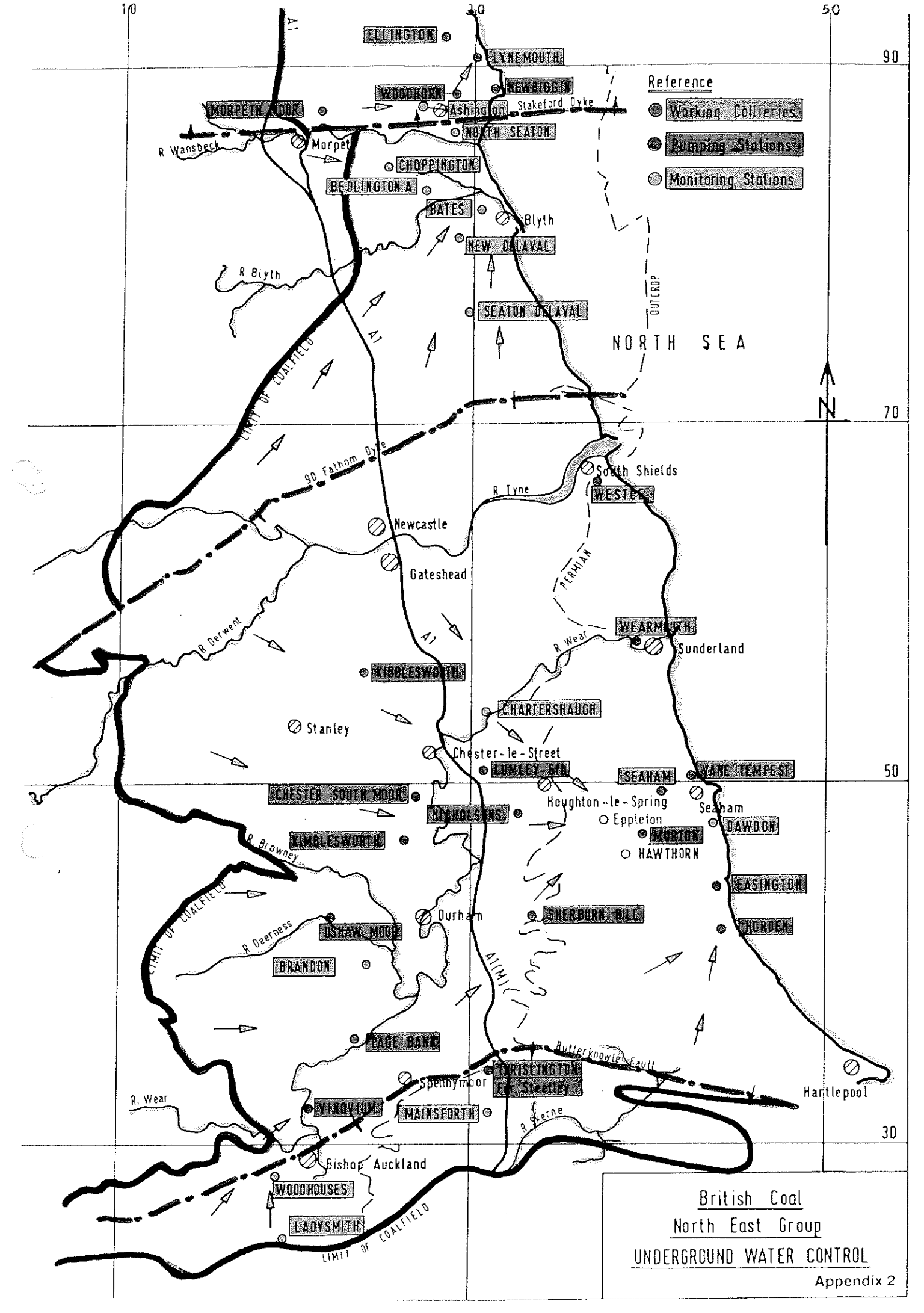
5 Consents to discharge

6 Gravity discharges

North East Group
Underground Water Control
Diagrammatic Section



Appendix 1


10
30
50
90
70
50
30
A1
A1
A1(M)
ELLINGTON
LYNEMOUTH
WOODHORN
NEWBIGGIN
Ashington
Stakeford Dyke
MORPETH AREA
NORTH SEATON
Morpeth
R Wansbeck
CHOPPINGTON
BEDLINGTON A
BATES
Blyth
NEW DELAVAL
R Blyth
SEATON DELAVAL
OUTCROP
NORTH SEA
LIMIT OF COALFIELD
90 Fathom Dyke
South Shields
R Tyne
WESTOE
Newcastle
Gateshead
PERMIAN
R Derwent
WEARMOUTH
Sunderland
R Wear
KIBBLESWORTH
CHARTERSHAUGH
Stanley
Chester-le-Street
LUMLEY GEN
SEAHAM
VANE TEMPEST
CHESTER SOUTH MOOR
NICHOLSONS
Houghton-le-Spring
Seaham
Eppleton
DAWDON
MORTON
HAWTHORN
KIMBLESWORTH
R Browney
EASINGTON
Durham
SHERBURN HILL
HORDEN
USHAW MOOR
R Deerness
BRANDON
PAGE BANK
Butterknowle Fault
TYNESLINGTON
Spennymoor
Fr. Steetley
Hartlepool
R. Wear
VINOVIUM
MAINSFORTH
R Skerne
Bishop Auckland
WOODHOUSES
LADYSMITH
LIMIT OF COALFIELD
Reference
Working Collieries
Pumping Stations
Monitoring Stations
N
British Coal
North East Group
UNDERGROUND WATER CONTROL
Appendix 2

BRITISH COAL CORPORATION
NORTH EAST GROUP

MINE WATER

Total pumped in the North East Group, year ended March 1992

18,348,704,803 gallons = 83,413,212 tonnes
Saleable Coal Produced = 7,548,877 tonnes
Ratio - water to coal = 11 to 1

Mine Water Pumped - Year Ended March 1992

COLLIERY	TOTAL WATER PUMPED GALLONS	RATE OF PUMPING OVER 24 HOURS - GPM
Dawdon	685,440	4 ceased 26.07.91
Easington	2,371,824,000	4,523
Ellington	1,170,618,400	2,488
Lynemouth	260,550,000	500
Murton (inc Hawthorn)	587,628,000	1,135 Hawthorn ceased 28.12.91
*Seaham	169,859,732	326
Vane Tempest	4,815,812	20 Pumping for 6 months only
Wearmouth	227,461,760	432
Westoe	2,046,018,699	3,881
TOTAL	6,839,461,843	

*Limestone Water

PUMPING STATION	TOTAL WATER PUMPED GALLONS	RATE OF PUMPING OVER 24 HOURS - GPM
Chester South Moor	795,366,780	1,515
Horden	2,587,091,400	4,935
Kibblesworth	1,911,423,420	3,636
Kimblesworth	984,621,300	1,879
Lumley 6th	194,298,000	369
Morpeth Moor	88,200,000	265 Pumps isolated 19.11.91
Newbiggin	245,890,560	470
Nicholsons	259,110,000	491
Page Bank	1,114,852,080	2,119
Sherburn Hill	682,772,760	1,296
Thrislington (for Steetley MFG)	25,404,600	48
Ushaw Moor	751,092,060	1,439
Vinovium	1,772,640,000	3,385
Woodhorn	96,480,000	183
TOTAL	11,509,242,960	

BRITISH COAL CORPORATION
NORTH EAST GROUP

MINE WATER

COLLIERY	CALENDAR YEAR				FISCAL YEAR							
	RATE OF PUMPING OVER 24 HOURS - GPM											
	1980	1981	1982	1983	1984/85	1985/86	1986/87	1987/88	1988/89	1989/90	1990/91	1991/92
Ashington	742	630	590	560	685	618	622	599	-	-	-	-
Bates	900	827	719	700	700	700	-	-	-	-	-	-
Bearpark	606	680	693	-	-	-	-	-	-	-	-	-
Blackhall	3,059	-	-	-	-	-	-	-	-	-	-	-
Boldon	133	133	-	-	-	-	-	-	-	-	-	-
Brenkley	77	72	68	73	85	-	-	-	-	-	-	-
Dawdon	99	105	93	222	262	290	180	603	641	708	138	-
Easington	711	1,079	1,285	1,450	1,365	1,538	1,956	2,243	2,679	3,622	4,400	4,523
East Hetton	1,293	1,320	1,345	-	-	-	-	-	-	-	-	-
Eccles	-	-	-	-	-	-	-	-	-	-	-	-
Ellington	1,942	1,882	1,609	1,454	1,526	1,693	2,404	2,639	2,857	2,919	2,853	2,488
*Eppleton	360	363	343	360	343	343	-	-	-	-	-	-
Herrington	125	145	141	151	184	-	-	-	-	-	-	-
Horden	2,218	2,113	2,414	2,853	3,579	3,543	-	-	-	-	-	-
Houghton	132	-	-	-	-	-	-	-	-	-	-	-
Hylton	-	-	-	-	-	-	-	-	-	-	-	-
Lynemouth	1,118	772	520	632	183	296	548	482	537	540	577	500
Marley Hill	380	289	87	-	-	-	-	-	-	-	-	-
Murton	484	543	463	440	442	409	381	750	925	489	661	1,135
Sacriston	507	477	346	377	335	-	-	-	-	-	-	-
*Seaham	599	609	609	609	608	608	609	575	573	562	466	326
Shilbottle	577	573	477	-	-	-	-	-	-	-	-	-
*South Hetton	585	411	262	277	209	283	73	-	-	-	-	-
Vane Tempest	47	26	14	46	36	50	24	0	0	0	0	20
Wearmouth	216	207	169	139	82	244	303	312	318	345	353	432
Westoe	1,700	1,842	1,928	2,273	1,818	1,872	1.893	1,964	2,247	1,924	2,496	3,881
Whittle	374	395	471	1,038	1,013	1,013	1,190	-	-	-	-	-
Woodhorn	72	-	104	324	504	393	-	-	-	-	-	-
Collieries closed during period	1,232	219	133	1,273	295	684	1,043	-	216	-	-	4
TOTAL	20,288	15,712	14,982	15,823	14,254	14,577	11,226	10,167	10,993	11,109	11,944	13,309

