

ENVIRONMENTAL IMPACT ASSESSMENT

PROJECT BRIEF FOR THE CONSTRUCTION AND OPERATION OF

A REMANUFACTURING FACTORY

ON PLOT NO. 2350/M, LUSAKA INTERNATIONAL AIRPORT ROAD, LUSAKA

FOR

**Hitachi Construction Machinery
Zambia Co., Ltd**



Final Report: November 2010

**DH ENGINEERING
CONSULTANTS**

PO Box: 37928, Lusaka, Zambia

Telephone: 260 21 1 227176

Fax: 260 21 1 229555

Email: dhec@iconnect.zm

Table of Contents

LIST OF FIGURES	4
LIST OF TABLES	4
1.0 INTRODUCTION	5
2.0 LEGISLATIVE REQUIREMENTS.....	7
2.1 ZAMBIAN ENVIRONMENTAL POLICY	7
2.2 ZAMBIAN ENVIRONMENTAL LEGISLATION	7
2.3 ZAMBIAN REQUIREMENTS FOR ENVIRONMENTAL ASSESSMENTS.....	8
2.4 OTHER APPLICABLE LEGISLATION	8
3.0 DESCRIPTION OF THE SITE AND EXISTING ENVIRONMENT.....	11
3.1 SITE LOCATION AND VICINITY	11
3.2 LAND OWNERSHIP AND TENURE	14
3.3 EXISTING PHYSICAL DEVELOPMENTS AND INFRASTRUCTURE.....	14
3.4 CLIMATE	14
3.5 AIR QUALITY.....	14
3.6 TOPOGRAPHY	15
3.7 GEOLOGY AND SOILS	15
3.7.1 Soil Quality.....	17
3.8 HYDROLOGY	17
3.8.1 Surface Water.....	17
3.8.2 Hydrogeology.....	17
3.9 FLORA / FAUNA	17
3.10 TRAFFIC AND COMMUNICATION	18
4.0 DESCRIPTION OF THE PROJECT.....	20
4.1 OBJECTIVES AND NATURE OF THE PROJECT	20
4.2 PHYSICAL AND TECHNICAL ASPECTS OF THE PROJECT.....	20
4.2.1 Buildings	21
4.2.2 Services	23
4.2.2.1 Water Supply.....	23
4.2.2.2 Sewage Treatment	23
4.2.2.3 Electrical Supply and Reticulation	23
4.2.2.4 Roads and Parking.....	23
4.2.2.5 Storm Water	24
4.2.2.6 Bulk Fuel Storage.....	24
4.2.2.7 Workshop Utility Works	25
4.2.2.8 Fire Protection and Preparedness.....	25
4.3 RAW MATERIALS DURING CONSTRUCTION.....	26
4.4 ACTIVITIES DURING CONSTRUCTION	27
4.5 WASTE PRODUCTS DURING CONSTRUCTION.....	27
4.6 RAW MATERIALS DURING OPERATION	28
4.7 ACTIVITIES DURING OPERATION.....	29
4.8 WASTE AND BY-PRODUCTS DURING OPERATION.....	30
5.0 PROJECT ALTERNATIVES.....	31
5.1 SITE LOCATION	31
5.2 BUILDING CONSTRUCTION	31
5.3 RAW MATERIALS AND PROCESS TECHNOLOGY.....	31

