REPORT

METALKOL ROAN TAILINGS RECLAMATION PROJECT: ENVIRONMENTAL IMPACT STUDY EXECUTIVE SUMMARY

METALKOL SA

Submitted to:

ERG Africa

Submitted by:

Golder Associates Africa (Pty) Ltd.

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[1] The present document is the executive summary of an existing document and therefore may not reflect the status at time of writing

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1.0 INTRODUCTION

The Metalkol Roan Tailings Reclamation (RTR) Project will entail the reclamation of fine-grained copper and cobalt bearing tailings from the Kingamyambo tailings dam and Musonoi/Kasobantu River valley upstream of the Kasobantu Dam and processing of these tailings to extract copper and cobalt metal.

The project once operational will entail the reprocessing of existing tailings deposited by previous mining operations. The project aims to retrieve the tailings through a hydrometallurgical process. Approximately 100 Mt of tailings material will be mined over the 14-year life of mine and processed through the RTR plant, producing an estimated 1.4 Mt of copper cathode over this period. These tailings contain copper and cobalt at an average grade of 1.49% copper and 0.32% cobalt. The extraction of the residual metals will be by a leaching process followed by solvent extraction (SX) and electro-winning (EW) to produce cathode copper and cobalt hydroxide. The tailings from the Kingamyambo tailings dam will be reclaimed by hydro-sluicing, while the Musonoi River/Kasobantu tailings dam will be reclaimed by dredging using cutter head suction dredges mounted on either dredge barges or amphibious excavators.

The tailings mined from both sites will then be transferred to the processing plant as a slurry via a pipeline and pumping. Waste products, or residue, will be pumped to the purpose-built residue storage facility (RSF) for permanent disposal. After the completion of operations, and decommissioning, the closure plan will be put into effect with the rehabilitation of the project area. Note that rehabilitation will start during the life of mine when possible.

1.1 Proponent

The Metalkol RTR project is located in the Territory of Mutshatsha, Lualaba Province of the DRC. It is approximately 5 km northwest of the city of Kolwezi. The location is shown in Figure 1.

The RTR project is wholly owned by Metalkol SA (Metalkol), a subsidiary of ERG Congo BV, a Dutch company, registered with the Amsterdam Chamber of Commerce, and with a registered office at No. 8 Jan Luijkenstraat, 1071CM Amsterdam, Netherlands. Metalkol is a DRC registered company (N°441/047).

The RTR project is held under Permis d'Exploitation des Rejets des Mines (PER) 652 (or "the Permit") which is a tailings mining permit. PER 652 covers an area of approximately 66.7 km2 and was acquired by Metalkol on December 5, 2009 (ceded by La Générale des Carrières et des Mines (Gécamines) to Metalkol SA).

Table 1 below presents the name and contact details of the project developer.

Table 1: Name and contact details of the project developer

Name of Project Developer	Metalkol SA
Contact Details	No. 238, Route Likasi, Common Appendix to Lubumbashi, in Katanga Province, Democratic Republic of Congo.
Business and National Identification Number	Registre de Commerce : 8990 Identification Nationale : N°441/047
Owners	ERG Congo BV

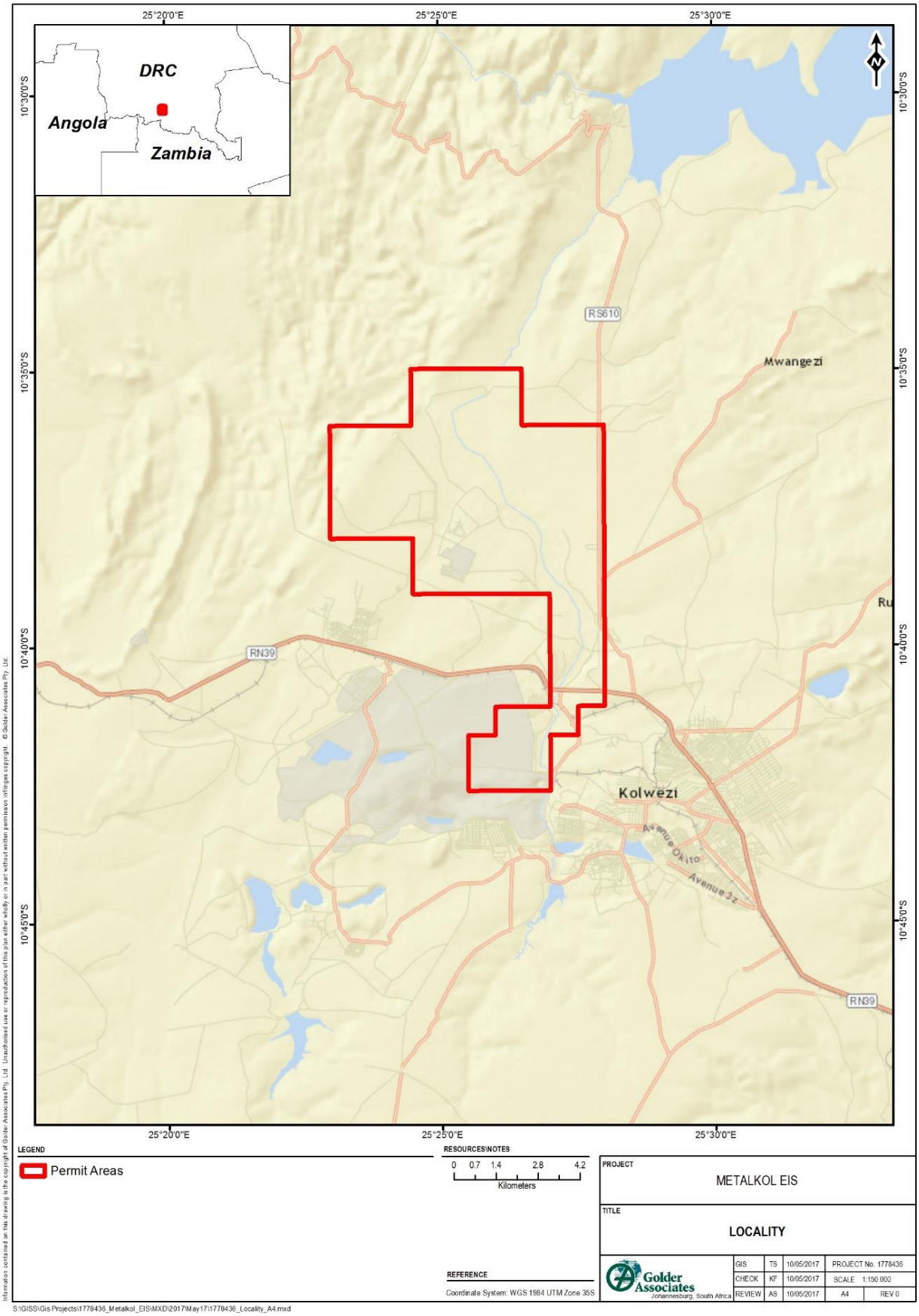

Figure 1: Location of the RTR concession area (Permit Area - PER 652)

1.2 The ESIA Practitioner

Metalkol SA appointed Golder Associates DRC SARL (Golder) to undertake the EIS update for the Metalkol RTR project. Golder is an independent company registered with the DPEM and has no vested interest in Metalkol RTR project.

