Prioritisation of abandoned non-coal mine impacts on the environment

SC030136/R1 A methodology for identification and prioritisation of abandoned non-coal mines in England and Wales

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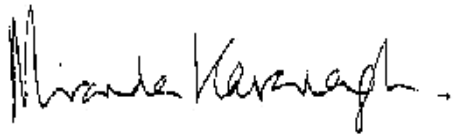

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Director of Evidence

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Section 1: Background and overview of methodology

1. Background

The UK has an excellent track record of addressing water pollution arising from abandoned deep coal mines and remediating surface waste from coal mining operations. However, notwithstanding the need to continue that programme of remediation, the advent of the European Commission's Water Framework Directive (2000/60/EC), in particular, has focused attention on environmental pollution arising from abandoned mines other than those that extracted coal, and especially how to address remediation of such mines, and discharges from them, in a logical manner.

The UK has a long history of mining for resources other than coal; the extraction of metal-bearing minerals in the UK dates back to the Bronze Age, for example. Consequently water pollution problems due to the oxidation and dissolution of these minerals, during and after mining, are widespread in the UK. However, at a national scale, assessment of the extent and severity of the problem has been piecemeal to date. Valuable bodies of data exist for certain areas of England and Wales, but equally there are substantial gaps in some regions. In addition, no concerted attempt has been made to either (a) collate information about environmental problems at abandoned non-coal mine sites from the various regions into a national database or (b) quantify the scale of these problems across England and Wales in order to develop a framework that will facilitate an informed strategy to address remediation of pollution from abandoned non-coal mines in a logical and cost-effective manner. This document concerns the development of a methodology to undertake a national impact assessment exercise to address such matters.

This report is broken down into two sections:

- Section 1 (this section) provides the background to the project and presents and overview of the methodology proposed for identification and prioritisation.
- Section 2 is a detailed discussion of the identification and prioritisation methodology itself.

In addition there is an appendix comprising an inventory of information used to populate the abandoned non-coal mine identification and prioritisation database.

This is one of 13 reports that detail the final results of the implementation of the methodology across England and Wales. In every report the 13 reports that comprise the outputs of the project are listed, so that the reader may cross-reference between them at need. They are:

I. *A methodology for identification and prioritisation of abandoned non-coal mines in England and Wales*
II. *Prioritisation of abandoned non-coal mine impacts on the environment: The national picture*

III. *Prioritisation of abandoned non-coal mine impacts on the environment in the Dee River Basin District*
IV. *Prioritisation of abandoned non-coal mine impacts on the environment in the Northumbria River Basin District*
V. *Prioritisation of abandoned non-coal mine impacts on the environment in the South West River Basin District*
VI. *Prioritisation of abandoned non-coal mine impacts on the environment in the Western Wales River Basin District*
VII. *Prioritisation of abandoned non-coal mine impacts on the environment in the Humber River Basin District*
VIII. *Prioritisation of abandoned non-coal mine impacts on the environment in the North West River Basin District*
IX. *Prioritisation of abandoned non-coal mine impacts on the environment in the Severn River Basin District*
X. *Prioritisation of abandoned non-coal mine impacts on the environment in the Anglian, Thames and South East River Basin Districts*
XI. *Prioritisation of abandoned non-coal mine impacts on the environment in the Solway-Tweed River Basin District*
XII. *Future management of abandoned non-coal mine water discharges*
XIII. *Hazards and risk management at abandoned non-coal mine sites*

2. Technical context to the identification and prioritisation methodology

There have been some notable previous approaches to prioritising mining sites (and mine water discharges in particular) in the UK. These are summarised below and have informed the development of the methodology outlined here.

The first, and most widely applied nationally, was the Environment Agency's (then National Rivers Authority) ranking methodology for abandoned coal mine water discharges. This priority list has remained the UK Coal Authority's principal reference for prioritising coal mine water discharges for treatment, critically informing its rolling programme of remediation initiatives over the past decade or so. That this priority list has guided the development of more than 40 treatment systems across the UK is testament to its utility and applicability. However, there are a number of reasons why this approach cannot be invoked wholesale for application to abandoned non-coal mines:

1. The prioritisation procedure relies on detailed sampling and analysis results, for both chemical and ecological variables, at each mine water discharge identified. The level of investment required for such a detailed exercise is simply not available for this project, which instead must rely principally on existing data.
2. Visual impact was a major influence on the final prioritised list of abandoned coal mine water discharges. However, this is far less of an issue in the majority of abandoned non-coal mine water discharges since iron is not always present in high concentrations.

3. The final ranked list was based on the severity of impact of coal mine water discharges on benthic macroinvertebrates in receiving watercourses. In some cases the low pH of coal mine water discharges may impact on invertebrate abundance and diversity, but in the majority of instances faunal impoverishment is due to physical smothering by iron hydroxide precipitates (Jarvis and Younger, 1997). In most cases abandoned non-coal mine discharges are near-neutral, and therefore do not have an impact due to low pH. More importantly, many abandoned non-coal mine water discharges do not contain elevated concentrations of iron (there are, of course, notable exceptions), and it is in fact very difficult to make a causal and widespread link between elevated concentrations of dissolved metals such as zinc (the principal concern in many non-coal mine waters) and faunal impoverishment. Given the Biological Monitoring Working Party (BMWP) assessments are designed for identifying pollution from (principally) sewage discharges, they are unlikely to be sensitive to the complex biotic responses downstream of non-coal mine discharges, at least where they do not contain elevated iron concentration and / or a low pH. These responses can include fundamental changes to the local structure of the benthic environment (e.g. blooms of metal-tolerant algae limiting colonisation by new-generation benthic organisms) in addition to direct acute toxicity (which itself can cause differential biotic response: e.g. toxicity to higher predator species may increase abundance of prey invertebrates). Therefore the nationally collected BMWP data are unlikely to be the most informative impact metric for prioritisation of abandoned non-coal mine water discharges.
4. The abandoned coal mine water discharge prioritisation approach takes no account of issues other than water quality and ecology, but it is widely acknowledged that for non-coal mine sites there are other (equally) important considerations, including water resources issues, conservation and heritage designations, and other stakeholder concerns.

The Metal Mines Strategy for Wales (MMSW: Environment Agency, 2002) endeavoured to address this latter issue of stakeholder concerns at abandoned mine sites, principally focussing on the multifarious conservation and heritage issues that are often associated with water pollution problems at long-abandoned mines. The mines were ranked in the MMSW on the basis of size of ore production and similar criteria. Identifying all abandoned mine sites in a country where mineral extraction has taken place over 2000 years is not trivial, yet it does not help identify the sites which are causing the greatest environmental impact. The outputs from the MMSW principally focused on identifying sites at which there were ‘diverging’ issues or ‘converging’ issues, the former relating to sites at which remediation of the site appeared to be in conflict with stakeholder issues, and the latter designation assigned to sites where remediation and stakeholder issues were complimentary. However this approach took little explicit account of water quality matters, and yet for the current project this is clearly a critical consideration in the prioritisation given that the EU Water Framework Directive is the main impetus for this exercise.

Mullinger (2004) subsequently endeavoured to address the absence of explicit recognition of water quality and ecological impacts in the MMSW. The approach adopted by Mullinger, crucially, incorporated metal loadings assessments to evaluate the severity of instream increases in contaminant flux at the top 50 priority Welsh

mine sites. The calculated loading data used a combination of measured and derived flow (using Low Flows 2000) and were integrated in a site scoring system with ecological indices. The use of derived flow measures were shown in cases to provide order of magnitude agreement with measured flow (where available). However in other cases, where there were multiple tributaries between upstream and downstream sample points, or major alteration to the drainage patterns in upland catchments (due to mining or river regulation) the derived flow values would disagree with measured values significantly (up to a factor of 90 in one case). Whilst this approach could assist in pre-assessment of feasibility of site remediation, the volume of data required, the lack of measured flow data in the vicinity of mine water discharges, and the error margins attached to flow derivations (and therefore calculated loading) make the approach unsuitable for the national screening exercise undertaken here. Additionally, when priority sites are being considered for remediation, there will be a need for accurate flow data to apportion instream contamination to specific discharges and highlight whether there are significant diffuse fluxes associated with particular mine sites.

