REPORT

The Lisheen Mine - Closure, Restoration & Aftercare Management Plan

As Built Document

Submitted to:

The Lisheen Mine
Killoran
Moyne
Thurles
Ireland

Submitted by:

Golder Associates Ireland Limited
Town Centre House, Dublin Road, Naas,
Co. Kildare, W91 TD0P Ireland

+353 45 810 200

1896511.600.B0

November 2020

Distribution List

Table of Contents

TABLES

FIGURES

1.0 CHAPTER 1 - INTRODUCTION

This Final Validation Report should be read in conjunction with the approved 2016 CRAMP for background information, Case Number LR022405 on EDEN.

1.1 Background

Development of the Lisheen Mine began in 1997, with production commencing in 1999. Over the life of the Mine an annual average of ca. 165,000 MT in zinc metal concentrates and ca. 22,000 MT in lead metal concentrates were produced from the processing plant on the Mine Site and transported to various smelters across the world from the Port of Cork. Final operations ceased at the end of 2015.

Prior to the commencement of the Mine an approved closure plan was put in place. Over the years the plan has been reviewed and revised following consultations and workshops that considered substantial environmental and geochemical information. A closure framework for directing activities towards successful closure of the Mine that became the Closure, Restoration and Aftercare Management Plan, the CRAMP was developed on this basis.

Successful closure of the Mine required remediation and restoration of all lands affected by the mining operations, the careful management of social aspects, and securing the long-term stewardship of land within the Lisheen Mine land holding.

A fully approved and funded closure plan was in place prior to commencement of mining. In 2007 the Mine began to focus on closure planning and preparation with the development of the capping and restoration of the Tailings Management Facility (TMF). The Mine entered into the Active Closure stage in March of 2014 with the development of the Lisheen Mine Closure Team who ensured that the closure project was executed and that all success criteria were achieved. This phase ended in February 2018. After the completion of the Active phase of closure, the Mine then entered into a Passive period to monitor the site and assess the effectiveness of the closure works. It was during this Passive period that Lisheen Mine identified a seepage issue on the southern corner of the TMF and engaged with the Authorities to address this issue, arguably moving the site back into a period of Active closure while this issue was resolved. An extensive period of investigation and remediation took place between late 2018 and early 2020 to identify the source of the seepage and resolve it. As of March 2020, the repair work was complete, and the Mine re-entered a Passive closure period. During this Passive period monitoring took place to ensure that the repair works resolved the issue successfully, and data was presented to the Mine Closure Committee in October 2020 to demonstrate this.

The primary aim of the Lisheen Mine Closure Plan is to facilitate the orderly closure and winding down of the Mine, whilst ensuring that a sustainable long-term stewardship of the mined land is implemented and maintained, and the socio-economic impacts of the Mine are minimised. Lisheen is of the opinion that this aim has been achieved and will use this final validation report as part of the process in order to enter the Aftercare phase, with the agreement of the relevant Authorities.

1.2 Aftercare Plan

As per condition 10.3 of the P0088-04 IPCL a fully detailed and costed plan to ensure a long-term sustainable closure of the Mine Site following the closure and restoration phases has been prepared. This includes the measures that are required to be taken for the aftercare of the installation in order to minimise the risk of environmental pollution or environmental damage after closure, decommissioning and rehabilitation of the installation for a minimum period of 30 years.

During Novemebr 2020 Lisheen achieved approval for the Lisheen Aftercare Plan costings, Case Number LR053538 on EDEN.

1.3 Technical Amendments to IPCL P008-04

With the completion of the site clean-up and rehabilitation, along with the validation reports from Tobin Consulting Engineers and the two satisfactory EPA exit audits, Lisheen is satisfied that the condition of the site and subsoil in Stages 1 and 2 is in a satisfactory state and is not causing, or likely to cause, environmental pollution.

In April of 2019 Lisheen applied to the EPA for a technical amendment to the IPCL P008-04 under condition 1.2 for a reduction to the licensed site boundary and this request was approved in April 2020. Granting of this technical amendment, and removal of the specific lands from the Mine's licence, is a demonstration of the EPA's satisfaction with the closure works that were completed and that there are no remaining environmental liabilities remaining on these lands. From an initial licenced area of ca. 1,200 acres, the Lisheen Mine's licenced area is now in the order of ca. 300 acres and is made up predominantly of the TMF.

In July of 2020 Lisheen applied for another technical amendment for a further reduction to the site boundary, CR07660, to remove additional lands not already removed under the previous amendment. The outcome of this request is pending.

1.4 Success Criteria

The Lisheen Mine closure strategy is underpinned by a set of success criteria, and these have been used as a framework for validation of the restoration performance. The criteria are specific, measurable, achievable, realistic and time related, (SMART) and have been used as indicators to determine whether closure objectives have been met.

The achievement of these success criteria has been verified through a monitoring process and will subsequently lead to sign off and approval from the Regulatory Authorities. The final objective is to obtain an agreement with the relevant Authorities to enter the Aftercare phase.

This will be achieved once the Regulatory Authorities are satisfied that the success criteria have been met and that there are no environmental liabilities remaining on site.

Table 1-1 gives a summary of the objectives and the validation measurement tools applied to determine their success rate.

Table 1-1: Summary of the objectives and validation measurement tools

No.	Description	Objective	Validation Measurement Tools	Relevant Chapter	Progress %
1	Mine Site Decommissioning (Hunterdale Contract)	Full decommissioning and disassembly of the Tepee, Processing plant, Backfill plant and all associated elements.	Final sign off completed by an external consultant, Hunterdale Limited and Lisheen Management on the 26 October 2016. Majority of area has been released from the IPCL as per Technical Amendment CR06282.	3	**100**
2	Mine Site Decommissioning (all other areas)	Full decommissioning or demolition of unusable site structures and return footprint to suitable lands for provision for alternative industry. All holes / pits and other openings are to be securely capped, filled or otherwise made safe. Buried services removed as required.	Tobin Engineers completed two validation reports that demonstrate that all residual material, which could result in environmental pollution, has been removed from the site to predetermined Industrial guideline levels. All other materials were recycled, recovered or disposed of in accordance with the conditions of the IPC Licence and in compliance with all relevant regulations. Majority of area has been released from the IPCL as per Technical Amendment CR06282.	3	**100**
3	Underground Decommissioning	Before an area is rendered inaccessible all hazardous material must be removed and the sign off sheet must be signed off in full and accepted by the Environmental Coordinator.	Areas inspected and signed off by nominated personnel which confirmed each area had been cleared, with all hazardous material removed, before any areas were rendered inaccessible and flooded. Underground workings have been released from the IPCL as per Technical Amendment CR06282.	3	**100**
4	Plugging Vent Shafts and openings to the Mine	Plug / seal Mine Portal to prevent access to the Mine with a target to backfill to 20 m below ground level.	This was accomplished once all service pipes; conveyor steel framework and rubber-based components were removed from the entire length of	3	**100**

No.	Description	Objective	Validation Measurement Tools	Relevant Chapter	Progress %
			the Decline and the plug consisting of rock fill and concrete grout constructed along the top section of the decline. A detailed report of the actual plugging process completed in line with the geotechnical design was produced by the Mine Manger in 2016. To backfill the Decline to a distance that equated to 20 m below ground level, a vector distance of 188 nm of the Decline was filled with a combination of rock and grout. Following comments from the DCCAE, Lisheen Mine agreed to establish a Cautionary Zone on surface that extends beyond the length of Decline that was backfilled. No building will take place on this Cautionary Zone area unless permission is received from DCCAE and they will be advised of any land sale that includes area from within the Cautionary Zone. This area has been released from the IPCL as per Technical Amendment CR06282.		
		Plug / seal all vertical shafts and rehabilitate to surrounding ground level.	The vent shaft filling was completed per the CQA plan by July 2016. These areas have been released from the IPCL as per Technical Amendment CR06282.	3	**100**
5	Life of Mine Backfill	Complete all required backfill underground (including any surface top up), to minimise surface subsidence.	Subsidence Monitoring has demonstrated that subsidence is within permissible levels and that the ground is stable. Underground workings have been released from the IPCL as per Technical Amendment CR06282.	3	**100**

No.	Description	Objective	Validation Measurement Tools	Relevant Chapter	Progress %
6	Dry Closure of TMF	Rehabilitate and restore entire TMF surface to agricultural grassland. Installation of a 700 mm rock cap and 300 mm growth medium layer.	External CQA Validation Reports have been completed for all phases. The final Phase, phase 7 was completed in January 2018. 1. TMF CRAMP works 100% complete 2. TMF seepage issue investigation and repair works (as agreed) – 100% complete 3. Assessment of seepage repair works 100% complete - The facility is deemed to be stable and monitoring will continue into the aftercare period	4	**1. 100** **2. 100** **3. 100**
7	Management of TMF Water Treatment & discharge	Design and construct three spillways from the TMF.	Completed as per CQA plans during 2017.	4	**100**
		Provision of Water Treatment System if required to aid the removal of TMF water cover.	A water treatment system was temporarily installed to treat the TMF water cover that was being drawn down during the closure works. Treatment was pH adjustment and metal precipitation at the point of abstraction on the TMF using sodium hydroxide, followed by settlement of precipitate in condition ponds.	4	**100**
		Design and construction of stilling box and wetland.	Construction was completed as per CQA plans during 2017.	4	**100**
8	TMF management into perpetuity	Form a strategy for the long-term custodianship of the Site / TMF and associated IPCL.	The TMF has been restored so that it can be managed for its selected use without any on-site Lisheen management input. The Aftercare management plan ensures that adequate monitoring will be carried out on the TMF into the future to ensure the stability of the structure is monitored and the risk of environmental pollution is	4	**100**

No.	Description	Objective	Validation Measurement Tools	Relevant Chapter	Progress %
			also monitored. Monitoring will include surface water, groundwater and subsidence and information will be routinely reported to the EPA. An annual external audit of the TMF will continue to be conducted as part of the aftercare plan.		
9	Carrick Hill Restoration	Rehabilitate Carrick Hill Borrow Pit as per Planning conditions.	The restoration of Carrick Hill has created an area of open water with associated wetland features that provides an area of considerable wetland nature conservation interest. This area has been released from the IPCL as per Technical Amendment CR06282.	3	**100**
10	Land Holdings	Demolition of existing structures on Lisheen Land Holdings.	Selected buildings, outbuildings and sheds were demolished within the land holding. These areas have been released from the IPCL as per Technical Amendment CR06282.	3	**100**
		Remedial work to existing structures on Lisheen Land Holdings.	Engineer inspections and reports, if required. These areas have been released from the IPCL as per Technical Amendment CR06282.	3	**100**
11	Restoration of Groundwater	Restoration of water level to baseline conditions.	Monitoring data demonstrates that the groundwater system has fully recovered, and monitoring wells do not show any impact from the Mine workings.	2	**100**
		Transfer Group Water Scheme to full ownership / management by MGWS committee.	The Moyne group Water Scheme committee agree that the water-table has recovered and as intended, they have taken over the management of the scheme and the running costs since February 2018.		**100**

No.	Description	Objective	Validation Measurement Tools	Relevant Chapter	Progress %
		Installation of Groundwater monitoring wells.	Two compliance wells were drilled and have in operation since March 2016. Compliance is high for both wells. CW2 has recorded some elevated ammonia concentrations, which are associated with livestock located close to the well and are not linked to the Mine. CW1 has recorded some anomalous results for nickel. While on many occasions nickel has been compliant, there have been some outlier values in excess of the limit value. The groundwater wells between CW1 and the TMF provide data demonstrating no commensurate spikes in nickel, indicating whatever the source of the nickel, it is not due to the TMF or mining operations. Other factors were discussed at the October 2020 MCC meeting, for example the anomalous readings were recorded even when the Mine rewatering was taking place (i.e. there was an inward gradient for groundwater from the TMF towards the underground workings and TMF water could not flow towards CW1).		**100**
12	Maintain an appropriate level in the Rossestown River	Augment river, if required.	Regular monitoring of the river levels demonstrated that there was sufficient volume in the River and augmentation was not required	3	**100**
13	Port of Cork	Render safe or remove for disposal or recovery, any soil, subsoil, plant or equipment, or any waste, materials or substances that may result in environmental pollution. Follow control measures in place to prevent unwanted incidents.	Following the dismantling and restoration of the facility the Port of Cork Authorities accepted that all materials that could result in Environmental pollution were removed from the site and agreed to surrender the lease and released Lisheen from its obligations under it.	3	**100**

No.	Description	Objective	Validation Measurement Tools	Relevant Chapter	Progress %
14	Completion of any required remediation on rivers	Develop plan with Inland Fisheries Ireland.	Working with the Fisheries, Lisheen completed cleaning and upgrading works which involved removing vegetation and the placement of protectors along the River during the summer of 2016. Inland Fisheries Ireland are satisfied that the work undertaken benefits the Drish River habitat and will continue into the future to benefit the fish species in the Drish River.	3	**100**
		Implement plan with Inland Fisheries Ireland.			**100**
		Complete risk assessment of sediment in Rivers and carry out appropriate works if required.	Risk assessment based on sediment results and biological monitoring, demonstrated that there was no requirement to remove sediment from either the Drish or the Rossestown Rivers.		**100**
		Complete drainage works on lands in consultation with local farmers (to prepare for return to baseline groundwater levels in the region).	Lisheen engaged with the local community and local branch of the IFA to agree a dredging programme to restore land drains that may have dried up and become overgrown due to the dewatering effects of the Mine. A programme of work was agreed and implemented.		**100**
15	Orderly closure and winding down of the Mine, ahead of entering into Aftercare	Satisfaction that there are no remaining environmental liabilities remaining on site.	Confirmation that the Regulatory Authorities are satisfied that the success criteria has been met and that there are no remaining environmental liabilities remaining on site.		**With Authorities**

2.0 CHAPTER 2 - MINE RE-WATERING

2.1 Rate of Recovery

As per the Closure Success Criteria, No. 2, one of the objectives for “Restoration of Groundwater” was the restoration of water levels to baseline conditions.

The underground pumping system was switched off at the end of December 2015 allowing the underground workings to flood. The initial rate of recovery was rapid, most likely due to excessive rainfall during the period, which meant that the water levels within the individual mining zones equilibrated within 2 months. The recovery rate then occurred across the Mine at the same rate. The rate did decrease with time, as expected. The aquifer was substantially recovered by the summer of 2017. Full recovery was recorded in January 2018, meaning that groundwater recovery took in the order of a two-year period, Figure 2-1.

This objective is 100% complete.

