Force Crag mine

Peter Bardsley

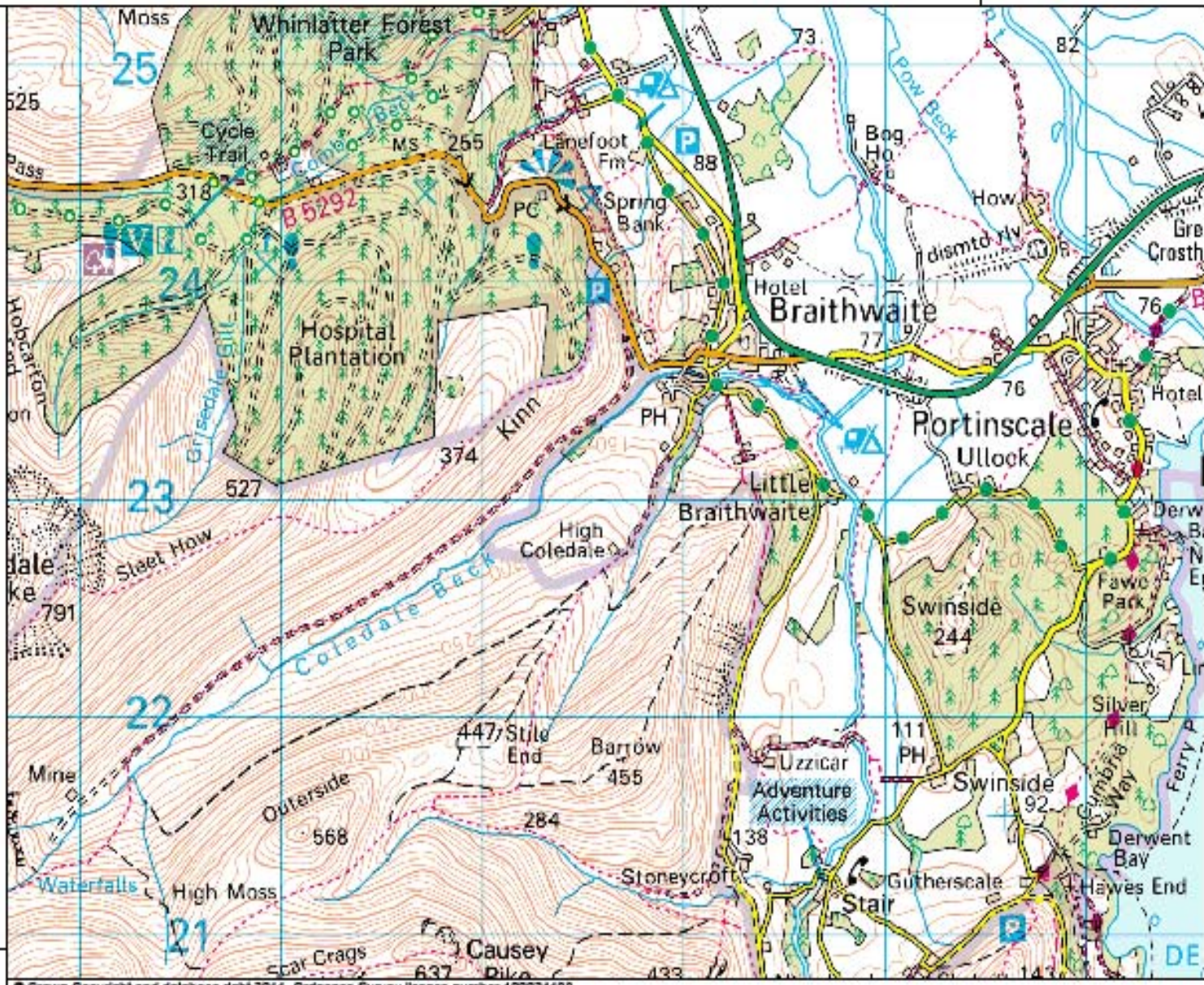
North Area Operations
Technical Lead –
Mines & Minewater

01768 215727

force craglocation

Environment Agency

Legend



0 280 620 780 m.

Background

- Force Crag mine, near Keswick, was worked for lead, zinc and barytes from 1835 until 1991
- owned by the National Trust

Lake District High Fells SAC;

and within two SSSIs: the Force Crag Mine itself and Butttermere High Fells.