More recently, the Environment Agency (Environment Agency 2008a: 2008b) assessed the risks posed by mine waters to surface and groundwater bodies as part of the River Basin Characterisation (RBC1) in support of the Water Framework Directive (WFD) Article 5 Pressures and Impact analysis. This assessment was subsequently reviewed in May 2007 (RBC2) for surface waters. The RBC assessments placed water bodies into the four UKTAG categories (at risk, probably at risk, probably not at risk, not at risk), but was not able to identify the impacts within water bodies nor prioritise water bodies within each category.

3. Overview of the identification and prioritisation methodology for abandoned non-coal mines

The approach in developing the current methodology has therefore been to make provision for assessment of all the key issues that influence the prioritisation of abandoned non-coal mines (e.g. water quality, ecology, stakeholder issues, higher impacts), based primarily on the substantial body of information that already exists for such sites.

The overall approach adopted in this programme is to use existing data to perform an impact assessment at a *national scale* to prioritise *individual catchments* by the level of impact caused by abandoned non-coal mines on a range of receptors, and then identify the main culprit mine sites within those catchments. All water bodies in England and Wales will be assigned to one of four 4 categories: *Impacted, Probably Impacted, Probably Not Impacted,* and *Not Impacted*. These categories are formulated through a series of analyses in a Geographic Information System (GIS) using data detailing a range of issues relating to abandoned non-coal mines and their impacts.

A national data collation exercise is then undertaken gathering expert local knowledge from specialists at the Environment Agency and Local Councils on the

level of impact (e.g. on ecology, groundwater and water resources) and nature of the mine sites (e.g. locations of discharges, diffuse pollution issues, stakeholder concerns, solid waste issues) in priority water bodies (i.e. *Impacted* and *Probably Impacted* water bodies) and confirmation that the apparent impacts are related to former non-coal mining activity. This local information is used in conjunction with nationally available datasets (e.g. on ecological impacts) to score the priority water bodies on the severity of impacts.

The categorisation places great emphasis on the level of confidence these data provide in being able to link polluting abandoned mines with instream water quality pollution. This approach permits prioritisation of sites for remediation planning (where there is a sufficient body of information to accurately define the impact: e.g. *Impacted* water bodies) or further data collection (where additional data is needed to verify the extent and nature of impacts at a site: i.e*. Probably Impacted* water bodies).

It is important to realise that the methodology is designed in such a way that new information added to the database in future years will automatically result in reclassification of sites (e.g. a site initially categorised as *Probably Impacted* could become *Impacted* as the results of further data collection became available). The prioritised list and supporting data is held in a geodatabase permitting rapid viewing and interrogation of the data along with future editing functionality on a GIS platform.

This project is not intended to repeat the formal characterisation assessments undertaken in RBC1 and RBC2 but will investigate the impacts of abandoned non-coal mines on surface water bodies. The project will provide Defra, the Welsh Assembly Government and the Environment Agency with a prioritised list of water bodies in each *Impacted* and *Probably Impacted* categories, and summarise the known impacts on water and ecological quality. It will also begin to identify the sources of pollution (mine sites) within each water body (subject to available data). This will allow development of a national strategy for remediating abandoned non-coal mines analogous to the existing coal mine priority system.

The approach proposed follows four broad stages, summarised as follows:

1) The identification and provisional prioritisation of water bodies (i.e. sub-basins defined by the European Commission's Water Framework Directive: 2000/60/EC) impacted by pollution from abandoned non-coal mines.
2) The prioritisation of water bodies with respect to pollution from abandoned non-coal mines against a range of criteria including surface water quality impact, groundwater quality impact, ecological impact and other impacts on water resources (where such information exists).
3) The identification of polluting abandoned non-coal mine sites within priority water bodies.
4) The formulation of priority lists with technical summaries for (a) mine sites with risk of mine water outbreak, and (b) mine sites with surface waste issues with regard the Mining Waste Directive.

Section 2: Identification and prioritisation methodology: detailed description and explanation

1. Introduction

This document details the methodology and provides a logic framework for identifying and prioritising abandoned non-coal mine sites in England and Wales. There are four broad stages to the impact assessment methodology: (1) the identification of water bodies impacted, or potentially impacted by non coal mine pollution, (2) prioritisation of these water bodies against a range of impact criteria, (3) the identification of polluting mine sites within the priority water bodies, and (4) production of national lists detailing sites with risk of mine water outbreak and sites with surface waste issues.

The first two stages relied predominantly on nationally-available databases to perform rapid GIS screening exercises on large datasets. These exercises prioritised the water bodies against a range of water quality, ecological and water resource criteria.

Stages 3 and 4 were more dependent on site specific information which was gathered during regional assessments, such as details of mine site discharges, stakeholder concerns and technical details on outbreak risk and solid waste issues.

The methodology is targeted principally at abandoned metal and ironstone mines. It is unlikely that other abandoned non-coal mines (e.g. gypsum) will be assessable using this methodology. However, since there are so few such sites, these will be evaluated on a case-by-case basis during the regional assessments (e.g. local Environment Agency experts can alert us of any special cases that are not picked up by the systematic analyses).

Groundwater bodies were not directly assessed by this project because we consider that:

1. The main pollution threat from abandoned non-coal mines is to surface water.
2. Mine water from abandoned non-coal mines does not usually pose a risk of pollution to groundwater bodies, other than to groundwater within the mine itself. This is a different situation than for abandoned coal mines.

Evidence of contaminated groundwater was collected as part of Stages 1 and 2 to test these assumptions.

2. STAGE 1: Water body identification and initial prioritisation

This stage used nationally available datasets to identify WFD water bodies potentially impacted by abandoned non-coal mine pollution through highlighting water quality failures in mining areas. The surface water bodies were screened against national Environmental Quality Standard (EQS) failures for eight metals/metalloids (arsenic (As), cadmium (Cd), copper (Cu), iron (Fe), manganese (Mn), nickel (Ni), lead (Pb) and zinc (Zn)) to identify and prioritise the water bodies impacted by pollution from non-coal mines.

The results of this project will inform Defra, the Welsh Assembly Government and the Environment Agency about the impacts of abandoned non-coal mines on water bodies. However, it is not intended to be a formal characterisation for the WFD. The impact categories are summarised in Table 1. The criteria used to allocate water bodies into each impact category are different from those used by the Environment Agency in RBC1 and RBC2. New data sets have been used to show actual impacts on water quality rather than simply identifying potential risks. It should be noted that exercises 2.1 to 2.3, below, will largely occur concurrently, and thus there is cross-referencing between these elements in the text below.

Table 1. Identification and prioritisation of water bodies by impact from non-coal mining

CATEGORY	CRITERIA	ACTION
IMPACTED	Any EQS failure in surface water body with known mine sites (either surface mine or from mine plans)	Surface water body prioritisation (Stage 2)
PROBABLY IMPACTED	Any EQS failure in surface water body in mining area with no known mine sites **OR**	Identify mine sites in surface water body Identify upstream mine sites Water body prioritisation (Stage 2)
	Any EQS failure in surface water body immediately downstream of mining area	Identify upstream mine sites Surface water body prioritisation (Stage 2)
PROBABLY NOT IMPACTED	Mining area with no EQS failures in water body **OR** Mining area with no EQS failures in immediately downstream surface water body	Low priority for prioritisation unless contrary information arises in regional assessments.
NOT IMPACTED	A non-mining area with or without any EQS failure not already categorised	Eliminate surface water bodies from prioritisation unless contrary information arises in regional assessments.