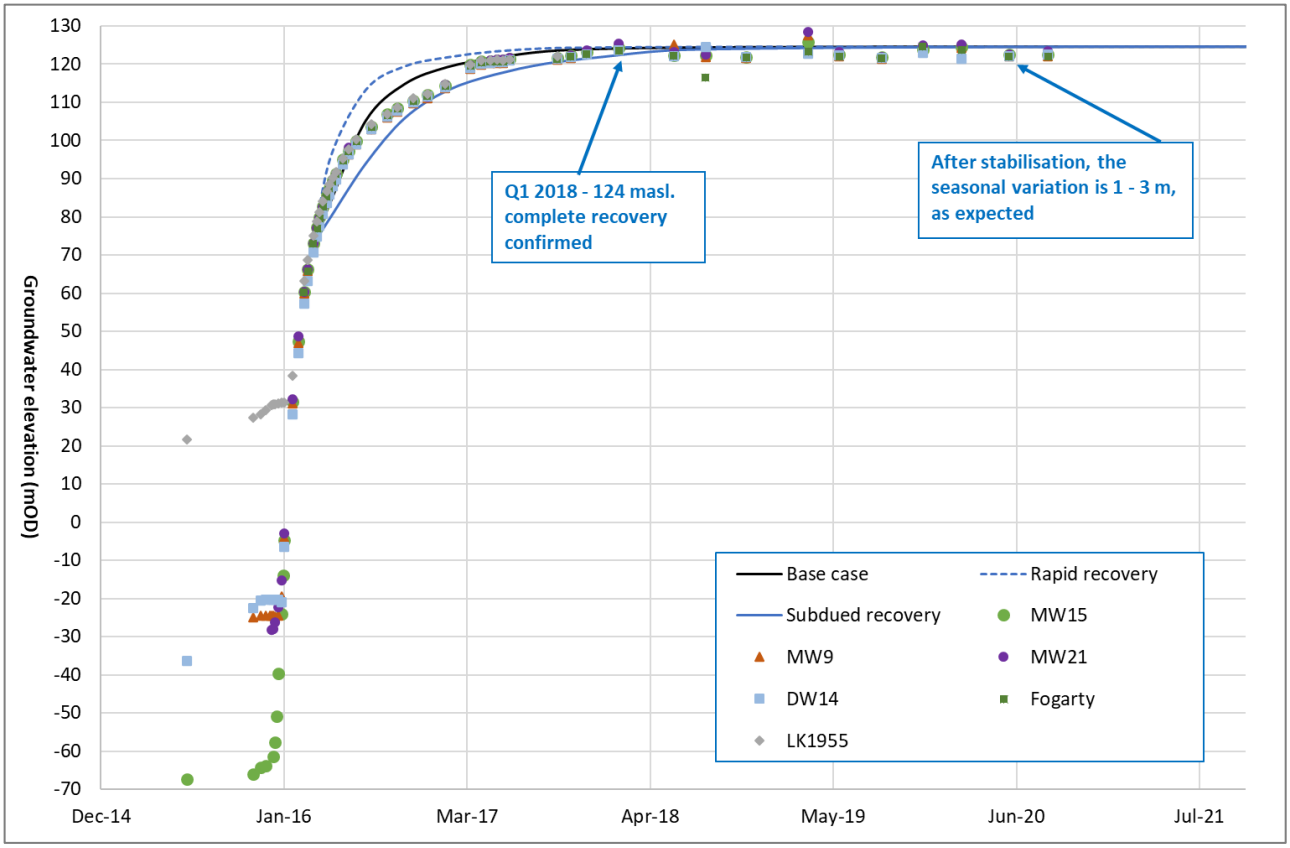


Figure 2-1:Groundwater Recovery

2.2 Review of Current Water Database

Piteau Associates were retained by Lisheen in 2019 to complete an analysis of the surface and groundwater response following the completion of all mining operations, as well as reviewing the water levels along with the surface and groundwater quality. Their 2019 report focused on the Active closure and immediate post closure periods to determine the current status of groundwater and surface water conditions in the mining district and any potential impacts on downgradient receptors.

The conclusion from the report is that:

"Groundwater conditions around the Lisheen Mine had fully recovered by January 2018, two years after the last dewatering pumps were switched off. Peak groundwater levels observed on 31st January 2018 were between 123 mOD and 125 mOD, compared to a pre-mining groundwater elevation of between 122 and 127 mOD. Pre-mining groundwater gradients to the south and southwest have re-established but, as predicted, a slight flattening of the hydraulic gradient appears to have occurred in vicinity of the Mine workings due to the greater connectivity of the groundwater system in the old workings."

"Monitoring data from the two compliance wells show that any influence from the TMF is minimal and there is no influence of groundwater from the workings. Water quality data from the Drish River also show no evidence of groundwater flow from the flooded workings or the TMF."

"Groundwater levels and water quality in all of the regional (domestic) wells monitored as part of the closure programme were largely unaffected by the Mine dewatering operation and the post closure groundwater recovery. Both groundwater and surface water data show that water quality is generally good and within compliance/regulatory standards. However, there are the following exceptions:

"Nickel is elevated in both SW1 and CW1 (surface water and groundwater at the same location) and zinc in SW1. This is likely to be due to the same source which, currently, is uncertain. Further monitoring and review is required to determine the source or to monitor the trend until it is compliant."

The full report completed by Piteau Associates can be found under Case Number LR041931 on EDEN.

Piteau Associates were once again retained to carry out another water review in September of 2020. This review was presented to the Authorities during the MCC. The full review has been uploaded to EDEN, LR052638.

The conclusions from the 2020 review are that:

"The groundwater levels, hydraulic gradients and normal seasonal variations have returned to baseline conditions."

"Groundwater quality downgradient of the workings meets the closure objectives and groundwater regulations with the exception of nitrate, ammonia and nickel; all of which are commonly elevated throughout the district."

"Regional (domestic) well water levels and quality have not been impacted by the mine during operations or closure."

"Available evidence indicates that elevated nickel in CW-01 is not due to the TMF or mining operations."

3.0 CHAPTER 3 - SURFACE MINE SITE AND UNDERGROUND DECOMMISSIONING AND RESTORATION

3.1 Introduction

This Chapter of the Final Validation Report describes the physical decommissioning and restoration programme of the surface Mine Site and the Underground Mine.

In accordance with the Tipperary County Council Master Plan Policy, the Mine Site has been fully rehabilitated to a standard suitable for industrial / commercial land use for the provision of alternative industry.

Lisheen has demonstrated that all residual material, which could result in environmental pollution, has been removed from the site to predetermined Industrial guideline levels: “Category 4 Screening Levels derived in relation to metals by DEFRA, 2014”. All other materials were recycled, recovered or disposed of in accordance with the conditions of the IPC Licence and in compliance with all relevant regulations.

3.2 Surface Decommissioning and Rehabilitation

As per the Closure Success Criteria, No. 2, the objective for “Mine Site Decommissioning” was to demolish unusable site structures, securely cap / fill or otherwise make safe holes, pits and any other openings and to return the entire footprint to suitable lands for the provision for alternative industry. Redundant buried services were to be removed as necessary. All residues associated with the ore or processing reagents were to be identified and removed.

This was accomplished once surface plant buildings, equipment, services and all associated elements within were demolished. Materials, wastes or any other materials, which could result in environmental pollution, were removed from the site and recycled, recovered or disposed of in accordance with relevant procedures / regulations. Full restoration of the Mine Site was also completed. Prior to demolition or dismantling, all services connected to buildings and other structures were disconnected and removed.

To evaluate the success of the project the facility was assessed and validated by suitably qualified engineers, Tobin Engineers, who reported that all residual material had been removed to predetermined Industrial guideline levels. Table 3-1 below references the Case numbers against the various reports submitted and received from the EPA.

Table 3-1: Reports submitted and received from the EPA

Case Number	Title
LR031208	Tobin Engineers Initial Risk Assessment, 2015
LR031208	Tobin Engineers Stage 1 Validation Report
LR036661	Tobin Engineers Stage 2 Validation Report
SV12504	EPA Exit audit Stage 1
SV16109	EPA Exit audit Stage 2

This objective is 100% complete.

3.2.1 Retention of Surface Buildings for Appropriate Secondary Use

The Lisheen Mine Task Force, which is made up of previous Lisheen Management members and a number of governmental and non-governmental organisations, have been actively involved in attracting new industries to site since 2013. Their remit was to replace mining activities on the Lisheen Mine Site in whole or in part. The vision for the Lisheen site is to develop the National Bioeconomy Campus. The Lisheen site is referred to in the National Policy Statement on the Bioeconomy published by the Department of the Taoiseach in March 2018.

To date, two separate industries have received planning permission to develop operations on the Lisheen site. A further three additional companies have had pre planning meetings with Tipperary Co. Co. and are expected to submit planning applications in 2021. The prospect of sustainable development has meant that some buildings and associated infrastructure have been retained on the Mine Site for secondary use. The warehouse and workshops building, and the main parking facility have been retained for future industrial use. One of these buildings, the workshop building, has been refurbished, to carry out pilot plant test-work, by one of the industries planning to develop an operation on the site. The administration building is being donated to the Irish Bioeconomey Foundation with the transfer due to be completed in 2021.

3.2.2 Road Network

Necessary parts of the site's internal road network have been retained to provide access to the retained buildings, with the current access road retained as the primary access route into the restored Mine Site. Certain infrastructure has also been retained for the purposes of servicing the Lisheen Wind Farm.

Other site roads including disused haul roads, the overflow car park and hard standings were removed to formation level and the material crushed. Overburden that contained residues from the mining and processing processes were disposed of in the TMF in accordance with the conditions of the IPCL. Uncontaminated overburden was used as infill material in the TMF below the level of the geotextile layer. Surplus decontaminated material was used for re-profiling across the site.

All other waste materials were segregated and disposed of by authorised waste disposal contractors. Certain areas including the overflow car park and some haul roads were fully rehabilitated back to greenfield in harmony with the surrounding environment.

3.2.3 Mine Water Treatment Plant

The steel tanks, structural steelwork, piping, pumps and electrical services were removed for recycling, sale or disposal. Reinforced concrete in the clarifier, overflow and conditioning tanks, foundations, floor slab, plinths and rising walls, was crushed with the reinforcement removed as scrap and the crushed concrete was disposed of to the TMF and used as infill material below the geotextile layer.

3.2.4 Demolition of the Magazine

The magazine compound, associated structures and bunds were demolished. All clean demolition rubble was disposed of into the TMF where it was used as infill material. All other wastes were segregated and disposed of by authorised disposal facilities. The entire footprint of the magazine compound was rehabilitated in harmony with the surrounding environment.

3.2.5 Fuelling Depot and Oil Storage Facilities

Fuel tanks and their associated distribution systems were carefully drained, desludged and flushed by specialist contractors. Contaminated materials were removed from site and uncontaminated concrete and earth bunding was used for filling sub geotextile void space in the TMF.

3.2.6 Demolition of Buried Services

Any buried services that are required for the wind farm or for potential secondary use upon cessation of the mining operations have been left in-situ. All other redundant buried services, ducting and pipework have been removed.

3.2.7 Demolition Works to the Existing Dwellings on the Lisheen Landholding

Selected buildings, outbuildings and sheds were demolished within the landholding. All clean demolition rubble was transported to the TMF where it was used as infill material. All other wastes were segregated and disposed of by authorised waste disposal contractors.

3.2.8 Concentrator, Tepee and Backfill Plant (Hunterdale Contracted Project)

As per the Closure Success Criteria, No. 1, the objective for “Mine Site Decommissioning, Hunterdale Contract”, was to fully decommission and disassemble the Tepee, Processing Plant, Backfill Plant and all associated elements.

This portion of the surface plant was sold to an international natural resources company. The demolition and transport of the plant to the new owners was managed by Hunterdale Ltd, who took over the designated area and carried out the disassembly of the processing plant for shipping overseas. They also demolished other plant along with all associated buildings that were not required to be transported. The process included the dismantling, removal and disposal of structural steelwork, support steelwork, feeders, conveyor, cladding, walkways, walls, floors, ceilings, foundations, slabs, sanitary fittings, services and the like. Reinforced concrete foundations, floor slabs, plinths and rising walls, were demolished and crushed, with the reinforcement removed as scrap and the crushed concrete disposed of to the TMF and used as infill material.

To evaluate the success of the project it was reviewed and signed off by an external consultant C3 Projects, Hunterdale Limited and Lisheen Management following the successful completion without any environmental issues and within a specified time frame. The footprint was returned to concrete level and returned to Lisheen in October 2016.

Figure 3-1 and Figure 3-2 compare conditions at the Mine Site pre demolition, with conditions post demolition and rehabilitation.

This objective is 100% complete.

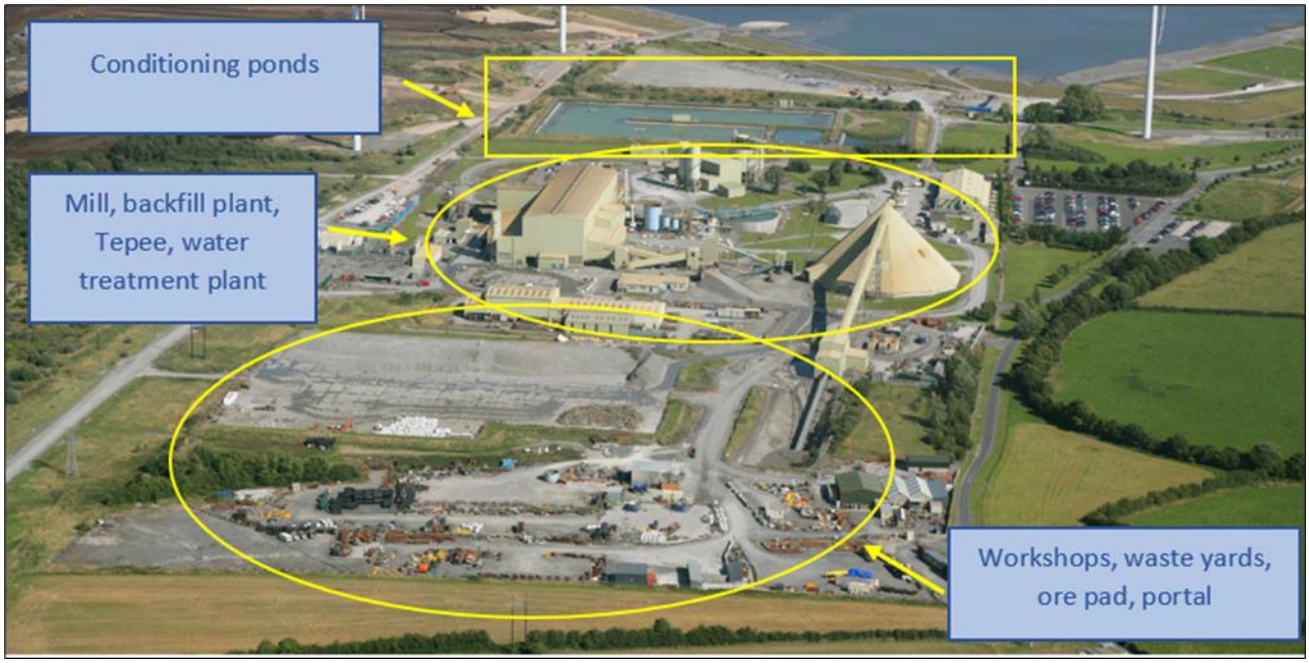


Figure 3-1: Mine Site pre demolition

Figure 3-2: Mine Site post demolition and rehabilitation

3.3 Underground Decommissioning

As per the Closure Success Criteria, No. 3, the objective for “Underground Decommissioning” was to remove all hazardous material from the underground workings and to complete a specific sign off sheet, which confirmed

the areas had been cleared of all items that could pose a risk to the environment, before any areas were rendered inaccessible and flooded.

Decommissioning of the underground facilities were completed once mining operations and backfilling was complete. Fixed and mobile underground assets of value, and not required for underground withdrawal purposes, were brought to the surface and sold as part of Lisheen Mines Asset Disposal Procedure. The Mine was split into 19 different zones for the withdrawal project. Each area was inspected and signed off by 7 individuals, including the Closure Engineer and the General Manager, once all items that could pose a risk to the environment were removed. Please refer to Appendix 3.2 of the 2016 CRAMP for details on the procedure. Any plant, equipment, tanks, and fuel containers remaining underground were drained down of oil and fuel and stripped of rubber-based components. Once each area had been signed off no placing of additional materials was permitted, and the area was suitable for re watering. The water pumps were turned off on 30 December 2015, allowing the Mine to re-water.

This objective is 100% complete.

3.4 Mine Openings

Sealing off all openings to the Mine provided a robust solution to prevent future access to the underground workings and ensure the ground stability around the openings to the Mine.

3.4.1 Ventilation Shafts

As per the Closure Success Criteria, No. 4, one of the objectives for “Plugging Ventilation Shafts” was to plug / seal all vertical shafts and rehabilitate to surrounding ground level.

There were 12 shafts in total varying in diameter from 2.5 m to 5.5 m and varying in depth from 80 m to 240 m. Each individual shaft was stripped of infrastructure as required.

Each shaft has a base rock plug and a base concrete plug above the Mine excavation. The full columns of the shafts were filled with rock followed by a concrete plug on top which was then covered with a lintel on surface (Figure 3-3). Each ventilation shaft location was rehabilitated in harmony with the surrounding environment.

The finalised construction of this work package ensures that the Mine cannot be accessed by any of the shafts and it also ensures that the surface of all shafts are stable with no chance of settlement expressing itself on surface.