6.0 ASSESSMENT OF ENVIRONMENTAL IMPACTS.....	32
6.1 POSITIVE IMPACTS.....	32
6.2 NEGATIVE IMPACTS DURING CONSTRUCTION.....	32
6.2.1 <i>Impacts on Air Quality and Noise Environment.....</i>	32
6.2.2 <i>Impacts on Surface and Ground Water.....</i>	32
6.2.3 <i>Impacts on Vegetation and Habitat.....</i>	33
6.2.4 <i>Impacts on Traffic and Road Safety.....</i>	33
6.2.5 <i>Impacts on Occupational Health and Safety.....</i>	33
6.2.6 <i>Impacts on Public Health and Safety.....</i>	33
6.3 NEGATIVE IMPACTS DURING OPERATION.....	34
6.3.1 <i>Impacts on Noise Environment.....</i>	34
6.3.2 <i>Impact on Air Quality.....</i>	34
6.3.3 <i>Impacts on Soils and Water Quality.....</i>	34
6.3.4 <i>Impact on Surface Water Flow.....</i>	35
6.3.5 <i>Impacts on Occupational Health and Safety.....</i>	35
6.3.6 <i>Impacts on Public Health and Safety.....</i>	35
6.4 EVALUATION OF POTENTIAL IMPACTS.....	36
7.0 MITIGATION MEASURES	40
7.1 MITIGATION MEASURES DURING CONSTRUCTION.....	40
7.1.1 <i>Impacts on Air Quality and Noise Environment.....</i>	40
7.1.2 <i>Impacts on Surface and Ground Water.....</i>	40
7.1.3 <i>Impacts on Vegetation and Habitat.....</i>	40
7.1.4 <i>Impacts on Traffic and Road Safety.....</i>	40
7.1.5 <i>Impacts on Occupational Health and Safety.....</i>	40
7.1.6 <i>Impacts on Public Health and Safety.....</i>	41
7.2 MITIGATION MEASURES DURING OPERATION.....	41
7.2.1 <i>Noise Environment.....</i>	41
7.2.2 <i>Impacts on Air Quality.....</i>	41
7.2.3 <i>Impacts on Soil and Water Quality.....</i>	42
7.2.4 <i>Impacts on Surface Water Flow.....</i>	43
7.2.5 <i>Impacts on Occupational and Health and Safety.....</i>	43
7.2.6 <i>Public Health and Safety.....</i>	45
7.3 WASTE MANAGEMENT PROTOCOLS.....	45
8.0 ENVIRONMENTAL MANAGEMENT AND MONITORING PLAN (EMMP).....	48
9.0 CONCLUSION.....	55
APPENDICES.....	56

Appendix 1: Certificate of Incorporation

Appendix 2: Application for Planning Permission

Appendix 3: Letter to ECZ from NISIR Dated 1 November, 2010

Appendix 4: Geotechnical Report

Appendix 5: Soil Testing Results

Appendix 6 Project Layout and Design Drawings

Appendix 7: Standard Septic Tank and Soakaway Details

Appendix 8: Standard installation layout and details for a 5,000 litre above ground steel skid tank

Appendix 9: Standard Oil Interceptor Details

List of Figures

Figure 1: Google Earth image showing site location	11
Figure 2: Google Earth image showing site vicinity	12
Figure 3: Google Earth image of the site (approximate boundaries)	13
Figure 4: Average number of days with smoke/haze in Lusaka	15
Figure 5: Topographical survey diagram of the site	16
Figure 6: View of the site, facing east.....	18
Figure 7: The Airport Road facing north; the site is located to the right.	19
Figure 8: Bird's eye view of proposed development.	22
Figure 9: Workshop displacement ventilation system	41

List of Tables

Table 1: Outline of proposed buildings	21
Table 2: Main facilities	21
Table 3: Water demand table	23
Table 4: Raw materials for construction	26
Table 5: Raw materials for operation	28
Table 6: Evaluation of impacts.....	37
Table 7: Summary of Waste Management Protocols.....	46
Table 8: Environmental Design Features	49
Table 9: Environmental Management and Monitoring Plan (EMMP)	52

1.0 Introduction

Hitachi Construction Machinery Zambia Co., Ltd (HCMZ) propose to construct and operate a Remanufacturing Factory on, Plot No. 2350/M along the Lusaka International Airport Road, about 3.3 km from the Junction with Great East Road (T4). The principal aim of the project will be to remanufacture (recondition) used parts and components from heavy duty earth moving machineries so as to provide more cost effective maintenance solutions for clients, primarily in the mining sector, within Zambia as well as adjacent countries. The proposed project site covers some two hectares in extent and will be leased from the National Institute for Scientific and Industrial Research (NISIR) on a long term basis.

The total investment is expected to be to the order of 15 million USD, and will involve the construction of workshop of 2,587.9 m² floor area, a warehouse (687.3 m²) and a main office building (930.4 m²). The total building footprint area will be 3,911.5 m², with a gross floor area of 4,480.9 m². Provision will be made for future expansion of the floor area by 2,520 m². Ancillary facilities will include a small standby power generation plant, provision for bulk storage of diesel (2x 5,000 litres) and an external washing bay. The works are scheduled to commence 4th Quarter 2010, to be completed over an 8 month construction cycle by 3rd Quarter 2011.

HCMZ is a Zambian registered company (a copy of the Certificate of Incorporation is included in Appendix 1) and is incorporated as a 100% subsidiary of Hitachi Construction Machinery Africa Co., Ltd, (HCMA), a South African registered company. Previous experience of projects undertaken by HCMA within Zambia and the region include:

- Operation of service and maintenance plant at Lumwana Mine in North-Western Province for 32 rigid dump trucks and 8 excavators of various sizes;
- Operation of service and maintenance plant for 4 large scale excavators (@ 500 tonnes) in Tete, Mozambique, used by the MOATIZE coal mining project.
- Construction and operation of the Hitachi Light Manufacturing Plant in Johannesburg, South Africa, for the manufacturing of excavator buckets and vessels for dump trucks.

