Conceptual Mine Closure and Rehabilitation Plan

Yaoure Gold Project

Perseus Yaoure SARL, Côte d'Ivoire

Submitted to

Perseus Yaoure SARL

Submitted by

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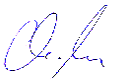
Author	**Christian Kunze**	 Signature & Date	
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1.0 INTRODUCTION

1.1 Approach

Perseus Yaoure SARL (Perseus) is developing a gold mining Project (the Yaoure Project, or Project) in the Bouaflé Prefecture of the Marahoué Region in Côte d'Ivoire.

Perseus has carried out an Environmental and Social Impact Assessment (ESIA) as part of the formal permitting procedures for the Project and subsequently a Definitive Feasibility Study (DFS). Prior to the ESIA , the Project design was defined by a Pre-Feasibility Study (PFS), which covered all phases of the Project life cycle, including the closure and rehabilitation phase.

One of the ESIA deliverables is a Conceptual Mine Closure and Rehabilitation Management Plan. The objectives of the closure plan for the Yaoure Project, are to ensure that the potential environmental, economic, and social impacts associated with the cessation of mining activities are identified at an early stage. In addition, these impacts will be minimised as a consequence of actions taken during the operational phase. Another important objective is to design closure and rehabilitation measures in a manner that minimises the need for extended care and maintenance operations by Perseus or whoever will assume responsibility for the rehabilitated mine site over the long-term under agreed handover provisions.

Based on the above, this Closure Plan shall

- Transparently inform the public, Regulatory Authorities and all stakeholders about the closure and post-closure phase and the measures foreseen to achieve the beneficial after-use and minimize negative environmental impacts;
- Assist the management of Perseus in ensuring the protection of public health and safety during and after closure of the mine and associated facilities;
- Reduce or eliminate long-term environmental impacts;
- Restore disturbed land to a productive condition as soon as practical;
- Encourage progressive closure activities to commence before mine production ceases;
- Inform the stakeholders about planned measures in case of temporary suspension and premature closure; and
- Serve as a resource to Perseus in Project-specific budget and schedule planning activities, such as the costing of provisions for closure and rehabilitation as part of the annual reporting.

Responses from the Stakeholder Consultation Meetings held by Amec Foster Wheeler and rePlan during the Scoping and ESIA phases have indicated a number of concerns

and issues raised by Community stakeholders in relation to mine closure and rehabilitation. Information materials distributed by NGOs[1] in Côte d'Ivoire also highlight the importance of mine closure and rehabilitation. This Conceptual Closure Plan is a first step to address these concerns.

This document is a Conceptual Closure Plan which is based on the current knowledge of mining infrastructure and waste facilities as developed during the PFS phase of the Yaoure Project. This plan will be updated and refined during the operation phase of the Project, as more details from the Definitive Feasibility Study (DFS), detailed design and operational experience become available.

A more detailed Closure Plan, based on the Conceptual Closure Plan presented here would be prepared as part of the detailed engineering of the Project following on from the PFS, DFS and during the early stages of operations. This Plan would be updated and revised through the operation of the Project, this process culminating in the establishment of a Final Closure Plan prior to decommissioning. That Final Closure Plan would detail the land uses, goals, closure and after-care provisions agreed with the Project stakeholders and following appropriate consultation.

The development of a closure and rehabilitation plan is therefore a process that commences at the Environmental Impact Assessment stage and continues through subsequent detailed design and operational phases.

It should be noted that a mine closure and rehabilitation plan was developed by AMEC in 2011/2012 for the then Angovia Mine of Cluff Gold plc. At that stage the closure cost was estimated at US$ 2,567,000. During recent ESIA stakeholder consultation meetings, the Ministry of Environment and the Ministry of Mines indicated that the Conceptual Closure and Rehabilitation Plan shall take account of the provisions included in that previous plan.

The structure of this Conceptual Plan follows the guidance in ICMM Guidance on Integrated Mine Closure (2008). 33a contains an estimate of the closure costs. Details of the closure cost estimate are provided in Section 10.0.

1.2 Links between the Closure Plan and other documents of the ESIA

The Closure Plan is intimately linked with other documents of the ESIA, including, but not limited to, the following:

- Stakeholder Engagement Plan;
- Social Management Plan including frameworks of
    - Livelihood Restoration Plan;
    - Community Development Plan;

[1] NGOs "Social Justice" & "OSIWA": Guide du Citoyen Pour Mieux Comprendre Le Code Minier (Citizen's Guide to Better Understand the Mining Code). December 2014

- Water Management Plan;
- Soil Management Plan;
- Biodiversity Management Plan; and
- Waste Management Plan.

2.0 REGULATORY BACKGROUND AND GUIDELINES

2.1 Legislation of Côte d'Ivoire

2.1.1 Mining Code

Law No. 2014-138 of 24 March 2014 on the Mining Code is the relevant legislative document for all mining activities, including closure and rehabilitation.

Article 144 stipulates that an escrow account shall be established for environmental rehabilitation at the start of the mining operation. It shall be set up in a leading financial institution in Côte d'Ivoire. This account shall cover costs related to environmental rehabilitation at the end of mine life. Payments into the account are made by the licence holder according to a schedule established by the competent authority.

Article 145 requires the applicant for an operating permit to provide, along with the ESIA, a Mine Closure and Rehabilitation Plan. The Plan shall be submitted for approval by competent authorities for mining and the environment. If/when changes in the mining operations require a change in the closure plan, the permit holder shall submit a revised Plan for review.

The closure plan shall take into account the following aspects:

- Clean-up of the mine site;
- Dismantling and removal of mining facilities;
- Rehabilitation of the site;
- Post-rehabilitation monitoring of the site;
- Possible conversion of the site for other purposes; and
- Transfer (return) of the rehabilitated site to the competent authorities.

Article 147 requires that the Closure Plan shall describe the procedures, equipment and techniques foreseen for dismantling and rehabilitation. The Plan shall also provide for progressive rehabilitation works during the operation phase of the mine.

Article 148 defines civil liability of a licence holder for damages and accidents which might be caused by the facilities over a period of five years after closure.

Title XI (Article 151-154) of Decree No. 2014-397 of 25 June 2014 laying down the procedure for the application of the law No. 2014-138 of 24 March 2014 on Mining Code specifies the requirements to the financial guarantee for closure and rehabilitation ("Closure Fund"):

Article 151 stipulates that the trust fund shall be readily available at request; its size shall be determined based on the ESIA that takes into account the environmental risks at closure and during post-closure.

Article 154 requires that in case the operator fails to comply with his obligations to rehabilitate the mine, the State has full access to the guarantee and may at its own discretion use the funds for environmental rehabilitation of the mine.

2.1.2 Environmental Impact Assessment Legislation

The ESIA process in Côte d'Ivoire is guided by Code No 96-766 of 3 October 1996 and Decree No. 96-894 of November 1996.

This Conceptual Closure Plan is part of the suite of documents that are being developed as part of the ESIA process for the Yaoure Project. It has been specifically proposed as part of the Terms of Reference (ToR) for the ESIA. The Agence Nationale de l'Environnement (National Environmental Agency, or ANDE) reviewed the ToR proposed by AMEC and approved them on 26 December 2014.

2.2 International Standards and Best Practice Guidance

Although adherence is not legally binding in Côte d'Ivoire, there is a series of documents that describes international best practice and standards related to closure and environmental rehabilitation. They include, but are not limited to, the following:

- ICMM Planning for Integrated Mine Closure Toolkit (2008);
- ICMM Good Practice Guidance on Mining and Biodiversity (2006);
- Western Australia Department of Mines and Petroleum Guidelines for Preparing Mine Closure Plans (2010);
- Strategic Framework for Mine Closure (Australia/New Zealand: ANZMEC, MCA, 2000), and the Western Australia Guidelines for Preparing Mine Closure Plans (2011);
- Mine Closure Handbook of Finland (2008);
- UNEP, UNDP, NATO, EU: Mining for Closure (2005);

- European Mine Waste Directive 2006/21/EC, especially Articles 5 (Waste Management Plan), 21 (Closure and after-closure procedures for waste facilities) and 14 (Financial Guarantee); and

- BAT Reference (BREF) "Management of Tailings and Waste Rock in Mining Activities" (BREF MTWR), European Commission, January 2009.

For the development of closure cost estimates, the following guidelines and best practice documents exist and have been taken into account, in addition to the above documents:

- European Commission Decision 2009/335/EC on technical guidelines for the establishment of the financial guarantee in accordance with Directive 2006/21/EC;

- World Bank: Guidelines for the Implementation of Financial Surety for Mine Closure (Final Report, September 2006);

- Guidelines on Financial Guarantees and Inspections for Mining Waste Facilities (Montec 2008);

- ICMM International Council on Mining and Metals: Financial Assurance for Mine Closure and Reclamation (2005);

- The Policy Framework in Canada for Mine Closure and Management of Long-Term Liabilities: A Guidance Document (Canada: NOAMI, 2010);

- A Deeper Level of Detail – Improving the Reporting of Mine Closure Liabilities (Deloitte, 2007) Financial Reporting in the Mining Industry (PwC, 2007); and

- International Council on Mining and Metals (ICMM): Financial Assurance for Mine Closure and Rehabilitation. (ICMM 2005).