2.1 Screening EQS Failures against Water Bodies

Inputs:

1) **EQS failures** for As, Cd, Cu, Fe, Mn, Ni, Pb and Zn.
2) **Mine sites (see stage 2.2)**
3) **Known mine sites from plans**
4) **WFD water bodies for England and Wales** (with **"Mining Area"** descriptor – **see 2.3**)

Analysis:

This stage assigned each surface water body to an impact category. The criteria for the four responses are detailed in Table 1 (Note that the water body file contains a field detailing the downstream water body (where applicable). This was used to define the upstream/downstream scenarios in the *Probably Impacted* category).

Outputs:

1) A field in the water body attribute table called **"Mining Impact"** was populated with the responses detailed in Table 1. These water body classes can be graded by colour in the GIS system as follows: *Impacted* = red; *Probably Impacted* = orange; *Probably Not Impacted* = light blue; *Not Impacted* = clear.

2) Triggers for subsequent action (see Table 1). These triggers are a critical component of the methodology. These target and prioritise water bodies for further data collection to aid re-categorisation of the *Probably Impacted* water bodies.

The *Impacted* category details water bodies with any EQS failures and known mine sites coincident.

The *Probably Impacted* category covers two basic scenarios:

1) where there is a reported quality failure in a mining area but no reported mines. This is where mining area is determined based on geology (given there are no known mine sites) and the priority is to identify mine sites in the water body or upstream water bodies contributing to the instream contamination. If no former mine sites are identified in the wider drainage area then it is likely the EQS breach will be a feature of natural mineralisation or other non-mining sources.

2) The second scenario is where there is a quality failure in the water body immediately downstream of a water body in a mining area. This scenario is largely be applicable to water bodies on the margins of metal orefields and aims to cover situations where EQS monitoring points are downstream of the mining area. The cut-off to "immediate downstream water body" identified that we needed some spatial buffer in identifying downstream mining impacts. Using a downstream spatial buffer is more justifiable in terms of the reality of pollutant transfer processes than a simple 10km radius from EQS failure for example. A one water body buffer was chosen given that downstream propagation of mining pollution from an individual site is unlikely (in most cases) to be discernable at a distance over two separate water bodies. While some water bodies are quite small in the upland areas with a metal mining legacy, situations where mining pollution is apparent in downstream water

bodies outside the mining area are likely to be high priority sites that are well characterised already (and should become apparent in the regional assessment exercise).

The water bodies categorised as *Probably Impacted* will require efforts to either:

- identify mine sites if none are present in the upstream drainage area, and/or
- prioritise upstream mine sites / mine sites newly added to the database in stage 2.

The data actioned to be collected for *Probably Impacted* water bodies will enable subsequent reclassification of these water bodies into either the *Impacted* or *Probably Not Impacted* categories.

The *Probably Not Impacted* category covers mining areas with no quality failures in the water body or downstream water body. This covers situations where, for example, there are no Environment Agency monitoring points in affected water bodies or no reported impact. These water bodies are a low priority for further attention unless contrary data arises during future monitoring campaigns.

The *Not Impacted* category allows elimination of quality failures in non-mining areas. This category gives the first major cut in the water body data. This highlights the importance of the geological units used to define **mining area** in 2.3 as these are ultimately the principal discriminator to which water bodies remain in the active *Impacted* and *Probably Impacted* categories in this exercise (i.e. they are carried forward to Stage 2).

These categories should be viewed as dynamic since further data will be collated beyond the timeframe of the project. For example a *Probably Impacted* water body initially categorised due to EQS breach in a mining area but with no reported mine sites will become *Impacted* if additional information is gathered identifying hitherto unreported abandoned mine sites in the water body

2.2 Merging existing mine site list

This was created through merging details of mine sites from various regional assessment exercises:

Inputs:

1) **"mines_data.dbf"** = south west mines,

2) **"metal_mines_wa.dbf"** = Welsh metal mines from Metal Mine Strategy for Wales.

3) **"non coal mines.xls**" and **"non_coal.dbf**" = metal mine sites predominantly outside NE/Wales/SW compiled by Dave Johnston (Environment Agency Technical Advisor Mine Waters) from various sources – principally the open-access BGS online mine registers.

4) **"NE Project GIS shapefiles/MetalMines.dbf"** = north east metal mine list – in subfolder "NE Project GIS shapefiles".

The only common fields that these files have are site name and grid reference. The Welsh and South west regional assessments include a number of additional site fields (e.g. ore, date of workings etc.). These data were merged into a new table **"defra_merged_mines".** As new sites were added to the database during regional assessment exercises they were appended to "defra_merged_mines" table.

2.3 Define mining area

This stage defines what is referred to as a "**Mining Area"**

Inputs:
1) **BGS geology** 1:50000 and 1:650000
2) **Mine sites** (composite dataset of all non-coal mine sites from stage 2.1).
3) **WFD water bodies for England and Wales**

Analysis:
Mining area equals any WFD water body which contains:
1) Mineralised/relevant geology (as defined by Table 2)
OR
2) A known surface mine site detailed in "**mine sites**"

Outputs:
1) Field in WFD water body attribute table created called "**Mining area"** defining whether the water body is in a mining area (value = 1) or a non-mining area (value = 0).

2.3.1 Relevant geological strata

What constituted "relevant" geology was determined through discussions with the Environment Agency on what to include to make sure that the methodology was precautionary in identifying geology units which may have been mined, and may therefore have an impact on the hydrogeology of that area and result in mobilisation of contaminants. It should be noted that economic minerals such as halite and gypsum have been excluded, with only metalliferous minerals included, or, in the case of the Greensand, aggregates with known associated metal problems in discharge waters (given the signals of water quality impact are only assessed with metal / metalloid EQS failure).

Based on the above, the Economic Geology section from the relevant regions from the BGS Regional Geological Guides series was used to search the whole area. From this, a table was produced detailing: BGS guide number and region, publication date, a list of geological units / ores which have been economically extracted by region and the geological product being extracted.

Due to the regional focus of these guides, local or regional names are often given to strata which may be part of a national formation or group. The regional details have been recorded, although these may not be searchable using national geological formation names. These results were then used to interrogate the 1:50,000 geological map database provided by the BGS. A combined list of geological units

was then compiled for the whole dataset. This has been tabulated in Table 2 to show the geological product extracted, the geological unit worked, and which of the BGS Regions this has been recorded in.

Table 2. Geological Units used to formulate the "Mining Area" criterion by product and region

Geological Product	Geological Unit	BGS Region Recorded
Ironstone / Iron ore Iron	Cornbrash Formation	Eastern England
	Crease Limestone Formation	Bristol and Gloucestershire
	Dogger	Eastern England
	Drybrook Limestone	Bristol and Gloucestershire
	Roachstone	Eastern England
	Eller Beck Formation	Eastern England
	Ironstone, carstone or puddingstone	London Valley
	Northampton Sand Ironstone	Central England, Eastern England
	Blackband Ironstones	Central England
	Frondingham, Cleveland, Claxby & Pecten Ironstones	Eastern England
	Clay Ironstone	Wealden
	Kellaways Rock	Eastern England
	Lower Dolomite	Bristol and Gloucestershire
	Lower Limestone Shale	Bristol and Gloucestershire
	Marlstone Rock Bed	Central England
	Wealden Group (Beds)	Wealden
	Granite	South West England
	Penarth Group	Bristol and Gloucestershire
	Lower Carboniferous	South Wales
Sand and Gravel	Upper and Lower Greensand	London Valley
Lead	Harptree Beds	Bristol and Gloucestershire
	Lower Carboniferous	Pennines
	Upper Inferior Oolite	Bristol and Gloucestershire
	Penarth Group	Bristol and Gloucestershire
Zinc	Lower Carboniferous	Pennines
	Lower Carboniferous	North Wales
Manganese	Lower Carboniferous	South West England
	Lower Carboniferous	North Wales
	Manganese Shale	North Wales
	Menevian Clogau Shales	North Wales
	Arenig rocks	North Wales
	Cefn y Fedw Sandstone	North Wales
Copper	Meldon Chert Formation	South West England
	Meldon Shale	South West England
Tin	Meldon Chert Formation	South West England
	Meldon Shale	South West England
	Granite	South West England

