

VIRTUAL REALITY ANIMATION OF THE PROPOSED EL DORADO MINE IN EL SALVADOR ASSISTS REGULATORS IN REVIEWING AN EIA

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Abstract

An interactive, three-dimensional video animation was developed that provides a fly-over and walk-around view of Pacific Rim Mining Corporation's proposed El Dorado Mine in El Salvador. The mine life-cycle video animation was presented to El Salvador's Environmental Ministry in an educational seminar as part of the EIA review. The 6-minute animated video allowed the reviewing agency to visualize the 10-year mine plan from initial construction through operations, concurrent reclamation and closure. Visually demonstrating the concepts of post-closure beneficial use and sustainable development effectively facilitated and expedited the permitting process through an agency previously unfamiliar with modern mining, closure and reclamation processes.

Introduction

Pacific Rim Mining Corporation is currently in the process of obtaining an environmental permit, which is required before they can begin constructing the El Dorado Mine in El Salvador. The El Dorado Project will be the first commercial-scale underground gold mine in El Salvador in nearly fifty years. The absence of significant commercial mining activities outside of the sand/gravel and limestone/cement sectors has resulted in tremendous permitting challenges within the government and with public relations.

Pacific Rim has adopted a policy of mentoring government officials, community leaders and the general public. As a company committed to compliance with national and international laws and standards, Pacific Rim has found it necessary to implement programs to educate the local El Salvadoran population in matters relating to the current mining industry's construction, operations, closure and reclamation practices and technologies. Programs in place at this time focus on school children,

community leaders and ministry-level national government agencies (the Ministry of Mines and the Ministry of the Environment and Natural Resources).

The communication of basic concepts has been easily achieved through meetings and conversations; however, the Ministries' lack of first-hand experience with any commercial metal mines has resulted in communication problems. The Pacific Rim staff is fluent in Spanish, with years of Latin American experience; hence language is not the problem. The challenge lies in how to show someone what a modern mining operation looks like, when they've never seen one. Due to travel restrictions imposed on ministerial staff members resulting from fallout from recent scandals, visits to working mines with similar ore bodies, mining methods and processing techniques was not an option. Even if travel were permitted, finding mines in various stages of construction, operation and closure in climatic settings similar to those experienced locally is no small task.

The increasing complexity of finding solutions to the communicational challenges is demonstrated through the following brief examples.

Example # 1 – Exploration Permitting

The El Salvadoran mining law erroneously presumes that exploration and operations are mutually exclusive activities, with the first being completed before the latter begins. The issue became apparent when Pacific Rim first opened discussions related to the preparation of the Environmental Impact Study (EIS) for the project. The official government response was that Pacific Rim would not be allowed to submit an EIS for the project until the exploration program and related environmental activities had been satisfactorily completed.

During the course of a meeting held in the government offices, the company was able to demonstrate that it is not reasonable to expect that any company is going to dedicate the resources required to completely explore 75 km² prior to initiating. A simple project development timeline with a theoretical reserve base was

prepared to demonstrate the current practice of maintaining 5+ years of reserves for an operating project of the size contemplated. With this simple graphical tool, mutual understanding was achieved and the issue was resolved.

Example # 2 – Underground Pre-Production Development

The mining law proclaims that once an exploration license has been converted to an exploitation concession, the concession holder must advance the project toward commercialization within one year. Early discussions quickly revealed that the expectations for commencement of commercial production were not attainable – simply stated, it would be impossible to develop 2,400 meters of decline and subsequent horizontal development drifts in the period of time contemplated.

With the help of three-dimensional displays generated by McIntosh Engineering Inc. using Vulcan mine planning software, Pacific Rim was able to demonstrate the magnitude of the underground development. The graphical presentation coupled with a technical description of the development process quickly led to understanding of the time constraints and the necessary concessions related thereto.

Example # 3 – Process Plant and Tailings Storage Facility Layout

In February, 2004 Pacific Rim held nine public consultations to explain the basic tenants of the project and solicit feedback, especially the public's concerns that should be incorporated into the EIS. While modern mining practices are not locally understood, photos taken at various underground mines in North and South America were used to explain the unit operations and provide illustrations of what is contemplated. The process area proved to be more challenging. Photographs used in these initial meetings were taken at operations with process facilities or operational challenges similar to those proposed for El Dorado (Andacollo Gold, La Camorra and El Peñon mines in South America and the Ken Snyder Mine in North America). In several cases the comparatively stark background (northern-central Chile, the Atacama Desert, and northern central Nevada) created some powerful misconceptions. One of the conclusions drawn by the general public was that the lack of vegetation was a result of the mining operation. Immediately it was apparent that we needed to visually demonstrate the impacts of a process plant and tailings facility in their proposed locations.