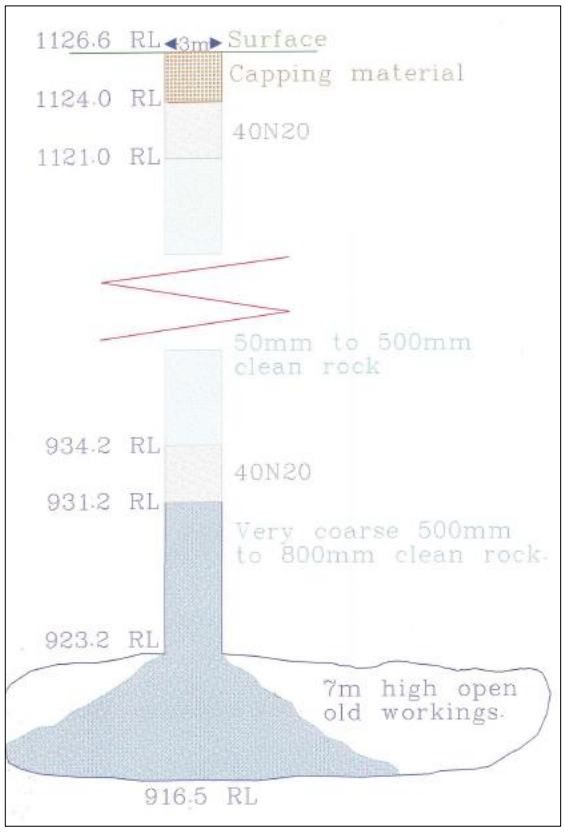


Figure 3-3: Vent Raise 2 – typical of all the shaft fill designs

The ventilation shaft filling was completed per the CQA plan and the works were fully supervised for quality assurance and quality control by Advanced Mining Services Ltd. The Shaft Filling Final CQA Report, which can be found under Case number LR037159 on EDEN, includes the individual designs for each vent shaft, the methodology followed, and the quality control of the material used to meet Quality Control standards.

3.4.2 Alteration to Original Design

Following a site visit and discussion with the Department of Communication, Climate Action and Environment, (DCCAE), to review the ventilation shaft filling process, the DCCAE made a recommendation for an alteration to the design of the top section.

Initially they were designed to be topped with glacial till and a final layer of topsoil, peat or hardcore to blend in with its surrounding features. Subsequently the design of the top sections was revisited and replaced with concrete lintels and approved by DCCAE prior to completion.

Measuring bars were anchored into the major fill underneath the lintel and run through the lintel in a sleeve which can be used for measuring potential settlement. The purpose of the recommendation was to further protect against any future consolidation in the shaft from expressing itself on surface.

Figure 3-4 below shows the re-design following the DCCAE visit which includes the concrete lintel.

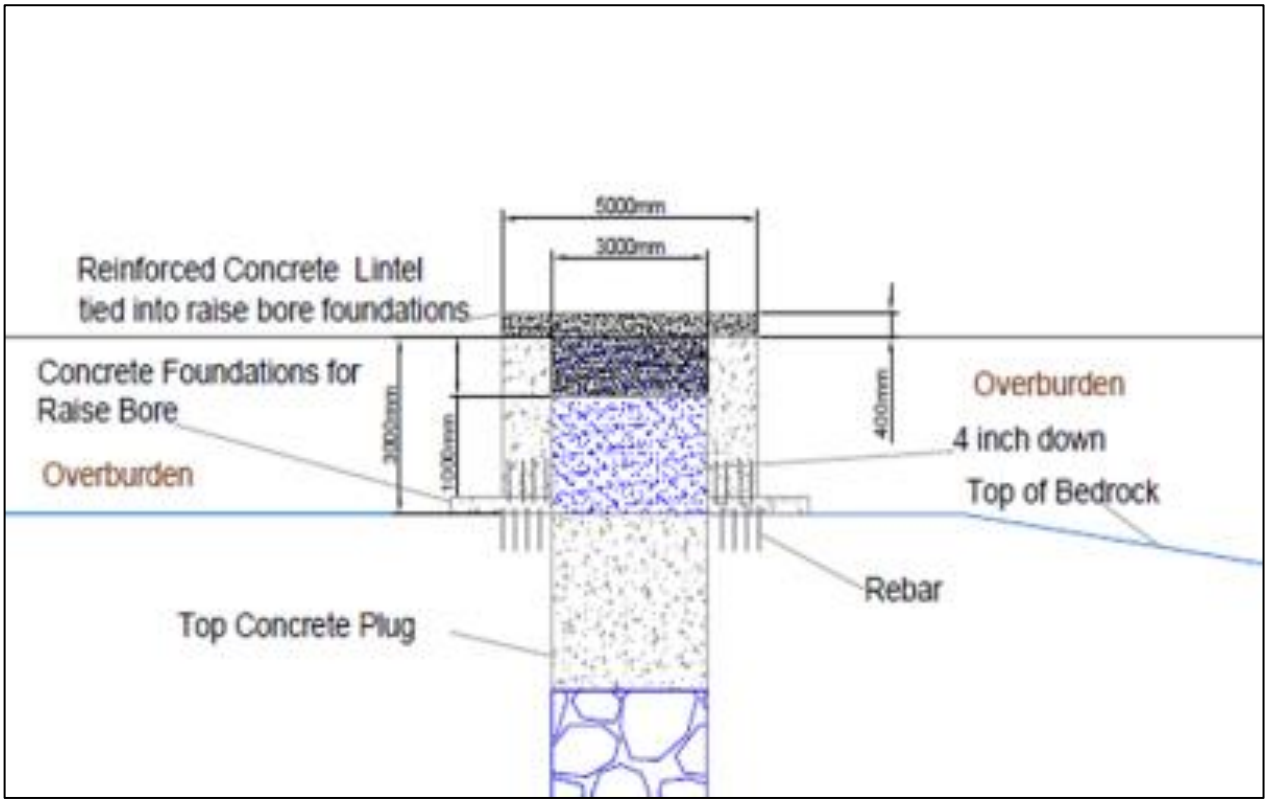


Figure 3-4: Re-design of shaft filling featuring concrete lintel

Figure 3-5 and Figure 3-6 compare conditions at Ventilation Shaft 6 pre demolition, with conditions post demolition and rehabilitation.

Figure 3-5: Ventilation Shaft 6 pre demolition

Figure 3-6: Ventilation Shaft 6 post demolition and rehabilitation

3.4.3 Backfilling and Monitoring Structural Stability

A comprehensive paste backfilling programme was completed throughout the life of the Mine with the process forming an integral part of the mining operations. The paste comprised of tailings and a binder (cement and / or GGBS). These were mixed with water and thickened in the backfill plant, to form a paste.

The paste was pumped underground and directed to mined out areas where it was used to fill or "backfill" voids where it provided ground support. The process also ensured that the overall volume of material disposed into the TMF was reduced. Waste rock, which is essentially non mineralized rock with very low or no metal content, was also separated from the ore stream and used underground to fill voids and to provide localised support. In some areas a tight fill was required, and these areas were topped up from surface following closure. The areas filled with backfill were agreed with the DCCAE and the Mines Inspector.

3.4.4 Structural Stability and Support

The extraction of the orebodies at the Lisheen Mine generated very significant rock mass changes in the surrounding and overlying area. The creation of large voids changes the pressure pattern within the rock mass resulting in rock movements, opening on faults, deflection of roof beams – resulting in a small amount of regional subsidence of the surface. Monitoring for ground control behavioural changes was carried out throughout the life of the Mine and continues on a regular basis. The measured subsidence has been within the initial levels that were predicted in the EIS before mining commenced.

Based on historic monitoring, data guidelines have been developed to form the Trigger Action Response Plan. Should any movement occur above the guidelines as set out in the plan, immediate barricading off of the affected area on surface will be undertaken and a full review of the monitoring will be carried out to determine if further actions are required.

Subsidence monitoring clearly shows the three stages of mining: primary which are single stopes with no requirement for backfill, secondary which are stopes backfilled to allow removal of secondary pillars, and tertiary with the final pillars removed. The amount of surface subsidence increased for each of the stages of mining, as was expected, and this is what was measured at Lisheen. Importantly once mining ceased all subsidence ceased, and in fact, once the Mine was allowed to flood there was actually a slight uplift in ground elevation (by approx. 10 mm). This too has since now stabilised, and all monitoring demonstrates that the ground is stable. Figure 3-7 below gives an example of how the ground settled during the mining period and how this settlement has ceased at all locations since mining ceased. The settlement data has essentially flatlined from 2017 onwards, demonstrating that movement has ceased.

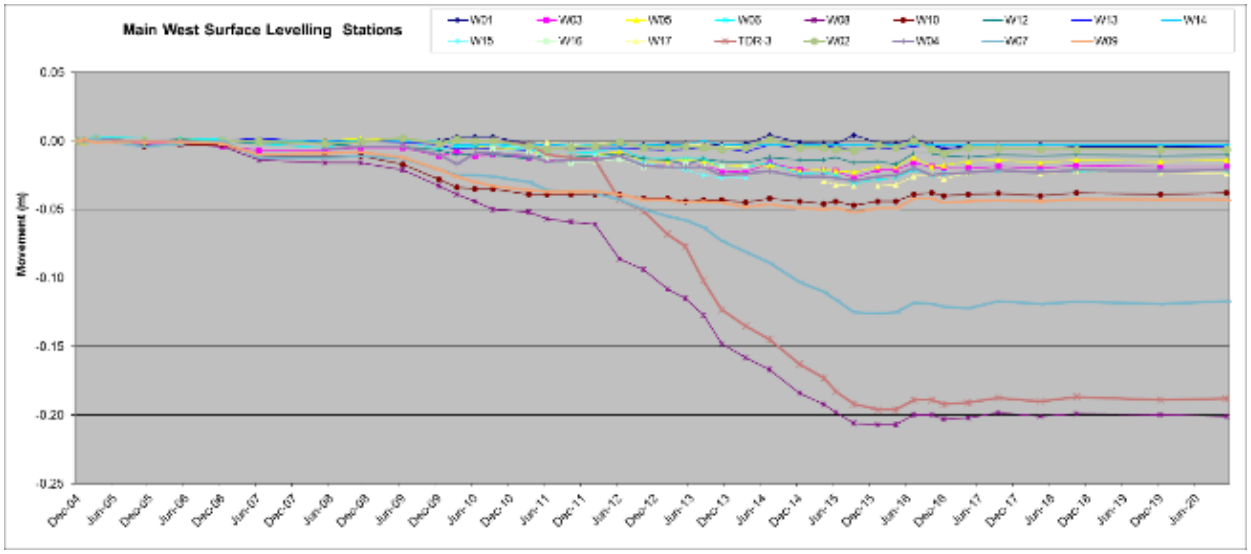


Figure 3-7: Graph of Main West surface level monitoring

3.4.5 Sinkhole / Subsidence Risk

An annual Land Risk Review is carried out to review the performance of the surface and sub surface ground above the Lisheen mining area and to evaluate the stability of the ground. The land has been categorised into four risk categories and agreed with the DCCAE. All land is being retained under the ownership of Lisheen until such time as it is deemed stable and suitable for sale.

3.4.6 Sealing of the Main Drift Decline

As per the Closure Success Criteria, No. 4, one of the objectives for “Plugging Vent Shafts” was to plug / seal the Mine Portal to prevent access to the Mine.

This was accomplished once all service pipes, conveyor steel framework and rubber-based components were removed from the entire length of the decline. The plug consists of rock fill and concrete grout constructed along the top section of the decline.

A Geotechnical Review of the Decline and Portal was completed ahead of the works to understand the future stability and evaluate the risk of surface subsidence based on its geological setting and support previously installed. A design was proposed for its closure to ensure its long-term stability with respect to potential failure and caving. The full Geotechnical Review was uploaded to the EDEN portal, Case numbers LR037164 and LR037165.

A berm was constructed at a vertical distance of ca. 20 m below surface – which gave a linear distance of ca. 188 m in the Decline that had to be filled. The vertical distance of ca. 20 m was derived by an experienced geotechnical engineer who previously worked at Lisheen for 15 years. The design for the Decline fill is presented in Figure 3-8.

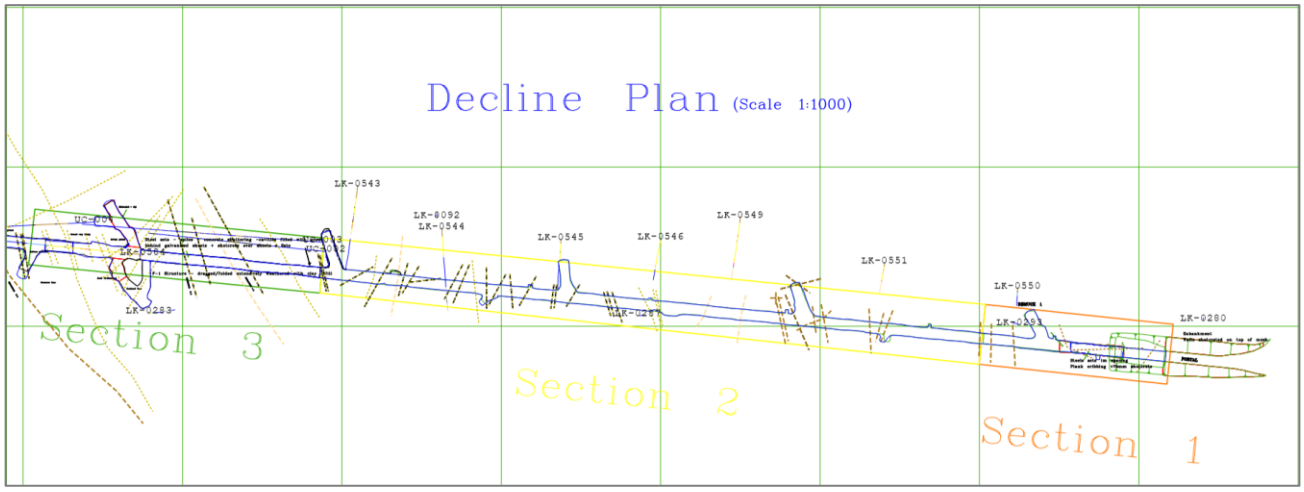


Figure 3-8: Design for the Decline Fill

The Decline fill design was split into three sections. Section 1 extends ca. 188 m from the surface. Due to a risk of caving on surface if failure were to occur the section was backfilled. A pressure bulkhead was installed below Remuck 1 with a grout plug up gradient of it with the remainder of the area up to the Portal packed with washed rock which was sealed with fibre reinforced shotcrete.

It was determined that if a collapse in the Decline was to occur along Section 2 the cave was not predicted to reach within 10 m of the surface. This area was not backfilled.

It was determined that in the unlikely event of a collapse along Section 3 there is no risk of the cave propagating to surface. This area was not backfilled.

Once the plug was complete, the shotcrete was removed from the sides of the open area of the decline; the area was filled with clean rock and profiled to surface with glacial till and topsoil.

A detailed report of the actual plugging process completed in line with the geotechnical design requirement can be found under Case number LR037166.

The DCCAE had some concerns in relation to the area around Remuck 2 on the Decline (a remuck is an excavated area to the side of a long straight excavation - in this instance the excavation height was higher than the Decline height). This area was not backfilled as it was outside the area that was required to be backfilled based on calculations completed for Lisheen. Although Lisheen and its consultants remain satisfied that all risks have been adequately addressed, Lisheen took the Department's concerns on board and it was agreed that a specific area on surface around Remuck 2 would be referred to as a Cautionary Zone on the land risk map as agreed with the DCCAE. It has been demarcated off and future land use in this section is restricted.

