

Historic and Operational Mines Project 2020 – 2021

Office of Radiation Protection and Environmental Monitoring,
Environmental Protection Agency



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Executive Summary

Historic and operational mines can be a source of metal contamination in river waterbodies and can result in those rivers failing to meet the requirements of the Water Framework Directive (WFD). To assess the concentrations of metals in local waterbodies from current and historical mining activities, extensive sampling and analysis was undertaken during 2020 and 2021. The approach to and findings of this work are reported here.

A previous study, the *2009 Historic Mine Sites - Inventory and Risk Classification (HMS-IRC) Project*, was undertaken by the Environmental Protection Agency (EPA), Geological Survey of Ireland (GSI) and the Exploration and Mining Division of the Department of Communications, Marine and Natural Resources (DCMNR) to assess the impact of mining on the local environment. It included the analysis of surface water, stream sediments, mine water discharges and solid mine waste.

The purpose of the Historic and Operational Mines Project 2020-2021 was to obtain an up-to-date assessment of the presence of metals in river waterbodies close to mine sites. Developments in mining in Ireland since 2009 were considered and different categories of mine sites were included. Twenty-two mine sites were investigated:

- fifteen historic mine sites, which were previously classified in the HMS-IRC project,
- two closed EPA licensed mine sites,
- two operational EPA licensed mine sites,
- and three prospecting licence areas.

Since river water samples only were assessed, a direct comparison with the 2009 study cannot be made. In total, 90 river monitoring stations were selected to assess the potential impact of mining activities on those water bodies. These included both downstream and upstream (where available) monitoring stations. Samples were taken over a two-year period (2020-2021) and were analysed for metals, pH, dissolved organic carbon and calculated hardness.

The results of these analyses were assessed against Environmental Quality Standards (EQS) for the relevant metals. An EQS is the maximum concentration of a metal that can be present in the water without adversely affecting the riverine fauna. Where possible, the Annual Average EQS (EQS_{AA}) and Maximum Allowable Concentration EQS (EQS_{MAC}) were included in the assessment.

Two Risk Quotient (RQ) values were calculated for each site and used to classify that site as very low, low, moderate, high or very high risk. The assessment for each mine is presented in this report along with recommendations for further monitoring under the WFD monitoring programme at locations which had an EQS exceedance or a moderate, high or very high RQ classification.

Fifteen of the twenty-two mine sites have been recommended for further monitoring. Eight of these had an EQS exceedance, five had a moderate, high or very high RQ classification, and two low risk mine sites (with no EQS exceedance) have been recommended for further monitoring as they are EPA licensed sites. This monitoring will be carried out in the 2023-2024 WFD Work Programme. Monitoring will be carried out for a minimum of one year after which it will be further reviewed.

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1 Introduction

1.1 Background to Mining in Ireland

Ireland has a long history of mining activity dating from the Bronze Age to the present day. There are many historical mining sites located throughout Ireland where operations have ceased, but these sites continue to pose a potential risk to the surrounding aquatic environment. Mine sites were often closed without considering remediation, reclamation or ongoing maintenance of the sites after production ceased. In 2009 the EPA, GSI and DCMNR published a report detailing the findings of the *Historic Mine Sites - Inventory and Risk Classification (HMS-IRC) Project* (EPA, 2009). The HMS-IRC Project investigated 27 priority historic mine sites and districts in Ireland and assessed the potential risk posed by these sites to human and animal health and to the wider environment.

Since the publication of the HMS-IRC report, two of the mines included in that study have closed and are currently in the aftercare phase:

- Galmoy zinc and lead mine ceased its mining operations in October 2012; and
- Lisheen zinc and lead mine ceased its mining operations in October 2015.

There are currently two mines actively operating in Ireland:

- Boliden Tara Mines Navan producing zinc and lead (temporary closure in July 2023); and
- Knocknacran Opencast and Drummond Mine producing gypsum.

There are also several locations in Ireland where exploration licences have been granted and early exploratory phase work has been carried out. Mine status can quickly change due to economic pressures on global supplies of minerals. Closed mine sites may be reconsidered for exploration due to mineral deposits becoming economically viable.

1.2 Mining in Ireland – Impact on the aquatic environment

Mining has been identified as a significant pressure on Ireland's aquatic environment in Cycle 2 and Cycle 3 of Ireland's River Basin Management Plans (Fig. 1) (EPA, 2022). Mining activities are potential sources of metals in water bodies and may result in individual water bodies not achieving their water quality objectives (EPA, 2022). Chemical status is assessed against compliance with the Environmental Quality Standards (EQS) Directive (2008/105/EC). Between 2016 and 2021 26.4% of EQS exceedances in waterbodies were due to metals (Fig. 2) (EPA, 2022). The main sources of these metals were atmospheric deposition from the burning of fossil fuels and emissions from mining sites. The key purpose of this project was to better understand how mining activities contribute to metal concentrations in waterbodies.

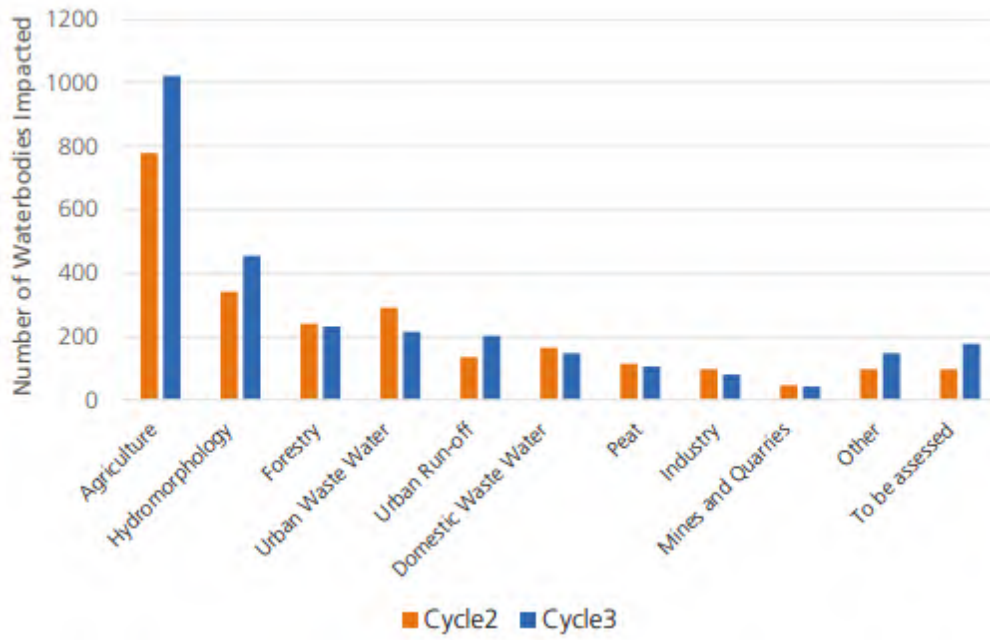


Figure 1 Significant Pressures Identified in Cycle 2 and Cycle 3 of Ireland's River Basin Management Plans (EPA, 2022)

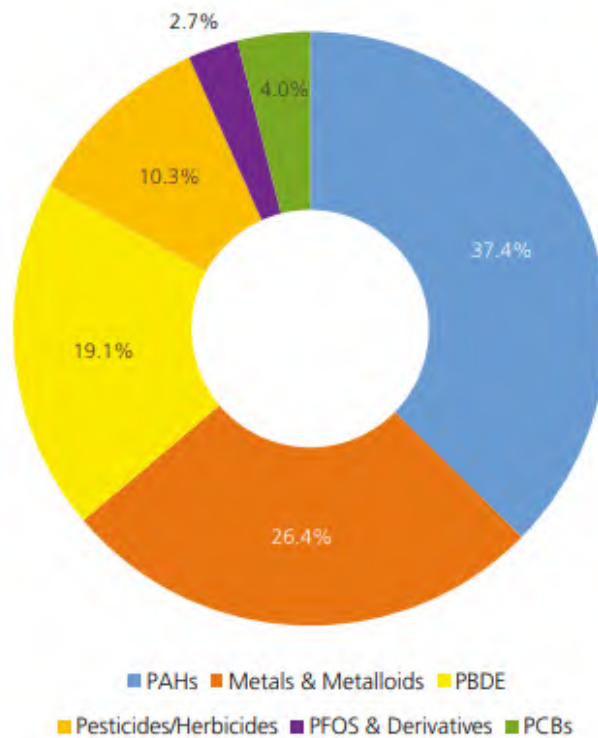


Figure 2 Percentage of EQS failures between 2016 - 2021 by priority substance (EPA, 2022)

2 Previous EPA Studies

The EPA has previously undertaken and funded several studies focussing on mining activities in Ireland and their risk to the environment, investigations into sites of concern, and management of mines after closure. Details of these studies are outlined in Table 1.

Table 1 Previous EPA Studies focussing on mining activities

Title	Description	Conducted by	Year	Link
EPA Register of Former Mine Sites	Small-scale study of 128 former mine sites with a factsheet for each site.	EPA	1996	Link
Mine Closure Planning Ireland: Water Aspects	Details of mine closure plans, measures and processes for zinc-lead mines.	EPA	1999	Link
A Survey of Dangerous Substances in Surface Freshwaters 1999- 2000	Includes details of 1994 metals monitoring data.	EPA	2001	
Expert Group on Lead in Silvermines Co Tipperary Interim Report	Interim report considering guidance in relation to protection of human health, animal health and the environment in the Silvermines area.	EPA	2002	Link
Report of The Investigation into The Presence of Lead and Other Heavy Metals in The Tynagh Mines Area, Co Galway	Report on an investigation of the Tynagh Mine site including recommendations in relation to ongoing management of the site.	EPA	2003	Link
Final Report of Expert Group for Silvermines County Tipperary: Lead and Other Relevant Metals	Final recommendations for guideline values for lead in the environment and guidance on human health and animal health.	EPA	2004	Link
Characterisation of Historic Mine Sites in Ireland and their Environmental Risks	Project proposal by the EPA, the GSI and the Exploration and Mining Division of the Dept. of Communications, Marine and Natural Resources (DCMNR).	EPA, GSI, DCMNR	2005	Link
Historic Mine Sites - Inventory and Risk Classification Volume 1 (Full report and appendices)	This joint project created an inventory of Irelands historic mine sites and looked at potential risk posed by these sites to humans, animals and the environment.	EPA, GSI, DCMNR	2009	Link
Historic Mine Sites - Inventory and Risk Classification (Mine documents – site reports)	Detailed site investigations and characterisations of priority historic mine sites in Ireland for each mine site.	EPA, GSI, DCMNR	2009	Link
Report of an Inter-Agency Group on the Silvermines Area of County Tipperary	Report from an inter-agency group (IAG) following the detection of elevated lead levels in milk in the Silvermines area of Co Tipperary.	DAFM, DCCAE, EPA, FSAI, HSE, Teagasc, TCC	2018	Link
Silvermines Wetland Substrate Reprocessing	Study to establish, in principle, if the metals held in the substrate could be extracted as a resource.	EPA (SLR Consulting)	2018	Link
The Potential for Economic Reprocessing of Mine Waste in Ireland	Small-scale study looking at the potential for economic reprocessing of mine waste in Ireland.	EPA (SLR Consulting)	2018	Link
Use of Constructed Wetlands for Treating Mine Waste Leachates: Assessment of Longevity and Management Implications	This study provides evidence of the effectiveness of constructed wetlands for treating mine waters from different settings over time frames of several years.	EPA	2021	Link

2.1 Historic Mine Sites - Inventory and Risk Classification (HMS-IRC) Project, 2009

The 2009 HMS-IRC Project was undertaken to satisfy the requirements of Directive 2006/21/EC and Directive 2004/35/EC on an inventory of closed mine sites in Ireland. The project was jointly conducted by the EPA, GSI and Exploration and Mining Division in the Department of Communications, Marine and Natural Resources. The aim of the HMS-IRC project was to carry out site investigations at 27 priority historic mine sites/districts in Ireland, assess the potential risk posed by these sites to human and animal health and to the wider environment, and to consider issues related to safety at each of the sites. Mine sites/districts were ranked under the HMS-IRC scoring system detailed in Table 2. These risk ratings were based on different matrices analysed including surface water, stream sediments, mine water discharges and solid mine waste. The project report presented an inventory of historic mine sites in Ireland, protocols for site visit risk assessments and characterisation of historic mine sites, and site-specific risk classifications and reports for all the mine sites included in the inventory.

Table 2 HMS-IRC Scoring System - Class 1 represents the sites with the highest risk and Class V represents the sites with the lowest risk (EPA, 2009).

Class	Description
I	Relates to large complex sites that have a number of issues, the sites contain large volumes of metal rich waste that potentially pose risks to human and animal health and safety as well as the environment.
II	A district consisting of several sites, containing numerous small spoil piles with high concentrations of metals and are visited regularly by the public. Accordingly, these sites potentially pose risks to human and animal health and safety as well as to the environment.
III	Sites containing fewer and smaller spoil piles that have high concentrations of metals. The sites are used by the public and potentially pose risks to human and animal health and safety as well as to the environment.
IV	Sites that generally have large volumes of waste with low concentrations of those metals that potentially pose risks to human and animal health and safety as well as to the environment. Any high metal spoil piles are very small in volume
V	These sites pose little threat to humans, animals or the environment, although there may be minor site-specific issues which need to be addressed

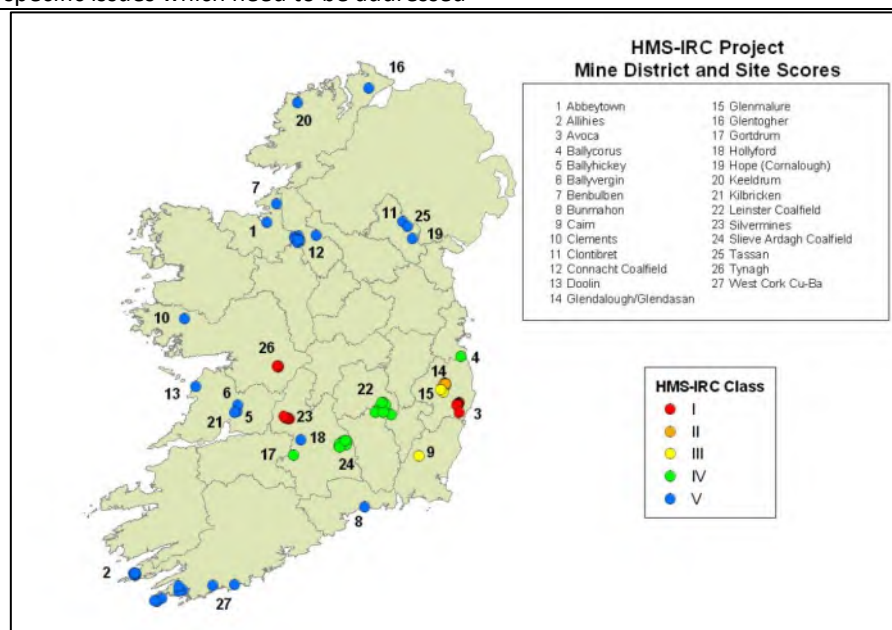


Figure 3 HMS-IRC Project Mine District and Site Scores (EPA, 2009)

3 Historic and Operational Mines Project 2020 – 2021

3.1 Introduction

Mining activities are a potential source of metals in water bodies and can cause EQS failures for metals. To assess the current impact of mining sites, the EPA undertook a Historic and Operational Mines Project in 2020 and 2021. In 2020, an Historic and Operational Mines Project Working Group was set up comprising staff from the Office of Radiation Protection and Environmental Monitoring (ORM) in Dublin and Kilkenny EPA Regional Inspectorates to investigate the impact of these sources. This project provides an update on the presence of metals in surface waters at mine sites and investigates monitoring requirements at these sites.

3.2 Scope

The Historic and Operational Mines Project 2020-2021 was undertaken to provide a comprehensive status update on the effect of mining activities in Ireland (past and present) on surface water quality in relation to WFD metals of concern (priority substances, priority hazardous substances and river basin specific pollutants).

This differs from the previous HMS-IRC IRC both in its scale and insofar as only surface water is considered in the current project (the HMS-IRC project included surface water, stream sediments, mine water discharges and solid mine waste). To reflect the difference in mining activities over the intervening 11 years, new categories of mine sites were included in this project.

Figure 4 below illustrates the four different categories of mine site considered in this project:

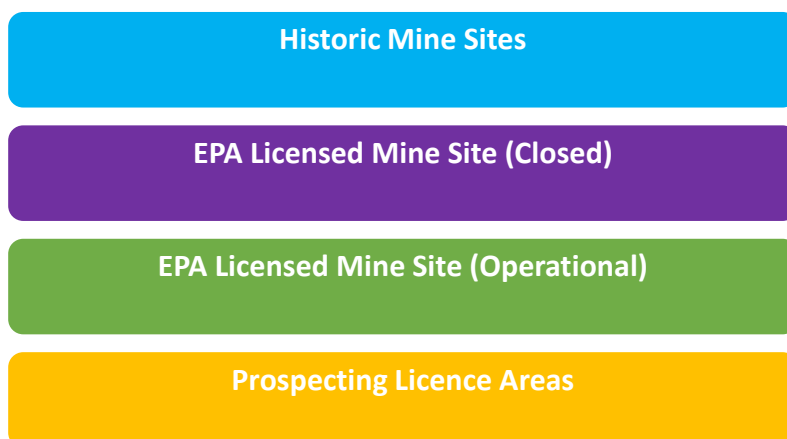


Figure 4 Mine site categories for the Historic and Operational Mines Project 2020 – 2021

Only metals with established EQS limits were considered in the project. These metals include WFD Priority Substances (nickel and lead), WFD Priority Hazardous Substances (cadmium and mercury) and WFD River Basin Specific Pollutants (copper, zinc and arsenic). Figure 5 shows the project workflow.

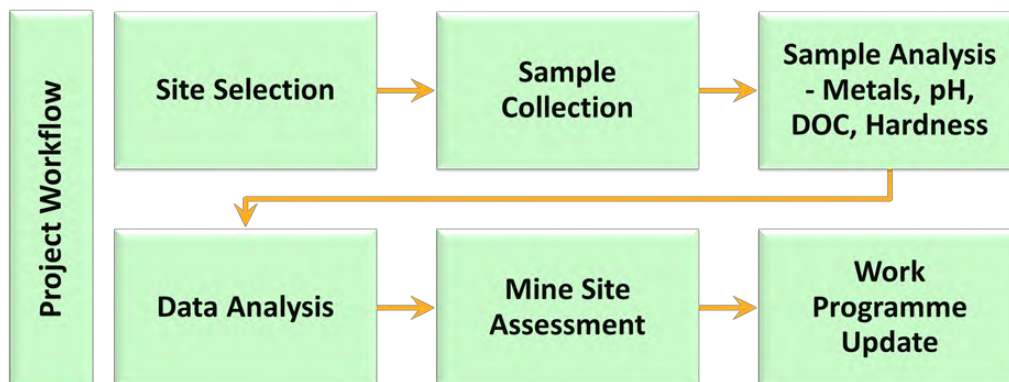


Figure 5 ORM Historic & Operational Mines Project Workflow

While some of the surface water sites monitored in this study may be used for drinking water abstraction, the data was not assessed against the recast 2020 Drinking Water Directive Parametric Values for relevant chemical parameters. However, data for relevant chemical parameters is available for others to undertake this in the future. Furthermore, ecological sampling and testing was not performed at the sites in this report.

The outputs of this project will help to inform the EPA’s approach in reviewing and optimising the WFD Operational and Surveillance Monitoring Programmes.

3.3 Site Selection

The 2009 report included 27 mine sites, and these were considered when selecting sites in the current project. Fifteen historic mine sites from the 2009 HMS IRC Project were selected for the Historic and Operational Mines Project 2020-2021. These include Avoca, Ballycorus, Benbulbin, Caim, Clare Lead Mines (Ballyhickey, Ballyvergin, Kilbricken), Connacht Coalfield, Glendalough/Glendasan/Glenmalure, Glentogher, Gortdrum, Hollyford, Leinster Coalfield, Monaghan Lead Mines (Clontibret, Hope, Tassan), Silvermines, Slieve Ardagh Coalfield and Tynagh.

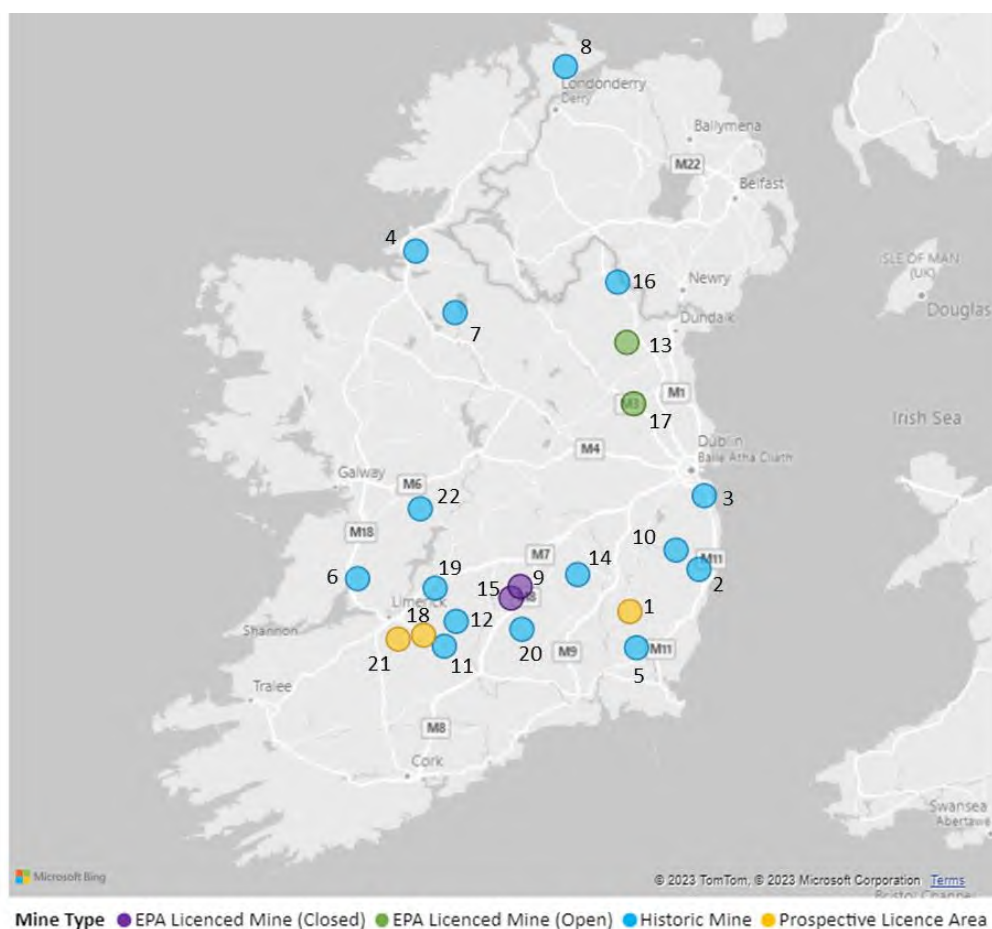
Some sites at the lower end of the classification scale (Class V) were omitted from this project as they were unlikely to have significantly changed since 2009 or they did not have a suitable downstream monitoring point (Abbeytown, Allihies, Bunmahon, Clements, Doolin, West Cork Cu-Ba). Keeldrum was selected to be included in the project, but sampling issues arose, and it was therefore not included. Additional mining sites that warranted further investigation were also selected for inclusion in the current project. These include operational mine sites at Tara Mines in Navan (temporarily closed as of 2023) and Knocknacran/Drummond, recently closed mine sites at Galmoy and Lisheen and prospecting licence areas in Limerick and Carlow.

This report presents the results of metals analysis of surface water sampling carried out at 90 national monitoring stations in waterbodies at 22 selected mine sites in 2020 and 2021. This includes:

- fifteen historic mine sites, which were previously classified in the HMS-IRC project;
- three prospecting licence areas;
- two closed EPA licensed mine sites; and
- two operational EPA licensed mine sites.

This includes monitoring stations downstream of the mining activities as well as upstream stations (where these were available).

Figure 6 shows the location of the mine sites selected and the mine types.



Historic and Operational Mine Sites 2020-2021			
1	Aclare	12	Hollyford
2	Avoca	13	Knocknacran/ Drummond
3	Ballycorus	14	Leinster Coalfield
4	Benbulbin	15	Lisheen
5	Caim	16	Monaghan Lead Mines
6	Clare Lead Mines	17	Navan
7	Connacht Coalfield	18	Pallas Green
8	Glentogher	19	Silvermines
9	Galmoy	20	Slieve Ardagh Coalfield
10	Glendalough/Glendasan/Glenmalure	21	Stonepark
11	Gortdrum	22	Tynagh

Figure 6 Mine sites selected for the Historic and Operational Mines Project 2020-2021

3.4 Methodology

Monitoring data was evaluated against WFD EQS_{AA} and EQS_{MAC} thresholds to determine compliance with these quality standards for chemical status assessment. In addition, Risk Quotients were calculated to integrate the results of exposure and ecotoxicity data where Risk Quotient (RQ) is a measure of exposure and toxicity and provides an insight into the level of risk at each site in terms of acute and chronic toxicity.

