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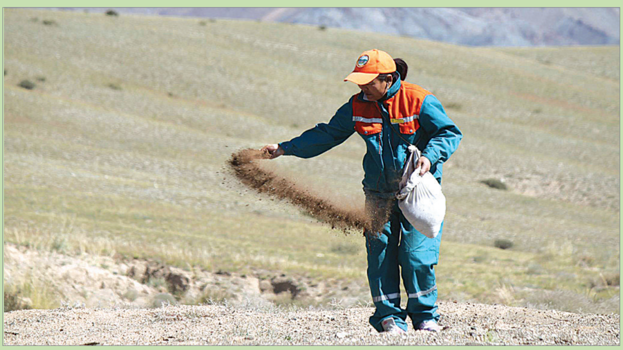
FRUGAL REHABILITATION METHODOLOGY (FRM)

FIELD HANDBOOK



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LIST OF ABBREVIATIONS

ASM	Artisanal and Small Scale Mining
ASMrs	Artisanal Miners
ESEC	Engaging Stakeholders in Environmental Conservation Phase I and II
FR	Frugal Rehabilitation
FRD	Frugal Rehabilitation Demonstration
FRM	Frugal Rehabilitation Methodology
FRT	Frugal Rehabilitation Team (of national experts)
GASI	Generalized Agency for Specialized Inspection
LMC	Local Multi-stakeholder Councils
LSM	Large-Scale Mining
MoEGDT	Ministry of Environment, Green Development and Tourism
MoM	Ministry of Mining
MRAM	Minerals Resources Agency of Mongolia
NGO	Non-governmental organization
PAC	Project Advisory Committee
RAP	Rehabilitation Action Plan
SAM	Sustainable Artisanal Mining Project
SDC	Swiss Agency for Development and Cooperation
TAF	The Asia Foundation
WMCA	Whole Mine Cycle Approach

CONTENT

ACKNOWLEDGEMENTS

The Frugal Rehabilitation Methodology (FRM) was based on an action research approach of practical demonstration, and was developed by the Engaging Stakeholders for Environmental Conservation (ESEC) II Project through collaboration with many national and local partners in Mongolia. The Asia Foundation is grateful to the Swiss Agency for Development and Cooperation (SDC) for its generous support of the project.

The Asia Foundation (TAF) would like to thank the following ESEC II staff who worked as a team to ensure that Frugal Rehabilitation Demonstration (FRD) projects be developed, planned and implemented through the efforts of participating ASM NGOs. The ESEC II Team members involved in the development of the methodology were Bolormaa Purevjav, Erdenechimeg Regjiibuu, Khandarmaa Ayush, Undraa Nergui, Anujin Baatarkhuu, Tselmeg Erdenetogtokh, Bakhytgul Titov, Tsomorlig Tserenbat and Orgil Batsukh. A Frugal Rehabilitation Technical Team played a crucially important role in the field and in the development of the FRM and comprised Erdene Dorjsuren, Sodnom Damba, Oyumaa Jamsran, Tungalag Sukhbaatar, Danzan-Osor Avaadorj, Mendbaatar Osorjin, and Batsukh Sharav.

The FRM was directly informed through the ten FRD Case Studies undertaken in 2014, with additional reference to seven FRD project implemented in 2015. The ESEC II project is very grateful to the cooperation and efforts of the 18 ASM NGOs who played a crucial role in demonstrating rehabilitation techniques that informed this methodology.

Consultation on early drafts of the FRM resulted in improvements to the final methodology presented here. Such improvements were made possible with the participation, commitment, and expertise of institutional representatives from the Ministry of Mining (MoM), the Mineral Resources Authority of Mongolia (MRAM), the General Agency for Specialized Inspection (GASI), and the Ministry of the Environment, Green Development and Tourism (MoEGDT). A first draft was formally submitted to the ESEC II Project Advisory Committee in November 2014 and national government representatives made useful contributions, as did the Mongolian National Mining Association, Wildlife Conservation Society, the ASM Federation and the Sustainable Artisanal Mining Project (SAM). A consultative workshop in Ulaanbaatar in November 2014 enabled wider stakeholders to provide feedback and comments to the FRM. The ESEC II Project Advisory Committee provided further comment in February 2015 and in early April 2015 the FRM was submitted to a Working Group established by the Ministry of Mining, to facilitate the revision of Regulation 308 for Small-scale Mining, with the FRM attached as annex. The Asia Foundation thanks all those who participated in this process.

TAF is grateful to the many local government officials who participated in the FRM development process through the FRD program. We also thank Hishgee Dondov for her valuable assistance in helping to prepare this final publication. The Responsible Mining Initiative (RMI) played an important role in developing and delivering training on the FRM in the field.

We trust the FRM can be made to work for the benefit of all Mongolian stakeholders, whose commitment and efforts are fully appreciated.

Jonathan Stacey

Project Manager, Engaging Stakeholders in Environmental Conservation (ESEC) II
The Asia Foundation

FOREWORD

The Engaging Stakeholders in Environmental Conservation Project (ESEC II) was established in 2013 to help develop and build capacity for formalized and environmentally responsible ASM. To facilitate this, an environmental toolkit needed to be developed based on economic affordability, social responsibility and ecological viability. It needed to be of value to government, ASMrs and to wider stakeholders from the communities whose lives were affected by ASM.

This Frugal Rehabilitation Methodology (FRM) is the product of action research-based approaches in rehabilitation demonstration, stakeholder consultation and over two years of effort in training and capacity-building. It provides practical guidance which has been demonstrated to be successful across seventeen frugal rehabilitation demonstration projects across the country. It is now available for widespread use both for ensuring that the formalized ASM sector can operate to a high standard of environmental responsibility, and to address the rehabilitation of ASM degraded lands in Mongolia.

The Ministry of Mining encourages ASM communities to use this Frugal Rehabilitation Methodology as it is intended, both as a guide to rehabilitate lands degraded by previous miners and to help effectively rehabilitate their own ongoing and future artisanal operations.

In addition to the methodology itself, this Field Handbook also provides an FR Performance Monitoring Checklist that can be useful for both artisanal miners and local environmental inspectors in assessing and monitoring progress with a local FRM-based rehabilitation project. It also provides a template for effective Rehabilitation Action Plan (RAP) development, which ASMrs can use to document their past successful rehabilitation efforts, as well as plan for rehabilitation within their current and future activities. It provides a useful format for ASMrs to use in communicating their environmental performance and plans.

I trust artisanal and small-scale miners and government officials engaged in assessing formalized ASM-led rehabilitation efforts find this Field Handbook useful. The Ministry of Mining hereby fully endorses the Frugal Rehabilitation Methodology presented in this handbook for use nationally and locally across Mongolia.

B.Batkhuu

Director of Policy Implementation and Coordination Department
Ministry of Mining

BACKGROUND AND INTRODUCTION

Why is it important to have a Frugal Rehabilitation Methodology?

Artisanal and Small-scale Mining (ASM) is a form of economic activity that has been important to many in Mongolia since the 1990s. Since the country transitioned to a market economy, it has faced numerous significant economic and social shocks, during a transition following the withdrawal of socialist support and a series of *dzuds.* The former led to massive loss of formal jobs and the latter to the deaths of millions of livestock which supported many in the rural and national economy. Over 13000[1] rural unemployed found employment opportunities in artisanal and small-scale mining (ASM). Unofficial estimates suggest that more than 38,000 people may be involved in this largely informal activity.

Mongolia is still endowed with rich mineral resources which now account for 17.1 per cent of GDP,[2] 2014. The economy grew by 17.3 per cent in 2011 but expectations of continued high economic growth have not been met, with a significant downturn in the national economy that is aligned with a fall in global commodity prices and economic downturns being experienced regionally and globally. As a result, poverty levels remain high, and were reported as 21.6 per cent[3] in 2014. The largely informal and illegal ASM sector remains substantial and has the potential to grow during periods of economic constraint. Much of artisanal mining in Mongolia however is associated with gold production, and despite current low commodity prices of other strategic minerals such as copper and coal, gold is still an attractive option for mining, both at artisanal and small-scale levels. Therefore economic interest in ASM is ongoing and potentially growing.