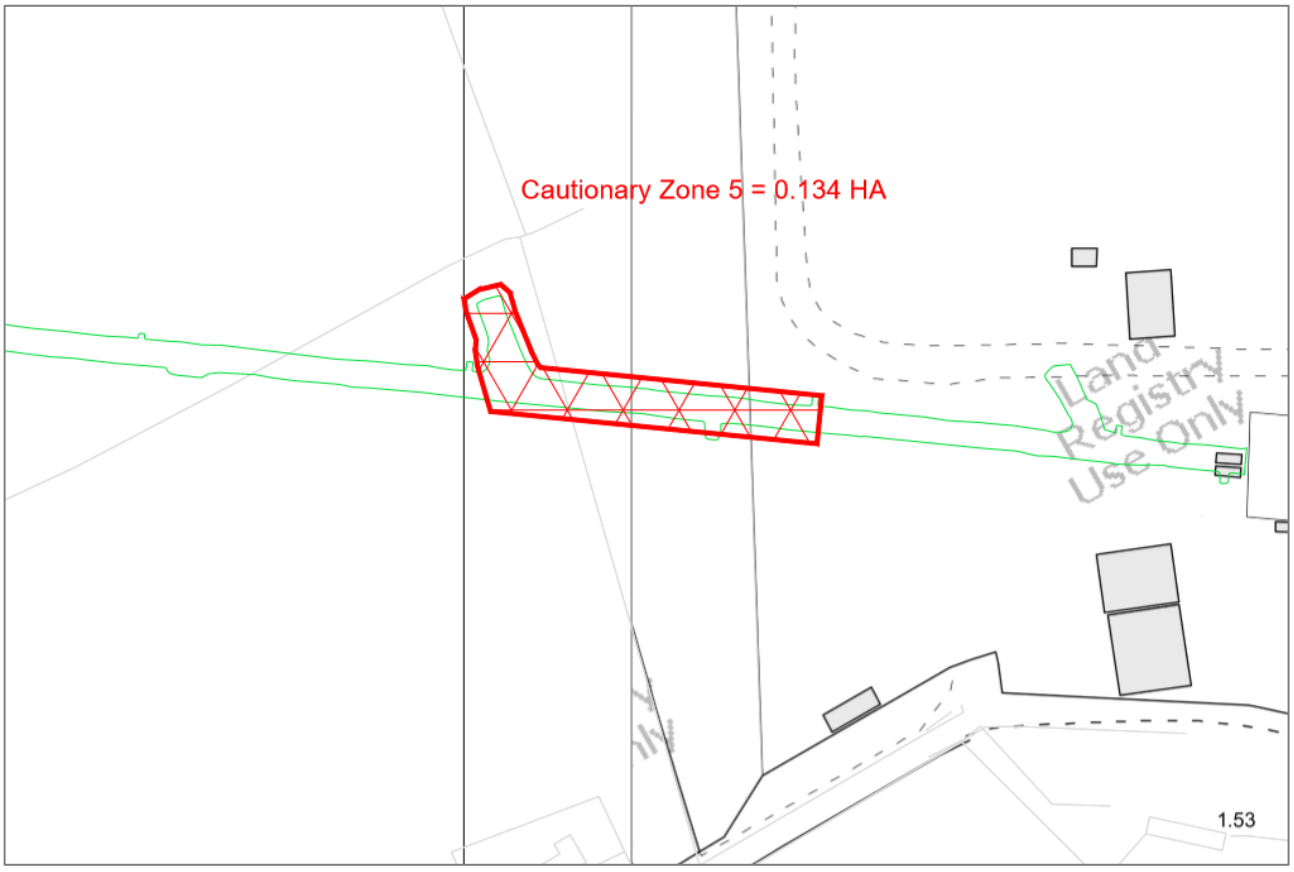


Figure 3-9: Cautionary zone 5

A Special Condition will be included as part of the contract of sale of any lands owned by Lisheen and ultimately will be incorporated within any potential Deed of Transfer of this area as a burden. The special condition reads as follows:

The Transferee, (to include its mortgagees, assigns and successors in title) covenants with the Transferor to:-

(1) *Not to do or permit or allow any building or buildings to be constructed on the Cautionary Zone at any time.*

(2) *Not to do or permit or allow any development of the Cautionary Zone at any time.*

(3) *Not use or permit or suffer the Cautionary Zone to be used at any time for any purpose other than as agricultural land.*

(4) *Erect and maintain stock proof fencing around the entire perimeter of the Cautionary Zone.*

Figure 3-10: Mine Portal pre demolition

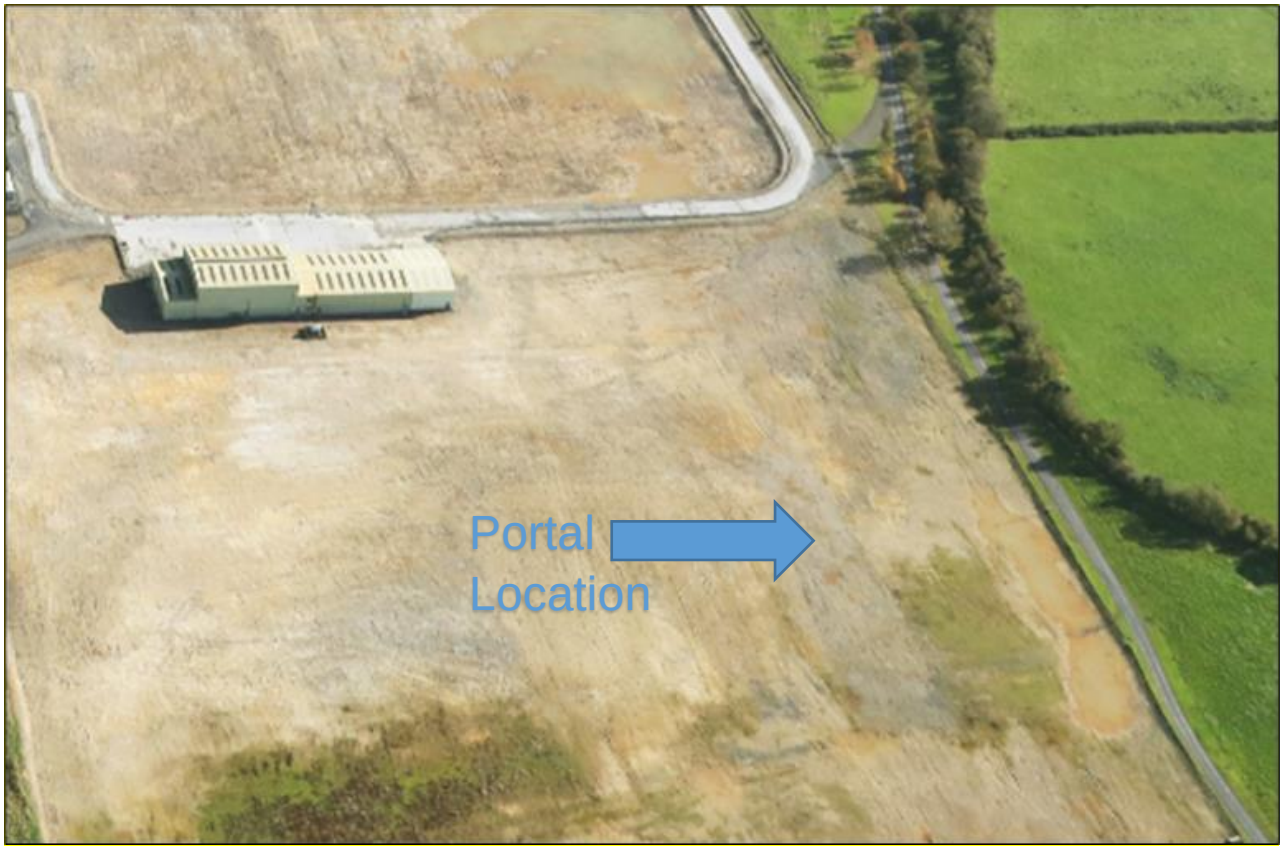


Figure 3-11: Mine Portal post demolition and rehabilitation

3.5 Water Management Facilities

3.5.1 Demolition of the Conditioning Ponds

Pumps were removed and sold as part of the asset sale process and the pump houses were demolished. All associated pipework was removed and sold for scrap. All metals and plastics were removed for recycling to a licenced facility while all concrete materials were hauled to and disposed of in the TMF as infill material.

Residual sludge from the ponds was removed to the TMF and the liners were shredded and removed from site. The earth berm sides of the ponds were levelled, with top soiling and seeding completed over the pond areas and associated footprints.

3.5.2 Phasing out of PWE1 Discharge

The phasing out of the discharge at PWE1, into the Drish River, occurred gradually over a number of weeks. The discharged ceased completely on the 03 May 2017.

Lisheen made a commitment to the Inland Fisheries Ireland that they would be able to provide a source of water that could be discharged during the summer of 2016 if there was a risk that the river might dry out in places. There was no such requirement to discharge water during 2016, or since. The pipeline will remain in place as to remove it would be too disruptive to local farmers. It is also a potentially valuable item of infrastructure that is expected to be required by industries planning to locate within the National Bioeconomy Campus. Any industry that plans to discharge via the pipe will need approval to do so from the relevant Statutory Authority. Additionally, the pipeline will also be available to Lisheen for use to discharge surface water under licence should the need arise, subject to the appropriate enabling works to reinstate a discharge.

3.5.3 Demolition and Rehabilitation of the Drish Pond Area

All water and sludge were removed from the Drish Pond and the entire Drish Pond and Channel area was rehabilitated. The works involved breaking out the concrete chambers and sumps and hauling the demolition rubble to the TMF. All residues and silt from the pond area were also hauled and placed within the TMF.

Figure 3-12 and Figure 3-13 compare conditions at the Drish Channel and Pond pre demolition, with conditions post demolition and rehabilitation.

Figure 3-12:Drish Channel and Pond pre demolition

Figure 3-13:Drish Channel and Pond post demolition and rehabilitation

3.5.4 Phasing Out of Discharge to the Rossestown River

It was expected that Lisheen would need to maintain a discharge to the PWE2 location, into the Rossestown River, until the groundwater levels and springs had recovered.

This was a requirement in the 1997 Planning Permission, however regular monitoring of the river levels demonstrated that there was sufficient volume in the River and augmentation was not required. Site discharge to the Rossestown River ceased completely on the 21 December 2017. The pipeline will remain in place as similar to the Drish pipeline; its removal would be disruptive to landowners and it too is of value to the Industries that plan to locate within the Bioeconomy Campus.

3.5.5 Demolition of the Chamber and Rehabilitation at the Rossestown Outfall

The compound at the Rossestown outfall was demolished and removed. Works included the removal of all demolition rubble to the main TMF for use as infill material and the rehabilitation of the facility.

3.5.6 Remediation on Rivers

As per the Closure Success Criteria, No. 14, one of the objectives for “Completing Required Remediation on the Rivers” was to complete a risk assessment of the metal contamination within the sediment in the rivers and carry out appropriate works if required.

The outcome of this risk assessment, which was based on sediment results and biological monitoring, demonstrated that there was no requirement to remove sediment from either the Drish or the Rossestown Rivers. A copy of the Risk Assessment can be found in EDEN under Case Number LR037167.

This objective is 100% complete.

Further objectives for Closure Success Criteria No. 14 were to “Develop and Implement a plan with the Inland Fisheries Ireland” to enhance the rivers and to complete drainage works to ensure that waterbodies all performed adequately post rewatering of the Mine (due to dewatering of the Mine there were surface channels that had become overgrown with vegetation due to lack of water flow over the last ca. 15 years).

Part of the plan was to improve the environmental quality of the Drish River by completing some dredging and upgrading works. Prior to the works the Drish River had a flow regime that was laminar in nature with limited areas of velocity diversity resulting in long stretches of deep pools or glides. The works carried out over a 3 km

stretch of the Drish were to increase velocity diversity using a series of in-stream flow modifications structures. These structures were constructed using large rock and created a meandering channel increasing the areas of fast flowing riffles, which in turn created a habitat for juvenile salmonids. This resulting diversity of flow also increased the spawning areas available for all fish species. These works also resulted in both in-stream and riparian habitat improvements. While no electrofishing surveys have taken place since these works were completed, a number of walk over surveys by the Inland Fisheries Ireland have resulted in visual improvements to the channel.

This plan also included removing significant quantities of vegetation along the Clogheen Stream, (tributary to the Drish), and the Rossestown River to ensure the free and unencumbered flow of water.

Case number LR048161 contains a report compiled by Inland Fisheries Ireland stating that they are satisfied that the works are a benefit to the Drish habitat and will continue into the future to benefit the fish species in the Drish River. They also stated that these works were a justified investment by Lisheen Mines and will have a worthwhile return on the investment in terms of ecological and environmental benefits.

Figure 3-14 and Figure 3-15 compare conditions at the Drish River pre rehabilitation, with conditions post rehabilitation.

These objectives are 100% complete.

Figure 3-14:Drish River pre rehabilitation

Figure 3-15:Drish River post rehabilitation

3.5.7 SW1 Discharge

This location is now the primary licensed discharge location in operation for site surface water discharge.

Precipitation that falls within the catchment of the TMF will need to be managed into perpetuity. This precipitation will undergo evaporation and evapotranspiration, but this will not remove all water, therefore there will be seasonal discharge from the facility.

TMF surface water exits the facility via engineered spillways towards a stilling box before entering the storm water attenuation basin. It then flows by an open channel to a final smaller wetland before discharge to the Clogheen Stream, which is a tributary of the Drish River, via SW1.

At the time of this report SW1 is recording non-compliances for zinc and occasionally nickel. The on-going non-compliances have been influenced by the rehabilitation works that were being carried out on the TMF. As part of these works it was necessary to pump tailings water into Spillway 1, which forms part of the water that exists at the compliance location (SW1). This pumping was required to carry out excavations in order to expose the areas of liner that had to be repaired, this pumping also prevented tailings water exiting the TMF in an uncontrolled manner via seepage pathways in the wall.

While non-compliances for these metals have been recorded, the average mass emission to the Drish is greatly reduced on what it was during the operational phase of the Mine (nickel from 1.68 kg/day to 0.07 kg/day and zinc from 20.01 kg/day to 1.48 kg/day, a reduction of 96% and 93% respectively). The concentration for both zinc and nickel is compliant in the Drish River, downstream of the location where SW1 water confluences with the Drish.

The TMF works are now complete and there is no pumping of tailings water into Spillway 1. The quality of Spillway 1 water and SW1 water is being tracked and is showing an improvement. However, it may take a

period of time for the system to purge or flush the residue of tailings water from the spillway and associated drainage pathways. Lisheen is also mindful of the possible influence of pore water from the main TMF (raised section) on the quality of water in Spillway 1, this can be better assessed now that the repair works are complete.

Lisheen Mine is planning a review of the IPCL which will introduce modifications to the licence to cater for all changes that have been brought about by closure of the mine and implementation of the closure plan. The modifications will include the removal of all conditions relating to emission that no longer exist.

The IPCL review will also seek to reduce the limit for water volume emission to cater for the significant reduction in water being discharged from the site and modify the concentration ELV accordingly. Piteau Associates conclude that it is 'considered to be a very conservative approach to assigning ELVs whereby the quality of the discharge must be equal to, or better than, some of the highest quality rivers in the country'. The limits are arguably not appropriate for a closed industrial site. The Piteau report looks at the assimilative capacity of the river and will be submitted as part of the justification for ELV revisions.

3.5.8 Demolition of Killoran Pond, Canal and Wetland Area

The entire footprint of the Killoran Pond including the walled embankments, Canal and associated Wetland were excavated and transported to the TMF where the material was used as infill below the geotextile layer.

All other waste materials such as piping, fencing and steel were segregated and disposed of to authorised disposal facilities. The entire footprint was fully rehabilitated and landscaped with topsoil.

Figure 3-16 and Figure 3-17 compare conditions at the Kiloran Pond, Canal and Wetland area pre demolition, with conditions post demolition and rehabilitation.