3. STAGE 2: Water body prioritisation

After the identification of water bodies that may be impacted by pollution from abandoned non-coal mines, and division of them into the 4 impact categories described above, Stage 2 of the methodology integrates an array of archive data with expert local opinion from contaminated land specialists, aquatic ecologists and hydrogeologists in each of the 10 RBDs wholly in England and Wales to validate and

weight the severity of the mine-related pollution in each impacted water body. Only sites which fall within the *Impacted* and *Probably Impacted* categories are carried forward for this phase of prioritisation. (Note: While some of the scoring exercises were based on GIS screenings which for ease of analysis were carried out for all water bodies nationally, only information for priority water bodies was requested from the Environment Agency through a questionnaire). A scoring system was devised based on four key indices (which are discussed in more detail below):

(1) the severity and number of concurrent EQS breaches
(2) any documented impacts on ecology
(3) impacts on groundwater quality and
(4) any documented higher impact (e.g. abstractions, recreational or commercial fisheries).

An internet-hosted questionnaire (Figure 1) was used as the medium for obtaining the responses from regional experts in a consistent format which was then converted to a numeric score. The questions were designed to accommodate limited responses (e.g. question: “Is there an ecological impact from non-coal mine waters in this water body?” responses = “Yes,” “No”, “Suspected” or “Unknown”), with particular criteria clearly given to ensure consistent response between users (Table 4). Adjacent text fields were provided next to each question for citation of reference sources or further information, all of which is held in the geodatabase (“Mining Impact” table) for future reference. The questionnaire also provided an avenue for any hitherto unidentified impacted water bodies, that the geological screening and mine site assessments may have overlooked, to be identified by local experts. As the geological screening was precautionary in identifying all potentially economic non-coal mineral strata in the UK, there was only one case nationally where a water body was incorrectly categorised as *Not Impacted* until the regional surveys highlighted pollution from a small band of worked ironstone that was not represented on the 1:50000 geological maps due to issues of scale.

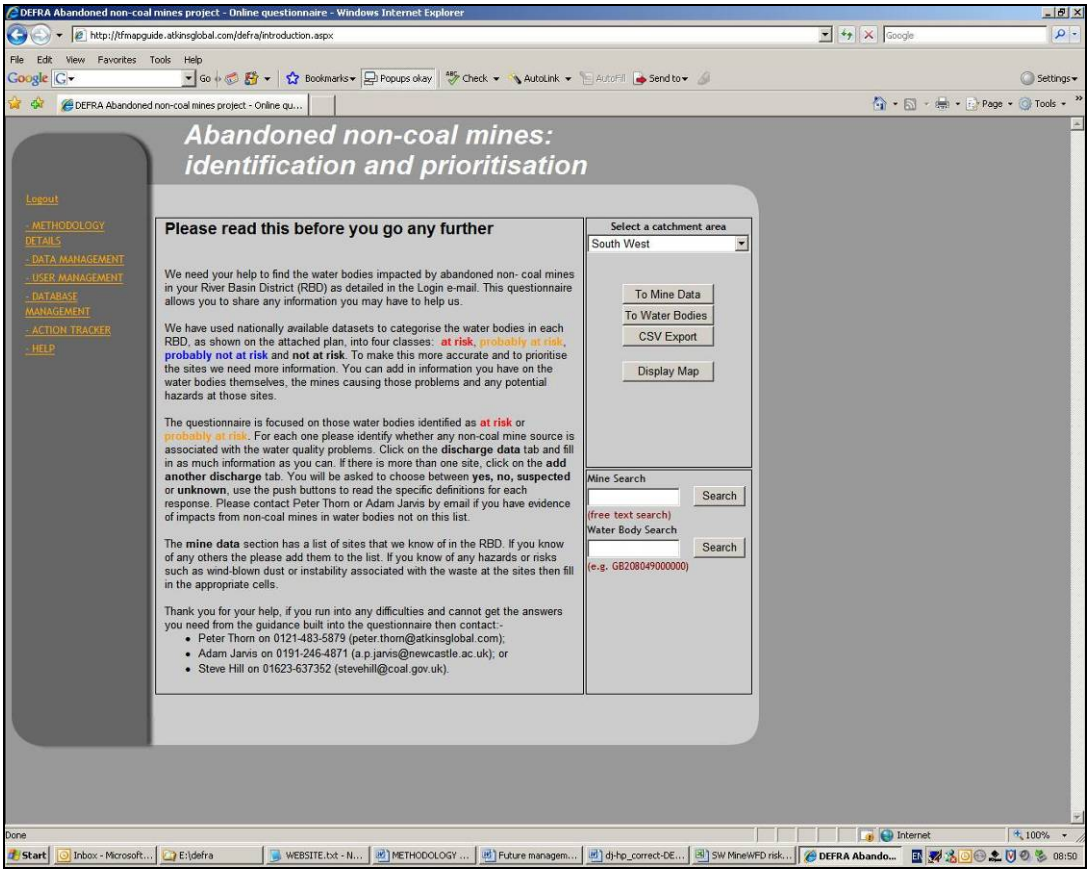

Figure 1. Screenshot from the front page of the internet hosted questionnaire

3.1 Severity of EQS breach

The database detailing all the statutory failures of Environmental Quality Standards (EQS) for eight metals over the period 1999 to 2004 provides a detailed account of the location and average contaminant concentrations at sites in breach of aquatic-life standards. While these data do not represent the full range of contaminants arising from abandoned non-coal mines (e.g. Al, S and H^+ may affect receiving streams), they do cover the most commonly encountered metals / metalloids. In cases where more uncommon contaminants are present, one or more of the eight elements in the EQS database are often concurrent at elevated concentrations. In the rare occasions where pollution from non-coal mines may not be characterised by metal / metalloid release (e.g. a gypsum mine may produce elevated sulphate loadings in site drainage) the regional assessment provided the opportunity for local experts to highlight any anomalous situations that may have been systematically overlooked by the national screening exercises.

Table 3. Bandings for EQS failure in *Impacted* and *Probably Impacted* water bodies.

Metal	Band 1 (1-2x EQS breach)	Band 2 (2-5x EQS breach)	Band 3 (>5x EQS breach)
As	50 – < 100	100 – < 250	≥ 250
Cd	0.25 – < 0.50	0.50 – < 1.25	≥ 1.25
Cu	1 – < 2	2 – < 5	≥ 5
Fe	1000 – < 2000	2000 – < 5000	≥ 5000
Mn	7 – < 14	14 – < 35	≥ 35
Ni	20 – < 40	40 – < 100	≥ 100
Pb	7.20 – < 14.4	14.40 – < 36	≥ 36
Zn	7.80 – < 15.6	15.60 – < 39	≥ 39

Notes: All values in µg/L. The bandings are listed to 2 decimal places and represent the magnitude of EQS breach from 1-2x breach (band 1); 2-5x EQS breach (band 2) and >5x EQS breach (band 3).