*Includes Limestone Water

BRITISH COAL CORPORATION
NORTH EAST GROUP

MINE WATER

	CALENDAR YEAR				FISCAL YEAR							
	RATE OF PUMPING OVER 24 HOURS - GPM											
PUMPING STATION	1980	1981	1982	1983	1984/85	1985/86	1986/87	1987/88	1988/89	1989/90	1990/91	1991/92
Bedlington 'A'	651	639	527	556	525	628	-	-	-	-	-	-
Bedlington 'E'	106	108	106	102	111	102	-	-	-	-	-	-
Blackhall	-	3,602	3,459	3,778	4,042	3,719	-	-	-	-	-	-
Castle Eden	1,181	1,147	1,162	1,104	1,096	1,110	-	-	-	-	-	-
Chatershaugh	490	408	400	370	323	351	400	-	-	-	-	-
Chester South Moor	1,346	1,573	1,744	1,429	1,503	1,618	1,696	1,736	1,607	1,717	1,489	1,515
Choppington 'A'	469	458	442	356	403	332	-	-	-	-	-	-
Dinnington	704	654	710	638	396	615	-	-	-	-	-	-
East Tanfield	1,367	1,134	938	-	-	-	-	-	-	-	-	-
Horden	-	-	-	-	-	-	4,533	5,104	5,404	5,112	5,410	4,935
Isabella	984	911	878	757	754	813	-	-	-	-	-	-
Kaysburn	450	421	379	401	381	-	-	-	-	-	-	-
Kelloe Winning	454	408	410	-	-	-	-	-	-	-	-	-
Kibblesworth	4,248	4,350	3,904	4,015	4,521	4,710	4,315	5,161	4,149	3,628	2,962	3,636
Kimblesworth	1,041	1,067	1,053	1,061	1,126	1,666	1,880	2,489	2,723	2,430	1,676	1,879
Lumley 6th	575	487	501	540	484	538	505	498	464	401	315	369
Morpeth Moor	592	671	614	531	542	441	386	438	406	357	266	265
Newbiggin	624	764	812	846	841	704	487	452	424	603	507	470
New Delaval	361	770	1,060	557	612	702	-	-	-	-	-	-
Nicholsons	589	575	579	600	585	586	590	627	543	286	405	491
North Seaton	721	757	598	662	675	631	-	-	-	-	-	-
Page Bank	1,900	1,921	1,898	1,958	2,137	2,155	2,191	2,268	2,270	2,316	2,073	2,119
Seghill	-	-	-	-	-	-	-	-	-	-	-	-
Sherburn Hill	1,270	1,161	1,080	1,072	1,130	1,140	1,103	1,010	1,209	1,097	1,109	1,296
Ushaw Moor	2,002	1,620	1,198	1,560	1,347	1,400	1,713	1,981	1,456	1,147	1,042	1,439
Vinovium	4,907	4,722	4,156	4,125	4,135	3,963	4,127	4,104	3,931	3,521	3,146	3,385
Weetslade	-	-	-	-	-	431	-	-	-	-	-	-
Woodhorn	-	-	-	-	-	-	184	289	215	171	210	183
Stations closed during period	97	-	-	1,359	-	449	7,729	-	-	-	-	-
TOTAL	27,165	30,238	28,608	28,377	27,669	28,804	31,839	26,157	24,801	22,786	20,610	21,982

BRITISH COAL CORPORATION
NORTH EAST GROUP

PUMPING STATIONS

STATION	SECT 1 RESP	RUNNING TIMES	NO OF PUMPS & SIZE
Chester South Moor	Vane Tempest	2245-0730	2 x 2000gpm x 370 fthd
Horden *	Easington	2000-0730	7 x 2150gpm x 1220 fthd
Kibblesworth	Vane Tempest	2000-0745	3)2 x 4000gpm x 570 fthd)1 x 1500gpm x 570 fthd
Kimblesworth *	Vane Tempest	2000-0730	2 x 1500gpm x 500 fthd
Lumley 6th	Vane Tempest	0045-0715	1 x 1500gpm x 500 fthd
Morpeth Moor	Ellington	2035-0730	2 x 800gpm x 400 fthd
Murton	Vane Tempest	0045-0715	2 x 1050gpm x 1450 fthd
Newbiggin	Ellington	0115-0730	2 x 1500gpm x 720 fthd
Nicholsons	Vane Tempest	0045-0730	2 x 1500gpm x 500 fthd
Page Bank *	Easington	2010-0730	3 x 1200gpm x 250 fthd
Sherburn Hill	Easington	2130-0730	2 x 1500gpm x 600 fthd
Thrislington (For Steetley)		Intermittent	2 x 165gpm x 500 fthd
Ushaw Moor	Easington	0040-0730	2 x 2000gpm x 370 fthd
Vinovium	Easington	0045-0730	2 x 6000gpm x 200 fthd
Woodhorn	Ellington	2230-0730	2 x 790gpm x 800 fthd

*In addition these stations have one or more pumps that operate continuously from Friday night until low level trip or 0730 Monday whichever occurs first

W1TBDB13M

BRITISH COAL CORPORATION
NORTH EAST GROUP
CONSENTED DISCHARGES TO CONTROLLED WATERS
SEPTEMBER 1992

PUMPING STATIONS

SOURCE	RECEIVING WATER	N G R	NATURE OF DISCHARGE	MAX QUANTITY	MAX RATE	FORM OF CONSENT	REF	DATE
CHESTER SOUTH MOOR	TRIB. OF THE SOUTH BURN *	NZ 27072 49294	MINEWATER	26,000 m3/day	300 l/sec (3,960gpm)	WATER RESOURCES ACT 1991	245/0948	05/08/92
DAWDON	NORTH SEA	NZ 43680 47741	MINEWATER	4,600 m3/day	53 l/sec (700gpm)	WATER RESOURCES ACT 1991	255/1035	05/08/92
HORDEN	NORTH SEA	NZ 45032 42170	MINEWATER	35,000 m3/day	870 l/sec (11,482gpm)	WATER RESOURCES ACT 1991	255/1038	05/08/92
KIBBLESWORTH	RIVER TEAM	NZ 25940 56937	MINEWATER	81,700 m3/day	910 l/sec (12,000gpm)	RIVERS P.O.P ACT 1951	235/A/476	05/05/77
KIMBLESWORTH	BLACKDENE BURN *	NZ 26316 47098	MINEWATER	20,000 m3/day	227 l/sec (3,000gpm)	WATER RESOURCES ACT 1991	245/0973	05/08/92
LUMLEY 6TH	LUMLEY PARK BURN *	NZ 31020 50833	MINEWATER	19,640 m3/day	227 l/sec (3,000gpm)	WATER RESOURCES ACT 1991	245/0974	15/07/92
MORPETH MOOR	DITCH TO RIVER WANSBECK	NZ 21125 86830	MINEWATER	9,500 m3/day	110 l/sec 1,452gpm)	WATER RESOURCES ACT 1991	225/0936 *	05/08/92
MURTON	MURTON DENE	NZ 40242 47032	MINEWATER	6,400 m3/day	74 l/sec (977gpm)	WATER RESOURCES ACT 1991	225/1078	01/09/92
NEWBIGGIN	NORTH SEA	NZ 31720 88830	MINEWATER	20,000 m3/day	227 l/sec (3,000gpm)	WATER RESOURCES ACT 1991	225/0909	04/08/92
NICHOLSONS	DITCH TO RED BURN *	NZ 32735 48677	MINEWATER	16,360 m3/day	190 l/sec (2,500gpm)	WATER RESOURCES ACT 1991	245/1009	11/08/92
PAGE BANK	RIVER WEAR *	NZ 23441 35460	MINEWATER	24,000 m3/day	272 l/sec (3,590gpm)	WATER RESOURCES ACT 1991	245/0881	05/08/92
SHERBURN HILL	COALFORD BECK *	NZ 33503 42856	MINEWATER	19,640 m3/day	227 l/sec (3,000gpm)	WATER RESOURCES ACT 1991	245/0977	15/07/92
USHAW MOOR	DITCH TO RIVER DEERNESS *	NZ 22127 42683	MINEWATER	26,500 m3/day	303 l/sec (4,000gpm)	WATER RESOURCES ACT 1991	244/0891	05/08/92
VINOVIUM	BELL BURN *	NZ 20904 32207	MINEWATER	78,500 m3/day	909 l/sec(12,000gpm)	WATER RESOURCES ACT 1991	243/0882	05/08/92
WOODHORN	DITCH TO SPITAL BURN	NZ 29237 88394	MINEWATER	5,200 m3/day	60 l/sec (792gpm)	WATER RESOURCES ACT 1991	224/0908	05/08/92
	* INDICATES TO RIVER WEAR							