Golder is an employee-owned, global company specialising in ground engineering and environmental services. From 160 offices worldwide, our nearly 6 000 employees work with clients who want to manage their environmental and engineering activities in a technically sound, economically viable and socially responsible manner.

Golder are responsible for updating the EIS for Metalkol RTR – see Table 2

Table 2: Contact details of Golder

Name	Golder Associates DRC SARL
Contact Details	17, Avenue Okito, Lubumbashi Haut-Katanga Province Democratic Republic of Congo
Business and National Identification Number	RCCM: CD/TRICOM/L'SHI/RCCM: 14-B-1561 ID.NAT.: 6-83-N 85264 K Numéro Impôt: A1006563

2.0 NAME OF THE PROJECT

The name of the project is the Roan Tailings Reclamation (RTR) project.

3.0 PROJECT LOCATION

Metalkol RTR is located approximately 5 km northwest of the city of Kolwezi in the Territory of Mutshatsha, the Sector of Kazembe, Luilu Grouping, in the Lualaba Province of the DRC.

Kolwezi is the provincial capital and principal city of Lualaba Province. The N39 National Highway connects Kolwezi with Mutshatsha and the Angolan border to the west and with Likasi, Lubumbashi and the Zambian border to the east and southeast. The SNCC railway passes through Kolwezi and the PER652 permit area and connects with Likasi, Lubumbashi, and Zambia, though service to the west and the Angolan border has not yet been re-established. The Kolwezi airport receives daily flights connecting to Lubumbashi and occasional charter flights to and from South Africa. There are numerous hospitals and clinics in the Kolwezi area. Numerous primary and secondary schools and a university serve the population.

Figure 2 is a general location map showing the project location in relation to nearby communities, adjacent mines, the city of Kolwezi and Lac Nzilo to the North-east.

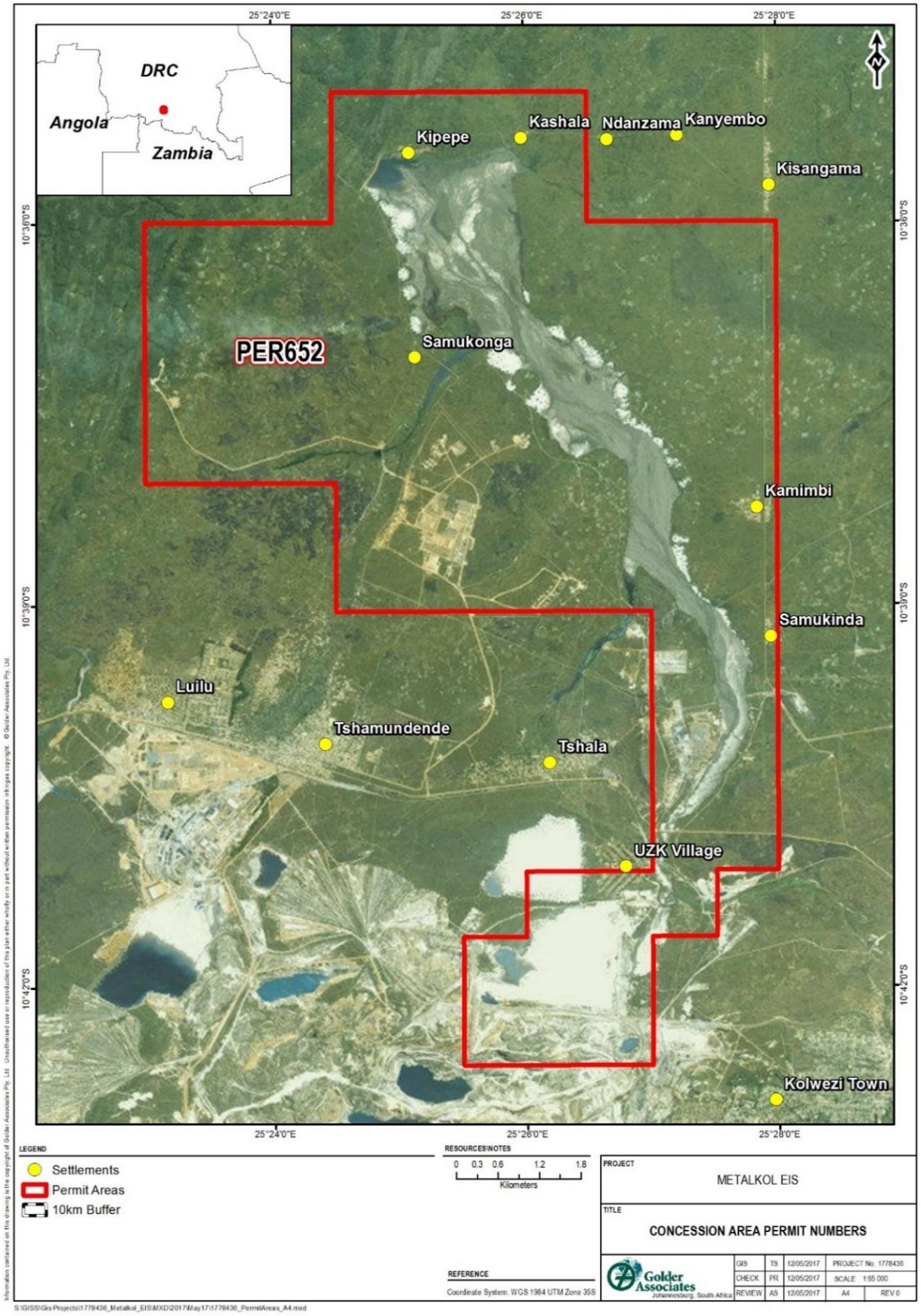

Figure 2: Location of the RTR project (PER652 permit or concession area)

3.1 Legal Framework

In developing the EIS Update for the RTR project, the Environment and Social Impact Assessment (ESIA) and Environmental Management Plan for the Project (EMPP), conditions, substantive and technical environmental standards as defined in Annex IX of Decree No. 038/2003 of 26 March 2003, and the IFC Performance Standards have been followed.

3.2 ESIA Process

3.2.1 Stages in the Development of the Environmental Impact Study

During the preparation of the updated EIS for the RTR project, the framework of the Directive on Environmental Impact Assessment as set out in Annex IX of the Mining Code (2003) was followed. This includes eight major titles of Annex IX of the DRC Mining Code; namely:

- Awareness of the EIA directive when developing an ESIA / EMPP;
- Presentation of the project;
- Analysis of the environmental system affected by the project;
- Analysis of the impacts of operations on the environment;
- Program of mitigation and rehabilitation measures;
- Detailed budget and financial plan for the mitigation and rehabilitation program and the financial guarantee for the environmental rehabilitation;
- Public consultation during the preparation of the EIS and sustainable development plan; and
- Conformity certification.

The previous EIS was approved by the Department for the Protection of the Mining Environment (DPEM) in 2014, and as per the mining code, an EIS is required to be updated every 5 years and/or if there is to be a significant change to the project description. This document presents a summary of the latest update of the RTR project's EIS. It includes an ESIA and EMPP, and a summary of public consultations with interested and affected parties. An ESIA was commenced by SRK consulting in 2016 and the current ESIA, while it builds upon the work conducted previously by SRK, Golder undertook a comprehensive and updated ESIA study for this submission.