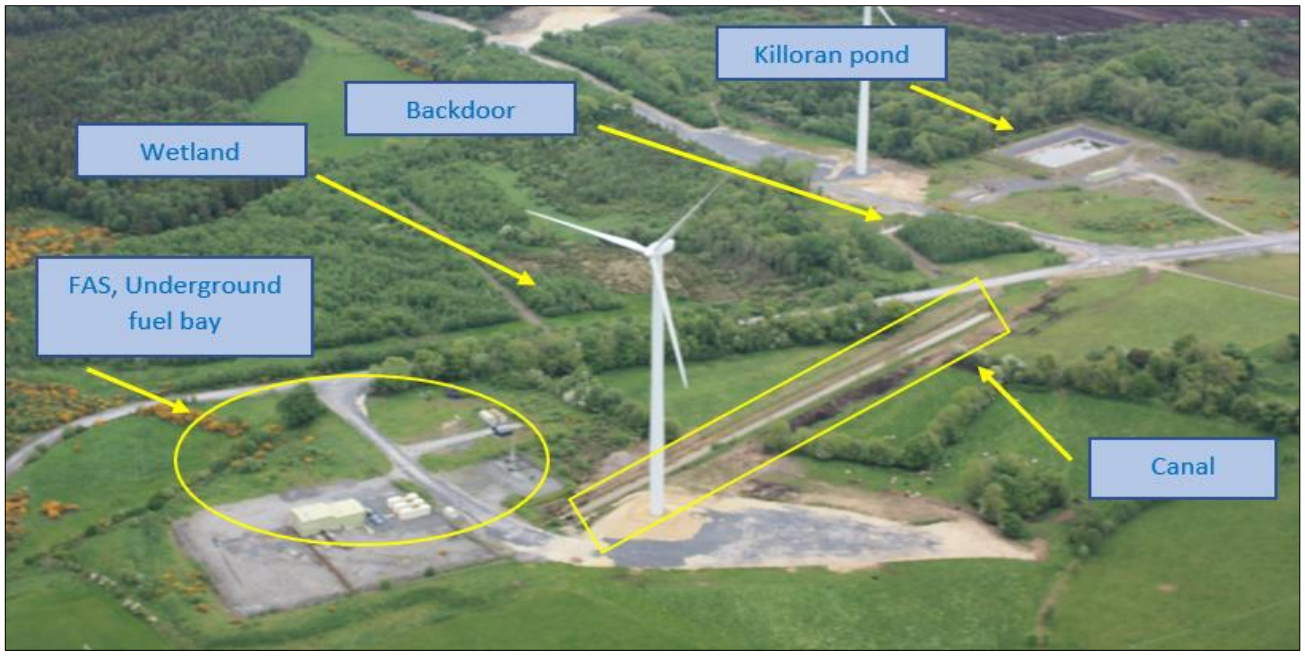


Figure 3-16: Killoran pond, canal and wetland area pre demolition

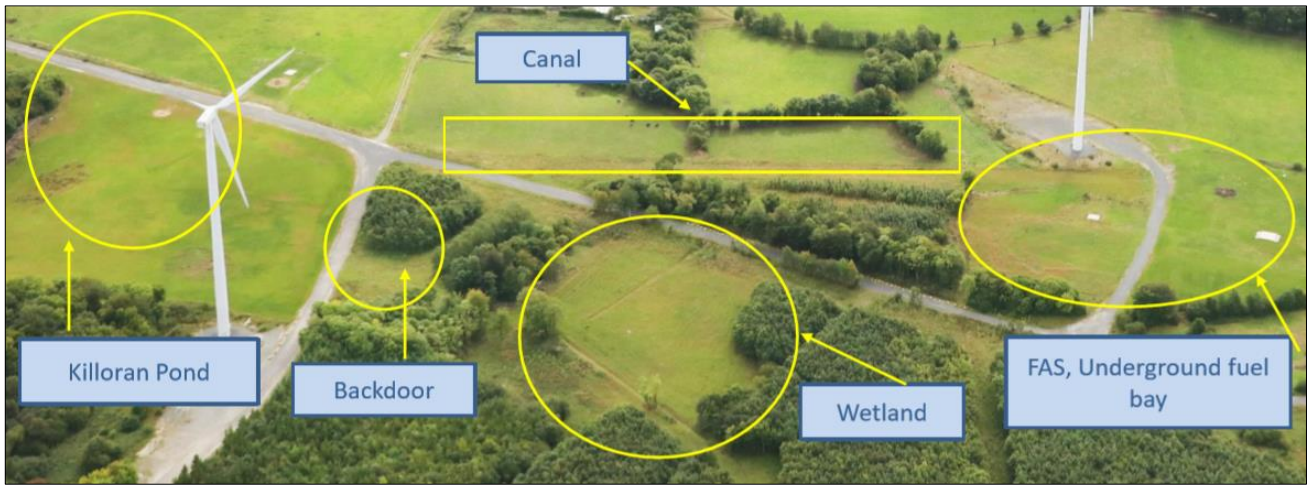


Figure 3-17: Killoran pond, canal and wetland area post demolition and rehabilitation

3.5.9 Carrick Hill – Restoration Works to the Borrow Pit Area

The Carrick Hill Borrow Pit Area was used for sourcing construction material throughout the life of the Mine. The material sourced was primarily used for the construction of the TMF dam wall and the Lisheen Wind Farm. It was also used for closure rehabilitation and restoration works.

As per the Closure Success Criteria, No. 9, the objective for “Carrick Hill Restoration” was to complete restoration and create an open area of water with associated wetland features providing an area of considerable wetland nature conservation interest.

The borrow pit area was rehabilitated upon closure with works that included the construction of an outlet structure to the adjacent Rossestown River, raising of the access road to the wind turbine and creating an access road around the top perimeter of the borrow pit.

The detail of the connection between the Rossestown River and Carrick Hill was agreed with Inland Fisheries. The connection is via a gabion basket wall which allows water flow but not fish, (to protect against fish migrating from Carrick Hill to the river).

Surfacing of the entire perimeter road was also carried out. Other works included profiling, grading and shaping the slopes and bunds prior to top soiling and hydro seeding. Woodlands with native species were also planted.

As the groundwater level recovered the area became flooded forming a large body of water.

Figure 3-18 and Figure 3-19 compare conditions at Carrick Hill pre demolition, with conditions post demolition and rehabilitation.

Figure 3-18: Carrick Hill pre rehabilitation

Figure 3-19: Carrick Hill post rehabilitation

3.5.10 Demolition Works to Wellfield Boreholes and Pipework

All associated wellfield pipework was excavated, with overhead power lines and transformers decommissioned and dismantled. All pipework and metal were removed from site for recycling while all concrete materials were hauled and disposed of in the TMF as infill material.

3.5.11 Moyne Group Water Scheme

During the construction of the Lisheen Mine Site the Moyne Group Water Scheme (MGWS) was expanded to provide a water supply to the general area affected by the cone of drawdown. The Scheme has proved very successful in providing the village of Moyne and the wider community with potable water. As well as on-going

maintenance, substantial upgrades were completed on the scheme by Lisheen to ensure that upon handover the scheme was state of the art and able to meet the needs of the local community into the future.

The Moyne Group Water Scheme committee agreed that the water-table has recovered and, as intended, they took over the management of the scheme and the running costs in February 2018.

As a part of the Closure Success Criteria, No. 11, one of the objectives for the restoration of groundwater was the transfer of the MGWS to full ownership / management by the MGWS committee.

This objective is 100% complete.

3.6 Port of Cork Concentrate Storage Facility

Throughout the life of Mine, the Lisheen Mine leased a facility that was used for exporting zinc and lead concentrate through the Tivoli Dock in Cork.

As per the Closure Success Criteria, No. 13, the objective for the 'Port of Cork' was to render safe or remove for disposal or recovery, any soil, subsoil, plant or equipment, or any waste, materials or substances that may result in environmental pollution.

To evaluate the success of the project the facility was assessed and validated by Independent Engineers. This was accomplished once all buildings, equipment, materials, wastes or any other materials, which could have resulted in environmental pollution, were removed from the site and recycled, recovered or disposed of in accordance with relevant procedures / regulations. All works were independently overseen and carried out under strict guidelines to the satisfaction of the Port of Cork Authorities and the Lisheen Mine. The works were signed off by RPS Group who were jointly appointed by Lisheen and the Port of Cork. Subsequently the Port of Cork Authorities accepted to surrender the lease and released Lisheen from its obligations under the lease.

This objective is 100% complete.

The project was split into two parts: 1) Dry cleaning of the facility, and 2) Demolition works.

3.6.1 Dry Cleaning of the Concentrator Facility

Lehane Environmental & Industrial Services Limited were engaged to clean down the concentrate storage facility. Works included dry cleaning of the conveyor system and the internal warehouse facility.

All concentrate residues from the cleaning process were collected, transported to the Lisheen Mine Site and disposed of into the TMF as infill material. All hydrocarbon residues were collected and disposed of separately by an appropriate licensed contractor.

3.6.2 Demolition Works of the Concentrator Facility

O'Kelly Brothers Civil Engineering Ltd completed the demolition and rehabilitation works to the conveyor system, main warehouse building and substation.

Works included the demolition of the warehouse and conveyor 2. Structure and building waste material were removed to authorised disposal facilities. The concrete floor of the warehouse and conveyor 1 were cleaned and left in-situ so that the Port of Cork could sell or reuse in the future. The car park and access roads were also retained.

All works were independently supervised and signed off by RPS Group. They also carried out all the environmental monitoring required for the duration of the works.

3.6.3 Environmental Monitoring

As part of the requirements for the handover of the site, Lisheen were required to conduct a round of environmental monitoring of concrete ore, marine sediment, dust, noise and soil monitoring, in order to determine lead and zinc levels for the site post demolition works.

Results of marine sediment sampling demonstrated the lead and zinc levels are below the recommended lower limit as defined by the "Guidelines for assessment of dredge material for disposal in Irish Waters 2006" (Table 3-2). The average lead concentration was 41 mg/kg verses the lower recommended limit of 60 mg/kg. The average zinc concentration was 130 mg/kg verses the lower recommended limit of 160 mg/kg.

Table 3-2: "Guidelines for assessment of dredge material for disposal in Irish Waters 2006"

Parameters	Units (dry wt)	Lower level	Upper level
Lead	mg/kg^{-1}	60	218
Zinc	mg/kg^{-1}	160	410

Results of the soil sampling demonstrated that the levels of lead and zinc are below the "DEFRA Category 4 Screening Levels" for lead values, 59 mg/kg vs. 2,300 mg/kg, and "Land Quality Management and Chartered Institute of Environmental Health" for zinc values, 219 mg/kg vs. 730,000 mg/kg, for commercial land use.

Validation sampling of the concrete core following cleaning demonstrated that one location, sample reference core 6, was above the lead guideline values, 3,700 mg/kg vs. 2,300 mg/kg. Following receipt of the results the area was sand blasted to remove the top layer of concrete. Subsequent sampling demonstrated that all contamination had been removed with an average lead concentration of 463 mg/kg vs. 2,300 mg/kg was recorded.

Industrial Guideline Screening Values

According to the EPA's "Guidance on the Management of Contaminated Land and Groundwater at EPA Licensed Sites" it is recommended to use Generic Assessment Criteria while carrying out risk assessments and validation of EPA licensed sites. These criteria are based on the UKEA Contaminated Land Exposure Assessment model known as Soil Guideline Values, SGV's, or values generated using the CLEA model by reputable third-party organisations such as Land Quality Management (LQM) or Contaminated Land: Applications in Real Environments (CL:AIRE). It also suggests the use of the UK Department for Environment Food and Rural Affairs, DEFRA, methodology as a useful reference.

Table 3-3 below presents the guidelines and sources used as the generic assessment criteria applied for validation.

Table 3-3: Sources of guidelines

Units – mg/kg	Source	
Parameter	DEFRA C4SL's	LQM/CIEH
Lead	2,300	
Zinc		730,000

Dust and noise monitoring during the demolition phase was below the limits set by the conditions of the planning permission for the demolition of the building.

Please refer to case number LR037168 on the EDEN portal for documents in relation to the demolition works completed at the Port of Cork.

Figure 3-20 compares conditions at the Port of Cork pre demolition, with conditions post demolition and rehabilitation.

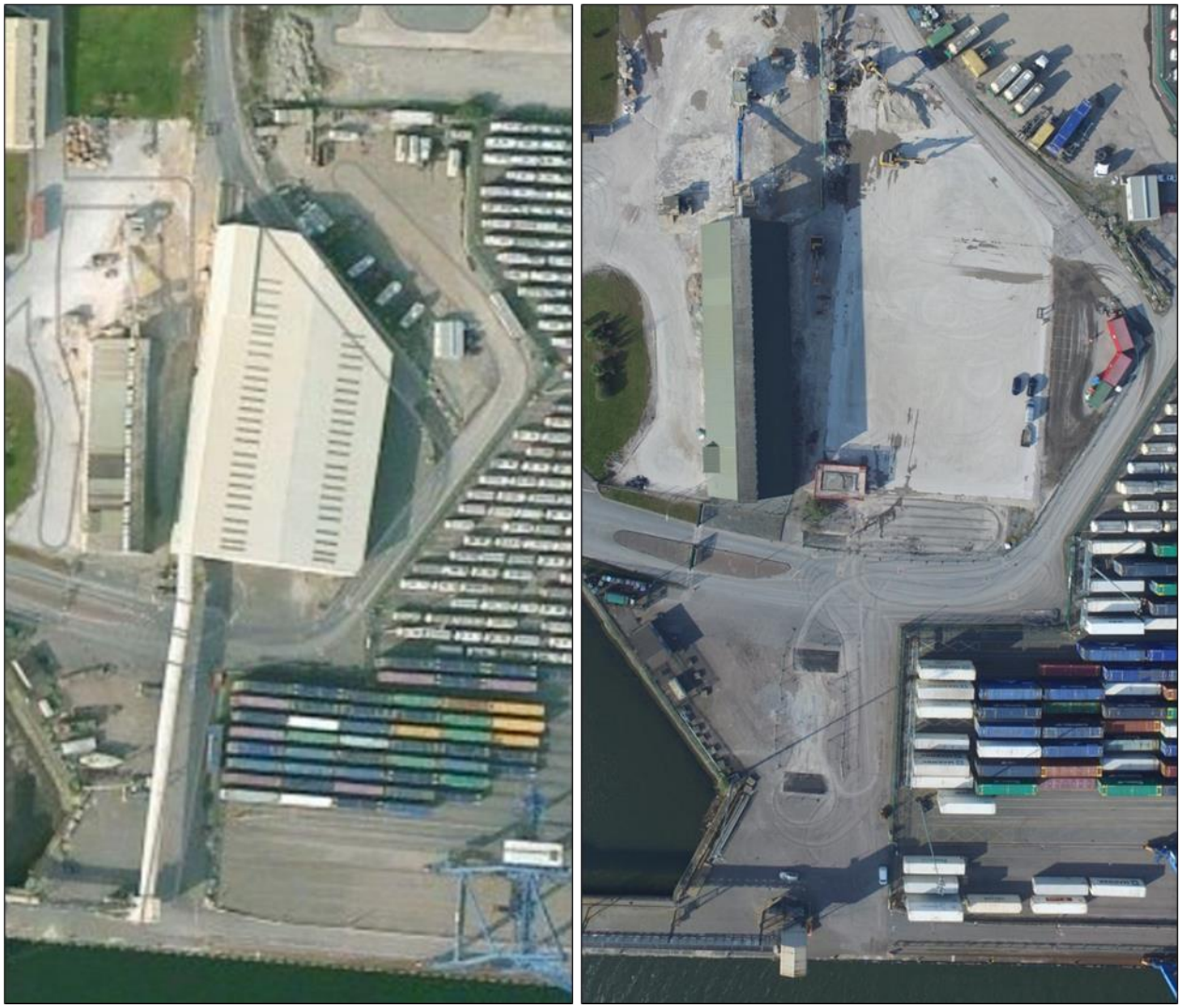


Figure 3-20: Port of Cork pre demolition (LHS), and post demolition and rehabilitation works (RHS)

4.0 CHAPTER 4 – TMF REHABILITATION AND RESTORATION

4.1 Introduction

The fully lined facility contains over 12 million tonnes of tailings placed into two tailings lagoons, which are 64 and 6 hectares in area, respectively, at crest elevation.

The Lisheen TMF requires a closure methodology to alleviate the acid generation potential of the tailings. Prior to the commencement of mining operations an approved rehabilitation plan was in place. Over the years this plan has been reviewed and revised.

In early 2006, a programme of expert consultations and workshops were held where it was concluded that a complete wet closure concept for the Lisheen TMF was inappropriate in terms of residual environmental impact risk. The consequence of this was the adoption of a dry closure methodology for TMF with the development of a specification for capping the facility. The design allows for the storage of a depth of water above the tailings surface, approximately 500 mm in depth, within a 700 mm deep rock fill layer, prior to discharge via spillways, which are set at 500 mm below the crest elevation of the respective zones. Therefore, the Lisheen TMF can be considered somewhat of a hybrid as the surface of the facility is dry, while the tailings remain saturated, with a layer of water present within the capping structure. In this chapter, the closure method will continue to be referred to as a 'dry closure' or 'dry surface' to distinguish it from the previously planned completely 'wet closure'.

As per the Closure Success Criteria, No. 6, the objective for "Dry Closure of the TMF" was to rehabilitate and restore the entire TMF surface to agricultural grassland, with established and sustainable vegetation growth. The objective was to restore the TMF surface so that it can be managed for its selected after use without any greater management inputs.

This was accomplished with the installation a composite cap made up of a layer of geotextile placed above the tailings, an approximately 700 mm depth of limestone rock fill cap and an approximately 300 mm depth of soil material layer to sustain vegetation. This approximately 1 m depth cap ensures that the tailings are comprehensively covered and decoupled from the grassland vegetation on the surface (Figure 4-1).