In addition, Hitachi has constructed and operates remanufacturing plants in Indonesia and Australia, which are based on the same concept and design as the proposed project.

Since the remanufacturing factory project falls under the First Schedule of the Statutory Instrument No. 28 (EIA regulations) of the Environmental Protection and Pollution Control Act, it is therefore a requirement that an Environmental Project Brief be submitted to the Environmental Council of Zambia, for consideration and approval of the project. For this purpose this project brief will provide information on the following:

- Information describing the site and its environment

- Information describing the technical, operational and construction features of the project
- Assessment of positive and negative impacts
- Mitigating measures
- Environmental management and monitoring for the project.

HCMZ Contact Person Details:

Mr Yoji Akaike (MD)

Cell: + 260 969 576057

+27 795 094 758

Email: y.akaike.ed@hitachi-kenki.com

2.0 Legislative Requirements

2.1 Zambian Environmental Policy

The National Conservation Strategy (NCS) was adopted as a policy document by the government in 1985 which led to the establishment of environmental legislation and institutions (see below).

To meet the demands of an economy undergoing liberalisation and to update technical information, the NCS was updated by the government in 1992 through the National Environment Action Plan (NEAP) process of which the overall objective is to integrate environmental concerns into the social and economic development process in the country. The main thrust of NEAP is to identify environmental issues and problems, analyse their causes and recommend measures to resolve the issues for each sector.

The NCS and NEAP are the precursor of the overall policy on environment. The National Policy on Environment (NPE) which was adopted in 2007 (and officially launched in 2009) provides environment and natural resources management policies to address current and future threats to the environment and to human livelihoods and provides policy guidelines for sustainable development.

2.2 Zambian Environmental Legislation

The NCS led to the passing of the Environmental Protection and Pollution Control Act (EPPCA) in 1990 to provide for the protection of the environment. The Act also provides for the establishment of the Environmental Council of Zambia (ECZ) to implement the provisions of the Act and to harmonize and co-ordinate all issues related to environmental management in the country.

As part of the implementation process the government through the EPPCA has adopted a framework for environmental impact assessment for all developmental projects in Zambia and the Environmental Impact Assessment Regulations¹ were established in 1997. Under the EPPCA it is mandatory that all development plans, policies and projects undergo a process of environmental impact assessment.

In addition the Act, through the applicable statutory instruments, controls and regulates the following areas, relevant to the present study:

- Waste Management (licensing of waste transporters and waste disposal sites); these regulations (Statutory Instrument No. 71 of 1993) provide for the ECZ to regulate and monitor the disposal of non-hazardous waste. Licences are issued by the ECZ for the transportation of waste and operation of disposal sites according to the type of waste and classification.

¹ Environmental Protection and Pollution Control Act, 1990 – Statutory Instrument No.28 of 1997 Part 2 and 3

Relevance: The project will result in the generation of solid waste during the construction and operational phases, the handling and disposal of which will be subject to these regulations.

- The Hazardous Waste Management Regulations (Statutory Instrument No125 of 2001) - these regulations provide for the ECZ to control and monitor the generation, collection, storage, transportation, treatment and disposal of hazardous waste.
- **Relevance:** The project is expected to generate a certain amount of waste that can be considered as hazardous under these regulations such as used oil/lubricants, petroleum sludge generated by the oil interceptors, etc, the handling and disposal of which is subject to these regulations.
- Noise.
- Natural Resources Management.

2.3 **Zambian Requirements for Environmental Assessments**

Zambian environmental legislation contains a number of specific requirements for the assessment of impacts of construction projects on the environment. The Environmental Impact Assessment Regulations² require that:

*“A developer shall not implement a project for which a project brief or environmental impact statement is required under these Regulations, unless the project brief or the environmental impact statement has been concluded in accordance with these regulations and the Environmental Council of Zambia has issued a decision letter”*³

This project falls specifically under category (b) (Storage of hydrocarbons) of the First Schedule of EIA regulations; this lists projects that require an Environmental Project Brief.

An Environmental Project Brief has therefore been prepared for the project in accordance with the EIA guidelines in order to be submitted to the Environmental Council of Zambia for consideration and approval.