The license concerned is the *Permis d'Exploitation des Rejets des Mines* (PER) 652. Key changes to the project configuration are the proposal that the annual throughput of the Processing plant which is currently under construction, be increased to 105 kt of copper cathode/yr and 20 kt/y of cobalt as an impure hydroxide salt, with a further consideration to increase this throughput to 122 kt/yr of copper cathode and associated cobalt in 2020.

The objective of this document is to provide a summary of the EIS covering the following activities that were concluded for this most recent EIS update:

- Present the updated description of the RTR project;
- Update the physical, biological and social baseline systems of the RTR project in its current context (a number of baseline studies were undertaken during 2017 to date (social, cultural heritage, health, biodiversity (terrestrial and aquatic ecosystems), noise and vibration, geochemistry, greenhouse gas emissions assessment, soils/land use, radiology, surface water, groundwater and air quality);

- Update the analysis of the physical, biological and socio-economic impacts of the RTR project for all project phases (construction, operations, and decommissioning/closure) against local DRC requirements and aligned IFC performance standards; and
- Based on the updated analysis, revise and update the EMPP which provides suitable mitigation measures for the predicted impacts, in order to reduce negative impacts and enhance positive impacts.

3.2.2 Impact Assessment methodology

To assess impacts on the baseline conditions, an Impact Assessment Matrix has been used which provides a quantitative indication of the severity of an impact prior to and following mitigation. The matrix is based on the requirements outlined by the DRC Mining Code (2003) and international standards, and consists of assessing impacts in terms of **intensity, extent, duration, value of affected component, risk to human population and probability** of occurring. Each feature has an assigned weighting and is determined to have either a negative or positive direction. Once these factors are ranked for each impact, the significance of the impact is defined using the following formula:

SP (significance points) = (Average of Intensity, Extent, Duration, Value of affected component and Risk to the human population) * (Probability)

The maximum value is 25 significance points (SP). The impact significance was then rated as follows:

SP >20	Indicates **Severe** environmental significance/risk	An impact which could influence the decision about whether or not to proceed with the Project regardless of any possible mitigation.
SP 16 – 20	Indicates a **major** environmental significance/risk	An impact or benefit which is sufficiently important to require management and which could have an influence on the decision unless it is mitigated.
SP 9 - 16	Indicates **moderate** environmental significance/risk	An impact or benefit which is sufficiently important to require management and which could have an influence on the decision unless it is mitigated.
SP 4 - 9	Indicates **low** environmental significance/risk	Impacts with little effect and which can be mitigated easily and would be easily absorbed by the environment or human population.
SP <4	Indicates a negligible impact/risk	Impacts with little real effect and which should not have an influence on or require modification of the Project design.

Impacts are then re-assessed and rated following mitigation to determine residual impacts.

During the EIS update process, issues and impacts were identified through professional experience and data analysis, community consultation and by referencing previous environmental assessments and guidance notes as issued by the IFC and World Bank.

After all the impacts were assessed, none of the environmental residual impacts were considered severe and that suitable mitigation measures were devised for the management of project impacts.

4.0 PROJECT DESCRIPTION

4.1 Land and Mining Rights on the Perimeter of the Exploitation Right

No landowners with title deeds have been identified within the perimeter of the RTR permit area (PER 652).

The RTR permit area contains a few small hamlets or villages; namely Samukonga, Kipepa, and Kashala, with a combined population of a couple hundred inhabitants. A Gécamines mine village, UZK, straddles the

concession boundary, and so does Kamimbi both of which have larger populations that run into the thousands. The existing mining infrastructure, Kolwezi town, Gécamines villages and other villages lay largely outside and on the south to the south-west of the RTR permit area. Samukonga village, with an estimated population of 53 persons (in 2017), was found to be in close proximity to the new Residue Storage Facility (RSF) and was needed to be relocated for reasons of health and safety. A Resettlement Action Plan (RAP) was updated in 2018 in alignment with the IFC Performance Standard 5.

The RTR permit area overlaps the surface area of three Mining Rights, these being PE 11600, PE 7044 and PE 652. Under Chapter III, Articles 86 & 87, and Chapter II Articles 28, 29 & 30 of the DRC Mining Code, it is permissible to establish a PER over a PE. The owner of the PE retains all rights to mineral deposits found in the sub-soil while the owner of the PER is granted mining rights to technogenic deposits such as tailings and stockpiles.

5.0 PROJECT RELATED ASPECTS

The RTR project consists of the following key operating components:

- Processing plant (approximately 65 hectares (ha));
- Residue Storage Facility (RSF) (approximately 371 ha);
- Linear infrastructure: railway line, powerlines, roads and slurry pipelines;
- Workshops and lay-down areas; and
- Offices, car park, employee camps, stores and a laboratory.

The RTR project layout and location of the proposed infrastructure are shown in Figure 3.

The copper and cobalt tailings ore will be mined from the Kingamyambo tailings dam using hydrosluicing, or hydraulic monitoring (high-pressure water canon). Ore will be reclaimed from the Musonoi /Kasobantu tailings dam sections using cutter head suction dredges mounted on either dredge barges or amphibious excavators.

The ore will then be transferred to the Processing plant via slurry pipelines and pumping stations. Processing of the tailings is carried out by dewatering of the slurry, addition of raffinate, agitated tank leaching of the tailings ore for copper with solvent extraction (SX) followed by a primary SX-electrowinning (EW) finish, agitated tank leaching for cobalt recovery with subsequent counter current decantation (CCD) followed by a secondary copper SX/iron removal/ uranium removal/cobalt precipitation and filtration and then drying of the cobalt hydroxide precipitate.

The produced tailings or waste from the processing plant will be pumped to the RSF. The RSF starter embankment is 2.4 km by 900 m facility which is designed to contain 112 million tonnes of residue.

As mentioned previously, the original construction of the RTR project started in 2008, as such, the processing plant and associated infrastructure are in a semi-completed condition (approximately 45% construction completed: Ausenco, 2016). This includes the following infrastructure which has already been completed:

- Project Power Supply from Société Nationale d'électricité (SNEL) electricity substation;
- Administration offices;
- Workshops (including the pipeline fabrication workshop);
- Plant access road; and
- Accommodation facilities (Construction camp and Management camp).

Importantly, very little additional infrastructure will be required as a result of the increase in proposed throughputs to 105 and 122 kt/yr respectively, as the original infrastructure design had already incorporated the requirements for potential increases in throughput sometime in the future.

The associated infrastructure that did require modifications or design revisions included:

- The addition of a process water source from the Kasobantu dam;
- Raw water borefield and water supply lines;
- Slurry delivery pipelines to the processing plant;
- RSF starter embankments and pipelines to the RSF; and
- Process water dam and process water return lines to the Processing plant (Ausenco, 2016).