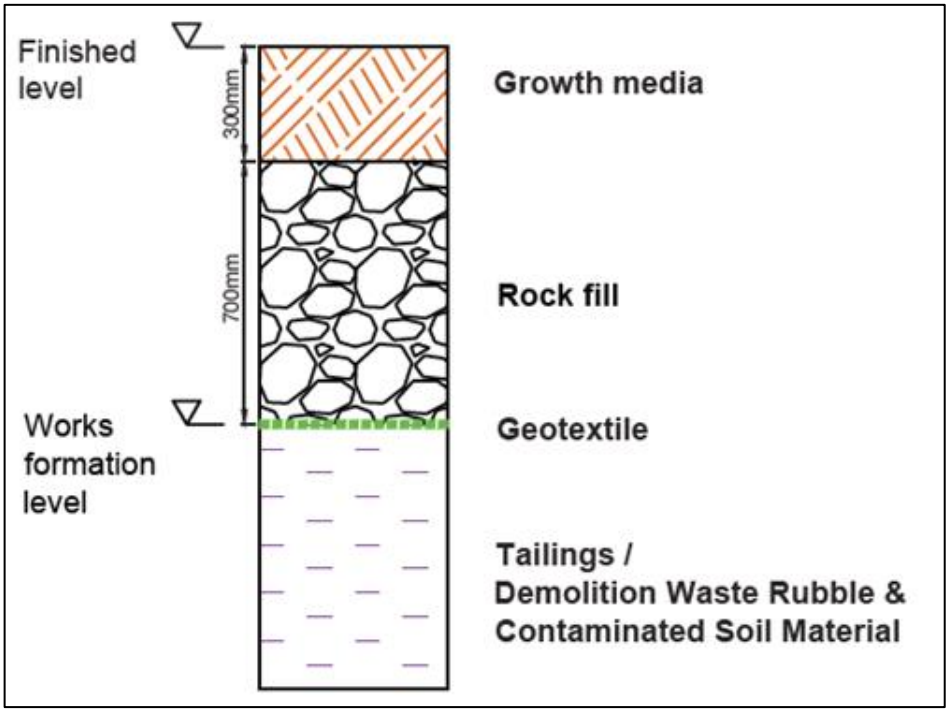


Figure 4-1: Cap Cross Section Detail

To evaluate the success of the project external Construction Quality Assurance (CQA) Validation Reports were completed by Golder following each phase of the capping works and a summary report was compiled upon completion of all of the phases. Table 4-1 below references the Case numbers against the CQA Validation Reports submitted to the EPA following each capping phase. Note CQA for Phase 1 was included in the 2007 CRAMP, which was subsequently approved by the Authorities.

Table 4-1: CQA Validation Reports submitted to the EPA

Case Number	Title
LR037154	Phase 2 CQA Validation Report
LR012246	Phase 3 CQA Validation Report
LR015377	Phase 4 CQA Validation Report (1 of 2)
LR015379	Phase 4 CQA Validation Report (2 of 2)
LR020966	Phase 5 CQA Validation Report
LR036453	Phase 6 CQA Validation Report
LR036454	Phase 7 CQA Validation Report
LR037078	Spillways and Wetland CQA Validation Report (1 of 2)
LR037078	Spillways and Wetland CQA Validation Report (2 of 2)
LR049427	Lisheen TMF Seepage Remediation CQA Validation Report

Lisheen adopted a progressive approach to rehabilitation and set a target to achieve 60% completion before mining operations had ceased. The remaining portion was completed post closure with the final capping complete in February of 2018, leaving the facility fully rehabilitated and restored to pasture grassland. This pasture cover can be used for livestock activities amongst other potential future uses. Figures 4-2 and 4-3 show aerial photographs of the TMF pre- and post-rehabilitation, respectively.

This objective is 100% complete.

Figure 4-2: The TMF pre-Rehabilitation

Figure 4-3: The TMF post-Rehabilitation

4.2 Progressive Rehabilitation and Restoration Strategy

During 2007 and 2008 a specification for capping and final restoration was developed using a 'Demonstration Cell'. Test data and observations were carried out to assess its performance following establishment.

On the back of positive observations and data, Lisheen received permission from the EPA to extend the capping methodology to a larger footprint which then developed into Phase 1 of the Rehabilitation Project and encompassed approximately 9 hectares at the crest of the Stage 2 elevation.

The monitoring data gathered from the Demonstration Cell and Phase 1 TMF was sufficient to enable the Regulatory Authorities to approve the final design for remainder of the TMF capping (EPA reference: P0088-03/gc06pos Approval of CRAMP and Rehabilitation Programme).

The progressive restoration approach taken while the Mine was still operating had a number of advantages:

- It provided reassurance to all stakeholders that the plans devised were successful;
- It allowed additional time for the collection of monitoring data that was used to assess the performance of the rehabilitation methodology;
- It allowed the Mine to reduce liability sooner rather than later;
- There was the availability of the key staff to implement, test and review the process prior to the cessation of mining; and
- It allowed for the production of tailings to fill the remaining void in the TMF which reduced the requirement and additional expense of using soil materials and rock fill to achieve the design subgrade elevation for the capping.

Figure 4-4 shows the progressive TMF capping strategy completed from Phases 1 to 7 from 2012 to 2018.

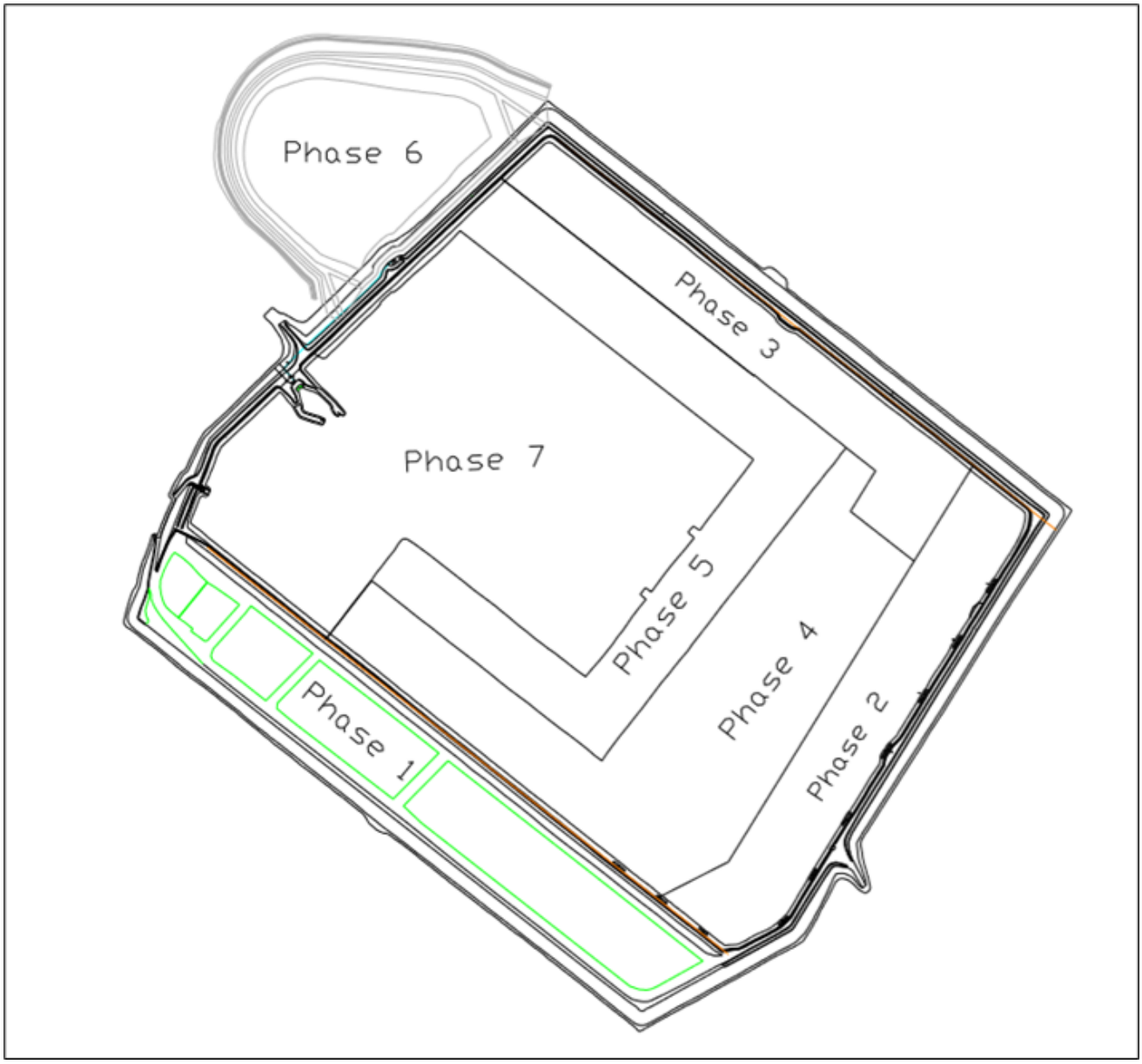


Figure 4-4: Phases 1 to 7 of the Progressive Rehabilitation Strategy for the Lisheen TMF

4.3 Cap Formation

The specification for cap formation consisted of approximately 1 m depth of caping made up of a layer of a separation geotextile placed above the tailings beach, a minimum 700 mm depth of limestone rock fill cap and an approximately 300 mm depth of a growth medium layer comprising a till - peat blend, which was supplemented with fertilizer following establishment (Figure 4-1).

4.3.1 Beach Formation

The formation of the beaches was achieved by the deposition of tailings from the TMF perimeter walls; from the leading edge of previously capped phases and from constructed jetties extending out onto the tailings pond via a system of spigot pipes (Figure 4-5).

Figure 4-5: Spigot pipe system

The formed beaches initially had a slight gradient (1 to 2%) towards the reclaim water pond located centrally on the north dam wall. This final infilling of the TMF from the edge of capped phases and via jetties allowed for the construction of near level tailings beaches which were then allowed to dry / desiccate for a minimum of up to nine weeks before rock fill cap construction.

4.3.2 Geotextile

The primary function of the separation geotextile was to prevent tailings particles from passing through it and thus leading to potential contamination of capping rock fill layer. The separation geotextile also provided a secondary reinforcement function, in that it prevented local 'punching' of the placed rock fill into the tailings surface. This reinforcement function enabled the rock fill platform (capping) to be constructed on the tailings surface and helped to alleviate pore pressure build-up as mobile plant loading was more widely distribute by the platform.

Once the tailings beaches had been desiccated sufficiently, they were inspected by the CQA team, prior to the placement of the separation geotextile material, to ensure that there were no excessive voids beneath. When required, the Capping Contractor was directed to fill voids with rock fill, which were graded to the level of the surrounding tailings. The separation geotextile was then extended across the exposed tailings beach, with panels overlapped with a minimum lap length of 750 mm (Figure 4-6).

Figure 4-6: Placement of geotextile above the beached tailings

Samples of geotextile were taken every ca. 15,000 m^2 of capping footprint and sent for conformance testing, results of which are included in the CQA Validation Reports. Inspections of all geotextile laid and lapped ensured that they have been placed in compliance with specifications. The minimum required overlap of 750 mm was increased at the discretion of the CQA team and Capping Contractor and was dependant on the condition of the tailings and the performance of the tailings during construction; the typical lap length was 1,000 mm. Any holes or tears found in the geotextile were repaired as they occurred using a patch mode from the same geotextile lapped with a minimum of 750 mm overlap in all directions from the defect.

4.3.3 Rock Fill

The placement of an adequate depth rock fill (typically 1 m) allowed for the establishment of a stable working surface for plant traffic and haulage of material during the rehabilitation project, a capillary break between the tailings and the growth medium, and a drainage and retention medium for storm water above the tailings. It also provided a ‘leading edge’ from which tailings were distributed, ensuring that the void space in the TMF was maximised and that a level final subgrade tailings beach was achieved.

A rock fill depth of approximately 1 m was typically placed above the separation geotextile and this rock fill was subsequently graded to the design elevation as the capping works progressed (Figure 4-7). The minimum total depth of rock fill cap was at least 700 mm (0.7 m). Regular surveying of the material placed confirmed that the minimum depth of material was achieved and, in most locations, exceeded by 200 mm (based on settlement survey data).

All rock fill specified for use during construction was tested in accordance with the CQA plans and the standards and procedures set out in “BS1377:1990, British Standard Methods of Testing Soils for Civil Engineering Purposes” and “BS EN 993-1 2012, Tests for Geometrical Properties of Aggregates, Part 1”.

Figure 4-7: Placement of the rock cap above the geotextile layer

4.3.4 Restoration Substrates

The upper layer of the capping was designed as a growth medium and required the blending of two material types sourced on site (i.e. recovered peat from excavation of the TMF footprint and glacial till), blended to an approximately 1:1 ratio. Both materials were readily available on site as Lisheen had created stockpiles during construction projects throughout the life of the mine.

When combined, these materials created a substrate resembling a loam (sandy silt) soil. Mixing peat and glacial till involved a power screener, mixing and blending using an excavator and a final mix using a disc harrow. This process helped to mix the two materials and to screen out debris and any large stones.

The peat provided soil moisture retention and with the addition of a fertiliser supplement, after initial establishment, provided a viable nutrient resource capable of supporting vegetation growth. Along with the till, the peat created a restoration substrate that had soil forming potential which provided for the development of sustainable grassland vegetation.

4.4 Vegetation Establishment

Following trials on Phase 1 using two different approaches to developing vegetation; natural regeneration and seeding; it was determined that the seeding approach was most suitable to establish grassland vegetation. A specific seed mix was developed which was derived from an assessment of the existing composition of established grassland within a pasture reference site. The outer embankments of the facility and internal bunds

were top soiled and seeded during the final stages of the project. Hedgerows of native species were also planted on the bunds of the facility.

4.4.1 Monitoring and Interpretation

Monitoring was used to observe indicators of successful establishment and formative development of grassland and hedgerow vegetation introduced as part of the TMF restoration. In addition, monitoring also provided the mechanism to observe indications of restoration failure that required intervention through remedial works if required.

Lisheen engaged with an external consultant to carry out soil consistency and vegetation nutrient analysis. Soil and vegetation tissue are also analysed for metal concentration, focusing on zinc, lead, arsenic, cadmium and nickel.

The soil material blend was assessed using the "Dutch Target and Intervention Values, 2000" as a guideline. The measured metal concentrations indicate that the concentrations are significantly below the Intervention Values (Table 4- 2).

Table 4-2: Metal concentration measured within the soil

Soil Analysis, mg/kg			
	Target value	Intervention Guideline	Average Result
Total Zinc	140	720	111
Total Lead	85	530	27
Total Arsenic	29	55	10
Total Cadmium	0.80	12	0.64
Total Nickel	35	210	13

Lead, arsenic and cadmium in leaf tissue have guidelines as set by the EU Directive 2002/32/EC. There are no guidelines for zinc or nickel in leaf tissue. The measured metal concentrations indicate that the concentrations are significantly below the EU Directive guidelines (Table 4-3).

Table 4-3: Metal concentrations measured within the plant tissue

Plant Tissue Analysis, mg/kg		
	EU Directive guidelines	Average Result
Total Lead	10	1.14
Total Cadmium	10	0.03
Total Arsenic	2	0.108

In addition to the testing, phased site visits during the growing period are conducted to perform regular visual and physical assessments of the site.

4.5 Quality Control / Assurance

The entire TMF rehabilitation project was managed under a Client-Led Project Management Structure with the Lisheen team providing full time Construction Quality Assurance (CQA) personnel for the duration of the Works.

Having designed the original TMF, subsequent raises and the additional cell; Golder were appointed as the Project Supervisor Design Process (PSDP) for the construction of the restoration capping system of Phases 2 to 7. They also provided CQA Management services and part-time CQA attendance to supplement the Lisheen CQA Team for the duration of the Works. The CQA Validation Reports describe the activities used to manage the quality of the construction works at the site as well as providing copies of all relevant compliance testing. Copies of the CQA Validation Reports for each Phase were submitted to the EPA for approval following completion.

The Capping Contractor for each Phase was responsible for fulfilling the role of Project Supervisor Construction Stage (PSCS).

With the exception of Phase 7, the capping works were carried out in accordance with the design drawings and in support of all design assumptions, in accordance with industry best practice, to a high standard, while satisfying relevant conditions of the IPC License.