To recognise and support the contribution of ASM to sustainable livelihoods in more recent times an amendment was made to the Mongolian Minerals' Law in 2010, allowing for the formalization of ASM miners. It has been long recognised that the primary concern regarding the informal ASM sector related to the fact that environmental degradation by past and current ASM activity was a key obstacle limiting the contribution of ASM to sustainable local development and to its formalization. It was recognised that a lack of approved and appropriate green technologies limited the capacity of the sector to formalize, and furthermore, the lack of formal local platforms for stakeholder engagement on ASM issues prevented the development and demonstration of any green technologies from being recognized and promoted. In particular the capacity for ASM to develop and demonstrate environmental rehabilitation best practices needed to be developed and profiled, within the context of local government environmental planning. National government stakeholders, particularly the Ministry of Mining, recognised that more needed to be done to develop and promote environmental responsibility as a component of successful and ongoing ASM formalization. As indicated, the Minerals' Law was amended in 2010 to recognize ASM as a legal form of economic activity in lands officially designated for such use. An amendment is being initiated for ASM regulation with an opportunity to attach a frugal rehabilitation technology that would be appropriate to the ASM sector.

[1] Small scale miners' survey 2012, National Statistical Office
[2] MRAM, Division of monitoring and evaluation, 2015
[3] National Statistical Office, WB, 2014

The Engaging Stakeholders in Environmental Conservation project – Phase 2 (hereafter referred to as ESEC II), was established in August 2013 as a partnership project between the Ministry of Mining, Swiss Agency for Development and Cooperation's (SDC) Sustainable Artisanal Mining (SAM) Project and The Asia Foundation to specifically enhance the contribution which Mongolia's artisanal and small-scale mining (ASM) sector makes to sustainable development, through the development of environmental capacity and responsibility. The ESEC II project had an explicit goal of working with national and local government and with the formalized ASM sector to address poor performance in environmental rehabilitation, and to develop a methodology and a code of practice that could be adopted by the ASM sector which would in effect, support their formal license to operate. The ESEC II project was established as a complementary project to the Sustainable Artisanal Mining (SAM) Project, focusing on the development of a rehabilitation methodology and an environmental planning framework that would enable the formal ASM sector to better demonstrate its environmental responsibilities to local stakeholders impacted by ASM.

One of ESEC II's project goals was to assist by developing a Frugal Rehabilitation Methodology (FRM) which would receive national endorsement from relevant national ministries, namely the Ministry of Mining (MoM), its associated Minerals Resources Agency (MRAM), the Ministry of Environment, Green Development and Tourism (MoEGDT) and the Generalized Inspection Agency (GASI).

This Field Handbook is the result of over two years intensive development, demonstration and consultation on the Frugal Rehabilitation Methodology. The FRM is now submitted as an attachment to the revised Regulation 308 on Artisanal and Small-scale Mining.

So, what exactly is Frugal Rehabilitation? And how can it benefit the ASM sector and the community of environmental stakeholders impacted by ASM activity? Frugal rehabilitation is an approach to rehabilitate and restore lands degraded by artisanal and small scale mining that is defined as being ***economically affordable, socially acceptable and ecologically viable.*** Its techniques, as demonstrated in seventeen different Frugal Rehabilitation Demonstration projects undertaken during 2014 and 2015, ensure acceptable and sustainable rehabilitation results at reasonable cost that are accessible and affordable to ASM (and other communities) undertaking them. Being affordable, they can be supported by a variety of funding sources such as local government funds identified for rehabilitation of degraded lands, or by other parties such as large-scale mining companies. However, by approaching artisanal mining planning and operations through the Whole Mine Cycle Approach, which is outlined within the methodology, ASM practitioners can incorporate and reduce the costs and efforts of rehabilitation throughout their ongoing mining efforts. The demonstration projects described above have clearly indicated that such efforts can be successfully and affordably implemented by ASM NGOs.

Given the success of FRM implementation across many demonstration case studies, implementation of the FRM should ensure that the concerns of local community land-users and stakeholders are also addressed. Importantly, the results also demonstrate that the FRM, if implemented systematically and with due attention paid to topsoils and the surrounding vegetation types in biological rehabilitation, will return the site to eventual ecological recovery within a reasonable timescale. The seventeen Frugal Rehabilitation Demonstration (FRD) case studies which both informed the development of the methodology (FRM) and demonstrated its practicability are profiled in a companion publication - the FRD Case Studies Handbook - which documents frugal rehabilitation implementation and success across a variety of sites in nine aimags (and fourteen soums) across a wide range of environmental situations that have experienced ASM activity and degradation in Mongolia.

As is evident in the accompanying methodology (FRM), frugal rehabilitation, as with other forms of mining rehabilitation, are comprised of both technical rehabilitation and biological rehabilitation. However, the FRM is designed to be implemented by organized or formalized ASM NGOs and/or partnerships that are representative of the responsible ASM communities. They can be implemented either as a response of ASM communities to environmental degradation resulting from their activities, or to assist other stakeholders in rehabilitating abandoned ASM degraded lands in the area that are the responsibility of others. The FRM is an approach that takes account of varied circumstances and environmental conditions. It is adaptable, and when assessing an area for its implementation, it is important that practitioners and environmental inspectors recognize both limitations, constraints and opportunities that present themselves in each and every situation.

In this way, the FRM provides a guided approach to making the most of the resources and opportunities available at any given site, taking into account previous mining operations, topsoils availability and local vegetation ecology. The range of Frugal Rehabilitation Demonstrations undertaken in 2014 and 2015 indicate the value and effectiveness of manual approaches, as well as highlighting opportunities and constraints associated with mechanized approaches. Frugal rehabilitation has been shown to be more effective where the necessary use of machines is limited to essential heavy lifting of infill materials. Trends where increasing dependence on mechanized approaches are employed will see divergence from the FRM and its demonstrated affordability and success. Recognition that mechanized assistance (where appropriate) needs to be balanced with commitments to manual approaches for both technical and biological rehabilitation and soil management will ensure both effective rehabilitation results and benefits for ASM communities engaged in rehabilitation.

This Field Handbook is designed to be used by ASMrs and environmental staff from government to inform and guide rehabilitation efforts. It includes a FR monitoring checklist that can be used to assess performance and record progress with frugal rehabilitation. Also provided is a Rehabilitation Action Plan template for use by ASMrs in documenting past, current and/or future rehabilitation efforts in consultation with local communities.

ASM FRUGAL REHABILITATION METHODOLOGY

1. INTRODUCTION

1.1 **Frugal Rehabilitation - what is it exactly?** Frugal rehabilitation is a proposed form of rehabilitation of degraded mining land that is defined as being ***economically affordable, socially acceptable and ecologically viable*** (see Annex 1). It proposes techniques that seek to address acceptable and sustainable rehabilitation results at reasonable cost that are accessible and affordable to ASM and other communities undertaking them, supported by other funding sources such as local government funds identified for rehabilitation of degraded lands. The results need to address the concerns of local community land-users and stakeholders. The results also need to place the site on the path to eventual ecological recovery within a reasonable timescale (such terms are more fully defined in Annex 1). Frugal rehabilitation, as with other forms of mining rehabilitation, are comprised of both technical rehabilitation and biological rehabilitation.

1.2 The technical and biological rehabilitation prescriptions proposed in this methodology are specifically designed for application at sites indicating degraded and abandoned artisanal and small-scale mining as well as active ASM areas soon to be rehabilitated. While some prescriptions could have potential for application at sites involving other mineral or energy resource extraction, they are specifically designed for artisanal mining of alluvial and hard-rock gold, and of fluorspar. This guideline shall not be used for the rehabilitation of mining of ore deposits with radioactive elements, oil and natural gas extraction and water abstraction.

1.3 The Frugal Rehabilitation Methodology (FRM) is designed to be implemented by organized or formalized ASM NGOs and/or partnerships that are representative of the responsible ASM communities. They are designed to be implemented either as a response of ASM communities to environmental degradation resulting from their activities, or to assist other stakeholders in rehabilitating abandoned ASM degraded lands[1] in the area that are the responsibility of others. The conducting of rehabilitation activity by the small scale miners is based on their financial capacity and by considering the future use of the site, consistent with local ecology at the small scale mine site.

1.4 Frugal Rehabilitation is series of comprehensive activities designed to improve value and productivity of degraded lands, re-create acceptable living conditions for local residents, and establish such lands on the route to ecological recovery. The ASM rehabilitation is divided into technical and biological operations.

[1] "Abandoned" also refers to lands no longer being mined, and ready for rehabilitation

2. TECHNICAL REHABILITATION

2.1 Preparation for technical rehabilitation

2.1.1 Technical rehabilitation is a stage that refills, infills excavation works, and re-grades and re-profiles the rehabilitation surfaces so that available top soils can be replaced over the area in preparation for biological rehabilitation. In order to be effective, some preparation work should be done well before the technical rehabilitation itself. Such preparation should:

2.1.2 Define the degree of land degradation, from high/severe through medium to minor, based on assessment of topsoil loss and other factors.