A scoring system was devised to convert the extent of any EQS breach and number of concurrent failures in an impacted water body into a simple numeric score. The extent of the breach was scored by the order of magnitude of the failure in three bandings (concentration = >1x, >2x, >5x EQS), which gives a maximum possible score of 24 for a water body failing all 8 metal EQS by at least a factor of 5 (Table 3). The EQS values were chosen based on discussions with the Environment Agency in 2007 about the standards expected to be in use for the WFD, and were deliberately precautionary; not all of these new EQS have been introduced. Some EQS values were hardness-related (Cd, Cu); this was taken into account when screening Environment Agency data to identify failures.

Inputs:

1) All EQS breach data for the 8 metals.
2) The output of exercise 2.1 detailing **"Mining Impact"**

Analysis:

The *Impacted* and *Probably Impacted* water bodies were screened against EQS failure and categorised as detailed in Table 3. This identifies the number of concurrent EQS failures in a water body / downstream water body and offers a broad classification of the magnitude of each breach.

These bandings were then converted to scores as follows: Band 1 = score of 1; Band 2 = 2; Band 3 = 3. A field in the WFD water body attribute table called **"EQS score"** is populated with the sum of the EQS band scores for the 8 metals, i.e. a maximum score of 24 is possible.

Outputs:

1) A field in the "**Water Body Prioritisation**" table called **"EQS score"** with a score out of 24 for each of the *Impacted* and *Probably Impacted* water bodies
2) A priority list for further data collection of those water bodies *Probably Impacted*

3.2. Ecological Impact

The categorisation of water bodies by the General Quality Assessment national biological monitoring scores aims to identify impacts not identified by the statutory water quality monitoring network using the RIVPACS methodology (Wright *et al*., 1993). While this method is designed primarily to identify ecological perturbation in response to organic pollution, where there are wholesale changes in aquatic ecosystems owing to extreme metal pollution, the RIVPACS tool is sensitive to identify such changes (e.g. Armitage *et al.*, 2007). Scope for inclusion of additional data sources (such as published ecological studies) is also provided in the exercise to aid categorisation.

Inputs:

1) **General Quality Assessment (GQA) biological grades** (failure = grade c or below).
2) Published Environment Agency reports
3) Published literature

The criteria for responses in the ecological impact field are detailed in Table 4.

Outputs:
A field in the "**Water Body Prioritisation**" table called "**Ecological Impact"** details responses for the *Impacted* and *Probably Impacted* water bodies. Responses subsequently scored in prioritisation exercise 3.6.

3.3. Groundwater impact

There are no EQS values for groundwater, and therefore groundwater impact assessment was based principally on mine water quality (given that this is one of the main criteria for assessing quality in the WFD groundwater classification exercise in metal mining districts).

Inputs:

1) Mine water chemistry data from EQS data files.
2) Targeted data collection from regional Environment Agency offices/ Local Authority offices

The criteria for responses in the groundwater impact field are detailed in Table 4.

Outputs:
A field in the "**Water Body Prioritisation**" table called "**Groundwater impact"** details responses for reported groundwater impacts for each of the *Impacted* and *Probably Impacted* water bodies. Responses subsequently scored in prioritisation exercise 3.6.

Table 4. Response criteria for ecological, groundwater and higher impact fields

Response	Ecological Impact criteria	Groundwater Impact	Higher impact
Yes	Documented evidence of impact to ecology (e.g. flora, invertebrates and fish) **confirmed** due to abandoned non-coal mining (e.g. published papers/ Environment Agency reports or investigations)	Metal EQS breach in any mine water discharge within the water body. **OR** Metal EQS breach in groundwater quality network confirmed due to mining.	Source Protection Zone within water body. **OR** Surface abstraction within water body **OR** Other confirmed impact (e.g. on fisheries / domestic water abstraction confirmed by local Environment Agency office)
Suspected	Biological GQA grade C or less in "mining area" water body **OR** Biological GQA grade C or less in downstream water body to a "mining area" water body. **OR** Documented evidence of impact to ecology **unconfirmed** due to mining (e.g. published papers/ Environment Agency reports)	Metal EQS breach in groundwater quality network in mining area-unconfirmed due to mining.	Surface abstraction in immediately downstream water body **OR** Other unproven anecdotal evidence (e.g. higher impact suspected by community / angling group)
Unknown	No data	No data.	No data.
No	Grade A or B in host water body to mine **OR** confirmed no ecological impacts	Confirmed no groundwater impacts	Confirmed no higher impacts

3.4. Higher impact

The higher impact field identifies whether there are known or suspected impacts on water resources or other, environmental / human impacts arising from abandoned non-coal mines (excepting outburst risk and surface waste issues, which are addressed separately – see sections 5.1 and 5.2 respectively). Specific to water resource issues, there are 2 datasets which permitted a rapid, GIS screening exercise to enable responses: Source Protection Zones (SPZ) and the National Abstraction Licence Database (NALD). . The use of SPZ and the NALD is again a precautionary measure to highlight *potential* impact on sensitive receptors such as downstream surface or groundwater abstractions. While impacts of polluted mine waters on downstream surface water abstractions have a more obvious pathway for impact than groundwaters, there are cases where abstractions from downstream alluvial sands and gravels could be impacted (e.g. River Ystwyth, River Wear and Tyne) as such a precautionary approach is adopted to highlight such potential sensitivities. Again, the questionnaire provides scope for including other impacts

(e.g. physical impacts due to changed flow routing) gathered in regional assessments. These responses for the higher impact field are detailed in Table 4.

Inputs:
1) **Groundwater Source Protection Zones** map
2) **National Abstraction Licence Database**
3) Published Environment Agency reports
4) Published literature

Outputs:
A field in the "**Water Body Prioritisation**" table called **"Higher Impact"** details responses for reported higher impacts for each of the "*Impacted*" and *"Probably Impacted"* water bodies. Responses are subsequently scored in prioritisation section 3.6.

3.5. Water body scoring and prioritisation

This final exercise of stage 2 assigned scores for each of the attributes screened in exercises 3.1-3.4 for each water body. Evaluation of the above criteria gives a range of alpha-numeric responses for each impacted water body: a score between 1 and 24 for EQS failure, and a Yes-Suspected-Unknown-No response for each of the other three criteria. To attain a single overall summed value to represent *Mining Impact* on the various receptors, an approach for converting these responses into a single numeric score was devised. In any impact assessment exercise weighting of an individual criterion ahead of others can contain a degree of subjectivity between observers and thus requires systematic justification. Of the four criteria assessed, the statutory failures for the eight metals listed above (EQS failures) are the main driver for identifying and prioritising polluting sites and thus greater weight in the final priority is assigned to it. There are three reasons for this:

(1) the EQS dataset is very comprehensive and provides the best coverage of all the national datasets at spatial scales relevant to the individual water body management units, i.e. there are very few situations where there is not water quality data across any given two linked water bodies (hence the downstream impact assessment in Stage 1)
(2) the instream water quality monitoring points are typically near the outlets of sub-catchments at scales in the order of 10-30km^2; if there is an EQS failure in such relatively large streams then it implies a significant contaminant flux must be entering upstream for dilution / instream attenuation effects to have not sufficiently lowered contaminant concentrations below EQS thresholds, and
(3) with the ecological, groundwater and higher impact criteria, in most cases there exists some uncertainty of the nature, scale and source of the impact, e.g. ecological surveys will reflect a complex array of environmental variables to which mining pollution may contribute, whereas the EQS data provide evidence of an *actual* impact on the chemical quality of a water body that is known to be mining related since non-mining related pollution will have been identified via responses on the internet-hosted questionnaire. Equally, the presence of an abstraction may elevate Higher Impact scores but it is more

indicative of potential sensitivities, as opposed to certain impact on a particular receptor.