After reviewing EQS data and RQs, monitoring stations were retained for metals monitoring on future WFD Work Programmes to allow for further assessment. In these cases, monitoring will be carried out for a minimum of one year at priority substance frequency. Following review, stations may be added to or removed from future WFD Priority Sampling Monitoring Programmes.

3.5 Sample Collection and Analysis

As agreed with the relevant local authorities, samples were collected in 2020 and 2021 and transported to EPA laboratories. Metals analysis was carried out in the Dublin Laboratory with pH and DOC tested in the closest EPA regional laboratory. All samples were analysed for dissolved metal concentrations, pH, dissolved organic carbon (DOC) and calculated hardness (from calcium and magnesium) resulting in 24,300 individual determinants. The EPA holds ISO 17025:2017 accreditation from the Irish National Accreditation Board for all these parameters.

Metals testing was carried using a Perkin Elmer 350x ICP-MS instrument. An Analytik Jena multi-N/C 3100 and Multimeter WTW 197i were used for DOC and pH analyses, respectively. Figure 7 shows examples of the instruments used to analyse the samples. Calculated hardness used in the metal's bioavailability calculations was derived from calcium and magnesium data.



Figure 7 Perkin Elmer 350x ICP-MS instrument (metals analysis), Analytik Jena multi-N/C 3100 (DOC analysis), Multimeter WTW 197i (pH analysis).

3.6 Bioavailability of Metals

Metals are naturally occurring in freshwater and to account for the bioavailability of metals in the freshwater environment, Biotic Ligand Models were employed. These are predictive tools that can account for variation in metal toxicity using information on the chemistry of local water sources, i.e., pH and dissolved organic carbon. The bioavailability of nickel was calculated using the Bio-Met bioavailability tool. This is a 'user friendly' software tool, based on Biotic Ligand Models and is available as an MS Excel Spreadsheet. It is currently not appropriate to use the Bio-Met tool to derive bioavailable lead EQS for chemical status classifications under WFD. For the assessment of site-specific lead EQS under WFD, a lead specific screening tool was applied.

3.7 Environmental Quality Standards

Under the EC WFD, Environmental Quality Standards (EQSs) are used as regulatory values to verify whether the risk of substances is acceptable (Directive 2008/105/EC). The risk is considered acceptable if the measured environmental concentration is lower than the EQS. EQSs are substance-specific concentrations of individual chemicals in the aquatic environment below which no harmful effects on aquatic organisms are expected. In general, the more toxic a substance is, the less it can be tolerated by the aquatic organisms in a waterbody. There are limits on the concentration of the priority (hazardous) substances in water, i.e., thresholds which must not be exceeded if good chemical status is to be met. EC Member States also identify relevant pollutants of regional or local importance and set EQSs for them, these are called River Basin Specific Pollutants (RBSPs). There are two types of EQSs;

- i. Annual Average EQS (EQS_{AA}); A threshold for the average concentration of the substance concerned calculated from measurements over a 1-year period. The purpose of this standard is to ensure protection against long-term exposure to pollutants in the aquatic environment (i.e., chronic toxicity).
- ii. Maximum Allowable Concentration EQS (EQS_{MAC}); A maximum allowable concentration of the substance concerned, that is, the maximum for any single measurement. The purpose of this standard is to ensure protection against short-term exposure such as pollution peaks (i.e., acute toxicity).

Metal concentrations in the samples were compared with EQS_{AA} and EQS_{MAC} as set out in EC Directives and transposed into Irish legislation as detailed in Table 3 below.

Table 3 EQS values for Metals

Category	Legislation	Metal	EQS _{AA} (µg/l)	EQS _{MAC} (µg/l)	Note	Assessment used for:
River Basin Specific Pollutants	2008/105/EC SI No. 272 of 2009	Arsenic	25			Ecological
		Copper	5		Hardness <100mg/l CaCO ₃	
			30		Hardness >100mg/l CaCO ₃	
		Zinc	8		Hardness <10mg/l CaCO ₃	
			50		Hardness >10 & <100mg/l CaCO ₃	
		100		Hardness >100mg/l CaCO ₃		
Priority Substances	2013/39/EU SI No. 386 of 2015	Lead	1.2	14	Refers to bioavailable concentration	Chemical
		Nickel	4	34	Refers to bioavailable concentrations	
Priority Hazardous Substances	2013/39/EU SI No. 77 of 2019	Cadmium	0.08	0.45	(Class 1) Hardness <40mg/l CaCO ₃	Chemical
			0.08	0.45	(Class 2) Hardness 40 to <50mg/l CaCO ₃	
			0.09	0.6	(Class 3) Hardness 50 to <100mg/l CaCO ₃	
			0.15	0.9	(Class 4) Hardness 100 to <200mg/l CaCO ₃	
			0.25	1.5	(Class 5) Hardness ≥200mg/l CaCO ₃	
		Mercury		0.07		

3.8 Environmental Risk Assessment & Risk Quotients

A commonly used deterministic approach to evaluate risk is the Risk Quotient (RQ). The RQ is calculated by dividing a point estimate of exposure by a point estimate of effect to identify the level of risk. This ratio is a simple, screening-level estimate of high or low risk situations.

$$\text{Risk Quotient} = \frac{\text{Exposure}}{\text{Toxicity}}$$

Deterministic approaches are used to assess adverse impacts of a given hazard scenario and serve as a method to integrate the results of exposure and ecotoxicity data. Low RQ values imply that ecological threats are minimal and therefore no further work is needed. Moderate RQ values suggest that the ecological risk assessment should be kept under review. High RQ values (generally above 1) indicate that there is the possibility of adverse ecological effects, and a more detailed ecological risk assessment or programmes of measure should be implemented to address the issue.

For this project, the risk of EQS exceedances was calculated by dividing exposure estimates by the acute ecotoxicity value for the Annual Average Risk Quotient (RQ_{AA}) and the chronic ecotoxicity value for the Maximum Allowable Concentration Risk Quotient (RQ_{MAC}). To determine the RQ_{AA}, the mean of the sample data was divided by the EQS_{AA}. To measure the RQ_{MAC}, the highest measurement was divided by the EQS_{MAC}.

$$\text{Risk Quotient} = \frac{\text{Measured Environmental Concentration}}{\text{Environmental Quality Standard}}$$

Table 4 below outlines the categories of Risk Quotient that were applied and Appendices 2 and 3 provide a detailed breakdown of the calculated RQs for the relevant metals at each mine site.

Table 4 Risk Quotient Categories

Risk category	Risk Quotient scale
Very Low	RQ < 0.1
Low	0.1 ≤ RQ < 0.5
Moderate	0.5 ≤ RQ < 1
High	1 ≤ RQ < 10
Very high	RQ ≥ 10

4 Findings from Mine Sites

A comprehensive description of the findings at each mine site are available as individual [Mine Fact Sheets](#). The results of EQS and RQ assessments at each mine site are discussed in this section.

4.1 Environmental Quality Standard (EQS) Assessment

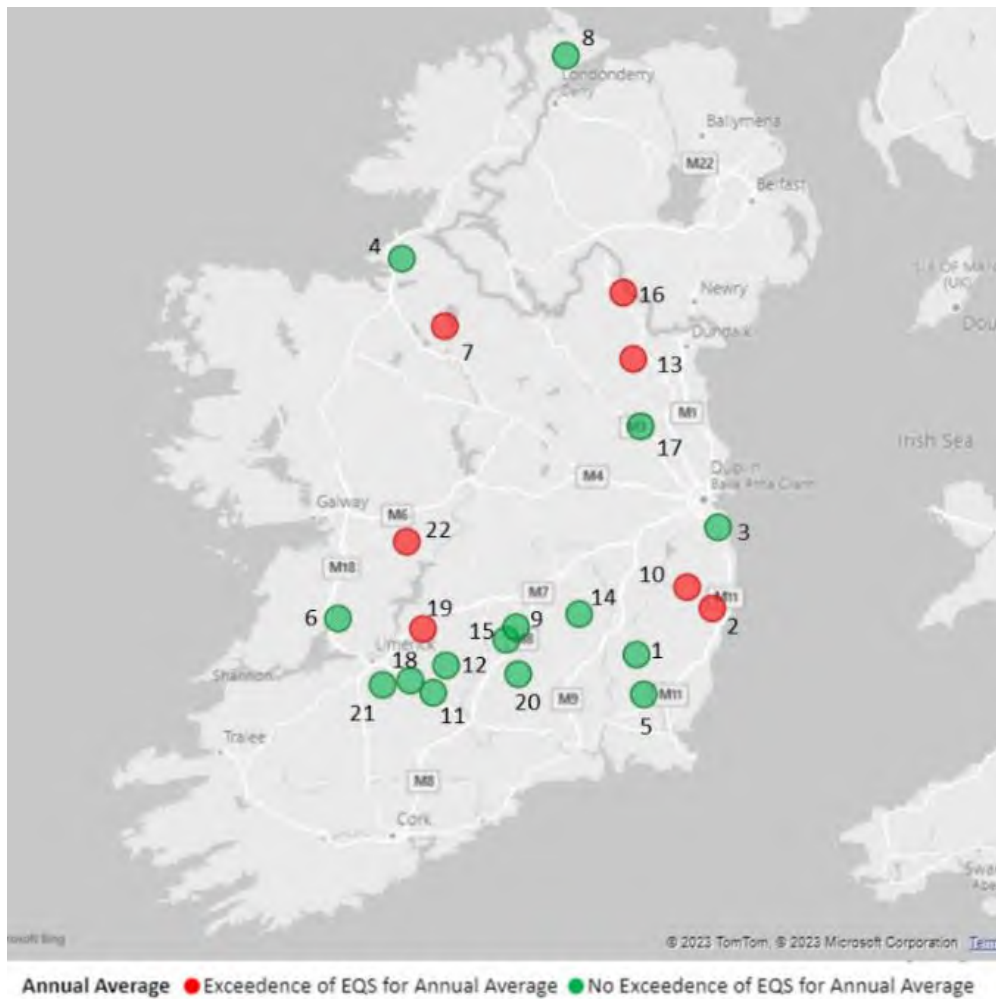
It is evident that some mines do not pose a significant risk to the ecological and chemical status of the waterbodies in their vicinity. However, it is also clear that some sites consistently fail the EQS_{AA}, EQS_{MAC} or both.

EQS_{AA}

Seven mine sites had at least one exceedance of the EQS_{AA} over the two-year period – Avoca, Connacht Coalfield, Glendalough/Glendasan/Glenmalure, Knocknacran/Drummond, Monaghan Lead Mines, Silvermines and Tynagh. Figure 8 shows the EQS_{AA} results for all mine sites.

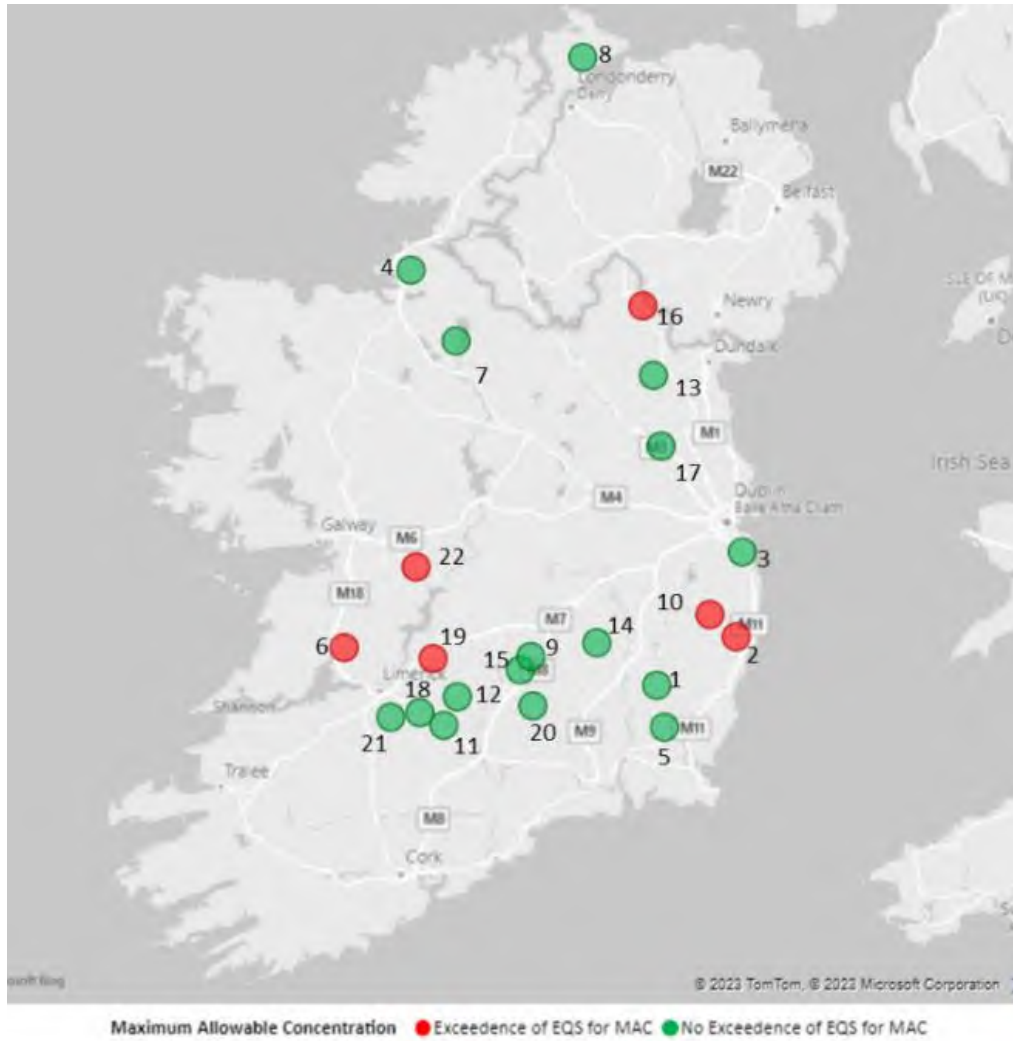
EQS_{MAC}

Six of the mines had at least one exceedance of the EQS_{MAC} over the two-year period – Avoca, Clare Lead Mines, Glendalough/Glendasan/Glenmalure, Monaghan Lead Mines, Silvermines and Tynagh. Figure 9 shows the EQS_{MAC} results for all mine sites.



Historic and Operational Mine Sites 2020-2021 EQS _{AA}					
1	✓	Aclare	12	✓	Hollyford
2	✗	Avoca	13	✗	Knocknacran/ Drummond
3	✓	Ballycorus	14	✓	Leinster Coalfield
4	✓	Benbulbin	15	✓	Lisheen
5	✓	Caim	16	✗	Monaghan Lead Mines
6	✓	Clare Lead Mines	17	✓	Navan
7	✗	Connacht Coalfield	18	✓	Pallas Green
8	✓	Glentogher	19	✗	Silvermines
9	✓	Galmoy	20	✓	Slieve Ardagh Coalfield
10	✗	Glendalough/Glendasan/Glenmalure	21	✓	Stonepark
11	✓	Gortdrum	22	✗	Tynagh

Figure 8 EQS_{AA} Map (Pass: ✓, Fail: ✗)



Historic and Operational Mine Sites 2020-2021 EQS _{MAC}					
1	✓	Aclare	12	✓	Hollyford
2	✗	Avoca	13	✓	Knocknacran/Drummond
3	✓	Ballycorus	14	✓	Leinster Coalfield
4	✓	Benbulbin	15	✓	Lisheen
5	✓	Caim	16	✗	Monaghan Lead Mines
6	✗	Clare Lead Mines	17	✓	Navan
7	✓	Connacht Coalfield	18	✓	Pallas Green
8	✓	Glentogher	19	✗	Silvermines
9	✓	Galmoy	20	✓	Slieve Ardagh Coalfield
10	✗	Glendalough/Glendasan/Glenmalure	21	✓	Stonepark
11	✓	Gortdrum	22	✗	Tynagh

Figure 9 EQS_{MAC} Map (Pass: ✓, Fail: ✗)

4.2 Risk Quotient Assessment

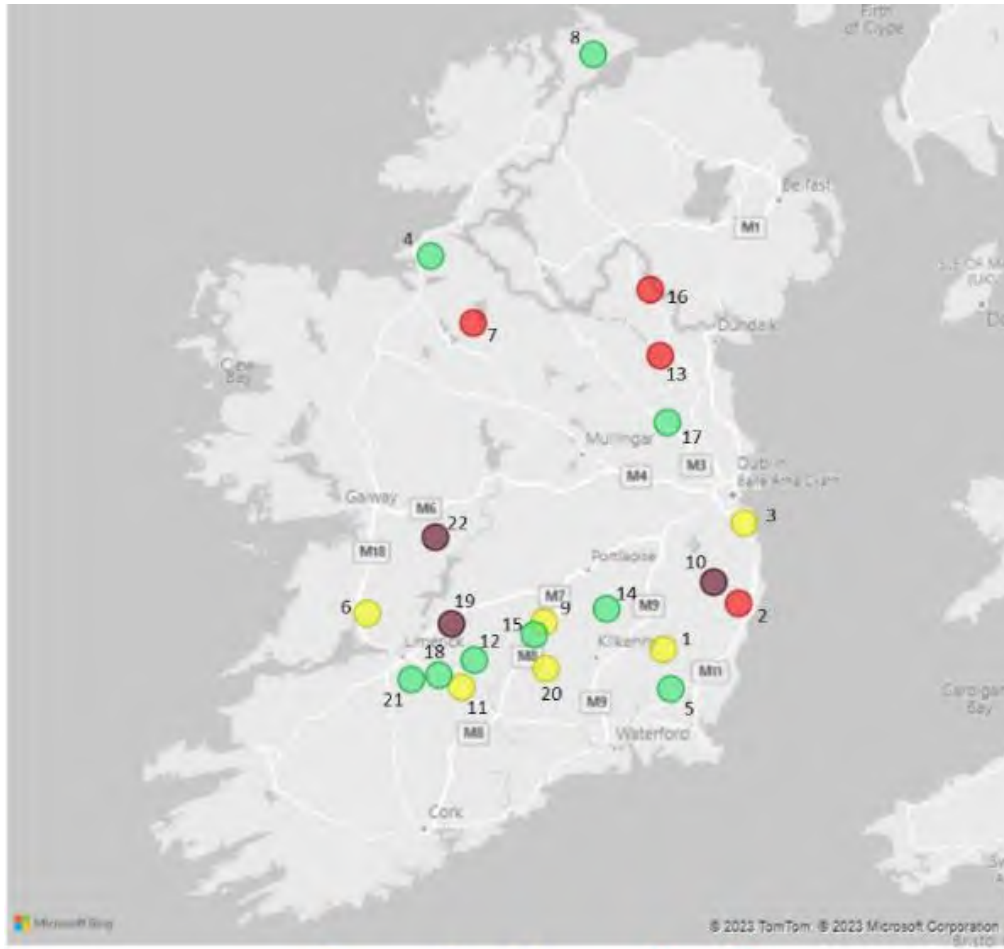
Risk quotients were used to assess the level of risk of EQS failures and to aid in decision making for further monitoring requirements. For all monitoring stations, both the RQ_{AA} and RQ_{MAC} were calculated. A full breakdown of all calculated RQs can be viewed in [Appendix 1](#) and [Appendix 2](#).

RQ_{AA}

When the RQ_{AA} is considered, it is evident that three mine sites have very high risk – Glendalough/Glendasan/Glenmalure, Silvermines and Tynagh. Four mine sites are high risk – Avoca, Connacht Coalfield, Knocknacran/Drummond and Monaghan Lead Mines. These sites will be prioritised for further monitoring as they have EQS_{AA} exceedances. Five other mine sites were classified as moderate risk also need to be considered for further monitoring – Aclare, Ballycorus, Galmoy, Gortdrum and Slieve Ardagh Coalfield. Figure 10 shows the RQ_{AA} results for all mine sites.

RQ_{MAC}

Six mines have high risk RQ_{MAC} – Avoca, Clare Lead Mines, Glendalough/Glendasan/Glenmalure, Monaghan Lead Mines, Silvermines and Tynagh. Figure 11 shows the RQ_{MAC} results for all mine sites.

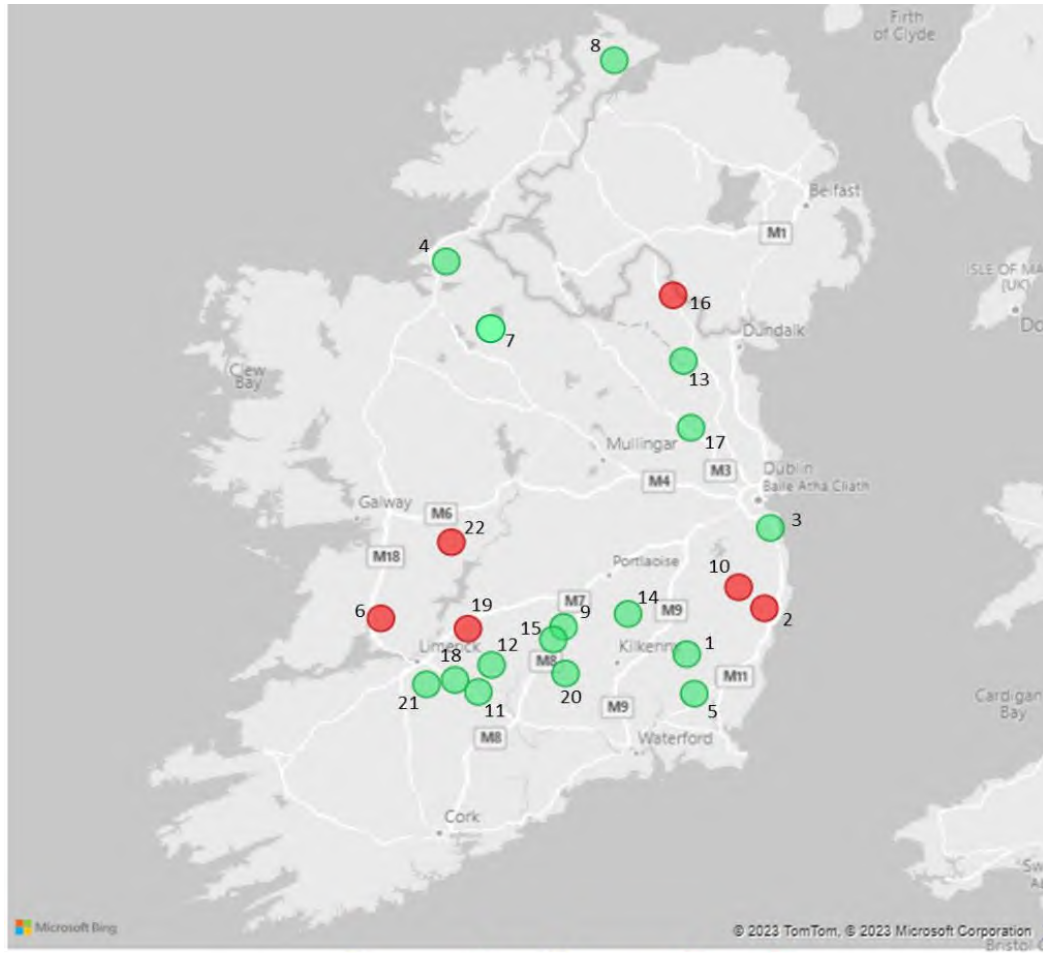


Risk Quotient AA: ● Very Low ● Low ● Moderate ● High ● Very High

Historic and Operational Mine Sites 2020-2021 RQ _{AA}		Risk
4	Benbulbin	Low
5	Caim	
8	Glentogher	
12	Hollyford	
14	Leinster Coalfield	
15	Lisheen	
17	Navan	
18	Pallas Green	
21	Stonepark	
1	Aclare	Moderate
3	Ballycorus	
6	Clare Lead Mines	
9	Galmoy	
11	Gortdrum	
20	Slieve Ardagh Coalfield	
2	Avoca	High
7	Connacht Coalfield	
13	Knocknacran/Drummond	
16	Monaghan Lead Mines	
10	Glendalough/Glendasan/Glenmalure	Very High
19	Silvermines	
22	Tynagh	

Risk Category	Risk Quotient Scale
Very low	RQ < 0.1
Low	0.1 ≤ RQ < 0.5
Moderate	0.5 ≤ RQ < 1
High	1 ≤ RQ < 10
Very high	RQ ≥ 10

Figure 10 RQ_{AA} Map



Risk Quotient MAC: ● Very Low ● Low ● Moderate ● High ● Very High

Historic and Operational Mine Sites 2020-2021 RQ _{MAC}		Risk	
1	Aclare	Low	
3	Ballycorus		
4	Benbulbin		
5	Caim		
7	Connacht Coalfield		
8	Glentogher		
9	Galmoy		
11	Gortdrum		
12	Hollyford		
13	Knocknacran/Drummond		
14	Leinster Coalfield		
15	Lisheen		
17	Navan		
18	Pallas Green		
20	Slieve Ardagh Coalfield		
21	Stonepark		
2	Avoca		High
6	Clare Lead Mines		
10	Glendalough/Glendasan/Glenmalure		
16	Monaghan Lead Mines		
19	Silvermines		
22	Tynagh		

Risk Category	Risk Quotient Scale
Very low	RQ < 0.1
Low	0.1 ≤ RQ < 0.5
Moderate	0.5 ≤ RQ < 1
High	1 ≤ RQ < 10
Very high	RQ ≥ 10

Figure 11 RQ_{MAC} Map

4.3 Summary of Findings from Mine Sites

The results of this study are being used to inform the EPA's WFD Monitoring Programme. Sites with EQS exceedances or sites with moderate, high or very high RQ have been included in the 2023/2024 WFD River Monitoring Programme. These sites are – Aclare, Avoca, Ballycorus, Clare Lead Mines, Connacht Coalfield, Galmoy, Glendalough/Glendasan/Glenmalure, Gortdrum, Knocknacran/Drummond, Monaghan Lead Mines, Slieve Ardagh Coalfield, Silvermines and Tynagh.