2.1.3 Assess and agree existing and future land-uses of area: pastureland, agricultural land, conservation area, riparian corridor (river corridors).

2.1.4 Take a note of the site-specific conditions of the environmental context: habitats such as flood plains, valleys, plains, forest-steppe, desert and mountain-steppe, desert-steppe and gobi.

2.1.5 Undertake hydrological assessment: how does water flow through the area? Assessments of sheet flow across planned rehabilitated surfaces and linear flows along valleys, gullies, main watercourses. Design for stable water flows across rehabilitated areas.

2.1.6 Before the rehabilitation work, take soil samples from the degraded area to be rehabilitated and from surrounding undisturbed areas for analysis. Soil analysis should assess organic matter and gravel content, texture, pH, and compaction. However in most situations comprehensive testing for pollutants will not be practical or necessary but *if determined* necessary by relevant environmental inspectors, environmental pollutants need to be tested for.

2.2 Define boundaries of the area to be rehabilitated

2.2.1 Determine the area of degraded land to be rehabilitated by identifying the coordinates of the area by GPS and create a large-scale map;

2.2.2 Mark the area by putting stones-piles, small flags and signboards on the GPS coordination points;

2.2.3 Put a sign board at access points/roads around the site and in elevated areas indicating that the area is a rehabilitation site, prohibiting other non-rehabilitation activities.

2.2.4 It is not necessary to demarcate boundaries with trenches or other environmentally-damaging means.

2.3 Planning

2.3.1 Develop a rehabilitation work plan based on estimation of work load required in terms of labor and the timeframe for work to be completed. Submit the rehabilitation work plan to aimag/soum environmental inspector for review and attach the approved rehabilitation work plan by the relevant local authority.

2.3.2 Estimate required labor, equipment to conduct the rehabilitation work, establish a rehabilitation team and to ensure that all costs are identified beforehand: such as transportation, fuel, food, water and salaries of workers.

2.3.3 Prepare required tools and equipment, both manual (shovels, picks, etc) and mechanical (small-scale mining machinery, excavators, trucks, etc.) required for rehabilitation.

2.3.4 Identify financial sources (ASM joint fund, LDF, project funds, etc.) required to undertake the rehabilitation works.

2.4 Waste management

2.4.1 Collect and remove garbage from the degraded area and stockpile it for appropriate specific local burial at agreed sites (if non-toxic) and removal from area (if hazardous/toxic).

2.4.2 Hazardous or toxic waste[2] such as all types of batteries, fuel-spilled soil, plastic containers and packaging shall be disposed of at a disposal site defined by the environmental inspector; the identification of hazardous wastes should be determined using the MoEGD decree A-209 (2013) and environmental inspectors should be engaged to ensure correct identification of such types of waste.

2.4.3 Waste that is evident within stockpiles being removed and used for infilling, needs to be separated and treated as in 2.4.1 and 2.4.2 above.

2.4.4 Remove waste mining equipment left behind within degraded areas.

2.5 Estimation of the infill materials

2.5.1 Record and count all pits, shafts, stockpiles and trenches (excavated from all sides) at the site.

2.5.2 Quantified specification of the area to be rehabilitated shall be determined (total amount of the damaged area, minimum, maximum and average pit depth, stockpile diameters and average height, etc).

2.5.3 The total amount of materials to be used for rehabilitation shall be calculated based on the estimation of the total volume of the stockpile and excavated shafts according to equations prescribed in Annex 2.

2.5.4 Determine the infilling material adequacy by comparing the volumes of the stockpiles and pits calculated by the above formulas.

2.5.5 Map the pits, shafts, stockpiles, trenches and roads at the area to be rehabilitated. Assess steepness of slopes to be rehabilitated: ensure safe profiling that may require more area to be disturbed along the boundaries, such as along trench sides.

[2] Hazard rating of the waste shall be determined in accordance to the “Index list of waste by sources” A-209 decree approved by the Minister of Environment and Green Development, 2013

2.6 Conducting technical rehabilitation

2.6.1 Identify pits and tunnels that are liable to collapse or result in significant ongoing subsidence. If risks of subsidence and collapse are too high, then this guideline may not be appropriate.

2.6.2 Refilling of pits and shafts: undertake safe demolition of unstable tunnels where possible, followed by infilling using larger, heavier materials such as rocks (where available) to fill deeper sections of shafts and tunnels.

2.6.3 Use gravels and sands to fill the upper reaches of pits and tunnels, followed by lighter materials nearer the surface.

2.6.4 Re-grade uneven surfaces to create slopes similar to surrounding natural areas.

2.6.5 Where gullies can become erosion hazards for the site, infill using excavated materials, using rocks where possible to provide stability and resist water erosion. Re-profile such areas to acceptable slope angles.

2.6.6 Informed by hydrological assessment during preparation, create and implement plans to prevent erosion along watercourses where present. If watercourses are present, strengthen outside bends with large heavy rocks and attempt to design meandering course to reduce erosive energy.

2.6.7 In hard-rock situations (gold and fluorspar), pits and shafts may not be able to be filled completely due to lack of stockpiled materials. It is important here to make such pits safer for livestock and wildlife by creating access and exit ramps to allow animals to be able to escape such pits. However, if it is imperative to completely fill in such shafts or pits (for stock and human safety) then appropriate capacity machinery may need to be used to infill such pits using material from agreed sources away from the site.

2.6.8 Use small-capability mining equipment[3] to re-grade stockpiles, overburdens, and castellated deposits using such materials to fill shafts as advised above.

2.6.9 If possible, use manual approaches (hand tools) to re-grade and re-profile in-filled areas or if necessary, use small-capability mining equipment and machinery. Recommended specification of machinery for frugal rehabilitation use is outlined in Annex 3

2.6.10 Slope angles of re-profiled trench sides and depressions should not exceed 35 degrees

2.6.11 De-compaction of areas compacted by mining equipment use and stockpiling should be undertaken where necessary.

2.6.12 Cover the final technical rehabilitation surfaces first with subsoils followed by conserved topsoils in order to provide receptive surfaces for biological recovery (revegetation).

[3] refer to an Annex 3 discussing machine specification

3. IDENTIFICATION AND PREPARATION OF TOPSOIL

3.1 Topsoil identification at rehabilitation sites, followed by correct removal, storage and conservation are critical factors in effective frugal rehabilitation

3.1.1 Identify sources of topsoil in the abandoned site. Topsoil may found in the following areas at an abandoned ASM site identified for rehabilitation.

- Separate topsoil piles stored throughout the site;
- Topsoil at the base of stockpiles and excavation piles;
- Topsoil can be found at the edge of trenches which need to be reprofiled to agreeable slope angles, and appear as darker surface bands of organic rich soils. If the availability of topsoil in the area is poor, topsoil can be collected from other areas with the appropriate permit, subject to limits on further environmental damage being caused by winning topsoils from such other areas;
- Other environmentally-friendly and opportunistic sources, such as molehills.

3.1.2 It is useful to calculate the indicative amount of the topsoil required based on the area disturbed and topsoil depth, where the indicative topsoil layer should be not less than 10 cm thick. The formula to be used for calculating the total amount of topsoil is detailed in Annex 2.

3.1.3 Cover all technically rehabilitated areas by topsoil if there is sufficient topsoil and if not, identify target priority areas to be so treated.

3.2 Topsoil capping and covering

3.2.1 Use as much as possible manual efforts (hand tools) for topsoil capping, covering and preparing the final surface for the biological rehabilitation. Manual efforts reduce hazards of soil compaction often caused by machines, especially when conditions are wet or damp.

3.2.2 Collect topsoils manually (by hand tools) from the process of re-profiling trenches, castellations, edges of pits and shafts and include in the final store for topsoil distribution across rehabilitated surfaces. Where possible, cover the technically rehabilitated areas with not less than 10 cm of topsoils subject to the availability and amount of the topsoil that can be won on site or from appropriate sources elsewhere.

3.2.3 De-compaction of the rehabilitation area should be done by the hand tools such as harrow, forks, pickaxes, rather than shovels.

4. BIOLOGICAL REHABILITATION

4.1 Biological rehabilitation is the final phase of the frugal rehabilitation approach. It is conditional on the **optimal treatment of topsoil** (identification, winning, storage and distribution) throughout the technical process, which leaves the site in the best possible condition to receive specific biological prescriptions designed specifically for the site, aligned with future agreed land-use/land management objectives and local ecological context. It also leaves the site in the best possible condition to receive natural regeneration from surrounding vegetation communities so as to complete the overall rehabilitation process, and allow natural succession to occur to an ecologically viable outcome.