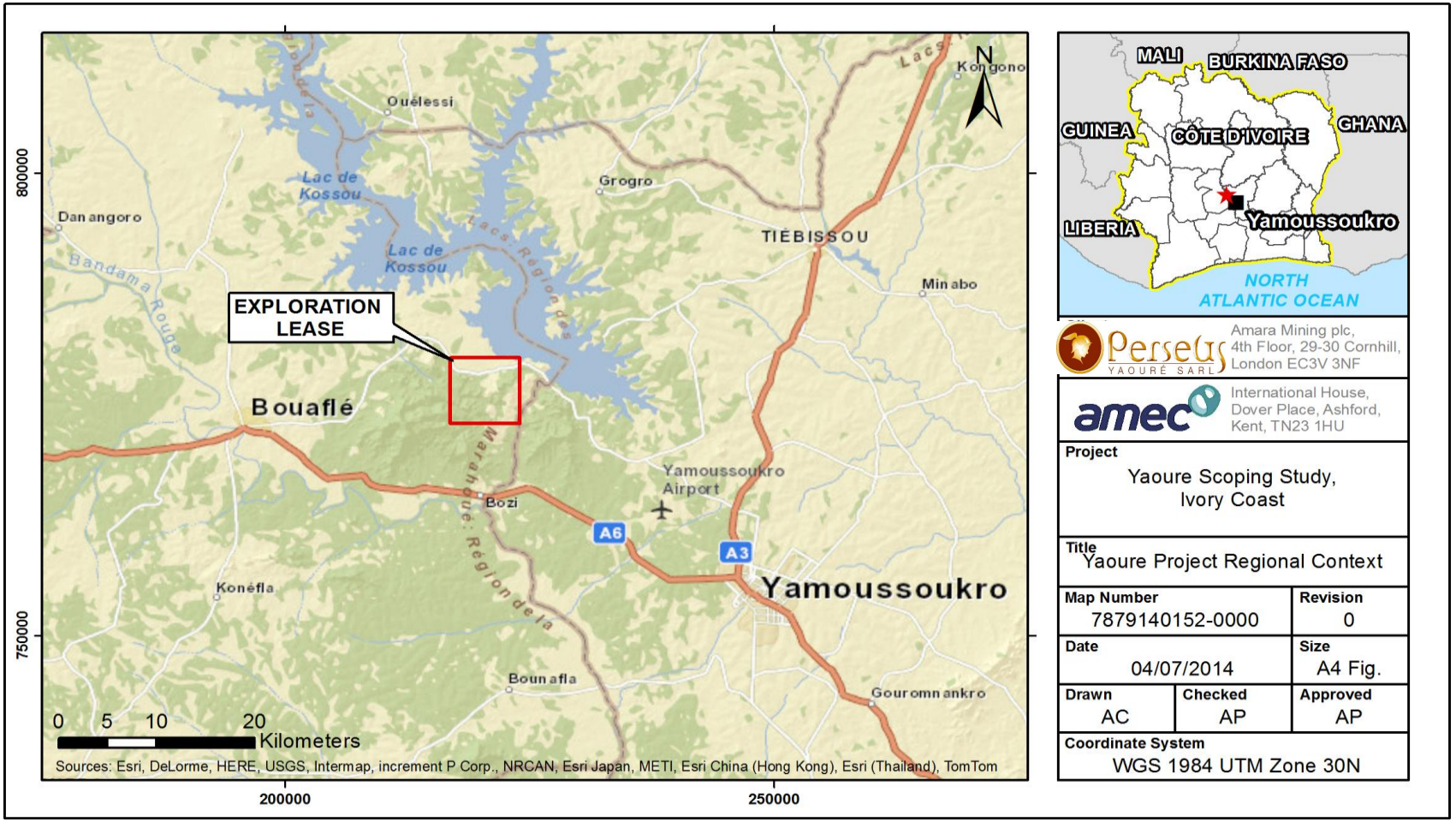
3.0 CONTEXTUAL INFORMATION

3.1 Locality, Geography, Land Use

The Yaoure Gold Project is located in the Bouaflé Prefecture of the Marahoué Region in Côte d'Ivoire. The Project is approximately 40 km northwest of the political capital Yamoussoukro, 260 km northwest of the economic capital Abidjan and 25 km east of the regional capital Bouaflé.

The mine is located approximately 6 km west from Lake Kossou and the associated hydro-power station. The Project location is shown in Figure 3-1.

Figure 3-1 Location of the Yaoure Project in Côte d'Ivoire



The land uses associated with the Project can be divided into three main categories, namely:

- Grassland and shrub land savannahs to the North and Northeast of the area; and
- Woodland savannahs and degraded forests to the South and Southwest, and riparian forests/galleries along the Bandama River.
- Human activities have led to various types of modified land-use including Lake Kossou, open pit and artisanal mining areas, mining infrastructure, a dense network of roads and tracks, as well as agriculture, dominated by cocoa culture. Agricultural activities are mainly associated with areas in the North-Northeast (zone around Angovia and Allahu Bazi), to the south-southwest (around Patizia).

3.2 Brief Description of the Yaoure Project

3.2.1 History

The Project is a brownfield open pit gold mining operation which has historically and recently been subjected to various gold mining activities.

Angovia Mining undertook gold exploitation activities, including trenching, core drilling and some open pit activities from the 1980s up to 1991. During 1993 the Compagnie Minières d'Afrique (CMA) was awarded an exploration licence over the larger Yaouré project area. CMA changed the name of the operation to the CMA Mine and subsequently undertook heap leach gold mining operations from 1999 until the mine closed during 2003. This involved open pit mining through stripping and stockpiling of overburden and waste rock and the processing of ore through a cyanide heap leach process.

Amara Mining Plc (Amara) acquired the CMA Project in 2004.The purchase was made, under Amara's previous name, Cluff Gold plc (Cluff) which was formed in 2003 (the company subsequently changed its name to Amara Mining plc in October 2012). The purchase agreement included the transferring of the exploration licence. Between 2008 and January 2011, Cluff produced 54,382 ounces of gold from mining at the existing pits and the processing of gold through heap leach using cyanide. Mining and gold processing ceased in 2011 and since then activities have been focussed on exploration drilling and the company subsequently changed its name to Perseus Yaoure SARL . The current status of the project is that infill drilling is being undertaken to update the resource estimate with the aim of re-commencing mining through the expansion of the former Angovia, CMA and Cluff Project as the Yaouré Gold Project.

As noted in Section 1.1, this Conceptual Closure Plan builds upon a previous closure plan for Cluff Gold's operations. Reference to the 2011/2012 Closure Plan is made wherever appropriate to ensure continuity.

3.2.2 Mining parameters

The mine will be operated as an open pit (drill & blast, load & haul). The open pit will be mined at an average rate of 25Mtpa (ore and waste rock), of which ore is mined at an average rate of 4.5 Mtpa. The maximum mining rate will be 30 Mtpa. The mining rate of waste rock will drop off towards the end of the mine life (estimated 6 years). Over the operational life of the mine, a total of 162 Mt rock will be mined, of which 137 Mt are waste rock and 25 Mt are ore. The strip ratio, i.e., the ratio of waste rock to ore, is 5.4:1 The approximate final depth of the open pits will be 200 m below surface level. The average ore grade is 1.8 g/t. In the last year of operation (year 6), it is proposed that only stockpiled ore will be processed.

3.2.3 Site layout and infrastructure

A preliminary layout of the open pit, waste facilities and other mining infrastructure is provided in Figure 3-2.

Figure 3-2 Preliminary site layout

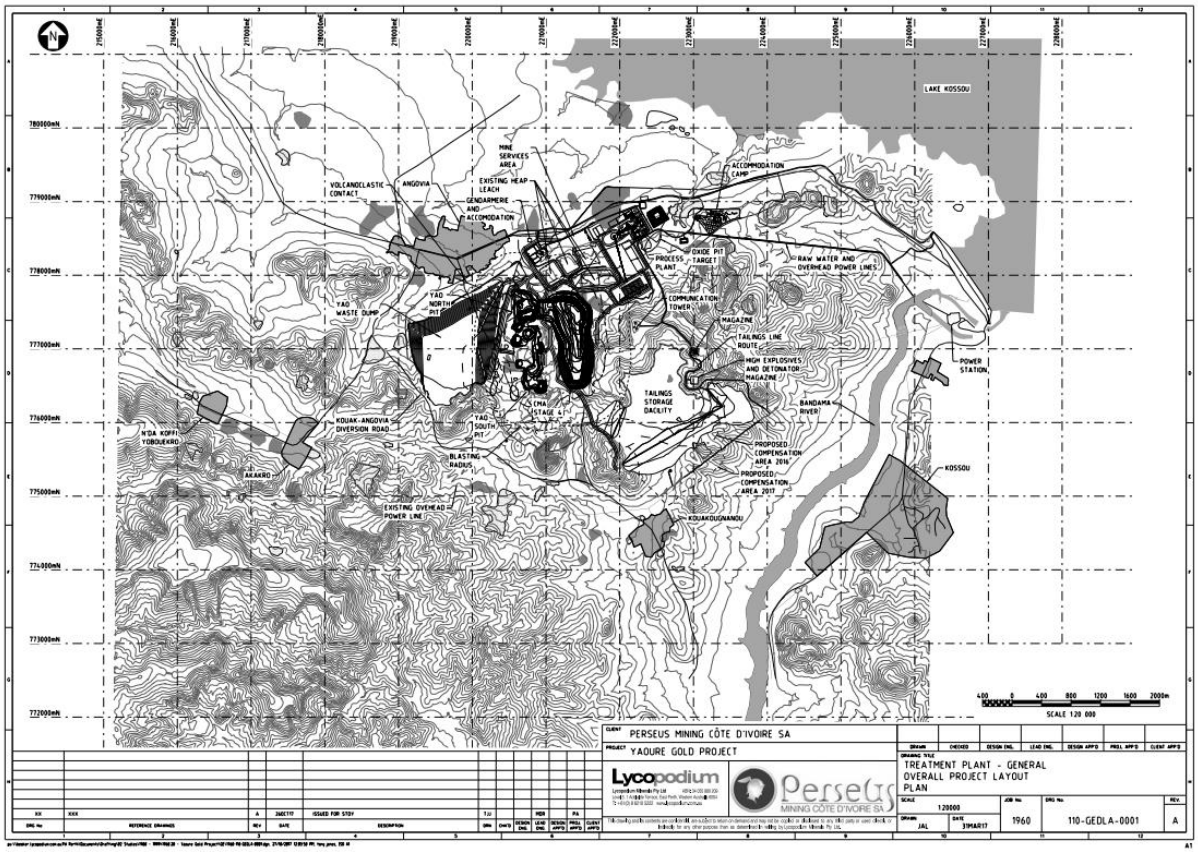


Table 3-1 sets out relevant information on the operational areas defined in Figure 3-2.

Table 3-1 Footprints of project infrastructure elements (rounded)

Infrastructure element	Area (ha)
Camp	9
Plant & Admin Office Area	43.5
Waste Rock Dump	147
Recycling and Waste Disposal	0.5
TSF Pond	125
TSF Embankment/s	72
Water Storage Dam	9
Pit	50
ROM Pad & Stockpile	27
Haul Roads	25
Other Site Roads	5
Perimeter Fence	5
New Workshop (MSA)	10
Water Line Corridor – Plant to TSF	3.5
Gendarme Accommodation	0.5
HV Powerline Corridor	6.5
Magazine Area	2
Total footprint	**540.5**

Around the WRD, a 10 m strip (use as road where required) and a 4 m wide berm with a water drainage channel may be built.

The compaction of ground under waste facilities was deemed unnecessary in the Feasibility Study asthis final design stage also included a waste characterisation programme.

3.3 Land Tenure

Customary tenure is of great significance in the Project area. Customary land ownership and land use is acknowledged by Decree No. 71-74 of 16 February 1971. The Decree states that land and the right to use the land belong to the people. It further states that these rights cannot be transferred in any capacity whatsoever. No one can purchase these rights throughout the territory of Côte d'Ivoire.

Land can be used if compensation is paid. Compensation for the use of land has to be made according to the current legal framework[2]. This Order established the scale of compensation for crops destroyed and for loss of livelihood. Compensation also has to be made with the approval from the Minister of Agriculture.

3.4 Relevant Stakeholders

Stakeholder engagement is of paramount importance in closure planning. A stakeholder engagement and social assessment process, as part of the ESIA process for the Project, has been ongoing since June 2014.