Two mine sites that are low risk (Lisheen and Navan) have also been retained for further monitoring as they have current EPA licences and may warrant on going compliance assessment.

The remaining low risk sites do not require further monitoring for metals – Benbulbin, Caim, Glentogher, Hollyford, Leinster Coalfield, Pallas Green and Stonepark. Future monitoring will only be required if there is significant change in mining activities in these areas e.g., in the case of prospecting licence areas.

A summary the findings from each mine site is presented in Table 5.

Table 5 Historic and Operational Mines Project 2020-2021: Findings from Mine Sites

No.	Mine	County	Mine Type	EQS _{AA}	RQ _{AA}	EQS _{MAC}	RQ _{MAC}	Further Monitoring	Link to Fact Sheet
1	Aclare	Carlow	Prospecting Licence Area	✓	Moderate (Cu)	✓	Low	Yes	🔗
2	Avoca	Wicklow	Historic Mine Site	✗	Moderate (Pb) High (Cd, Cu, Zn)	✗	High (Cd)	Yes	🔗
3	Ballycorus	Dublin	Historic Mine Site	✓	Moderate (Pb)	✓	Low	Yes	🔗
4	Benbulbin	Sligo	Historic Mine Site	✓	Low	✓	Low	No	🔗
5	Caim	Wexford	Historic Mine Site	✓	Low	✓	Low	No	🔗
6	Clare Lead Mines	Clare	Historic Mine Site	✓	Moderate (Ni)	✗	Moderate (Ni) High (Hg)	Yes	🔗
7	Connacht Coalfield	Roscommon/ Leitrim	Historic Mine Site	✗	Moderate (Cu) High (Cd, Ni)	✓	Low	Yes	🔗
8	Galmoy	Laois	EPA Licensed Mine Site	✓	Moderate (Pb, Ni)	✓	Low	Yes	🔗
9	Glendalough/ Glendasan/ Glenmalure	Wicklow	Historic Mine Site	✗	Very High (Cd, Cu, Pb, Zn)	✗	High (Cd, Pb)	Yes	🔗
10	Glentogher	Donegal	Historic Mine Site	✓	Low	✓	Low	No	🔗
11	Gortdrum	Tipperary	Historic Mine Site	✓	Moderate (Ni)	✓	Low	Yes	🔗

No.	Mine	County	Mine Type	EQS _{AA}	RQ _{AA}	EQS _{MAC}	RQ _{MAC}	Further Monitoring	Link to Fact Sheet
12	Hollyford	Tipperary	Historic Mine Site	✓	Low	✓	Low	No	
13	Knocknacran/ Drummond	Monaghan/ Cavan	EPA Licensed Mine Site	✗	Moderate (Cu) High (Zn)	✓	Low	Yes	
14	Leinster Coalfield	Laois/ Kilkenny/ Carlow	Historic Mine Site	✓	Low	✓	Low	No	
15	Lisheen	Tipperary	EPA Licensed Mine Site	✓	Low	✓	Low	Yes	
16	Monaghan Lead Mines	Monaghan	Historic Mine Site	✗	Moderate (Cd, Cu, Ni) High (Cd, Zn)	✗	High (Cd)	Yes	
17	Navan	Meath	EPA Licensed Mine Site	✓	Low	✓	Low	Yes	
18	Pallas Green	Limerick	Prospecting Licence Area	✓	Low	✓	Low	No	
19	Silvermines	Tipperary	Historic Mine Site	✗	High (Cu, Ni, Zn) Very High (Cd, Pb)	✗	High (Cd, Pb)	Yes	
20	Slieve Ardagh Coalfield	Tipperary	Historic Mine Site	✓	Moderate (Ni)	✓	Low	Yes	
21	Stonepark	Limerick	Prospecting Licence Area	✓	Low	✓	Low	No	
22	Tynagh	Galway	Historic Mine Site	✗	Moderate (Cu) High (Ni) Very High (Cd, Zn)	✗	Moderate (Ni) High (Cd)	Yes	

5 Conclusions and Recommendations

Mining areas have inherently high natural background levels of metals that are difficult to reduce. Therefore, it is recommended that relevant EPA units or national stakeholders explore programmes of measures to reduce additional emissions of hazardous metals.

The use of risk quotients in this study facilitated the prioritising of mine sites for further monitoring. This information can be used for future characterisation of pressures and emission sources in these waterbodies.

The results of this study are being used to inform the WFD Monitoring Programme. Sites with EQS exceedances or sites with moderate, high or very high RQs have been included in the 2023/2024 WFD River Monitoring Programme. Where there are multiple river monitoring stations on the same waterbody, a representative station will be selected. These stations will be monitored at priority substance frequency (i.e. 8 times per year) for a minimum of one year. If there are continued exceedances, the sites may be retained for further monitoring.

Further work could include passive sampling and biological/ecological monitoring. This work would be targeted for specific areas of concern as the original chemical assessment at the 22 mine sites is already completed by this report.

For those regions with high natural background levels, the use of Diffusive Gradients in Thin films (DGT) passive samplers for in-situ pre-concentration of relevant metals could be considered to determine the natural background levels. This would enable the determination of accurate mine discharge levels to surface waters above background levels to be established. Such information could also provide insights into the genuine loading in these waters as well as the exposure to aquatic fauna in sensitive headwaters which are regarded as important nurseries for such ecosystems. A targeted study of chemical monitoring coupled with ecological monitoring would provide evidence on the effect of high concentrations of hazardous metals on local biota populations and structures.

6 References

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Appendix 1 - Annual Average Risk Quotients (RQ_{AA})

Annual Average Risk Quotient (RQ_{AA}) by mine site, monitoring station and metal

Summary of All Mine Sites Annual Average Risk Quotients (RQ _{AA})									
Mine No.	Mine Site	Location to Mine/Station	Year	Arsenic RQ _{AA}	Cadmium RQ _{AA}	Copper RQ _{AA}	Lead RQ _{AA}	Nickel RQ _{AA}	Zinc RQ _{AA}
1	Aclare	Downstream RS12C100500	2020	N/A	N/A	N/A	N/A	N/A	N/A
			2021	0	0.4	0.6	0.1	0.3	0.1
2	Avoca	Upstream RS10A030680	2020	0	1.3	1.1	0.5	0.1	0.7
			2021	0	1	0.3	0.3	0.1	0.5
		Downstream RS10A030700	2020	0	6.9	3.9	0.7	0.2	3.8
			2021	0	8.6	3.8	0.7	0.3	4.6
3	Ballycorus	Upstream RS10S010200	2020	0.1	0.2	0.1	0.2	0.2	0
			2021	0.1	0.1	0.1	0.2	0.3	0.1
		Upstream RS010S010440	2020	0.1	0.2	0	0.2	0.1	0
			2021	0.1	0.2	0	0.1	0.1	0
		Upstream RS010S010450	2020	0.1	0.2	0.1	0.9	0.2	0.1
			2021	0.1	0.2	0	0.8	0.1	0.1
		Downstream RS010S010460	2020	0.1	0.2	0.1	0.7	0.3	0.1
			2021	0.1	0.2	0.1	0.7	0.1	0.1
4	Benbulbin	Downstream RS35D040200	2020	0	0.1	0.2	0.1	0.2	0.1
			2021	N/A	N/A	N/A	N/A	N/A	N/A
5	Caim	Upstream RS12U010200	2020	0	0.3	0.1	0.1	0.2	0.1
			2021	0	0.2	0.2	0.1	0.2	0.2
		Downstream RS12U010300	2020	0	0.1	0.1	0.1	0.1	0.1
			2021	0	0.2	0.1	0.1	0.1	0.1
		Downstream RS12B020500	2020	0	0.1	0.1	0.1	0.1	0.1
			2021	0	0.1	0.1	0.2	0.2	0.1
6	Clare Lead mines (Ballyhickey, Ballyvergin & Kilbricken)	Upstream RS27H010100	2020	0	0.1	0.1	0.1	0.4	0
			2021	0	0.1	0	0.1	0.4	0
		Downstream RS27H010200	2020	0	0	0.1	0.1	0.3	0
			2021	0.1	0	0	0.1	0.6	0.1
		Downstream RS27H010300	2020	0.1	0	0.1	0.1	0.7	0.1
			2021	0.1	0	0	0.1	0.4	0.1
		Downstream RS27M120740	2020	0.1	0.1	0.1	0.1	0.4	0.1
			2021	0.1	0.1	0	0.1	0.4	0.1

7	Connacht Coalfields	Downstream RS26A020100	2020	0	0.9	0.1	0.2	0.2	0.1
			2021	0	1.1	0.4	0.2	0.2	0.3
		Downstream RS26A020200	2020	0	0.5	0.1	0.2	1	0.2
			2021	0	0.4	0.1	0.3	0.7	0.2
		Downstream RS26A020300	2020	0	0.5	0.1	0.1	0.7	0.2
			2021	0	0.4	0.1	0.2	0.6	0.1
		Upstream RS26F020080	2020	0	0.1	0.1	0.1	0.1	0
			2021	0	0.1	0.8	0.3	0	0
		Downstream RS26G020200	2020	0	0.4	0.1	0.2	0.1	0
			2021	0	0.3	0.1	0.1	0.1	0
Downstream RS26F020400	2020	0	0.3	0.3	0.1	0.1	0.1		
	2021	0	0.3	0.3	0.1	0.1	0.1		
8	Glentogher	Upstream RS40D010020	2020	0	0.2	0.4	0.2	0.3	0.1
			2021	0	0.2	0.3	0.2	0.3	0.1
		Downstream RS40D010040	2020	0	0.4	0.3	0.4	0.2	0.2
			2021	0	0.4	0.2	0.2	0.2	0.1
9	Galmoy	Downstream RS15B120050	2020	0	0.1	0.1	0.1	0.4	0.1
			2021	0	0.1	0.1	0.1	0.3	0.1
		Downstream RS15E010100	2020	0	0.1	0	0.3	0.3	0
			2021	0	0	0	0.1	0.3	0
		Downstream RS15G020100	2020	0	0	0.1	0.1	0.2	0.1
			2021	0	0	0	0.1	0.2	0.1
		Downstream RS15G020200	2020	0	0	0	0.1	0.2	0.1
			2021	0	0	0	0.1	0.2	0.1
		Downstream RS15G020300	2020	0	0.1	0	0.1	0.2	0.1
			2021	0	0	0.2	0.5	0.1	0.1
		Downstream RS15G020500	2020	0	0	0	0.1	0.2	0.1
			2021	0	0	0	0.1	0.2	0.1
		Downstream RS15H020100	2020	0	0	0	0.1	0.4	0
			2021	0	0.1	0	0.1	0.3	0
		Downstream RS15R030100	2020	0	0.1	0.1	0.4	0.7	0.2
			2021	0	0.2	0.1	0.2	0.9	0.1
Downstream RS15R030500	2020	0	0.1	0.1	0.1	0.6	0.1		
	2021	0	0.1	0	0.1	0.5	0.1		
Downstream RS15R030600	2020	0	0.1	0	0.3	1	0.3		
	2021	0	0.1	0	0.1	0.5	0.1		
10	Glendalough, Glendasan & Glenmalure	Downstream RS10G050100	2020	0	1.1	0.1	0.4	0.1	2.3
			2021	0	7.2	0.2	1.3	0.2	10.2
		Downstream RS10G060150	2020	0	22.8	0.7	10.7	0.1	7
			2021	0	33	0.6	14.9	0.1	10.1
	2020	0	23.1	0.8	11.6	0.2	7.4		

		Downstream RS10G060200	2021	0	30.8	0.6	12.7	0.2	10
		Downstream RS10A040100	2020	0	0.5	0.3	0.8	0.1	0.2
			2021	0	0.5	0.1	0.3	0.1	0.2
		Downstream RS10A040400	2020	0	2.2	0.3	2.5	0.1	1
			2021	0	2.8	0.1	6.1	0.2	1.3
		Downstream RS10A040600	2020	0	1.3	7.9	1.1	0.2	1.1
			2021	0	1.1	13.3	1.8	0.1	1.5
11	Gortdrum	Upstream RS25H160070	2020	0	0	0	0.1	0.2	0
			2021	0.1	0	0.1	0.1	0.7	0
		Downstream RS25D010100	2020	0.1	0.1	0.2	0.1	0.4	0.1
			2021	0.1	0.1	0.2	0.1	0.6	0
12	Hollyford	Upstream RS16M020200	2020	0	0.1	0.3	0.1	0.2	0.1
			2021	0	0.1	0.2	0.1	0.2	0
		Downstream RS16M020540	2020	0	0.1	0.2	0.1	0.1	0.1
			2021	0	0.1	0.3	0.1	0.2	0
13	Knocknacran & Drummond	Upstream RS06M010096	2020	0	0.1	0.5	0.1	0.3	0
			2021	0	0.1	0.1	0.3	0.3	0.1
		Downstream RS06G020100	2020	0	0.1	0.1	0.1	0.4	1.4
			2021	0	0.1	0.1	0.1	0.3	1.3
		Downstream RS06M010098	2020	0	0.1	0.1	0.1	0.3	0
			2021	0	0.1	0.4	0.1	0.3	0.3
14	Leinster Coalfields	Upstream RS14S110100	2020	0	0.1	0	0	0.1	0
			2021	0	0.5	0.1	0.1	0.1	0
		Upstream RS14S110300	2020	0	0.1	0.1	0	0.1	0
			2021	0	0.5	0.1	0	0.2	0
		Downstream RS14F030290	2020	0	0.1	0	0	0.1	0
			2021	0	0.2	0.1	0	0.1	0.1
		Downstream RS15C030200	2020	0	0.3	0.2	0	0.3	0.1
			2021	0	0.3	0.1	0	0.3	0.1
		Downstream RS15D070250	2020	0	0.2	0.1	0	0.2	0.1
			2021	0	0.2	0.1	0	0.1	0.1
		Downstream RS15D070300	2020	0	0.2	0.1	0	0.1	0.1
			2021	0	0.1	0.1	0	0.1	0.1
15	Lisheen	Upstream RS16R010040	2020	0.2	0.1	0	0.1	0.1	0
			2021	0.2	0.1	0	0.1	0.1	0.1
		Downstream RS16D020068	2020	0.1	0.1	0	0.1	0.1	0.1
			2021	0.1	0.1	0	0.1	0.1	0
		Downstream RS16D020070	2020	0.1	0.1	0.1	0.1	0.1	0
			2021	0.1	0.1	0	0.1	0.1	0.1

		Downstream RS16D020100	2020	0.1	0.1	0	0.1	0.2	0.1
			2021	0.1	0	0	0.1	0.1	0
		Downstream RS16D020200	2020	0.1	0.1	0	0.1	0.1	0
			2021	0.1	0	0	0.1	0	0
16	Monaghan Lead mines (Clontibret, Hope & Tassan)	Upstream RS03C010800	2020	0	0.2	0.7	0.1	1	0.1
			2021	0	0.2	0.6	0.2	0.9	0.3
		Downstream RS03C011000	2020	0	0.3	0.5	0.3	0.8	0.1
			2021	0	0.2	0.6	0.1	0.9	0.2
		Downstream RS03C011100	2020	0.1	0.2	0.6	0.2	0.8	0.1
			2021	0.1	0.3	0.6	0.3	0.9	0.3
		Upstream RS06A010400	2020	0	0.3	0.6	0.1	0.3	0
			2021	0	0.3	0.6	0.1	0.2	0.3
		Downstream RS06A010800	2020	0	0.4	0.6	0.1	0.3	0
			2021	0	0.2	0.5	0.1	0.2	0
Downstream RS06C040115	2020	0	4.7	0.7	0.1	0.3	1		
	2021	0	3.4	0.7	0.1	0.3	1.1		
Downstream RS06F010190	2020	0	0.6	0.6	0	0.2	0.2		
	2021	0	0.6	0.6	0	0.3	0.3		
17	Navan	Upstream RS07Y010900	2020	0	0.2	0.2	0.1	0.3	0
			2021	0	0.2	0.1	0.1	0.2	0
		Downstream RS07B011790	2020	0	0.2	0.4	0.1	0.4	0.1
			2021	0	0.2	0.4	0.1	0.3	0.1
		Downstream RS07Y011100	2020	0	0.2	0.2	0.1	0.4	0.1
			2021	0	0.2	0.2	0.1	0.2	0.1
18	Pallas Green	Downstream RS25G050100	2020	0	0	0	0.1	0.4	0.1
			2021	0	0	0	0.1	0.3	0
		Downstream RS25M040200	2020	0	0.1	0.1	0.5	0.3	0
			2021	0	0.1	0.1	0.1	0.2	0
19	Silvermines	Downstream RS25K040120	2020	0	0.9	0	0.3	0.1	0.4
			2021	0	0.4	0	0.2	0.1	0.4
		Downstream RS25K040300	2020	0	0.4	0.1	0.2	0.1	0.5
			2021	0	0.3	0	0.2	0.2	0.4
		Downstream RS25K040700	2020	0	2.2	0.1	0.9	0.3	1.2
			2021	0	1	0	0.7	0.2	0.9
		Downstream RS25K040800	2020	0	2.1	0.1	0.7	0.2	1.2
			2021	0	0.9	0	0.7	0.2	0.8
		Downstream RS25K041000	2020	0	0.9	0.1	0.2	0.1	0.5
			2021	0	0.7	0	0.1	0.1	0.4
		Downstream RS25Y010200	2020	0	8.1	3.7	5.8	0.1	2.1
			2021	0	7.8	2.3	11.2	0.4	2.5

		Downstream RS25Y010300	2020	0	15.6	3.6	8.3	0.2	6.4		
			2021	0	20	0.3	14.2	1	6.9		
20	Slieve Ardagh Coalfield	Downstream RS15C200040	2020	0	0.1	0.1	0.1	0.2	0.1		
			2021	0	0.1	0	0.1	0.2	0		
		Downstream RS15K020100	2020	0	0.1	0.1	0.1	0.2	0.1		
			2021	0	0.1	0.1	0.5	0.2	0		
		Downstream RS15K020200	2020	0	0.1	0.1	0.1	0.4	0.1		
			2021	0	0.1	0.1	0.1	0.2	0		
		Downstream RS16B030100	2020	0	0.1	0	0.1	0.1	0		
			2021	0	0	0	0.1	0.1	0		
		Downstream RS16C010050	2020	0	0.1	0.1	0.1	0.1	0		
			2021	0	0	0	0.2	0.1	0		
		Downstream RS16K050100	2020	0	0.1	0.1	0.1	0.1	0		
			2021	0	0.1	0.1	0.2	0.5	0		
		21	Stonepark	Downstream RS25W210770	2020	0	0	0	0.1	0.3	0
					2021	0	0	0	0.1	0.3	0
22	Tynagh	Upstream RS25L060200	2020	0	0.2	0	0.1	0.5	0.2		
			2021	0	0.2	0	0.1	0.5	0.2		
		Upstream RS25M060200	2020	0	0.1	0	0.1	0.3	0.1		
			2021	0	0	0	0.1	0.3	0		
		Downstream RS25B140100	2020	0.1	22.5	0.1	0.3	3.2	29.3		
			2021	0.1	18.7	0.1	0.5	3.7	29.8		
		Downstream RS25L060400	2020	0	0.9	0	0.1	0.8	1.6		
			2021	0	1	0.1	0.2	0.7	1.3		
		Downstream RS25L070050	2020	0.1	0.2	0	0.2	0.1	0.1		
			2021	0.2	1.4	0.1	0.5	0.4	1.8		
		Downstream RS25L070200	2020	0	0.7	0	0.1	0.7	1.5		
			2021	0	0.8	0	0.1	0.6	1.3		

Appendix 2 - Maximum Allowable Concentration Risk Quotients (RQ_{MAC})

Maximum Allowable Concentration Risk Quotient (RQ_{MAC}) by mine site, monitoring station and metal

Summary of All Mine Sites Maximum Allowable Concentration Risk Quotients (RQ _{MAC})							
Mine No.	Mine Site	Location to Mine/Station	Year	Cadmium RQ _{MAC}	Lead RQ _{MAC}	Mercury RQ _{MAC}	Nickel RQ _{MAC}
1	Aclara	Downstream RS12C100500	2020	N/A	N/A	N/A	N/A
			2021	0.1	0.0	0.1	0.0
2	Avoca	Upstream RS10A030680	2020	0.3	0.3	0.3	0.0
			2021	0.2	0.1	0.1	0.0
		Downstream RS10A030700	2020	2.4	0.4	0.1	0.0
			2021	1.9	0.2	0.4	0.0
3	Ballycorus	Upstream RS10S010200	2020	0.0	0.0	0.1	0.0
			2021	0.1	0.0	0.1	0.0
		Upstream RS10S010440	2020	0.1	0.0	0.1	0.0
			2021	0.1	0.0	0.1	0.0
		Upstream RS10S010450	2020	0.0	0.1	0.1	0.0
			2021	0.0	0.1	0.1	0.0
		Downstream RS010S10460	2020	0.0	0.1	0.1	0.1
			2021	0.1	0.1	0.1	0.0
4	Benbulban	Downstream RS35D040200	2020	0.0	0.0	0.1	0.2
			2021	0.0	0.0	0.1	0.0
5	Caim	Upstream RS12U010200	2020	0.1	0.0	0.1	0.0
			2021	0.0	0.0	0.1	0.0
		Downstream RS12U010300	2020	0.0	0.0	0.1	0.0
			2021	0.0	0.0	0.1	0.0
		Downstream RS12B020500	2020	0.0	0.0	0.1	0.0
			2021	0.0	0.0	0.1	0.0
6	Clare Lead mines (Ballyhickey, Ballyvergin & Kilbricken)	Upstream RS27H010100	2020	0.0	0.0	0.1	0.1
			2021	0.0	0.0	0.7	0.3
		Downstream RS27H010200	2020	0.0	0.0	0.1	0.0
			2021	0.0	0.0	0.8	0.1
		Downstream RS27H010300	2020	0.0	0.0	0.1	0.2
			2021	0.0	0.0	0.3	0.8
		Downstream RS27M120740	2020	0.0	0.0	0.6	0.1
			2021	0.0	0.0	2.1	0.1

7	Connacht Coalfields	Downstream RS26A020100	2020	0.2	0.0	0.1	0.0		
			2021	0.2	0.0	0.1	0.0		
		Downstream RS26A020200	2020	0.1	0.0	0.1	0.2		
			2021	0.1	0.1	0.1	0.1		
		Downstream RS26A020300	2020	0.1	0.0	0.1	0.1		
			2021	0.1	0.0	0.1	0.1		
		Upstream RS26F020080	2020	0.0	0.0	0.4	0.0		
			2021	0.0	0.1	0.4	0.0		
		Downstream RS26O020200	2020	0.1	0.0	0.1	0.0		
			2021	0.1	0.0	0.1	0.0		
		Downstream RS26F020400	2020	0.1	0.0	0.1	0.0		
			2021	0.1	0.0	0.1	0.0		
		8	Glentogher	Upstream RS40D010020	2020	0.0	0.0	0.1	0.1
					2021	0.0	0.0	0.1	0.0
Downstream RS40D010040	2020			0.1	0.0	0.1	0.0		
	2021			0.1	0.0	0.1	0.0		
9	Galmoy	Downstream RS15B120050	2020	0.0	0.0	0.1	0.1		
			2021	0.0	0.0	0.1	0.0		
		Downstream RS15E010100	2020	0.1	0.1	0.1	0.1		
			2021	0.0	0.0	0.1	0.1		
		Downstream RS15G020100	2020	0.0	0.0	0.1	0.0		
			2021	0.0	0.0	0.1	0.0		
		Downstream RS15G020200	2020	0.0	0.0	0.1	0.0		
			2021	0.0	0.0	0.1	0.0		
		Downstream RS15G020300	2020	0.0	0.0	0.4	0.1		
			2021	0.0	0.2	0.1	0.0		
		Downstream RS15G020500	2020	0.0	0.0	0.1	0.0		
			2021	0.0	0.0	0.1	0.0		
		Downstream RS15H020100	2020	0.0	0.0	0.1	0.1		
			2021	0.0	0.0	0.1	0.1		
		Downstream RS15R030100	2020	0.0	0.1	0.1	0.1		
			2021	0.0	0.0	0.1	0.1		
		Downstream RS15R030500	2020	0.0	0.0	0.3	0.1		
			2021	0.0	0.0	0.1	0.1		
		Downstream RS15R030600	2020	0.0	0.1	0.1	0.2		
			2021	0.0	0.0	0.1	0.2		
10		Downstream RS10G050100	2020	0.4	0.5	0.1	0.0		
			2021	1.5	1.2	0.1	0.0		