4.2 Increasing soil organic matter content

4.2.1 Topsoils are invariably lost to the site during the mining process, or their quality is compromised by being mixed or stored with other materials. Therefore efforts should be made to improve organic matter content of all soils and improve their moisture retaining qualities and fertility.

4.2.2 This can be done in a number of ways that can be built into the biological rehabilitation prescriptions: Livestock manure and dung can be collected from the surrounding areas. This can be stored to use as a base material for dispersal of seeds of target rehabilitation species (representative of local vegetation). Such livestock manure and dung should be distributed over the rehabilitation surface area at appropriate concentrations, targeting areas poorly covered by topsoil but also contributing to better topsoils.

4.2.3 Distribution of hay, straw and other cropped vegetation from surrounding areas (where available) across the final rehabilitation surface, mixing or embedding such materials within topsoils. Such cropped vegetation has several functions: it helps maintain soil moisture content, helps trap seeds and further vegetation blown across site from elsewhere, and introduces seeds and organic matter directly into soils.

4.2.4 In forests and forest-steppe environments, distribute deadwood of fallen trees onto the rehabilitated areas. Such deadwood breaks down into soils, provides habitats for invertebrates and helps trap further vegetation blowing into the site.

4.3 Assess capacity for natural regeneration

Biological rehabilitation work needs to be informed by the vegetation of the area, and the capacity of the surrounding environment to assist natural recovery of such vegetation. Such capacity can be classified as follows:

a. *High*
b. *Medium;*
c. *Low.*

4.3.1 If the capacity for natural regeneration of technically rehabilitated land is *high*, then the need for the biological intervention is lower, and the technically rehabilitated area may be left with a good covering of topsoil, which should assist with biological rehabilitation through natural regeneration, without the need for strong interventions.

"High" category includes following indicators:

i. Soil indicators are very good in the damaged area,
ii. Abundant and prolific vegetation in adjacent/surrounding area,
iii. Good seasonal precipitation in the region,
iv. Land use is compatible with natural recovery.

4.3.2 If the capacity for natural regeneration of the technically rehabilitated land is *medium*, and then some biological interventions are needed such as increasing of the organic content in the topsoil and planting of seeds and seedlings.

"Medium" category includes following indicators:

i. Soil indicators are relatively good in the damaged area,
ii. Relatively abundant and prolific vegetation in adjacent/surrounding area,
iii. Sufficient seasonal precipitation in the region,
iv. Relatively low land use pressures, etc.

4.3.3 If the capacity for natural regeneration of the technically rehabilitated land is *low*, then a comprehensive biological rehabilitation effort may be necessary, including identification, storing and protecting topsoil, fertilizing soils with organic materials, collection and dispersal/planting of seeds and seedlings and even irrigation activities will be crucially important in the rehabilitated area. However, due to the characteristics of the environment, the biological rehabilitation activities may be limited such as where there is sparse vegetation cover, low precipitation and lack of fertile topsoils, such as in arid environments.

"Low" category includes following indicators:

i. Soil indicators are poor in the degraded area,
ii. Vegetation sparse in surrounding areas,
iii. Low precipitation in the region,
iv. Incompatible land use, etc.

4.4 Identification of relevant vegetation communities and preparation of species lists

4.4.1 Determine levels of necessary biological intervention based on the assessment of the vegetation cover abundance and use appropriate local native species for the rehabilitation.

4.4.2 Biological rehabilitation needs to be appropriate to ecoregion and local environment. This is best informed by the identification of local vegetation communities. Prepare and classify lists of local vegetation communities and species into following three categories:

a. Master list: a number of quadrats should be sampled to identify all species within the area (quadrat sizes can vary from $1m^2$ to $5m^2$). Identify dominants and co-dominants species based on surrounding vegetation.

b. Based on vegetation context, identify and determine species most appropriate and relevant for seed collection/dispersal and/or planting for the biological intervention: these are **target rehabilitation species**.

c. Identify species most likely to dominate successional recovery through natural regeneration: these are **successional colonizers** and can be useful to get vegetation onto the site quickly. Determine whether those species are appropriate for the biological intervention.

d. Assess target rehabilitation species in terms of post-rehabilitation land-use (grazing value, etc).

e. In some situations the use of appropriate leguminous species (e.g. *Caragana* shrubs) can improve soil fertility.

4.4.3 If in a forest-steppe or forested environment, determine the tree seed/seedling collection and preparation area and identify the total number of the trees/seedling to be planted. Obtain the permission from the appropriate authority after identifying total number of the cuttings or seedlings.

4.5 Conducting the biological rehabilitation

4.5.1 Depending on the levels of necessary biological intervention, the biological rehabilitation shall be divided as following:

4.5.2 Seed collection of **target rehabilitation** and **successional colonizer species.** As much seed of the target and colonizer species should be collected as is possible, bearing in mind affordability of labor effort. Recommended amounts of seed per hectare may approximate 5 kg per hectare.

4.5.3 Seeds to be mixed with manure/dung base ready for dispersal over topsoils. Proportionate manual dispersal of the manure-seed mix over areas with both good and poorer topsoil cover.

4.5.4 Manure-seed mixes to be **raked into topsoils** to ensure penetration of seeds and organic matter into rehabilitation surfaces.

4.5.5 Where hay, straw or other cropped vegetation is used from surrounding areas, these should also be raked into topsoils to provide some stability.

4.6 Tree and shrub planting

4.6.1 Autumn planting: plant trees before the land-freeze, from 20th of September to 20th of October with consideration for natural conditions.

4.6.2 Spring planting: indicative dates will vary according to environment and climatic zone and should make reference to the National Standard for spring planting.

4.6.3 Specifically prepare the trees, bushes and shrubs planting sections by considering the size of the area to be rehabilitated.

4.6.4 Prepare the tree cuttings and seedlings by cutting and pruning for planting along target locations within the rehabilitation area, such as along riverbeds, or within forest edges and clearings.

4.6.5 Obtain native tree and shrub seedlings and saplings from a nursery stocking appropriate provenance of required trees. Foreign trees and shrubs not native to area should not be used.

4.6.6 Options occur where young trees with roots may be transplanted from regeneration thickets in the surrounding area with appropriate permission and transplant in the rehabilitated area.

4.6.7 For autumn and spring planting consider applying appropriate irrigation techniques (e.g. charge irrigation, etc)

4.6.8 Irrigate and care for trees and shrubs until they are sustainable and independent.

4.7 Grass/herb planting

4.7.1 Establish seed banks of perennial grass/ herb of **target rehabilitation species** identified for specific area by collecting fully ripened seeds starting from early August in gobi habitats through to mid-autumn elsewhere (mid-September).

4.7.2 Store plant seeds in cotton and paper bags in a dry condition

4.7.3 Autumn seed dispersal: sow seeds before the land-freeze, from 20th of September to end of October with consideration for natural conditions.

4.7.4 Spring seed dispersal: needs to be informed by best practices for seed storage during winter (dry and cold). Many seeds in nature require freezing conditions to trigger germination condition.

4.7.5 Preparation for spring seed dispersal may consider enhancing germination capacity by soaking of 100 grams of perennial seed in 200 ml of water for at least 24 hours and then sun-drying for at least 6-8 hours

4.7.6 Mix target seeds with manure-dung base and disperse manually on days with no wind, if possible. Windy days to be avoided for sowing manure-seed mixes.

4.7.7 Rake the manure-seed mix into the topsoil and include hay/straw in the raking process, if included, after seed distribution.

5. WHOLE MINE CYCLE APPROACH (ASM FRUGAL REHABILITATION AND THE MITIGATION HIERARCHY)

5.1.1 Mine design and Planning: the whole mine cycle approach should be adopted when ASM/small-scale miners move into a new to area to mine. Careful planning can reduce the effort in achieving effective frugal rehabilitation, while maximizing its quality.

5.1.2 The Mitigation Hierarchy seeks to minimize impacts and uses resources so that rehabilitation can be most effective.

5.1.3 First focus is on impact avoidance, followed by mitigation through mine operations and finally, effective rehabilitation.

5.1.4 At the outset: identify the environmental and biodiversity risks of the area and seek to avoid them in the design, layout and undertaking of mining operations at the earliest possible stage

5.1.5 Rehabilitation is most effective when mining operations are planned with a view to identifying, conserving and managing topsoils so as to resurface mined areas when mining and initial technical rehabilitation activities are complete.