Given these factors, a higher weighting for impact scores in the EQS data was given than in the other three categories (Table 5). Groundwater scores were given a maximum score of 3 to account for issues of heterogeneity in aquifers in mining areas. Previous WFD mining characterisation exercises in England and Wales (Environment Agency, 2008a; Johnston *et al*., 2007) have used EQS failures of metal contaminants in mine waters at point of surface discharge as an indicator of poor status of the host groundwater body. For consistency, a similar approach was adopted here; groundwater impact acquired an affirmative response if there were EQS failures in point mine water discharges (Table 4). However, given that this failure at discharge point may not be representative of water quality across larger geological units, the maximum weighting attached to groundwater impact was lower than other categories of impact.

The sum total of the scores is used to produce a ranked list by which to prioritise impacted water bodies for remediation planning.

Inputs:
The output responses/fields for exercises 3.1 – 3.4 from the "**Water Body Prioritisation**" table.

Analysis:
The responses for Stages 3.1-3.4 were converted into scores. These scores were summed for each water body to give a single numerical value to describe the impact from non-coal mine pollution in the priority water bodies using the scoring system detailed in Table 5.

Outputs:
A single field in the "**Mining Impact**" table called "**Impact",** populated with a summed numeric score of the responses from Stages 3.1-3.4. This water body prioritisation list is used to rank priority water bodies for remediation planning / further data collection.

Table 5. Scoring system for water body prioritisation

RESPONSE	Ranked EQS Score	Ecological Impact	Groundwater Impact	Higher Impact
Yes or EQS Score 22-24	10	5	3	5
EQS Score 19-21	9			
EQS Score 16-18	8			
EQS Score 13-15	7			
EQS Score 10-12	6			
EQS Score 7-9	5			
EQS Score 4-6	4			
EQS Score 1-3	3			
Suspected	-	2	2	2
Unknown	-	1	1	1
No	-	0	0	0

3.6. Elimination of known non-mining related pollution impacts

The methodology is precautionary in assessing potential impacts of non-coal mining. For example, a *Probably Impacted* site can be an EQS failure in an area of suitable geology with no known mine sites. The opportunity was therefore created to downgrade the impact category where there was certainty that the instream pollution was related to something other than abandoned non-coal mines (e.g. sewage discharge, industrial effluent, coal mine water). As such, local specialists at the Environment Agency in each of the RBDs were presented with a list of *Impacted* and *Probably Impacted* water bodies within their RBD and had to respond to the question:

"Do you know for certain that the EQS failure is NOT caused by non-coal mining?"

Answers in the online questionnaire were limited to "YES" or "NO" responses. An adjacent open text field provided opportunity to provide detail, e.g. "YES, industrial discharge at X, Y known to cause failure".

Where a Yes response was received, the impact category for the water body became *Probably Not Impacted* and thereafter eliminated from future remediation planning / data collection unless contrary data arises.

The Stage 1 and Stage 2 screening exercises are summarised schematically in Figure 2.

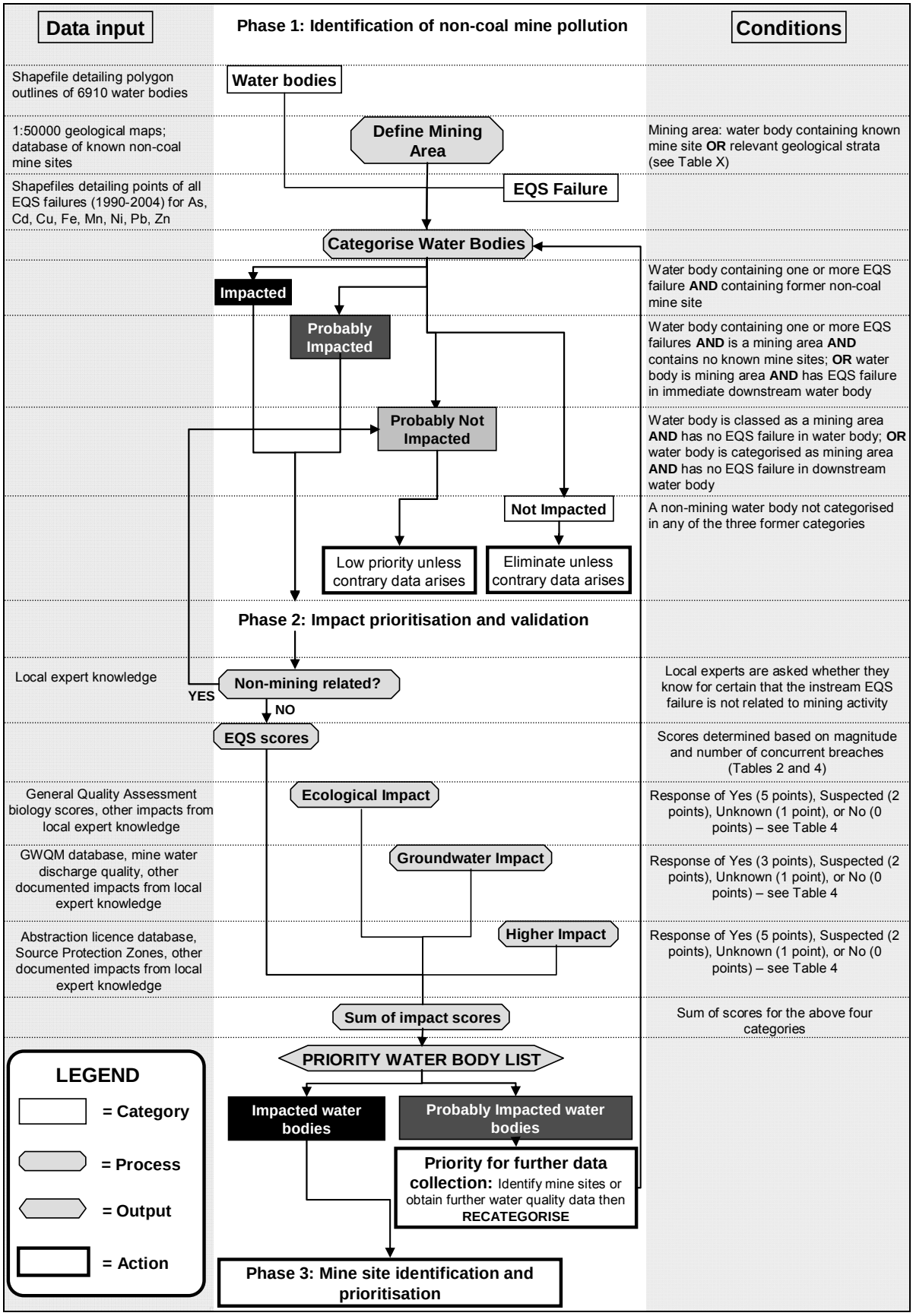

Figure 2: Schematic diagram depicting the methodology for identifying and prioritising abandoned non-coal mine sites.

4. STAGE 3: Mine site identification

Stage 3 carries forward the priority water bodies (i.e. *Impacted* and *Probably Impacted*) from Stages 1 and 2 and focuses on gathering mine site-specific information within impacted catchments. The data gathered will provide the foundation for subsequent scoping studies and remediation planning in impacted water bodies. This stage aims to discern which mine sites are likely to be the major contributors to instream pollution in impacted water bodies and the main focus for future remediation planning.

4.1. Known mine water discharges

The first stage in identifying these polluting discharges was undertaken during the regional assessment exercise of Stage 2. When collating water body information on known impacts on ecology, groundwater and other water resources, the online questionnaire was also used to identify where there were known polluted mine water discharges. A field in the water body prioritisation table (Mining Impact) populated response to the question, "Do you know of any mine water discharges in this catchment". Response was limited to those detailed in Table 6.