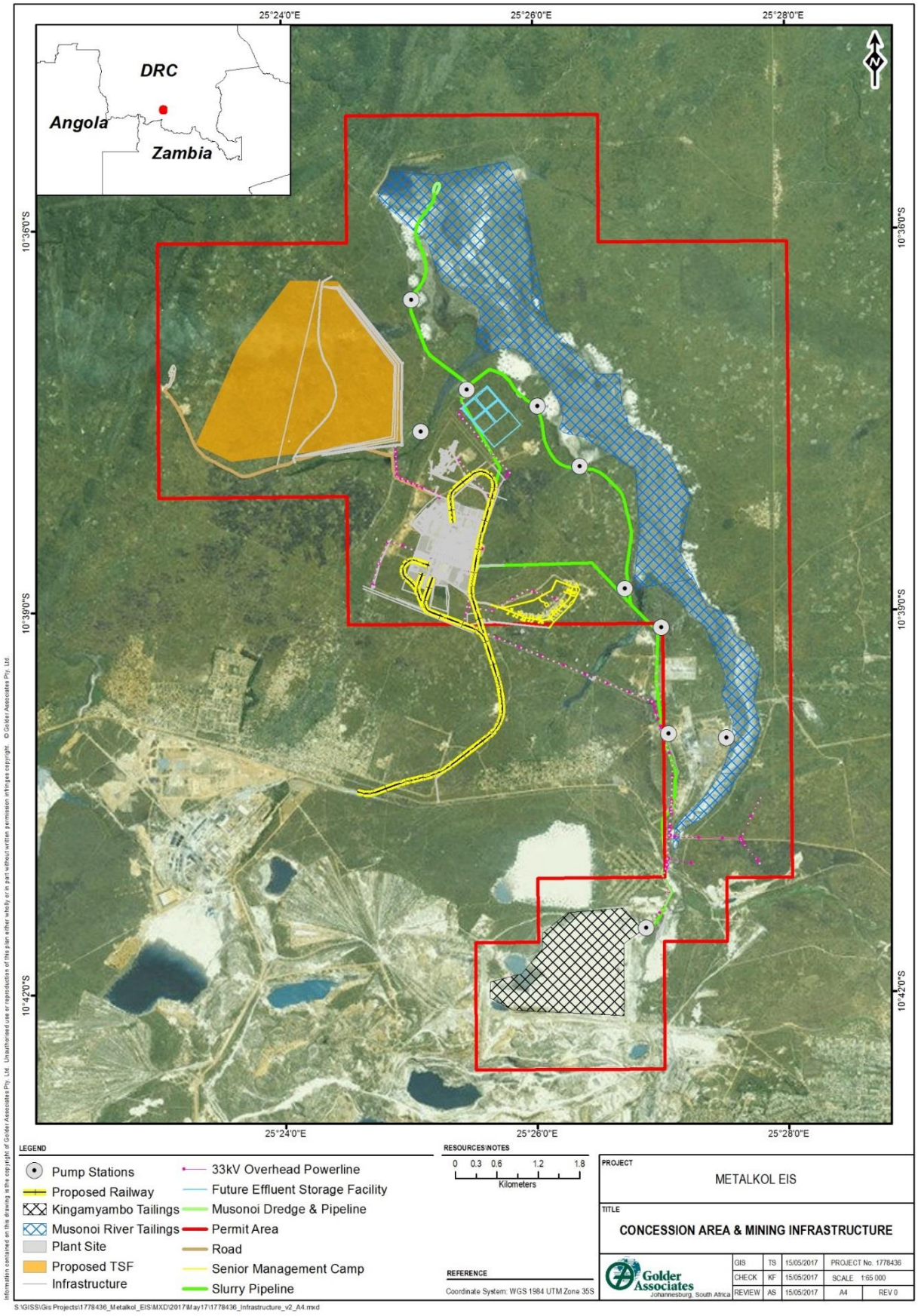

Figure 3: RTR project layout plan

6.0 BASELINE SUMMARY

6.1 Biophysical Environment

The Roan Tailings Reclamation Project is located within the river valley of the Musonoi River and elevations across the site range from 1 475 mamsl in the south to 1 375 mamsl in the north. The margins of the valley are typically gently sloping with slopes between 0.005% and 0.02%. The primary drainage feature is the Musonoi River though numerous tributaries, mostly ephemeral, enter the Musonoi along its' course through the PE652 permit. It is important to note that the entire length of the Musonoi River on the RTR concession is filled with mine tailings from upstream deposition into the river by legacy mining operations that continue to date. The Musonoi River is therefore heavily impacted by these mine tailings.

The surrounding area to the northeast of the permit is gently undulating and largely devoid of trees, having been subjected to slash and burn agricultural practice or charcoal production. The area to the northwest of the project area is lower than the plateau which hosts the Kolwezi area and the RTR project, but the topography of this area is dominated by ranges of hills and valleys, which mark the transition to the Kibarien basement.

The climate within Kolwezi area is semi-equatorial with annual temperatures varying between 16 and 28 degrees Celsius (°C) with the average being 20.2°C. The average rainfall for the area is approximately 1 176 mm per year with periods of extreme precipitation and extreme aridity. The wet season occurs during the months of October to the end of March and a dry season between April and September (Climate-Data.org, 2017).

The RTR project area is located within the Zambezian Phytoregion of the Savanna Biome. The dominant vegetation type that occurred historically within the RTR project area is the Miombo woodlands, which is one of the common vegetation types of the Zambezian Phytoregion. These woodlands are near non-existent through the pressures of rapid urbanisations and human use as a source of wood for fuel, charcoal production, and other purposes. The limited vegetation on the RTR concession is therefore heavily impacted by these anthropogenic influences with only sparse grasses and various invasive or alien species occurring throughout. There are very few trees left on the concession and surrounding areas.

The nutrient-poor status of soils in Miombo woodlands creates a protein-deficient landscape, resulting in generally low levels of herbivory (Byers, 2001) - grazer biomass is roughly 20% of the more fertile savannas. This coupled with a lack of moisture during the long dry season, results in miombo woodlands being locked in a slow nutrient cycle, which, in turn, creates a 'high-carbon' landscape characterised by abundant woody biomass. Two prominent ecological peculiarities arise because of this; firstly, fungal biomass and diversity are appreciably higher than other savannas; and secondly, termites rather than large mammalian herbivores fulfill the role of major landscape engineers through high levels of vegetation consumption and the subsequent creation of small-scale nutrient-hotspots (Byers, 2001).

One important feature within the Katanga Province is the Lac Nzilo, a lake that was designed as a hydroelectric dam on the Lualaba River. Although the Lac Nzilo lake is artificial, it is now considered as an important habitat for aquatic biota and water birds. The Lac Nzilo, together with the RTR Concession falls within the drainage of the larger Upper Lualaba Freshwater Ecoregion (Abell *et al.,* 2008).

Katanga Province has a remarkable habitat heterogeneity and a correspondingly high flora and fauna diversity (Broadley and Cotterill, 2004). Amongst other things, the region has a notable bird richness – five Important Bird Areas (IBAs) have been identified in the province (Birdlife International, 2017; Louette and Hasson, 2011). Three of these are located in southern Katanga Province; namely Upemba National Park (CD017), Kundelungu National Park (CD018) and the Lufira Valley IBA (CD019) (Demey and Louette, 2001). Bird diversity was expected to be lower on the RTR concession due to anthropogenic influences that have modified natural habitat extensively.