Vector Colorado, LLC (Vector) and Mine & Mill Engineering (MME) were already working on tailings impoundment and process plant designs respectively. Pacific Rim's staff in El Salvador used general site

layouts provided by Vector and MME to create a General Facilities Arrangement (GFA) drawing for the project. The GFA was used in the formal presentation required to enter the project into the environmental permitting process with MARN. It was soon apparent that even well-conceived engineering plans are not readily understandable by all engineers.

It was at this point that Vector proposed the use of technology that had not yet been contemplated. Vector demonstrated a simple animated simulation that they had developed previously to demonstrate a tailings dam expansion. With a simple vision, Vector and Pacific Rim laid the ground-work for the production of an animated video that would demonstrate the construction process, life of operations and closure and reclamation. It was agreed that the animation would need to be presented in a form that would be easily understandable and that the features would need to be easily recognizable by the local community.

Animation Production

The initial step was to define the battery limits for the animation, which included all of the area potentially impacted by the project. All of the facilities for the El Dorado project are located in close proximity to one another and comprise a Project Area (PA) of approximately 125 hectares. Next, a project chronogram or timeline was developed, which identified the chronologic development of the mine facilities. Key viewpoints were then established to provide the viewer a thorough observation of all of the facilities with respect to the local landscape. Finally, a level of detail for buildings and infrastructure was determined as well as color schemes and scene labels. Following the establishment of these initial criteria the animation went into production.

Vector utilized readily available project engineering design drawings, data and information, as well as specific graphics and animation software programs to generate the animation, including

- Digital 1-meter topographic mapping of the project site,
- Color aerial photographs of the project site,
- Autocad design drawing files of the process plant facilities, and site infrastructure
- Autocad design drawing files of the tailings impoundment facility,
- Autodesk Land Desktop with Civil Design (Autodesk)
- 3D Max (Discreet)
- Combustion (Discreet)
- Photoshop (Adobe)

Using the 1-meter topographic mapping, Vector created TIN (triangular integrated network) digital terrain models (DTM) of the PA. Recent aerial photographs were then used to texture the DTMs to create an exact geophysical replication of the PA.

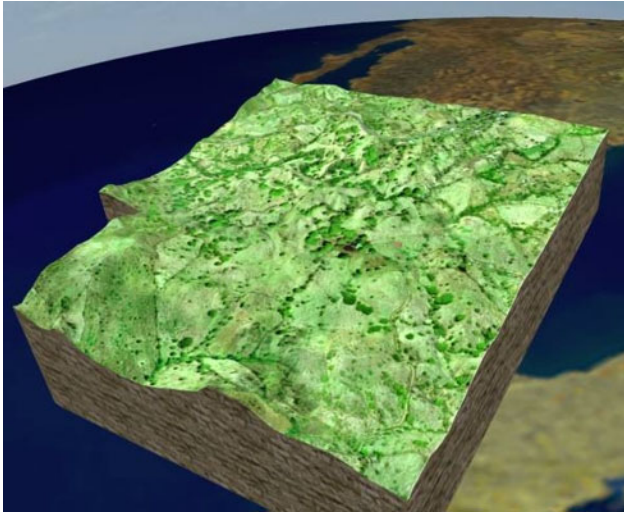


Figure 1. Digital terrain model of project area.

Following the chronologic order of events, access roads, building foundations and pre-construction infrastructure were then animated.



Figure 2. Infrastructure development.

The initial stage of tailings dam construction is shown next.



Figure 3. Tailings dam construction.

AutoCAD drawing files were then used to animate the plant facilities, administrative buildings and infrastructure. Geometric objects were textured, painted and assembled to build the process plant facilities, crushing circuit and administrative buildings.

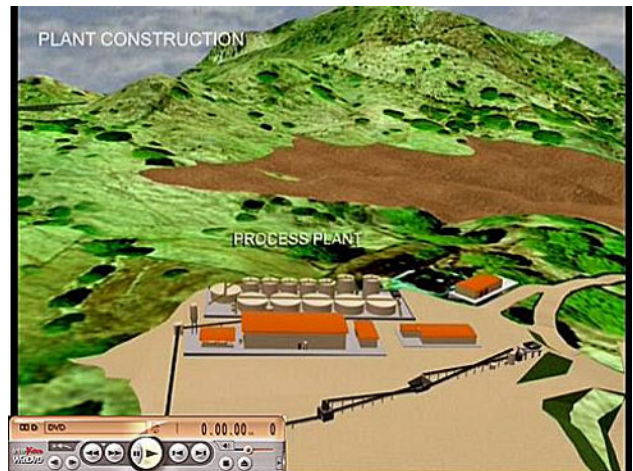


Figure 4. Process plant.

Following the completed construction of the tailings dam, the impoundment basin was shown lined with an HDPE geomembrane. Throughout the animation different lighting techniques were incorporated, which provided realistic reflections and shadows.



Figure 5. Impoundment liner.

A plant “walk-through” allows the viewer to get “up close and personal” with the operations.