Scheduled Ancient monument.

Background

- Major source of heavy metal pollution in the Coledale Beck, a tributary of the Newlands Beck and the River Derwent & Bassenthwaite
- Lake Special area of Conservation (SAC)& Site of Special Scientific Interest (SSSI).

Zinc Loading Map Bassenthwaite Lake 14.5.10

Environment Agency

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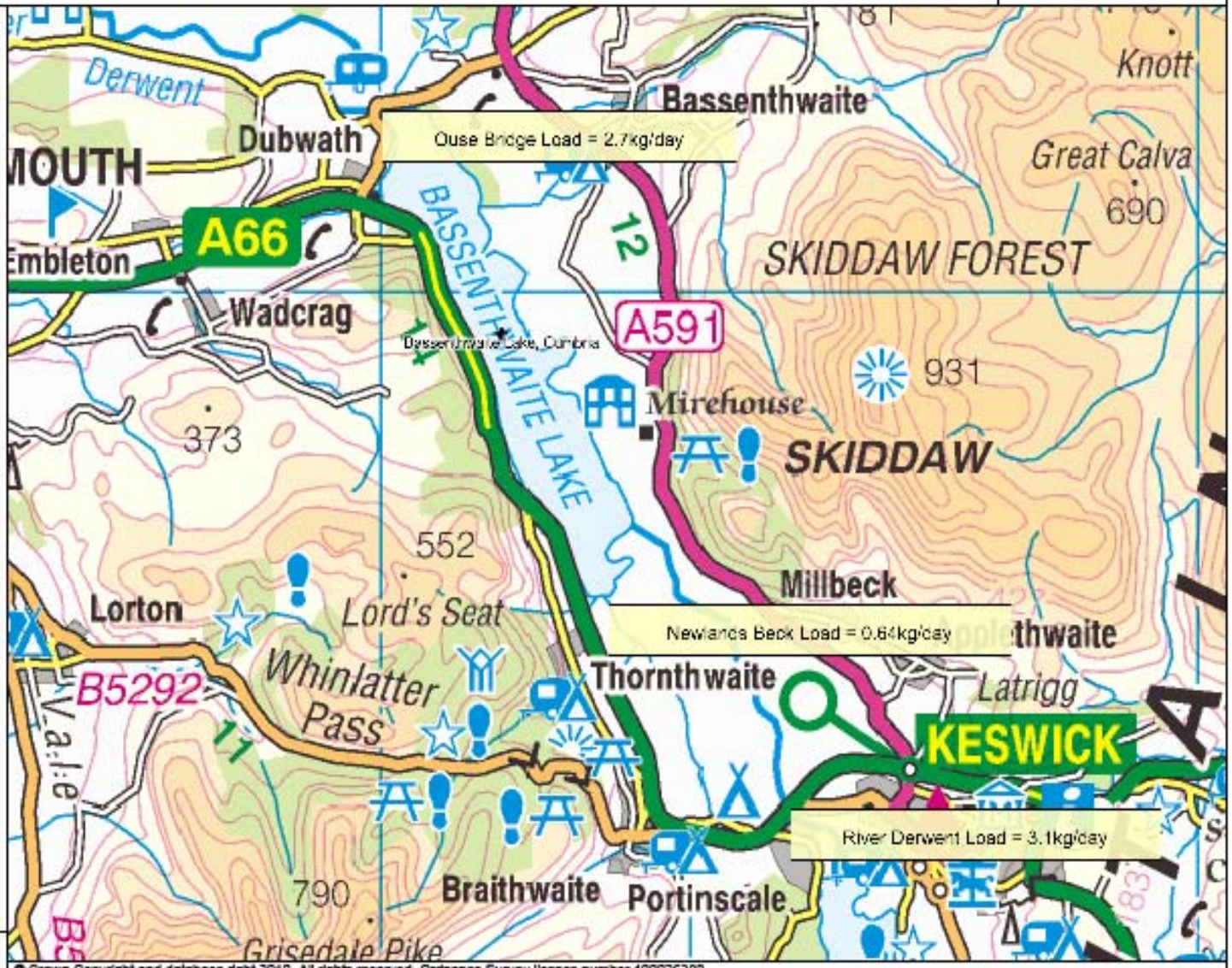


0 650 1300 1950 m.