An assessment of available satellite imagery and GeoTerraImage (2017) landcover classifications confirms that virtually the entire area comprising the RTR Concession area has been subject to some form of disturbance. The central and southern portions of the concession are dominated by mine infrastructure and are considered transformed. Across the remainder of the concession, woodland habitat over large areas has been modified by a combination of shifting subsistence-agriculture and tree felling for charcoal production. In the east of the concession, cleared woodland habitat is slowly regenerating. Compared to primary woodland, these areas are too dissimilar to be classified as natural habitat, yet they aren't strictly modified either. They have therefore been classified as 'modified/regenerating' habitat. Much of the remaining land to the west of the tailings is actively or has recently been cultivated or felled of trees. These areas are currently classified as 'modified' habitat. Remaining pockets of woodland and wetland areas are considered 'natural' habitat. A delineation of modified and natural habitat, based on GeoTerraImage (2017) land cover mapping, is shown in Figure **4**.

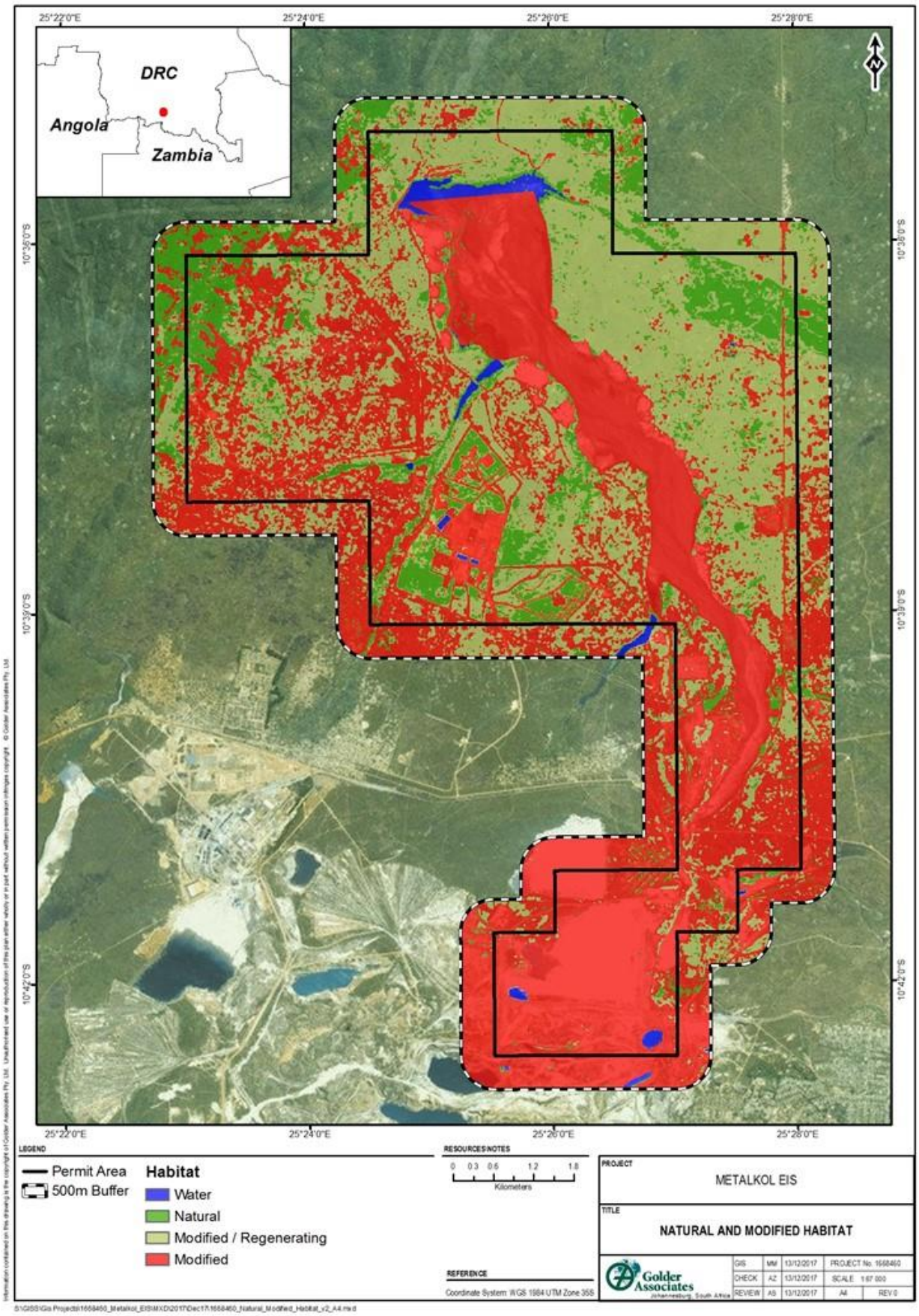

Figure 4: Delineation of natural and modified habitat across the CHAA

6.2 Socio-economic Environment

The RTR project is located in the Lualaba Province (Kolwezi District, Mutshatsha Territory and Lulua and Lufupa sectors) in the southeast of the DRC (Schoeman, 2017). Each province consists of several districts responsible for administrative matters. Government representation is then found at Territory and Sector level. Below sector level, administrative matters are handled by traditional governing systems; each sector consists of a number of Groupings led by chiefs responsible for managing individual village chiefs operating at a grassroots level. Village chiefs are responsible for settling disputes and maintaining peace and harmony in the village, although some matters may be deferred to the Grouping Chief for resolution. Each Grouping also has a *Chef de Terre*, "chief of the land" who is considered the owner of all land.

The RTR permit area includes six villages (Kipepe; Kashala; Samukonga (current village, but the new site is located outside permit area); Kamimbi; Samukinda and UZK Village) and is also located within close proximity of six additional villages (Tshala; Kisangama; Ndanzama; Kanyembo; Luilu; and Tshamundende). The city of Kolwezi is located beyond these villages to the south of the concession.

Social baseline information derived from Focus Group Discussions (FGD) held within each of the villages in and around the permit area as well as interviews and notes were taken during the site visit (Schoeman, 2017) informed the Social Impact Assessment.

With regard to education, the affected communities have a high level of illiteracy or functional illiteracy. It was also indicated by the villagers that the majority of primary school children attend school, although relatively few older children attended secondary school. This is said to be as a result of the costs attached to schooling and the distance of the nearest school from some communities.

The general major health issues within the communities relate to a high reported incidence of malaria, diarrhea (said by villagers to be as a direct result of poor water quality) as well as upper respiratory tract infections, especially during the dry season and attributed to the pervasive presence of dust. This information has been confirmed through the Health Impact Assessment that was part of the ESIA specialist studies carried out.

