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ENVIRONMENTAL EXCELLENCE IN EXPLORATION AT TAMBOGRANDE

Rick Allan[1], Rob Marsland[2] and Jose Luis Vega[3]

1. Manhattan Minerals Corp., Suite 350, 885 Dunsmuir St, Vancouver, BC V6C 1N5
2. Klohn Crippen Consultants Ltd., Suite 202, 542 Baker St, Nelson, BC V1L 4H9
3. Manhattan Sechura Compania Minera S.A., Piura, Peru

ABSTRACT

This paper describes the approach taken during exploration activities to minimize environmental impacts and maximize social benefits to the local communities as the first step in implementing a program of sustainable development and environmental stewardship for the Tambogrande Project in Peru. This included providing lined sumps to collect drill water, revegetation of drill sites and hiring local residents to provide support for the drilling program.

INTRODUCTION

This paper describes the approach taken by Manhattan Minerals during exploration activities, to minimize environmental impacts and maximize social benefits to the local communities, as the first step in implementing a program of sustainable development and environmental stewardship for the Tambogrande Project in northern Peru. While this work was undertaken well before the initiation of the E3 program currently under development, many of the practices contained within it were applied.

E3

In August 2001, the Prospectors and Developers Association of Canada (PDAC) launched the ***Environmental Excellence in Exploration*** (E3) project, ..."driven by the recognition that the minerals industry can only maintain its long term viability by ensuring its continued access to lands to explore for, and develop, new mines. Widespread implementation of sound environmental management practices by the exploration community and improved education and understanding of that by stakeholders will help substantially in accomplishing this, and E3 is designed to meet these needs. Exploration crews are now viewed as ambassadors for the global mining community. Their performance in managing the environmental aspects of an exploration program can demonstrate a commitment on the part of the international mining sector to environmentally responsible exploration and mining. We have all observed that failure to behave responsibly can alienate local residents, encourage anti-mining NGOs and jeopardize development." (Westoll, 2002)

Historical Background

Manhattan Minerals Corporation, a junior mining exploration company with its head office in Vancouver, Canada and traded on the Toronto Stock Exchange, has been an active exploration company in Latin America since 1990. In 1997, the Company began geophysical survey work in the lightly explored coastal region of northern Peru, in the Department of Piura and more specifically in the District of Tambogrande. In 1999, Manhattan and the Peruvian government signed an agreement that gave Manhattan the rights to earn a majority interest in the mineral rights to 10 concessions covering 10,000 hectares of land surrounding the Town of Tambogrande. In addition, Manhattan controls a further 80,800 hectares of exploration concessions in the region.

A drilling program was conducted on the TGI deposit in 1999 and 2000, as well as on a number of other geophysical anomalies. A probable mineral reserve at TGI has been identified consisting of 8 Mt of gold ore grading 3.5 g/t Au and 67 g/t Ag; plus 49 Mt of sulphide ore grading 1.6% Cu and 1.0% Zn with minor Au and Ag. Base metal rich sulphides were encountered at 6 of the 9 targets, but insufficient drilling has been conducted to establish a mineral reserve other than for the TGI deposit.

Site Conditions

The town of Tambogrande is located in approximately the center of the concession area. The town is located on the north shore (right bank) of the Piura River and covers a small rocky knoll. The town is served by paved highways from the west and north and a gravel road to the east. Driving distance from Piura, the regional capital, to the town of Tambogrande is approximately 75 km. The area south of the Piura River is accessible from an older paved highway through a network of poorly developed roads. There are no permanent bridges across the Piura River in the vicinity of the concession area. Areas to the south of Tambogrande are also served during wet periods by a makeshift ferry system allowing persons with light loads to cross the Piura River at Tambogrande and, during the dry season, by a small hand built wooden bridge.

The area north of the river is mostly cultivated and irrigated from the San Lorenzo reservoir to the north. A number of small creeks and irrigation canals empty into the Piura River in the vicinity of Tambogrande.

The climate in the District of Tambogrande is classified as moderately humid and warm with the median annual temperature approximately 25 C. The most extraordinary facet of the local climate is the influence of the El Nino phenomena. The median annual precipitation is about 150 mm but El Nino has caused

annual rainfall at high as 4,400 mm. The evaporation in Tambogrande is estimated to be about 1,600 mm and the relative humidity, 65 %, with little variation throughout the year. The average annual hours of sun per day are about 6.5 h/day, again with little variation. In the afternoons (around 4pm) there are often whirlwind type winds, which raise large quantities of dust. The force and volume of these winds can be significant. These winds drop by around 8 pm.