Impact of discharge

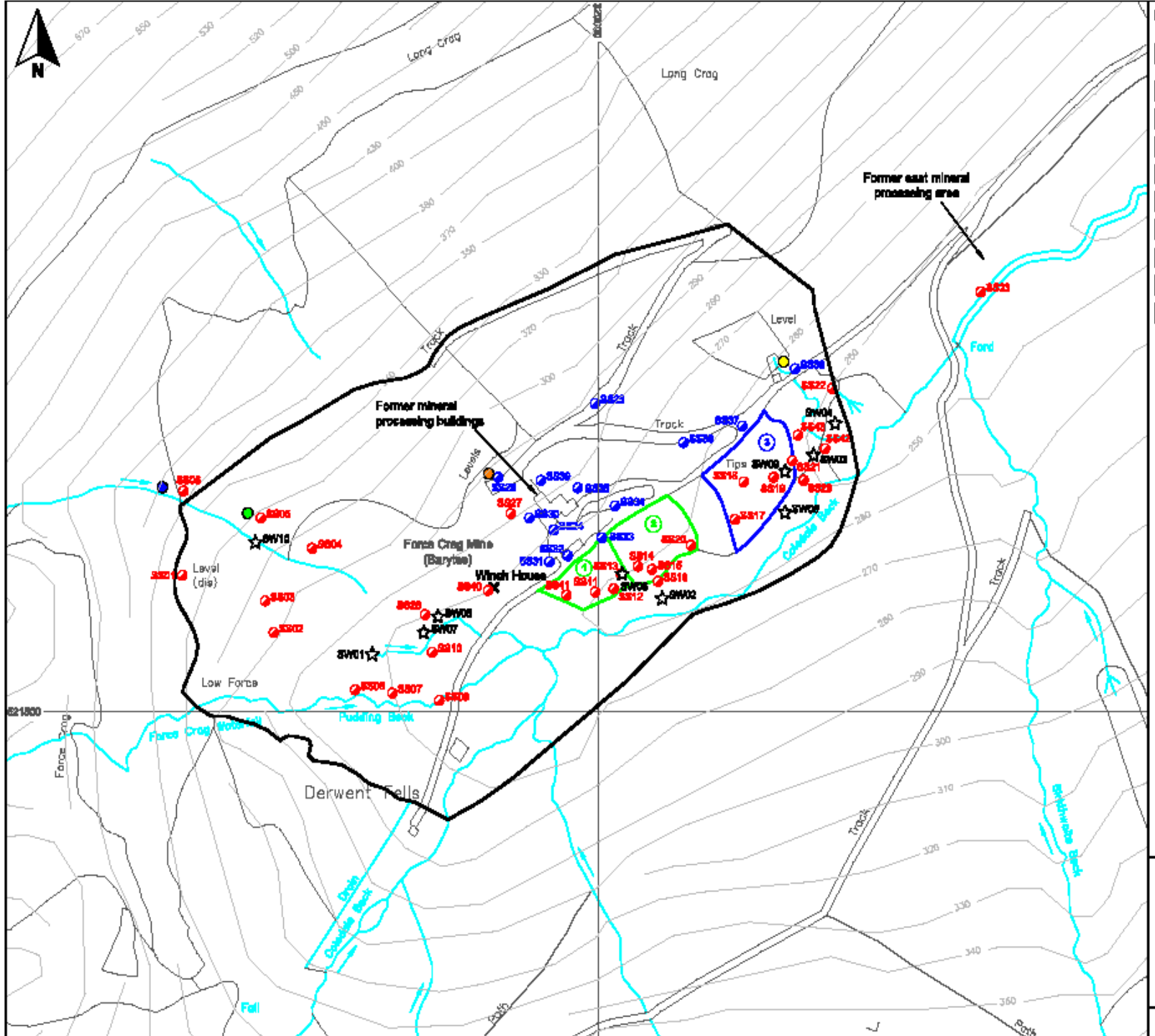
- Cadmium 17 ug/l
- Load of zinc discharged per annum up to 3 tonnes

Current situation

- There are two minewater discharges, as well as diffuse pollution from waste heaps and old tailing lagoons at the mine. This results in high levels of metals,: lead, zinc, copper and cadmium,
- Adit 0 is partially blocked causing a head of water to build up in the mine