The stakeholders selected from the Stakeholder Engagement Plan (rePlan 2015) as being particularly relevant in the development of this Conceptual Closure Plan include the following:

Table 3-2 Stakeholders relevant to the closure planning process

Stakeholder	Project Activity
Governmental authorities	
Ministry of Mines and Industry	Approval of the Mine Closure Plan (required according to Art. 145 of the Mining Code
National Environmental Agency (ANDE)	Approval of the ESIA, Mine Closure and Rehabilitation Plan is part of the ESIA documentation
Ministry of Agriculture	Use of Customary Land, Return of rehabilitated land to communities, reinstatement of agricultural land
Prefect (Préfet)/Sub-prefect (Sous Préfet) of Bouaflé	Land ownership committee is chaired by the Prefect
Traditional Authorities	
Town Chiefs, Village Elders	After-use of rehabilitated mining area
Other stakeholders	
Civic and Non-Governmental Organisations	Mainly those that can assist with closure and post-closure activities (maintaining offsetting areas, wells, health facilities, etc.),. However, it must be noted that the Project life is 6 years and some of these stakeholders

[2] Loi n°98-750 du 23 Novembre 1998 relative au domaine foncier rural modifiée par la loi 2004-412, du 14 Août 2004 ; decret 2014-25 du 22 Janvier 2014, modificant le decret 2013-224 du 23 Mars 2013, portant reglementation de la purge des droits coutumiers sur le sol pour intérêt général; Arrêté Ministériel n°247 MINAGRI/MPMEF/MPMB du 17 Juin 2014, portant fixation du barême d'indemnisation des cultures détruites

	may not be active in the area at the time of closure
Suppliers and local businesses	Loss of income when mining Project closes
Project proponent	
Perseus Yaoure SARL	Viability of the Project Technical feasibility of closure measures
Perseus shareholders	Financial interest in minimising closure costs

Other stakeholders listed in the Stakeholder Engagement Plan of Perseus will be involved on a case-by-case basis as required.

3.5 Other Contextual Information

Further contextual information (see ICMM 2008, Tool 6: "Contextual Information") can be obtained in detail from the following baseline studies:

Table 3-3 Sources of further detailed contextual information

Type of information	Source
Geology	Perseus Yaoure Project NI 43-101 Report[3]
Hydrology	ESIA, Water Baseline Study
Hydrogeology	
Water quality in surface and aquifer resources	
Biodiversity including the extent of pre-Project biodiversity degradation	ESIA, Biodiversity Baseline Study
Soils and land use	ESIA, Soil Baseline Study
Settlements, land use	Social/socio-economic baseline study
Population, demographics, languages	
Household composition, density and distribution	
Employment, livelihood and income streams	
Community groups, organisations and infrastructure	
Agriculture and yield	
Education, literacy and numeracy levels	
Vocational skills and capacity	
Health facilities and public health situation	ESIA, Community Health section and Social/socio-economic baseline study
Artisanal mining, mining history of the area	ESIA, Socio-Economic Study
Culture and Heritage	ESIA, Cultural Heritage Baseline Study

3.6 Government Regional Development Planning Schemes

In order to maximise the benefits of a mining Project for society, it is important to integrate closure and post-closure phases into regional development strategies. The applicable strategy documents for Côte d'Ivoire are briefly analysed in the following with respect to their relevance to closure and rehabilitation planning.

[3] M.E. Rossi, P. Brown: NI 43-101 Technical Report for Perseus Mining Côte d'Ivoire SARL. 05 January 2015

The National Environmental Policy (NEP), adopted by the Government of Côte d'Ivoire in 2011, aims at creating a framework to take into account the environmental issues in development strategies and policies. The objective of the NEP is to ensure a healthy and sustainable environment and to preserve natural resources.

In the area of social development, the Government of Côte d'Ivoire has developed the Poverty Reduction Strategy Plan (PRSP) that addresses urgent and effective solutions especially in the field of peace and reconciliation, reconstruction of the country and sustainable development.

This Mine Closure and Rehabilitation Plan is in line with the above-mentioned policies, by describing ways of:

- Restoring the environment as far as technically and economically possible;
- Preserving the benefits of the Yaoure projects in terms of physical and social infrastructure, training and education, and improved health for the post-Project period; and
- Mitigating the risk of poverty and disenfranchisement after the mine has ceased to operate.

3.7 Values Requiring Protection or Enhancement

The ICMM Guidance on Integrated Mine Closure, Toolkit 6, recommends the listing of environmental, social and economic values that the Project will create or maintain and which require protection or enhancement during closure and post-closure. This can provide useful guidance for the Closure and Rehabilitation Action Plan and help to improve the sustainability of the Project.

Environmental, social and economic values that require protection or enhancement during Project closure and rehabilitation are listed in Table 3-4.

Table 3-4 Values requiring protection or enhancement

Value	Comments, explanations
Environmental	
Biodiversity and ecosystem services	Perseus will operate the Project in an ecologically responsible way. Mitigation and offsetting measures will be implemented in order to protect and enhance biodiversity value. It is important that these efforts continue in the post-closure phase. This includes biodiversity monitoring, awareness of vulnerable habitats, protecting ecosystems required for Ecosystem Services, responsible land use.

Surface water quality	Perseus will minimise water pollution and erosion to the extent possible. Post closure, it must be ensured that the quality of water is not impacted (or success achieved by environmental rehabilitation undone) by unabated pollution or erosion, e.g., by inappropriate land use (erosion, over-fertilisation), ASM (use of mercury, suspended solids), or negligent use and handling of oils and fuels (cars, trucks, diesel generators).
Social values	
Employability	Post-closure employability of Perseus employees should be maximised by the broad skill sets training received as part of their employment.
Qualification levels	Qualification levels that have developed in the Project area as a result of the mining Project should be maintained where possible by continued professional training.
Public infrastructure	Infrastructure created during the mining Project (roads, water wells, health facilities, cultural/sports etc.) should be maintained by the government and/or communities in the post-closure phase. Clear take-over procedures should be developed to ensure uninterrupted responsibility for facilities and infrastructure. Note: Communities must have the means to maintain infrastructure post-closure.
Economic and livelihoods	
Access to Ecosystem Services	Responsible use of ecosystems post-closure, to ensure continued access and use

4.0 TARGETS AND GOALS

4.1 Legislative Requirements and International Best Practice

There are relatively few specific requirements under Ivorian legislation regarding closure and rehabilitation (see Section 2.1.1 above). The rehabilitation and closing of mines are dealt with in Chapter VII of the 2014 Mining Code. In addition to the escrow account for rehabilitation of the environment provided for under the 1995 Mining Code, applicants for extraction permits (permis d'extraction, PE) are henceforth required to establish a plan for the closing and the rehabilitation in the framework of the ESIA. They also assume civil liability for a period of five years following the closing of the site for damages and accidents which could be triggered by the prior installations.

International best practice guidance such as the EU Best Practice Reference for Tailings and Waste Rock (BREF 2009) provides the following general closure objectives:

- Physical stability of slopes and waste facilities;
- Safe access to the site, or restriction of access to non-authorised persons where hazards remain after closure;
- Prevention or minimisation of polluted water runoff and erosion of fines from waste facilities;
- If polluted runoff (including eroded particulates) cannot be completely prevented, discharge of water must comply with discharge criteria permitted by the authorities and in line with the beneficial water uses;
- Removal of all types of organic contamination (oils, lubricants, diesel) and potential contamination sources;
- Prevention of dust from waste facilities and other surfaces;
- Stable growth of vegetation, in line with the preferred after-use of the vegetated areas; this includes the selection of local species or species that can readily adapt to local climatic and soil conditions that require minimal human care and are robust with respect to competing but unwanted species;
- Return of the site to a state that accommodates beneficial after-uses by the community, following a thorough stakeholder consultation process;
- Preservation of infrastructure and buildings that can be used by the government and/or the local community for beneficial after-uses;
- Social Stability: Consideration shall be given to opportunities for local communities whose livelihoods may depend on the employment and economic fallout of the mining activities. Adequate measures are made to ensure that the [positive] socioeconomic consequences of closure are maximized; and
- Aesthetics: Landscaping of visible waste facilities (residual tailings heap) to improve aesthetic appearance, as necessary, and in accordance with the defined after-use scenarios for the post-mining landscape, and removal of visually disturbing buildings and infrastructure elements.

4.2 Input from Stakeholder Consultation Meetings

The following general targets of closure and rehabilitation were discussed with stakeholders during the Stakeholder consultation meetings in 2014-2015:

- Economic decline, caused by loss of employment – how can this be mitigated and what will the impacts of eventual mine closure on livelihoods be?

- Visual intrusion of pits, stockpiles, infrastructure and plant, and impacts to visual aesthetic of Lake Kossou – how will the visual appearance and landscape character be reinstated when the mine has ceased to operate?

- Reduction in productive land base available to local communities through land acquisition – what is the risk that these will not be replaced post-closure?

- To what extent will soil capability be restored at the end of the mine life? How will Perseus manage topsoil, rehabilitation activities and post-closure monitoring?

- Seepage from the open pit (and possibly waste facilities) after mine closure – what are the potential negative impacts on water quality and how will they be mitigated?

4.3 Closure and Rehabilitation Goals

Based on the general targets discussed in the previous sections, more specific goals can be defined. The following is based on the goal setting checklist (ICMM Integrated Mine Closure Toolkit, Tools 7-9) and was discussed with the ESIA Committee in May 2015.

The goals are structured according to the following:

1. Government stakeholders (National and County level);

2. Perseus (company level); and

3. Communities (local level).

Table 4-1 Closure and rehabilitation goals

Level of responsibility	Area of concern	Goals
Government	Sufficient capacity (human resources, financial resources) must be available by the end of the mining Project to make active use of the assets that the Yaoure Project will have left behind	Government to develop structures and capabilities to optimally use infrastructure left behind, at Government's expense
Government	Involvement and empowerment of local communities in the conceptual preparation and implementation of national and regional development programmes	Ivorian Central Government to provide communities with financial and human resources to actively participate in development programs and make optimal use of infrastructure developed by Perseus
Community/Region	To whom should land be given back? Which community entities or individuals should use it?	Rehabilitated land should be returned to communities, land-use restrictions may apply in certain areas (TSF, WRD)

Community/Region	What are preferred post-closure land use scenarios?	Preferred post-closure land-use is agriculture
Community/Region	What plans do the communities have for after-use of rehabilitated areas?	Define crops so that soil cover and possibly fertility can be optimised
Community/Region	How can transport networks (roads, tracks) be maintained to serve socio-economic development, without destroying vulnerable habitats?	Land-use should be restricted to land that is already modified, no pristine areas. Restored mining land (including covered waste rock dumps) should be preferably used for agriculture Communities need support (financial, human resources) from Government to make use of the infrastructure
Community/Region	How can health and educational infrastructure developed by Perseus under the Community Development Plan be maintained? Who should do this? NGOs? Government? What structures could Perseus help to put in place that can be taken over when mining is over?	Communities to work with Regional and National Government to prepare them for continued operation and maintenance of infrastructure Communities need support (financial, human resources) from Government to make use of the infrastructure
Community/Region	Project infrastructure that is not removed after closure but left in place for community use: how can it be maintained after closure?	Responsibilities for maintaining infrastructure should be assigned in communities People should get training to operate and maintain wells properly Develop plans to ensure that continuing funds are available to pay for repairs, such as charging small amounts for water use
Community/Region	Requirements regarding surface water	Perseus to ensure no polluted runoff reaches rivers However, Perseus has no control over ASM and other activities that may be a source of water pollution (e.g., cyanide, mercury, turbidity)
Community/Region	Which livelihood and income streams that Perseus helps develop (businesses, trade, craftsmen, agriculture/supplies etc.) can be kept up? How can this be done?	Businesses that thrive during the mining Project should look beyond the Yaoure Project for a wider basis of customers and markets Perseus may also be able to assist with new/additional customers prior to closure
Community/Region	How can employment be kept up, using the qualification levels developed in the mining Project?	Work with Perseus to define qualification requirements during and after the mining Project, establish