4.5.1 Deviation from Original Design - Phase 7 Capping Works

The Phase 7 capping works were expected to advance in a similar fashion to previous capping phases, however the area near the location of the reclaim pumps on the north dam wall was of insufficient strength to support the rock fill capping methodology that had been successful to date. The tailings near the reclaim ponds, known as ‘slimes’, comprise very fine tailings which have settled out far from the perimeter of the facility. These slimes are low strength and high in water content and do not improve in bearing capacity sufficiently even when desiccated.

Rock fill that was placed on the separation geotextile tended to sink excessively which caused a heave or surge of tailings to push out in front of the advancing cap. Not only was it consuming significant quantities of additional rock fill, the advancing surge of tailings ahead of the cap introduced a risk that there would be insufficient capacity remaining to cater for all of the tailings, with the capacity being used by the additional rock that was being placed and sinking into the tailings.

A number of different approaches were trialled to develop a new procedure to progress the works, the section was compartmentalised into different areas and additional sumps were introduced to dewater the tailings, but this only resulted in marginal improvements. The solution that proved successful and allowed work to continue was blending lean-mix concrete with the tailings near surface (upper 500 mm) to improve its bearing strength, thus allowing the capping works to be completed. Details of the different approaches and the methodology are contained in the CAQ Validation Report for Phase 7.

4.6 Water Management

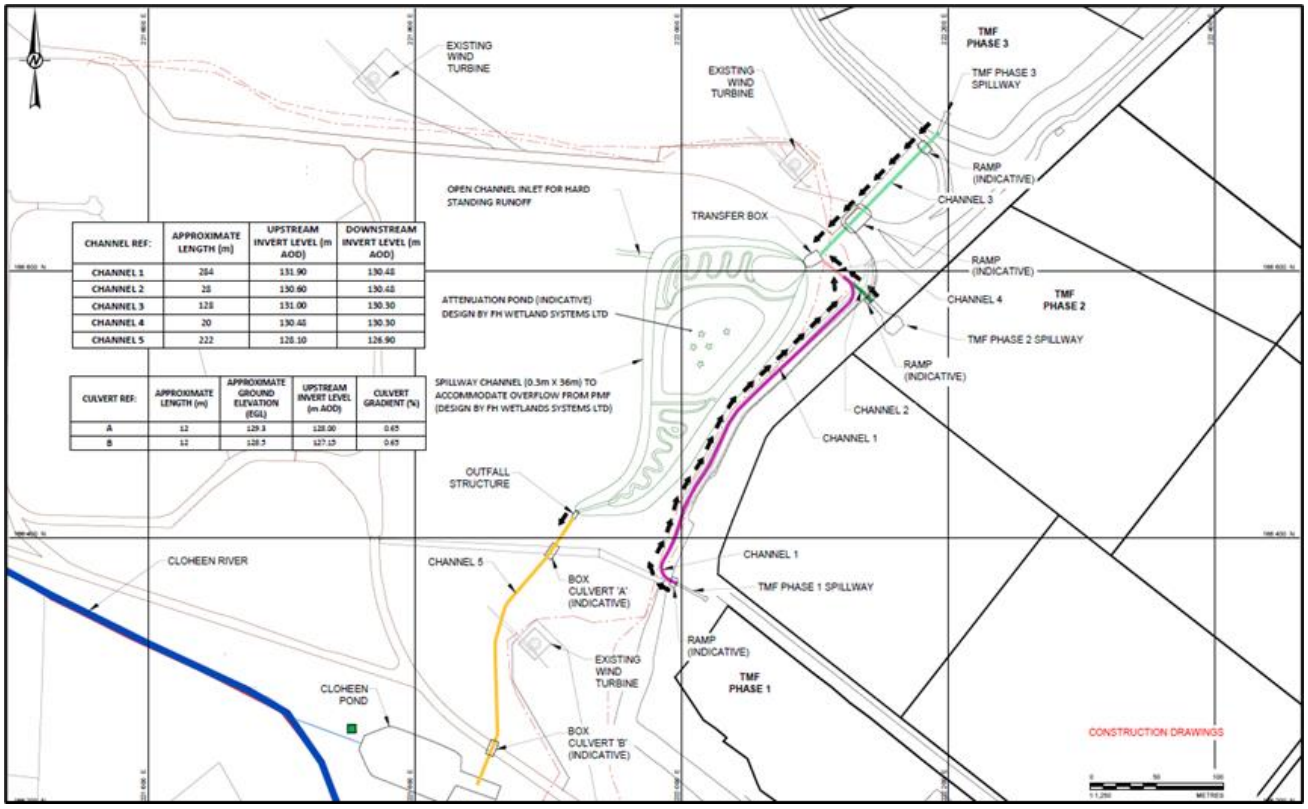
4.6.1 Surface Water

The discharge of water from the surface of the TMF and the rock fill cap required the construction of a downstream water management system. A nominal volume of the precipitation falling on the TMF surface can be expected to be captured within the growth medium in the fields, some of which will be lost through evapotranspiration. However, this will not eradicate all surface water, particularly during winter, and therefore there will be always be a discharge from the facility that will vary seasonally.

The surplus surface water will travel within the rock fill cap towards the designated spillways for each TMF area, and subsequently be channelled into the Transfer Box. The Transfer Box allows for any solids that may be in the surface water to fall out of suspension and accumulate in the basin prior to exiting into the storm water

Attenuation Pond. A series of aquatic plants capable of providing substantial biodiversity interest have been extensively planted and established, within the Attenuation Pond.

Water discharges from the Attenuation Pond, once it has reached full capacity, via the Outlet Structure and then along a surface channel towards a small well-established settlement pond (Cloheen Pond) prior to eventual discharge to the Drish River via SW1. The general arrangement for the surface water management system is shown in Figure 4-8.



CHANNEL REF:	APPROXIMATE LENGTH (m)	UPSTREAM INVERT LEVEL (m AOD)	DOWNSTREAM INVERT LEVEL (m AOD)
CHANNEL 1	284	131.90	130.48
CHANNEL 2	28	130.60	130.48
CHANNEL 3	128	131.00	130.30
CHANNEL 4	20	130.48	130.30
CHANNEL 5	222	128.10	126.90

CULVERT REF:	APPROXIMATE LENGTH (m)	APPROXIMATE GROUND ELEVATION (EGL)	UPSTREAM INVERT LEVEL (m AOD)	CULVERT GRADIENT (%)
A	12	129.3	128.00	0.65
B	12	128.5	127.15	0.65

Figure 4-8: Surface Water Management

As per the IPC License conditions, regular monitoring takes place during times of surface water discharge.

4.6.2 Groundwater

Groundwater levels and the chemistry of the water around the TMF are recorded in piezometers within the embankment and in monitoring wells adjacent to the embankment.

Regular monitoring provides information on the physical and chemical stability of the facility. Physical stability is assessed by visual inspection and the water levels monitored in the piezometers in the downstream sector of the dam wall. As the piezometric level rises in the dam wall the stability of the dam wall decreases. Trigger levels are in place in the event of water levels rising that will ensure investigations are completed immediately. Chemical monitoring will indicate any direct seepage from the TMF at the monitoring locations. A gradual increase of sulphate levels is indicative of spillage through the lining system containing tailings.

4.7 Demolition of Structures and Equipment on the TMF

All redundant structures and equipment within the boundary of the TMF were decommissioned and demolished upon cessation of operation of the facility by an appropriately qualified contractor. All HDPE pipelines were decommissioned and cleaned for sale or recycling. The MCC, reclaim pumps and associated infrastructure was

also decommissioned and cleaned for sale as scrap, or reuse depending on their state of repair upon closure of the Mine.

4.8 After Use Options

The broad objective for after use of the TMF was to rehabilitate the TMF such that it would provide an endpoint that would be available for the maximum amount of potential after uses. One of the preferred after use options is agricultural grassland, as it has been proven to be sustainable on the Phase 1 section of the TMF. This would support the environmental protection objectives of the TMF rehabilitation and also compliment the character of the countryside surrounding Lisheen. Restoring to a grassland end point is also advantageous in that it does not impact on the development of other options into the future if there is a justification (e.g. energy crops, solar power etc.).

4.9 Seepage Issue (May 2018 to July 2019)

A known minor seepage location between chainage CH2450 and CH2600 was noticed to be becoming more significant during May 2018 (Figure 4-9). The TMF capping works had been completed in early 2018 and the reclaim pumps turned off, thus allowing the water level in the rock fill cap to fill to the spillway discharge depth.

The degree of seepage was monitored regularly during the subsequent months and samples were taken and tested for water quality. The samples returned results showing sulphate contents of approximately 800 mg/l, which is indicative of tailings cap water. The scale of the seepage volume increased during August / September 2018 and an investigation was initiated in October 2018.

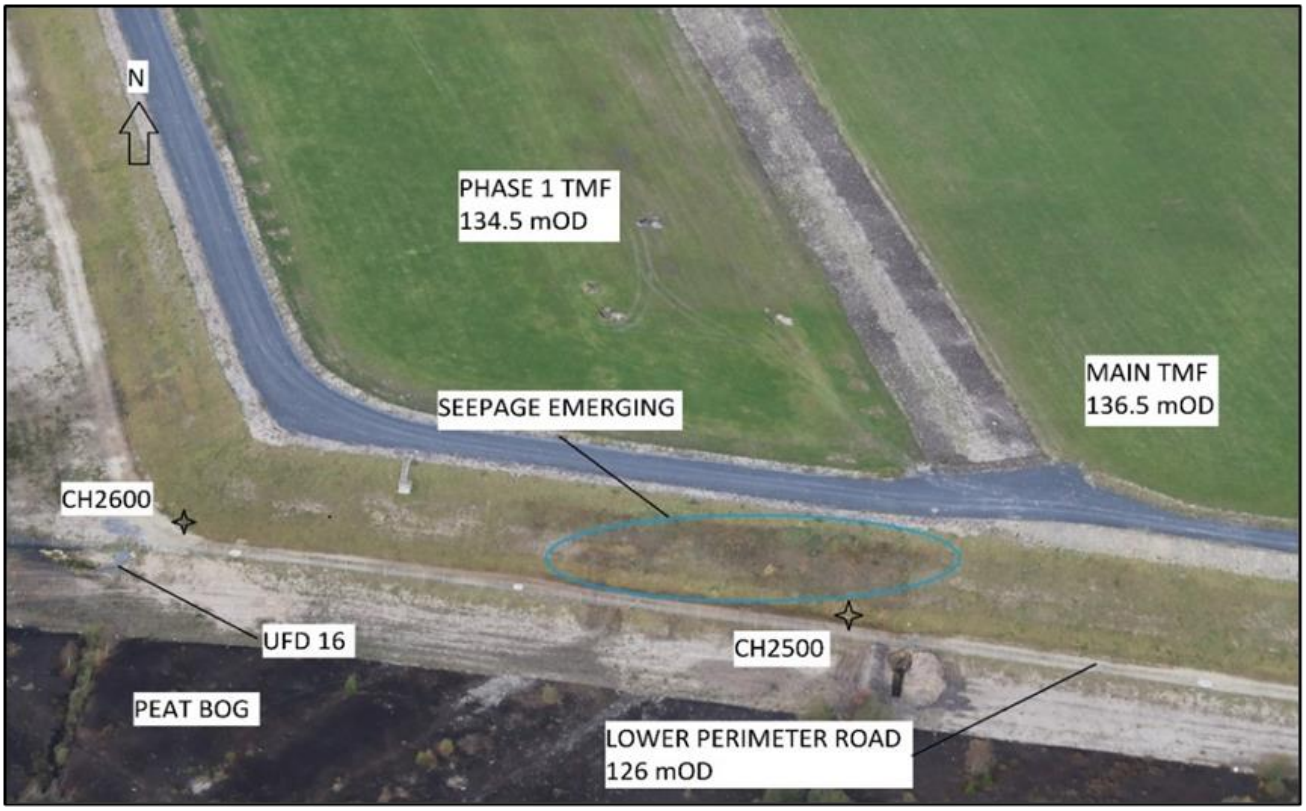


Figure 4-9: Lisheen TMF Aerial Photo (October 2018)

Investigations carried out between November 2018 – April 2019, through non-intrusive and intrusive methods led to the uncovering of seepage eroded ‘wash-out areas’ within the Phase 1 TMF dam wall, primarily at chainage CH2500 where the bulk of the seepage was exiting the dam wall. Seepage erosion ‘pipes’ were uncovered on the downstream side of the installed lining system and subsequent excavations tracked the flows

further east towards the Main TMF. No defects were uncovered in the lining system for the Phase 1 TMF and the investigation moved into the Main TMF. The seepage emerging at CH2500 was being driven by the greater head of the elevated cap water in the Main TMF.

Further intrusive investigations identified seepage eroded 'pipes' and defects in the Stage 2 lining system of the Main TMF at approximately 133.5 mOD elevation. The excavation of test pits confined the 'seepage area' to the interval between chainage CH2300 and CH2460. Several defects in the lining system were located by the test pit work and subsequently repaired, which led to a significant reduction in the volume of seepage but not the elimination of the issue.

The defects were being fed directly from the water stored in the rock fill of the Main TMF cap and in the upstream portion of the Stage 3 Raise and thus a remediation plan was developed for the 'seepage area' to try to eliminate this source.

4.10 Seepage Remediation (July 2019 to March 2020)

The initial design comprised of the installation of a geocomposite upstream lining system on the Stage 3 Raise, for the extent of the 'seepage area', to alleviate the water sources from the TMF rock fill cap and eastern upstream sections of the Stage 3 Raise (also comprising of rock fill), from entering the 'seepage area'. The design relied on the relatively low permeability of the tailings to provide an effective barrier. A level of seepage was still expected to emerge through the remaining defect locations following the completion of the works and the expected daily range was estimated to be ca. 0.3 m^3/day to ca. 3.0 m^3/day.

The remediation works were constructed during July and August 2019 and a monitoring period began in early September 2019. By the end of September 2019, the 'seepage area' had fully recharged and seepage flows were again emerging at the toe of the downstream slope of the dam wall at CH2500 and the water elevation was beginning to rise in the nearby piezometers.

Further bulk investigative excavation works were conducted during October and November 2019 to excavate through the Stage 3 Raise and fully investigate the underlying Stage 2 Crest, within the 'seepage area' from CH2280 to CH2480. The exposed Stage 2 Crest was deformed for the length of the excavation, had boulders protruding and numerous defects. The defects were isolated and repaired.

An updated design was prepared to reconstruct the Stage 3 Raise and lining system within the 'seepage area'. The works commenced in December 2019 and were completed on 7th March 2020. The damaged upper 1 m of the crest of the Stage 2 Raise was excavated for its full extent within the 'seepage area' and the upstream section of the Stage 3 Raise was re-shaped to accommodate the installation of the new geomembrane panel which connected to the existing Stage 2 geomembrane at the toe and to the new geomembrane installed in August 2019 at the crest.

The downstream section of the Stage 3 Raise was partially reconstructed with sufficient ballast to counterbalance the bulging of the new Stage 3 geomembrane when the 'seepage area' has fully recharged. The ballast rock fill, the dam wall and the residual seepage flow monitoring point have been monitored daily since the completion of the works.

Additional drainage was installed in the TMF cap to help promote faster draining of the capping rock fill and additional monitoring installations were installed around the TMF to reduce the interval between monitoring instrument clusters around the perimeter of the TMF to circa 100 m.

Following completion of the works the total seepage from the TMF is less than the USEPA threshold of 200 l/ha/d, (litres per hectare per day). The facility is deemed to be stable and monitoring will continue into the aftercare period to provide ongoing assurance for all stakeholders.

The remaining section of the Stage 3 raise was re-constructed during June 2020 and the TMF capping surface and perimeter crest road was rehabilitated for this section of the TMF.

The residual seepage from the Lisheen TMF has been monitored from the completion of the works in March 2020 to the time of reporting (September 2020) and is scheduled to continue at a minimum weekly frequency for 2020 and 2021.

Figure 4-11 provides the timeline for the remediation of the Lisheen TMF.