2.4 **Other Applicable Legislation**

Zambia has in all 32 pieces of legislation or statutes that provide guidelines to institutions that are mandated to administer them in relation to environmental management. In addition to the EPPCA, other national legislation that is relevant to environmental aspects of the project includes:

² Ibid

³ Environmental Protection and Pollution Control Act, 1990 – Statutory Instrument No. 28 of 1997 Part 2 – Section 3(1)

1. The Zambia Development Agency Act, 2006

The act provides a legal framework for investment in Zambia and recognises the role of other agencies, including those responsible for environmental protection, in authorizing specific projects. In considering an application from an investor for a licence, permit or certificate of registration, the Act stipulates that the Board shall have regard to the impact the proposed investment is likely to have on the environment and, where necessary, the measures proposed to deal with an adverse environmental consequence in accordance with the Environmental Protection and Pollution control Act.

Relevance: The developer is in the process of obtaining an investors licence from Zambia Development Agency and is subject to the provisions of the Act.

Compliance: The carrying out of an EPB for the project complies with the terms of the Act.

2. Public Health Act, Cap 295

The Act provides for and regulates all matters connected with public health in the country under the local authority of each district as the enforcement agency.

Relevance: For the proposed development, this will cover such matters as waste management and the standards of the general working environment.

Compliance: The necessary licenses and permits will be obtained in accordance with the Act.

3. Factories Act, Cap 441

The Factories Act provides a framework for the setting of regulations to ensure the safety, health and welfare of persons employed on construction work sites and in factories.

Relevance: The proposed installation comprises an industrial work site

Compliance: Construction and operational procedures and workers PPE will be required to meet the provisions of this Act. Inspection procedures for the operation of all plant and equipment during construction and operation will be governed by this Act.

4. Petroleum Act, Cap 439

The areas of the Petroleum Act of relevance to this project are regulations for the conveyance and of petroleum, inflammable oil and liquids (e.g. petrol and diesel) which shall apply both during the construction and operational phases.

Relevance: Fuel will be delivered in bulk to the site

Compliance: Only transporters who comply with the provisions of the act will be authorised to deliver fuel

5. Energy Regulation Act, Cap 436

This Act allows for the establishment of procedures for the transportation, handling and storage fuels to minimise negative environmental impacts.

Relevance: The power generation plant includes a bulk fuel storage installation

Compliance: the design, construction and operation of the plant will comply with the standards of the Act.

6. Local Government Act, Cap 281

The Act was enacted in 1991 following the repeal of the Local Administration Act of 1981 which incorporated the One Party State political party organs in the local government system. It provides for the functions of local authorities including the implementation of environmental protection and natural resources management functions.

Relevance: Implementation and operation of the new development is subject to the procedures laid out by the local authority (LCC).

Compliance: All applicable by-laws will be adhered to.

7. Town and Country Planning Act, Cap 283

This Act, which came into force in 1962, provides for the establishment of planning authorities and the preparation, approval and revocation of development plans. It further provides for the control of development in a district and the subdivision of land.

Relevance: As a new project, the development cannot proceed without town and country planning approval from the local authority.

Compliance: The necessary documentation has been submitted to LCC and approvals will be obtained for project implementation in accordance with the terms of the Act (see application for planning permission, Appendix 2).

8. Road and Traffic Control Act, Cap 464

The Roads and Traffic Control Act provides for the control of traffic and for the regulation of storm water disposal structures.

Relevance: The project will involve the construction of an internal road network and access road to the site subject to the provisions of the Act.

Compliance: The proposed development, roads, and associated infrastructure will be designed in accordance with the provisions of this act.

3.0 Description of the Site and Existing Environment

3.1 Site Location and Vicinity

The project site comprises Plot 2350/M, a two hectare parcel of land which forms a section of a larger tract of land belonging to the National Institute for Scientific and Industrial Research (NISIR) along and to the east of the Lusaka International Airport Road. The site is located on the outside of a bend in the Airport Road, about 3.3 km from the junction with the Great East Road (T4) and access is gained directly from the road. The co-ordinates of the site are shown in the topographical survey diagram, Figure 5. The co-ordinates of the site are shown in the topographical survey diagram, Figure 5.



Figure 1: Google Earth image showing site location

The area surrounding the site represents a mixture of land use. To the west across the Airport Road is an extensive commercial farming area growing rain fed and irrigated crops. About 300m to the north of the site is a residential housing estate, formerly owned by the Civil Aviation Department and since sold to sitting tenants by the National Airports Corporation. A number of private residential smallholding plots are also to be found in this area to the north east. A gravel road reserve bounds the site to the north.