Appendix 5

BRITISH COAL CORPORATION
NORTH EAST GROUP
KNOWN GRAVITY MINEWATER DISCHARGES
SEPTEMBER 1992

Identity of Discharge	Dry Weather Flow (Gal/day) Approx.	Adverse Qualities
NORTHUMBERLAND		
Wylam James Pit (Consented)	1,000,000	
Throckley	864,000	Iron
Ayle East	15,000	
Acomb Drift	40,000	Iron
Fourstones	30,000	Iron
Haydon Bridge	7,200	Iron
Lemington	1,500	
Bardon Mill (Consented)	2,880,000	Iron
Ford Hill Drift	21,600	Iron
Bothal Drift	21,600	Iron
Make-Me-Rich Fm. Capheaton	72,000	Iron
Byrons Drift Greenhead	2,880,000	
Spital Main Coal Drift	72,000	Iron
SOUTH DURHAM		
Engine Pit St Helens Auck.	288,000	
Dere Avenue St Helens Auck.	28,800	Iron
Throstle Nest Drift	43,200	
Low Mill Wood Drifts	14,000	
Bells House Drift	7,200	
Lane Foot Drift	7,200	
Low West House Drift	7,200	
East Hedleyhope Drift	21,600	
Castleways Hutton Drift	2,880	
Pithouse Yard Drift	Trickle	
Helmington Row Hutton	28,800	Iron
Butterknowle Brockwell Dr	144,000	
Emms Hill Marshall Green	7,200	
Bearpark Low Main Drift	4,320	
Hamilton Row Drift	21,600	
Lynesack	50,400	Iron
Low Lands	?	
Batts Drift Bp. Auckland	?	Iron
NORTH DURHAM		
JK1 Water Level	20,000	
Garesfield Tilley	2,000	
Addison U/cst (u/g culvert)	144,000	Iron
Hazard Shaft Blaydon	7,500	
Thornley Wood	29,000	
Axwell Water Level	2,000	
Clockburn Wood Brockwell	2,000	
Whittonstall Drift	151,000	
Barnes Dr Parkwd. Whittnstl	43,000	
Garesfield Ruler	7,000	
Garesfield Townley	36,000	

Appendix 6

North Durham cont.		
Old Coal Lev. Chopwell No3	3,000	
Chopwell Hutton Drift	21,600	Iron
Milkwell Burn Drift	72,000	
Blackhall Mill	21,600	
Burn Day Hole	36,000	
Hamsterley John Shaft	2,880,000	
Derwent Cote Drift	14,000	
Cairns Drift	36,000	
Main Coal Drift,Derwent	7,200	
Main Coal(L) Drift,Derwent	72,000	
Lilley Drift, Rwlds. Gill	288,000	Iron (I.C.)
Snipes Dene Drift,Gibside	1,500	
Barons Close Dr Victoria T	15,000	
South Garesfield Victoria T	43,200	
Burnopfield Main Coal Dr	7,200	Iron
ont Water Level Drift	57,600	
Raven Drift Medomsley	3,000	
Main Coal Drift Medomsley	1,500	
Main Coal Dr Sth Medomsley	3,000	
I/tone Dr O/Crop Stoney Hp	36,000	Iron
Causey Mill Drift	1,500	
Watergate Hutton Drift	1,500	
Mill Drift Kibblesworth	4,300	
Drift to High Main	3,000	
Beamish Park Waterway Drift	7,200	
Mahogany Row Drift	3,000	Iron
Beamish 2nd Pit W.L. Drift	36,000	
Dolls Hole Drift to "F"	4,320	Iron
Drift to Yard Seam (G)	7,200	
Beamish Ling Shaft	21,600	
Waldridge Water Level Drift	300	
Garden Drift	150,000	
High Main Water Level Drift	21,600	
Stockerley Brockwell O/Crp	?	Iron
L Dr from Yd to Cong Burn	43,000	
WL Dr from High Main Seam	43,000	Iron
WL Dr from Yd to Black Burn	14,000	Iron
Drift at Smithy Dene (82)	3,000	Iron
Drift at Smithy Dene (83)	7,200	
Drift at Smithy Dene (84)	3,000	Iron
Shield Row Drift Sacriston	144,000	
Edmondsley Drift	14,000	Iron
Iveston Drift	3,000	

BRITISH COAL CORPORATION
NORTH EAST GROUP

Underground Water Survey in the Northumberland and Durham Coalfield
August 1992

1. PRESENT POSITION (Ref Plan No 1)

North Durham Area

1.1. The North West Zone - north of the River Derwent

(a) There are no working mines and no pumping stations in this zone.

(b) The water in that part of the zone north of the 90 fathom dyke, is connected, via the strata, with water in the Throckley Colliery workings (Northumberland Area). Both ponds maintaining approximately the same level during the water build-up period.

Apart from seasonal variations the pond, as measured at Clara Vale shaft up until 1986, was static at a level of 10026 ft approximately. At a level of 10013 ft approximately 100/200 gpm overflows to the surface via the rising main left intact in the infilled Addison upcast shaft, and through the shaft infill. Water also overflows to the surface from the open Throckley Isabella shaft at a level of 10021 ft approximately.

The water in this area has been virtually static since March 1970. In January 1977, during a high rainfall period, a feeder of approximately 1000 gpm issued from strata, exposed at the surface during factory site works, at an approximate level of 10024 ft, adjacent to the Addison Colliery, Atkinson Drift Mouth. This water appears to have been collected in the new drain constructed by the site operator. In 1979 water also appeared on the Haugh land north of Addison Colliery at an approximate surface level of 10011 ft and adopted a rest level only a few inches deep over an area of approximately 5 yards square.

Further issues may occur in the vicinity of Addison Colliery, particularly during periods of heavy rainfall, otherwise the water position is static and unlikely to change.

The combined feeders during the period of active mining at the collieries supplying the Clara Vale/Throckley Pond is estimated at 8000/9000 gpm. The water issuing at the surface during high rainfall periods is not greater than 2000 gpm.

(c) The water in that part of the zone south of the 90 fathom dyke migrates eastwards issuing to the River Derwent at various points en route. In the extreme east, ponded water has risen to a level of 10026 ft and a feeder varying between 0 and 450 gpm overflows to the surface via hardcore infill of the Blaydon Hazard Shaft.

1.2. **Western Zone** - bounded by the line of impoverishment in the Busty seam to the east and the North Durham Area boundary to the north, south and west.

(a) There are no working collieries in this zone and the pumping stations are:-

Pumping Stations	GPM Pumped To Surface	Static Head Ft
Kimblesworth	1879	450
Kibblesworth	3636	540
Chester Sth Moor	1515	350
	7030	

(b) Drainage from the Brockwell (S) Seam western outcrop through collieries west of Eden Mine has accumulated against solid barriers of coal and faulting east of that mine and overflows, at a level of 10163 ft, to the River Derwent via the open Hamsterley John Shaft, at the rate of approximately 2000 gpm. There is a tendency for this outlet to become partially obstructed creating an occasional surge of water as an apparently increasing head clears the obstructing material. In view of the tendency of the John Shaft to 'block off' the Hamsterley No 1 shaft has been retained in an open condition as an alternative outlet, at a level of 10190 ft.

(c) To the south of the above pond, water has accumulated in the Woodside Drift Licensed Mine to a static level of 10396 ft and is thought to migrate through the strata to Morrison Busty Mine.

(d) Water from the disused Morrison Busty, Tanfield Lea, Beamish, Craghead, Pelton, Handen Hold, Chester South Moor and South Pelaw Mines has a restricted flow, to Urpeth Mines, through barriers in the Busty Seam. As a result a proportion of the water has ponded against the restrictions and extended westwards causing the Chester South Moor pond, which had been static at a level of 9818 ft between 1970 and 1975, to commence to rise.