	Craftsmen, mining experts, service providers etc. What will ensure best employability post-mining?	additional training needs for post-closure phase and arrange for training where possible Communities need support (financial, human resources) from Government to make use of the infrastructure
Community/Region	What should be done to protect biodiversity post-mining?	Roads of the mining operations (haul roads, access tracks etc.) that would allow uncontrolled access to vulnerable habitats should be closed off and regraded Support from the Government is required to effectively enforce biodiversity protection measures
Community/Region	Safe environment, no environmental and health/safety risks from closed infrastructure	Remove or render safe all mining infrastructure
Community/Region	What competencies will the mine employees have developed that will be needed for closure and post-closure activities?	Develop skills matrix of Perseus employees and assess for closure and post-closure requirements
Community/Region	How can these competencies and qualifications be developed during the mine life cycle so that they are readily available when the mine closes?	Develop gap analysis (qualifications/skills required by Perseus vs. qualifications/skills required by local businesses at the time of closure and post-closure)
Community/Region	How can Perseus develop its purchasing strategy to help local businesses develop during the mine life and at the same time diversify so that they can survive after the mine has closed?	Develop purchasing strategy adapted to local purchasing opportunities relating to locally made or locally value-added products Encourage local businesses to adapt to Perseus's needs, but also to be self sustaining beyond the needs of the company Develop longer-term supply contracts if possible
Community/Region	Long-term stability of closed site	Post-closure provisions in the Community Development Plan Sufficient funds to cover environmental liabilities in the post-closure phase (e.g., closure fund)

From the above tables it is clear that the closure goals at national, community and company level cannot be considered in isolation. Rather, the goals in Table 4-2 are intimately linked and responsibility is shared. It is important to note that collaboration at all levels (government, community, company) prior to closure is essential to ensure that

detailed plans and budgets are prepared in order to implement these goals, and that local communities require government support.

Table 4-2 Shared responsibilities for closure goals

Goal	Responsibility		
	Government Level	Community Level	Company Level
After-use of infrastructure by communities	Provide human and financial resources to communities	Define needs and develop plans for sustainable after-use	Leave assets behind Identify and inventorise assets that can be handed over to community or government to manage (i.e. mine clinic, roads etc.)
Qualifications, skills, employability	Facilitate micro-loan schemes if possible Extend development programs to Yaoure Project area	Use opportunities of building a healthy business environment during operation phase	Develop local businesses by a thought through purchasing and training strategy throughout mine life
Environmental Protection	Enforce environmental legislation in Protected Areas	Ensure local businesses develop in an environmentally friendly way	Leave behind clean environment without environmental liabilities

It should be noted that Perseus does not have full control over all of these shared goals. Table 4-3 summarises the closure and rehabilitation goals over which Perseus does have control. These goals will be regularly checked and updated, according to the provisions in Section 12.0 of this Plan.

Table 4-3 Summary of closure and rehabilitation goals of Perseus

Area of concern	Goals
Land ownership and land use	• Work with communities to agree post-closure land use and ownership
Infrastructure maintenance (roads, wells, buildings, health and education facilities)	• Hand over infrastructure “as is”, with maintenance plans developed as appropriate
Safe environment	• Adequate structures for post-closure water management (sufficient design criteria with respect to return periods of storm events) • Minimisation of water pollution (ground and surface water) • Geotechnical stability of waste facilities • Make people aware of use restrictions (e.g., TSF)
Biodiversity	• Natural re-vegetation growth based on sufficient return of top-soil which would eventually (many years later) establish new habitat, that can easily turn to restoring natural habitat
Employment and social welfare	• Preparing people for post-Project economy by sufficiently broad qualification
Economic development	• Optimise purchasing policy to build sustainable local business base for locally made or locally value-added goods and services

	• Integration of rehabilitated site into regional development plans
Visual appearance	• Blend rehabilitated areas into surrounding environment

5.0 PREMATURE CLOSURE AND TEMPORARY SUSPENSION

This Conceptual Closure Plan deals primarily with planned closure and rehabilitation. However, premature closure may be required if the operations are no longer viable due to a change in Project economics or other difficulties such as civil war or Ebola. Premature closure may often lead to closure costs that are higher than those linked to the programmed closure plan, but this can be minimised if progressive rehabilitation measures are implemented where technically feasible. Consideration of premature closure as part of the closure and rehabilitation planning process is considered international best practice[4].

Temporary suspension of the operations may occur if for a certain period of time the operations are not economically viable or if there is a danger to the employees i.e., civil war, Ebola or similar circumstances. Depending on the economic forecast, they may either be placed on a care and maintenance programme and restarted at a later time, or subsequently closed permanently, which is then equivalent to premature closure.

In case of temporary suspension of the operations, the following actions will be taken:

- Put the site infrastructure into Care and Maintenance according to adequate operation procedures;
- Remove all hazardous reagents from storage tanks and/or ensure leakage detection systems are fully operational;
- Render safe all slopes (e.g., pits walls, waste rock dumps) if necessary;
- Ensure that fencing and warning signs around all areas are intact;
- Reduce site security to the minimum required to ensure that there is no unauthorised site access and a regular inspection of all facilities is carried out.

More details on premature closure and temporary suspension are provided in Section 6.0 in the context of the various elements of the mining infrastructure.

[4] See, for example, Art. 1 (2) of Commission Decision 2009/358/EC of 20 April 2009 on technical guidelines for the establishment of the financial guarantee in accordance with Directive 2006/21/EC of the European Parliament and of the Council concerning the management of waste from extractive industries

6.0 DESCRIPTION OF REHABILITATION MEASURES

The following sub-sections describe the rehabilitation measures that will be used to ensure that the closure and rehabilitation goals are met to the extent possible.

6.1 Open Pit

The Yaoure open pit will cover an area of 50 ha, under the assumption of a 1,200 USD/oz pit shell.

Pit slope stabilisation and access control

The pit slopes are usually steep, which is a risk to public safety in the post-closure period. However, pit benches and slopes must be stabilized wherever possible, and the distance of safety berms and fences from the pit slopes must be sufficient to ensure protection against subsidence and slope failure. The stability of the rock faces will be assessed by an independent expert.

Pit slope angles must be geotechnically stable during the entire life of mine, therefore the need for additional stabilisation during closure is expected to be minimal. Locally, smaller sections may require stabilisation as part of the final closure. The choice of the appropriate stabilisation method(s) will depend on operational experience with the materials involved as well as the configuration of the open pit at closure. This will also include careful investigation of temporary risk of pit wall/slope instability due to water level re-bound.

The open pit will remain a permanent landscape element. Usage scenarios for the post-closure period shall be established with the community in an interactive process, such as fish breeding (if water quality is suitable). However, restrictions may apply depending on the water quality (see below). In case of community use of pit lakes, shoreline contours and roads may need modifying to make access safe.

In order to ensure a basic level of safety, a perimeter berm of approximately 6-7 m base width and 2 m height will be built around the pits.. The berm material will be non-acid-generating waste rock to minimise cost. It is likely that a fence or warning signs would be stolen over time. This is therefore not included here.

Vegetation around the pits will be planted mainly on the safety perimeter berm.

The public shall be informed about the remaining risks and safe access, and a detailed plan of the closed pit shall be lodged with the land register or comparable authorities for future reference.

Pit lake formation

During closure, when pit dewatering is turned off, pit lakes will form as a result of groundwater rebound, depending on the depth of the pit bottom.

The pit is expected to fill with water during the closure period and a pit lake will form. Monitoring data of existing pit water quality (see Table 6-1) indicate that any environmental concern for water quality in the new pits is unlikely to be justified.

Table 6-1 Current pit water quality data (January 2015)

Parameter	Zone Nord	Zone centre	Zone sud	Unit
pH	8.3	8.4	8.3	
Conductivity	29.	20.8	19.7	mS/m
TDS	2	6	3	mg/l
SO4	13.	4.	2.	mg/l
Cl-	5.5	3.8	3.5	mg/l
NH3-N	<0.02	0.02	0.05	mg/l
NH4-N	<0.1	<0.1	<0.1	mg/l
NO3	<0.06	<0.06	<0.06	mg/l
NO2	<0.05	<0.05	<0.05	mg/l
HCO3	159.	116.	112.	mg/l
CO3	<1	<1	<1	mg/l
CaCO3	131.	95.	91.	mg/l
Turbidity	1.3	1.6	1.9	NTU
Hardness	125.	95.	87.	mg/l
BOD5	<5	<5	<5	mg/l
COD	<25	<25	<25	mg/l
Hg	<0.0001	<0.0001	<0.0001	mg/l
As	0.0029	0.0006	0.0015	mg/l
Cd	<0.0001	<0.0001	<0.0001	mg/l
Cr	<0.001	<0.001	<0.001	mg/l
Co	<0.001	<0.001	<0.001	mg/l
Cu	<0.001	<0.001	<0.001	mg/l
Pb	<0.0005	<0.0005	<0.0005	mg/l
Mn	<0.002	<0.002	<0.002	mg/l
Ni	0.002	0.002	0.001	mg/l
Se	<0.01	<0.01	<0.01	mg/l
Fe	<0.1	<0.1	<0.1	mg/l
Hg-tot	<0.0001	<0.0001	<0.0001	mg/l
As-tot	0.0041	0.0009	0.0015	mg/l
Cd-tot	<0.0001	<0.0001	<0.0001	mg/l
Cr-tot	0.016	0.012	0.012	mg/l
Co-tot	<0.001	<0.001	<0.001	mg/l
Cu-tot	<0.001	0.001	<0.001	mg/l

Pb-tot	0.0006	<0.0005	<0.0005	mg/l
Mn-tot	0.016	0.016	<0.002	mg/l
Ni-tot	0.004	0.003	0.003	mg/l
Se-tot	<0.01	<0.01	<0.01	mg/l
Zn-tot	<0.005	<0.005	<0.005	mg/l
Ba-tot	0.015	0.006	0.009	mg/l
B-tot	0.04	<0.02	<0.02	mg/l
Sr-tot	0.258	0.075	0.079	mg/l
Al-tot	0.05	0.1	<0.03	mg/l
Ca-tot	27.	20.	17.	mg/l
Na-tot	14.7	9.1	7.6	mg/l

During the operation phase, a waste characterisation program will be implemented that allows conclusions to be drawn on the post-closure water quality of the new pit. Should predictions of the “new” pit lake water quality be significantly different from the benign water quality of the existing pit lake, appropriate measures will be taken such as prevention of access to the pit lakes and use for fishing breeding, swimming etc. (warning signs).