	Glendalough, Glendasan & Glenmalure	Upstream RS10G060150	2020	6.0	8.6	0.1	0.0
			2021	7.8	3.3	0.1	0.0
		Downstream RS10G060200	2020	5.8	8.6	0.1	0.0
			2021	5.8	2.8	0.1	0.0
		Downstream RS10A040100	2020	0.1	0.1	0.1	0.0
			2021	0.1	0.0	0.1	0.0
		Downstream RS10A040400	2020	0.3	2.4	0.1	0.0
			2021	0.3	1.7	0.1	0.0
Downstream RS10A040600	2020	0.2	0.6	0.1	0.0		
	2021	0.2	1.1	0.1	0.0		
11	Gortdrum	Upstream RS25H160070	2020	0.0	0.0	0.1	0.1
			2021	0.0	0.1	0.1	0.4
		Downstream RS25D010100	2020	0.0	0.0	0.1	0.0
			2021	0.0	0.0	0.1	0.4
12	Hollyford	Upstream RS16M020200	2020	0.0	0.0	0.1	0.0
			2021	0.0	0.0	0.1	0.0
		Downstream RS16M020540	2020	0.0	0.0	0.1	0.0
			2021	0.0	0.0	0.1	0.0
13	Knocknacaran & Drummond	Upstream RS06M010096	2020	0.0	0.0	0.3	0.0
			2021	0.1	0.1	0.1	0.1
		Downstream RS06G020100	2020	0.0	0.0	0.1	0.1
			2021	0.0	0.0	0.1	0.0
		Downstream RS06M010098	2020	0.0	0.0	0.1	0.0
			2021	0.0	0.0	0.1	0.1
14	Leinster Coalfields	Upstream RS14S110100	2020	0.0	0.0	0.1	0.1
			2021	0.4	0.2	0.1	0.1
		Upstream RS14S110300	2020	0.0	0.0	0.4	0.1
			2021	0.2	0.1	0.0	0.1
		Downstream RS14F030290	2020	0.0	0.0	0.1	0.0
			2021	0.1	0.1	0.1	0.1
		Downstream RS15C030200	2020	0.1	0.0	0.1	0.1
			2021	0.1	0.0	0.1	0.1
		Downstream RS15D070250	2020	0.0	0.0	0.3	0.1
			2021	0.1	0.1	0.3	0.1
		Downstream RS15D070300	2020	0.0	0.0	0.1	0.1
			2021	0.0	0.0	0.1	0.1
15	Lisheen		2020	0.0	0.0	0.1	0.1

		Upstream RS16R010040	2021	0.0	0.0	0.1	0.2
		Downstream RS16D020068	2020	0.0	0.0	0.1	0.1
			2021	0.0	0.0	0.1	0.1
		Downstream RS16D020070	2020	0.0	0.0	0.1	0.1
			2021	0.0	0.0	0.1	0.1
		Downstream RS16D020100	2020	0.0	0.0	0.3	0.1
			2021	0.0	0.0	0.1	0.1
		Downstream RS16D020200	2020	0.0	0.0	0.4	0.2
			2021	0.0	0.0	0.1	0.1
16	Monaghan Lead mines (Clontibret, Hope & Tassan)	Upstream RS03C010800	2020	0.0	0.0	0.1	0.1
			2021	0.1	0.0	0.6	0.1
		Downstream RS03C011000	2020	0.1	0.0	0.1	0.1
			2021	0.1	0.0	0.1	0.2
		Downstream RS03C011100	2020	0.0	0.0	0.1	0.1
			2021	0.1	0.0	0.1	0.1
		Upstream RS06A010400	2020	0.1	0.0	0.1	0.2
			2021	0.1	0.0	0.1	0.1
		Downstream RS06A010800	2020	0.1	0.0	0.3	0.2
			2021	0.0	0.0	0.1	0.1
		Downstream RS06C040115	2020	1.0	0.0	0.1	0.0
			2021	1.2	0.0	0.1	0.0
Downstream RS06F010190	2020	0.1	0.0	0.3	0.0		
	2021	0.2	0.0	0.1	0.0		
17	Navan	Upstream RS07Y010900	2020	0.0	0.0	0.1	0.1
			2021	0.0	0.0	0.1	0.1
		Downstream RS07B011790	2020	0.0	0.0	0.1	0.1
			2021	0.0	0.0	0.1	0.0
		Downstream RS07Y011100	2020	0.0	0.0	0.1	0.1
			2021	0.1	0.0	0.1	0.1
18	Pallas Green	Downstream RS25G050100	2020	0.0	0.0	0.1	0.1
			2021	0.0	0.0	0.1	0.0
		Downstream RS25M040200	2020	0.0	0.0	0.1	0.1
			2021	0.0	0.0	0.1	0.0
19	Silvermines	Upstream RS25N010050	2020	0.0	0.0	0.1	0.0
			2021	0.0	0.0	0.1	0.0
		Downstream RS25K040120	2020	0.2	0.2	0.1	0.0
			2021	0.2	0.1	0.1	0.0
				2020	0.2	0.2	0.4

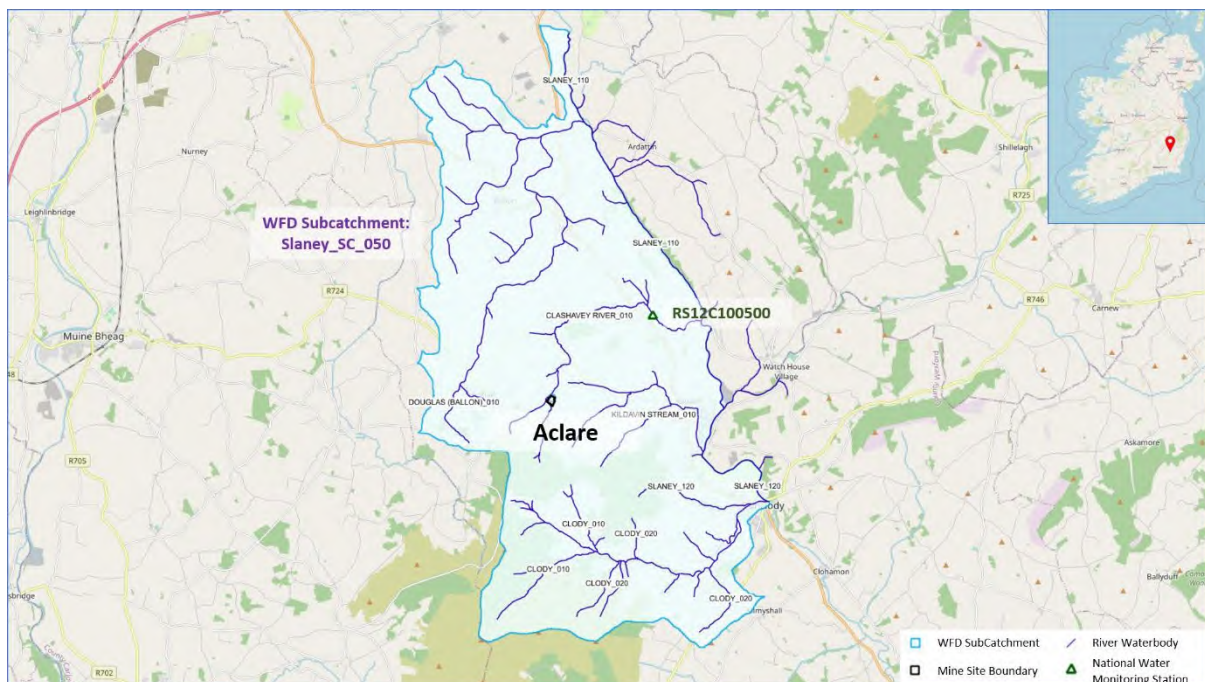
		Downstream RS25K040300	2021	0.2	0.1	0.1	0.1
		Downstream RS25K040700	2020	0.7	0.6	0.1	0.1
			2021	0.6	0.5	0.1	0.1
		Downstream RS25K040800	2020	0.7	0.6	0.1	0.1
			2021	0.7	0.4	0.1	0.1
		Downstream RS25K041000	2020	0.4	0.2	0.3	0.0
			2021	0.5	0.3	0.1	0.0
		Downstream RS25Y010200	2020	1.6	6.3	0.1	0.1
			2021	1.8	9.3	0.1	0.2
		Downstream RS25Y010300	2020	4.7	6.7	0.1	0.2
			2021	3.7	5.5	0.1	0.3
20	Slieve Ardagh Coalfield	Downstream RS15C200040	2020	0.0	0.0	0.1	0.1
			2021	0.0	0.0	0.1	0.1
		Downstream RS15K020100	2020	0.0	0.0	0.1	0.1
			2021	0.0	0.1	0.1	0.1
		Downstream RS15K020200	2020	0.0	0.0	0.1	0.1
			2021	0.0	0.0	0.1	0.1
		Downstream RS16B030100	2020	0.0	0.0	0.1	0.0
			2021	0.0	0.0	0.1	0.0
		Downstream RS16C010050	2020	0.0	0.2	0.5	0.0
			2021	0.0	0.1	0.1	0.1
		Downstream RS16K050100	2020	0.0	0.2	0.5	0.0
			2021	0.0	0.2	0.1	0.5
21	Stonepark	Downstream RS25W210770	2020	0.0	0.0	0.1	0.1
			2021	0.0	0.0	0.1	0.1
22	Tynagh	Upstream RS25L060200	2020	0.1	0.0	0.1	0.1
			2021	0.1	0.0	0.1	0.1
		Upstream RS25M060200	2020	0.0	0.0	0.1	0.0
			2021	0.0	0.0	0.1	0.0
		Downstream RS25B140100	2020	5.1	0.0	0.1	0.5
			2021	3.9	0.1	0.1	0.6
		Downstream RS25L060400	2020	0.2	0.0	0.1	0.1
			2021	0.3	0.0	0.1	0.1
		Downstream RS25L070050	2020	0.1	0.0	0.1	0.0
			2021	0.4	0.1	0.1	0.1
		Downstream RS25L070200	2020	0.2	0.0	0.3	0.1
			2021	0.3	0.0	0.1	0.1

Appendix 3 - Mine Fact Sheets

Aclare

is a mining exploration area located 2 km east of Myshall in Co. Carlow. There is currently no active mining occurring in this area but there is an exploration licence held by Blackstairs Lithium Company (BLC), a subsidiary of Ganfeng Lithium Corporation. Aclare is part of the southeast region Avalonia Project where there are several lithium pegmatite occurrences which contain lithium. Drill results at the Aclare target area shows lithium pegmatite bodies up to 20 m thick. Exploration licences have been renewed in the area since 2009. Any future development of mining operations at this site could warrant further monitoring of surrounding waterbodies. The results of investigative monitoring in this project will provide a baseline for metal concentrations in waterbodies in this area.

 Mine District: Aclare	 Mine Type: Prospecting Licence Area	 Location: Co. Carlow
 Grid Reference: E284700, N160000	 Minerals of Interest: Lithium Pegmatite	 Mine Operation: Historically explored & first phase in 2016
 HMS-IRC Class: N/A	 WFD Catchment: 12 Slaney & Wexford Harbour	 WFD Subcatchment: 12_8 Slaney_SC_050
 River Waterbodies: Clashavey River_010	 Elements of Interest: N/A	 EPA Licence No: N/A



Data Evaluation

Results of EQS_{AA} data analysis (Pass: ✓, Fail: ✗) for monitoring stations adjacent to Aclare

Monitoring Station	Location to Mine	Year	Arsenic	Cadmium	Copper	Lead	Nickel	Zinc
RS12C100500	Downstream	2020	N/A	N/A	N/A	N/A	N/A	N/A
		2021	✓	✓	✓	✓	✓	✓

Results of EQS_{MAC} data analysis (Pass: ✓, Fail: ✗) for monitoring stations adjacent to Aclare

Monitoring Station	Location to Mine	Year	Cadmium	Lead	Mercury	Nickel
RS12C100500	Downstream	2020	N/A	N/A	N/A	N/A
		2021	✓	✓	✓	✓

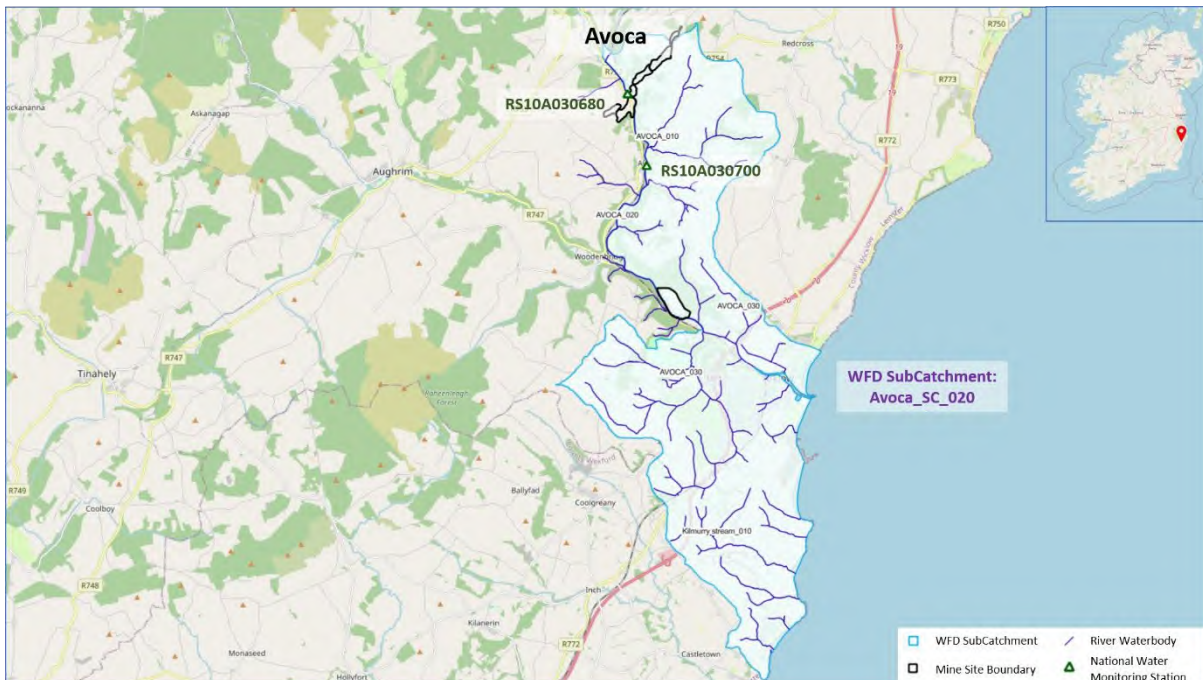
Key Observations

- The monitoring station downstream of Aclare (RS12C100500) has satisfactory metal concentrations with no exceedances of the EQS_{AA} or EQS_{MAC} values in 2021.
- Due to the lack of data for 2020 and a moderate RQ_{AA} classification from copper the monitoring station RS12C100500 has been included in the 2023 WFD Work Programme to allow for further assessment.
- If development of mining activities occurs in the future, consideration may be required for additional monitoring of metals in this area.

Avoca

mine district is located either side of the Avoca River northwest of the town of Avoca in Co. Wicklow. It was a copper mine with the earliest historical mining recorded around 1720 and activity continuing episodically for the next 260 years. The latest mining effort closed on the site in 1982. Historically the mine was subdivided into a series of small properties, but in modern times has generally been comprised of two distinct areas, East and West Avoca. In addition, tailings were pumped to a site at Shelton Abbey, 8 km downstream of the mine. Throughout the mine’s history, mine water was drained directly to the Avoca river. As a result, the mine water at Avoca is both acidic and metal rich. Several other historic mines are also located upstream of the Avoca mine district including Glendalough, Glendasan and Glenmalure.

 Mine District: Avoca	 Mine Type: Historic Mine	 Location: Co. Wicklow
 Grid Reference: E320502, N182865	 Minerals Worked: Cu, S, Ag	 Mine Operation: Closed since 1982, Long history of mining at site
 HMS-IRC Class: I	 WFD Catchment: 10 Ovoca-Vartry	 WFD Subcatchment: Avoca_SC_020, Avonmore_SC_020, Avonbeg_SC_010
 River Waterbodies: Avoca_010	 Elements of Interest: Pb, As, Zn, Cd, Ni	 EPA Licence No: N/A



Data Evaluation

Results of EQS_{AA} data analysis (Pass: ✓, Fail: ✗) for monitoring stations adjacent to Avoca Mine

Monitoring Station	Location to Mine	Year	Arsenic	Cadmium	Copper	Lead	Nickel	Zinc
RS10A030680	Upstream	2020	✓	✗	✗	✓	✓	✓
		2021	✓	✗	✓	✓	✓	✓
RS10A030700	Downstream	2020	✓	✗	✗	✓	✓	✗
		2021	✓	✗	✗	✓	✓	✗

Results of EQS_{MAC} data analysis (Pass: ✓, Fail: ✗) for monitoring stations adjacent to Avoca Mine

Monitoring Station	Location to Mine	Year	Cadmium	Lead	Mercury	Nickel
RS10A030680	Upstream	2020	✓	✓	✓	✓
		2021	✓	✓	✓	✓
RS10A030700	Downstream	2020	✗	✓	✓	✓
		2021	✗	✓	✓	✓

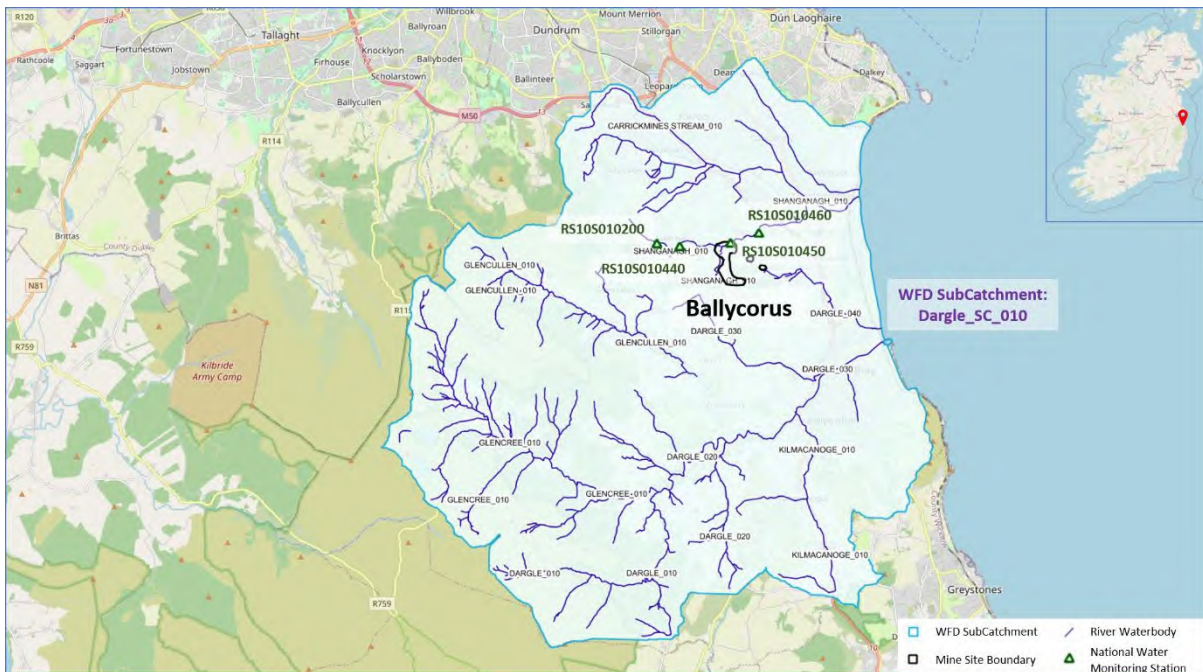
Key Observations

- The monitoring stations upstream and downstream of Avoca have unsatisfactory metal concentrations with exceedances of the EQS_{AA} for cadmium, copper and zinc and exceedances of the EQS_{MAC} for cadmium.
- Due to the exceedances of the EQS_{AA} and the EQS_{MAC} both monitoring stations RS10A030680 and RS10A030700 have been included in the 2023 WFD Work Programme to allow for further assessment.

Ballycorus

is located in south Co. Dublin, north of the Wicklow border. Mining began in the early part of the 19th century with shallow workings recorded in 1807. Some lead was mined here, but it was better known for its smelter and shot manufacturing. In addition, lead mined from the Glendalough district was processed here. The production of lead at Ballycorus rarely matched expectations due to mining being frequently interrupted from the discontinuous nature of the vein. Mining and exploration ceased at Ballycorus in 1860. Several original buildings are still visible around the site. The smelter chimney on the top of the hillside is intact as is much of the flue that carried the lead-rich smoke to the chimney from the smelter. There are no direct mine discharges on the Ballycorus site.

 Mine District: Ballycorus	 Mine Type: Historic Mine	 Location: Co. Dublin
 Grid Reference: E322283, N221384	 Minerals Worked: Pb, Ag	 Mine Operation: Mine closed in 1913
 HMS-IRC Class: IV	 WFD Catchment: 10 Ovoca-Vartry	 WFD Subcatchment: Dargle_SC_010
 River Waterbodies: Shanganagh_010	 Elements of Interest: Pb, Zn	 EPA Licence No: N/A



Data Evaluation

Results of EQS_{AA} data analysis (Pass: ✓, Fail: ✗) for monitoring stations adjacent to Ballycorus

Monitoring Station	Location to Mine	Year	Arsenic	Cadmium	Copper	Lead	Nickel	Zinc
RS10S010200	Upstream	2020	✓	✓	✓	✓	✓	✓
		2021	✓	✓	✓	✓	✓	✓
RS10S010440	Upstream	2020	✓	✓	✓	✓	✓	✓
		2021	✓	✓	✓	✓	✓	✓
RS10S010450	Upstream	2020	✓	✓	✓	✓	✓	✓
		2021	✓	✓	✓	✓	✓	✓
RS10S010460	Downstream	2020	✓	✓	✓	✓	✓	✓
		2021	✓	✓	✓	✓	✓	✓

Results of EQS_{MAC} data analysis (Pass: ✓, Fail: ✗) for monitoring stations adjacent to Ballycorus

Monitoring Station	Location to Mine	Year	Cadmium	Lead	Mercury	Nickel
RS10S010200	Upstream	2020	✓	✓	✓	✓
		2021	✓	✓	✓	✓
RS10S010440	Upstream	2020	✓	✓	✓	✓
		2021	✓	✓	✓	✓
RS10S010450	Upstream	2020	✓	✓	✓	✓
		2021	✓	✓	✓	✓
RS10S010460	Downstream	2020	✓	✓	✓	✓
		2021	✓	✓	✓	✓

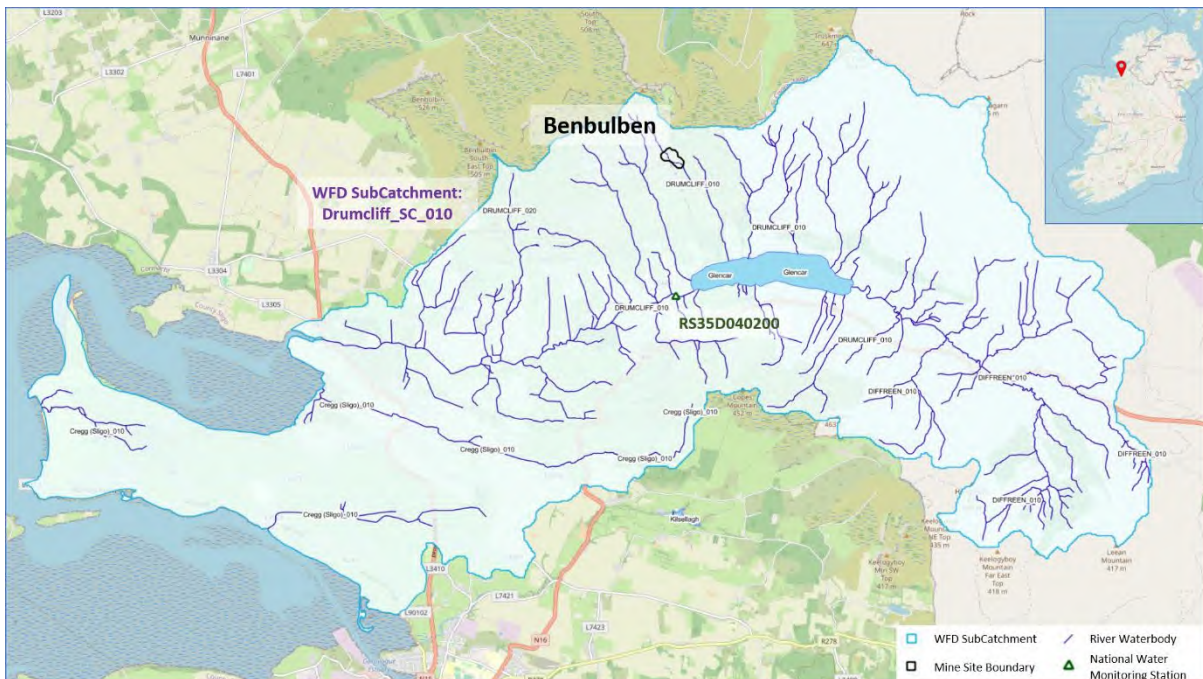
Key Observations

- The monitoring stations upstream and downstream of Ballycorus have satisfactory metal concentrations with no exceedances of the EQS_{AA} or EQS_{MAC} values in 2020 and 2021. This site does not require monitoring of metals at the upstream monitoring stations at present.
- Due to a moderate RQ_{AA} classification from lead the monitoring station RS10S010460 downstream of Ballycorus has been recommended for inclusion in the 2024 WFD Work Programme to allow for further assessment.