5.2 Topsoil management and the whole mine cycle approach: the topsoil protocol

5.2.1 A topsoil protocol should help maximize rehabilitation effectiveness. Careful mine planning should aim to stockpile topsoils and excavated materials (for infilling) separately.

5.2.2 Separate stockpiles adjacent to excavation sites should be planned:

a. one for topsoils,

b. one for overburden materials,
c. one for larger rocks if evident

5.2.3 Topsoils to be stored furthest from the excavation, and heaviest materials/rocks placed closest to the excavation.

5.2.4 As a priority, topsoils should be carefully removed from such areas until non-fertile soils are evident, and then stockpiled at least at 5 -10 m from excavation sites,

5.2.5 Topsoil stockpiles should not interfere with mining activity or be buried by excavation materials during mining.

5.2.6 Topsoils will not be specifically stockpiled in rocky areas, where they will be difficult to remove.

5.2.7 Topsoil stockpiles should not be too high or deep: risk of becoming anaerobic (starved of oxygen)

5.2.8 After soil removal is completed in the areas, the mining operations can commence.

5.2.9 Cyclic rehabilitation in mined out areas: infilling in reverse order, with heavier rocky materials first, then the overburdens, and finally topsoils

5.2.10 Best topsoil management means less need for fertilization or high seed load dispersal

5.2.11 In this way, technical rehabilitation and the preparation for biological rehabilitation can occur immediately following mining completion, or at least soon thereafter, with stockpiles so placed as to facilitate systematic technical rehabilitation with minimum effort to miners.

6. LABOR: HEALTH AND SAFETY

6.1 Involve expert organizations and individuals to organize and give training on labor safety. Every individual who will participate in the rehabilitation projects should be included in trainings on labor safety.

6.2 Provide every individual in the rehabilitation projects with complete protective gears and equipment (work uniforms, helmet, gloves, protective boots, face mask, eye protection, etc.).

6.3 Identify sinkholes, tunnels, dams, holes, pits, shafts, unstable ground and areas at risk of subsidence that can cause injuries to humans, and place red flags or ribbons next to such high risk areas.

6.4 NGOs and Partnerships shall develop and follow guidelines on labor safety for the rehabilitation work.

7. HANDING OVER THE REHABILITATED AREA

7.1 Soum/District Governor establishes a working group or committee to consider assessment, approval and ongoing monitoring of rehabilitation effort.

7.2 On basis of approval, the soum receives land from the ASM community responsible for the environmental rehabilitation, subject to ongoing monitoring. Significant changes to the handover area for which the ASM community is considered responsible (such as subsidence occurring after handover) should be addressed by the responsible party.

II. ANNEXES

1. Commentaries on Frugal Rehabilitation criteria: economic affordability, social acceptability and ecological viability.
2. Prescriptive formulae for estimating volumes of infill materials and topsoils
3. Commentary on specification and use of appropriate machinery.

ANNEX 1: Frugal Rehabilitation – defining considerations: Economic Affordability, Social Acceptability and Ecological Viability

Commentary with respect to FRD and the developing methodology. **As a sustainable development approach, frugal rehabilitation is defined as being affordable, acceptable and viable.**

Economic Affordability is one of the three pillars of the environmental rehabilitation approach for artisanal and small-scale mining being developed by ESEC II. It is a critical consideration. ASM communities, even if formalized/organized generally do not have the capital resources held by medium and large-scale mining companies. They also do not generally have profitable turnovers that would allow for such rehabilitation investments after working an area. This is one reason why **Whole Mine Cycle** approaches need to be developed to help make the planning of small-scale mine design deliver more effective rehabilitation - operationally, practically and economically. Similarly, if co-funding arrangements are to be developed with aimag and soum development funds (LDF), then costs need to be kept lower so as to be affordable by government authorities and to compete with current arrangements being deployed by local authorities to rehabilitation companies (who are often mining gold as a way to make their rehabilitation costs affordable).

Reference is made to the Frugal Rehabilitation Demonstration costs presented in the accompanying FRD Case Studies Handbook (FRD Summary Tables 2014-2015). It should be noted that MNT:USD exchange rates varied between 2014 and 2015 and at the time of printing are again different to when FRD was undertaken. In 2014 FRD project management costs were built into both technical and biological costs whereas in 2015, management costs were addressed separately from technical and biological costs and this was considered a more effective approach.

Generally, it can be seen that **technical rehabilitation** costs for alluvial gold mining sites were within the range of **USD 1,159** and **2,866** per hectare, while biological rehabilitation costs for alluvial sites ranged between **USD 190** and **USD 754** per hectare. The technical rehabilitation costs for the two hard rock fluorspar sites in Airag, Dornogobi were also reasonable and comparable to alluvial gold mining rehabilitation sites: **USD 2,028** and **USD 2,780** per hectare. Technical rehabilitation cost at a remote, hard-rock gold site in Altai, Khovd depended on mechanized assistance, but was relatively low at **USD 1,907** per hectare, while in the remote Uyench site, which used limited mechanized assistance, it was **USD 1,436**.

The Noyod hard rock gold site was comparatively expensive to technically rehabilitate due to the expense of getting a rented excavator machine to a steep remote hillside to move and infill heavy materials: **USD 5,996**. It would appear that machine rental costs at this site were unusually high and perhaps not typical. Machine use accounted for 55% of total technical rehabilitation cost at Noyod. Expenses for biological rehabilitation were also quite high at **USD 1,510** per hectare. Analysis of this particular case study concluded that economies of scale were partly responsible for the higher cost. Only one hectare was rehabilitated in a remote location requiring a vehicle to be transported some distance to a difficult site for a limited period. These impacted the technical costs, while the biological costs were higher due to labor, time and equipment costs being deployed on only one hectare. Such costs could have been reduced when applied to a greater area. Economies of scale issues are important to consider when allocating funds to small areas, and prioritizing and targeting larger continuous areas of degradation within soums will often be more cost effective than targeting smaller areas.

Labor costs were generally the same or similar over all the 2014 FRD sites. 60% of sites costed at MNT 20,000 per person per day (pppd), while 40% of sites costed MNT 25,000 pppd. In 2015, FRD labor costs were standardized at MNT 25,000 pppd.

It was considered important that the biological rehabilitation costs were kept down to a reasonably low level, so as to keep the overall cost affordable and competitive, while still maintaining a commitment to biological prescriptions that would achieve ecologically viable results. For 2014 FRD sites, biological rehabilitation costs ranged between 17 – 24% of total cost (averaging 20%). For 2015 FRD sites, biological rehabilitation costs ranged between 10 – 33% of total FRD cost (also averaging 20%).

Monitoring 2014 FRD sites during 2015, and 2015 FRD sites during the implementation field season, indicated that technical approaches were largely robust and sustainable and required little effort to repair subsidence or erosion. Rainfall in 2015 was good at most southern sites rehabilitated in 2014 (Dornogobi, Bayankhongor and Gobi-Altai), but early summer drought in the northern sites (Selenge and Khentii) delayed biological recovery. However by the end of the 2015 growing season, widespread rainfall resulted in promising biological recovery at all 2014 FRD sites and even at some 2015 sites showing successional recovery. Further monitoring at all sites will contribute to a fuller appreciation of biological recovery, a key aspect of FR.

Each FRD site has its own ecological parameters and variability within each site. There could be a great deal of biological research done on topsoils, manure fertilizers, seed loads and autecology of a variety of target species. However, such research costs are beyond the scope of this project and if applied at each and every site would take the rehabilitation costs beyond the design concept of what is considered affordable. The approach so far has tried to balance affordability with acceptability and ecological viability.

Social Acceptability is a very important consideration and is the issue that has driven many stakeholders to highlight the problems associated with unregulated artisanal mining. Many local stakeholders in rural environments depend on herding and pasture management as a primary livelihood. Artisanal and small-scale mining can pose real risks and hazards to livestock heath and survival, which directly impacts on herders' livelihoods (as can large-scale mining).

In the case of ASM, abandoned sites often feature dense or isolated clusters of vertical shafts and pits which have proved to be a significant hazard to livestock, with animals falling in and unable to escape the pit. This has been a distressing impact of ASM and is often the main social driver for addressing rehabilitation of degraded lands within the wider community and local government. Such hazardous areas were also registered as posing significant hazards to people directly, particularly to those using motorcycles. In areas important for wildlife, such hazards also pose a mortality factor for Mongolian Gazelle, Argali and other wildlife, and administrators of Protected Areas also indicated concerns.