6.2 Waste Rock Dumps

6.2.1 Geotechnical stabilisation

For work safety reasons, waste rock dumps will have a slope angle during operation which should be sufficiently stable. However, if waste rock dumps are located on sliding ground layers, if slopes are too steep to be stable over the long term, or if they are too steep from a visual/landscape perspective, sufficient countermeasures such as regrading, buttressing or lowering of the dump height will be applied (following a geotechnical assessment where appropriate).

6.2.2 ARD management

Geotechnical characterisation testwork carried out by Amec Foster Wheeler (see Waste Management Plan of the ESIA and Waste Characterisation Report[5]), indicates that the Yaoure waste rock has a low level of total Sulphur and hence sulphides. The Acid Base Accounting (ABA) and Non-Acid Generating (NAG) testing concludes that the potential for acid generation from the waste rock is low. Selected samples were further characterized by mineralogical techniques and it was found that when compared with the average composition of the Earth’s crust the concentration levels of the following elements were significantly elevated: As, Bi, I and Sb. However, the short term leaching results suggests that the metal leachability of these elements is unlikely to be significant (i.e. these elements will be present but have low potential to be liberated to the environment).

[5] Amec Foster Wheeler, Yaouré Geochemical Characterisation – Waste Rock, Construction Materials and Tailings. Report Number A151-15-R2286l, April 2015

For areas of the WRD that can be shown to be non-acid generating (NAG), a simple soil cover is required to prevent erosion (see Section 6.2.3). If there is any potentially acid generating (PAG) material, it can be encapsulated by NAG material, which should be feasible for the largest part of the waste rock.

It should be noted that the wastes from Cluff Gold's previous operation were not acid generating either, as the ore processed at that time was oxidic (see Closure Plan for Angovia, AMEC, 2011/2012).

Monitoring of the quality of seepage water will provide quantitative input into the future planning of water management during closure and post-closure. This information will be used in further updates of this Closure Plan.

Water drainage ditches will be installed where needed as part of the operational water management. Diversion and collection ditches for erosion protection of the cover may be needed, with design to be based on a hydraulic assessment based on rainfall, slope length and inclination, and cover properties. During and after closure, the ditches will need maintenance (cleaning, de-silting).

6.2.3 Erosion control and revegetation

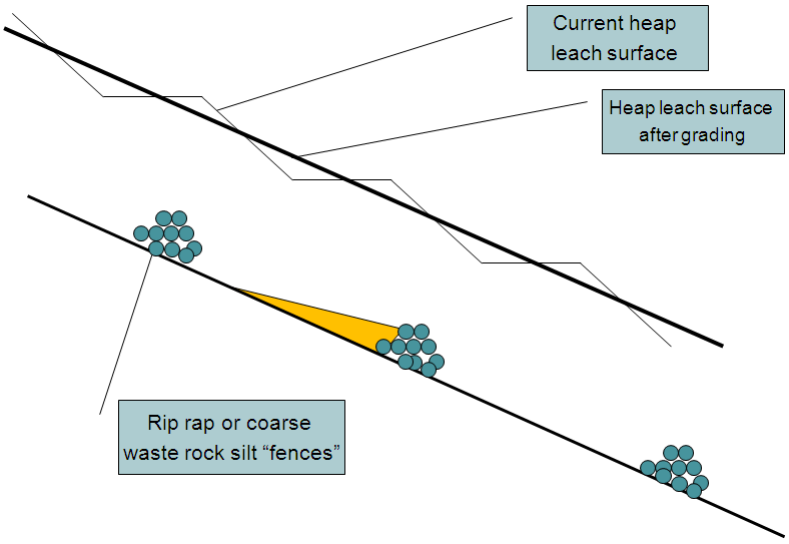
On waste rock and barren pit faces, vegetation does not readily take hold, but due to the favourable climatic conditions it is expected that vegetation will quickly establish if a thin topsoil layer of only several centimeters thickness is placed (see Figure 6-1). A 0.2 m thick soil cover on the waste rock dumps will minimise wind- and water-borne erosion of waste material, support vegetation and thereby help improve the visual appearance of the waste rock dump after closure.

Standard equipment (graders, dozers) may find it difficult to place an even soil layer of less than 0.25-0.3 m thickness, particularly on rough surfaces such as waste rock dumps. Therefore, soil may be dumped in heaps and then, if necessary, manually spread out by raking to form a cover with relatively even thickness of 0.2 m.

Where necessary, additional erosion protection measures such as silt fences will be adopted, as outlined in the 2011/2012 Closure Plan, see Figure 6-2.

Figure 6-1 Vegetation rapidly taking hold on thin soil layers

Figure 6-2 Simplified sketch of silt erosion fences (from 2011/2012 Closure Plan for Angovia)



Whether the soil cover can be used for agricultural purposes will be decided when the post-closure land-use is agreed with the communities.

6.2.4 Ore Stockpiles

Under planned operational conditions, the ore stockpiles will be removed and processed. In case of unplanned/premature closure, ore stockpiles will be covered in the same way as described for waste rock dumps above.

6.2.5 Cover Test Plots

The performance of cover systems in terms of infiltration, vegetation support and erosion control, stability etc. will be verified by test plots. Experience has shown that performance may deteriorate within a few years. Test plots of realistic cover systems operated over several years can provide additional confidence in the long-term stability and inform the selection and detailed engineering of a cover. Cover test plots may be set up as part of covers on waste rock and tailings under progressive rehabilitation, or as separate trial sites.

6.2.6 Progressive Rehabilitation

The waste rock dump will be progressively rehabilitated during the operation period. Sections of the waste dump that are no longer used for waste rock disposal will be rehabilitated in the same way as described above.

Details of progressive rehabilitation measures depend on the mine plan and, more specifically, the WRD areas that need no longer be accessed for waste disposal.

6.2.7 Post-closure Restrictions

No buildings or other structures with deep foundations should be erected on the cover, as this would damage the cover and compromise its function of minimising infiltration and oxygen ingress. Local communities should be made aware of this restriction. This should also be included in the handover agreement between Perseus and the Government, in order to limit Perseus's liability.

6.3 Tailings Management Facility (TSF)

6.3.1 TSF Closure

A test work programme was applied to six tailings samples available during the PFS stage. The Yaoure CMA Sulphide Lower (Y CMA L) sample was classified as potentially acid generating while the oxide tailings might have a metal leachability concern with respect to arsenic. The mineralogical results presented would suggest that the following elements are of potential environmental concern: As, Bi, I, Mo, Sb and W. Other elements that are above average are: Cr, Cu, Ni, Sn and V.

At the time of writing this Conceptual Closure Plan, it is not possible to provide a definite conclusion regarding whether these findings will be realised and what the likely impact would be based on the available testwork results and therefore it was recommended that a geochemical model is developed based upon the required testwork for this.

The closure concept for the TSF consists of contouring the tailings beach through a strategic deposition plan in the last few years of the LOM, followed by placing a 0.2 m thick layer of topsoil and revegetation. Placement of cover material on soft tailings may be technically difficult and some consolidation of the tailings has to occur before a cover can be placed.

For the purpose of this Conceptual Closure Plan it is assumed that no infiltration and oxygen barrier will be required to prevent ARD generation in the tailings body. However, this assumption will have to be revisited when more testwork results for tailings are available.

Details of the thickness and the structure of the cover are contingent on the results of the geochemical testwork of the tailings, and subsequent geochemical and hydraulic predictive modelling of the likely quality of the seepage collected at the tailings dam.

Depending on the final beach level and contour, a channel may be required from the covered tailings beach to the spillway so that the TSF remains free from substantial ponding at closure. The channel and spillway would need to be protected with vegetation and rock to reduce water velocities to minimise erosion.

The TSF is a significant landscape element that will last after Project closure and rehabilitation. After closure, the TSF will be characterised by a large, relatively flat surface and a dam. More specific rehabilitation goals are developed in a consultative process with the local communities in order to ensure that the post-closure end state is compatible with land use requirements. It must be noted that agricultural use of the closed TSF may not be desirable. Any use of covered waste surfaces may damage the cover and ultimately lead to its failure. Water quality of the ponds may not be suitable for any use. Therefore, access to waste surfaces should be discouraged where possible, e.g., by planting thorny or dense shrubs around the perimeter.

6.3.2 Water Management

As noted above, geochemical test work that was carried out by AMEC indicates that there is a potential risk of the tailing to generate ARD. This risk will be quantified further with more tailings samples becoming available for geochemical test work.

It is expected that the seepage rate of infiltration water through the tailings will decrease significantly as consolidation of the tailings progresses and hydraulic permeability decreases. The majority of seepage from the TSF is expected to be recovered through the underdrainage and embankment internal drainage system. At closure, the operations maximum discharge to the seepage collection pond is expected to reduce significantly.

The timeline that the water quality remains unacceptable to release to the environment and possibly requires treatment will be established with further testing. A passive treatment lagoon may be an acceptable option, but it will depend on what needs to be treated.

Monitoring of the quality of groundwater under the waste facilities and down-gradient will provide quantitative input into the future planning of water management during closure and post-closure. This information will be used in further updates of this Closure Plan.

6.3.3 Post-Closure Use Restrictions

No buildings or other structures with deep foundations should be erected on the tailings cover. Local communities should be made aware of this restriction. This should also be included in the handover agreement between Perseus and the Government.

Gold processing tailings are often regarded as a resource of gold that can be re-mined by artisanal miners. However, Perseus's gold recovery from the ore will be sufficiently high that re-processing of tailings will not be viable even under low economic

expectations. On the other hand, re-mining of tailings will lead to severe damage of the cover system. Excavation of the tailings for re-processing will also lead to an uncontrolled dispersion in the environment, which will eventually undo the efforts to isolate the tailings from the environment. The ASM community in the area will therefore be made aware of the very low residual gold content and a ban on re-processing should be included in the handover agreement of the mine site.

Handover agreements shall contain clear provisions for the limitations of Perseus's liability once the site has been taken over by the communities or the Government.

6.4 Tailings Pipeline

At the end of its regular operation, the proposed tailings pipeline and the water return pipeline between the process plant and the TSF will be flushed to remove any loose tailings. The resulting wastewater will be directed to the TSF.

Upon closure, the pipeline including any foundations, stilts or similar elements will be removed and the narrow strip of the pipeline route will be re-integrated into the environment. After removal of the pipeline, embankments will be flattened and cuttings backfilled so that they blend into the environment, where required.

The pipeline corridor with an assumed width of 2 m will then be covered with a soil layer of 0.2 m thickness as vegetation support.

The pipe can be sold/re-used (depending on the residual wall thickness due to tailings abrasion) or will be disposed of.

6.5 Lined Ponds

At closure, any residual water in the ponds will be removed and treated before discharge. Peroxide will be used for cyanide detoxification; an alternative method that was investigated would be the use of sodium hypochlorite but peroxide is preferred because it is easier to dose and monitor, and peroxide treatment will not add chloride to the discharged stream. The volume of residual water will depend on the season in which the plant is taken out of operation, but the amount of water will be small compared to the supernatant pond of the TSF that will also have to be managed during closure.