Table 6. Response criteria for Known Polluted Mine Water Occurrence field

RESPONSE	CRITERIA	COMMENT
Yes	Confirmed polluted mine water discharge from site	Confirmed by Agency or Consortium staff
Suspected	Mine water discharge suspected but unconfirmed	
Unknown	No data	
No	Confirmed no mine water discharge from site	Confirmed by Agency or Consortium staff

4.2. Mining discharge table

Where an affirmative (Yes or Suspected) response was given in 4.1, the opportunity to populate relevant details about each discharge was provided in a new table, linked with the water body prioritisation (Figure 3). This table is called "**mining discharge"** and has no limit on the number of discharges that could be added for each water body. The information collated during this mining discharge assessment is detailed in Table 7.

The responses in the above table relied solely on data-return from the Environment Agency during regional assessments. While most of the fields had a fairly self explanatory set of responses (e.g. complaints, visual impact, flow and chemistry) additional guidance notes were provided in the questionnaire as to what the diffuse pollution responses would comprise. Examples of what would constitute a Yes (e.g. riparian metal-rich spoil being undercut by a river, known polluted groundwater upwelling into a surface water for example along a fault) and suspected (e.g. known

areas of spoil, but unsure about potential hazard to surface waters) responses were provided in the questionnaire to ensure consistency in data return.

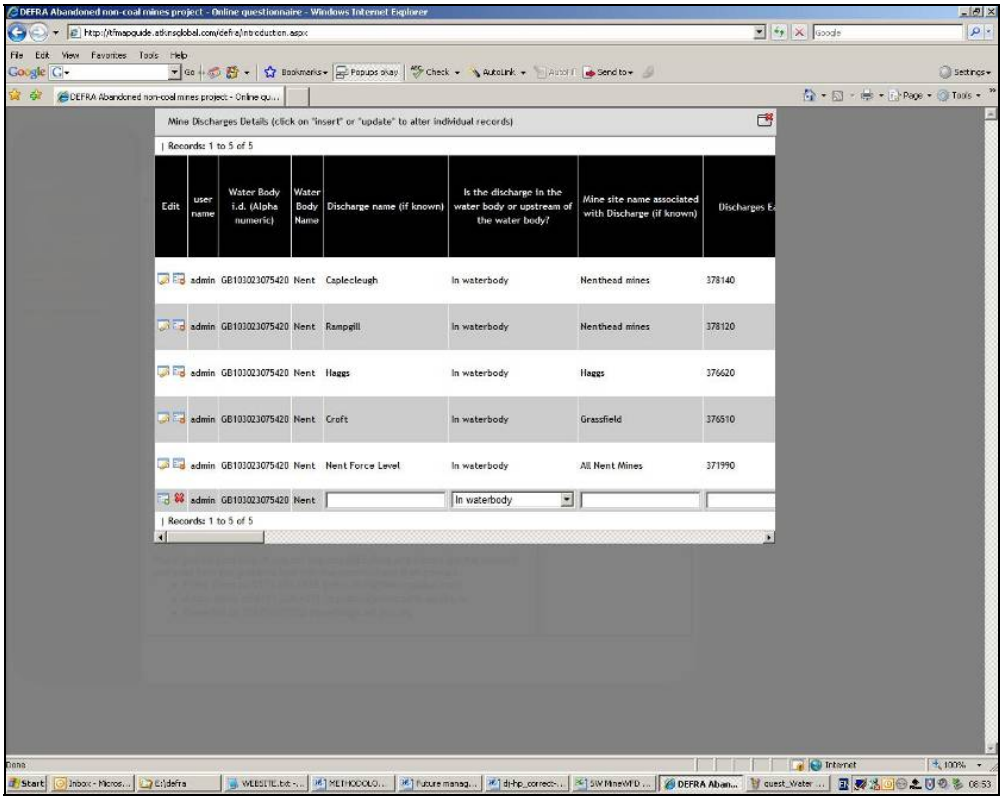

Figure 3. Screenshot from the internet questionnaire highlighting functionality for adding mine discharges

Initially it was anticipated that some screening of national datasets would aid data return for the mine sites / discharges, for example using conservation site shapefiles to assess proximity to potential sensitive receptors. However, given the density of designated conservation sites nationally (and particularly in rural settings where former metal mining has taken place), this would have led to affirmative responses for most mine sites. Spatial proximity does not necessarily determine an inter-relationship and equally it tells nothing about whether the issue is converging or diverging. For example, a downstream protected estuarine SSSI may be adversely impacted by ongoing metal input from upstream mining areas and thus a converging force for upstream remediation, whereas the colonisation of leachate-producing waste rock heaps by rare bryophytes may prevent capping of the spoil as a remedial strategy and is therefore diverging. Given this, the best approach for ensuring a meaningful data return in this phase was deemed to be through obtaining only relevant mine site / discharge specific information from local specialists.

Table 7. Fields and responses for the "mining discharge" table

FIELD	RESPONSES	COMMENT
Water Body ID	Numeric ID	
Water Body name	Text	Not an unique identifier
Discharge name	Text	
Water Body of discharge	In water body, upstream of water body	Is the discharge within the named water body or in the immediately upstream water body
Associated mine site(s)	Text	Names of associated workings if different from mine water name
Discharge X	Numeric	Grid ref easting
Discharge Y	Numeric	Grid ref northing
Receiving water course	Text	Stream name into which mine water discharges. This may be a subcatchment of the water body given in field "Water Body Name"
Diffuse Pollution	Yes, Suspected, Unknown, No	Is diffuse pollution thought to be an issue in the reach around this discharge?
Diffuse pollution comment	Alpha-numeric	Opportunity to describe potential diffuse sources in open text field.
Ecological Impact	Yes, Suspected, Unknown, No	Output from stage 2
Groundwater Impact	Yes, Suspected, Unknown, No	Output from stage 2
Higher Impact	Yes, Suspected, Unknown, No	Output from stage 2
Visual Impact	Yes, Suspected, Unknown, No	Is there a visual impact in the reciving watercourse from the mine discharge.
Visual Impact Length	Numeric	Length in kilometres of stream reach where there is noticeable visual impact
Stakeholder Issues	Yes, Suspected, Unknown, No	
Converging / Diverging	Converging, Diverging, Unknown, No	Converging = in support of remedial activity, Diverging = in opposition to remedial activity
Complaints	Yes, Suspected, Unknown, No	Has the regulator received complaints about this discharge?
Discharge flow	Numeric	Mean flow rate of discharge in litres / second
Discharge As	Numeric	Mean concentration in mg/L
Discharge Cd	Numeric	Mean concentration in mg/L
Discharge Cu	Numeric	Mean concentration in mg/L
Discharge Fe	Numeric	Mean concentration in mg/L
Discharge Mn	Numeric	Mean concentration in mg/L
Discharge Ni	Numeric	Mean concentration in mg/L
Discharge Pb	Numeric	Mean concentration in mg/L
Discharge Zn	Numeric	Mean concentration in mg/L
Discharge comments	Alpha-numeric	Opportunity for end-users to provide references for source information

5. STAGE 4: Other issues: outburst risk and solid waste

5.1. Hazards and solid waste issues at abandoned non-coal mine sites

The data collation and prioritisation in Stages 2-4.2 relates solely to impacts of abandoned mine sites on the water environment and some of the stakeholder issues that could of significance for remediation planning. As part of the project various other hazard information was collected for mine sites. Some of these issues are again focussed on impacts on the water environment (e.g. risk of mine water outbreak), but the bulk of the data is concerned with solid waste issues and hazards and aims to feed into the mining waste inventories required of the EU Mining Waste Directive (2006/21/EC). Two avenues for data collection were followed:

1) the regional assessment exercise used the online questionnaire as a medium for Environment Agency staff to return information on mine sites
2) A separate email-based survey of all Local Councils in England and Wales.