As described the site forms part of a larger property belonging to NISIR which surrounds it to the east and south. The land adjacent to the site comprises un-developed scrubland and subsistence agricultural fields. The NISIR complex is situated about 400m to the south east of the site. Some 400m to the south is located another housing compound formerly owned by NISIR, also sold to sitting tenants.



Figure 2: Google Earth image showing site vicinity



Figure 3: Google Earth image of the site (approximate boundaries)

3.2 Land Ownership and Tenure

The ownership of Plot No. 2350/M is vested in the interest of NISIR under statutory leasehold. The property will be leased to the developer under agreement with NISIR for the purposes of the project (please see copy of letter from NISIR to the ECZ, dated 1st November 2010, included in Appendix 3).

3.3 Existing Physical Developments and Infrastructure

Existing developments surrounding the project site were discussed above. The project land in question is currently completely undeveloped and represents a Greenfield site. As described, the site is bounded by the International Airport Road to the west and a gravel road reserve to the north. In addition:

- An 11 kV ZESCO power line runs adjacent to the site within the Airport Road reserve.
- A Lusaka Water and Sewerage Company water main (8") runs along the Airport Road to the International Airport.

3.4 Climate

The climate of Lusaka, which is situated at an altitude of about 1200 m above sea level, is typical of much of the Central African Plateau with three distinct seasons a cool dry season from mid-April to August, a hot season from September to October and a rainy season from November to April. Lusaka receives an annual rainfall in the region of 500mm to 1000mm with a mean annual rainfall of 800 mm, the months of December, January and February receiving over 70% of the rain for an entire year.

Mean monthly temperatures range between about 15 °C in the cold season to about 30 °C in the hot season when humidity is comparatively high. The Lusaka plateau is dominated by prevailing easterly winds during the dry season with fresh winds experienced in the months of July and August. The rains experience light variable winds predominantly northerlies and north - easterlies in January and February. Mean wind speed ranges from 4.0 km/hr to 9.0 km/hr.

3.5 Air Quality

The ambient air of the area can be described as clean with a general absence of pollutants in the air although a certain amount of vehicle exhaust pollution, albeit localised, can be expected from the Airport Road.

The burning of bush and scrub within and around the environs of Lusaka, especially during the dry season, results in the emission of smoke and ash particles into the air with a corresponding deterioration in air quality. A distinct haze is visible on many days in the atmosphere around Lusaka as well as other areas during the dry and dusty months of August to October (see Figure 4 below).

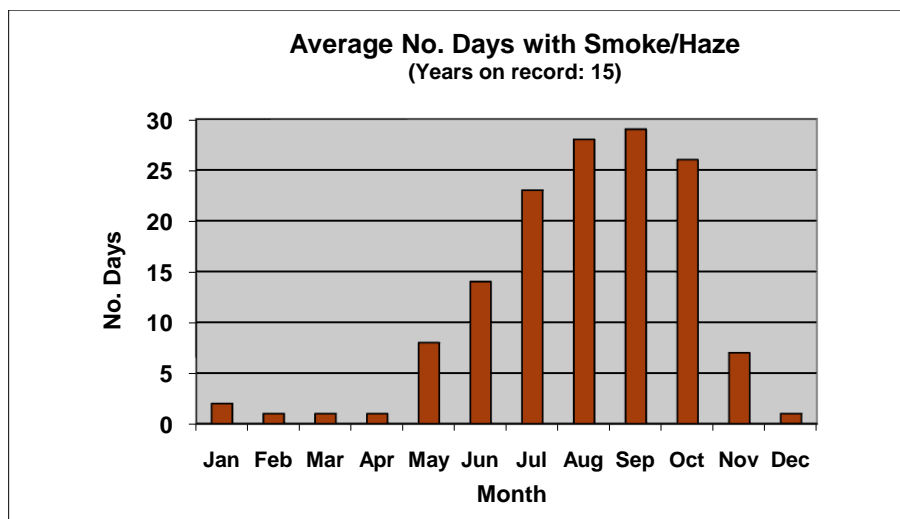


Figure 4: Average number of days with smoke/haze in Lusaka (Source: weatherbase.com)

3.6 Topography

The site is located in a relatively low lying area about 1170m above mean sea level. Gradients in the area are very low, sloping slightly to the northeast, and the terrain appears flat to the human eye excepting a few low termite mounds scattered about the site. A topographical survey diagram of the site is shown in Figure 5 below.