During the baseline survey and subsequent public consultation rounds, the local Villagers indicated to the assessment team the major issues in the community. This was identified as the lack of formal employment being readily available and that adults often undertake subsistence agricultural activities. Agricultural activities mainly encompass the cultivation of maize, sorghum, cassava, sweet potato, peanuts, and haricot beans. There are household gardens in between each of the homesteads and goats and chickens roam free. There are avocado and mango trees as well as plantain/banana plants. None of the households produce sufficient crops to meet all their food needs at all times and the general consensus was that no-one in the Village had "enough" to eat, with more than 50% of households reported to have a maximum of one meal a day at least for part of the year. At the time of the interviews, villagers further indicated that they do not engage in artisanal mining activities to any major degree, except for the village of Luilu.

During the assessment, the local Villagers also identified areas where they would like assistance in the improvement of their lives through, but not limited to the following ways;

- Provision of improved water supply;
- Employment opportunities;
- Agricultural extension and provision of seed;
- Schools, and
- Health facilities.

ERG continues to engage with local villagers in a variety of ways, including the ongoing community engagement and Participatory Rural Appraisals (PRA) and community surveys.

7.0 IMPACT ASSESSMENT FINDINGS

The potential environmental and socioeconomic impacts of the Project were identified through a process of developing a baseline through both desktop studies and fieldwork. The proposed project infrastructure and associated activities were analysed against this baseline and impacts were predicted using both quantitative and qualitative methods. A variety of potential impacts were identified for the Biophysical Environment and the Socio-economic Environment. The following section summarizes the main potential impacts identified and mitigation measures to reduce negative impacts and enhancing positive impacts.

After all the impacts were assessed, no residual environmental impacts were considered severe and suitable mitigation measures were devised for the management of project impacts.

7.1 Biophysical Environment

Air Quality

The baseline air quality was monitored previously since 2015 and established monitoring points have been taken over from the previous ESIA, see Figure 5.

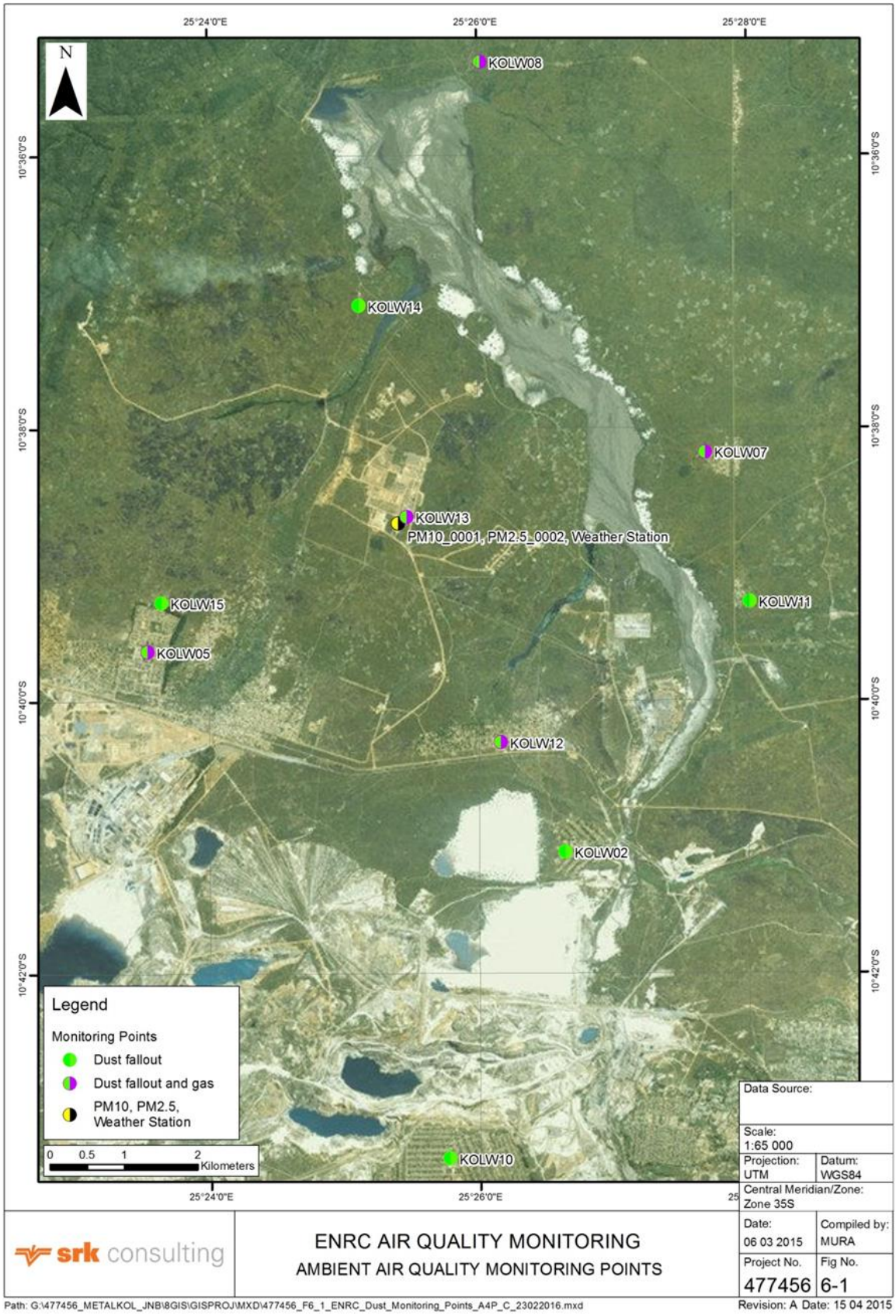

Figure 5: Baseline air quality monitoring locations (SRK, 2016c)

Dust fallout

Dust fallout monitoring occurred at specific villages shown in Figure 5 in and around the RTR permit area. All monitoring points, with the exception of KOLW13 located at the Processing plant, are considered residential. The dust fallout monitoring was undertaken in accordance with the American Society for Testing Materials (ASTM) D1739-98 Standard Method for Collection and Measurement of Dustfall. Dust fallout monitoring is undertaken monthly over a period of 30 days (± 2 days).

The baseline showed that the dust fallout concentrations exceeded the Residential Area guideline (600 mg/m^2/day) 58% of the time. At the beginning of the wet season dust fallout concentrations typically decreased, however, most locations still recorded levels above the Residential Area guideline. All dust fallout levels in January would fall below the Residential Area guideline.

Fine particulates

Continuous particulate matter (PM_{10} and $PM_{2.5}$) monitoring has been undertaken as a part of the baseline, with intermittent electrical and flow failures on the monitors. $PM_{2.5}$ concentrations exceeded the WB/IFC guideline on several occasions.

SO_2 monitoring

SO_2 was monitored as part of the baseline and all concentrations for all monitoring points were below the most stringent SO_2 guideline: the 24-hour period World Bank guideline of 20 µg/m^3.

NO_2 monitoring

NO_2 monitoring was done as part of the baseline assessment and all concentrations for all monitoring points were below the most stringent NO_2 guideline: the IFC annual guideline of 40 µg/m^3.

Increase in Ambient Air Emissions

Potential increase in ambient trace gas (SO_2) concentration from the use of diesel (back-up electricity generation, vehicles, and plant).

Mitigation measures

- Maintain a site-wide emissions inventory for the reclamation activities;
- Metalkol will continue monitoring dust, fine particulate (PM_{10}) and SO_2 at receptor locations surrounding the RTR project activities. Monitoring should continue for the duration of the operations to monitor compliance with local and international guidelines. Seven (7) monitoring locations are proposed, as shown Figure 6.

