

EIA CASE STUDY: Mining - Colombia

Case study is based on the following sources: AngloGold Ashanti (2012); AngloGold Ashanti (2015); B2Gold (2014); Cornare (2014); Gramalote Performance 2012.

Project name: Open-pit Gold Mine Development- "Project Gramalote Mine TM 14292"

Sector: Mining

Date: 2015

Location: Municipality of San Roque, Antioquia, Colombia

Project Information

The Gramalote mining project proposes to develop an open-pit gold mine. The ore deposit covers an area of 7.221 km² within the central mountain range in the area. The mining potential for this mine ranges between 5 to 7 million ounces of materials, of which 3,651 million ounces are gold. The mineral exploration process undertaken prior to this EIA involved analysis of sediment samples, rocks and soils samples, use of geological maps, alteration and structural maps, geophysical maps, development of an exploratory tunnel, drilling exploration, metallurgic tests, as well as geo-technic and hydro-ecologic studies.

The purpose of this project is to develop and grow the local, regional and national economies in Colombia through large-scale mineral extraction. It is thought that the project will remove between 350 to 450 million ounces of gold per year. Construction is estimated to stimulate approximately 3,500 direct and 7,000 indirect jobs, decreasing to 700 direct and 2,000 indirect jobs during the production period. It is also thought that, because of the magnitude of the project, the mine will also stimulate other economic sectors such as the service industry, food, construction, education, transportation, local agriculture and financial among others.

The Gramalote mine project has developed a mining plan in four stages over a 25-year period;

1. Resettlement (3 years). This will involve land acquisition and easements.
2. Mine construction and assembling (2.5 years).
3. Operation (11 years).
4. Closing, decommission and post-decommission (7.5 years).

Project Area

This mining project is located in the municipality of San Roque, department of Antioquia, located approximately 125 km from the city of Medellin. Mining concessions for this project are connected to the mining title 14292.

As per the terms of reference, the analysis of the area of influence must include, abiotic, biotic and socioeconomic factors, and may incorporate larger or smaller areas depending on these elements. The direct social impact areas include areas of El Iris, La Linda, Peñas Azules, Manizales, La Trinidad, El Balsal, El Diluvio, Guacas Abajo and La Maria. The principal biophysical direct areas of influence include Ravine La Bella, Ravine Guacas and the Nus River. This project also includes an indirect social influence area, which encompasses the larger region and examines impacts of markets, trade, biological features such as vegetative cover, landscape and hydrology. This area includes the municipalities of Yolombo, Maceo, Cisneros and San Roque.



Screening

The screening process in Colombia requires the project developer to fill out a list of questions which helps to determine whether or not the project will require an EIA. EIAs are only required for projects that fall under the law and its regulations. In Colombia there is only one project category—and so only one type of environmental impact study—but the depth and content of the EIA are subject to terms of reference laid out by the administrative body governing the EIA process.

Because the scope of this project will involve large impacts to all aspects of the physical, biological, social and economic environments, an in-depth EIA was necessary to obtain an environmental licence.

Scoping

Once the screening process has taken place, the Colombian government issues terms of reference to carry out the scoping and impact assessment portions of the EIA process. These TOR are issued by the Ministry of the Environment. The TOR are specific to each project and industry. The following link provides the TOR for mining projects in the country (in Spanish).

http://www.anla.gov.co/documentos/normativa/tdr_materiales_construccion.pdf.

Impact Assessment and Mitigation

The impact assessment was undertaken by a multidisciplinary team of consultants that included national and international private consulting firms and public institutions. The environmental baseline was started in 2010 in order to have sufficient quality data for the EIA. There are no protected or especially fragile ecosystems located within the area of influence, nor are there threatened or endangered flora or fauna.

Impact Evaluation Method

Multi-objective Analysis Framework

The impact evaluation process had three steps:

1. Identification of impacts. This includes identifying and defining environmental factors and aspects as well as identifying activities, interactions between activities and environmental factors and differentiating between direct and indirect impacts.
2. Prediction of impacts. This involves classifying impacts by assigning values, justification and elaboration of an impact/activities matrix.
3. Evaluation of impacts. Here a matrix of importance is developed and a general analysis of results from the environmental evaluation and an economic impact evaluation is done.