Figure 6. Plant walk-through.



Figure 7. Plant walk-through.

One of the most important messages that the animation conveyed was the concept of site reclamation and sustainable development. The animation clearly demonstrated that a “progressive reclamation plan” would be implemented before the mine completed operations. Figure 8 shows a tailings cover being placed during the mines later years of operation.



Figure 8. Closure cover on tailings impoundment.

Decommissioning the mine includes the dismantling of buildings; and sealing and re-contouring of the mine portal.

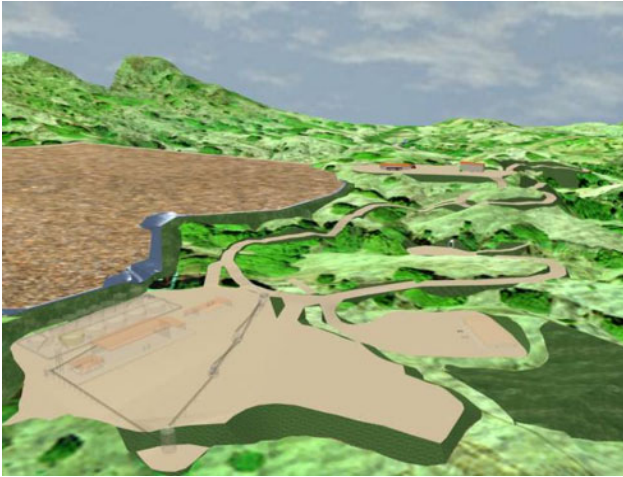


Figure 9. Mine decommissioning.

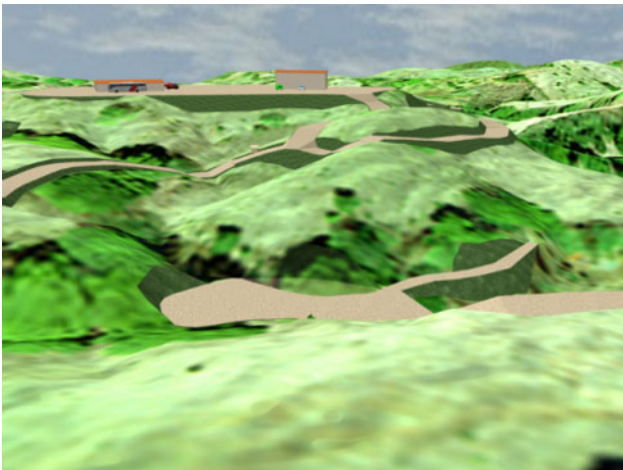


Figure 10. Recontouring portal.

Sustainable development is demonstrated to the audience by showing that the reclamation plan will return the site to a condition that would continue to provide a beneficial use to the communities following the cessation of mining. Figure 11 shows the post-closure site following re-vegetation.

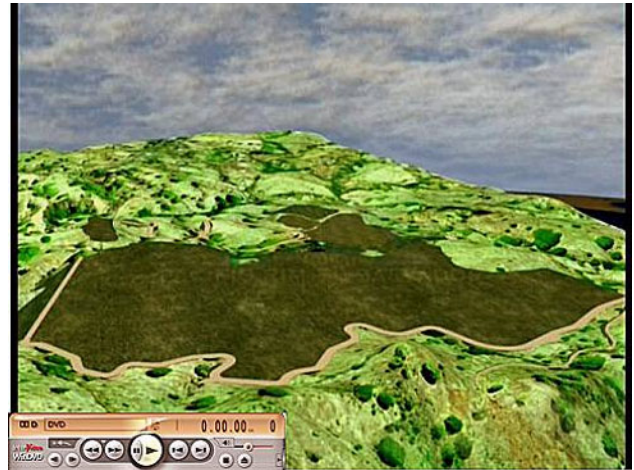


Figure 11. Post closure condition.

Summary

Vector Colorado, LLC. produced a virtual reality mine life-cycle animation showing the development of Pacific Rim Mining Corporation's proposed El Dorado Gold Mine in El Salvador. The 6-minute animation allowed El Salvador's Ministry of Mines, Ministry of the Environment, NGO's and the El Salvadoran public to visually experience mining operation being proposed. This was a critical step in the EIA review process because neither the reviewing agencies nor the El Salvadoran public are familiar with modern mining methods.

The mine life-cycle animation was shown in training seminars conducted for the reviewing agencies and in public meetings during the EIA comment period. Pacific Rim's animation provided a very simple, yet graphically accurate, demonstration of the 10-year mine life beginning with current geophysical conditions and progressing through mine construction, operations, closure and reclamation. Not only did the animation educate the public and agencies as to what the mining operation would look like, it also effectively demonstrated the concepts of "progressive reclamation", "post closure beneficial use" and "sustainable development"; and was instrumental in expediting the EIA review and permitting process.