There is a possible migratory water route, via the strata at a level of 9830 ft, between workings in the Chester South Moor/Waldridge Tilley which overlie Sacriston Busty workings, so in order to safeguard the Sacriston Mine pumps were installed at Chester South Moor in 1975 to maintain the Chester South Moor pond at a static level of 9820 ft. Since installation of the Chester South Moor pumps the pumped feeder has gradually increased to 1515 gpm. The increasing feeder indicated a restricted flow to Chester South Moor which apparently increased in quantity as the head acting on the restriction increased. This was confirmed when the Craghead pond, which previously overflowed eastwards at a level of 9900 ft approximately, began to rise in 1977.

In July 1980 the level of water measured in the Craghead Shaft became static at 10013 ft and varied between 10006 and 10026 seasonally until December 1983 when it again began to rise, reaching 10092 in September 1987 where it remained until the shafts were filled in August 1988.

South Pelaw pond which had virtually been static until 1968 began to rise in that year, when water from the abandoned Chester South Moor Mine was believed to be migrating via the strata to South Pelaw. South Pelaw water rising at the rate of approximately 12 ft per year had reached a level of 9935 ft when the shaft was filled in 1980. This pond will probably become static when it reaches the level of the Craghead pond. There may be seepage from South Pelaw eastwards to Chatershaugh.

(e) Following the closure of Nettlesworth Drift, pumps were withdrawn from the Alma Shaft in August 1974. In July 1975 the Hutton (L) Seam pond previously maintained by these pumps reached a static level of 10063 ft probably overflowing to Nettlesworth Mine. Water from the Nettlesworth Drift Mine is probably overflowing to Pelton Mine.

(f) The Morrison Busty East and West pit shafts, Tanfield Lea and Pelton shafts have been filled with Washery Tailings.

(g) After the closure of Kibblesworth Mine and the installation of pumps in the Kibblesworth Glamis shaft in November 1976, pumping ceased at Urpeth B, Dunston, Ravensworth Park, Ravensworth Ann and Bewicke Main. There appears to be restrictions in the migratory routes between Urpeth and Ravensworth with the result that water in the Urpeth pond had risen above the expected 9730 ft overflow level to a level of 9828 ft by February 1989 when the shaft was filled. Disused workings at Dunston colliery are connected to Elswick Colliery in the Northumberland Southern Zone in the Brockwell (S) Seam. After pumping ceased at Dunston the pond reached a static level of 9840 ft apparently overflowing to Watergate Mine, via a holing at a level of 9828 ft. A water measurement taken in the Elswick shafts prior to filling, in 1979, gave a water level of 9865 ft. Watergate Busty (Q) Mine workings are connected to the Ravensworth Ann Tilley mine workings via the Ravensworth Park Shaft. The Dunston/Watergate pond overflows via this route to Ravensworth Ann Mine at a level of 9755 ft and combines with the Urpeth B and Ravensworth Ann feeders to form a pond which overflows to Kibblesworth pumping station at a level of 9720 ft. When pumping ceased at Bewicke Main Shaft the Hutton (L) Seam pond, previously controlled by this pump, overflowed to Kibblesworth at a level of 9900 ft approximately.

(h) Marley Hill Colliery closed in April 1983 and pumping subsequently ceased at East Tanfield in June 1983. The water level at East Tanfield had risen to a level of 10113 by August 1985 when the shaft was filled and was expected to eventually overflow to Marley Hill via

Byermoor. The accumulating water at Marley Hill which was expected to rise to a level of 10085 and overflow to the surface via Clockburn Drift appears to have migrated via strata breaks to reach Kibblesworth Pumping Station in 1984, increasing the feeder pumped at that station by approx 500 gpm (ie approximately half the Marley Hill/East Tanfield feeder).

(i) Pumps installed in the Kibblesworth Glamis shaft maintain the Kibblesworth pond at a level of 9700 ft to prevent overflow, via Ravensworth Ann, to the Central Zone at a level of 9790/9800 ft.

(j) Submersible pumps installed in the Kimblesworth shaft maintain the Kimblesworth pond at a level of 9836 ft to prevent overflow to the Chester Moor Pumping Station via Sacriston, of feeders too large for the Chester Moor Station to handle.

1.3. **Central Zone** - east of the western zone up to Boldon, Hylton and Silksworth Collieries.

(a) There are no working collieries in this zone and the pumping stations are:-

Pumping Stations	GPM Pumped to surface	Static Head ft
Lumley 6th	369	480
Nicholsons	491	445
	860	

(b) The disused Hebburn workings are connected to disused Wallsend and Rising Sun workings (Northumberland Area). Water in these collieries had reached a level of 9668 ft in July 1980. No shafts are available to monitor the rising level in this pond which is expected to overflow to Eccles Colliery at a level of 9806 ft. These workings are isolated from the remainder of the North Durham Area by barriers (minimum 80 -100 yds). It was estimated in 1981, that the head of water acting on the Boldon Maudlin (H) Seam barriers was 700/800 ft.

(c) Following the closure of Washington and Usworth Mines pumping ceased at Heworth and Wardley No 2 pumping stations. The Heworth water had risen to a level of 9674 ft in November 1977 at which time the Heworth shafts were filled. The Heworth water will eventually rise to the combined, Usworth, Wardley, Washington pond, via Springwell probably at a level of 9750 ft approximately. All the shafts giving access to the rising Usworth, Wardley, Washington pond have been filled. The last recorded level was 9131 ft taken at Wardley No 1 shaft in May 1979 prior to filling. It is estimated that the present level will be 9650 ft approximately and may be exerting a head of 850/950 ft on the Usworth/Boldon barriers in the Hutton(L) Seam and

550/750 ft head on Hylton barriers in the Maudlin (H) and Brass Thill (K) Seams. It is expected that this pond will overflow to Chatershaugh at a level of 9750 ft at which time the head on the Usworth/Boldon barriers in the Hutton (L) Seam will be 950/1050 ft and on the Hylton barriers in the Maudlin (H) and Brass Thill (K) Seams will be 650/850 ft. Washery Tailings were discharged into the Usworth Shaft and the effect of these on the water position is not known.

(d) Following the closure of the Rainton Adventure Drift Mine the water previously pumped from that mine will have ponded to a level of 9766 ft and will be overflowing to the Nicholsons pumping stations.

(e) Following the closure of Houghton Mine the colliery feeder of 132 gpm will pond to a level of 9560 ft approximately and may overflow to Herrington Mine, via boreholes, (said to be fitted with wood plugs) and/or the strata between the Low Main (J) and Maudlin (H) Seams lying to the north east of the Houghton Shafts and thence via a staple Maudlin (H) to Yard (G) Seams and Drifts Yard (G) to Brass Thill (K) and Brass Thill (K) to Hutton (L). If none, or only part, of the feeder flows to Herrington then the Houghton pond will rise to a level of 9630 ft and overflow to Eppleton Colliery via a connection in the Maudlin (H) Seam. The Houghton shafts were filled with Washery Tailings however which may have sealed off certain water migratory routes and prevent some of the feeders reaching Herrington or Eppleton.

(f) Nicholsons and Lumley 6th Pumping Stations protect the working collieries in the South Durham North East Zone.

1.4 **Eastern Zone** - east of and including Boldon, Hylton and Silksworth Collieries.

(a) There are no pumping stations in this zone and the working collieries are:-

Working Collieries	GMP Pumped to Surface
Westoe	3820
Wearmouth	520
	4340

(b) Following the closure of Silksworth Colliery Washery Tailings were deposited in the Silksworth shaft to a level of 9800 ft approximately, ie above the top inset. This colliery is isolated by barriers from the remainder of the Area. Prior to closure the total pit feeder was only 125 gpm.

(c) Following the closure of Harton Colliery the pit feeder of approximately 210 gpm is ponding in the workings against the Boldon/Harton barrier which follows the line of a Whin Dyke. A Boldon/Harton connecting roadway through the Dyke at the Hutton (L) seam horizon contains a water dam originally designed to withstand a pressure head of 600 ft. This dam was, in fact, constructed 14 ft longer than designed. In 1975 some leakage occurred due to the corrosion of 6" inspection pipe. The dam was extended a further 8 ft to prevent this leakage and fitted with a copper pipe and pressure gauge. On the closure of Boldon there was a 323 ft head of water acting on the dam equivalent to a Harton pond level of 8850 ft. A small area of workings in Yard (G) Seam worked to Harton Colliery on the Boldon side of the Dyke lies 50 ft above Boldon workings in the Maudlin (H) seam. These overlapping workings may form a migratory route for water as the level of the Harton pond increases.

(d) Apart from the dammed connection with the Harton Colliery through the Whin Dyke (see para 1.4 (c)) Boldon has no direct connection with other mines. The feeder of 140 gpm will accumulate in the workings. As the Boldon pond rises minor feeders may reach Hylton, via the strata, where workings overlap. Any additional feeders from this source will flow to Wearmouth. Washery Tailings have been discharged into Boldon Colliery shafts, and are still an emergency disposal point, but this should have no detrimental affect on the water position.