The Piura River varies commensurately with the rainfall, with low flows less than 0.5 m3/s and peak, El Nino flows of 3,400 m3/s.

The Tambogrande Project is located in the Dry Equatorial Forest Eco-Region, which is noted for its relatively flat relief, warm dry climate and exposure to extreme variations in precipitation. This last factor is a strong determinant in the flora and fauna that can be identified at any one time. The project is located in an area with alternating patches of low density forest and savanna dominated by Algarrobo *(Prosopis spp.)* (known as Mesquite in the southern USA) and overo *(Cordia spp.).* Also present, to a lesser degree, are dense forest, matorral (heath-shrub) and riparian communities. No threatened or endangered flora species included on the current list (D.S. 158-77-AG) were identified within the exploration area. One species of Algarrobo *(Prosopis pallida)* that was found in the study area is included on a proposed revised list.

Town of Tambogrande

The town of Tambogrande (pop. 16,000) is the capital of the district and its largest town. While the town has existed since pre-Inca times, it was only in the early 1960s when extensive irrigation was introduced that agricultural development could take place on any commercial scale. The town began to grow and accommodate the needs of the agriculture industry. Approximately 75% of the economic activity in the region is related to agriculture.

San Lorenzo Irrigation District

The San Lorenzo Reservoir is approximately 30 km northeast of Tambogrande. This reservoir feeds an extensive irrigation network to the south and west. Crops in the immediate area of the reservoir are primarily rice, while a wide variety of crops; including corn, citrus, mangos and bananas predominate further south. Farmlands are largely privately held, ranging in size from small family plots to larger more commercial scale operations

Communities of Locuto and Tavera

South of the Piura River, on the left bank, is the campesino (peasant) communities of Locuto and Tavera. This land is primarily community owned, with subsistence based agriculture and some forest production. The land is used for grazing of goats, sheep and cattle. Cultivation is seasonal (except for those areas adjacent to the river) during the rainy season, with crops of corn and beans.

ENVIRONMENTAL ASPECTS OF DRILL PROGRAM

The drilling program generally falls into three categories: drilling in the streets of the town; drilling in the flood plain of Quebrada Carneros or the Piura River; or drilling in the dry forest land south of the river. Nevertheless, the environmental issues are relatively consistent:

- site clearing for drill pad construction and site access;
- provision of drill water;
- disposal of drill return water and drill mud;
- noise, and;
- the potential for spills of fuel and drill residues.

To minimize environmental impacts, extensive environmental management planning was conducted and an environmental assessment was prepared and submitted to the Peruvian Ministry of Energy and Mines (MEM). All drilling was carried out in keeping with the "Guia Ambiental Para Actividades de Exploración de Yacimientos Minerales en el Perú" prepared by the MEM (1995).

To minimize the impacts on the total of 12 ha of site clearing that was required, temporary drill access roads were be located, to the extent practical, with the advice of the resident farmers, to minimize the disturbance to their lands and crops. Road widths were typically less than 3 m. Drill site pads were also located with the assistance of the resident farmers, to minimize land and crop disturbance. Typical drill sites occupied an area 25 m by 25 m. Upon completion of drilling at each drill pad, outside town, the area was reclaimed. Where new roads had been developed, and this road access is desired by the community (or land users), and they agree to on-going maintenance, the roads were left in a serviceable condition for the community. Elsewhere, road surfaces were be scraped or loosened to reduce compaction, if required. All places where drilling has occurred were also be rehabilitated, returning them to near original use, whenever possible. In areas south of the river this included revegetation with native

or agricultural species where practical. Fertilizer, in the form of manure was applied in areas where soils were naturally depleted in organic matter and nutrients, e.g., areas above river flood level that had been heavily grazed in the past, to provide a more resilient growth media for revegetation.

Drill water was obtained from sources not otherwise used by the locals to avoid placing any incremental demand. For the most part, drill water was taken from the Piura River and either pumped or hauled by small tanker truck to the drill site. Approximately 5000 L/d of make-up water was required to supplement the water recovered from drill return. The river water typically had elevated levels of fecal coliform that rendered the water unsuitable for human consumption as drinking water but was still acceptable for drilling purposes.