Potential Project Impacts of the Gramalote Mine

Environment Impacted	Phase	Details
Abiotic	Construction Operation	<p>Air and noise quality: 1) Construction activities will put dust and particles in the air. 2) Major particle emissions will be produced from machinery transporting materials within the mine. 3) Generation of gas emissions from smelting and electro-injection processes in the production facility. 4) Noise pollution.</p> <p>Surface and underground water resources: 1) Use and required availability of water resources for the project will be high. 2) Sediment may be found in surface water during the construction and operation phases. 3) Potential chemical contamination in surface water.</p> <p>Diversion of Guacas Ravine: 1) The ravine will be diverted for 15 years. When exploitation is finished, it will return to its natural flow.</p>
Biotic	Construction	<p>Removal of vegetation: 1) Project does not fall within a protected area, and most of the impact area has already been exploited for economic purposes.</p> <p>Alteration of fauna: 1) Animal habitat may be destroyed from removal of vegetation.</p>
Socio-economic	Construction	<p>Forced displacement of people: This project will inevitably require the forced physical and economic displacement. 173 households currently reside within the area of direct influence. Artisanal mining and agriculture (sugar cane) will need to be moved from the production area. Major emphasis is placed on the District of Providencia.</p>

In Colombia, there are general requirements that must be met for the Diagnostic of Environmental Alternatives. They include: the objectives of the project; a project description; location alternatives; identification of special management issues and social and economic alternatives; a land-use study; comparison of potential environmental and natural resource risks and impacts for the different alternatives; identifying communities and mechanisms used for public participation; selection and justification of the best alternative; and a cost-benefit analysis of alternatives for the environment.

Identification of Alternatives

The criteria laid out to identify alternatives for project impacts include:

- Optimizing the use of natural resources.
- Minimizing the affected area.
- Co-existing with the activities currently taking place within the mining concession title.
- Minimization, reduction and control of environmental impacts using state-of-the-art technologies and innovation.
- Improvement of environmental capital in the region.
- Maximizing the use of residuals or by-products generated from the production process.

Project Alternatives

For this project, environmental, social and health baselines were undertaken to provide the project with insight and data in order to determine what significant impacts the mine may have on the region. These baselines have helped inform alternative scenarios, with and without the potential mining operations.

A: Without the project

In scenario A, within the abiotic environment, cattle ranching and artisanal mining would be the sectors that create the largest impacts in the area, as they both rely on the removal of vegetation for their development. These activities will result in the loss of flora and fauna in the area, making land more susceptible to wind and water erosion. In the biotic environment, both aquatic and terrain



ecosystems will see a similar amount of deterioration. The socioeconomic sphere consists primarily of artisanal mining of subsoil which provides a portion of income for communities; however, they also affect air and water quality. Similarly, the extraction of wood, agriculture, cattle ranching, fishing and hunting are all livelihood strategies that enable locals to maintain a peasant lifestyle; however, these activities can also have an impact on the surrounding natural resources.

B: With the project

In scenario B, infrastructure construction as well as start-up and running equipment will have the highest impact on the abiotic and social environments—in particular, building a tunnel to divert the Guacas ravine and extraction of mineral deposits. In the biotic environment, the largest impact will be seen from construction. This will require removal of vegetative cover, which implies the loss of parts of forest, secondary vegetation or vegetation in transition, and vegetative cover that is substantially rich and diverse. The modification of the natural environment will result in the loss of flora and fauna species, fragmentation of habitats are a concern in for terrestrial environments. Within the aquatic environments, the water supply near various work sites and hydro-biological communities will be affected.

Water is of particular concern in this project because the region receives high rainfall, and surface water contamination from storm water overflow is a concern. Also, the mine requires large quantities of water to function. As the region is highly dependent on water for agriculture, the mine project has considered many alternatives for infrastructure placement in order to minimize impacts on critical water sources.

For the socioeconomic environment, the resettlement, and infrastructure construction phases will generate the most impacts, both positive and negative. In some cases, forced resettlement both physical (communities) and economic (artisanal mining) will have to happen within the scope of the project. The project will also impact this environment by contracting labour, goods and services. It will also affect local health conditions as people migrate to the region for employment. During the operation phase, the largest impacts will be effects from particulate matter, noise and vibrations, especially within the Providencia District. During the decommissioning phase, the largest impacts will be felt in the decrease of employment and funds to the local municipal administration.

Mitigation Measures

As the project will require, affect and take advantage of a large amount of natural resources, the project proponents must provide a list of all the authorization and concessions necessary to support the EIA evaluation, monitoring, management and mitigation measures. The natural resources permits include: water concessions, industrial dumping permits and domestic dumping permits. Additional natural resources used or affected include: use of waterways, construction materials, atmospheric emissions, forest area, lifting bans on endangered species.