The lined ponds will be left on site for fish breeding or similar activities by the community. Therefore, no provision for the removal of the ponds has been made. However, during consultation meetings that will be held with the community and the authorities closer to the end of the mine life, it will have to be confirmed that there is:

- A substantial interest by the community in keeping the ponds after closure;
- A credible concept and proof of economic viability of such after-use; and

- The consent of the authorities to the intended after-use and acceptance of the ponds remaining in place.

Should it turn out as a result of the consultations that the ponds will have to be removed as part of the site closure, this will have to be taken into account in an update of the Closure Plan and the closure cost estimate.

6.6 Plant and Stationary Equipment

The process plant including workshops, laydown areas, crusher, mill, leach circuit and administrative buildings will have foundations that are typically made of concrete.

A careful inventory control will be carried out to minimise the quantities of reagents in storage tanks at the end of the mine's operational life. At closure, reagent tanks are flushed and cleaned, and any spills and contamination cleaned and removed. Any contaminated liquor and solids from this operation will be disposed of in the TSF basin. All decommissioning and cleaning tasks will be performed by trained personnel, in accordance with standard workplace health and safety procedures. Work will be carefully planned, sequenced, and scheduled so that functional installations are properly and safely segregated from those areas that will be subject to disassembly (if any). This is particularly important for plant areas where cyanide was used.

The onsite electrical power system will be maintained during transition or closeout as long as necessary for the operation of essential equipment such the water treatment and any detoxification plant.

Particular care will be taken with regard to the use of respiratory protection devices and other personal protective gear, as well as lockout/tagout procedures so that electrical equipment or machinery will not be inadvertently energised during disassembly. Work areas will be strictly delineated via temporary fencing, warning panels, visual and acoustic signalling and warning devices, or other appropriate means.

Care will be taken to minimise the accumulation of debris that could endanger workers engaged in further disassembly or demolition activities, where assets are not taken over by the Government and equipment is removed. At disassembly, all connectors and fasteners will be sorted by size as necessary to support potential future reassembly. The disassembly sequences for major equipment items will, in general, be the reverse of the assembly order. Heavy parts will be strapped, chained, or bolted to wooden pallets or skids to prevent inadvertent rotation and to facilitate forklift handling and truck loading operations.

Concrete structures will be disassembled and removed up to a depth of 1 m in the ground. Concrete rubble will be transported to the TSF and disposed of in soft tailings areas using dozers or in the general waste dump. This requires the observation of strict safety precautions for working on tailings surfaces.

The diesel fuel, gasoline and lubricant tanks and dispensing systems are assumed to continue to be used, if deemed worthwhile, in the early years of closeout during which waste and other surfaces are being graded and the covers are being installed and major earthworks are being carried out. The advantage of maintaining these tanks and dispensing systems will be to realise the benefits of existing infrastructure and to minimise the potential for accidental spills and pollution. They will finally also be disassembled and removed.

Cleanup of accidental spills of oil, fuel, lubricants and other soil pollutants is assumed to be part of the operation costs and is therefore not included in the closure cost estimate.

Explosives and chemicals will be returned to the supplier or will be disposed of by a licensed contractor. Inventory control measures in the final years of operation will be implemented to reduce the quantity of explosives/chemicals remaining at closure. The explosive storage magazines will be decommissioned.

Where plant and equipment are removed, the areas will be reclaimed and made available for agricultural purposes or other community use. This involves levelling and/or scarification as appropriate, placing of 0.2 m soil and seeding/planting.

6.7 Camps

The new (2014) Mining Code of Côte d'Ivoire does not now contain provisions similar to those of the previous Mining Code (1995[6]) regarding the hand-over of infrastructure to the land owner and/or Government. However, it seems sensible in view of community development to discuss with the Sous-Préfet and the communities which parts of the mining infrastructure can be used to the benefit of the country after closure, and would therefore remain in place.

Camps are planned as pre-fabricated concrete structures. Some housing may also be in the form of zinc metal or block structures. Part of the mine camp infrastructure includes drinking water and sewage treatment plants.

Camp buildings as well as ancillary buildings such as mess, recreation rooms, stores etc. are assumed to remain on site for use by the community. This requires a clear handover procedure, which will be agreed as the end of the mine life approaches.

6.8 Roads

For the Project, approximately 30 ha of haul and access roads will be built. In general, the onsite access and haul roads will be retained during the early years of closeout to

[6] Art. 29 of the 1995 Mining Code stipulated that buildings and permanent mining infrastructure shall be transferred to the government upon relinquishment of the mining title. Article 63 stipulated, somewhat differently, that buildings shall be given to the owner of the land, under the conditions defined in the Environmental Management Program and the Mine Closure and Rehabilitation Plan.

maintain access to work areas undergoing closure reclamation activities. Lockable gates and appropriate signs will restrict use of the access roads required for closure activities.

Haul roads will be scarified, covered with 0.2 m soil and revegetated.

A few haul road sections (albeit much narrower) may remain necessary in the closure and post-closure phase for access to monitoring and maintenance points.

The re-aligned access road from Kouakougnanou to Angovia will be retained post-closure for public use.

Care must be taken to ensure that roads are closed off if there is a risk of uncontrolled access to vulnerable habitats or supporting illegal logging or artisanal mining.

6.9 Landfill Cell

It is currently assumed that a small landfill cell will be required for hazardous and non-hazardous waste that cannot be returned to the suppliers, incinerated nor managed off-site. The landfill cell for on-site storage of non-recyclable waste will be closed according to industry standards. For budgeting purposes, it is assumed that the cell will be covered with a 2.5 mm HDPE liner, a protection layer (geo-fabric), a drainage layer of coarse sand or gravel, and a protection layer of crushed waste rock material of approximately 1 m thickness. On top of the protection layer, a 0.2 m thick soil layer to support vegetation will be placed, which is seeded with an appropriate seed mix.

Alternatively, the landfill cell may also be transferred to the community for continued use. However, operation of a landfill requires substantial care, as well as technical and institutional capacity, and the lack thereof will lead to adverse environmental impacts. Furthermore, landfill cells left behind unclosed by operators tend to attract uncontrolled waste disposal by the local population which will also lead to a visual nuisance which will damage the original operator's (i.e., Perseus's reputation). Therefore, unless the community can demonstrably manage the landfill after Perseus has left the site, it is envisaged that the cell will be closed at the end of the Project's lifetime, so that a clear demarcation of liability is established.

6.10 Vehicles and Mobile Plant Equipment

Vehicles and mobile plant equipment will be sold or scrapped if they are no longer needed for remedial measures, depending on their remaining useful life.

6.11 Soil placement and Revegetation

6.11.1 Soil requirements for closure and rehabilitation

The return of stockpiled soil is the key condition for natural revegetation of disturbed areas and the development of stable ecosystems (albeit not necessarily the restoration of original habitats or a "pre-mining" environment).

The decision on how much soil shall be stripped prior to construction of mining infrastructure (and from which construction areas), stockpiled and conserved for re-use during rehabilitation (including concurrent rehabilitation) is driven by the rehabilitation objectives that shall be achieved, and to what extent soil is required and available in this process.

Table 6-2 Closure objectives in relation to soil management

Rehabilitation Objectives*	**Relevance with regard to soil availability during closure**	**Comments**
Natural re-vegetation growth	Suitable, high-quality growth medium with defined properties is required, must ensure that growth and natural/controlled succession patterns are predictable and not left to chance Revegetation will be implemented bearing in mind that disturbed areas where full restoration is impractical shall be subject to biodiversity off-setting and potential for aggregated off-setting, where appropriate and feasible	Major waste facilities disturb large areas of natural habitat, see Table 3-1 for footprints Natural vegetation would eventually (many years later) establish forest habitat, that can easily turn to natural habitat Offsetting is required where appropriate and feasible
Prevention of inadvertent access to tailings material by local population	Access to tailings area should be discouraged by un-inhabitable vegetation such as thorny shrubs (on or around tailings surface)	This objective is best compatible with restoration of high-value ecosystems/habitats, as less human access to habitats ensures minimal disturbance in the post-closure period
Low-intensity use of waste facilities (sports ground, grassland)*	A soil layer is required to support the growth of grass on tailings or waste rock dumps	It may be preferable to prevent access to the TSF in order to preclude damage to cover. Despite cover, tailings may remain soft for a few years and may therefore not represent a suitable area for any human use
Erosion stability	Soil stratum required as erosion protection relies on vegetation cover	Can be achieved by vegetation cover or rip-rap cover, in combination with suitable hydraulic design (diversion channels)
Minimising water quality impacts	Isolating (inert) layer between tailings and surface runoff should be applied, which must be stabilised by vegetation to prevent erosion	Contact of bare tailings with surface runoff should be minimised
Landscape/visual appearance	Fertile soil is required as vegetation support	

The Soil Baseline Report has identified various soil types that will be stripped during the construction phase (for details see the Soil Baseline Report). These soil types differ with respect to sensitivity and hence management/conservation requirements. They will be stripped and stockpiled as per the Soil Management Plan, so that they are available when required for concurrent or final rehabilitation.

Apart from the soil that will be stripped during construction of the Yaoure Project, there is a stockpile from the previous Angovia operations holding approximately 100,000 m³ of topsoil. This soil stockpile is also available for use during concurrent and final closure and rehabilitation.

The total amount of soil that will be stripped will be determined with greater certainty during the operations phase. However, as a preliminary estimate, the amount of soil that will be available for rehabilitation works is almost 1.2 million m³ (see Table 3-1, which includes the stockpiled soil from the Angovia operations).

Soil placement and revegetation procedures will follow the Soil Management Plan and the Biodiversity Management Plan. The general guidelines listed below will be observed:

- In order to avoid damaging the soil structure and site drainage capabilities, no planting operations will be carried out in unfavourable weather conditions or in excessively damp soils - no planting will be carried out when the soil is saturated with water or excessively dry;
- Weeds will be removed and destroyed prior to replanting any area of the site;
- The use of excessively heavy equipment and repeated vehicle runs over the same replanting area will be avoided;
- After planting, no heavy equipment will be used on the planted areas - any planted area affected by such inappropriate equipment, will be rehabilitated;
- Large-diameter stones and refuse will be removed during soil reclamation and spreading;
- Adequately workable sub-surface ground (e.g., waste rock of sufficient rock size distribution to enable soil placement) will be levelled and sloped to ensure effective drainage;
- Any minor recesses, pits, or hillocks in the soil cover will be filled;
- Manufacturers' recommendations will be followed concerning the storage, handling and spreading of fertilisers and herbicides, should they need to be applied;
- As first stage in the revegetation process, applying seed mixes on areas covered with soil are expected to be a suitable method to avoid erosion; this

may be followed by planting shrubs or trees where required from a biodiversity conservation point of view (to be defined in the Biodiversity Management Plan);

- If planting of shrubs or trees is part of the final revegetation strategy, it will occur in the dry season to avoid torrential rainfalls that would wash away saplings;
- If planting needs to be postponed, the plants will be protected against degradation or unfavourable weather conditions; and
- Pits for saplings dug on inclined surfaces will have vertical edges and the pit horizontal bottom diameter will be large enough to accommodate fully stretched roots.