Outside town, drill mud sumps were excavated into the overburden sands. These were lined with a layer of pwedered lime covered with 8 mil polypropylene liner to reduce water loss and minimize potential for contamination of near surface solids with drill cuttings. The drill return water containing high concentrations of suspended solids (drill cuttings and additives such as bentonitic mud) was passed through a small clarifier located at the drill rig. This facilitated reclaim of clarified water for re-use in drilling. The thickened underflow was discharged by gravity to the sump where it was allowed to consolidate and the unrecoverable water was allowed to evaporate. If the drill sump was located within the active floodplain of the river, the drill solids were subsequently excavated out and transported to a central disposal site. These remote drill mud sites were used for the drill mud collected in town as well. After thickening the drill cutting, the solids were collected in a holding tank and hauled daily to a temporary evaporation pond outside town. The drill mud disposal sites outside of town and above the floodplain were reclaimed by covering the dried drill mud with a layer of powdered lime and wrapping the polypropylene liner over the top then covering it with the excavated overburden in a layer at least 0.5 m thick and up to 2 m thick, and graded to match the local contour. This surface was then revegetated with native or agricultural species. At some sites manure was added to improve moisture retention and provide some fertalization. The end result was that at the drill sites and at the drill mud disposal sites, no drill cuttings or other residues were left exposed on surface and the sites were restored to as close to their original condition as possible.

To mitigate noise impacts only certain types of drills were used within 100 m of any human habitation. Specifically, in town, for the most part only the quieter hydraulic rigs were used or a specially acoustically insulated Longyear 38 or 44, while outside of town the more powerful Longyear Super 38

was used. The drills in town were muffled and shielded to reduce the sound levels as much as practical. Similarly, drilling activity in town was limited to approximately 10 h per day while 24 h drilling was used elsewhere when appropriate.

To ensure that there were no adverse effects from spills of diesel fuel, hydraulic fluid, lubricants or drill return water, etc., a detailed Spill Contingency Plan was prepared. This was submitted as part of the EA document and was included as part of the contractual requirements of the drilling contractor and their sub-contractors. The contingency plan included contact information and spill reporting requirements, including reportable quantities for different materials and receptors (e.g., land or surface water). It obligated the drill contractor to provide appropriate spill clean-up equipment and provide training to the drill crews in their application. Worker health and safety training was a prerequisite for all drill crew staff, including first aid and environmental awareness, and refresher classes were held every 30 days during drilling. Community representatives, as identified in the next section, were included in the reporting requirements, providing local accountability for the drill operators.

SOCIAL ASPECTS OF DRILL PROGRAM

Manhattan began its community relations program at the time of its first work in the area, a geophysical survey in the cooperative lands to the south of the Piura River, in 1997. In order to facilitate this work, meetings were held with local residents in the communities explaining the work to be done, the rights of the communities, to discuss the benefits to be received and to listen to concerns.

These initial meetings developed into the formation of Community Consultation Committees (CCC) with the communities of Locuto and Tavara. The CCCs became a successful approach to dealing with local concerns. Through these committees, Manhattan successfully negotiated land access and community benefit agreements with people who were initially very distrustful of the Company. These Exploration Access and Community Benefits Agreements gave Manhattan the right to explore and in return defined a list of benefits that would be provided as compensation. The agreements gave both parties greater certainty over the legal rights and obligations governing Manhattan's exploration activities.

The CCCs provided an effective information and communications venue and liaison process that is proving effective in maintaining open communications in the region.

To support the process of drilling within the town of Tambogrande, drilling was divided into blocks, with each street having a block captain. Employment was provided to all interested residents in the block in accordance to their abilities and experience.

Sustainable Development

Manhattan understands that mining and agriculture can coexist and thrive together in the District of Tambogrande. It will however, require a coordinated effort to achieve this end and involve Manhattan, local, regional, and the national Government and most importantly, the participation of the local community. The interests and concerns of all citizens in the District need to be represented and they must have the ability to participate in the dialogue and discuss the proposals to integrate and develop a mine in the District. Each participant must be objective in the pursuit of reaching a complete understanding of the mining project being proposed.