Mitigation Measures at the Gramalote Mine

Impact Details	Mitigation Methods	Residual Impact
<p><i>Abiotic</i></p> <p>Air and noise quality: 1) Construction activities will put dust and particles in the air. 2) Major particle emissions will be produced from machinery transporting materials within the mine. 3) Generation of gas emissions from smelting and electro-injection processes in the production facility. 4) Noise pollution.</p> <p>Surface and underground water resources: 1) use and availability of water resources for the project will be high. 2) Sediment may be found in surface water during the construction and operation phases. 3) Potential chemical contamination in surface water.</p> <p>Diversion of Guacas Ravine: 1) The ravine will be diverted for 15 years. When exploitation is finished, it will return to its natural flow.</p>	<ul style="list-style-type: none"> Dust to be controlled using water tank sprayers on dirt roads. Models were developed to create control levels that do not exceed maximum allowable limits as stated by law. On the surface, irrigation with surfactants will control dust. Gas will be controlled with filters and scrubbers to comply with levels of allowable emissions defined in legislation. Models developed will consider all stationary and movable sources that may contribute to increased noise levels. All machinery will be maintained and monitored to ensure it complies with levels set within the model. Efficiency was built into all water use designs including water recirculation. Based on the models, 83% of the water used will be recirculated. Driving, control and sediment treatment systems to keep within legal limits. Quality control models developed to monitor the process and potential for rock acid to drain into the system. There was a low probability of this issue but control and monitoring will still take place. Alternative water sources were considered; waters below the excavation and the San Antonio ravine. Guacas ravine was found to be the best alternative. 	<p><i>Impact Reduction</i></p> <p><i>Impact Reduction</i></p> <p><i>Impact Reduction</i></p> <p><i>Impact Reduction</i></p> <p><i>Impact Reduction</i></p> <p><i>Impact Reduction</i></p> <p><i>Impact Reduction</i></p> <p><i>Impact Reduction</i></p> <p><i>Impact Reduction</i></p>
<p><i>Biotic</i></p> <p>Removal of vegetation: 1) project does not fall within a protected area and most of the impact area has already been exploited for economic purposes.</p> <p>Alteration of fauna: 1) animal habitat may be destroyed from removal of vegetation.</p>	<ul style="list-style-type: none"> Building a rescue and recovery centre to relocate species with low mobility and determining their need for protection in new areas identified. 	<p><i>Improvement:</i> Some fragmented forests still exist. A plan to collect seeds and reforest areas will ensure that impacts larger than those authorized will not occur and will help to preserve native species.</p>
<p>Forced displacement of people: This project will inevitably require the forced physical and economic displacement. 173 households currently reside within the area of direct influence. Artisanal mining and agriculture (sugar cane) will need to be moved from the production area.</p>	<ul style="list-style-type: none"> Move families: a Resettlement Action Plan was developed to guarantee the best conditions possible for those affected. Land acquisition was undertaken using international standards established by the World Bank and IMF. The process includes Restitution for Livelihoods and Family Life plans that will help to 	<p>Compensation plan in place for resettlement outside the direct area of impact.</p>



Impact Details	Mitigation Methods	Residual Impact
	<p>improve living standards from those the displaced currently experience.</p> <ul style="list-style-type: none">• Providencia: Particular attention has been taken for the District of Providencia, as it is situated close to the mine site. Seven studies and models were developed to determine the future health and safety of this community.	

Impact Management

The environmental management plan provides an overarching set of activities aimed to prevent, mitigate and correct any significant impacts—both environmental and social—that may occur as a result of project activities. Each section of the plan can be implemented to allow for an integrated approach during the development of the project so that future impacts and changes to impacts can be forecast for each future stage of the project. Activities focus on the abiotic, biotic and socioeconomic areas of impact.

Environmental Management Plan

Because of the magnitude and impact this project will have on the surrounding environment, the environmental management plan contains a series of specific plans for the biotic (6), abiotic (10) and socioeconomic (13) aspects of the project. The management plan focuses on an integrated approach to all affected elements and will be implemented throughout the lifetime of the project.

Each of the following plans indicates in which stages of development the impacts will occur, the general objective of the plan, the impacts to be monitored, the type of mitigation measure (prevention, mitigation, correction or compensation), specific objectives, parameters for monitoring, methods for sampling and analysis, where the monitoring will occur, how often monitoring will occur, and indicators to be tracked and observations.