(e) Following the closure of Hylton Colliery the shafts were filled. The total pit feeder prior to closure was approximately 20 gpm. Only minor ponding is likely to have occurred overflowing at a level of 8298 ft to Wearmouth Colliery via a goaf connection in the Harvey (N) Seam and/or a drift connection between Hylton Harvey (N) and Wearmouth Maudlin (H) at a level of 8366 ft.

(f) Following the closure of Whitburn Colliery, Washery Tailings were put into the Whitburn shafts to a level of 9423 ft (Maudlin inset level). Prior to closure, in 1968, the total pit feeder, pumped to the surface, was approximately 200 gpm. After local ponding this water would flow to the south, or dip, side of Whitburn workings. In 1974 Hylton Yard (G) Seam workings encountered small feeders, at levels of 8636 and 8840 ft issuing form the floor (approximately 10 gpm) which appeared to be from Whitburn Maudlin (H) dip side workings, approximately 70 ft below. Wearmouth North Harvey (N) longwall workings contacted an open 8" borehole from the Whitburn Maudlin (H) dip side workings, at a level of 8654 ft, which, initially, passed a considerable quantity of water. At the present time Wearmouth pump, from this borehole and strata breaks, an estimated 60 gpm. Westoe Colliery is in contact with water ponded in Whitburn North Maudlin (H) workings and presently maintains this pond at a level of 8895 ft, pumping a feeder of 30/40 gpm.

South Durham Area

1.5 South Zone - south of Butterknowle Fault

(a) There are no working mines or pumping stations in this zone other than one known commercial station namely Thrislington abstracting approximately 50 gpm.

(b) West of Auckland Park ponded water measured at Ladysmith shaft is virtually static, subject to seasonal variations, at a level of 10343/10360 ft ie 16/33 ft below shaft top. The bulk of the water from this pond will be discharging into the natural water table. In one or two instances feeders have reached the surface, via shafts and outlets and further discharges of this type may occur in the future, particularly during periods of heavy rainfall. Restricted feeders from this pond also flow to workings north of the Butterknowle fault via a connection through the fault near Etherley Lane at a level of 10134 ft and also eastwards to a pond south of the Butterknowle fault between Auckland Park and the Dean & Chapter/Mainsforth barrier. Water in the latter pond, last measured at Chilton shaft in September 1988, prior to the shafts being filled, appeared to have reached a static level of 10224 ft approximately, thought to be the rest level in the Permian Limestone which overlies the coal measures east of Auckland Park. Restricted feeders from this pond also flow to workings north of the Butterknowle Fault, via a connection near Westerton Lane at a level of 10040 ft and to Mainsforth which, in turn, is connected to Thrislington and Fishburn Collieries, all south of the Butterknowle Fault. The last recorded water level at Fishburn, taken July 1987 prior to the filling of the shafts, was 10220 ft. At present some 50 gpm is pumped from Thrislington shaft for commercial purposes, the water level varying between 10220 and 10240 ft approx. Mainsforth shaft has been purchased by the Northumbrian Water Authority to provide an emergency water supply. No pumping has been carried out at this shaft since 1974 and the water is virtually static, subject to seasonal variation, with levels ranging between 10230 and 10240.

1.6 Western Zone - north of Butterknowle fault and west of the line of impoverishment in the lower seams.

(a) There are no working collieries in this zone and the Pumping Stations are:-

Pumping Stations	GPM Pumped To Surface	Static Head ft
Vinovium	3385	170
Page Bank	2119	140
Ushaw Moor	1439	320
	6943	

(b) These pumping stations prevent water migrating to the North Durham Western Zone pumping stations, namely Kimblesworth and Chester South Moor via Langley Park. Vinovium maintains water at a level of 10045 ft approx. Page Bank at a level of 10040 ft approximately and Ushaw Moor at a level of 10050 ft approximately.

(c) Metal Bridge Drift Mine has been used for the disposal of Washery Tailings via pipes laid through the stowed adits. Apart from a possible minor discharge to Bowburn Harvey (N) Seam via a water drainage hole which may be sealed by Tailings the water in this mine is self contained.

1.7 **South Eastern Zone** - bounded by the Butterknowle fault to the south; the Ludworth Whin Dyke to the north and the line of impoverishment in the lower seams to the west.

(a) There are no working collieries in this zone and the pumping stations are:-

Pumping Stations	GMP Pumped To Surface	Static Head ft
Horden	4935	1185
	4935	

(b) The Ludworth Whin Dyke forms an effective seal between this zone and the North East Zone. There are known connections through the Dyke but these have been dammed and are considered to be sealed.

(c) Ponded water at Bowburn Colliery measured at Tursdale shaft showed the pond to be virtually static from 1977, subject to seasonal variations, with levels ranging from 10015 to 10025 ft. The final measurement being taken in October 1985 prior to the shafts being filled.

(d) Salvage work at East Hetton Colliery ceased in December 1983 and it is expected that the mine water will pond and rise towards the Magnesian Limestone rest level of approximately 10370 ft.

Pumping at Kelloe Winning Pumping Station ceased at the same time and this water will rise and merge with the East Hetton pond

The East Hetton shafts were later used for Washery Tailings disposal to a final level 10146 ft prior to the shafts being filled in December 1987 and capped in February 1988.

It is not considered that any migration will take place in the future from this area towards the coastal collieries.

(e) Deaf Hill shafts have been filled with Tailings to the surface. Thornley shafts were partially filled with Washery Tailings prior to 1976 and subsequently filled to the surface with building rubble. Wingate Grange shafts were also used for Washery Tailings disposal which reached a level of 9900 ft in the shafts and consequently the water level in these shafts cannot be measured. The last measurement taken at Wingate Grange in Jan 1980 recorded a rising water level of 9740 ft. Shotton Shafts were filled in 1973 and consequently the water level cannot be measured there either.

(f) Castle Eden Pumping Station closed in October 1986 following the closure and salvage of the Horden/Blackhall Mine.

(g) Blackhall Colliery ceased pumping in July 1986, again following the closure of the Horden mine.

1.8 **North East Zone** - north of the Ludworth Whin Dyke and east of the line of impoverishment in the lower seams.

(a) The working collieries and pumping stations are:-

Working Collieries	GPM Pumped To Surface	Pumping Stations	GPM Pumped To Surface	Static Head ft
Seaham / Vane Tempest	0	Sherburn Hill	1296	560
Easington	4523	Murton	150	1430
	4523		1346	

(b) The Seaham/Vane Tempest Combined Mine has total underground feeders of only 20 gpm and these are currently being pumped to abandoned underground workings within the mine and not to the surface.

(c) Murton Pumping Station has only recently commenced pumping (June 1992) and is currently dealing with only part of the underground feeders which are expected to total some 600 gpm when they have all arrived.

(d) Dawdon Colliery at cessation of mining (July 1991) had water feeders totalling 708 gpm of which approximately 500 gpm came from the High Main E90 Face. A later inspection, at the end of salvage operations, revealed that the E90 feeder had stopped. This has resulted in the establishment of the submersible pumping station at Dawdon, designed for the protection of Easington, being shelved, pending the results of future monitoring of water levels in the Dawdon Shafts.

Northumberland Area

1.9 **North Zone** - north of the Stakeford Dyke

(NOTE: the northern part of this zone, Whittle and Shilbottle, is not shown on the attached plans).

(a) The working collieries and pumping stations are:-

Working Collieries	GPM Pumped To Surface	Pumping Stations	GPM Pumped To Surface	Static Head ft
Ellington/ Lynemouth	2988	Morpeth Moor	265	220
		Woodhorn	183	700
		Newbiggin	470	610
	2988		918	

(b) Submersible pumps installed in Morpeth Moor shafts maintain water in that mine at a level of 9980 ft approximately to prevent overflow to Lynemouth via Pegswood and Ashington. Some of this water can be used for commercial purposes by Glaxo Ltd.

(c) Submersible pumps installed in Woodhorn shaft maintain water in that mine at a level of 9400 ft approximately to prevent overflow to Lynemouth at a level of 9648 ft.

(d) Since the closure of Ashington Colliery in May 1988, the Ashington feeders of approximately 1000 gpm have been filling up the abandoned Ashington workings and are expected to rise to a level of 9590 ft around the shaft area before overflowing via the Brass Thill (K) Seam inset to join the Hutton (L), Three Quarter (R) and Bottom Busty (Q2) Seam feeders which are expected to overflow to Woodhorn at a level of 9639 ft. Should some of the Ashington feeders arrive at Woodhorn prior to the planned re-organisation of pumping in this zone (see paragraph 1.9 (f)), then some or all of the additional feeder could be dealt with by pumping longer hours if this was felt necessary, however, as the current pumping level is approximately 250 ft below the overflow level to Lynemouth there will be a considerable "filling up" time before Lynemouth is affected.