Benbulbin

mine is located 10 km north of Sligo town and lies between Truskmore and Kings mountain, part of the Benbulbin-Truskmore-Kings mountain table massif. It was a Barite mine that was first opened in 1858 and it moved through various forms of activity until the mine was finally closed in 1979. The mine site has several open mine workings as well as the remains of numerous 20th century mine buildings and structures. The mineralised vein was exploited from several adits (horizontal mining shafts) and underground levels over a length of more than 1 km. Due to the nature of the Benbulbin mine being located on the Benbulbin-Truskmore-Kings mountain the nearest waterbody downstream of the mine is the Glencar Lough and the downstream point selected for this study is on the outflow of the lake.

 Mine District: Benbulbin	 Mine Type: Historic Mine	 Location: Co. Sligo
 Grid Reference: E173217, N345263	 Minerals Worked: Barite	 Mine Operation: Mine closed in 1979
 HMS-IRC Class: V	 WFD Catchment: 35 Sligo Bay & Drowse	 WFD Subcatchment: Drumcliff_SC_010
 River Waterbodies: Drumcliff_010	 Elements of Interest: Cu	 EPA Licence No: N/A



Data Evaluation

Results of EQS_{AA} data analysis (Pass: ✓, Fail: ✗) for monitoring stations adjacent to Benbulben

Monitoring Station	Location to Mine	Year	Arsenic	Cadmium	Copper	Lead	Nickel	Zinc
RS35D040200	Downstream	2020	✓	✓	✓	✓	✓	✓
		2021	N/A	N/A	N/A	N/A	N/A	N/A

Results of EQS_{MAC} data analysis (Pass: ✓, Fail: ✗) for monitoring stations adjacent to Benbulben

Monitoring Station	Location to Mine	Year	Cadmium	Lead	Mercury	Nickel
RS35D040200	Downstream	2020	✓	✓	✓	✓
		2021	N/A	N/A	N/A	N/A

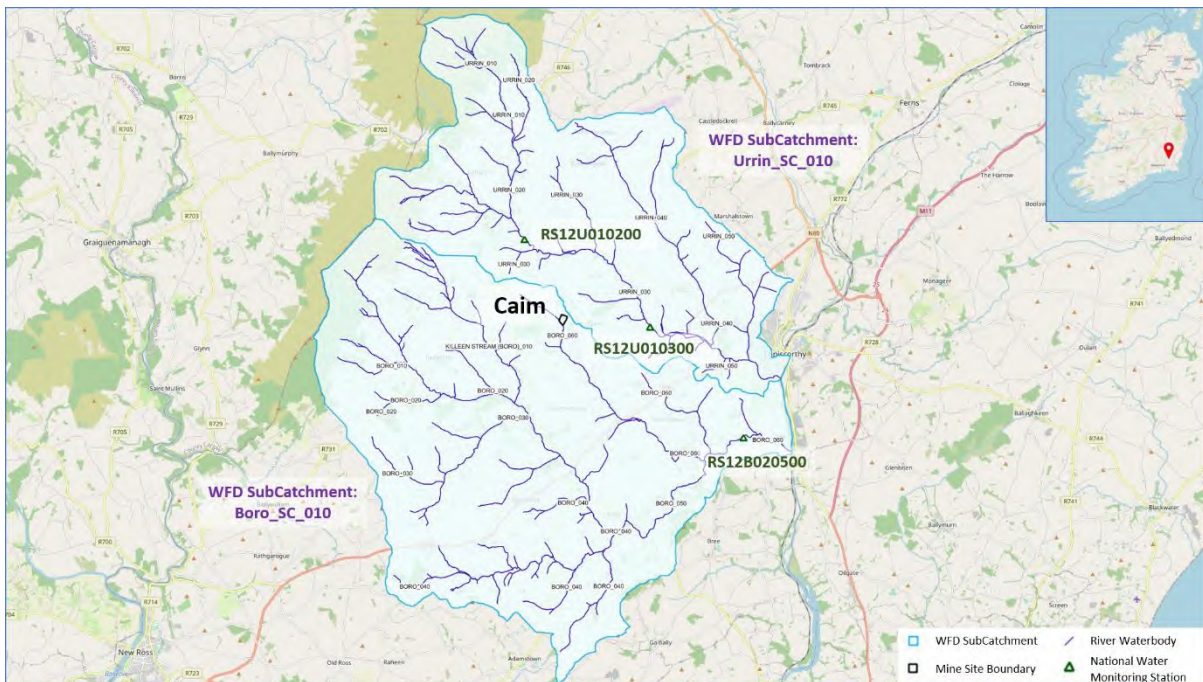
Key Observations

- The monitoring station downstream of the Benbulben mine has satisfactory metal concentrations with no exceedances of the EQS_{AA} or EQS_{MAC} values in 2020.
- Samples from 2021 were not included in this study due to a sampling error but the risk of issues with elevated metals is low for this site.
- This site does not require monitoring for metals at present.

Caim

is located in Co. Wexford and was open during the early to mid-19th century during which copper pyrites and lead yielding galena were mined. Production at the mine ceased in 1854 due to faulting in the mineralised zone. The mine site now comprises two distinct sections: the northern part, where most of the mining activity occurred and the southern part containing a large heap of processing waste. The site comprises legacy components of mining including a covered-over adit, overgrown/inaccessible shafts and two chimneys. Discharges from the site include surface waters on the site, adit discharge and spoil leachate.

 Mine District: Caim	 Mine Type: Historic Mine	 Location: Co. Wexford
 Grid Reference: E288549, N140967	 Minerals Worked: Pb, Cu	 Mine Operation: Production from approx. 1818 to 1854.
 HMS-IRC Class: III	 WFD Catchment: 12 Slaney & Wexford Harbour	 WFD Subcatchment: 12_7 Urrin_SC_010, 12_14 Boro_SC_010
 River Waterbodies: Urrin_020, Urrin_030, Boro_060	 Elements of Interest: Pb, Zn, Cu	 EPA Licence No: N/A



Data Evaluation

Results of EQS_{AA} data analysis (Pass: ✓, Fail: ✗) for monitoring stations adjacent to Caim

Monitoring Station	Location to Mine	Year	Arsenic	Cadmium	Copper	Lead	Nickel	Zinc
RS12U010200	Upstream	2020	✓	✓	✓	✓	✓	✓
		2021	✓	✓	✓	✓	✓	✓
RS12U010300	Downstream	2020	✓	✓	✓	✓	✓	✓
		2021	✓	✓	✓	✓	✓	✓
RS12B020500	Downstream	2020	✓	✓	✓	✓	✓	✓
		2021	✓	✓	✓	✓	✓	✓

Results of EQS_{MAC} data analysis (Pass: ✓, Fail: ✗) for monitoring stations adjacent to Caim

Monitoring Station	Location to Mine	Year	Cadmium	Lead	Mercury	Nickel
RS12U010200	Upstream	2020	✓	✓	✓	✓
		2021	✓	✓	✓	✓
RS12U010300	Downstream	2020	✓	✓	✓	✓
		2021	✓	✓	✓	✓
RS12B020500	Downstream	2020	✓	✓	✓	✓
		2021	✓	✓	✓	✓

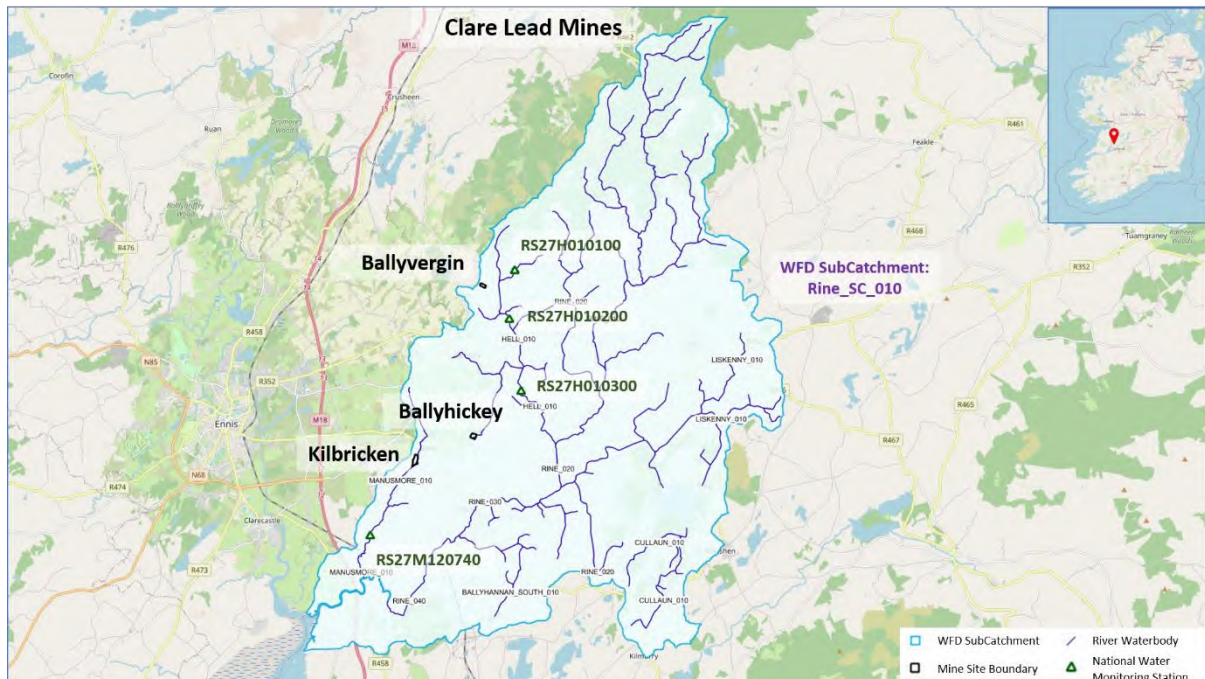
Key Observations

- The monitoring stations upstream and downstream of the Caim mine have satisfactory metal concentrations with no exceedances of the EQS_{AA} or EQS_{MAC} values in 2020 and 2021.
- This site does not require monitoring for metals at present.

Clare Lead Mines

consists of three closely spaced but separate mines, Ballyhickey, Ballyvergin and Kilbricken. They are located around Ennis and Quin in East Clare. The mine in Kilbricken was opened in 1834. A steam engine house and pump were installed in 1837 and another one in 1847, as the mine deepened. Production was ceased during 1854. The mine in Ballyhickey was opened in 1834. Between 1834 and 1838 a steam engine and engine house were erected on site and 2,500 tonnes of ore were extracted from an opencast mine. Mining appears to have died out rapidly and by 1840 production had declined to around 40 tons per month with the ore considered to have been nearly “worn out”. The works were reopened in 1853 and cleaned out but no ore was produced, and it is believed that production was ceased in 1854. Ballyvergin was operational between 1853 to 1861. It was opened specifically for mining copper, lead and silver.

 Mine District: Clare Lead Mines - Ballyhickey, Ballyvergin & Kilbricken	 Mine Type: Historic Mine	 Location: Co. Clare
 Grid Reference: E141735, N176868 E142143, N181731 E141735, N176868	 Minerals Worked: Pb, Ag, Cu	 Mine Operation: Legacy
 HMS-IRC Class: V	 WFD Catchment: 27 - Shannon Estuary North	 WFD Subcatchment: 27_6 Rine_SC_010
 River Waterbodies: Hell_010 & Manusmore_010	 Elements of Interest: Pb, Zn, Cu, As	 EPA Licence No: N/A



Data Evaluation

Results of EQS_{AA} data analysis (Pass: ✓, Fail: ✗) for monitoring stations adjacent to Clare Lead Mines

Monitoring Station	Location to Mine	Year	Arsenic	Cadmium	Copper	Lead	Nickel	Zinc
RS27H010100	Upstream	2020	✓	✓	✓	✓	✓	✓
		2021	✓	✓	✓	✓	✓	✓
RS27H010200	Downstream	2020	✓	✓	✓	✓	✓	✓
		2021	✓	✓	✓	✓	✓	✓
RS27H010300	Downstream	2020	✓	✓	✓	✓	✓	✓
		2021	✓	✓	✓	✓	✓	✓
RS27M120740	Downstream	2020	✓	✓	✓	✓	✓	✓
		2021	✓	✓	✓	✓	✓	✓

Results of EQS_{MAC} data analysis (Pass: ✓, Fail: ✗) for monitoring stations adjacent to Clare Lead Mines

Monitoring Station	Location to Mine	Year	Cadmium	Lead	Mercury	Nickel
RS27H010100	Upstream	2020	✓	✓	✓	✓
		2021	✓	✓	✓	✓
RS27H010200	Downstream	2020	✓	✓	✓	✓
		2021	✓	✓	✓	✓
RS27H010300	Downstream	2020	✓	✓	✓	✓
		2021	✓	✓	✓	✓
RS27M120740	Downstream	2020	✓	✓	✓	✓
		2021	✓	✓	✗	✓

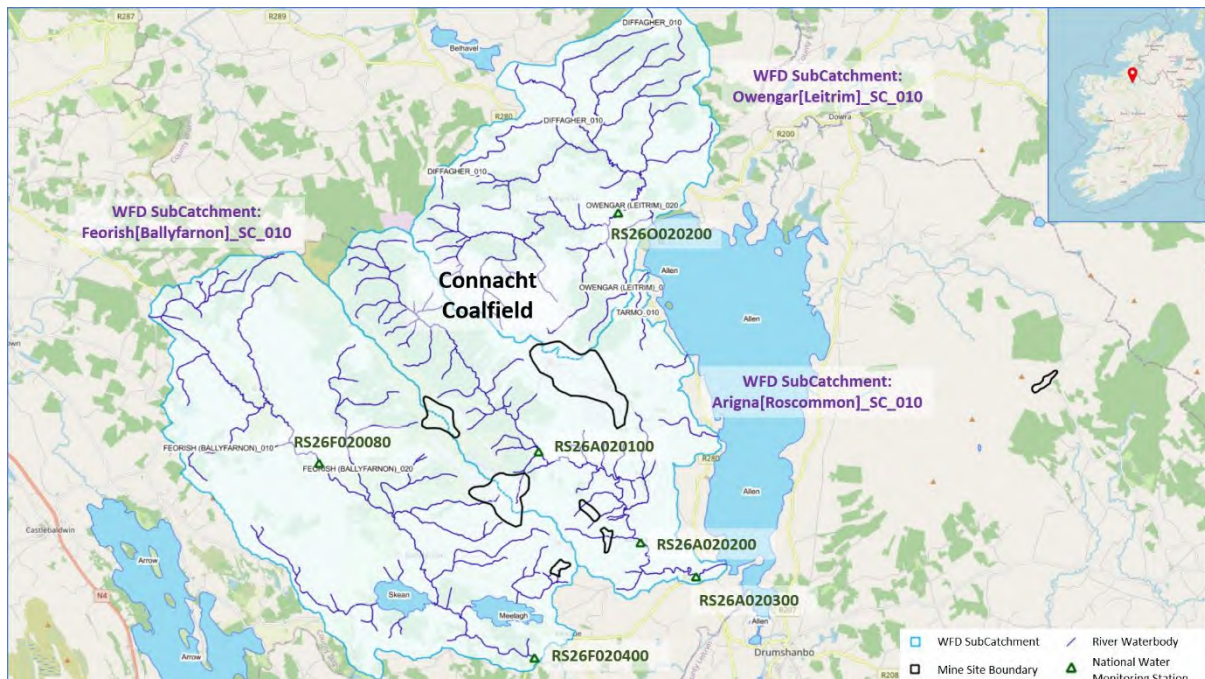
Key Observations

- Three of the monitoring stations upstream and downstream of Clare Lead Mines have satisfactory metal concentrations with no exceedances of the EQS_{AA} or EQS_{MAC} values in 2020 and 2021. These monitoring stations are in proximity to Ballyvergin and Ballyhickey mines.
- Due to moderate RQ_{AA} and RQ_{MAC} classifications from nickel, the monitoring station RS27H010200 downstream of Ballyvergin mine has been included in the 2023 WFD Work Programme to allow for further assessment.
- The downstream monitoring station RS27M120740 exceeded the EQS_{MAC} for mercury in 2021. This monitoring station is in proximity to Kilbricken mine. Due to the exceedance of the EQS_{MAC} for mercury, the monitoring station RS27M120740 downstream of Kilbricken Mine has been included in the 2023 WFD Work Programme to allow for further assessment.

Connacht Coalfield

is located in the hills east and west of Lough Allen, mainly in counties Leitrim and Roscommon. The initial mining activity in this area was concentrated around iron mining but a coal seam was discovered in 1765 and it was used to help fuel the furnaces for iron smelting. Coal mining continued after the iron mining ceased in 1872. Due to the remoteness of the area most of the coal produced was used in the local area as poor infrastructure meant access to a wider market was not feasible. Mining of the coalfield was extended when the ESB built a coal burning power station in the area in 1958. Once this was closed in 1990, mining ceased soon afterwards in the area. The main location of the coalfield is on two peaks either side of a valley with several streams running into Lough Allen.

 Mine District: Connacht Coalfield	 Mine Type: Historic Mine	 Location: Co. Roscommon
 Grid Reference: E193000, N314000	 Minerals Worked: Coal	 Mine Operation: Closed 1990
 HMS-IRC Class: V	 WFD Catchment: 26A - Upper Shannon	 WFD Subcatchment: Arigna_SC_010, Feorish_SC_010, Owengar_SC_010
 River Waterbodies: Arigna (Roscommon)_020	 Elements of Interest: Ni, Zn	 EPA Licence No: N/A



Data Evaluation

Results of EQS_{AA} data analysis (Pass: ✓, Fail: ✘) for monitoring stations adjacent to Connacht Coalfield

Monitoring Station	Location to Mine	Year	Arsenic	Cadmium	Copper	Lead	Nickel	Zinc
RS26F020080	Upstream	2020	✓	✓	✓	✓	✓	✓
		2021	✓	✓	✓	✓	✓	✓
RS26F020400	Downstream	2020	✓	✓	✓	✓	✓	✓
		2021	✓	✓	✓	✓	✓	✓
RS26O020200	Downstream	2020	✓	✓	✓	✓	✓	✓
		2021	✓	✓	✓	✓	✓	✓
RS26A020100	Downstream	2020	✓	✓	✓	✓	✓	✓
		2021	✓	✘	✓	✓	✓	✓
RS26A020200	Downstream	2020	✓	✓	✓	✓	✘	✓
		2021	✓	✓	✓	✓	✓	✓
RS26A020300	Downstream	2020	✓	✓	✓	✓	✓	✓
		2021	✓	✓	✓	✓	✓	✓

Results of EQS_{MAC} data analysis (Pass: ✓, Fail: ✘) for monitoring stations adjacent to Connacht Coalfield

Monitoring Station	Location to Mine	Year	Cadmium	Lead	Mercury	Nickel
RS26F020080	Upstream	2020	✓	✓	✓	✓
		2021	✓	✓	✓	✓
RS26F020400	Downstream	2020	✓	✓	✓	✓
		2021	✓	✓	✓	✓
RS26O020200	Downstream	2020	✓	✓	✓	✓
		2021	✓	✓	✓	✓
RS26A020100	Downstream	2020	✓	✓	✓	✓
		2021	✓	✓	✓	✓
RS26A020200	Downstream	2020	✓	✓	✓	✓
		2021	✓	✓	✓	✓
RS26A020300	Downstream	2020	✓	✓	✓	✓
		2021	✓	✓	✓	✓

Key Observations

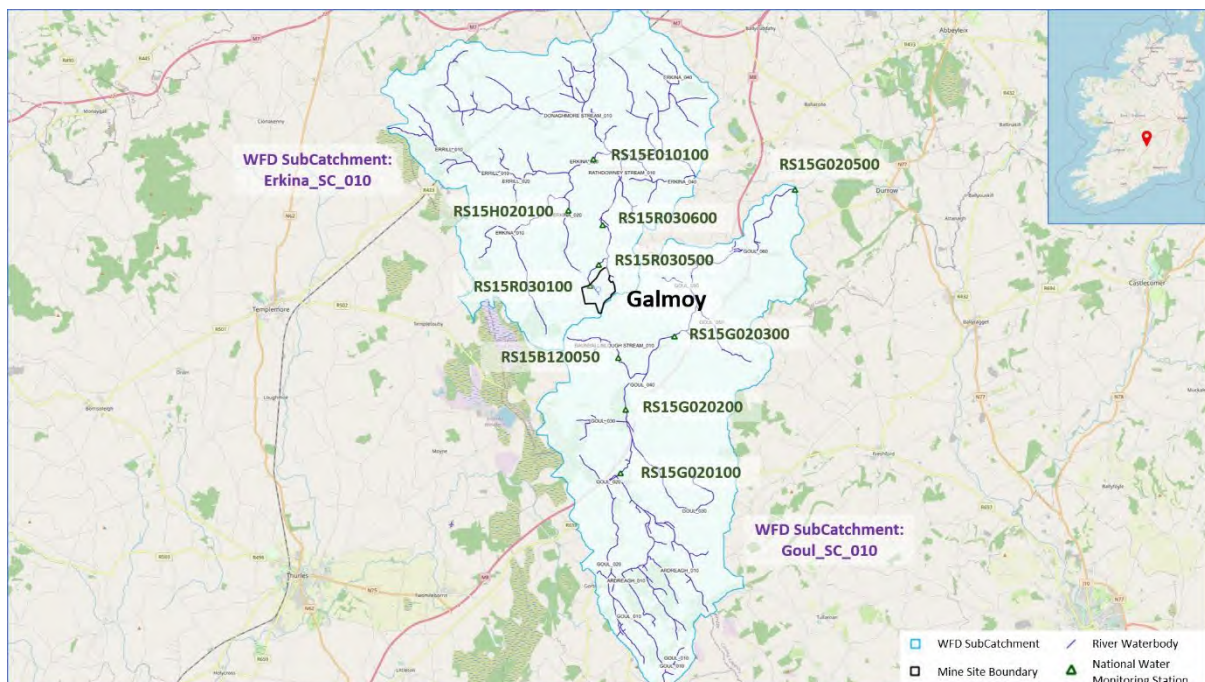
- The upstream monitoring stations and two of the downstream monitoring stations at Connacht Coalfield have satisfactory metal concentrations with no exceedances of the EQS_{AA} or EQS_{MAC} values in 2020 and 2021.
- The downstream monitoring station RS26A020100 exceeded the EQS_{AA} for cadmium in 2021. This monitoring station has been recommended for inclusion in the 2024 WFD Work Programme to allow for further assessment.
- The downstream monitoring station RS26A020200 exceeded the EQS_{AA} for nickel in 2020. This monitoring station has been included in the 2023 WFD Work Programme to allow for further assessment.
- Due to a moderate RQ_{AA} from copper the monitoring station RS26F020080 has been included in the 2023 WFD Work Programme to allow for further assessment.

Galmoy

mine is located in northwest Co. Kilkenny. From 1997 Galmoy Mines Limited produced 2.2 million tonnes of zinc and lead concentrate from the underground mine until the mine’s partial closure in 2009 and ceasing of extraction in 2012.

Galmoy is among the newer mines in Ireland which were opened, operated and closed under a regulatory framework for the mining sector which included provisions for the planned closures and rehabilitation of former mine sites. Galmoy, and IPC licensed EPA site is no longer in production, and continues to be monitored as part of its aftercare phase. In 2021 a new planning application was made by Shanon Resources Limited to Laois County Council to develop an underground mine extension to the former Galmoy Zinc & Lead Mine. The outcome of this application and any future development of mining operations at this site could warrant further monitoring of surrounding waterbodies.