The Abiotic Plans:

- Soil management
- Sterile debris and waste management
- Hydrological resource management
- Air resource management
- Solid residue management
- Gas and chemical substance management
- Explosives and volatile materials management
- Signs management
- Landscape management
- Cyanide management

The Biotic Plans:

- Program and protocols for management of wild animal species
- Program for the removal of vegetative cover
- Program to conserve and rescue fish
- Program to restore, rehabilitate and recover impacted areas
- Program to protect and conserve endangered and protected flora and fauna species
- Program for conservation of natural ecosystems and those that offer environmental services

The Social Plans:

- Program for management of awareness, information and public participation
- Program for hiring local labour
- Program to manage contracting of local goods and services



- Program to train and educate the community
- Program to train and educate workers
- Program for resettlement
- Program to assist in public and private institutional management
- Program for land acquisition and easements
- Program to manage migration pressure
- Program for third parties affected by the project
- Program to support cultural patrimony
- Program for preventive health and health promotion
- Archaeological program

Compensation Plan

This plan was developed specifically to compensate for the removal of vegetative cover. It takes into consideration the activities and irreversible impacts of the mine within the area of influence in order to determine what actions should be taken to compensate for the environmental degradation. The compensation strategy applies best practices and financial schemes to pay for use of water resources. According to best practices, compensation for the loss of biodiversity means approximately 3,000 ha of natural area will be conserved. Because the compensation plan only addresses irreversible impacts, all impacts that have been mitigated or corrected are not addressed here.

Decommissioning Plan

The conceptual development for the decommissioning plan was established within the TOR set out by the Ministry of the Environment. This plan will help the project prepare to rehabilitate and recover all areas impacted by the mine project. This will involve dismantling all structures, physical and chemical stabilization and landscape, water and soil rehabilitation. The plan will include the initial decommissioning plan, a progressive decommissioning program, a temporary closing program, a final decommissioning plan and post-decommissioning activities. As per legislation, the plan will be updated every five years to ensure that governmental and company standards are met.

1% Investment Plan

The 1% investment plan required of all large-scale projects in Colombia, established by decree 1900 in 2006. Because this project proposes to revert large amounts of surface water supplies throughout different stages of operations, an investment plan is necessary. Investments must be undertaken within the affected watershed in order to obtain the environmental licence. It is estimated that 11,785 million Colombian pesos (approximately 3.84 million USD) will be invested through this project. The following activities are planned:

- Conservation and restoration of vegetative cover to facilitate natural succession over 21 years.
- Installation of septic tanks in houses that receive their water from the affected water source: 589 families benefit.
- Environmental promotion in line with the national program for Environmental Community Promotion: 21 years, the entire population within the area of direct influence will benefit.

The EIA Report

This EIA report includes the following sections

- Executive Summary
- Company overview
- Geographical orientation of the project including the area of influence
- Description of the project
- Description of the production process
- Environmental Impact including, team overview, social and environmental base line, evaluation method used



- Impacts from the project including an evaluation with and without the project
- Demand of natural resources and renewable natural resources and the environment
- Environmental management plan
- Compensation plan
- Decommissioning plan
- The 1% investment plan
- Chronology for project implementation

Review & Licensing

Colombian environmental law promotes public and private organizations to participate in activities necessary for a company or individual to obtain, modify or cancel an environmental licence. Under the law, authorities must issue an act to start the environmental licensing process which must be published in a bulletin, with updates periodically available and mailed to anyone who wants to receive them. Also, all local indigenous and Afro-descendent communities must be consulted before any decision making about natural resource use.

Public acceptance is an essential factor to the success of the Gramalote mine development project. In order to gain local support and understanding, public participation was planned throughout the lifetime of the project. During the EIA stage of the project, public meetings were held in all affected communities at a number of stages: introduction of the project and baseline data collection, presentation of the baseline data to the community, discussion about the EIA process, workshops to check the baseline data and introduce upcoming environmental and social impact workshops, identification of impacts and control measures with communities within the area of direct influence and finally, workshops to report results of potential impacts back to the community.

Stakeholder engagement

As this project will have a profound impact on the communities living within both the immediate vicinity and the region in general. Stakeholder engagement has been essential to the support of the communities going forward and ultimately to the success of the project. Within the Environmental Impact Assessment there are 13 social plans, a compensation plan, and a 1% investment plan which will all require stakeholder engagement strategies. As this is an ongoing project as of 2015, engagement within the scoping phase of the EIA has thus far focused on education about modern gold mining techniques, benefits of the project, mitigation strategies as well as possible negative impacts and compensation. Some of the stakeholders who have been engaged to date are local citizen groups, local and regional businesses and business associations, commercial enterprises, academic institutions and local and regional governments. Negotiations with 153 artisanal miners successfully formed an agreement to recruit 40 per cent of the group and helped to set up small businesses providing services to the community and the company.

Community investment program

Investment projects in health, education and infrastructure, strengthening economic activities, especially agriculture and animal husbandry practices. Three main projects are currently underway in the area immediately surrounding the project. These projects focus on food security, improved agriculture practices and higher-quality living conditions with a focus on social institutions such as schools, sanitation and health institutions.

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