(e) Submersible pumps installed in the Newbiggin shaft maintain that pond at a level of 9430 ft approximately to prevent overflow to Lynemouth via Woodhorn colliery, by way of a Woodhorn to Newbiggin roadway connection in the Yard (G2) Seam, at a level of 9407 ft, driven during the war for egress purposes. This connection was fitted with an emergency door/dam and when Newbiggin water was allowed to rise to a level of 9499 ft there was no apparent overflow to Woodhorn. Boreholes were also driven between Bates Colliery and Newbiggin to pass

water through to be pumped to the surface at Newbiggin, but these were sealed in May 1986 prior to the closure of Bates Colliery. If the door/dam and the sealed boreholes prevent water migration, then Newbiggin will be a completely independent body of water as there are no other connections to any mines.

(f) A major re-organisation of pumping is planned in this zone which will involve the closure of the three current pumping stations, allowing the waters to rise and overflow to Lynemouth and be pumped to the surface there.

(g) Whittle Colliery, a Licensed Mine to the extreme north is connected only to the nearby Shilbottle Mine and remote from the rest of the coalfield. This mine is currently pumping approximately 400 gpm to the surface.

(h) Following the closure of Hauxley Colliery in 1966 and the cessation of underground pumping, mine water in the Hauxley, Broomhill area rose from a level of 9414 ft to a level of 9950 ft in 1971, and was still rising, when British Coal Opencast drilled two large diameter boreholes into the Hauxley workings and installed submersible pumps to lower the water to enable Opencast Mining to be carried out in the vicinity.

Between 1972 and 1973, approximately 10,000 gpm was pumped out of the workings, lowering the water level from 9950 ft to 9750 ft. This level was then maintained until 1976 by pumping approximately 3,500 gpm.

Reduced pumping between 1976 and 1980 allowed the water level to rise again to a level around 9900 ft. At this stage, two new boreholes were drilled into the Hauxley workings and two new pumps installed at a lower level. Increased pumping from these then lowered the water to a level of 9730 ft.

The water has since been maintained around this level, by pumping approximately 3,500 gpm, except for period of discontinuance each year in July and August during the salmon fishing period. During the period of discontinuance the water level rises approximately 90 ft

1.10 South Zone - South of the Stakeford Dyke.

(a) There are no working collieries or pumping stations left in this zone, minewaters are being allowed to pond and rise throughout the zone with monitoring being carried out at six stations, namely:-

Monitoring Station	Depth to Water	Level ft
Bedlington 'A'	382	9726
Choppington 'A'	378	9722
North Seaton	338	9732
Bates	288	9736
New Delaval	341	9748
Seaton Delaval	361	9768

(b) Bedlington 'A', Choppington 'A', North Seaton and Bates were all interconnected by direct holings and the waters at these former pumping stations have now risen to form one common pond. Whilst there is a range of 14 ft in the levels this is probably the result of the holings being restricted as the rise at each of these stations has been similar since June 1990.

(c) New Delaval and Seaton Delaval are interconnected via New Hartley in Seam (K) at a level of 9570 and via Shankhouse in Seam (G) at a level of 9715 ft. Both of these holings are below current water levels at each of the stations yet the waters are continuing to rise at different rates. This would appear to indicate that if the holings are allowing water to pass they are extremely restricted and that these waters are not at present rising as one pond as was expected.

(d) There are no recorded connections between the two above ponds ie. (b) & (c) but there may be strata breaks in seam (H) around 9520/9540 ft between New Delaval and Isabella, which in turn is directly connected to Bates, which could allow all the waters in this area to rise eventually as one common pond. However as the ponds are already much higher than these levels it would appear that this is not the case and that the waters may continue to rise as two or even three separate ponds. This may be determined by further monitoring.

(e) There are borehole connections between Seaton Delaval Low Main Seam (J) and Fenwick Brass Thill Seam (K) at a level of 9680 ft. The residue of the Seaton Delaval feeder may be flowing to Fenwick via this route although it is recorded that these boreholes were plugged during pillar extraction in 1957.

(f) Submersible pumps were installed in Seghill upcast shaft in 1974 and maintained water at a level of 9376 ft to prevent possible migration of water via strata breaks to Eccles Colliery. Following the closure of Eccles in 1980 the Seghill pumps were withdrawn and both Seghill and Eccles shafts were filled. The last recorded water level at Eccles in May 1981 was 9244 ft (a rise of 371 ft in five months). The Rising Sun/Wallsend/Hebburn pond is expected to overflow to Eccles mine at a level of 9806 ft (reference 1.3 (b)).

(g) Following the closure of Bates Colliery the submersible pumps were withdrawn from Weetslade Pumping Station which were controlling the Weetslade/Burradon pond. The final water level measured in the Weetlade shaft was 9730 ft November 1986, prior to the commencement of Washery Tailings disposal, (a rise of 59 ft in six months). This pond is the collection area for all water currently rising in disused Collieries of the Northumberland South Zone, south of Seaton Delaval Colliery. The potential feeder reaching this pond could be in the order of 3300 gpm. The Weetslade/Burradon pond will, after combining with the Seaton Delaval pond at 9690 ft, continue to rise to the overflow points to New Delaval and Dinnington at levels of 9715 ft and 9720 ft respectively.

(h) The Jubilee shaft which has now been filled gave access to the Regent, Jubilee, Fawdon and West Moor pond. Measurements taken in the shaft showed that this pond had reached a static level of 9934 ft prior to 1947 when the West Moor water broke through to Weetslade and the pond level gradually lowered to 9750 ft.

(j) Prestwick and Havannah can be considered as one unit. Following the closure of Havannah and Dudley mines the Prestwick and Dudley shafts and Havannah drifts were filled. Washery Tailings were discharged down Havannah drift via pipes extending through the drift stowing into the workings. The Havannah drifts are connected to Hazlerigg in the Main (F) Seam at a level of 10007 ft. It is expected that Tailings discharged into the drift will seal this connection. The Prestwick/Havannah pond will probably overflow to North Walbottle at a level of 10040 ft.

(k) North Walbottle and Montague Collieries form one common pond. Prior to the filling of the shafts in 1977/78, which gave access to the pond for monitoring purposes, the water had been virtually static from 1972 at a level of 10022/10033 ft. This water is not overflowing to the River Tyne via Kitty's drift nor was there any increase in the water pumped at Dunston shaft to indicate an overflow to Dunston via North Elswick. In the circumstances it would appear that this pond is overflowing to Throckley and discharging to the River Tyne. (Reference 1.1 (b)).

2. FUTURE POSITION (ie following the closure of successive collieries until all collieries are closed) (Ref: Plans Nos 1 & 2)

North Durham Area

2.1 The North West Zone

(a) There have been no working mines or pumping stations in this zone for many years and apart from small surface issues during heavy rainfall periods no changes are envisaged in this zone in the future.

2.2 Western Zone

(a) Should Kimblesworth Pumping Station cease to operate, the feeder of 1879 gpm may migrate at a level of 9830 ft to Chester South Moor, via the strata, increasing the feeder which will need to be pumped at that station to 3394 gpm subject to the capacity available, current capacity being 4000 gpm (2 No 2000 gpm pumps). If the Kimblesworth water does not flow to Chester South Moor, by the above route, then the pond will rise to a level of 10090 ft at Sacriston and overflow to Chester South Moor via Waldridge in the Brass Thill (K) and Hutton (L) Seams.

(b) Pumping will continue at Kibblesworth and Chester South Moor at least until all collieries are closed in the South Durham North East Zone (ie Seaham/Vane Tempest and Easington) or until it is decided that they can be safely shut down during the final stages of production. (See paragraph 2.8 (k) for final position).

2.3 Central Zone

(a) Lumley Sixth and Nicholsons Pumping Stations will also continue to operate until the closure of Seaham/ Vane Tempest and Easington or again until it is decided they can be safely shut down during the final stages of production.

(b) The migration of water from Nicholsons to Murton via Eppleton is unlikely to be affected by the disposal of tailings at Houghton.

2.4 Eastern Zone

(a) Following the closure of Westoe Colliery the feeders will pond to a level of 9410/9460 ft extending south into Whitburn and overflowing to Wearmouth via borehole and strata connections (see para 1.4 (f)) and via an 800 metre goaf connection between Hylton/Wearmouth in the Harvey Seam (N) at levels between 8210 & 8250 ft. If Wearmouth is still working when Westoe closes it will be necessary to maintain Westoe water below the 9410/9460 holdings by pumping at Westoe Mine. This could be done by installing submersible pumps in the Westoe Colliery shafts.

Note:
The present combined Westoe and Harton feeders amount to 3800 gpm but since 1970 the Westoe feeder has increased from 600 gpm to 3600 gpm and before the mine closes the feeders may be larger.