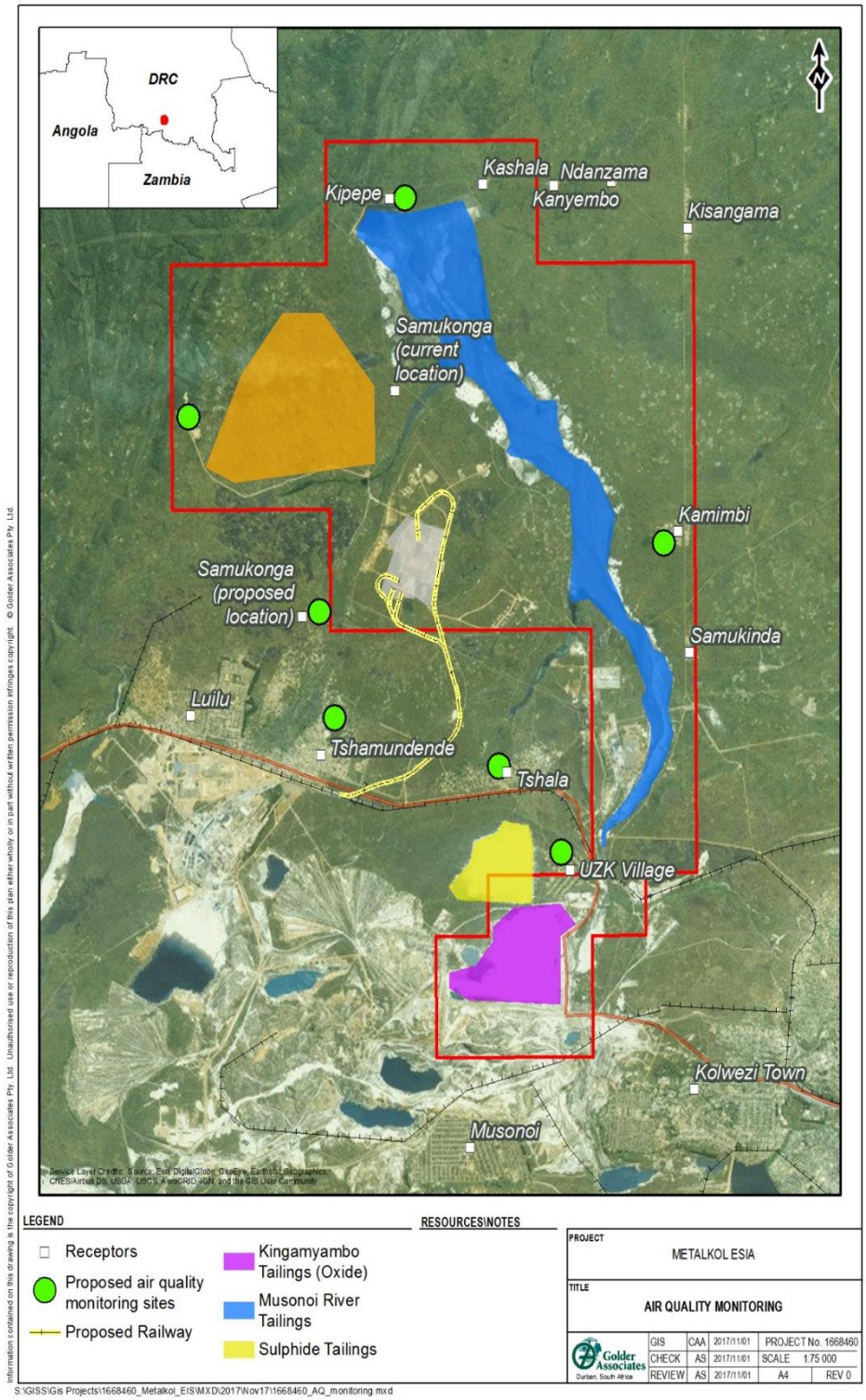

Figure 6: Proposed monitoring locations for fine particulates, dust and SO2 monitoring

Increase in DRC National Green House Gas emissions

The majority of GHG emissions associated with the RTR Project, during all three project phases, are from stationary and mobile combustion and lime use (Scope 1 emissions). Emissions management and mitigation efforts will start by focussing on stationary and mobile emissions sources, and then move on to addressing the other GHG emission sources over the medium term.

Mitigation measures

- An energy and GHG emission management program to assist in analysing and identifying opportunities at the operations to reduce energy consumption and GHG emissions will be prepared and implemented. This will include measuring GHG emissions on an annual basis, as is also required for the operational phase in terms of Section 8 of the IFC Performance Standard 3
- As far as feasibly possible, use solar-powered back-up electricity instead of diesel-fuelled generators
- As far as possible, replace diesel-fuelled mobile and stationary equipment with electrical equipment.

Increase in ambient Noise levels

The noise and airborne vibration from the RTR project may contribute to the prevailing ambient noise and airborne vibration levels within the RTR permit area and nearby noise-sensitive villages. Depending on the levels, the contributions to prevailing ambient noise levels could result in the loss of productivity and sleep disturbance. Increases in air-borne vibration levels associated with activities at the Processing plant have the potential to cause an annoyance for residents in nearby villages.

Mitigation measures

- Any additional project infrastructure lay down and access areas should be clearly indicated in final construction plans provided to contractors/employees.
- The plans should consider environmental (noise and air-borne vibration) constraints
- Access roads (etc.) should be planned to avoid sensitive areas
- Contractors (in particular heavy machinery) should be restricted to designated areas as defined by the Environmental Department.
- Procedures on noise and air-borne vibration monitoring should be adhered to
- A detailed noise and air-borne vibration program should be developed within the framework of the sustainable development plan

Impact on Surface Water and Groundwater

The RTR project may have an impact on surface water and groundwater as a result of seepage of leachate from the hydraulic monitoring of the Kingamyambo tailings dam, the hydraulic monitoring and dredging of the Musonoi/ Kasobantu tailings dam, and deposition of processing residue on the RSF. Furthermore, potential runoff from the processing plant may have an impact on the receiving surface water environment if not managed. At the same time, the tailings reclamation process of Metalkol and construction of a new engineered residual tailing storage facility should enhance baseline water conditions at the Musonoi (and dust at Kingamyambo).

Mitigation measures

A Surface Water Management Plan as well a Waste Management Plan has been developed in order to attenuate water degradation and pollution risks. A new engineered RSF will be constructed to contain and manage residue tailings after the reclaimed tailings have been processed at the plant (clean and dirty water separation will also be managed around this facility). The Surface Water and Waste Plans focus on the following: -

- Separation of clean and dirty water;
- Treatment of final effluent and surface run-off prior to discharge to the environment;
- Where practicable, reduce raw water consumption, maximise re-cycling of wastewater and reduce the volume of effluent discharged to the environment;

- Regular inspection and maintenance of the site drainage system and pollution control facilities;
- Regular monitoring of surface water effluent streams and flow rates and groundwater quality;
- Compliance with the DRC water quality standards and other relevant guidelines for effluent discharge to surface waters;
- Preparation of formal emergency response procedures in the event of a plant spill; and
- Development and regular updating of the site water balance in order to effectively and efficiently manage the water resources across the site.