A plant nursery to produce saplings may be considered at a later stage, when trialing of revegetation options allows a definite choice of the preferred plant species or community. Plant nurseries may help reduce social impacts during closure by providing extended employment to communities. Collecting or growing local seed would also be preferable to avoid spread of invasive species.

6.11.2 Soil quantities available for rehabilitation

Soil will be stripped and stored in the quantities shown in Table 6-3. The table also shows the amounts of soil required for rehabilitation.

It should be noted that the available soil volumes listed in Table 6-3 are based on the assumption that utilisable soil is stripped to a depth of 0.2 m. Under this assumption, the available stockpiled soil would approximately match the soil requirements for closure and rehabilitation.

Table 6-3 Stripped and stockpiled amounts of soil, and soil requirements for rehabilitation

	Footprint Area (m^2)	Footprint Area (ha)	Soil Stripping Area (ha)	Soil Stripping Volume (1,000 m3)	Soil Placement Area (ha)	Soil Placement Volume (1,000m3)
Camp	90000	9	9	18.0		
Plant & Admin Office Area	435000	43.5	43.5	87.0	43.5	87.0
Waste Rock Dump	1470000	147	147	294.0	147	294.0
Recycling and Waste Disposal	5000	0.5	0.5	1.0	0.5	1.0
TSF Pond	1250000	125	125	250.0	125	250.0
TSF Embankment/s	720000	72	72	144.0	72	144.0
Water Storage Dam	90000	9	9	18.0	9	18.0
Pit	500000	50	50	100.0		
ROM Pad & Stockpile	270000	27	27	54.0	27	54.0
Haul Roads	250000	25	25	50.0	12.5	25.0
Other Site Roads	50000	5	5	10.0	2.5	5.0
Perimeter Fence	50000	5	5	10.0	5	10.0
New Workshop (MSA)	100000	10	10	20.0	10	20.0
Water Line Corridor – Plant to TSF	35000	3.5	3.5	7.0	3.5	7.0
Gendarme Accommodation	5000	0.5	0.5	1.0		
HV Powerline Corridor	65000	6.5	6.5	13.0		
Magazine Area	20000	2	2	4.0	2	4.0
Existing topsoil stockpiles				100.0		
	TOTAL:	**540.5**		**1181.0**		**919.0**

6.12 Biodiversity Restoration Measures

Even though Perseus will design and operate the mining Project with as minimal impact on biodiversity as possible, restoration of habitats will play a crucial role during closure and rehabilitation. The following measures are planned for the closure and post-closure phase:

- Revegetation by using nurse crops and seeds/saplings from a local plant nursery – this would also contribute to continued local employment during the closure phase;
- Aquatic habitats – de-silting of streams where necessary, removal of redundant culverts;
- Ripping access tracks where possible and where tracks are not required by communities, and returning to forest with minimal human intrusion;
- Biodiversity monitoring could be ongoing up to 5 years after the site has closed. It will likely feature close monitoring of any threatened species which were present before the Project started;
- Bio-monitoring of offset areas to ensure success of established habitats for up to 5 years;
- Working with local communities, authorities and other organisations to ensure continued protection of offset areas; and
- Ecosystem Services – ensuring return of provisional services or at least offset of services are continued and maintained.

It is noted that Perseus's predecessor (Cluff Gold) committed to planting tree species with particular value as compensation areas, such as Acacia mangium and Teak to improve the economic value of community land, as outlined in the Closure Plan for Angovia (AMEC, 2011/2012). Prior to implementing this commitment, a biodiversity and soil study was recommended to optimise the planting program with respect to cost, location of the compensation areas, and community benefit. These studies have been developed as part of the ESIA for the Yaoure Project, and resulting from these studies, it seems that post-closure land-use (wildlife, sustainable agriculture) justifies alternative revegetation strategies for the reclaimed land.

6.13 Water Management and Treatment

In the early closure phase, some waste water streams may be characterised by high concentrations of pollutants (e.g., from cleaning equipment and removing the supernatant lake from the TSF). For these streams, the conventional water treatment installations from the operation phase will be used.

There may be a need to treat certain waste water streams such as seepage from the tailings dam over an extended period post-closure. A passive or semi-passive system will be preferable in order to minimise cost and dependency on human intervention.

However, the details of both flow rates and quality (and hence the need to treat before discharge into the environment) can only be determined with any certainty during the operation period and would be purely speculative at this stage. Likewise, the duration of time in which water treatment in some form will be required can only be estimated when a more detailed geochemical characterisation of wastes becomes available during operation. No reasonable time estimate can be made at this stage.

Sediment control (silt settling ponds) will continue into the post-closure period. Erosion protection is subject to the success of revegetation (see Section 6.12).

During temporary suspension and premature closure of the mine operations, any water treatment plants will be kept operational as they are needed to treat process and seepage water and possibly supernatant from the TSF before discharge into the environment.

7.0 CLOSURE AND COMMUNITY DEVELOPMENT INITIATIVES

7.1 Community Development Plan

Apart from closure and rehabilitation measures of the mining infrastructure, closure of the Yaoure Project will also affect the Community Development initiatives as described in the Community Development Plan (CDP).

The assets left behind by Perseus after closure, i.e., roads, buildings, and ponds may be taken over by the government and provided to the community for continued use.

For the transfer of assets an inventory must be drawn up towards the end of the mine life. As a minimum, the inventory will contain the following information:

- Type of asset;
- Location (co-ordinates);
- Approximate value (replacement cost);

- Approximate useful residual life; and
- Requirements for continued maintenance (technical, personnel, skills, financial).

The CDP will need to include a strategy for handing over these assets and programmes.

7.2 Pre-closure awareness raising and education program

Immediately before completion of the closure works, relinquishment of the site and return of the rehabilitated areas to the community, an awareness raising and education program will be implemented. It will raise awareness among the community with respect to

- Access and use restrictions of the rehabilitated sites;
- Residual risks (e.g., steep slopes) and safety issues (water quality); and
- “Dos” and “Don’ts” in the former mining area (distribution of easy-to-understand handouts to all families and multipliers).

Target groups include the following:

- Teachers;
- Parents;
- Children/pupils/students;
- Artisanal miners;
- Farmers;
- Other groups that intend to use the rehabilitated land.

The participants and results of the program should be recorded, signed off by all stakeholders and kept in an appropriate form as records for future reference.

8.0 AFTER-CARE AND LONG-TERM MEASURES

Post-closure inspections/monitoring and stewardship are likely to be required in the following areas:

1. Inspections and TSF safety assessments, including inspections for soil erosion on the rehabilitated areas;

2. Inspections and safety assessments of the waste rock dump;

3. Inspections of all rehabilitated areas to confirm the establishment of sustainable vegetation. Where needed, initiation of corrective measures (re-seeding or re-planting of failed vegetation);

4. Habitat monitoring;

5. Water monitoring in the water bodies affected by mining to ensure no unacceptable point-like or diffuse discharges of polluted water are taking place;

6. Subject to results of water monitoring: treatment of effluents until acceptable water quality has been reached; and

7. Inspections of drainage ditches and associated water management features (passive water treatment systems).

The Best Practice Reference Document (BREF) for the Management of Tailings and Waste Rock (MTWR 2009) provides the following guidance for inspections and stability assessments of the TSF and waste rock dumps:

Table 8-1 Proposed assessment regime of TSF and waste rock dumps (from EU Best Practice Reference MTWR 2009), closure and post-closure period

Assessment type	Frequency		Personnel
	Tailings	Waste rock dumps	
Visual inspection	Half-yearly	Half-yearly	Operator
Geotechnical review	Yearly	Every 2 years	Qualified engineer
Independent geotechnical audit	Every 5-10 years	Every 5-10 years	Independent expert
Stability assessment, SEED (Safety Evaluation of Existing Dams)	15 – 20 years	-	Team of independent experts

The given frequencies for the after-care phase are relevant for the initial period after closure. Based on the assessment results, the frequency may be decreased with time to an extent that inspections, audits/reviews are no longer necessary if restoration is properly completed.

Inspections will also include erosion of embankment and waste slopes, particularly after heavy rainfall. Ditches, culverts, water diversion channels and similar structures will be regularly inspected and cleaned/repaired where necessary.

Details of the post-closure monitoring and surveillance programme will be developed in updates of the Closure Plan as the end of the mine life draws closer.

It is important that sufficient funds and the institutional capacity (community, organisations) are available to carry out remedial measures (corrective action) in the post-closure phase, if inspections or monitoring programmes reveal that closure objectives have not been met and further work is required[7].

9.0 PROGRESS MONITORING

Risk-based progress monitoring throughout the entire life cycle of the Project is essential to ensure that the closure objectives are met. It is important to continuously identify, monitor and evaluate factors that could lead to undesirable closure outcomes (see for example ICMI Closure Toolkit, Tool 4 "Risks/Opportunities"). The following Table 9-1 shows six types of risk that closure outcomes and goals are not met. Table 9-1 also presents mitigation measures on a conceptual level and indicators that can be used to measure progression towards the closure goals.

Table 9-1 Risk areas, mitigation strategies, monitoring and achievement indicators for successful closure and rehabilitation

Risk area	Mitigation strategy	Monitoring and achievement indicators
Health and Safety	• Awareness program for the community during the entire mine life • Adhere to H&S Plans and set a good example for the community	• Number of incursions and accidents of local people into mining area • Feedback from stakeholder consultation
Environmental	• Concurrent rehabilitation • Avoid/minimise spills and accidents that require clean up, carry out clean up immediately and effectively • Adhere to Management Plans and international good practice throughout the entire mine life	• Per cent of areas that are no longer required for operations rehabilitated • Concurrence of model results (e.g., water quality) with actual monitoring data. If there is strong disagreement, closure plan may need to be adapted • Biodiversity/habitat monitoring to track improvement or damage of ecosystems
Social and economic	• Keep qualification levels up and make sure they meet post-closure requirements • Support local businesses that are sustainable post-closure	• Repeat socio-economic surveys (employment and economic figures) • Number of people meeting high qualification requirements

[7] See, for example, C. Kunze: Insurability of unknown post closure liabilities. J. Canadian Institute of Mining, Vol. 4, No. 4, 2013

		• Make closure part of stakeholder consultation process
Reputational	• Concurrent rehabilitation helps to demonstrate commitment to closure goals • During mergers, acquisitions and changes in management closure commitments must be taken seriously • Working closely with the government to ensure that government is aware of its responsibilities • Regular community meetings and working groups	• Opinion polls as part of repeated socio-economic surveys • Media clippings, identify upcoming discontent • Make closure part of stakeholder consultation process • Personal contacts with opinion leaders
Legal	• Agree closure plan regularly (after every update) with government authorities • Work closely with government to anticipate changes in legislation (e.g., new closure standards, environmental standards)	• Compare commitments with new requirements (if applicable) • Make closure part of stakeholder consultation process (government stakeholders)
Financial	• Have sufficient funds available for closure and rehabilitation at all times to cover premature closure • Concurrent rehabilitation to keep environmental liabilities to a minimum at all times • Be aware of discounting of closure costs (if this is the case) to avoid underestimating actual closure liabilities • Have sufficient funds in place for corrective measures should they be required in the post-closure phase	• Compare provisions for closure and rehabilitation with actual cost estimates

In a further update of this Plan, when more details about the operation are available, a likelihood and consequence/severity ranking should be carried out.