(b) Following the closure of Wearmouth Mine the feeders will pond to a level of 9410/9460 ft extending north into Whitburn and overflowing to Westoe Mine as in 2.3(a). If Westoe is still working when Wearmouth closes, the Wearmouth feeder, currently amounting to 520 gpm, should be controlled below the Westoe overflow by pumping at Wearmouth. This could be done by installing submersible pumps in the Wearmouth Colliery shafts. If this water is allowed to flow to Westoe then there is a danger that the direct connections between Westoe and Whitburn may be partially obstructed resulting in a perched pond acting directly on the connections.

(c) Following the closure of both Westoe and Wearmouth the Westoe/Wearmouth water can be allowed to form one common pond which will extend into Hylton Mine. Part of the total feeder may migrate (via strata breaks above 40 metre solid coal barriers) to the Washington/Usworth pond or vice versa subject to relative pond levels at any specific time. However, the bulk of the feeder will tend to be confined to the Eastern Zone and the pond is expected to rise to at least sea level and possibly to the surface at St Hilda's Shaft (surface level 10044 ft) although there is known to be ancient unrecorded mining at a shallow depth in the Templetown/Deans area and it is possible that rising underground feeders could migrate via strata breaks or fault planes to issue at lower levels via unrecorded shafts or drifts. It is expected that the quantity of water reaching the surface, if any, will be small since the bulk of the water currently being pumped from both collieries enters from under sea coal workings and presumably will exit by the same routes.

South Durham Area

2.5 South Zone

(a) It is not anticipated there will be any major changes in this zone but they cannot be totally ruled out as it is just possible that the pond levels may be affected by rising water levels in the Western Zone, resulting in discharges to the surface in low lying areas in the St Helens Bishop Auckland area, see para 2.8 (g)(i)

2.6 Western Zone

(a) The Ushaw Moor, Page Bank and Vinovium pumping stations will operate until both Seaham /Vane Tempest and Easington Collieries are closed or it is decided they can be safely closed down during the final stages of production (see para 2.8(k)). When pumping ceases at these stations the combined Western Zone pond will probably rise to a level of 10100' approximately before overflowing to the South Durham North Eastern Zone.

2.7 South Eastern Zone

(a) During the build up of the East Hetton pond the water at Bowburn, which is currently static at level of 10024/10025 ft, may begin to rise. All the workings made from Bowburn Shafts will be filled with water at a level of 10100 ft but the water level in the shaft may continue to rise to the level in the East Hetton ponds.

(b) The Bowburn, East Hetton, Trimdon Grange pond will eventually become static at a probable natural rest level of 10240/10300 ft.

(c) Prior to the closure of Horden Colliery the emergency connecting road passing through the Ludworth Whin Dyke between Horden Low Main (J) and Easington Main (F) Seams was sealed with a dam at a level of 9065 ft. This effectively sealed off all water migration routes between the South Eastern and North East Zones, however, for reasons of safety a submersible pumping station was established at Horden maintaining the water at a level of 9030 ft, ie below the level of the dam. When mining ceases at Easington Colliery, pumping will cease at Horden Pumping Station and the current feeders of (4935 gpm) will pond in the workings and rise to a probable level of 10026 ft which is the level of the former water delivery drift from Blackhall Shafts to the foreshore. There is however a record of reinforced concrete stopping being constructed in this drift 20 metres from the entrance. Should this stopping prove to be a water seal then the water will continue to rise to a level 10030 ft which is the level of the former water delivery drifts from Horden Shafts to the foreshore. These drifts are believed only to be stowed at the entrances with mine waste and though at a higher level than the Blackhall Drifts may prove to be the discharge route. Discharges however may occur at both locations.

(d) There is a drift connection between Horden (F) and Shotton Low Main (J) at a level of 9429 ft. This drift was sealed but there are conflicting reports of the extent of the sealing, however prior to the closure of Horden there was no evidence of water flowing from Shotton to Horden via this route. There are two companion drifts from Shotton to Haswell Collieries through the Ludworth Whin Dyke in the Hutton (L) Seam at an approximate level of 9230 ft. These drifts are fitted with dams, built into the dyke and said to be designed to withstand a pressure head of 620 lb/square inch but this is based upon pressure acting on the dams from the Haswell or north side of the dyke. Water on the Haswell side of the dyke was standing at a level of 9492 ft and overflowing to South Hetton, but following the abandonment of that district could by now have risen and be overflowing to Murton Colliery at a level of 9550 ft. Thus the maximum head placed upon these dams from Shotton side is likely to be 10026 -9550 = 476 ft.

2.8 North Eastern Zone

(a) The pumping stations at Sherburn Hill and Murton will be retained for as long as mining continues in this zone. ie Seaham/Vane Tempest and Easington Collieries or until it is decided they can be safely shut down during the final stages of production.

(b) Following cessation of pumping at Murton Pumping Station water will accumulate and overflow via Seaham to Vane Tempest at a level of 8535 ft. There are connections between Seaham and Dawdon, Murton and Dawdon, Murton and Easington and Dawdon and Easington but these are above the 8535 ft level.

Measures have been taken to seal off and prevent the Limestone feeders currently pumped at Seaham (400 gpm) from flowing into the mine after closure. The only unsealed connection between the limestone pumping staple and the working mine now being a drift to the No 3 Shaft at a level of 10035 ft which is above the natural water table level.

(c) The emergency connecting road in the Main (F) Seam between Dawdon and Murton was sealed with a stopping at a level of 8816 incorporating a 4 inch diameter pipe and valve which is believed to be open.

(d) The internal feeders at Dawdon now appear to be relatively small and therefore the build-up of water within the abandoned mine will be slow. Monitoring of this build up will continue and results will determine whether the planned submersible pumping station at Dawdon, designed for the protection of Easington, is required or whether any eventual leakage can be dealt with at Easington.

(e) Dawdon workings are connected to Easington workings in the Low Main Seam (J) at a level of 8505 and in Seam (F) at a level of 8786. The lower connecting road is recorded as being sealed but the details are unrecorded. The upper connection is still open.

(f) Following the closure of Seaham/Vane Tempest and Easington Collieries and assuming, at that time, all collieries in Durham are closed, with the possible exception of Westoe and/or Wearmouth, then all pumping stations in Durham will be abandoned. At this stage water in the South Durham North Eastern and North Durham Central and Western Zones will rise as one common pond and overflow at the surface. The lowest positive "open" overflow point from the above pond is the Easington shaft and beach tunnel to the sea at a level of 10022ft.

Other beach tunnels which have been "collapsed or stopped off" may however provide additional overflow routes for issues as follows:

Dawdon, level 10022 ft. blockwork stoppings in drift.
Horden, level 10030 ft. tunnels collapsed.
Blackhall, level 10026 ft. reinf conc stopping in drift.

However, bearing in mind that only the Easington tunnel is known to be completely open and thus the quantity of water which may reach the surface via this route, the capability of delivery of this should be carefully considered prior to the abandonment of Easington Mine.

The tunnel outlet is however, higher than the Haugh land adjacent to the River Tyne and the lower reaches of the River Team in the vicinity of Dunston. Within this Haugh land and below the level of Easington outlet there are three filled shafts and one filled adit, namely, Dunston (surface level 10019 ft), Norwood (surface level 10016 ft), Swalwell Henry (surface level 10017 ft) and Swalwell Tilley (P) adit (surface level 10014 ft). The hydraulic head required to overcome restrictions in the flow route from the Western Zone to the Easington outlet cannot be assessed but is likely to be considerable. In the circumstances a proportion of the total feeder, will almost certainly, reach the surface, via the shafts and adit, in the Dunston area and may also issue at the surface particularly on ground lying below, say, the 10025 ft surface contour. The feeders at present pumped from the four main zones supplying this pond total approximately 20,000 gpm. The proportion of these feeders which will reach the surface via the routes described cannot be assessed. Many will disperse in the natural water table and will have no noticeable affect. Certain pond areas, currently requiring a pressure head to overcome restrictions in the flow routes may require a similar head when the main pond has attained a rest level at or above the 10022 ft Easington overflow and this may result in isolated discharges to the surface at much higher levels.

(g) The effect of rising water in the **South Durham North Eastern and Western Zones** and the **North Durham Central and Western Zones** may affect other zones within Durham in the following ways:-

(i) **South Durham, South Zone** - the rise in water in the South Durham Western Zone after the closure of the Vinovium pumping station may place further restrictions on the overflow points from the South Zone at Etherley Lane and Westerton Lane and may cause the ponds west of the Dean and Chapter / Mainsforth barriers to rise resulting in further discharges to the surface in low lying areas such as the St Helens Bishop Auckland area.

(ii) **South Durham, South Eastern Zone** - there may be an increase, or decrease, in the quantity of water in this zone subject water migration in the permian limestone and basal sands and the relative levels in this zone and the adjoining North Eastern Zone at any particular time.

The Ludworth Dyke does not exist in the younger rocks above the Coal Measures and therefore does not provide an obstruction to water migration above the Coal Measures.