 Mine District: Galmoy	 Mine Type: EPA Licensed Mine Site (Closed)	 Location: Co. Kilkenny
 Grid Reference: E226956, N172510	 Minerals Worked: Pb, Zn	 Mine Operation: Production from 1997 to 2012
 HMS-IRC Class: N/A	 WFD Catchment: 15 Nore	 WFD Subcatchment: Goul_SC_010, Erkina_SC_010
 River Waterbodies: Goul_020, Goul_030, Goul_040, Goul_060, Rathdowney Stream_010, Erkina_020, Baunballinlough Stream_010	 Elements of Interest: Pb, Zn	 EPA Licence No: P0517-02



Data Evaluation

Results of EQS_{AA} data analysis (Pass: ✓, Fail: ✗) for monitoring stations adjacent to Galmoy

Monitoring Station	Location to Mine	Year	Arsenic	Cadmium	Copper	Lead	Nickel	Zinc
RS15B120050	Downstream	2020	✓	✓	✓	✓	✓	✓
		2021	✓	✓	✓	✓	✓	✓
RS15E010100	Downstream	2020	✓	✓	✓	✓	✓	✓
		2021	✓	✓	✓	✓	✓	✓
RS15G020100	Downstream	2020	✓	✓	✓	✓	✓	✓
		2021	✓	✓	✓	✓	✓	✓
RS15G020200	Downstream	2020	✓	✓	✓	✓	✓	✓
		2021	✓	✓	✓	✓	✓	✓
RS15G020300	Downstream	2020	✓	✓	✓	✓	✓	✓
		2021	✓	✓	✓	✓	✓	✓
RS15G020500	Downstream	2020	✓	✓	✓	✓	✓	✓
		2021	✓	✓	✓	✓	✓	✓
RS15H020100	Downstream	2020	✓	✓	✓	✓	✓	✓
		2021	✓	✓	✓	✓	✓	✓
RS15R030100	Downstream	2020	✓	✓	✓	✓	✓	✓
		2021	✓	✓	✓	✓	✓	✓
RS15R030500	Downstream	2020	✓	✓	✓	✓	✓	✓
		2021	✓	✓	✓	✓	✓	✓
RS15R030600	Downstream	2020	✓	✓	✓	✓	✓	✓
		2021	✓	✓	✓	✓	✓	✓

Results of EQS_{MAC} data analysis (Pass: ✓, Fail: ✘) for monitoring stations adjacent to Galmoy

Monitoring Station	Location to Mine	Year	Cadmium	Lead	Mercury	Nickel
RS15B120050	Downstream	2020	✓	✓	✓	✓
		2021	✓	✓	✓	✓
RS15E010100	Downstream	2020	✓	✓	✓	✓
		2021	✓	✓	✓	✓
RS15G020100	Downstream	2020	✓	✓	✓	✓
		2021	✓	✓	✓	✓
RS15G020200	Downstream	2020	✓	✓	✓	✓
		2021	✓	✓	✓	✓
RS15G020300	Downstream	2020	✓	✓	✓	✓
		2021	✓	✓	✓	✓
RS15G020500	Downstream	2020	✓	✓	✓	✓
		2021	✓	✓	✓	✓
RS15H020100	Downstream	2020	✓	✓	✓	✓
		2021	✓	✓	✓	✓
RS15R030100	Downstream	2020	✓	✓	✓	✓
		2021	✓	✓	✓	✓
RS15R030500	Downstream	2020	✓	✓	✓	✓
		2021	✓	✓	✓	✓
RS15R030600	Downstream	2020	✓	✓	✓	✓
		2021	✓	✓	✓	✓

Key Observations

- The monitoring stations upstream and downstream of Galmoy Mine have satisfactory metal concentrations with no exceedances of the EQS_{AA} or EQS_{MAC} values in 2020 and 2021.
- Due to moderate RQ_{AA} from lead and nickel and due to Galmoy being a recently closed mine site with an active EPA licence, eight monitoring stations - RS15B120050, RS15E010100, RS15G020100, RS15G020200, RS15G020300, RS15G020500, RS15H020100 and RS15R030100 downstream of the mine have been recommended for inclusion in the 2024 WFD Work Programme to allow for further assessment. These stations were selected to be representative of the affected waterbodies.
- There is also a current planning submission for the recommencement of underground mining at the former Galmoy Zinc and Lead Mine, comprising access portal, declines, ventilation shafts and extensions to existing underground workings. If recommencement of mining activities occurs, increased monitoring of metals in this area may need to be considered.

Data Evaluation

Glendalough

Results of EQS_{AA} data analysis (Pass: ✓, Fail: ✗) for monitoring stations adjacent to Glendalough

Monitoring Station	Location to Mine	Year	Arsenic	Cadmium	Copper	Lead	Nickel	Zinc
RS10G050100	Downstream	2020	✓	✗	✓	✓	✓	✗
		2021	✓	✗	✓	✗	✓	✗

Results of EQS_{MAC} data analysis (Pass: ✓, Fail: ✗) for monitoring stations adjacent to Glendalough

Monitoring Station	Location to Mine	Year	Cadmium	Lead	Mercury	Nickel
RS10G050100	Downstream	2020	✓	✓	✓	✓
		2021	✓	✓	✓	✓

Key Observations

- The monitoring station RS10G050100 downstream of Glendalough Mine exceeded the EQS_{AA} for cadmium and zinc in 2020 and 2021 and exceeded the EQS_{AA} for lead in 2021. This monitoring station has been included in the 2023 WFD Work Programme to allow for further assessment.

Glendasan

Results of EQS_{AA} data analysis (Pass: ✓, Fail: ✗) for monitoring stations adjacent to Glendasan

Monitoring Station	Location to Mine	Year	Arsenic	Cadmium	Copper	Lead	Nickel	Zinc
RS10G060150	Downstream	2020	✓	✗	✓	✗	✓	✗
		2021	✓	✗	✓	✗	✓	✗
RS10G060200	Downstream	2020	✓	✗	✓	✗	✓	✗
		2021	✓	✗	✓	✗	✓	✗

Results of EQS_{MAC} data analysis (Pass: ✓, Fail: ✗) for monitoring stations adjacent to Glendasan

Monitoring Station	Location to Mine	Year	Cadmium	Lead	Mercury	Nickel
RS10G060150	Downstream	2020	✗	✗	✓	✓
		2021	✗	✗	✓	✓
RS10G060200	Downstream	2020	✗	✗	✓	✓
		2021	✗	✗	✓	✓

Key Observations

- The monitoring stations RS10G060150 and RS0G060200 downstream of Glendasan mine exceeded the EQS_{AA} for cadmium, lead and zinc in 2020 and 2021. There were also exceedances of the EQS_{MAC} for cadmium and lead in 2020 and 2021. These monitoring stations have been included in the 2023 WFD Work Programme to allow for further assessment.

Glenmalure

Results of EQS_{AA} data analysis (Pass: ✓, Fail: ✗) for monitoring stations adjacent to Glenmalure

Monitoring Station	Location to Mine	Year	Arsenic	Cadmium	Copper	Lead	Nickel	Zinc
RS10A040100	Downstream	2020	✓	✓	✓	✓	✓	✓
		2021	✓	✓	✓	✓	✓	✓
RS10A040400	Downstream	2020	✓	✗	✓	✗	✓	✗
		2021	✓	✗	✓	✗	✓	✗
RS10A040600	Downstream	2020	✓	✗	✗	✗	✓	✗
		2021	✓	✗	✗	✗	✓	✗

Results of EQS_{MAC} data analysis (Pass: ✓, Fail: ✗) for monitoring stations adjacent to Glenmalure

Monitoring Station	Location to Mine	Year	Cadmium	Lead	Mercury	Nickel
RS10A040100	Downstream	2020	✓	✓	✓	✓
		2021	✓	✓	✓	✓
RS10A040400	Downstream	2020	✓	✗	✓	✓
		2021	✓	✗	✓	✓
RS10A040600	Downstream	2020	✓	✓	✓	✓
		2021	✓	✗	✓	✓

Key Observations

- The downstream monitoring station RS10A040100 had no exceedances of the EQS_{AA} or EQS_{MAC} values for 2020 and 2021. However due to a moderate RQ_{AA} from cadmium and lead the monitoring station RS10A040100 has been included in the 2023 WFD Work Programme to allow for further assessment.
- The RS10A040400 and RS10A040600 monitoring stations which are further downstream of the Glenmalure mine had several exceedances. There were exceedances of the EQS_{AA} for cadmium, copper, lead and zinc in 2020 and 2021. EQS_{MAC} exceedances were also observed for lead at the RS10A040400 and RS10A040600 monitoring stations for 2020 and 2021. These monitoring stations have been included in the 2023 WFD Work Programme to allow for further assessment.

Glentogher

mine is one of the Donegal lead mines and is located on the Inishowen Peninsula in Co. Donegal, mid-way along the Glentogher River valley between Quigley's Point and Carndonagh. Small volumes of lead ore were mined in the early 20th century. Little information is available regarding pre-20th century production although both silver and zinc were supposedly mined along with lead. The mine was reopened for a period in the early 20th century when lead and silver ores were mined.

 Mine District: Glenogher	 Mine Type: Historic Mine	 Location: Co. Donegal
 Grid Reference: E247847, N437881	 Minerals Worked: Pb, Ag	 Mine Operation: Closed 1905
 HMS-IRC Class: V	 WFD Catchment: 40 Donagh-Moville	 WFD Subcatchment: Glennagannon_SC_010
 River Waterbodies: Donagh_010	 Elements of Interest: Pb, Zn, As	 EPA Licence No: N/A



Data Evaluation

Results of EQS_{AA} data analysis (Pass: ✓, Fail: ✗) for monitoring stations adjacent to Glentogher

Monitoring Station	Location to Mine	Year Sampled	Arsenic	Cadmium	Copper	Lead	Nickel	Zinc
RS40D010020	Upstream	2020	✓	✓	✓	✓	✓	✓
		2021	✓	✓	✓	✓	✓	✓
RS40D010040	Downstream	2020	✓	✓	✓	✓	✓	✓
		2021	✓	✓	✓	✓	✓	✓

Results of EQS_{MAC} data analysis (Pass: ✓, Fail: ✗) for monitoring stations adjacent to Glentogher

Monitoring Station	Location to Mine	Year Sampled	Cadmium	Lead	Mercury	Nickel
RS40D010020	Upstream	2020	✓	✓	✓	✓
		2021	✓	✓	✓	✓
RS40D010040	Downstream	2020	✓	✓	✓	✓
		2021	✓	✓	✓	✓

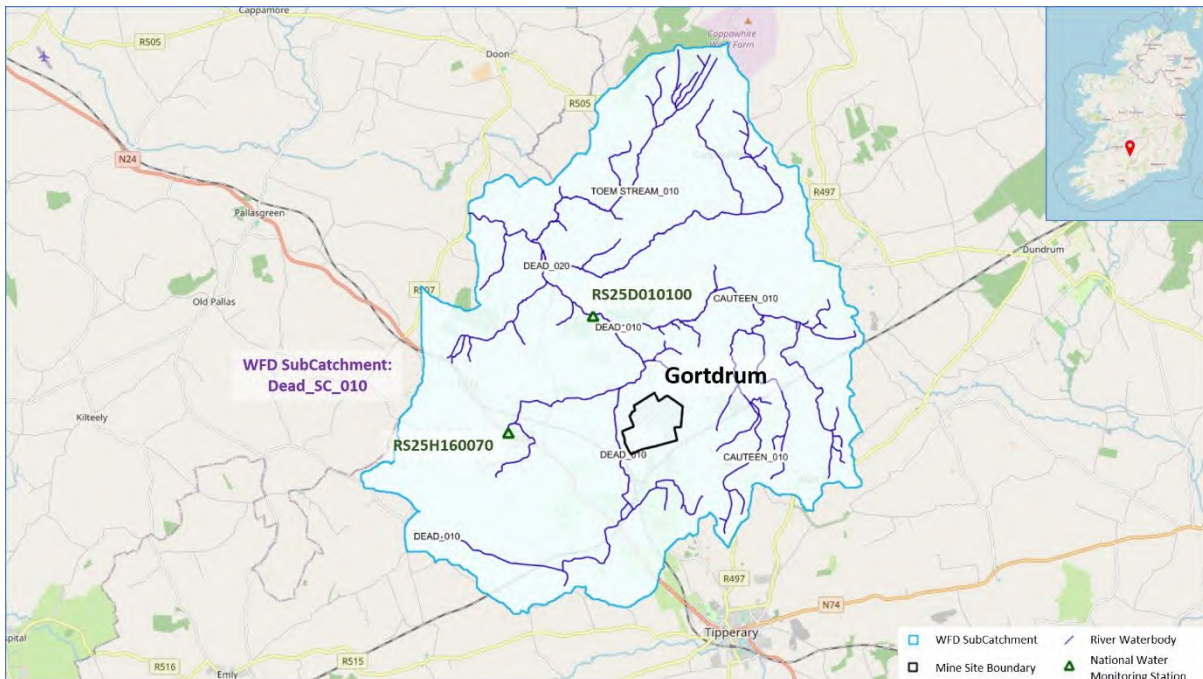
Key Observations

- The monitoring stations upstream and downstream of Glentogher have satisfactory metal concentrations with no exceedances of the EQS_{AA} or EQS_{MAC} values in 2020 and 2021.
- This site does not require monitoring for metals at present.

Gortdrum

mine is located 2.5 km north of Limerick Junction near Tipperary town. Copper, mercury, and silver were mined here between 1968 and 1975. Most mine buildings, including all the processing plant, have been removed. Production began in late 1967 but by early 1968 problems were encountered with mercury contamination of the copper concentrates. A mercury recovery plant was subsequently constructed and commissioned in 1969. Mine operation ceased in 1975. A prospecting licence was granted in 2015 to Group Eleven Resources Corp and forms part of the PG West Project (prospecting licence area).

 Mine District: Gortdrum	 Mine Type: Historic Mine	 Location: Co. Tipperary
 Grid Reference: E187111, N141012	 Minerals Worked: Cu, Hg, Ag	 Mine Operation: Closed - Production from 1966 to 1975. Prospecting licence granted in 2015.
 HMS-IRC Class: IV	 WFD Catchment: 25D Lower Shannon	 WFD Subcatchment: 25D_2 Dead_SC_010
 River Waterbodies: Clashavey Dead_010	 Elements of Interest: N/A	 EPA Licence No: N/A



Data Evaluation

Results of EQS_{AA} data analysis (Pass: ✓, Fail: ✗) for monitoring stations adjacent to Gortdrum

Monitoring Station	Location to Mine	Year	Arsenic	Cadmium	Copper	Lead	Nickel	Zinc
RS25H160070	Upstream	2020	✓	✓	✓	✓	✓	✓
		2021	✓	✓	✓	✓	✓	✓
RS25D010100	Downstream	2020	✓	✓	✓	✓	✓	✓
		2021	✓	✓	✓	✓	✓	✓

Results of EQS_{MAC} data analysis (Pass: ✓, Fail: ✗) for monitoring stations adjacent to Gortdrum

Monitoring Station	Location to Mine	Year	Cadmium	Lead	Mercury	Nickel
RS25H160070	Upstream	2020	✓	✓	✓	✓
		2021	✓	✓	✓	✓
RS25D010100	Downstream	2020	✓	✓	✓	✓
		2021	✓	✓	✓	✓

Key Observations

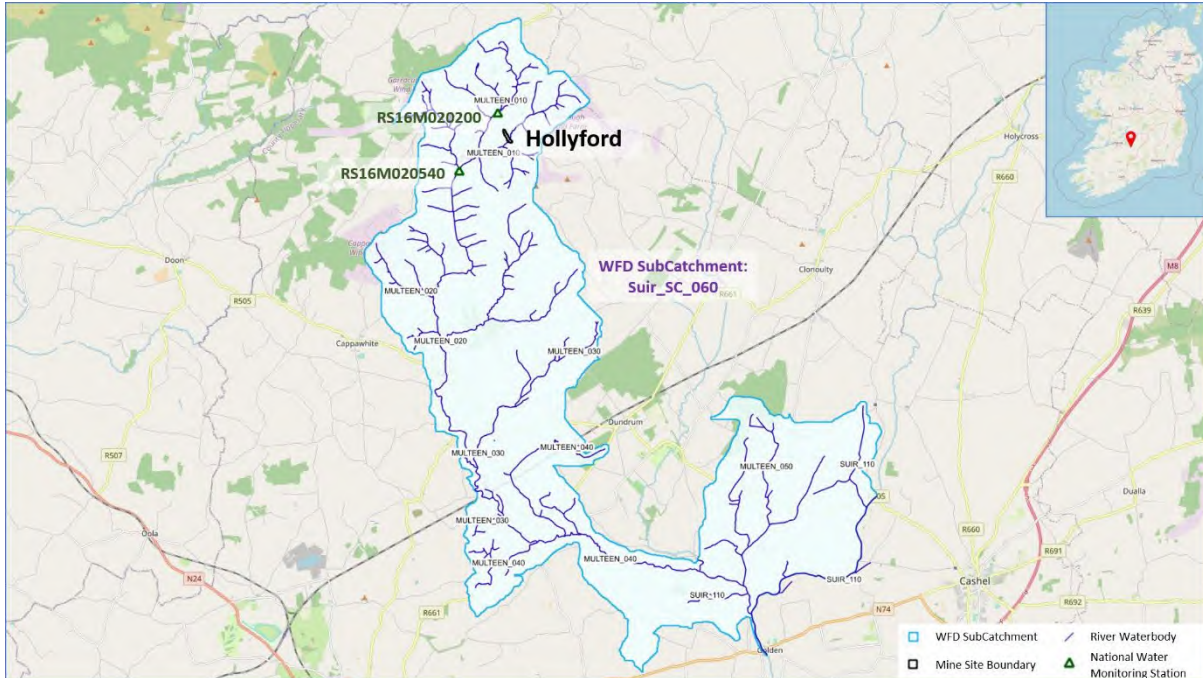
- The monitoring stations upstream and downstream of Gortdrum have satisfactory metal concentrations with no exceedances of the EQS_{AA} or EQS_{MAC} values in 2020 and 2021.
- Due to a moderate RQ_{AA} from nickel the monitoring station RS25D010100 downstream of Gortdrum has been recommended for inclusion in the 2023 WFD Work Programme to allow for further assessment.

Hollyford

mine is located 1 km north of Hollyford village and 20 km north of Tipperary town. This was a small mine that operated periodically between 1837 and 1862. The Mining Company of Ireland (MCI) controlled operations from 1837 to 1839

but due to problems with water, mining was suspended, and the lease was eventually cancelled in 1840. The mine was reopened under private ownership and was worked continuously from the mid-1840s until 1862 when low copper prices forced closure. Several mine features remain on the site including a chimney, a mine shaft, an adit and a solid waste heap.

 Mine District: Hollyford	 Mine Type: Historic Mine	 Location: Co. Tipperary
 Grid Reference: E193361, N154077	 Minerals Worked: Cu	 Mine Operation: Closed - Operated periodically from 1837 to 1862
 HMS-IRC Class: V	 WFD Catchment: 16 Suir	 WFD Subcatchment: Suir_SC_060
 River Waterbodies: Multeen_010	 Elements of Interest: Cu	 EPA Licence No: N/A



Data Evaluation

Results of EQS_{AA} data analysis (Pass: ✓, Fail: ✗) for monitoring stations adjacent to Hollyford

Monitoring Station	Location to Mine	Year	Arsenic	Cadmium	Copper	Lead	Nickel	Zinc
RS16M020200	Upstream	2020	✓	✓	✓	✓	✓	✓
		2021	✓	✓	✓	✓	✓	✓
RS16M020540	Downstream	2020	✓	✓	✓	✓	✓	✓
		2021	✓	✓	✓	✓	✓	✓

Results of EQS_{MAC} data analysis (Pass: ✓, Fail: ✗) for monitoring stations adjacent to Hollyford

Monitoring Station	Location to Mine	Year	Cadmium	Lead	Mercury	Nickel
RS16M020200	Upstream	2020	✓	✓	✓	✓
		2021	✓	✓	✓	✓
RS16M020540	Downstream	2020	✓	✓	✓	✓
		2021	✓	✓	✓	✓

Key Observations

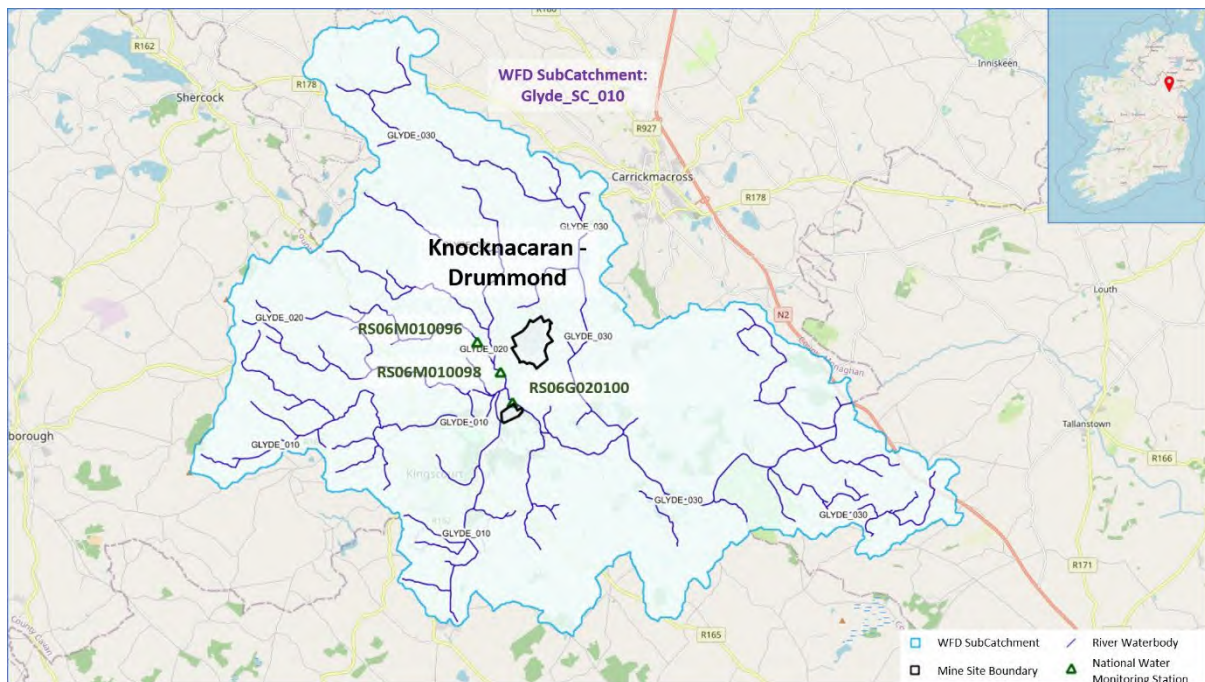
- The monitoring stations upstream and downstream of Hollyford have satisfactory metal concentrations with no exceedances of the EQS_{AA} or EQS_{MAC} values in 2020 and 2021.
- This site does not require monitoring for metals at present.

Knocknacran / Drummond

mine is a gypsum mine located between Kingscourt, Co. Cavan and Carrickmacross, Co. Monaghan. This is an active mining area and the gypsum mined from

the site is used in the nearby plaster and plasterboard plant in Kingscourt. The mine is split into two active mine sites: Drummond mine is an underground mine and the adjacent Knocknacran mine is an open pit mining operation. The mines produce between 300,000 to 500,000 tonnes of gypsum per annum. The mine has become well known in recent years after the mine shaft collapse at Drumgossatt in September 2018. Drumgossatt is a closed underground gypsum mine (used to store water pumped out of Knocknacran/ Drummond) and is currently the subject of a planning application seeking to redevelop the mine as an open cast activity for the extraction of gypsum. Knocknacran/ Drummond is an IPC licensed EPA site and is continuously monitored.

 Mine District: Knocknacran / Drummond	 Mine Type: EPA Licensed Mine Site (Open)	 Location: Co. Monaghan
 Grid Reference: E280740, N299480	 Minerals Worked: Gypsum	 Mine Operation: 1989 - Present
 HMS-IRC Class: N/A	 WFD Catchment: 06 - Newry, Fane, Glyde and Dee	 WFD Subcatchment: Glyde_SC_010
 River Waterbodies: Glyde_010, Glyde_020, Glyde_030	 Elements of Interest: N/A	 EPA Licence No: P0519-04



Data Evaluation

Results of EQS_{AA} data analysis (Pass: ✓, Fail: ✗) for monitoring stations adjacent to Knocknacran/ Drummond

Monitoring Station	Location to Mine	Year	Arsenic	Cadmium	Copper	Lead	Nickel	Zinc
RS06M010096	Upstream	2020	✓	✓	✓	✓	✓	✓
		2021	✓	✓	✓	✓	✓	✓
RS06G020100	Downstream	2020	✓	✓	✓	✓	✓	✗
		2021	✓	✓	✓	✓	✓	✗
RS06M010098	Downstream	2020	✓	✓	✓	✓	✓	✓
		2021	✓	✓	✓	✓	✓	✓

Results of EQS_{MAC} data analysis (Pass: ✓, Fail: ✗) for monitoring stations adjacent to Knocknacran/ Drummond

Monitoring Station	Location to Mine	Year	Cadmium	Lead	Mercury	Nickel
RS06M010096	Upstream	2020	✓	✓	✓	✓
		2021	✓	✓	✓	✓
RS06G020100	Downstream	2020	✓	✓	✓	✓
		2021	✓	✓	✓	✓
RS06M010098	Downstream	2020	✓	✓	✓	✓
		2021	✓	✓	✓	✓

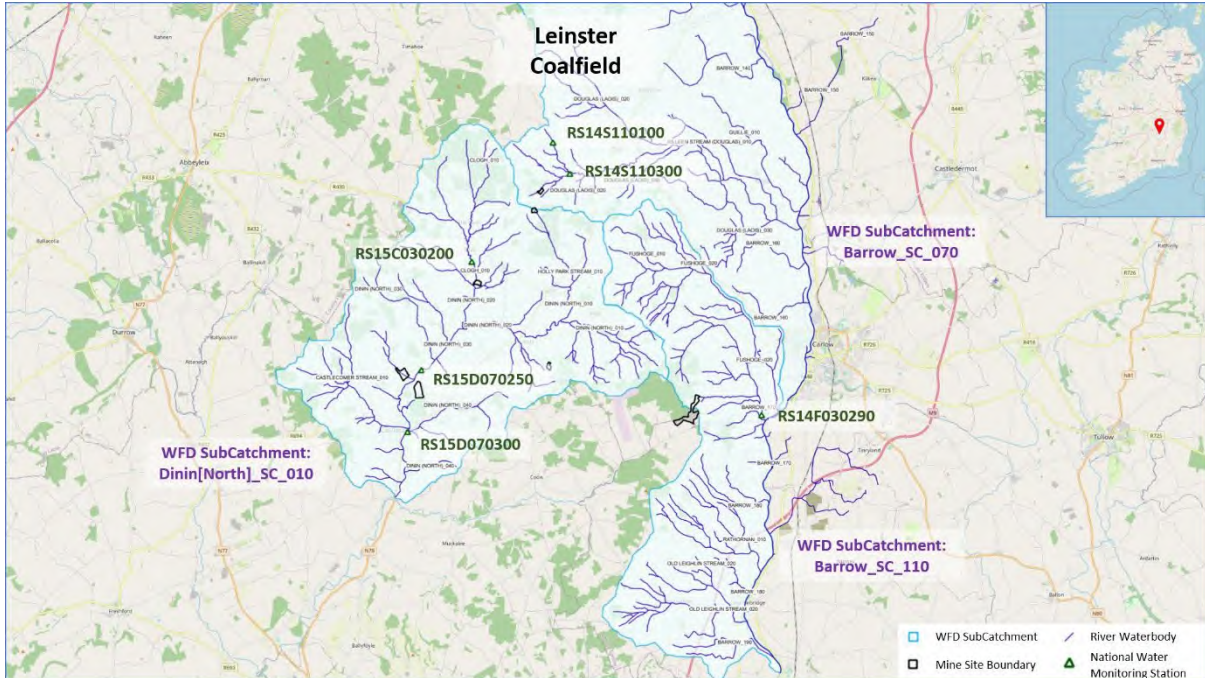
Key Observations

- The monitoring stations RS06M010096 and RS06M010098 upstream and downstream of Knocknacran/ Drummond have satisfactory metal concentrations with no exceedances of the EQS_{AA} or EQS_{MAC} values in 2020 and 2021.
- The downstream monitoring station RS06G020100 exceeded the EQS_{AA} for zinc in 2020 and 2021.
- Since Knocknacran/ Drummond is an operational mine site with an active EPA licence and because of the EQS_{AA} exceedance for zinc the monitoring station RS06G020100 downstream of the mine has been included in the 2023 WFD Work Programme to allow for further assessment.