Soil quality degradation

The RTR project may result in loss of limited natural soil fertility by removing organic horizon, soil compaction, destruction of the physical properties of the soil, destroyed vegetation and organisms and loss of original soil depth and volume during construction of new infrastructure.

Mitigation measures

- Minimize surface footprints to the extent possible and restrict heavy machinery and heavy truck access to sensitive soil areas (utilize machinery with the least amount potential to damage soils in sensitive soils areas i.e. smaller graders in sensitive areas);
- Stripping and stockpiling topsoil for later use in rehabilitation activities.

Change in land use

One potential impact of the RTR project is change in land use and physical disturbance. The RTR permit area has a number of traditional land uses that will give way to use for project-related activities. Previous land uses such as agriculture, charcoal production, collection of medicinal plants, and hunting will either be restricted or impeded.

Mitigation measures

- Minimise the RTR project footprint and therefore disturbance to a minimal area as possible;
- Minimise the extent of the fenced area to allow for traditional land use practices;
- During construction activities, Metalkol should avoid large scale disturbance and damage soil structure of topsoil;
- Soil erosion/sediment delivery needs to be minimized on areas stripped of vegetative cover prior to mining activities, during mining operation and on the post-mining landscape.
- Areas that may be prone to erosion or where signs of erosion are evident will need to be stabilized
- Storing stripped topsoil and subsoil for future site rehabilitation activities;
- Maintaining soils fertility for future rehabilitation;

Loss or disturbance of natural habitat

During the construction phase, the RTR will result in the direct clearing of about 292 ha of the Cultivation/Grass and Scrub Mosaic habitat unit and about 9 ha of Secondary Woodland/Scrub. The potential impact of loss or disturbance of natural habitat only applies to those infrastructural areas which have not yet been developed. The various proposed infrastructure footprints are located outside the delineated wetland areas and no direct loss of wetland habitat is expected to occur.

Mitigation measures

- Vegetation clearing will be restricted to proposed infrastructure footprints only, with a minimal clearing permitted outside of these areas;
- No stockpiling of material may take place within the wetland areas and temporary construction camps and infrastructure should also be located away from these areas, with a minimum buffer of 50 m maintained from delineated wetland boundaries;

Increased sediment runoff into wetland and rivers

Increased sedimentation causing water turbidity may result from:

- Soil erosion from the clearing of vegetation, coupled with increased surface water runoff during the construction phase; and
- The hydro sluicing of tailings material may increase sediment volumes during the operational phase.
- Eroded and tailings material can accumulate as sediment in rivers and wetlands, causing a smothering of aquatic habitats and direct impacts on biota (e.g. gill abrasion). The impact is rated as moderate before mitigation but can be reduced to low after mitigation.

Mitigation measures

Sediment transport off the site will be minimised through the following:

- Establishing perimeter sediment controls. This can be achieved through the installation of sediment fences along downslope verges of the construction site. Where channelled or concentrated flow occurs, reinforced sediment fences or other sediment barriers such as sediment basins should be used;
- Discharge stormwater from the construction site (dirty water) into adjacent grassland rather than directly into wetland habitat. Discharged flows must be slow and diffuse;

Water quality deterioration (Contamination of surface water entering rivers and wetlands)

Contaminated ground- and surface water emanating from a range of tailings reclamation activities, including *inter alia*, chemical spills and mobilisation of contaminated tailings, may enter downstream watercourses and may be harmful to the receiving wetland and aquatic ecosystems. With proactive mitigation across the mine, this impact can be maintained at a moderate significance.

Mitigation measures

- No runoff from construction sites will be introduced into wetlands directly. Runoff should first be directed onto dryland areas;
- Potential contaminants used and stored on site will be stored and prepared on bunded surfaces to contain spills and leaks;
- A detailed management and mitigation plan for spillages or possible overflow events will be developed. The RSF will be designed with appropriate ground preparation to prevent possible infiltration and pollution of the shallow sub-surface aquifer;
- Water quality monitoring will be undertaken of rivers/streams upstream and downstream of proposed mining operational areas to measure potential water pollution that may affect downstream aquatic habitats.

7.2 Socio-economic Environment

The following potential social impacts have been identified as a result of employment creation, local procurement, tax and royalty payments, project infrastructure development and community investment initiatives:

1) Population change due to inflow of workers
2) Relocation of Samukonga village;
3) Change processes/impacts on local movement patterns in the concession;
4) Change processes/impacts on social networks and demographic composition;
5) Safety and security change processes/impacts;
6) Macro-economic impacts;
7) Employment security, incomes and social security;
8) Increased disposable income of Metalkol employees and local multipliers;
9) Local business opportunities arising from Metalkol procurement of goods and services;
10) Increase in business confidence and attraction of investors;
11) Loss of land/crops and artisanal mining opportunities;
12) Community infrastructure related change processes and associated psychological impacts (related to Samukonga specifically);

A social management system including resettlement and compensation plan, stakeholder engagement plan and grievance mechanism will be implemented to manage potential socio-economic impacts. In addition to the mitigation measures, a Sustainable Development Plan will be developed and is aimed at improving the economic, cultural and social well-being of the local populations affected by the project during and after project operation, in accordance with Article 447 (e) and 451 (e). In particular, the developer must submit:

a) The mining company's commitments to local communities affected by the project;
b) Pecuniary and non-pecuniary compensatory measures and their terms and conditions;
c) Local development programs in various areas such as education, health, infrastructure and production, their operation, cost, financial participation of the mining or quarrying enterprise, monitoring and follow-up (NGO, local government, beneficiaries);
d) The timing and cost of this Sustainable Development Plan.

Health Impacts

The main baseline health issues within the RTR project area and neighbouring villages relate to a high reported incidence of malaria, diarrhoea (said by villagers to be as a direct result of poor water quality) as well as upper respiratory tract infections, especially during the dry season and attributed to the pervasive presence of dust. This information has been confirmed through the Health Impact Assessment.

The following potential health impacts of the project have been identified due to an increase in workforce especially during construction, industrial traffic (Shape Consulting Limited, 2017):

- Increased sexually transmitted infections (STIs) including HIV/AIDS;

- Increase in accidents, injuries associated with road traffic accidents;
- Increase in vector related diseases;
- Decline in food and nutrition and access to land;
- Environmental health impacts from water quality and other factors;
- Influx, social determinants of health, well-being and community expectations;
- Improved workplace health and camp facilities management; and
- Improved health systems and infrastructure.

A Social Management Plan will be developed to include mitigation measures for potential health impacts. This includes consideration of community health issues surrounding current inadequate water delivery and sewerage infrastructure, as well as potential effects of abstraction on water availability and water quality to downstream water users is recommended.

8.0 CONCLUSIONS

The ESIA update conducted for the Metalkol project did not identify any severe residual environmental impacts on the biophysical context that could not be adequately addressed by the implementation of mitigation measures proposed. The resettlement activities of Samukonga village were independently observed by Golder, who also interviewed affected parties with no major issues being noted.

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