Water filled Crown hole above adit 0

Environment Agency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Long Crag
Former mineral processing buildings
Former east mineral processing area
Force Crag Mine (Baryte)
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Level (dis)
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Ford
Low Force
Derwent Fells
Force Crag Beck
Coledale Beck
Pudding Beck
Skelthwaite Beck
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Key
Site area (as defined by Allerdale BC)
Soil sample
Human health soil sample
Surface water sample
Infilled tailing lagoon (1 and 2)
Partially filled tailing lagoon (3)
Adit Level 0
Adit Level 1
Adit Level 2
Adit Level 3
Environment Agency
Force Crag Mine Part 2A Assessment
Figure 2.1
Soil and Surface Water Monitoring Locations (2011 Site Inspection)
September 2011

Entec study 2008

- The Coledale Beck and the Newlands Beck in Braithwaite both fail their environmental quality standards (EQS) for zinc and cadmium.
- Immediately downstream of the mine the zinc and cadmium concentrations are up to 140 and 65 times the standard respectively.
- Five kilometres downstream of the mine in the Newlands Beck, zinc is seven times the EQS and cadmium four times.

Regulations & Control

Water Resources Act

Environmental Protection Act 1990 , Part 2A Contaminated land

Water Framework Directive

Mining Waste Directive

Environment Agency

Mining waste Directive – Article 20

we must produce 'an inventory of closed waste facilities, including abandoned waste facilities, which cause serious negative environmental impacts or have the potential of becoming, in the medium or short term, a serious threat to human health or the environment.‘

- The directive isn’t concerned with the impacts from mine 'workings' (ie shafts, addits, tunnels etc.) but only the mine waste facility.

- A mine waste facility is a tailings dam, tailing lagoon, tailings tip, waste rock dumps or spoil heap. These must be having an impact, or have the potential to have an impact, on the environment.The potential to have an impact should be over the next 5 to 10 years.

Water Framework Directive

- Ecological characteristics
- Chemical characteristics
- “good chemical and ecological status”
- Exceedence of Environmental Quality Standards affects status
- 6 yearly cycle -2012 programme of measures
- 2015 meet objectives good status

The problem

- 9% river failing “good status”
- 226 water bodies impacted by non-coal mining
- 243 water bodies probably impacted

- WFD River basin management plans
- £370 million over 10 years plus operating costs (90% minewater,10% risk outbreak)

Water Resources Act

- S. 161 Works notice
- S85 pollution offence
- Abandonment 1998 plans

- Most of the time the main minewater discharge contributes up to 90% of the site's metal load.
- At times of high flow a significant contribution (80%) arises from run off & seepage from diffuse sources such as the settlement lagoon and mine waste heaps.
- Force Crag mine contributes up to 70% of the total load of metals in the Newlands Beck.

Resolving the impoundment

- Grave environmental issue, would result in a major pollution incident in a sensitive area.

- National Trust have investigated methods of relieving the pressure behind the blockage to allow the minewater to drain safely
- NT concerned over liability/ownership issues and permitting requirements

Minewater Treatment

- The 'passive' treatment requires a pilot scale plant at the site before a full-scale system can be designed and built. Pilot plant now built
- Hydrometric installations require continued flow and quality monitoring.
- Drill to intercept water-filled tunnel and dewater – vertical & inclined drilling
- Ground Investigation for design of treatment

Potential Special Site –Regulation 3(b) Contaminated Land (England) Regulations 2006

- “Controlled Waters are being affected by the land and, as a result, those waters do not meet or are not likely to meet the criterion for classification applying to the relevant description of waters specified in regulations made under section 82 of the Water Resources Act 1991 (classification of waters)”

Inspection -Statutory Guidance (Defra Circular 01/2006)

- B.20(a) Desk study
- B.20 (b) Visual inspection /limited sampling

guidance

- EA technical advice to 3rd parties on pollution Controlled Waters fro part IIA (2002)
- Water Framework Directive – River basin Districts Typology,Standards and Groundwater Threshold Values (WFD) Directions 2010

Is there Pollution of Controlled Waters?