The first of these processes posed a series of questions to local Environment Agency staff about impacts at mine sites (as opposed to mine discharges), responses for which were populated in the **"defra_merged_mines"** table. The fields and responses for collating this information are presented in Table 8. Airborne pollution risk is concerned with risk of dust blows from metal-rich spoil, particularly in locations where local populations could be exposed. Safety concerns focuses principally on situations where open shafts or adits could pose a human safety issue. This is distinct from stability concerns which are related to geotechnical hazards such as spoil heap slumping / collapse. Outbreak risk encompasses sites where there is a risk of sudden outbreak of large volumes of mine water aiming to highlight those sites where concerns are immediate (e.g. large build up of mine water behind a blocked adit) and those where there is a history of outbreak. "Inspections" covers those sites where inspections have been undertaken or are planned under Part 2a of the Environmental Protection Act (1990) and subsequent Contaminated Land (England) Regulations (2006).

The responses to the questions are limited (i.e. Yes, Suspected, Unknown, No) with an adjacent text field provided for end-users to populate data sources, technical details and other relevant comments. The advantage of having a restricted field for impact response in addition to an open text field is that it allows data filtering by response. For example, all Yes and Suspected responses for mine water outbreak risk can be rapidly filtered and exported to provide a national list of sites where such concerns exist.

The second avenue for collating data was through a survey of all local councils asking for population of a table in MS Word. This table had a similar structure to Table 8 asking for mine name, location and restricted response to the safety, stability, Inspections and airborne pollution fields. A single comment field was also provided. Outbreak risk information was not requested from the Local Councils. One additional question was however included on the Local Council questionnaire and

concerned whether there were any additional public or animal health issues at the mine sites. This was to collate information on issues such as where contaminated river sediments had impacted on agricultural land or where allotments were situated on contaminated former mine sites. Such issues, where present, are likely to be registered with local council environmental / public health divisions rather than the Environment Agency; hence the additional question in this survey.

The Environment Agency data return and the Local Council data return were merged at the completion of the project.

Table 8. Fields and responses for the "defra_merged_mines" table

FIELD	RESPONSES	COMMENT
Water Body ID	Numeric ID	Host water body
RBD ID	Text	Host RBD
Water Body name	Text	
X	Numeric	Grid ref easting
Y	Numeric	Grid ref northing
Mine name	Alpha-numeric	
Ore	Alpha-numeric	
Source ID	Alpha-numeric	ID code used in original source
Source	Alpha-numeric	Original source of mine information (e.g. MMSW)
Airborne Pollution Risk	Yes, Suspected, Unknown, No	Are there issues with airborne pollution (e.g. dust blows) from the mine site?
Airborne Pollution Risk Comments	Text	Comments in relation to above
Safety Concerns	Yes, Suspected, Unknown, No	Are there public saftety issues at the mine (e.g. open shafts)
Safety Concerns comments	Text	Comments in relation to above
Stability Issues	Yes, Suspected, Unknown, No	Are there stability issues at the mine (e.g. unstable spoil heaps)
Stability Issues comments	Text	Comments in relation to above
Outbreak Risk	Yes, Suspected, Unknown, No	Is there risk of a sudden outbreak of mine water at the mine?
Outbreak Risk comments	Text	Comments in relation to above
Inspections	Yes, Suspected, Unknown, No	Is the site being or proposed to be investigated under Part 2A of the Environmental Protection Act?
Inspections comments	Text	Comments in relation to above

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Appendix: Inventory of data sources

(Provided under licence to each contractor by the Environment Agency)

	Data item	Received	Comments/Usage
1	OS base mapping data		
	- meridian	21/05/07	Used in GIS – background
	- 1:250 000 raster	21/05/07	Used in GIS – background
	- 1:50 000 raster	21/05/07	Used in GIS – background
	- Mastermap data	*No*	*Localised data request to be made later in project.*
	- Aerial photos	*No*	*Localised data request to be made later in project.*
2	BGS Geological mapping data (solid, drift and Artificial)		
	1:50 000	21/05/07	Used in GIS – analysis and background
	1:625 000	21/05/07	Used in GIS – analysis and background
3	GIS shape file of Environment Agency area offices	21/05/07	To be used in GIS – analysis. To limit extent of regional analyses and background
4	NALD abstraction database (shape file)	21/05/07	Used in GIS – analysis. Shapefile of all >20m^3/day licensed abstractions – lists NGR, usage. Use in identifying water resource issues in mining areas.
5	RQO		**Ignore at present** – will be used in GIS (analysis) but no NGR in database at present. **To be superseded**
	GQA		Not to be used – not relevant for mining impacts as only has DO, BOD and NH3 as chemical descriptors
	Dangerous Substances data		The new EQS data supersede the DSD
	The priority and other polluting substances report (Annex 8/10 compliance data)	9/5/07	Used in GIS – analysis. National EQS breach for As, Cd, Cu, Fe, Ni, Mn, Pb, Zn. All locations have site monitoring details. Include only sites prefixed "Freshwater.." in the site description (column SPT_DESCRIPTION) to remove trade effluents, mine waters etc. The mine water data will be needed later in the project
6	RBC review for mining pressures and impacts and all associated data	10/5/07	Background information - Word file detailing method for RBC mining pressures review
	RBC1 (including method)		**Superseded.**
	RBC2 (rivers, TRAC)	10/5/07	Used in GIS – background/validation. Shapefiles of surface waters and transitional/ coastal waters at risk from mining pollution.
	Groundwater characterisation	10/5/07	Used in GIS – background/validation. Shapefile of characterisation of gw bodies (at risk, probably at risk etc.) from DJ. Associated word doc detailing methodology for reference.
7	Water Framework Directive Waterbody boundaries and river basin districts	10/5/07	Used in GIS – analysis. Defines the boundaries of the >7800 WFD water bodies. Contains field detailing downstream water body to be used in analyses.
	WFD monitoring locations (phys-	10/5/07	Used in GIS – background, possibly analysis.

	chem surveillance & operational).		
8	Groundwater Quality Strategic Monitoring Network	10/5/07	Used in GIS – background. Location of all Environment Agency groundwater monitoring points, strata etc. background information.
9	Locations of mines	16/4/07	Used in GIS – analysis. In 4 separate files. Merged into single file prior to loading into GIS. The different source files have different fields in table (e.g. ore, date of working etc.). All have name and NGR.
10	DETR mining database	16/4/07	Background information. Some site specific details that will aid regional assessments / discharge data.
11	OSPAR data	16/4/07	Used in GIS – background. On CD from Dave Johnston. Shapefiles of metal loadings at tidal limits of rivers. Not to be directly used in analysis at first. Data is limited to 1 sample year.
12	Wales Metal mines report, April 2004	10/5/07	Background information – methodology development, some site specific data will be of use in Welsh regional assessments.
13	Draft Coal Mine Discharges prioritisation method	10/5/07	Background information – methodology development
14	Original WIMS request – Mark Blackmore	16/4/07	Not needed in database – EQS dbf/shapefiles supersede this. Unlikely to be needed for background information also.
15	Reasons for RQO failure (similar to item 5)	To be superseded	**To be superseded.** Reasons for RQO failure. New dataset to supersede.
16	Metal Mine Strategy for Wales	16/4/07	Background information. Some useful data for site prioritisation (water quality, stakeholder etc.)
17	SW mines database	16/4/07	Background information. Some useful site data for prioritisation.
18	Protected surface and marine waters– Fisheries, bathing waters etc.	25/5/07	Used in GIS – background information. Not on the original data request but lists designations under the Freshwater Fish Directive amongst others. Data has points which describe the river reaches protected. May well be some overlap with the SAC data.
19	Groundwater Source Protection Zones	25/5/07	Used in GIS – analysis. Shapefile of groundwater source protection zones requested on 25/5/07 to aid water resource impact assessments. Added to data licence RESTRICTION: No publication allowed without prior consent from Environment Agency
20	River network 1:50 000 1:250 000	6/6/07	Used in GIS – background, possibly analysis on reach ID.

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