The Approach

This guidance document outlines a process to assess and manage the environmental impacts of artisanal and small-scale mining (ASM) for governments and miners. The approach focuses on incremental and achievable environmental outcomes at individual ASM mines. It is based on a two-step, combined approach with roles for both governments and miners:

Governments’ Role
- Provide strategic environmental impact assessment (SEIA) of designated ASM zones

Miners’ Role
- Undertake environmental management (EM) of the effects of individual ASM operations

To support sustainable development in ASM, it is important that the guidelines for strategic environmental impact assessment (SEIA) by governments and environmental management (EM) by miners are achievable, given the resources and capacity of both groups. They must yield environmental gains while also supporting ASM communities

Social dimension of ASM

This document focuses on the environmental aspects of ASM. However, we recognize that the social dimension of ASM also requires impact assessment and management. Whenever possible, a fully integrated socio-economic and environmental approach to assessing and managing the challenges of ASM should be undertaken.

The Challenge

In many of the current regulatory systems, environmental impact assessment processes and management requirements for ASM are often too onerous and are not realistically achievable by governments or miners. In other cases, there are no environmental requirements, or ASM mines fall below the threshold for environmental management requirements based on the scale of the operation or presumed impacts of the mining activity. The lack of formalization policies for ASM and the resistance by some miners to transition to a formal system also makes assessment and management of environmental impacts challenging.

Despite these challenges, sustainable development of the ASM sector can only be realized by reducing its environmental impact. This can be achieved through a combined process of a regional-scale, strategic environmental impact assessment conducted by governments and operational environmental management by ASM miners.

Improvements in environmental management by ASM will be a long-term process and will require:
- Improvements in institutional capacity and policies that govern ASM zones.
- Capacity building and empowerment of the public sector.
- Knowledge development and training.
- Commitment to environmental management by miners.
- Formalization of the sector.
Effective environmental management and control of ASM must be linked to formalization, where miners are issued licences and permits to operate by government. This allows for control of where and how all phases of mining take place (including processing) and implements operational standards and monitoring. It also facilitates a regional or zone-based approach to the SEIA. Successful formalization depends of participation from both governments and miners.

**Governments’ Role**

- Establish longer-term mining licences to allow for environmental planning and the implementation of reclamation programs – a renewable period of 10 years would facilitate this planning.
- Facilitate the transition to a formal system with incentives that encourage miners to form cooperatives, improve their practices and adopt environmental management. Examples of incentives include:
  - Technical capacity building and access to low-cost leased equipment to improve return.
  - Access to geological knowledge and data to support exploration, mining and processing.
  - Decentralization of permitting to local government offices.
  - Access to financing mechanisms, tax abatement or other financial incentives.
  - Access to government or registered commodity buyers who provide a better price for commodities.
  - Training on leading techniques.

**Miners’ Role**

- Establish, with government support, co-operatives and organized mining communities – managing the environmental impacts of ASM mining will be more feasible when addressed by a group that collectively builds skills and knowledge and shares resources.
- Adhere to environmental and legal requirements of mining licences.

**Strategic Environmental Impact Assessment of ASM Zones – Governments’ Role**

SEIA is the process of assessing the effects of a proposed development, policy or regional planning decision on existing environmental and socio-economic conditions. It is proactive and normally related to the assessment of a region or sector of development. It supports sustainable development decisions as part of regional planning. Since ASM miners usually lack the capacity to conduct an environmental impact assessment, governments can provide leadership by undertaking the assessment with the support of mining communities. The approach taken in a SEIA is different than in a project-specific environmental impact assessment as detailed in the table below.

**Comparison between EIA and SEIA**

<table>
<thead>
<tr>
<th></th>
<th>EIA</th>
<th>SEIA</th>
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<tbody>
<tr>
<td>Is reactive to a development proposal.</td>
<td>Is pro-active and informs development proposals.</td>
<td></td>
</tr>
<tr>
<td>Relates to a specific project.</td>
<td>Relates to areas, regions or sectors of development.</td>
<td></td>
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<tr>
<td>Enables the identification of project-specific impacts.</td>
<td>Enables the development of a regional framework against which positive and negative impacts can be measured.</td>
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<tr>
<td>Has a well-defined beginning and end and focuses on informing a specific decision at a particular point in time.</td>
<td>Is an adaptive process aimed at the development of a sustainability framework to inform continuous decision-making.</td>
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<tr>
<td>Has a narrow perspective and includes a high level of detail.</td>
<td>Has a wide perspective and includes a low level of detail to provide a vision and overall framework.</td>
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Ecuadorian small-scale miners separate valuable ore from waste rock before sending to processing / ANTHONY PERSAUD
Environmental Assessment and Management for Artisanal and Small-scale Mining

Regional and Landscape Approach
The SEIA should be conducted on a regional basis in zones that have been defined for ASM. It should use a landscape approach by assessing a drainage basin, or series of interconnected drainage basins, or ecosystems. However, it should also consider mineral or geological belts that are suitable for ASM, even though these belts may cross ecological or drainage boundaries. In these cases, the SEIA may need to be divided into subsets that consider each ecological region separately within a larger ASM zone.