- Poisonous,noxious or polluting matter or any solid matter…
- Breaches of EQS..is the pollution significant?
- Since old EQS have not been revoked yet, compare site data with old and new Defra Directions (future proof)

S82 Water Resources Act 1991

- The Surface Waters (fishlife) (classification) Regs 1997 -95%tile
- The Surface Waters (River Ecosystem) (Classification) Regs 1994

Breach of WFD Directions standards

- Reg 3(b) Special Site does not mention WFD
- Currently, 3(b) applies when a site fails an EQS at a compliance point set under appropriate regulations
- Changes to monitoring network focus on WFD and many compliance points have been removed.. No compliance point means we cant demonstrate a failure to meet an environmental quality standard.
- Dangerous substance compliance (Reg 3(b))is at any point along the stretch

2011 Leaching data

- Lead EQS 7.2 ug/l
- min.0.156 mean 1106, max. 13900

- Copper EQS 1ug/l
- Min. <0.85, mean 9.3, max. 104

- Zinc EQS 8ug/l
- Min. 6.18, mean 3276, max. 63500

- Cadmium EQS 0.08ug/l
- Min. <0.1, mean 35.7, max. 630

surface water quality -

- Assess contribution from diffuse source as opposed to accumulative minewater and diffuse source.
- Flow regime proportion low-medium –high. Diffuse pollution accounts for up to 80% load under high flow

Metal	GAC (µg/l)	Magnitude of Exceedance of EQS		
		Leaching Tests on Spoil/Mine Waste/Tailings Lagoons	Drainage/Standing Water from Spoil/Mine Waste/Tailings Lagoons	Coledale Beck Downstream of Force Crag Mine Location A (contribution from diffuse sources under wet conditions)
Barium	1000 (DWS)	None	x 1	No data
Cadmium	0.08 (EQS)	x 3-7875	x 6-245	x 1-18
Copper	1 (EQS)	x 1-104	x 1-8	x 1-1.4
Lead	7.2 (EQS)	x 2-1931	x 3-63	x 1.4
Manganese	50 (DWS)	x 1-788	x 1-52	None
Zinc	8 (EQS)	x 1-7937	x 12-723	x 2-37

Special Site Status

- For cadmium (Dangerous Substance)–
- The surface Waters (Dangerous Substances) (Classification)1989,no.2286 – this relates to the **whole stretch** rather than a monitoring point
- Cd standard 5ug/l (total & dissolved and is an annual average.

- Need to show diffuse pollution causes annual average failure **at any point** in the watercourse.

Determination decision

- Meets criteria for determination as contaminated land (Section 78A(2)(b) Part 2A Environmental Protection Act 1990) due to pollution of Controlled Waters caused by copper, lead and zinc entering Coledale Beck

Determination Status

- Contaminated land= yes
- Sources identified - Level 3 gully as significant source during wet conditions- standing water and seepage exceed EQS

- Special Site =no
- Exceedence at Newlands Bridge Cu and Zn during wet weather only- It does not constitute to a 95th percentile failure
- Cadmium (annual average) concentrations not significant given overall flow regime.

Way Forward

- Combined pot £4.53 million – contaminated land capital projects in UK
- WFD £110 million over next 4 years non-coal mines
- October 19 the Energy Act received royal assent giving the Coal Authority new powers to take action in subsidence or water pollution issues at sites other than coal mines.
- Working in Partnership with National Trust

Objective Objectives

- SPL confirmed -water quality improvement required.
- EA asked LA to delay determination
- This will allow voluntary solution
- Not process driven
- Funding partnership (not from CL pot)
- Working together
- LA have more power to steer remediation – Can determine at any time

Costs and benefits of remediation

- Pilot plant cost £28k . full treatment option £1million
- Bassenthwaite Lake SSSI would be protected from a major pollution source
- The river corridor in a SAC would be improved
- The Newlands Beck would be better able to achieve good ecological status
- Ecological improvements would be made to 5 km of good quality habitat

Possible Remediation of Land Contaminated

- Diffuse sources of pollution from mine spoil addressed by intercepting & diverting clean sw
- capturing run-off from waste spoil heaps into treatment facility.
- The base liner of the treatment lagoons could also act as a cap, on the existing lagoon.
- Other work -Force Crag is not the only source of metals contributing to the failure of the Newlands Beck. Need investigations in Newlands valley

Conclusion

- Mine sites can be complex
- Proportionate assessment of impact is required
- Data supports SPL sufficient to determine site as contaminated land
- Significance does not warrant Special Status
- Working in partnership to improve water quality
- Treatment technology and remediation to be agreed.