Leinster Coalfield

lies across three different counties - Carlow, Kilkenny and Laois. Coal mining activities began in this region in the mid-17th century with larger scale activities occurring in the 20th century. Several distinct coal mine areas (collieries) with coal seams were worked over the lifetime of the mine. Mine features remaining in the area include buildings, adits, shafts, waste heaps and open pit lakes and these remain the potential sources of environmental impacts to the network of waterbodies in the district.

 Mine District: Leinster Coalfield	 Mine Type: Historic Mine	 Location: Co. Laois, Co. Kilkenny, Co. Carlow
 Grid Reference: E257000, N179000	 Minerals Worked: Coal	 Mine Operation: Coalfield was mined from the mid 17 th century to the 1980's
 HMS-IRC Class: IV	 WFD Catchment: 14 Barrow, 15 Nore	 WFD Subcatchment: Barrow_SC_070, Dinin[North]_SC_010
 River Waterbodies: Douglas (Laois)_010, Douglas (Laois)_020, Clogh_010, Dinin (North)_030, Dinin (North)_040, Barrow_170	 Elements of Interest: As, Cu, Ni, Pb, Zn	 EPA Licence No: N/A



Data Evaluation

Results of EQS_{AA} data analysis (Pass: ✓, Fail: ✗) for monitoring stations adjacent to Leinster Coalfield

Monitoring Station	Location to Mine	Year	Arsenic	Cadmium	Copper	Lead	Nickel	Zinc
RS14S110100	Upstream	2020	✓	✓	✓	✓	✓	✓
		2021	✓	✓	✓	✓	✓	✓
RS14S110300	Upstream	2020	✓	✓	✓	✓	✓	✓
		2021	✓	✓	✓	✓	✓	✓
RS14F030290	Downstream	2020	✓	✓	✓	✓	✓	✓
		2021	✓	✓	✓	✓	✓	✓
RS15C030200	Downstream	2020	✓	✓	✓	✓	✓	✓
		2021	✓	✓	✓	✓	✓	✓
RS15D070250	Downstream	2020	✓	✓	✓	✓	✓	✓
		2021	✓	✓	✓	✓	✓	✓
RS15D070300	Downstream	2020	✓	✓	✓	✓	✓	✓
		2021	✓	✓	✓	✓	✓	✓

Results of EQS_{MAC} data analysis (Pass: ✓, Fail: ✗) for monitoring stations adjacent to Leinster Coalfield













Monitoring Station	Location to Mine	Year	Cadmium	Lead	Mercury	Nickel
RS14S110100	Upstream	2020	✓	✓	✓	✓
		2021	✓	✓	✓	✓
RS14S110300	Upstream	2020	✓	✓	✓	✓
		2021	✓	✓	✓	✓
RS14F030290	Downstream	2020	✓	✓	✓	✓
		2021	✓	✓	✓	✓
RS15C030200	Downstream	2020	✓	✓	✓	✓
		2021	✓	✓	✓	✓
RS15D070250	Downstream	2020	✓	✓	✓	✓
		2021	✓	✓	✓	✓
RS15D070300	Downstream	2020	✓	✓	✓	✓
		2021	✓	✓	✓	✓

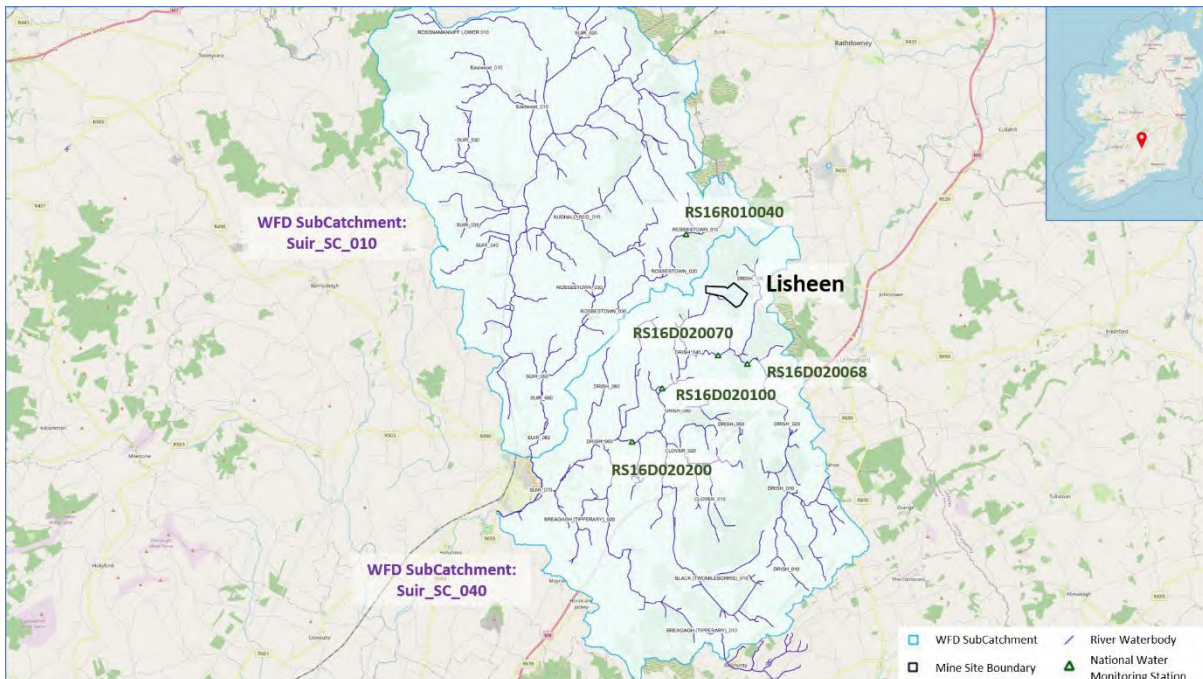
Key Observations

- The monitoring stations upstream and downstream of Leinster Coalfield have satisfactory metal concentrations with no exceedances of the EQS_{AA} or EQS_{MAC} values in 2020 and 2021.
- This site does not require monitoring for metals at present.

Lisheen

mine is located in northeast Co. Tipperary. From 1999 Vedanta Lisheen Mining Limited produced 4.8 million tonnes of zinc and lead concentrate from the underground mine until the mine’s closure in 2015. Lisheen is among the newer mines in Ireland which were opened, operated and closed under a regulatory framework for the mining sector which has provisions for the planned closures and rehabilitation of former mine sites. Lisheen is no longer in production and has been closed, decommissioned and rehabilitated and is currently in the aftercare phase. It continues to be monitored after its closure as part of its EPA-issued IPC licence.

 Mine District: Lisheen	 Mine Type: EPA Licensed Mine Site (Closed)	 Location: Co. Tipperary
 Grid Reference: E222213, N166377	 Minerals Worked: Pb, Zn, Ag	 Mine Operation: Production between 1999 and 2015.
 HMS-IRC Class: N/A	 WFD Catchment: 16 Suir	 WFD Subcatchment: Suir_SC_010, Suir_SC_040
 River Waterbodies: Rossestown_010, Drish_020, Drish_030, Drish_040, Drish_050	 Elements of Interest: Pb, Zn	 EPA Licence No: P0088-04



Data Evaluation

Results of EQS_{AA} data analysis (Pass: ✓, Fail: ✗) for monitoring stations adjacent to Lisheen

Monitoring Station	Location to Mine	Year	Arsenic	Cadmium	Copper	Lead	Nickel	Zinc
RS16R010040	Upstream	2020	✓	✓	✓	✓	✓	✓
		2021	✓	✓	✓	✓	✓	✓
RS16D020068	Downstream	2020	✓	✓	✓	✓	✓	✓
		2021	✓	✓	✓	✓	✓	✓
RS16D020070	Downstream	2020	✓	✓	✓	✓	✓	✓
		2021	✓	✓	✓	✓	✓	✓
RS16D020100	Downstream	2020	✓	✓	✓	✓	✓	✓
		2021	✓	✓	✓	✓	✓	✓
RS16D020200	Downstream	2020	✓	✓	✓	✓	✓	✓
		2021	✓	✓	✓	✓	✓	✓

Results of EQS_{MAC} data analysis (Pass: ✓, Fail: ✗) for monitoring stations adjacent to Lisheen

Monitoring Station	Location to Mine	Year	Cadmium	Lead	Mercury	Nickel
RS16R010040	Upstream	2020	✓	✓	✓	✓
		2021	✓	✓	✓	✓
RS16D020068	Downstream	2020	✓	✓	✓	✓
		2021	✓	✓	✓	✓
RS16D020070	Downstream	2020	✓	✓	✓	✓
		2021	✓	✓	✓	✓
RS16D020100	Downstream	2020	✓	✓	✓	✓
		2021	✓	✓	✓	✓
RS16D020200	Downstream	2020	✓	✓	✓	✓
		2021	✓	✓	✓	✓

Key Observations

- The monitoring stations upstream and downstream of Lisheen Mine have satisfactory metal concentrations with no exceedances of the EQS_{AA} or EQS_{MAC} values in 2020 and 2021.
- Due to Lisheen being a recently closed mine site with an active EPA licence four monitoring stations - RS16D020068, RS16D020070, RS16D020100 and RS16D020200 downstream of the mine have been recommended for inclusion in the 2024 WFD Work Programme to allow for further assessment.

Monaghan Lead Mines

comprises several small metallic mineral deposits located in the Castleblayney area of Co. Monaghan. Most of the mining operation in this area was lead mining. However, the mine near Clontibret is unique in Ireland in having produced mainly antimony. Most were short-lived operations, exploited mainly in the 19th century, while others amounted to little more than prospects abandoned after limited exploration. The three main areas of mining activity were Clontibret, Hope and Tassan. There has been recent exploration of the Clontibret area for a gold deposit.

 Mine Districts: Clontibret, Hope, Tassan	 Mine Type: Historic Mine	 Location: Co. Monaghan
 Grid Reference: E275550, N330110 E283126, N316125 E279228, N326112	 Minerals Worked: Sb, Pb, Ag	 Mine Operation: Closed 1984, 1867, 1866.
 HMS-IRC Class: V	 WFD Catchment: 6 - Newry, Fane, Glyde and Dee	 WFD Subcatchment: Clontibret[Stream]_SC_010, Fane_SC_010
 River Waterbodies: ClontibretStream_010, Annahale Stream_010, Fane_010	 Elements of Interest: Pb, Zn, As	 EPA Licence No: N/A



Data Evaluation

Clontibret

Results of EQS_{AA} data analysis (Pass: ✓, Fail: ✗) for monitoring stations adjacent to Clontibret (Monaghan Lead Mine)

Monitoring Station	Location to Mine	Year	Arsenic	Cadmium	Copper	Lead	Nickel	Zinc
RS03C010800	Upstream	2020	✓	✓	✓	✓	✓	✓
		2021	✓	✓	✓	✓	✓	✓
RS03C011000	Downstream	2020	✓	✓	✓	✓	✓	✓
		2021	✓	✓	✓	✓	✓	✓
RS03C011100	Downstream	2020	✓	✓	✓	✓	✓	✓
		2021	✓	✓	✓	✓	✓	✓

Results of EQS_{MAC} data analysis (Pass: ✓, Fail: ✗) for monitoring stations adjacent to Clontibret (Monaghan Lead Mine)

Monitoring Station	Location to Mine	Year	Cadmium	Lead	Mercury	Nickel
RS03C010800	Upstream	2020	✓	✓	✓	✓
		2021	✓	✓	✓	✓
RS03C011000	Downstream	2020	✓	✓	✓	✓
		2021	✓	✓	✓	✓
RS03C011100	Downstream	2020	✓	✓	✓	✓
		2021	✓	✓	✓	✓

Key Observations

- The monitoring stations upstream and downstream of Clontibret have satisfactory metal concentrations with no exceedances of the EQS_{AA} or EQS_{MAC} values in 2020 and 2021.
- Due to a moderate RQ_{AA} from copper and nickel the monitoring station RS03C011000 downstream of Clontibret has been recommended for inclusion in the 2024 WFD Work Programme to allow for further assessment. This is selected as the representative monitoring point for this river waterbody.

Tassan

Results of EQS_{AA} data analysis (Pass: ✓, Fail: ✗) for monitoring stations adjacent to Tassan (Monaghan Lead Mine)

Monitoring Station	Location to Mine	Year	Arsenic	Cadmium	Copper	Lead	Nickel	Zinc
RS06C040115	Downstream	2020	✓	✗	✓	✓	✓	✓
		2021	✓	✗	✓	✓	✓	✗
RS06F010190	Downstream	2020	✓	✓	✓	✓	✓	✓
		2021	✓	✓	✓	✓	✓	✓

Results of EQS_{MAC} data analysis (Pass: ✓, Fail: ✗) for monitoring stations adjacent to Tassan (Monaghan Lead Mine)

Monitoring Station	Location to Mine	Year	Cadmium	Lead	Mercury	Nickel
RS06C040115	Downstream	2020	✗	✓	✓	✓
		2021	✓	✓	✓	✓
RS06F010190	Downstream	2020	✓	✓	✓	✓
		2021	✓	✓	✓	✓

Key Observations

- The downstream monitoring station RS06C040115 exceeded the EQS_{AA} for cadmium in 2020 and 2021 and zinc in 2021. This monitoring station also exceeded the EQS_{MAC} for cadmium in 2020. This monitoring station been included in the 2023 WFD Work Programme to allow for further assessment.
- The monitoring station RS06F010190 downstream of Tassan has satisfactory metal concentrations with no exceedances of the EQS_{AA} or EQS_{MAC} values in 2020 and 2021. However due to a moderate RQ_{AA} from cadmium and copper this monitoring station has been recommended for inclusion in the 2024 WFD Work Programme to allow for further assessment.

Hope

Results of EQS_{AA} data analysis (Pass: ✓, Fail: ✗) for monitoring stations adjacent to Hope (Monaghan Lead Mine)

Monitoring Station	Location to Mine	Year	Arsenic	Cadmium	Copper	Lead	Nickel	Zinc
RS06A010400	Upstream	2020	✓	✓	✓	✓	✓	✓
		2021	✓	✓	✓	✓	✓	✓
RS06A010800	Downstream	2020	✓	✓	✓	✓	✓	✓
		2021	✓	✓	✓	✓	✓	✓

Results of EQS_{MAC} data analysis (Pass: ✓, Fail: ✗) for monitoring stations adjacent to Hope (Monaghan Lead Mine)

Monitoring Station	Location to Mine	Year	Cadmium	Lead	Mercury	Nickel
RS06A010400	Upstream	2020	✓	✓	✓	✓
		2021	✓	✓	✓	✓
RS06A010800	Downstream	2020	✓	✓	✓	✓
		2021	✓	✓	✓	✓





Key Observations

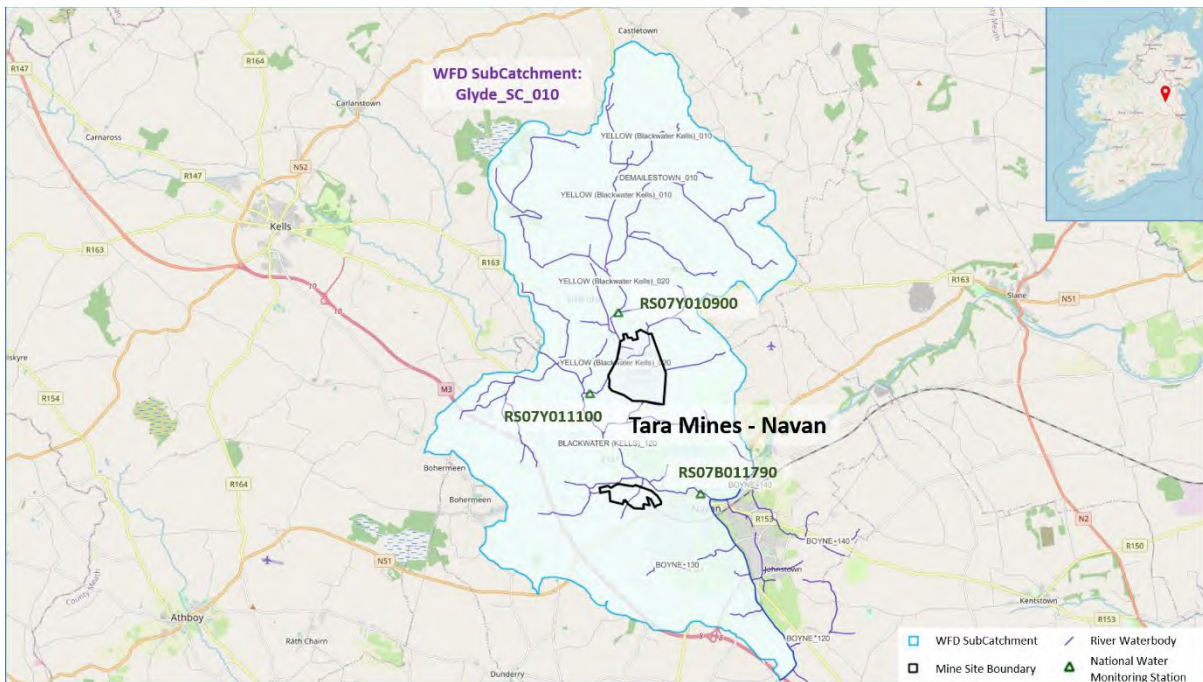
- The monitoring stations upstream and downstream of Hope have satisfactory metal concentrations with no exceedances of the EQS_{AA} or EQS_{MAC} values in 2020 and 2021.
- Due to a moderate RQ_{AA} from copper, the national monitoring station RS06A010800 downstream of Hope has been recommended for inclusion in the 2024 WFD Work Programme to allow for further assessment.
- Note: monitoring station RS06A010900 replaced RS06A010800 on the WFD Work Programme after 2021 and this station will be used for future monitoring.

Tara Mines (Navan)

(Boliden Tara) is the largest lead and zinc mine in Europe and is one of the largest in the world. Development of the orebody began in 1973 and the mine has been operating in Navan, Co.

Meath since 1977 up to the present day. Since mining began more than 85 million tonnes of ore have been extracted. Boliden acquired the mine in 2004. Operations at the mine consist of underground mining with the mine depth extending 1,000 m. The mine is located close to Navan town and the waste is pumped to the retention pond in Proudstown. A temporary mine closure is currently in place since early summer 2023. The mine is an IPC licensed EPA site and is continuously monitored. A temporary mine closure is currently in place at the mine since early summer 2023.

 Mine District: Navan	 Mine Type: EPA Licensed Mine Site (Open)	 Location: Co. Meath
 Grid Reference: E284736, N268116	 Minerals Worked: Pb, Zn	 Mine Operation: 1977 - Present
 HMS-IRC Class: N/A	 WFD Catchment: 7 Boyne	 WFD Subcatchment: Boyne_SC_100
 River Waterbodies: Blackwater (Kells)_120, Boyne_140, Boyne_150	 Elements of Interest: Pb, Zn	 EPA Licence No: P0516-04



Data Evaluation

Results of EQS_{AA} data analysis (Pass: ✓, Fail: ✘) for monitoring stations adjacent to Tara Mines (Navan)

Monitoring Station	Location to Mine	Year	Arsenic	Cadmium	Copper	Lead	Nickel	Zinc
RS07Y010900	Upstream	2020	✓	✓	✓	✓	✓	✓
		2021	✓	✓	✓	✓	✓	✓
RS07B011790	Downstream	2020	✓	✓	✓	✓	✓	✓
		2021	✓	✓	✓	✓	✓	✓
RS07Y011100	Downstream	2020	✓	✓	✓	✓	✓	✓
		2021	✓	✓	✓	✓	✓	✓

Results of EQS_{MAC} data analysis (Pass: ✓, Fail: ✘) for monitoring stations adjacent to Tara Mines (Navan)








Monitoring Station	Location to Mine	Year	Cadmium	Lead	Mercury	Nickel
RS07Y010900	Upstream	2020	✓	✓	✓	✓
		2021	✓	✓	✓	✓
RS07B011790	Downstream	2020	✓	✓	✓	✓
		2021	✓	✓	✓	✓
RS07Y011100	Downstream	2020	✓	✓	✓	✓
		2021	✓	✓	✓	✓

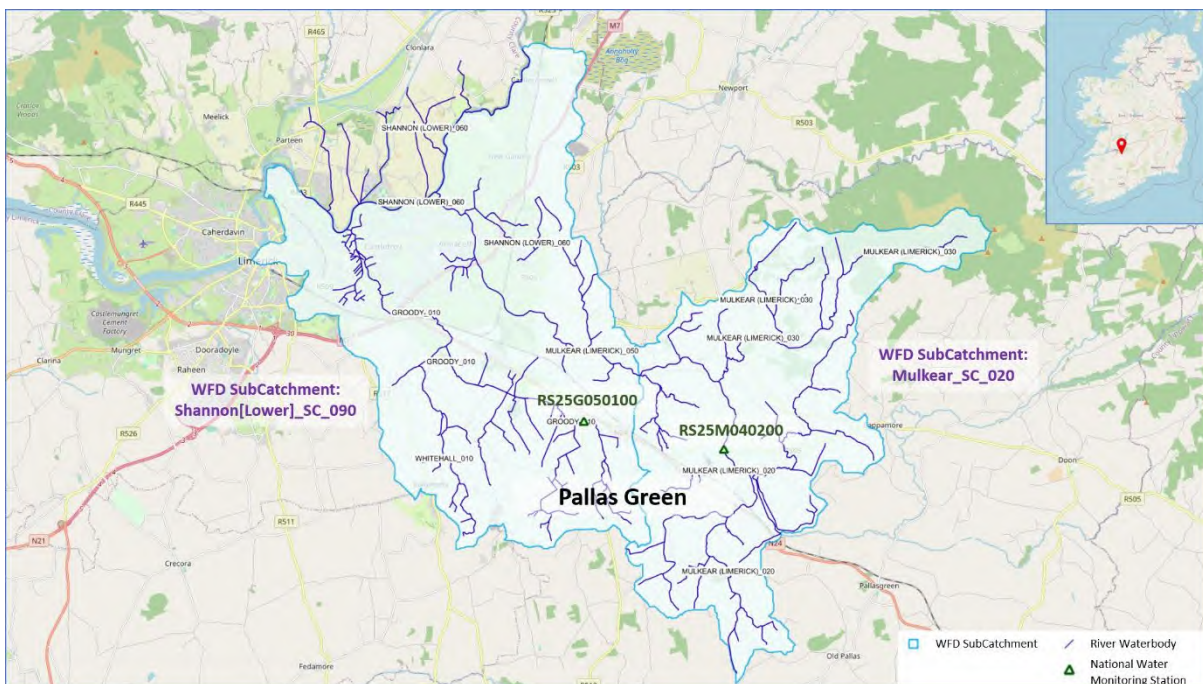
Key Observations

- The monitoring stations upstream and downstream of Tara Mines (Navan) have satisfactory metal concentrations with no exceedances of the EQS_{AA} or EQS_{MAC} values in 2020 and 2021.
- Due to Tara Mines (Navan) being an operational mine site with and active EPA licence the monitoring stations RS07B011790 and RS07Y011100 downstream of the mine have been recommended for inclusion in the 2024 WFD Work Programme to allow for further assessment.

Pallas Green

deposit found in east Co Limerick is one of the largest zinc deposits in the country. There is currently no active mining occurring or licensed in this area. The Pallas Green Project is currently at the exploration stage with prospecting licences held by Glencore Zinc Ireland Ltd. Any future development of mining operations at this site could warrant further monitoring of surrounding waterbodies. The results of investigative monitoring in this project will provide a baseline for metal concentrations in waterbodies in this area.