Overcoming Capacity Limitations
In addition to capacity limitations of miners, governments may also lack the resources and capacity to undertake a comprehensive, field-based SEIA. That should not limit the completion of a SEIA. Where resources are limited, governments can undertake a ‘desk-top’ assessment that draws upon the relatively well-documented environmental impacts of ASM combined with existing knowledge of the ecology and communities in an area. However where capacity is available, the SEIA should be a complete integrated socio-economic and environmental impact assessment conducted by government, which looks at all the activities in a region and assesses the cumulative impacts and management protocols of these activities.

Common Environmental Impacts of ASM Operations
ASM operations are normally restricted to the surface or near-surface, are small-scale, and involve limited capital infrastructure and technologies. Characterizing these impacts can help with the completion of a SEIA where resources do not allow for a thorough field-based assessment.

Common environmental impacts of ASM include:
- Deforestation, habitat fragmentation
- Loss of agricultural land
- Erosion and scarred landscapes
- Siltation of fresh water bodies
- Water pollution due to release of process chemicals and acid mine drainage
Achievable Environmental Management

– Miners’ Role

Environmental management is a process of managing the impacts of human activities on the environment in order to preserve the natural environment and its resources. This requires identifying the activities that create the impacts and the methods that can be used to mitigate those impacts. This is the role of the SEIA. It also requires defining who will be responsible for implementing the management methods (miners in this case) and who is responsible for monitoring and enforcement of those requirements (government).

Scaling EM to Local Circumstances and Capacity

To assist miners with implementing environmental management, it is recommended that a standardized and user-friendly environmental management form become part of the application for a mining licence. This form, filled-out with the support of government, would identify the key environmental impacts of the mining activities and outline how the miner will manage those impacts. Depending on the local circumstances, the type of mining (or processing) and the capacity of the applicant, the requirements could range from as little as describing how soil will be set aside for future reclamation to the process that will be used to remove cyanide from tailings and the design of a tailings storage area.

Scaling the management requirements to the local circumstance and capacity is important to achieving environmental gains. The requirements can be increased as capacity and knowledge increases.

Benefits of a Combined Approach

A combined approach of SEIA by government and EM by miners:

• Is achievable and scalable to reflect availability of resources and capacity.
• Allows for the integrated assessment and management of the cumulative impacts of a many ASM mines in the same region.
• Defines ecologically or culturally sensitive or unsafe areas where mining is a “no go”.
• Allows for the combined assessment of both mines and process plants and the related impacts between the two.
• Implements lifecycle planning and designing for closure before mining starts.

Training

CIRDI’s ASM program strategy emphasizes education of governments and miners as a critical entry point to organize and formalize the ASM section. Training is key to the success of the combined SEIA and EM process. In many cases miners may not have the knowledge or tools to implement environmental management processes such as effectively reclaiming backfilled pits with native vegetation. Training will be needed to initiate and expand the capacity of miners to manage the environmental impacts of their activities.

Mine Lifecycle Planning Benefits All

A significant benefit of this combined approach is that both governments and miners will develop a culture of mine lifecycle planning. Envisioning an environmentally sound site at the end of a mine’s life, will help guide how the mine is built and operated. The shift toward planning for closure at the start of mining in the large-scale mining sector, has lead to significant improvements in the environmental design and operation of large-scale mines.

Examples of Achievable Environmental Management Activities by ASM Miners

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<tr>
<th>Activity</th>
<th>Action</th>
<th>Benefit</th>
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<tbody>
<tr>
<td>Soil retention</td>
<td>Remove the soil or growth medium and set it aside for future use before excavating pits or trenches.</td>
<td>Soil is available for reclamation and revegetation of the site.</td>
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<tr>
<td>Pit backfilling</td>
<td>Backfill existing pits or trenches with material excavated out of new pits. This can be a sequential process such that only a few unfilled pits would exist at any one time.</td>
<td>Backfilled pits can be covered with soil and revegetated.</td>
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<tr>
<td>Water desedimentation</td>
<td>Redirect sediment-laden water into a number of settling ponds such as linked pits or excavations before it returns to natural waterways.</td>
<td>Sediment settles out of mine water before it returns to natural waterways. This will limit the impact of mining on the environment and down-stream users.</td>
</tr>
<tr>
<td>Reclamation and reseeding</td>
<td>Re-plant with local seedlings to establish a natural setting or agricultural land. This may require a successional approach where fast growing and sun-loving plants stabilize the ground and are gradually replaced with native species or crop species.</td>
<td>Stabilized the ground, which reduces erosion and runoff. Re-establishing natural ecosystems or productive land will improve environmental conditions. Reforestation provides for local access to fuel and timber.</td>
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<tr>
<td>Chemicals management</td>
<td>Dispose of tailings in stable storage facilities such as old pits or human-made ponds. Destroy cyanide in tailings through photodegradation.</td>
<td>Eliminates the disposal of tailings in rivers and removes cyanide before tailings disposal.</td>
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Yukon’s Placer Mining Regime – ASM in Canada