3.7 Geology and Soils

The rocks of the Lusaka area are generally characterised metamorphic rocks of Pre-Cambrian age belonging to the Katangan system although the site is underlain by more recent alluvium and thick colluvial deposits of the Chongwe River basin.

Geotechnical investigations were carried out at the site in September 2010 and a copy of the full report is attached in Appendix 4. Field tests included 7 core borings drilled on the site in areas where various buildings are proposed. Bedrock was struck at an average depth of 20m and test results indicated that the bedrock consisted generally of a sheared Quartzite that appeared as quartz-sericite schist in some of the holes. However, in B7, B9 and B10, the fine grained quartzite was less deformed, but was generally fractured.

A number of trial pits were also dug and grading analyses performed on soil samples, all samples taken exhibited fine grained texture. In accordance with the Unified Classification chart, the soils may be classified as CL-Inorganic Clays of low plasticity as the Liquid Limits were less than 35.



Figure 5: Topographical survey diagram of the site

3.7.1 Soil Quality

In order to form a baseline of potential soil contaminants prior to project implementation, soil samples were taken from the site and analyzed for their heavy metal characteristics. Samples were taken from two borings at depths of 3, 6, and 9m and analytes determined by use of Atomic Absorption Spectrophotometry. Metal analytes tested were: Copper, Zinc, Cadmium, Lead, Chromium, Nickel, Iron, Cobalt, and Mercury, and the full laboratory test results are given in Appendix 5. Results show that for the samples taken all heavy metal levels are substantially below the maximum permissible levels for soil and water.

3.8 Hydrology

3.8.1 Surface Water

No natural streams or water courses traverse the project site; however, a storm water drain emanating from a culvert under the Airport Road traverses the northwestern corner of the site (see topographical survey diagram, Figure 5). This drain discharges into the stormwater drainage system of the gravel road that runs along the northern boundary of the site, carrying water away from the Airport Road in an easterly direction (i.e. down slope).

Most of the site appears well drained although it is apparent that water logging may occur in the northwestern corner during the rains.

3.8.2 Hydrogeology

Under geotechnical investigations (Appendix 4), the core borings revealed the presence of a large 'Fissure' or 'Cavity' that was in-filled with unconsolidated sand that immediately overlies the bedrock (the bedrock was intersected between 17.5 to 22.5m depth). It is suspected that the cavity may be acting as an aquifer.

Core borings at the proposed site indicated that the water table was at 1.5 to 2.0m level, in most cases. This level would be expected to rise closer to the surface during the course of the rainy season.

3.9 Flora / Fauna

The area comprises a scrubland previously cleared, probably for agricultural purposes, and is characterized by juvenile or coppiced re-growth of trees and shrubs scattered or grouped about the site. The species noted are typical of the Munga (Savanna) Woodland type of vegetation that is found in the area and common around Lusaka. Dominant species include *Pilostigma thonningii* (msekese) and *Acacia polyacantha* (hook thorn). Two or three medium sized *Ficus sycomorus* (mukuyu) are conspicuous near the northern boundary of the site, and a stand of relatively mature trees (hookthorn and msekese) is grouped in the north-western corner. Other species noted, also common to the type of vegetation in the area were *Acacia siberana* (White Thorn), *Strychnos*

cocculoides (bush orange), *Albizia versicolour* and *Terminalia sericia*. Ground cover constitutes tall dense grasses (burned off) and weedy herbs.

No existing fauna was observed on the site although a scrubland may typically host foraging birds such as francolin, insects such as ants, termites and grasshoppers and reptiles (e.g. puff adder and black necked spitting cobra) as well as lesser mammals such as field mice and mole rats.

There was no evidence on the site or the surrounding area of the presence of any species of flora or fauna that could be classified as endemic to the area or of special scientific value.



Figure 6: View of the site, facing east.

3.10 Traffic and Communication

As such the site is well serviced by the Airport Road, offering good access via the Great East Road (T4). Lusaka has seen a sharp increase in the number of vehicles on the city's roads in recent years although the Airport Road remains, for the most part, relatively lightly trafficked. The site is also located in very close proximity to the Lusaka International Airport, providing for quick and convenient access by air for personnel and (some) materials.



Figure 7: The Airport Road facing north; the site is located to the right.