10.0 COST ESTIMATE

In order to carry the closure and rehabilitation works as described in this Closure Plan, sufficient financial resources are necessary. For financial planning, it is therefore necessary to estimate the closure costs.

As was stated in Section 2.1.1 above, Article 154 of the Decree No. 2014-397 of 25 June 2014 requires that a financial guarantee (closure fund) must be in place that can be accessed by the Government in case the operator fails to meet its obligations.

For a financial guarantee, the following principles are considered international best practice. These principles are largely identical with the provisions of the mining legislation of Côte d'Ivoire. However, it is worth noting that Art. 144 of the Mining Code specifically requires the financial guarantee to cover closure and rehabilitation costs at the end of the mine life, but not costs for premature closure.

Table 10-1 Best practice principles for the calculation and management of the closure fund

Criteria	Comments
Funds must be readily available at any given time	Cash fund at a reputable bank (Art. 144 of Mining Code, Art. 153 of Decree 2014-397)
Fund must be quarantined from company's assets so that it cannot be seized in case of bankruptcy	See above
Closure cost estimate to be developed from closure plan Clear description of liabilities covered by the financial guarantee	According to Art. 145 of the Mining Code, Closure Fund is based on the ESIA and the Closure Plan.
Adjustment of mine closure fund as project progresses, process of adjustment should be well understood and agreed in advance	According to Art. 145 of the Mining Code, an update of the Mine Closure and Rehabilitation Plan is required if changes of mine operations change.
Clear description of closure objectives and success criteria	
Closure cost estimate to be based on 3rd party cost basis (market prices rather than internal costs of the operator)	Implicitly required by the requirement of a cash fund accessible to the government in case of operator's inability to meet obligations
Provision of supporting information in standardized format (e.g., Excel spreadsheets) rather than proprietary database formats	
Return on sale of assets should not be used to offset cost of closure	
Fund should be consistent with the degree of disturbance at any given time	According to Art. 151 of Decree No. 2014-397, Closure Plan must be based on environmental risks at and post closure
Roles and responsibilities in the administration of the fund need to be clearly established	Art. 152 of Decree No. 2014-397 defines management structure of Closure Fund

On-going management and monitoring requirements after closure should be assessed and adequately provided for Sufficient financial assurance to fund the costs of ongoing site care Develop support mechanisms for the maintenance and monitoring phase, when operational support (e.g., accounting) is no longer available	Art. 147 of Mining Code requires Closure Plan (and hence closure fund) to include post-closure management Art. 152 of Decree No. 2014-397 defines management structure of Closure Fund
Monitoring to demonstrate that completion criteria have been met Allow sufficient time for monitoring and possibly corrective action (not less than 5 years) following cessation of mining	Art. 145 of the Mining Code specifically requires post-rehabilitation monitoring of the site. Article 148 of the Mining Code defines civil liability of a licence holder for damages and accidents which might be caused by the facilities over a period of five years after closure.
Record retention (as-built documentation, land-use restrictions)	
Cost estimates and certification by independent third party	
Outline description of the process, and parties involved in defining the scope of work and estimates of closure/decommissioning costs	Art. 147 of the Mining Code requires a description of the planned closure works.
Before any money is returned the regulatory authority should establish that the programme has been successful and no further work is required on the site. Public involvement: public should be given an opportunity to comment on works before a decision to release a bond	Art. 152 of Decree No. 2014-397 defines management structure of Closure Fund. In particular, the Closure Fund management committee decides how and when the money is released from the fund.
If the site requires long term monitoring, maintenance and/or remedial action, a separate fund should be set up to finance this for whatever period is required.	Post-closure liability of operator is limited to 5 years

It must also be noted that under the previous mining legislation (Art. 16 of Ordinance 96-600, 1996), Cluff Gold had paid a contribution to a fund accessible to the Government. According to information received from Cluff Gold in 2011 when the 2011/2012 Closure Plan was prepared by AMEC, no drawdown from the fund for remediation works had taken place since the start of the mining operation.

Based on the closure works described in the previous sections of this Plan, the closure and rehabilitation costs have been estimated. Appendix provides details of the closure cost estimate, which is summarised in Table 10-2.

It is important to note that costs for long-term water management and treatment have not been included, as they are currently very uncertain, and any financial provisions would therefore be speculative. They will be included when more details are known (assumed

to be during the operations phase) and they will be updated during the operation phase when monitoring data are available to confirm any assumptions.

Table 10-2 Summary of closure cost estimate

Works (see Appendix for details)	Cost, undiscounted (USD)	
Scarify/rip surface		198,750
Reshaping of slopes		200,100
Strom water channels and safety windrows		30,470
Topsoil placement & spreading		664,300
Erosion control & groundcover vegetation		786,750
Establish final vegetation		1,311,250
Monitoring & control		700,000
Removal of infrastructure		200,000
Total		**4,091,620**

11.0 CLOSURE AND REHABILITATION PLANNING ACTION PLAN

Table 11-1 contains a summary of the most relevant actions and responsibilities that are required in order to fulfill the commitments of this Closure Plan.

Table 11-1 Closure and Rehabilitation Action Plan

Action	Responsibility	Timing
Integrate closure related issues in stakeholder consultation process and update closure goals where necessary Integrate closure strategy in Community Development Plan	Perseus	Immediately (during early stages of operations), then follow up continuously
Include closure cost estimates in financial planning and make sufficient provisions in balance sheet	Perseus	When Project budget is finalised
Finalise waste characterisation test results and refine waste management strategy	DFS engineer	Completed during DFS phase
Build cover test plots	Perseus	As soon as feasible during operation phase
Start trials of passive water treatment systems	Perseus	As soon as feasible during operation phase

12.0 REVIEW AND UPDATES OF THE CLOSURE PLAN

The Closure Plan and the cost estimates shall be regularly updated, taking into account the following aspects, as applicable:

- Operational experience and results of trialling;
- Ongoing stakeholder consultation;
- New or higher liabilities due to progressed mining activities;
- Reduced liabilities due to progressive rehabilitation;
- New regulatory requirements and changed legislative framework;
- Changed scope of remediation works requested by the authorities;
- New or changed remediation technologies;
- New or changed after-use plans of the rehabilitated site by the local community which need to be adopted by Perseus in the closure planning; and
- Inflationary effects, wage rises and other changes of the cost basis.

There is no authoritative guidance on the frequency of the updates, however in line with international best practice[8] and taking into account the relatively short life time of the Project of around six years, two years would be advisable, and more often if major changes have occurred.

Updates of the Closure Plan should be synchronised with updates of other management plans with which the Closure Plan is linked (see Section 1.2).

Responsibility for the update lies with the SHEC Manager.

The next update of the Closure Plan should occur as soon as practical after construction, to reflect the site layout, footprints of plant areas, roads etc.

APPENDICES

Appendix 33a **Cost estimate worksheet**

[8] For example, the European Mine Waste Directive 2006/21/EC specifies a review period for waste management of no longer than five years, and in case of a substantial change to the operation of the waste facility.

	Footprint Area (m^2)	Footprint Area (ha)	Soil Stripping Area (ha)	Soil Stripping Volume (1,000 m3)	Soil Placement Area (ha)
Camp	90000	9	9	18.0	
Plant & Admin Office Area	435000	43.5	43.5	87.0	43.5
Waste Rock Dump	1470000	147	147	294.0	147
Recycling and Waste Disposal	5000	0.5	0.5	1.0	0.5
TSF Pond	1250000	125	125	250.0	125
TSF Embankment/s	720000	72	72	144.0	72
Water Storage Dam	90000	9	9	18.0	9
Pit	500000	50	50	100.0	
ROM Pad & Stockpile	270000	27	27	54.0	27
Haul Roads	250000	25	25	50.0	12.5
Other Site Roads	50000	5	5	10.0	2.5
Perimeter Fence	50000	5	5	10.0	5
New Workshop (MSA)	100000	10	10	20.0	10
Water Line Corridor – Plant to TSF	35000	3.5	3.5	7.0	3.5
Gendarme Accommodation	5000	0.5	0.5	1.0	
HV Powerline Corridor	65000	6.5	6.5	13.0	
Magazine Area	20000	2	2	4.0	2
Existing topsoil stockpiles				100.0	
TOTAL:		**540.5**		**1181.0**	
Monitoring & Control					
Removal of Infrastructure					

TOTAL

Average Stripping Depth (m)	0.2

Soil Placement Volume (1,000m3)	Scarify/Rip Surface ($2,500/ha)	Reshaping of Slopes ($1,150/ha)	Storm Water Channels & Safety Windrows ($110/ha)	Topsoil Placement & Spreading ($1,400/ha)	Erosion Control & Groundcover Vegetation ($1500/ha)
87.0	$108,750		$4,785	$60,900	$65,250
294.0		$169,050	$16,170	$205,800	$220,500
1.0	$1,250		$55	$700	$750
250.0				$175,000	$187,500
144.0				$100,800	$108,000
18.0			$990	$12,600	$13,500
			$5,500		$75,000
54.0		$31,050	$2,970	$37,800	$40,500
25.0	$31,250			$35,000	$37,500
5.0	$6,250			$7,000	$7,500
10.0	$12,500			$7,000	$7,500
20.0	$25,000			$14,000	$15,000
7.0	$8,750			$4,900	$5,250
4.0	$5,000			$2,800	$3,000
919.0	**$198,750**	**$200,100**	**$30,470**	**$664,300**	**$786,750**

Cover thickness (m)	0.2

Establish Final Vegetation ($2500/ha)	TOTAL COST OF REHAB	Comment
	$0	Government would keep Camp
$108,750	**$348,435**	
$367,500	**$979,020**	
$1,250	**$4,005**	
$312,500	**$675,000**	Final vegetation to be confirmed with TSF closure specialist
$180,000	**$388,800**	
$22,500	**$49,590**	End use to be confirmed with stakeholders
$125,000	**$205,500**	Cannot revegetate the pit
$67,500	**$179,820**	
$62,500	**$166,250**	Some roads will be left in place - allowed 50%
$12,500	**$33,250**	Some roads will be left in place - allowed 50%
$12,500	**$39,500**	
$25,000	**$79,000**	
$8,750	**$27,650**	
	$0	Government would keep Gendarmes Accommodation
	$0	HV Powerline would remain in place
$5,000	**$15,800**	
		No placement required as would leave some topsoil in place
$1,311,250		
	$700,000	Includes monitoring, maintenance of sediment control structures, vegetation manage
	$200,000	
	4,091,620	