Canada’s Yukon Territory has an active placer mining industry, which is focussed on the recovery of gold from river gravels (placer refers to a mineral deposit of sand or gravel that contains a concentration of valuable minerals, notably gold and platinum). Placer mining is the Yukon’s ASM sector. In order to support a sustainable mining industry and at the same time protect the Yukon’s highly valuable fish habitat and related fisheries, an integrated environmental regulatory and management regime has been established. Integral to the regime is the establishment, in advance, of clear rules for placer mining activity – in other words, the environmental management rules that miners must follow.

This regime takes a watershed approach in which water quality objectives, sediment discharge standards and other requirements are established in each of the 19 watersheds within the Yukon. The government has undertaken the strategic assessments in these watersheds to establish the specific requirements for each watershed based on biological health and the importance and sensitivity of fish habitat. This helps to manage the cumulative impacts of mining within a watershed. A Yukon watershed atlas was produced that placer miners can refer to in their license applications and regulators can use for decision making.

Detailed worksheets and guidebooks are provided to help miners prepare their environmental management plan. These worksheets are then submitted to the regulatory bodies for review and approval before a mining licence is issued.

Important aspects of this environmental management regime include:

- Clearly defined standards and performance targets based on sound science and local and Indigenous traditional knowledge.
- A simplified ‘single-window’ approach to licencing including forms and guidebooks for miners to follow.
- A risk-based approach that assesses the habitat sensitivity and proposed mining activity in a drainage area to determine the impacts of the operation and the risks to fish habitat.
- Active monitoring of both compliance and effectiveness of the environmental management requirement.
- Adaptive management approach to continuously improve the regime as the results of monitoring and new science, technology and information become available.

The Yukon’s placer mining regime is an excellent example of regional environmental assessment and standards that are established by government and environmental management requirements for miners.
Regulating tailings disposal of ASM operations in Southern Ecuador

The Portovelo-Zaruma area of southern Ecuador is an active ASM zone with hundreds of small-scale underground gold mines and more than 90 gold process plants. The process plants use varying degrees of mechanisation and technology for gold extraction and processing, but most lack basic infrastructure and capacity for tailings disposal and management. Processing plants occur alongside tributaries of the Puyango-Tumbes River for easy access to water necessary for milling and gravity concentration. The proximity to rivers is also convenient for low-cost disposal of wastewater and tailings.

Guimarães et al. (2011) reported that up to 880,000 tonnes of tailings disposal of wastewater and tailings. Concentration. The proximity to rivers is also convenient for low-cost disposal of wastewater and tailings.

In 2009, public outcry and scrutiny from governmental institutions and the Peruvian government over tailings disposal practices led to an initiative to assess the combined impacts of processing plants in the mining district of Zaruma-Portovelo. A strategic regional impact assessment led by the Government of Ecuador in conjunction with Provincial Government of El Oro province generated the idea of a central tailings disposal area. The communal management of tailings for around 90 processing plants was described by

Tarras-Wahlberg (2002), including the idea of transporting the tailings through a pipeline. It took many years for this idea to be realized, but in 2013 the construction of a community tailings-storage facility was initiated by the provincial Government of El Oro. The facility called El Tablón, occupies an area of 120 hectares and cost around USD$5 million to complete. The proposed pipeline system connecting the process plants to the tailings storage facility has not yet been built as a result of disagreements between plant operators and the government. However, as of early 2015 the owners of processing plants without an approved tailings storage facility are required to dispose of their tailings in El Tablón. Transportation is by dump trucks. The management of the facility is under the Provincial Government of El Oro and the control of tailings disposal is under the national governmental agency of mines regulation and control. The estimated lifetime of El Tablón is approximately 20 years, during which time it will receive an estimated 900,000 tonnes a year of tailings from most of the processing plants in the region.

The El Tablón project is a good example of a strategic environmental assessment that was completed by government combined with environmental management requirements of process plant operators. Challenges remain, such as spillage of tailings during transportation by dump truck, and a complex chain of custody between miners, process plant operators and the government-run El Tablón. However, this initiative has and will continue to result in a significant decrease in the environmental impact of mining in the region.

Legend:
- Processing Plants
- Mines
- El Tablón Storage Facility
- Rivers

The Portovelo-Zaruma area of southern Ecuador showing the location of the central tailings storage facility, El Tablón, as well as process plants and mines. El Tablón receives tailings from most of the process plants in the area.

Train cart entrance for ASM Mine / BRANDON NICHOLS
References

Yukon Case Study


The Yukon Placer Mining Regime Pamphlet:

Yukon Placer Mining Secretariat:
http://www.yukonplacersecretariat.ca/index.html

Ecuador Case Study


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We welcome your questions and comments.

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