However, degradation of artisanal mining lands also has an impact on pasture value, and this impacts herders' interests and wildlife further. The loss of natural vegetation from mining sites has a direct and accumulative impact on loss of pasture, and this is also of concern to herder interests, even though it may be less dramatic than the vertical pits and shafts. Herders may respond to such hazards as vertical pits and shafts, by moving traditional grazing away from these dangerous sites. This also has a significant impact on loss of available pasture, and until effectively rehabilitated, such areas are often off-limits to herders. The aim of frugal rehabilitation is to reestablish ecosystem services associated with the pre-mining environment or to offer reasonable viable alternatives.

All FRD projects presented in the case studies assessed these issues in consultation with local government, local herders and community groups at the soum and bagh level. It is important that such views were accommodated in the final FRD result.

Use of hazardous substances, such as mercury, have also been a key concern with respect to ASM and human health. While the FRD project is not addressing this directly, the ESEC II project is raising awareness about mercury and its potential use with ASM communities. The FRD project included mercury testing at some gold mining sites, within the soil analysis parameters. The results indicated no issues with mercury at any FRD sites.

One of the key goals of the ESEC II project is to promote inclusion of ASM organized and formalized communities in Local Multi-stakeholder Councils[4] (LMCs), which are generally headed by the head of local rural citizens khurals (CRKhs). Through such a mechanism, ASM NGOs can contribute to local community environmental planning through the development of Rehabilitation Action Plans (RAPs) that will be assessed and approved through the LMC process. This will ensure that ASM RAPs are developed to take full account of local stakeholder interests and contribute to soum-level Environmental Management Plans (EMPs - also under development through this project).

Ecological viability is often the aspect of stakeholder interest that receives less attention than the previous two issues. Yet it is crucially important and if built into the planning and operations of mining (both large-scale and small-scale) it can help reduce rehabilitation and other environmental costs in the medium to long term, as well as address stakeholder interests, so improving the social acceptability of rehabilitation efforts.

Regarding the frugal rehabilitation methodology or guideline, ecological viability is pursued in the following ways:

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[4] Local Multi-stakeholder councils have been established at 39 ESEC II project soums

1. Identification of natural vegetation communities in context. This is followed by identification of the dominant and co-dominant plant species typical of such vegetation communities, which become the **target rehabilitation species** for biological rehabilitation. Such prescriptions include seed collection and dispersal into distributed topsoils.
2. Topsoil identification, conservation and management. This is one of the most critical issues to be addressed through both technical rehabilitation, and the methodology/guideline treats topsoil management as a key priority. The success of natural revegetation will be determined by the quantity and quality of topsoils distributed across the site.
3. Topsoil enhancement. Where rehabilitation is being conducted on abandoned ASM sites, topsoils have often be lost or mixed with other materials so their quality is reduced. Therefore prescriptions for topsoils management and biological rehabilitation include activities to improve organic matter content, water retention qualities, and overall fertility. Frugal sourcing of such inputs include dung and manure collection from appropriate sources and deposition at reasonable concentrations, usually in the form of a base for seed dispersal. Concentrations that are too high are not appropriate because high nutrient status will not favor the re-establishment of native species typical of the local environment. Sources need to be informed by local vegetation, given the possibility of introducing non-typical species into the rehabilitation environment through imported seeds of weed species.
4. Hydrology: where perennial or seasonal watercourses were a feature of the pre-mining environment, then some attempt at re-instatement is to be considered. Hydrological design should seek to establish a strengthened and, where possible, a meandering watercourse channel that reduces erosive energy, prevents erosion of the rehabilitated surfaces, and establishes vegetation to provide ongoing stability.

Such aims seek to reestablish vegetation that has ecological values for both ecosystem recovery, rejuvenation and sustainability, which will provide land-users and wildlife with more sustainable options for future use. Natural vegetation provides important ecosystem services to stakeholders, whether it be pasture or hydrological function and regulation. Efforts to restore rehabilitation sites to a condition supporting natural vegetation communities, or at least dominated by typical native species, will best demonstrate ecological viability in the longer term.

ANNEX 2: Formulas for the calculation of the infilling materials and topsoil

1. Calculation of the infilling materials

1.1 Record and count all pits, shafts, stockpiles and castellation (excavated from all sides) at the site.

1.2 Quantified specification of the area to be rehabilitated shall be determined (total amount of the damaged area, minimum, maximum and average pit depth, stockpile diameters and average height, etc.

1.3 The total amount of materials to be used for rehabilitation shall be calculated based on the estimation of the total volume of the stockpile and castellation according to equations prescribed below:

$$Vo = (S1xh1) + (S2xh2) + \ldots + (Snxhn)$$

Vo- total volume of stockpile, $м^3$;

S1, S2 …Sn -average diameter of stockpile (area), $м^2$;

h1, h2 … ho - average height of stockpile, м.

1.4 The total amount of materials to be used for rehabilitation shall be calculated based on the estimation of the total volume of the pits according to the equations prescribed below:

$$V\text{н} = (S1xh1) + (S2xh2) + \ldots + (Snxhn)$$

Vн-total volume of the pits at the site, $м^3$;

S1, S2 …Sn - average diameter of stockpile at the site (area), $м^2$;

h1, h2 … hn - average depth of stockpile at the site, м.

1.5 Determine the infilling material adequacy by comparing the volumes of the stockpiles and pits calculated by the above two formulas.

2. Estimation and preparation of the topsoil

2.1 Topsoil volume shall be calculated by the following formula by measuring the topsoil depth in the new mine site and comparing it with the total area for the soil stripping:

$$\mathbf{V_{х.э} = S_{о.т} * h_{х.з}}$$

$V_{х.э}$ *-top soil volume, $м^3$;*

$S_{о.т}$ *-mine site, $м^2$;*

$h_{х.з}$ *-topsoil depth, м.*

2.2 Calculate the indicative amount of the topsoil required based on the area disturbed and topsoil depth, where the indicative topsoil layer should be not less than 10 cm thick. The formula to be used for calculating the total amount of topsoil is detailed below.

$$\mathbf{V_{н.х} = S_{х.т} * h_{х.з}}$$

$V_{н.х}$ *- top soil volume, $м^3$;*

$S_{х.т}$ *-area to be covered by soil, $м^2$;*

$h_{х.з}$ *- top soil depth, м.*

2.3 Cover all technically rehabilitated areas by topsoil if there is sufficient topsoil and if not, identify target priority areas to be so treated.

ANNEX 3: Commentary on specification and use of appropriate machinery - mechanization in artisanal environmental rehabilitation.

Artisanal mining is generally regarded as being largely a non-mechanized form of mining, with use of machines limited by law and by use to low specification operations. However in Mongolia, throughout the small and medium scale mining sector, use of larger specification machines is becoming increasingly prevalent. While machines might not be owned by ASM NGOs and partnerships, they may have access to them (through rental) from neighboring medium/large scale mining companies to undertake certain demanding operations for which machines are more convenient or more effective.

Not including the use of small trucks to bring infill materials onto site, across the FRD projects in 2014 and 2015 mechanized approaches were used in a number of rehabilitation projects. In five hard rock situations they were considered essential (Dornogovi, Khovd, Selenge). In six alluvial applications they were used for parts of the technical rehabilitation to handle major infill and regrading operations (Dundgovi, Khovd, Jargalant and Norovlin).

The FRM proposed in this consultation is designed with primarily manual artisanal rehabilitation efforts in mind but recognizes that machines are becoming an increasingly accepted way for people to undertake such work, if affordable. This is reasonable given the scale of works that sometimes needs to be accomplished. It was observed that a range of front-end loaders and excavators were used during FRD projects in 2014 and 2015, such as heavy-wheeled front-end loaders, and both large and medium-scale tracked excavators.

However, dependence of heavy machinery to undertake technical rehabilitation through to completion (topsoil distribution and placement) has significant disadvantages which can compromise a rehabilitation outcome/result. Front-end loaders and bulldozers may be very efficient in moving and regrading large volumes of material to a desired profile, but they can often result in widespread or localized **compaction** of the rehabilitation surface. Such compaction - while giving the appearance of stability - can prevent penetration of moisture/ precipitation and seeds and organic material, resulting in a form of sterilization where biological regeneration and recovery is blocked. It can also lead to sheet and gully erosion of the rehabilitation surface. This is particularly a problem if regrading and topsoil reprofiling and distribution occurs during damp or wet conditions by heavy machinery. The final surface often dries out and sets hard, like concrete. This is becoming a common observation on technically rehabilitated mine sites nearby the many FRD sites we have been working at, and elsewhere. Even after 3-4 years, such surfaces show little biological recovery of native vegetation, and often experience gully erosion.