 Mine District: Pallas Green	 Mine Type: Prospecting Licence Area	 Location: Co. Limerick
 Grid Reference: N/A	 Minerals of Interest: Zn	 Mine Operation: Exploration licences held for the area
 HMS-IRC Class: N/A	 WFD Catchment: 25D Lower Shannon	 WFD Subcatchment: Shannon[Lower]_SC_090
 River Waterbodies: Whitehall_010	 Elements of Interest: Zn	 EPA Licence No: N/A



Data Evaluation

Results of EQS_{AA} data analysis (Pass: ✓, Fail: ✗) for monitoring stations adjacent to Pallas Green

Monitoring Station	Location to Mine	Year	Arsenic	Cadmium	Copper	Lead	Nickel	Zinc
RS25G050100	Downstream	2020	✓	✓	✓	✓	✓	✓
		2021	✓	✓	✓	✓	✓	✓
RS25M040200	Downstream	2020	✓	✓	✓	✓	✓	✓
		2021	✓	✓	✓	✓	✓	✓

Results of EQS_{MAC} data analysis (Pass: ✓, Fail: ✗) for monitoring stations adjacent to Pallas Green

Monitoring Station	Location to Mine	Year	Cadmium	Lead	Mercury	Nickel
RS25G050100	Downstream	2020	✓	✓	✓	✓
		2021	✓	✓	✓	✓
RS25M040200	Downstream	2020	✓	✓	✓	✓
		2021	✓	✓	✓	✓

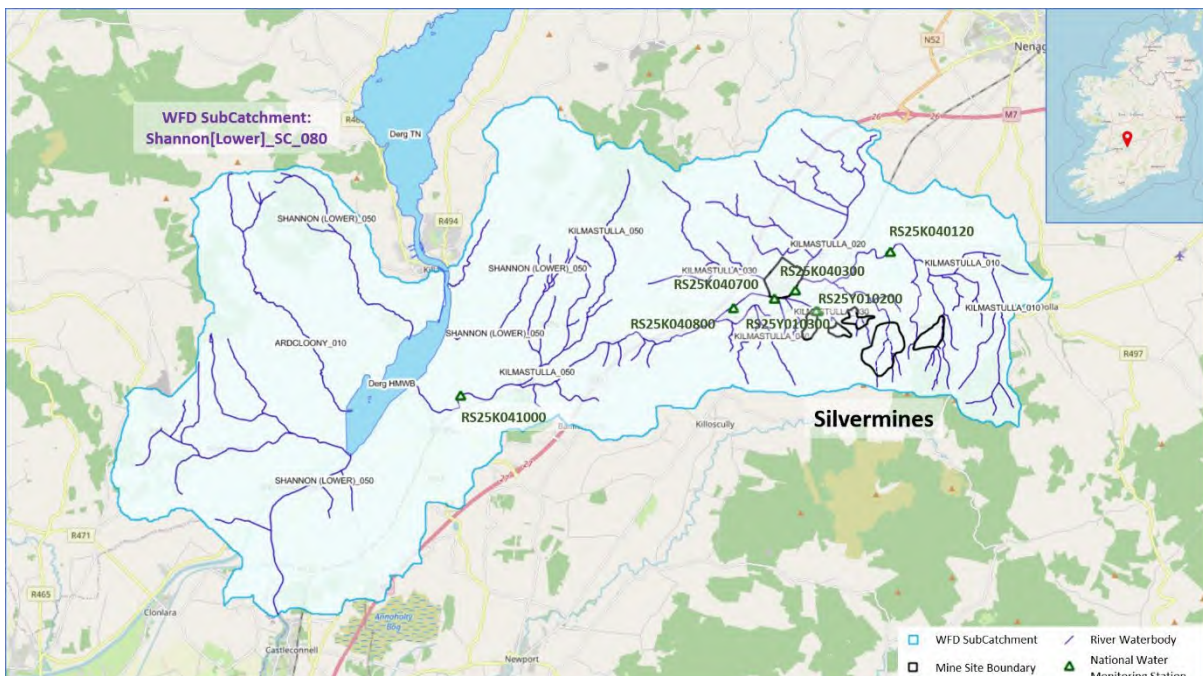
Key Observations

- The monitoring stations RS25G050100 and RS25M040200 downstream of Pallas Green have satisfactory metal concentrations with no exceedances of the EQS_{AA} or EQS_{MAC} values in 2020 and 2021.
- This site does not require monitoring of metals at present. However, if the area undergoes further development of mining activities, then consideration of additional monitoring may be required again in the future.

Silvermines

is located north of the Silvermine mountain range in Co. Tipperary and is one of Ireland's most well-known mining areas. Mining activity has been carried out intermittently over 1,000 years up until the mine closed in 1993. The area was mined for zinc, lead, silver, copper and barite, predominately in the 20th century but the site also retains pre-20th century features. Silvermines has been the subject of several investigations since its closure due to elevated levels of lead causing concern for human and animal welfare. Silvermines is an important area to monitor due to naturally elevated background levels of metals and the potential release into the environment due to natural weathering processes and centuries of mining.

 Mine District: Silvermines	 Mine Type: Historic Mine	 Location: Co. Tipperary
 Grid Reference: E182343, N171560	 Minerals Worked: Pb, Zn, Cu, Ba, Ag	 Mine Operation: Closed in 1993
 HMS-IRC Class: I	 WFD Catchment: 25D Lower Shannon	 WFD Subcatchment: Shannon [Lower]_SC_080
 River Waterbodies: Kilmastulla_010, Kilmastulla_020, Kilmastulla_030, Kilmastulla_050	 Elements of Interest: Pb, Zn, Cu	 EPA Licence No: N/A



Data Evaluation

Results of EQS_{AA} data analysis (Pass: ✓, Fail: ✗) for monitoring stations adjacent to Silvermines

Monitoring Station	Location to Mine	Year	Arsenic	Cadmium	Copper	Lead	Nickel	Zinc
RS25K040120	Downstream	2020	✓	✓	✓	✓	✓	✓
		2021	✓	✓	✓	✓	✓	✓
RS25K040300	Downstream	2020	✓	✓	✓	✓	✓	✓
		2021	✓	✓	✓	✓	✓	✓
RS25K040700	Downstream	2020	✓	✗	✓	✓	✓	✗
		2021	✓	✓	✓	✓	✓	✓
RS25K040800	Downstream	2020	✓	✗	✓	✓	✓	✗
		2021	✓	✓	✓	✓	✓	✓
RS25K041000	Downstream	2020	✓	✓	✓	✓	✓	✓
		2021	✓	✓	✓	✓	✓	✓
RS25Y010200	Downstream	2020	✓	✗	✗	✗	✓	✗
		2021	✓	✗	✗	✗	✓	✗
RS25Y010300	Downstream	2020	✓	✗	✗	✗	✓	✗
		2021	✓	✗	✓	✗	✗	✗

Results of EQS_{MAC} data analysis (Pass: ✓, Fail: ✗) for monitoring stations adjacent to Silvermines

Monitoring Station	Location to Mine	Year	Cadmium	Lead	Mercury	Nickel
RS25K040120	Downstream	2020	✓	✓	✓	✓
		2021	✓	✓	✓	✓
RS25K040300	Downstream	2020	✓	✓	✓	✓
		2021	✓	✓	✓	✓
RS25K040700	Downstream	2020	✓	✓	✓	✓
		2021	✓	✓	✓	✓
RS25K040800	Downstream	2020	✓	✓	✓	✓
		2021	✓	✓	✓	✓
RS25K041000	Downstream	2020	✓	✓	✓	✓
		2021	✓	✓	✓	✓
RS25Y010200	Downstream	2020	✗	✗	✓	✓
		2021	✗	✗	✓	✓
RS25Y010300	Downstream	2020	✗	✗	✓	✓
		2021	✗	✗	✓	✓

Key Observations

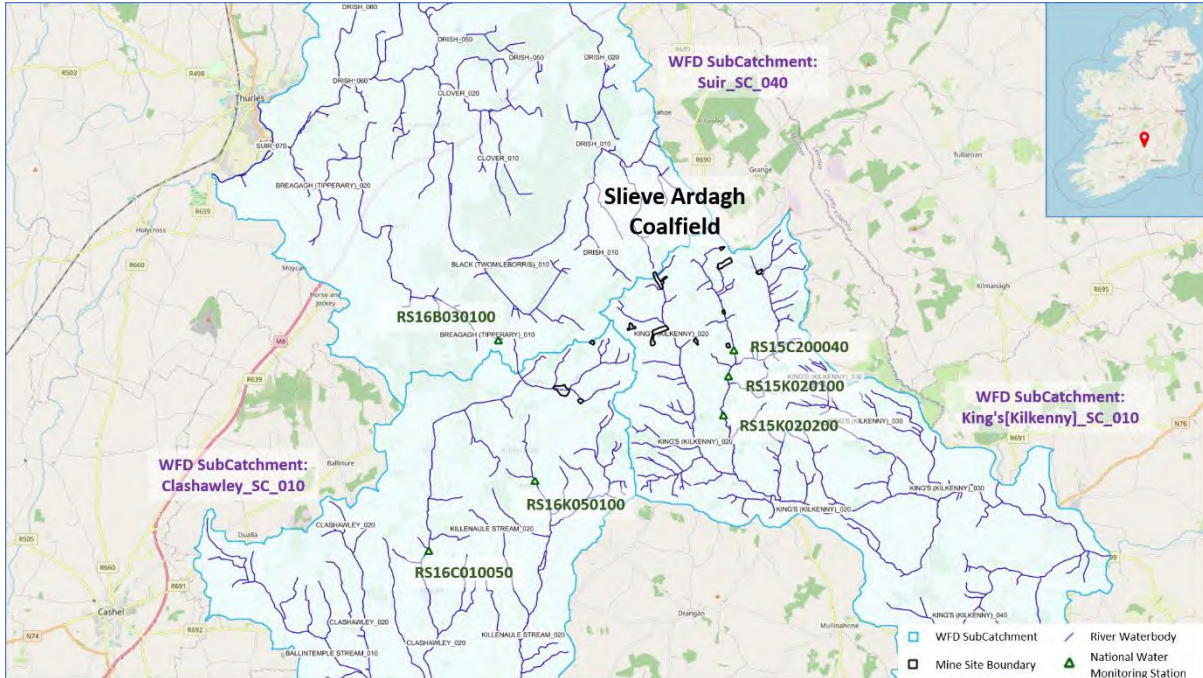
- Two of the monitoring stations downstream of Silvermines RS25K040120 and RS25K040300 have satisfactory metal concentrations with no exceedances of the EQS_{AA} or EQS_{MAC} values in 2020 and 2021. However due to moderate RQ_{AA} from cadmium and zinc these monitoring stations have been included in the 2023 WFD Work Programme to allow for further assessment.
- The monitoring stations downstream of Silvermines RS25K040700, RS25K040800, RS25K041000, RS25Y010200 and RS25Y010300 have unsatisfactory metal concentrations with exceedances of the EQS_{AA} for cadmium, copper, lead, nickel and zinc in 2020 and 2021 and the EQS_{MAC} for cadmium and lead in 2020 and 2021.
- Due to the exceedances of the EQS_{AA} and the EQS_{MAC} three monitoring stations - RS25K040700, RS25K041000 and RS25Y010300, have been included in the 2023 WFD Work Programme to allow for further assessment. These stations were selected to be representative of the affected waterbodies.

Slieve Ardagh Coalfield

is located in north Co. Tipperary, spanning 13 km between Ballynunty in the southwest and Commons in the northeast. Mining activity was carried out in the area for

400 years beginning in the mid-17th century with larger scale mining occurring in the 19th century up until the 1990s. Numerous mine features are scattered across the coalfield area e.g., buildings, adits, shafts, pits and waste heaps and these remain the potential sources of environmental impacts to the waterbodies in the district.

 Mine District: Slieve Ardagh Coalfield	 Mine Type: Historic Mine	 Location: Co. Tipperary
 Grid Reference: E228000, N150000	 Minerals Worked: Coal	 Mine Operation: Coalfield was mined from the mid 17th century to the 1980's
 HMS-IRC Class: IV	 WFD Catchment: 15 Nore, 16 Suir	 WFD Subcatchment: King's[Kilkenny]_SC_010, Suir_SC_040, Clashawley_SC_010
 River Waterbodies: Coalbrook Stream_010, King's (Kilkenny)_010, Breagagh (Tipperary)_010, Clashawley_010, Killenaule Stream_010	 Elements of Interest: As, Cu, Ni, Pb, Zn	 EPA Licence No: N/A



Data Evaluation

Results of EQS_{AA} data analysis (Pass: ✓, Fail: ✘) for monitoring stations adjacent to Tynagh

Monitoring Station	Location to Mine	Year	Arsenic	Cadmium	Copper	Lead	Nickel	Zinc
RS15C200040	Downstream	2020	✓	✓	✓	✓	✓	✓
		2021	✓	✓	✓	✓	✓	✓
RS15K020100	Downstream	2020	✓	✓	✓	✓	✓	✓
		2021	✓	✓	✓	✓	✓	✓
RS15K020200	Downstream	2020	✓	✓	✓	✓	✓	✓
		2021	✓	✓	✓	✓	✓	✓
RS16B030100	Downstream	2020	✓	✓	✓	✓	✓	✓
		2021	✓	✓	✓	✓	✓	✓
RS16C010050	Downstream	2020	✓	✓	✓	✓	✓	✓
		2021	✓	✓	✓	✓	✓	✓
RS16K050100	Downstream	2020	✓	✓	✓	✓	✓	✓
		2021	✓	✓	✓	✓	✓	✓

Results of EQS_{MAC} data analysis (Pass: ✓, Fail: ✘) for monitoring stations adjacent to Slieve Ardagh

Monitoring Station	Location to Mine	Year	Cadmium	Lead	Mercury	Nickel
RS15C200040	Downstream	2020	✓	✓	✓	✓
		2021	✓	✓	✓	✓
RS15K020100	Downstream	2020	✓	✓	✓	✓
		2021	✓	✓	✓	✓
RS15K020200	Downstream	2020	✓	✓	✓	✓
		2021	✓	✓	✓	✓
RS16B030100	Downstream	2020	✓	✓	✓	✓
		2021	✓	✓	✓	✓
RS16C010050	Downstream	2020	✓	✓	✓	✓
		2021	✓	✓	✓	✓
RS16K050100	Downstream	2020	✓	✓	✓	✓
		2021	✓	✓	✓	✓











Key Observations

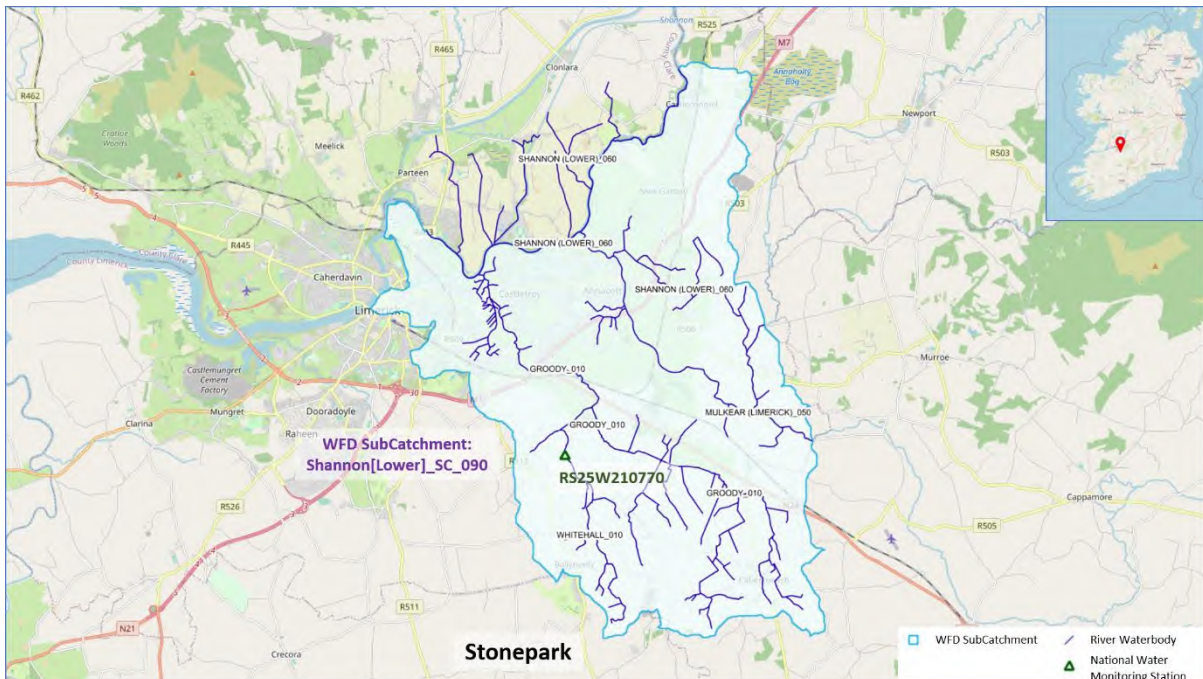
- The monitoring stations downstream of Slieve Ardagh Coalfield have satisfactory metal concentrations with no exceedances of the EQS_{AA} or EQS_{MAC} values in 2020 and 2021.
- Due to a moderate RQ_{AA} from nickel the monitoring station RS16K050100 downstream of Slieve Ardagh Coalfield has been recommended for inclusion in the 2024 WFD Work Programme to allow for further assessment.

Stonepark

Co. Limerick is a zinc deposit located to the west of Glencore’s Pallas Green deposit. There is currently no active mining occurring or licensed in this area. Exploration licences are held by Group Eleven and Arkle Resources PLC.

This area has a current exploration programme and has undergone drilling within three zones of known mineralisation: Stonepark North, Stonepark and Stonepark West. Any future development of mining operations at this site could warrant further monitoring of surrounding waterbodies. The results of investigative monitoring in this project will provide a baseline for metal concentrations in waterbodies in this area.

 Mine District: Stonepark	 Mine Type: Prospecting Licence Area	 Location: Co. Limerick
 Grid Reference: N/A	 Minerals of Interest: Zn	 Mine Operation: Exploration licences held for the area
 HMS-IRC Class: N/A	 WFD Catchment: 25D Lower Shannon	 WFD Subcatchment: Mulkear_SC_020, Shannon[Lower]_SC_090
 River Waterbodies: Mulkear (Limerick)_020, Groody_010	 Elements of Interest: Zn	 EPA Licence No: N/A



Data Evaluation

Results of EQS_{AA} data analysis (Pass: ✓, Fail: ✗) for monitoring stations adjacent to Stonepark

Monitoring Station	Location to Mine	Year	Arsenic	Cadmium	Copper	Lead	Nickel	Zinc
RS25W210770	Downstream	2020	✓	✓	✓	✓	✓	✓
		2021	✓	✓	✓	✓	✓	✓

Results of EQS_{MAC} data analysis (Pass: ✓, Fail: ✗) for monitoring stations adjacent to Stonepark

Monitoring Station	Location to Mine	Year	Cadmium	Lead	Mercury	Nickel
RS25W210770	Downstream	2020	✓	✓	✓	✓
		2021	✓	✓	✓	✓

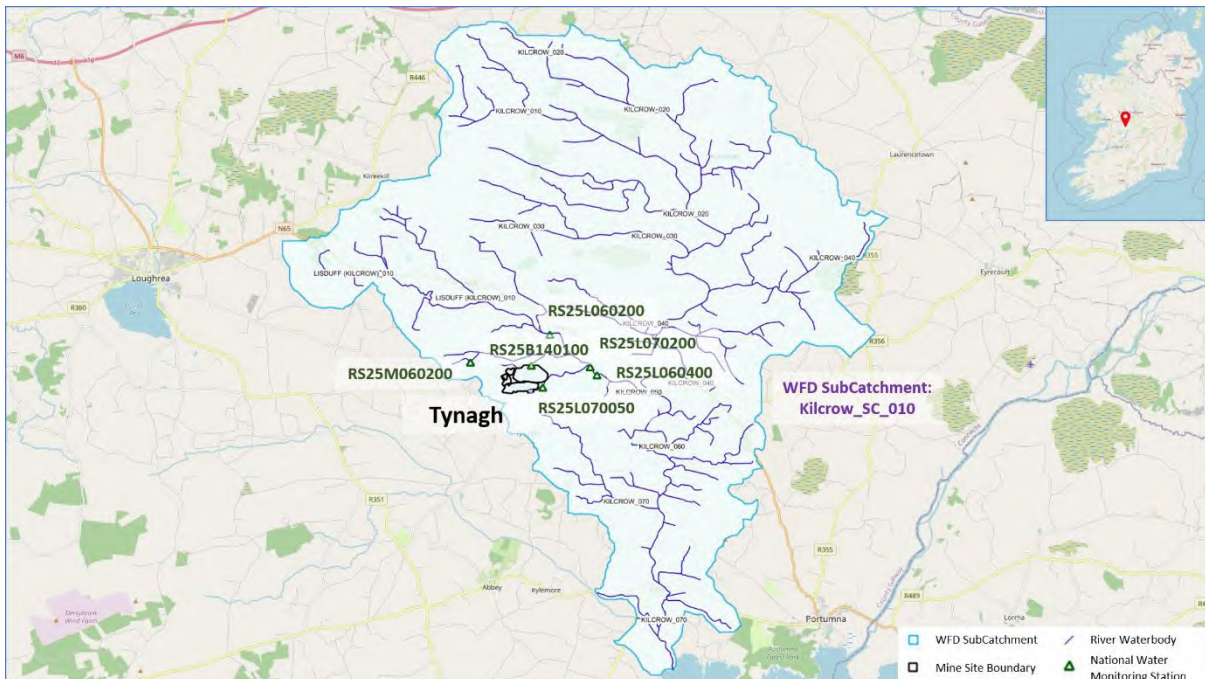
Key Observations

- The monitoring station RS25W210770 downstream of Stonepark has satisfactory metal concentrations with no exceedances of the EQS_{AA} or EQS_{MAC} values in 2020 and 2021.
- This site does not require monitoring of metals at present. However, if the area undergoes further development of mining activities, then consideration of additional monitoring may be required again in the future.

Tynagh

mines site is located 1.5 km north of the village of Tynagh in Co. Galway. The former mine site covers an area of approximately 115 hectares and is broken up into different sections including a tailings management facility. The mine production started in 1963 with open pit mining of lead and zinc. Following this the mining operation moved underground in the early 1970s until its closure in 1982. After closure, work was carried out to stabilise the site: heaps were contoured, buildings were reduced in size and the original shafts were closed and capped with concrete but most of the site has not undergone significant remediation and the open pit lake continues to be filled with water.

 Mine District: Tynagh	 Mine Type: Historic Mine	 Location: Co. Galway
 Grid Reference: E174785, N213078	 Minerals Worked: Pb, Zn, Ag, Ba	 Mine Operation: Production from 1965 to 1981
 HMS-IRC Class: I	 WFD Catchment: 25C - Lower Shannon	 WFD Subcatchment: Kilcrow_SC_010
 River Waterbodies: Kilcrow_050	 Elements of Interest: Zn, Pb, Cu, As, Ni, Cd	 EPA Licence No: N/A



Data Evaluation

Results of EQS_{AA} data analysis (Pass: ✓, Fail: ✗) for monitoring stations adjacent to Tynagh

Monitoring Station	Location to Mine	Year	Arsenic	Cadmium	Copper	Lead	Nickel	Zinc
RS25L060200	Upstream	2020	✓	✓	✓	✓	✓	✓
		2021	✓	✓	✓	✓	✓	✓
RS25M060200	Upstream	2020	✓	✓	✓	✓	✓	✓
		2021	✓	✓	✓	✓	✓	✓
RS25B140100	Downstream	2020	✓	✗	✓	✓	✗	✗
		2021	✓	✗	✓	✓	✗	✗
RS25L060400	Downstream	2020	✓	✓	✓	✓	✓	✗
		2021	✓	✗	✓	✓	✓	✗
RS25L070050	Downstream	2020	✓	✓	✓	✓	✓	✓
		2021	✓	✗	✓	✓	✓	✗
RS25L070200	Downstream	2020	✓	✓	✓	✓	✓	✗
		2021	✓	✓	✓	✓	✓	✗

Results of EQS_{MAC} data analysis (Pass: ✓, Fail: ✗) for monitoring stations adjacent to Tynagh

Monitoring Station	Location to Mine	Year	Cadmium	Lead	Mercury	Nickel
RS25L060200	Upstream	2020	✓	✓	✓	✓
		2021	✓	✓	✓	✓
RS25M060200	Upstream	2020	✓	✓	✓	✓
		2021	✓	✓	✓	✓
RS25B140100	Downstream	2020	✗	✓	✓	✓
		2021	✗	✓	✓	✓
RS25L060400	Downstream	2020	✓	✓	✓	✓
		2021	✓	✓	✓	✓
RS25L070050	Downstream	2020	✓	✓	✓	✓
		2021	✓	✓	✓	✓
RS25L070200	Downstream	2020	✓	✓	✓	✓
		2021	✓	✓	✓	✓

Key Observations

- Two of the monitoring stations upstream of Tynagh Mine RS25K040120 and RS25K040300 have satisfactory metal concentrations with no exceedances of the EQS_{AA} or EQS_{MAC} values in 2020 and 2021.
- The monitoring stations downstream of Tynagh Mine RS25B140100, RS25L060400, RS25L070050 and RS25L070200 have unsatisfactory metal concentrations with exceedances

of the EQS_{AA} for cadmium, nickel and zinc in 2020 and 2021 and the EQS_{MAC} for cadmium in 2020 and 2021. Station RS25B140100 is impacted by high concentrations of metals with very high RQ observed for cadmium and lead.

- Due to the exceedances of the EQS_{AA} and the EQS_{MAC} three monitoring stations - RS25B140100, RS25L060400 and RS25L070050 have been recommended for inclusion in the 2023 WFD Work Programme to give a full assessment.