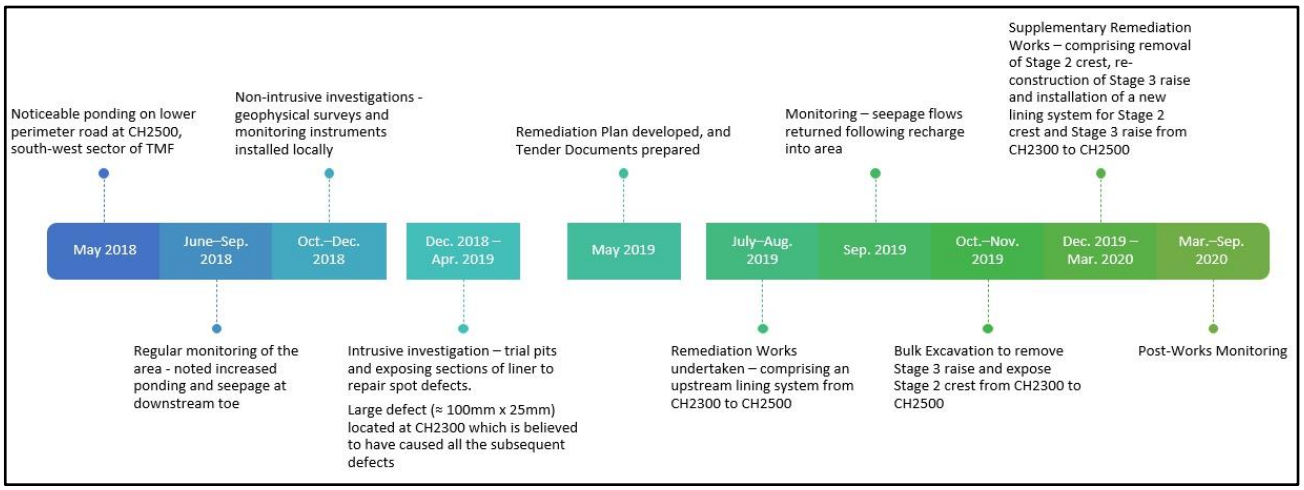


Figure 4-10: Lisheen TMF Seepage Remediation Timeline

Post-works Monitoring at a Weekly Frequency Comprises

Measurement of flow rate and conductivity at each of the three locations where seepage is emerging from the drainage system for the TMF dam walls i.e. via the upper finger drains (UFD07, UFD14 and UFD16) located at the downstream toe of the TMF and which are fed from the chimney drain system constructed within the dam walls.

Assessment of the downstream toe of the south dam wall at the lower perimeter access road and the downstream toe of the Stage 3 at the south dam wall area for seepages and/or ponding. Measurement of flow rates are measured in the channels emerging from the three spillways and flow rate and sampling is conducted at SW1.

Figure 4-11 below shows the flow rate monitoring data from March to September 2020 at the three UFD locations and Figure 4-12below shows the Action Leakage Rates (ALRs) and Response Plans agreed in April 2020.

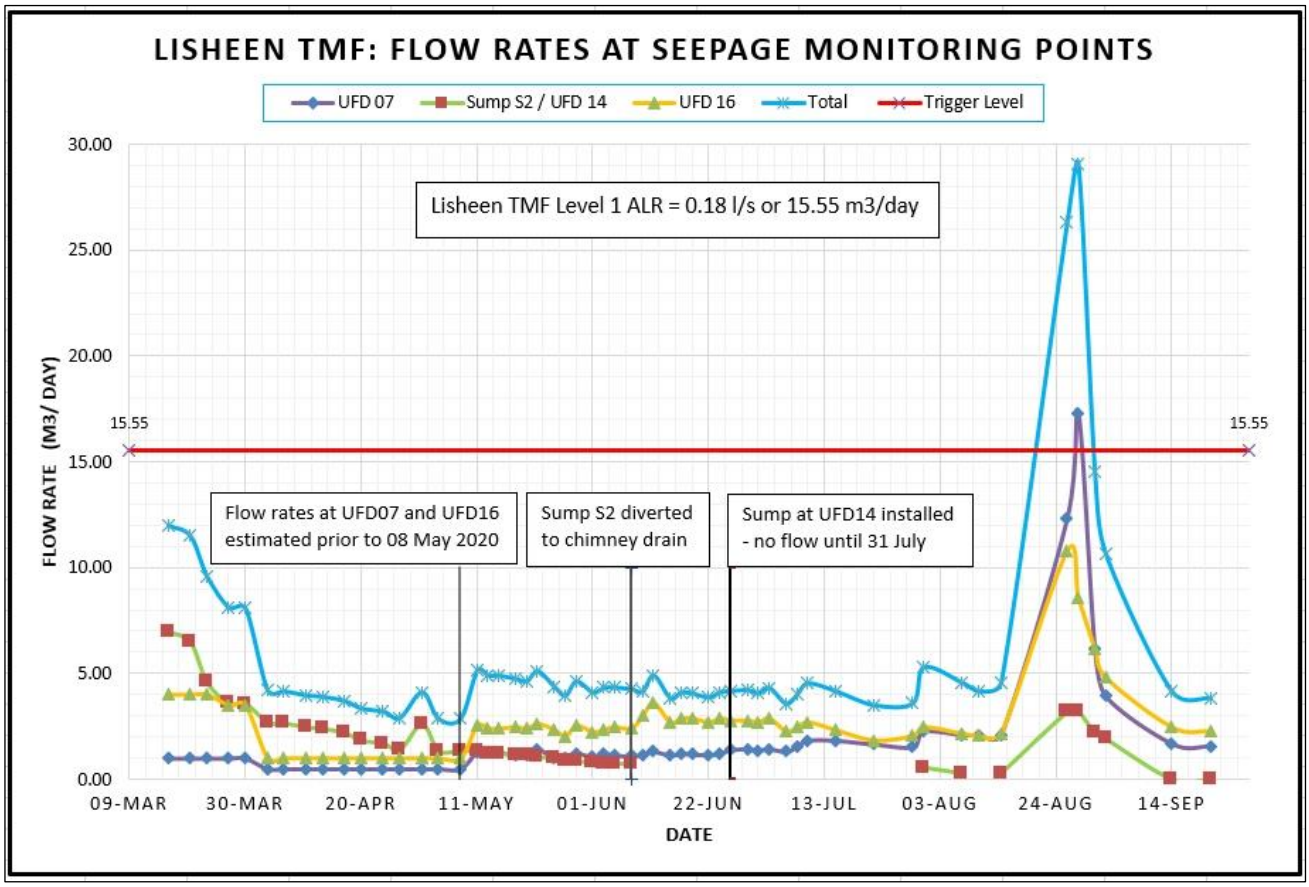


Figure 4-11: Lisheen TMF Seepage Flow Rates at Monitoring Points (March to September 2020)

Action Leakage Rates and associated Response Plan to be adopted for the Lisheen TMF:

- **Level 1 ALR:** Seepage rate <0.18 l/sec (15.55 m3/day) : Continue seepage flow monitoring and leachate testing as required by TMF closure and after care plan;
- **Level 2 ALR:** Seepage rate between 0.18 l/sec and 0.35 l/sec (15.55 m3/day and 30.24 m3/day): Investigate cause of leaks and continue monitoring and leachate testing; and
- **Level 3 ALR**: Seepage rate >0.35 l/sec (30.24 m3/day): Repair leaks and continue monitoring and leachate testing.

Figure 4-12: Lisheen TMF Action Leakage Rates and Response Plan for Seepage Flows

The rainfall events experienced in late August 2020 are evident in Figure 4-12 and led to an exceedance of the Level 2 ALR. The drainage system within the dam walls provides a dual function in the Lisheen TMF, removing both seepage emerging through the lining system and surface water that has infiltrated from the crest and slopes of the dam walls. Hence, during periods of significant rainfall, in particular events that lead to ponding on the perimeter crest road of the TMF, surface water can permeate into the drainage system and lead to an increased flow rate at the monitored locations. These increased flow rates have been established to correspond to a reduced level of conductivity and a return to the pre-rainfall event status in a short period after the rainfall event.

The ALR levels have subsequently been agreed to be adjusted to include the conductivity readings at each of the monitoring locations, prior to a level been exceeded, Figure 4-13 below.

- **Level 1 ALR:** Seepage rate <0.18 l/sec (15.55 m3/day): Continue seepage flow monitoring and leachate testing as required by TMF closure and after care plan;
- **Level 2 ALR:** Seepage rate between 0.18 l/sec and 0.35 l/sec (15.55 m3/day and 30.24 m3/day) **and** conductivity reading for UFD07 > 1,000 uS/cm **and** conductivity reading for UFD14 and UFD16 > 2,000 uS/cm: Investigate cause of leaks and continue monitoring and leachate testing; and
- **Level 3 ALR**: Seepage rate >0.35 l/sec (30.24 m3/day) **and** conductivity reading for UFD07 > 1,000 uS/cm **and** conductivity reading for UFD14 and UFD16 > 2,000 uS/cm: Repair leaks and continue monitoring and leachate testing.

Figure 4-13: Adjusted Lisheen TMF Action Leakage Rates and Response Plan for Seepage Flows

Monthly TMF inspections are undertaken by a Senior Golder Engineer, during which the dam walls for the full perimeter of the TMF are assessed, the surface water discharge structures are inspected and the drainage elements of the TMF surface are inspected.

Reading and sampling of the piezometers and monitoring wells is undertaken quarterly, and the data is assessed by a Senior Golder Engineer.

5.0 CHAPTER 5 – FINANCIAL PROVISIONS

5.1 Introduction

This chapter describes the financial measures, funds and mechanisms provided for the Lisheen Mine CRAMP in accordance with Articles 7, 8 & 9 of the European Union Council Directive 2004/35/EC on Environmental Liability. Also, this document demonstrates compliance with conditions 42 & 45 of the 1997 Lisheen Mine Planning Permission, planning register reference number PLC 17663.

This original estimate for the physical closure of the Mine Site, in 1997, has been revisited on a regular basis, to ensure that the estimate accurately reflects closure costs and that the funds provided by the Lisheen Mine are sufficient to cover such costs. The most recent review and update of the closure costs was carried out in November 2020.

The closure costs for the Lisheen Mine Site are fully funded and administered under financial bond arrangements. Therefore they cannot be reduced or accessed without the written consent of all of the respective parties, i.e. the Lisheen Mine, Tipperary County Council, the Environmental Protection Agency and the Department of Department of the Environment, Climate and Communications. Table 5-1 provides a summary of the Financial Funds provided by The Lisheen Mine.

Table 5-1: Summary of the Financial Funds provided by the Lisheen Mine as of October 2020

The Lisheen Mine Closure Funds Deposit Accounts											
30/10/2020	Original Bond Amount IEP	Original Bond Amount €	Indexed Bond Amount 31/07/2015 €	Deposit Account Required	Current Cash Deposit 31/10/2020 €	Current Cash Deposit 31/10/2020 US$	% Collateralised	CSO Index	Basis	Parties to Funds	Account Name
Closure and Rehabilitation Fund	9,500,000	12,062,512	21,992,515	Yes	619,682.70	723,632.51	100%	Wholesale Price Index - Building and Construction (Capital Goods)	To carry out all the works to comply with agreed Mine Closure Plan	(1) VLM / KLM / LML (2) Tipp Co. Co. (3) Minister for DECC (4) EPA	Vedanta Lisheen Mining Limited
Compensation Fund	500,000	634,869	930,974	Yes	1,114,216.54	1,301,122.84	100%	Consumer Price Index	To compensate landowners for any damage caused (S.31(3) Minerals Development Act 1940)	(1) VLM / KLM / LML (2) Minister for DECC	Vedanta Lisheen Mining Limited
EPA Fund	1,200,000	1,523,686	2,735,547	Yes	3,291,717.11	3,843,892.23	100%	Wholesale Price Index - Building and Construction (Capital Goods)	To comply with a minimum aftercare period of 30 years in accordance with Condition 10.3.1 of IPC Licence	(1) VLM / KLM / LML (2) EPA	Vedanta Lisheen Mining Limited

5.2 Cost Of Physical Closure

The most recent detailed review of the Mine closure estimate was completed in November 2020 to provide a comprehensive and robust cost estimate that covers the scope of the mine closure activities.

A summary of the overall Mine Closure Estimate is outlined in Table 5-2below and the full Mine closure estimate report can be found under Case Number LR053688 on EDEN.

The Aftercare Period is excluded from this Report and the costs are provided for separately.

Table 5-2: Mine Closure Estimate November 2020

REF.	DESCRIPTION	November 20
Active Management Period		
I	**Plant Site**	
1	Tepee (Course Ore Storage) (refer item 34)	€0.00
2	Workshop and Surface Storage	€0.00
3	Mine Water Treatment Plant	€149,471.72
4	Mill Building (refer item 34)	€0.00
5	Backfill Plant	€0.00
6	ESB Sub-Station	€0.00
7	Conditioning Ponds	€182,688.12
8	Other Infrastructure refer item 34)	€271,656.00
9	Roads and Fencing	€42,311.47
10	Buried Services (transferred to item 34	€76,401.00
II	**Mine Facilities**	
11	Fixed Plant	€0.00
12	Mobile Plant	€0.00
13	Mine Portal	€112,604.00
14	Cleaning & Disposal of Contaminated Material (refer to item 34)	€322,765.00
III	**TMF**	
15	Demolition of Structures & Equipment in TMF	€59.737.00
16	Dry Closure of TMF	€9,008,108.00
IV	**Other Surface Facilities**	

REF.	DESCRIPTION	November 20
17	Buildings & Structures	€758,176.71
18	Land Holdings	€80,607.88
V	**Shipping Yard Cork**	
19	Dredging of River	€0
20	Cleaning of all Facilities	€645,988.54
VI	**Miscellaneous**	
21	Landscaping (refer item 34)	0.00
22	Water discharge & power requirements	€1,308,086.61
23	Site Security	€386,241.55.
24	TMF Water Treatment & Disposal	€1,304,646.16
25	Consultants Fees	€916,017.55
26	Allow for Sampling and Monitoring of Project	€216,446.75
27	Mine Closure Project Team	€3,188,077.69
28	Insurances	€392,067.31
29	IPC Licence	€98,471.94
30	Commercial rates	€941,130.84
31	Escalation	€0.00
34	Site clearance and rehab works	€1,023,170.22
VII	**Passive Validation Period**	
32	Passive Validation Costs	€688,486.86
	Sub-total	€21,630,602.42
33	Contingency	€1,095,771.20
34	**FINAL MINE CLOSURE TOTAL**	€22,726,373.61

5.3 Risks and Liabilities

In accordance with the Mine Closure and Rehabilitation Project Continuous Risk Management Process, a Risk Focus Group workshop was held on the 13th of November 2020.

The aim of the workshop was to review the September 2018 Risk Report and identify any current risks associated with the Mine Closure Project. The risks were reviewed and considering the Mine Closure project status, the risks have all been ranked as zero (Table 5-3).

A copy of the full Risk Management Report can be found under Case Number LR053688 on EDEN.

Table 5-3: High level cost related risks

Risk ID	Description	Risk Score	Risk Owner
16	Magazine, fresh air shaft, vent shafts and core shed	0	Mrs Kathleen Quinn
21	TMF water treatment and disposal	0	Mrs Kathleen Quinn
22	Consultants Fees	0	Mrs Kathleen Quinn
23	Sampling and monitoring of the facilities	0	Mrs Kathleen Quinn
24	Passive validation costs	0	Mrs Kathleen Quinn
30	ESB Sub-station	0	Mrs Kathleen Quinn
34	TMF- Additional fertiliser to fields due to lack of nutrients	0	Mrs Kathleen Quinn
35	Settlement of topsoil on TMF	0	Mrs Kathleen Quinn
36	Sink Holes on Lisheen Land – Insured Risk	0	Mrs Kathleen Quinn
39	Increase in PM costs due to late completion of the mine closure works	0	Mrs Kathleen Quinn
41	Killoran House rehabilitation – Cost transferred to cost estimate	0	Mrs Kathleen Quinn
42	Environmental Non-Compliance	0	Mrs Kathleen Quinn
43	Environmental - Water monitoring	0	Mrs Kathleen Quinn
44	TMF – Land Drainage	0	Mrs Kathleen Quinn

Signature Page

Golder Associates Ireland Limited

DRAFT

Barry Balding
Environmental Scientist

DRAFT

Barry Balding
Principal Geologist

Registered in Ireland Registration No. 297875
Town Centre House, Dublin Road, Naas, Co. Kildare, W91 TD0P, Ireland
Directors: S. Copping, A. Harris, DRV Jones, A.L. Oberg-Hogsta
VAT No.: 8297875W

golder.com