The following guidelines may help to avoid such problems in ASM environmental rehabilitation:

1. If heavy machines are necessary to undertake infilling and regarding works, use them during the earlier stages of the technical rehabilitation. Do **not use them during final stages** of reprofiling and topsoil distribution, as this can lead to compaction of the final surface that becomes an obstacle to effective biological rehabilitation. Final stage reprofiling and topsoil distribution should use manual efforts, which often provide the greater attention to detail which is needed.
2. Use lighter machinery of reduced specification. Light excavators such as used in Jargalant and Bulgan FRD did not result in compaction of any kind. A variety of lighter machines are available in the sector, such as “bobcats” and lighter tracked excavators.
3. Where significant compaction caused by heavy machinery has occurred, a light tractor with an attached grubber (rake) can be used to decompact hardened surfaces. Resulting shallow furrows can help capture windblown seeds and moisture.
4. Topsoil distribution and preparation for biological rehabilitation should focus on manual approaches where possible.

III. FRUGAL REHABILITATION PERFORMANCE MONITORING CHECKLIST

Guidance on using FRM checklist on FR site performance and assessment:

As indicated in the Frugal Rehabilitation Methodology (FRM), Section 7, the Soum/District Governor will establish a local working group or committee to assess, monitor and receive the rehabilitated site from artisanal and small scale miners (ASM) undertaking frugal rehabilitation of a specific site. The aim of this checklist is to assist the working group to assess and monitor progress with the frugal rehabilitation being undertaken by the ASM NGO /partnership by checking and verifying key steps as indicated in the FRM.

The checklist can be applied as field guidance for the state environmental inspectors or other relevant officials to monitor, and evaluate rehabilitation performance of ASM NGOs/ partnerships, focusing on the following main aspects:

Is the rehabilitated land

a) safe to humans and wildlife?
b) non-polluting?
c) stable?, and
c) able to sustain an agreed post-rehabilitation land use?

Once these aspects are met, the frugal rehabilitation work will be regarded as complete with FRM requirements having been met for sign–off and approval.

On the basis of approval and acceptance of FR sites, the soum can use such evidence, in conjunction with any Rehabilitation Action Plan (RAP) that the ASM NGO/partner has submitted as supporting the facilitation of potential ASM land allocations for mining or for the rehabilitation of historically ASM degraded land. The purpose of this checklist is to better inform and guide environmental inspectors and ASM rehabilitation practitioners to assess, monitor and prepare the specific frugal rehabilitation for approval and handover to soum authorities.

The checklist format is developed to be consistent with the FRM structure and also the Rehabilitation Action Plan structure.

The FRM checklist has three parts:

Part I Provides background information on the ASM NGO/partnership, the rehabilitation site name, status and description. It specifies the workforce involved in the rehabilitation and whether and what kind of mechanized assistance was necessary. It identifies sources of funding being used to undertake the rehabilitation, and provides other general information on the environmental and cultural aspects of the site being rehabilitated, as relevant.

Part II includes a checklist to assess rehabilitation progress, ensuring that key aspects that are important to successful rehabilitation are undertaken, where completion criteria can be checked in a simple Yes/No format. If any given criteria is triggered by checking “no”, remarks or notes shall be given indicating reasons and remedial/ corrective actions. The completion criteria are based on prescriptions prescribed in the FRM covering essential steps relevant to the site.

Part III represents the inspection evaluation for approving completion and signing-off the frugal rehabilitation site.

I. General Information

<table>
<tr><td>Inspection date</td><td colspan="4"></td></tr>
<tr><th colspan="5">1.1 BRIEF PROFILE OF ASM NGO/PARTNERSHIPS</th></tr>
<tr><td>Name of ASM NGO/partnership</td><td colspan="4"></td></tr>
<tr><td>Team Leader of ASM NGO/partnership</td><td colspan="4"></td></tr>
<tr><td>Land ownership details (license)</td><td colspan="4"></td></tr>
<tr><td>Number and date of agreement made with local Government</td><td colspan="4"></td></tr>
<tr><th colspan="5">1.2 SITE DESCRIPTION</th></tr>
<tr><td>Name of site</td><td colspan="4"></td></tr>
<tr><td>Site location</td><td>Aimag:</td><td>Soum:</td><td>Bag:</td><td>Distance from an aimag/soum center:</td></tr>
<tr><td>Targeted hectares:</td><td colspan="4"></td></tr>
<tr><td>Coordinates established /area mapped:</td><td colspan="4"></td></tr>
<tr><td>Type of deposits and minerals (hard rock/alluvial)</td><td colspan="4"></td></tr>
<tr><td>Site status</td><td>Abandoned</td><td colspan="2">Current/active</td><td>Application for a new land</td></tr>
<tr><td rowspan="3">Brief summary on high conservation values (site specific)</td><td colspan="4">Ecological zone and Biodiversity:</td></tr>
<tr><td colspan="4">Water resources:</td></tr>
<tr><td colspan="4">Historical/Cultural heritages:</td></tr>
<tr><td>Land-use purpose</td><td colspan="4"></td></tr>
<tr><th colspan="5">1.3 FRUGAL REHABILITATION (FR) PROJECT INFORMATION</th></tr>
<tr><td>Period/duration</td><td colspan="4"></td></tr>
<tr><td>Workforce</td><td colspan="4">(How many people working on rehabilitation effort at site?)</td></tr>
<tr><td>Mechanized assistance</td><td colspan="4">(Type/ number of machines and function?)</td></tr>
<tr><td>Sources of funding</td><td colspan="4"></td></tr>
</table>

II. Rehabilitation completion criteria

No	Description	Completion criteria	Yes	No[1]	N/A	**Remarks** *(specify problems observed and proposed corrective actions)*
	1. **Waste management**					
1.1	Garbage collection and waste removal	Has all garbage/litter been removed from rehabilitation site?				
1.2	Hazardous waste removal	Have chemical or toxic wastes been identified and if so, have they been safely collected and properly disposed (as indicated in FRM)?				
	2. **Landform**					
2.1	Quantified specification of degradation	Have numbers of all pits, shafts, stockpiles and trenches been recorded and counted? (minimum/maximum and average pit depth, stockpile diameters and average height, etc).				
2.2	Hydrological assessment and management	Have potential or existing watercourses within the rehabilitation area been identified? Has watercourse design and management been undertaken to prevent erosion of rehabilitation area?				
2.3	Subsidence and safety risks	Have pits, tunnels and shafts been assessed for safety and stability. Has infilling reasonably reduced risk of subsidence and/or collapse?				
2.4	Safe and stable landscape, consistent with surrounding topography	Has regrading and reprofiling been done to an acceptable standard, whereby stability is ensured, and slopes are 35 degrees or less?				
2.5	Mineshafts, pits, holes or stockpiled waste materials	Have all shafts, pits and holes be infilled within agreed rehabilitation area? Have all stockpiles been used for infilling, regrading and reprofiling?				

1 Any "No" *recorded represents nonconformity with FRM requirement. Therefore details of nonconformity and corrective improvements should be recorded in the Remarks column.*

2.6	Additional infill materials	If infill is required to be brought in from outside of rehabilitation site, can this be done without creating further damage offsite?				
2.7	Mechanized approaches	If mechanized assistance is necessary has it been done to ensure that no additional damage is caused to undisturbed areas /vegetation around and within the site? Has compaction been avoided or mitigated following regrading and reprofiling?				
	3. Topsoil conservation and management					
3.1	Topsoil conservation and management.	Has available topsoil been identified and protected during rehabilitation process? If it is being brought in from elsewhere, what are the implications for an expanded FRD impact footprint?				
3.2	Topsoil use	Has available topsoil been distributed effectively across final rehabilitation surface?				
3.3	Soil enrichment approaches	Have efforts been made to collect and distribute significant amounts for manure/livestock dung in preparation for biological rehabilitation?				
3.4	Mechanization, where necessary and relevant	If machines have been used to prepare rehabilitation surfaces, has compaction been avoided or if it has occurred, has decompaction been undertaken (mitigated) either manually or by light machine?				
	4. Biological rehabilitation					
4.1	Natural vegetation/plant community identification and assessment.	Have vegetation communities and key plant species been identified and listed? Have the target rehabilitation species and colonizer species been identified?				
4.2	Native plants seed collection	Have significant seeds been collected of target rehabilitation and colonizer plant species. Where appropriate, have seedlings of trees or cuttings been obtained for planting within the rehabilitation?				
4.3	Soil enrichment/ fertility approaches	Have native seeds been mixed with manure/livestock dung and distributed across final rehabilitation surfaces?				