(iii) **North Durham, Eastern Zone** - rising water will increase, the head of water acting on the Washington Glebe/Hylton and Usworth/Hylton coal barriers. Hylton is connected to Wearmouth and if Wearmouth is still working at the date when the Chatershaugh/Herrington pond reaches a level of 9750 ft ie the overflow level of the inaccessible Washington/Usworth pond to the Chatershaugh/Herrington pond, then the head acting on these barriers will progressively increase from 800 ft to 1100 ft approximately. As a result water may migrate through the barriers to Hylton/Wearmouth and will need to be pumped at Wearmouth Mine, however these are recorded as being a minimum of 40 metres solid coal then such migration , if any, is likely to be small. However, if it is considered that the heads referred to are not acceptable then pumping at the major stations in Durham will need to continue for the life of Wearmouth Mine.

Northumberland Area

2.9 North Zone

(a) Ellington/Lynemouth Colliery is the only remaining British Coal deep mine operating within the County of Northumberland and currently protected by three outlying pumping stations to the south namely Morpeth Moor, Woodhorn and Newbiggin. It is proposed in the near future to close down these outlying pumping stations and allow the mine water feeders in this area to rise and overflow to Ellington/Lynemouth where they will be pumped direct to the surface via the Lynemouth Shaft. This will result in the Morpeth Moor pond rising to a level of approx 10027 ft before overflowing to Pegswood and joining the Pegswood, Ashington and Woodhorn pond which in turn will rise to a level of 9648 ft before overflowing to Lynemouth.

(b) Newbiggin, following the sealing of the pumping boreholes to Bates, has only one connection to any other mine, that being a single roadway to Woodhorn in the Harvey Seam (N) at a level of 9409 ft which was fitted with a proven water tight steel door. Should this door fail as result of increased pressures caused by the rising mine waters, then the Newbiggin feeders would also become part of the Pegswood, Ashington, Woodhorn pond. If, however, the door remains a watertight seal then the Newbiggin pond will rise as a completely independent body to a rest level estimated at 10010 ft. Should the latter prove to be the case, then the level of the Newbiggin pond will require monitoring for the life of the Ellington/Lynemouth Mine and depending upon results, decisions made as to whether the head of water on the door is acceptable from the safety aspect or whether submersible pumping at Newbiggin should be resumed.

(c) With the closure of Ellington/Lynemouth, all British Coal deep mining in the county will cease together with all its mine water pumping. This will result in the Ellington/Lynemouth, Pegswood, Ashington and Woodhorn pond rising to a natural water table level of approximately 10017 ft and whereas the bulk of the feeders will not rise above the natural water table an indeterminate amount may overflow to the surface via the Blakemoor Drift which was driven from Ellington High Main (D/E) Seam in the vicinity of Cresswell although this drift is recorded as having had a brick stopping built in, 16 metres from the entrance and backfilled to the surface and also possibly via the Newbiggin Shafts should Newbiggin become part of the overall pond.

(d) Following the closure of the Whittle/Shilbottle mine the combined feeder of approx 400 gpm will pond in the workings and will probably rise to a static level corresponding with natural water table without any apparent overflow at the surface. This mine is totally isolated from the remainder of the Area.

(e) Following cessation of Opencast Mining in this zone, all pumping from the Hauxley boreholes will cease and it is expected that the underground water will rise to a level of around 10020 ft. with the possibility of minor issues to the surface in low lying reclaimed opencast areas.

2.10 South Zone

(a) This is an area of rising underground mine waters currently being monitored as stated in para 1.10. Whilst results to date indicate that the Bedlington, Choppington, North Seaton and Bates waters have formed one pond, the New Delaval and Seaton Delaval waters appear at this stage to be separate although they may still eventually rise as one common pond as originally expected.

The pond is expected to reach a level of approximately 10016 ft with an indeterminate amount overflowing to the surface via either the Bates Shafts or the Mill Pit Shafts, both of which were sunk from a surface level of 10016 ft.

However, just to the east of the Mill pit is the recorded Crofton Shaft (seams contacted unknown, sealing details unknown) with a surface level of approximately only 10011 ft which may prove to be the main overflow to the surface. Thus it is possible that some minewaters may reach the surface, or the surface drains, in the centre of the township of Blyth either via the Crofton Shaft or perhaps via other low lying ancient unrecorded shafts, much of the town centre being built on made up ground, previously below high water mark and still subject to flooding at spring tides.

(b) The bulk of the water forming the Weetslade/Burradon pond is more likely to flow southwards via the Rising Sun to Wallsend and Hebburn probably rising up the infilled Wallsend (H) Shaft to a water culvert driven from the shaft at level of 10014 ft with an outlet into the River Tyne at an approximate level of 9996 ft. There are three manholes recorded as giving access to this culvert. On the shaft side of the manhole nearest the river a brick stopping has been erected in the culvert. This should be removed and replaced with a metal grid which will allow water to flow out but still prevent access.

Water may also rise up the infilled Hebburn A and/or B pit shafts and discharge into the River Tyne, via an existing culvert terminating in a 42" concrete pipe connected to the shafts at a level of 10010/10014 ft provided that this is not blocked. (Details relating to these culverts are filed in the British Coal, North East Group, Shaft Records.) It is also possible that within this zone discharges may occur from the Jarrow Alfred (E) or Deep Pit or the Jarrow Oval Pit or perhaps from other ancient unrecorded shafts along the low lying banks of the River Tyne.

CONCLUSIONS

From the mining viewpoint:-

Following the closure of Easington and Seaham/Vane Tempest Collieries, or during the final stages of production of these mines, it is planned to stop pumping at all the Durham Pumping Stations.

Minewaters throughout the Durham Coalfield, currently controlled by these pumping stations, will then rise and overflow to form large interconnected ponds. These ponds will continue to rise to natural water table level, subject to issues to surface from mine outlets.

It is anticipated that these issues will be from low level shafts in Haugh lands along the banks of the Rivers Tyne and Derwent, and the beach tunnels from the shafts of the South Durham coastal collieries.

Particular regard should thus be given to the treatment of the existing shafts and beach tunnels at both Easington and Dawdon prior to the abandonment of these sites as they may well be sources of major issue.

Following the closure of Wearmouth and Westoe Collieries, the minewaters from these collieries, together with small feeders from Hylton, Whitburn and Harton will merge to form one common, self contained pond. It is expected that this pond will also rise to natural water table level, with the possibility of a minor issue to surface at St Hilda shaft. Regard should thus be given to this, prior to the abandonment of the shaft.

Following closure of the Ellington/Lynemouth Colliery, all British Coal deep mine pumping in Northumberland will cease. This will result in the Ellington/Lynemouth, Pegswood, Ashington and Woodhorn feeders combining to form one common pond with the possible inclusion of Newbiggin. This pond is expected to rise to natural water table level with possible issues to the surface at the Ellington/Blakemoor drift and the Newbiggin shafts.

The future rising mine waters may also bring increasing problems of gas emission, particularly from shafts on the eastern side of the coalfield. This potential hazard will need to be taken into account should, in the future, any shafts have to prepared for pumping, water measurement, tailings disposal or filling.

CONCLUSIONS

From the National Rivers Authority viewpoint:-

Whilst British Coal have undertaken considerable research in an attempt to predict what will happen to the mine waters upon cessation of pumping, these predictions are based on the assumption that all underground roadways will allow water to migrate, particularly the roadways connecting adjacent mines and that all mine outlets, ie. shafts and drifts, will allow water to issue to the surface.

In the vast majority of cases in the past this has proven to be so, and presumably will be in the future. However there are known instances where, if mine waters are migrating, migration is extremely restricted, presumably due to roadway collapse. This has resulted in water levels in one mine being considerably higher than in an adjacent mine to which it is directly connected.

Thus whilst this report may be used as a basis for any mine water management scheme, it is strongly advised that a comprehensive monitoring programme be established to ensure all waters are rising as predicted.

This could include adopting the Corporations thirteen existing monitoring station shafts, six in Durham and seven in Northumberland, all of which are shown on the Stage 1 Plan, plus all current pumping station shafts and possibly some current working colliery shafts.

Then, if it is found that in certain areas waters are not rising as predicted, additional investigation could be carried out regarding higher level overflows and alternative migratory routes.

It is also advised that in addition to monitoring the rise in levels of the underground waters, a sampling programme be established to determine the quality of the waters. Such a programme should include sampling at various levels within the monitoring shafts as it is well known that water qualities can vary considerably within the depth of one shaft, ie. "banding". This is often caused by mine waters of different qualities from various parts of the same mine flowing into the shafts at different horizons (insets), these differences are known to be considerable at some mines.

It is also not uncommon to have a relatively clean upper strata water lying on top of the mine water in the shaft column. This, without various level sampling, could result in wrongful assumptions of the quality of the mine waters flooding the workings.

SAFETY PRECAUTIONS

Any member of staff required to visit old shafts, adits, or monitoring stations should be made aware of the possibility of mine gas emissions, particularly during periods of falling barometric pressure, and to detect their presence should be equipped with both an "Oxymeter" and a "Methanometer" and be familiar with their use.