4.0 Description of the Project

4.1 Objectives and Nature of the Project

The proposed project calls for the construction and operation of a Remanufacturing ('Reman') Factory on Plot No. 2350/M along the Lusaka International Airport Road. The nature of the principle business to be carried out at the site will be the remanufacturing (or reconditioning) of machine parts for large scale earth moving equipment for industries, especially the mining sector, within and outside Zambia. This will involve the re-manufacture of used parts and components of earth moving machineries so as to provide more economical solutions by supplying remanufactured components to customers at more economical prices.

The development will also serve as the headquarters for HCMZ's operations and activities in Zambia and adjacent countries which includes the sales of machineries and parts as well as service and maintenance of earthmoving equipment.

For this purpose the project will entail the construction of a workshop, a warehouse and a main office building covering a footprint of 3,911.5m² and with a gross floor area of 4,480.9m². A provision of 2,520m² floor area will be made for future expansion of the workshop and warehouse.

A reputable Zambian registered contractor will have overall construction responsibility for the project and will be required to work closely with local (and where necessary foreign specialised) contractors and sub-contractors to complete the works.

Construction of the factory scheduled to commence 4th Quarter 2010, with a eight month construction cycle and commissioning and hand-over scheduled for 3rd Quarter 2011.

Capacity building will form a principle component of the Company's activities at the site during operation and the development will include the required training facilities. Training will be provided on-the-job for permanent employees and the Company is also committed to providing industrial internships on a continuous basis for students from the Country's various technical colleges (e.g. Nortech).

It is anticipated that the remanufacturing plant will provide permanent employment for 30 skilled Zambian workers.

4.2 Physical and Technical Aspects of the Project

The various project layout and design drawings are given in Appendix 6 as follows:

- 1027-A-06: Site Plan
- 1027-A-07: Ground Floor Plans
- 1027-A-08: 1st Floor Plans
- 1027-A-09: Roof Plans
- 1027-A-10: Elevations

- 1027-A-11: Sections
- 1027-A-15: External Works

The development will include the following major components:

4.2.1 Buildings

An outline of the proposed building structures is given in Table 1 below.

Table 1: Outline of proposed buildings

	MAIN OFFICE	WAREHOUSE	WORK SHOP	GENSET ROOM	SECURITY OFFICE	TOTAL	
LAND AREA						20,000.0m ²	
STRUCTURES	Reinforced concrete 2 Storey	Reinforced concrete Structural steel Single storey	Reinforced concrete Structural steel 2 Storey	Reinforced concrete Single storey	Reinforced concrete Single storey		
BUILDING AREA	465.2m ²	687.3m ²	2,483.7m ²	219.3m ²	56.0m ²	3,911.5m ²	
GROUND COVERAGE						19.6%	
GROSS FLOOR AREA	930.4m ²	687.3m ²	2,587.9m ²	219.3m ²	56.0m ²	4,480.9m ²	
VOLUME RATIO						22.5%	
EACH FLOOR AREA	1F	465.2m ²	687.3m ²	2,483.7m ²	219.3m ²	56.0m ²	3,911.5m ²
	2F	465.2m ²	—	104.2m ²	—	—	569.4m ²

Buildings will include the main office block, a warehouse, the factory workshop, a standby generator set room and a security office. All buildings will be constructed of reinforced concrete. In addition, the warehouse and workshop buildings will comprise steel frame structures with IBR roof sheeting and steel sheet cladding. Asphalt waterproofing with concrete steel towelled finish will be employed for the office, genset and security buildings. Facilities to be included in the respective buildings are outlined in Table 2:

Table 2: Main facilities

Building	Ground Floor	1 st Floor
Office Building	<ul style="list-style-type: none"> • Training rooms x2 • Canteen • Meeting room • Lobby • Rest rooms 	<ul style="list-style-type: none"> • Directors office • General management rooms x4 • General office space • Meeting room • File room • Rest room
Warehouse	<ul style="list-style-type: none"> • Storage space • Office 	-
Workshop	<ul style="list-style-type: none"> • Spindle welding section • Engine assembly section • Cylinder assembly/disassembly section • Final drive section • Cylinder test room 	<ul style="list-style-type: none"> • Office • Rest room • Locker room • Shower room

	<ul style="list-style-type: none"> • Pump motor test room • Pump motor assembly room • Engine cleaning room • Engine dynamo room • Painting room • Drying room • Tool room • Compressor room • Oil storage room • Rest room 	
Genset	<ul style="list-style-type: none"> • Generator plant room • Fuel tank room • Trance room • Panel room 	-
Security	<ul style="list-style-type: none"> • Security office room 	-

In addition, ancillary facilities will include an external washing bay and a scrap yard.



Figure 8: Bird's eye view of proposed development.