4.4	Hay/vegetation cropping and distribution	Where available, has locally-cut hay/ vegetation been spread and raked into final rehabilitation surface to protect and enhance the biological rehabilitation?				
4.5	Irrigation/ watering of planted trees/ shrubs and /or seedlings	If tree seedling or shrubs have been planted has an irrigation plan and commitment been made to ensure watering and survival of plantings throughout growing season?				
5.	**Wider management (wildlife, livestock, cultural and stakeholder concerns, etc.)**					
5.1	Reduced impacts on wildlife	Has the ASM NGO taken efforts to avoid impacts to wildlife using the area? (collecting fuelwood, hunting and /or disturbance)				
5.2	Whole Mine Cycle Approach	In actively mined areas undergoing frugal rehabilitation, are efforts being made to avoid damage to vegetation, and maximize conservation of topsoil during the mining process?				
5.3	Livestock access and safeguards	Where trenches and pits cannot be completely infilled for practical reasons (in some hard-rock mining situations) have measures been taken to ensure livestock can exit from such holes (exit gradient ramps)?				
5.4	Cultural heritage protection	Have cultural heritage interests been identified and protected?				
6.	**Post-rehabilitation monitoring and maintenance**					
6.1	Post-rehabilitation Maintenance plan	Leading up to soum approval and sign-off, has a post-rehabilitation plan been discussed and agreed? Has the soum agreed to protect the site from future illegal mining activity in agreement with the ASM NGO/partnership?				

III. SITE INSPECTION EVALUATION

III.1 Evaluation

Have any key steps relevant to implementation of the FRM at this site been <u>omitted</u>?

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If, so what remedial/corrective actions have been identified and agreed to be implemented, to ensure soum approval?

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3.2 Overall Evaluation Remarks ……………………………………………………………
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SIGNED BY:

Site Inspection committee members:

1. ……………………………
2. ……………………………………
3. ……………………………………

Agreed by: …………………………………… **Head of the ASM NGO/partnerships**

Approved by:

…………………..

Governor of the ……..Soum….. Aimag

Reviewed by:

Environmental Inspector

.... soum ....aimag

Reviewed and agreed by:

Soum LMC meeting

IV. REHABILITATION ACTION PLAN

.... site .... soum .... aimag

I. GENERAL INFORMATION

1. Name of ASM NGO/Partnership:	**2. Team leader of ASM NGO/ Partnership(ASM NGO Head):**		
3. Brief profile of ASM NGO/Partnership (history; work interest; date registered, etc):			
4. Site name:	**5. Location:**		
6. Site status:	**Hectare**	**GPS coordinates**	**Period/duration**
i) Abandoned ASM land			
ii) Current/active ASM land mined by NGO/Partnership			
iii) Proposed new ASM area			
iv) Other area to be rehabilitated			
7. **Workforce** (number of people):			
8. **Mechanized assistance** (description of machine where used):			
9. **Sources of funding**:			
ASM Community fund	--------------------		
Local government	--------------------		
Aimag and soum government	--------------------		
LSM	--------------------		
Other	--------------------		
10. Site history			
11. Environmental baseline information:			
i) Ecological zone:			
ii) Water resources (underground and surface):			
iii) Soil, flora and fauna:			

II. FRUGAL REHABILITATION ACTION PLAN

Environmental factors	Duration	Responsibility	Budget
I. Preparatory works			
• To establish access roads to the site, establish parking area, campsite and place road signs; • To take safety measures and provide miners with personal protective equipment and working tools, and give safety instructions, including fire precautions; • Ensure appropriate sanitation measures are in place. • Take pre-rehabilitation photos/video recording for documentation purposes; • Waste disposal and removal as indicated in FRM (Section 2.4).			
Pollution prevention: Water quality and soils			
• Take measures to prevent water pollution around the site; • Take preventive measures to avoid soil pollution by petrol/ fuel/gasoline spillage			
Vegetation cover and erosion			
• Manage vehicle movement at rehabilitation site to reduce degradation or erosion of vegetation/pasture			
Fauna and Flora			
• Increase awareness of the miners of legal obligations to prevent illegal hunting, trading, and disturbance of wildlife • Identify and protect water sources used by wildlife around the area			
Cultural heritage			
• Pay attention to not disturb and to protect historical and cultural heritage features, located in the vicinity of the rehabilitation site			
Local Community and project workers			
• Implement stakeholder management to resolve complaints made by local herders and other local stakeholders for continuous improvement of the rehabilitation project's environment and social performance.			

II. Rehabilitation: with direct reference to the Frugal Rehabilitation Methodology (FRM) as it applies to the site(s).			
Technical rehabilitation (follow prescriptions as per FRM): • Measure the area to be rehabilitated by identifying the coordinates of the area by GPS; • Through local consultation agree on post- rehabilitation land-use purposes (pasture, agricultural purposes); • Prepare a thorough cost estimate of rehabilitation activities based on information required to undertake the following prescriptions. • Undertake hydrological assessment of area, as per FRM: location and pattern of watercourses; identify need for small-scale engineering to manage such watercourses • Prepare required tools and equipment, both manual (shovels, picks, etc) and mechanical (small-scale mining machinery, excavators, trucks, etc.) required for rehabilitation; • Mark the area by putting stones-piles, small flags and signboards at GPS coordination points; • Map the pits, shafts, stockpiles, trenches and roads at the area to be rehabilitated. • Undertake safety assessment of pits, tunnels and shafts to be infilled; can this work be done safely? • Assess steepness of slopes to be rehabilitated: ensure safe profiling that may require more area to be disturbed along the boundaries, such as along trench sides; • Record and count all pits, shafts, stockpiles and trenches (excavated from all sides) at the site; • The total amount of materials to be used for rehabilitation shall be calculated based on the estimation of the total volume of the stockpile and excavated shafts, as per FRM Annex 2. • As per FRM, undertake infilling of pits and shafts, using heavier materials for bottoms and lighter soils nearer the surface • Undertake regrading and reprofiling to appropriate slopes and levels. • Identify and assess minimal machine use and avoid final regrading and reprofiling with heavy machinery. • Cover the final technical rehabilitation surfaces first with subsoils followed by conserved topsoils in order to provide receptive surfaces for biological recovery (revegetation).			
Topsoil identification, conservation and management (follow prescriptions as per FRM): • Identification and conservation of valuable topsoil resources at rehabilitation site; • Distribution of available topsoils over rehabilitation area.			

<u>Biological rehabilitation (follow order of prescriptions as per FRM):</u> • Identification of relevant vegetation communities and preparation of species lists • Identify all species within the area (quadrat sizes can vary from 1m² to 5m²). Identify dominants and co-dominants species based on surrounding vegetation; • Based on vegetation context, identify and determine species most appropriate and relevant for seed collection/dispersal and/or planting for the biological intervention: these are target rehabilitation species; • Seed collection of target rehabilitation and successional colonizer species. Collect as much seed of the target and colonizer species as is possible; • Prepare and collect manure and livestock dung from nearest herder sites, where available (used to improve soil fertility); • Hay, straw or other cropped vegetation is collected from surrounding areas (where available); • Seeds from target rehabilitation species mixed with manure/dung • Seed-manure mix distributed across topsoils and other rehabilitation areas • Hay, straw or other cropped vegetation raked into topsoils. • If in a forest-steppe or forested environment, determine the tree seed/seedling collection and preparation area and identify the total number of the trees/seedling to be planted. • Obtain relevant permission to use tree cuttings/seedlings in forest or forest-steppe areas • Assess water and irrigation resources if trees are to be planted • Irrigate trees as required regularly throughout growing season			
III. Applying the Whole Mine Cycle Approach (WMCA), to new ASM lands proposed for mining (see Section 5 FRM			
• Identify location of vulnerable perennial vegetation (shrubs, trees) that will be difficult to rehabilitate. Plan to avoid where possible • Identification of shafts, pits and trench locations, so as to plan for strategic topsoil removal. • Specific removal and storage of topsoils to locations where such topsoils will be conserved and not lost in the mining process			
IV. Handing over the rehabilitated area to local authorities			
• Engage with soum working group to discuss RAP implementation throughout rehabilitation process • Agree sign-off and handover to soum government, subject to monitoring of results over an agreed time period.			