Manhattan is committed to applying the principles of sustainable development in any future proposal to develop a mine in the District. In planning, the Company intends that the development and operation of a new mine will contribute to long term regional economic development while providing the people of Peru with taxation and royalty revenues and delivering a return to Manhattan shareholders. Utilizing the consultation process with the communities and Government, the Company will continue to understand the development opportunities the people see for themselves and then work to ensure that a future mine will meet the needs of the communities for a fully integrated and sustainable development.

To date, some of the community benefits derived from Manhattan's exploration program have helped set the stage for sustainability, for example:

- Drilling and equipping water wells in the Comunidades Campesinos of Locuto and Tavara. This provides a long-term alternative to using untreated river water as drinking supply, providing long term health benefits to these communities.
- Distribution of building materials for home improvements. This will help these homeowners better weather future El Nino events.
- Creating a building training program for house construction skills.
- Construction of schoolrooms and community centers in each of the main rural areas.
- Construction and financial assistance for health clinics, focusing on treatment for women, children, and elderly people. The Tavara clinic serves 3,000 people.

- Assistance in a campaign of awareness and control of malaria. Reducing the incidence of this debilitating disease improves the economic productivity of the workforce.

- Purchase and distribution of drugs and medical supplies to rural communities. There are long term benefits which result from treatment and control of medical conditions.

- Funded a program by volunteer plastic surgeons from Lima to correct facial deformities of some local children, helping them to have a better quality of life for many years to come.

- Provided school supplies program for 6000 students in rural areas.

- Setup and operated an adult literacy program.

- Sponsored a pre-university academy to train students for entrance exams in cooperation with the National University in Piura.

- Provided summer school programs in Tambogrande for 1000 children in 1999 and 2000.

- Funded a sewing school and also a bakery school for 40 women (each program) from Tambogrande.

- Introduced government assistance to provide advice and assistance to farmers to export products beyond the local region.

- Developed a cooperation agreement with the Tambogrande Municipality and PROMPYME for the support of small local enterprises and micro-enterprises. The program is designed to train local people to identify and implement new business activities and take advantage of the district's large economic potential as regards to both mining and agribusiness development.

MONITORING

During the drilling program and following site reclamation a comprehensive monitoring program has been conducted. Prior to initiating any drilling, and to support the preparation of an Environmental Assessment, an overview of existing site conditions was made to identify any potential sensitive receptors (e.g., endangered species). During drilling, drill return water quality was monitored regularly and samples of the drill cuttings were taken. The environmental baseline studies to support the full project environmental impact assessment were initiated simultaneously with the start of the drill program. Baseline monitoring will continue until project construction commences or Manhattan drops their option.

Drill return water quality was found to be quite comparable to river water quality at the time of year of testing. The Piura River water quality varies considerably through the year corresponding with the river flow. However, monitoring did not show any significant increase in dissolved heavy metals, despite drilling through ore grade mineralization containing in excess of 1% copper and zinc.

Drill cuttings were also tested, and when drilling through ore mineralization, did exhibit elevated levels of heavy metals. It should be noted that of the 70,000 m of drilling, only two-thirds would be through material containing anomalous concentrations of heavy metals. As a consequence of the presence of heavy metals, the procedure for interring the small quantity of drill cuttings produced was justified.

MINE DEVELOPMENT PLANS

At the time of writing, the feasibility study for the development of the TGI ore body at Tambogrande is nearly complete. The Environmental Impact Assessment will be concluded shortly. The mine development concept is to construct a 7,500 tpd gold mill to first process a gold rich oxide deposit which overlies the base metal sulphide deposit. After 3 years of operation, a 20,000 tpd sulphide flotation mill would be brought on line. Tailings and potentially acid generating waste rock will be stored in a double-lined tailings impoundment in order to keep them saturated in perpetuity. On mine closure, the open pit will be flooded by the Piura Rive, resulting in gradual infilling of the pit with river sediment. It is expected that the mine can be developed, operated and closed with minimal environmental impact and great social benefit to the local communities. The same care in environmental management planning and implementation adopted for the exploration stage has been used for the EIA and will continue through mine construction and operation.

CONCLUSIONS

The exploration drilling at Tambogrande has been conducted in a manner that has resulted in no significant impacts to the area. This sets the stage for responsible mine development and clearly demonstrates Manhattan's corporate goodwill.