4.2.2 Services

4.2.2.1 Water Supply

Water supply will be from the existing council main along the Airport Road supplemented by on-site borehole. A maximum water demand of 11.4 m³ per day is anticipated (Table 3).

Table 3: Water demand table

	MAINFOFFICE	WORKSHOP	Security Office	Outside
Use For	Lavatory ,Washing Hand	and Washing Material	Lavatory,Pantry	Washing, Sprinkle
Number of Person	50	20	2	-
Water Supply Load	50p × 80L/p · d=4m ³ /d	20p × 120L/p · d=2.4m ³ /d	1m ³ /Day	4m ³ /Day
Supply Piping (A)	40	32	-	25
Others	Washing Area : Use High Pressure Washing Machine			

4.2.2.2 Sewage Treatment

Septic tank and soakaway facilities will be provided for the treatment of sewage arising on the site. A drawing showing standard septic tank and soakaway details is given in Appendix 7. Septic tanks, soakaways or sewer lines will be located a minimum of 60m from any boreholes on site.

Sewage return is estimated at 7.4 m³/day.

4.2.2.3 Electrical Supply and Reticulation

The electrical system will involve a ZESCO 11kV incomer line from the existing ZESCO 11kV Airport Road line into the developments substation. Electrical power will be stepped down and reticulated at low voltage (400/220V) around the development by cable piping and cable Rack.

Back-up power supply will be provided by a low voltage diesel generator (output 3φ4W380/220V, 500kVA) to be installed in the dedicated generator plant room. The unit will be connected to the standby generator panel and will start automatically when the site experiences a power failure and will remain running to supply continuous power to the site until the main supply has been restored where after the unit will switch off automatically.

All electrical glands will be flameproof and all electrical installations will be carried out in accordance with Institute of Electrical Engineers regulations and ZABS standards ZS 402 (The Classification of Hazardous Locations and the Selection of Apparatus for use in such Locations).

4.2.2.4 Roads and Parking

External paving will constitute:

- Roads will be concrete paved on macadam foundation
- Paving blocks will be used for parking facilities (24 slots)
- Colour asphalt paving will be used for pedestrian pathways

4.2.2.5 Storm Water

Storm water drainage will be by closed lined drains (covered by grating or concrete slab) to both the front and rear of the site and will tie into an open lined perimeter drain surrounding the boundary of the site. This will discharge to the existing drainage system in the road reserve along the northern boundary of the site via an oil separator. Waste water from the external washing bay and engine washing room in the workshop will be directed through dedicated oil interceptors prior to discharge to the storm water drainage system.

4.2.2.6 Bulk Fuel Storage

Bulk fuel storage will be provided in accordance with Energy Regulation Board regulations and the standards set by The Zambian Bureau of Standards: ZS 392: Part 2 (Zambian Standards for The Storage and Handling of Liquid Fuels: For large consumer installations exceeding 1,500 litres in the case of a liquid fuel having a flash point not lower than 38°C).

Bulk storage of diesel will be provided by two 5,000 litre above ground fuel storage tanks (i.e. a total of 10,000 litres) for the generator and for forklift trucks/machinery testing respectively.

In line with ZABS standards, the tanks and pipe work will be constructed within concrete containment bunds with a reinforced concrete slab and solid concrete block walls to prevent any egress of hydrocarbon fuels and/or lubricants outside the bund and thus to ground.

Each containment bund will have a capacity equivalent to 110% of the volume of the largest tank installed within it. All bunds will have a drainage sump with a valve fitted to the outside of the bund and a piped drain to a common oil interceptor constructed in accordance with the calculated flows of storm water anticipated. This valve will enable normal flow off the bund during wash downs and rain into the oil interceptor. However, in the event of a major leak/spill the valve can be closed to contain the fuels for pumping out into another tank or vehicle. In addition, the entire generator plant room floor and one brick height (110mm) of the wall will be painted with diesel resistant epoxy paint and will be utilized as a bund wall for the generator. This bund will also have a drainage sump with a valve fitted to the outside of the bund and a piped drain to the oil interceptor.

The off-loading pump, fuel filters and supply and return feeds will also be located within the same bund in order to prevent any fuel or lubricant leaks to ground due to pipe leaks or pump seal failure.

The loading / off loading point to and from vehicles will comprise a hard standing surface with drainage to the oil interceptor.

A drawing showing standard installation layout and details for a 5,000 litre above ground steel skid tank is given in Appendix 8. A detailed drawing of the oil interceptor is given in Appendix 9.

The above measures will ensure that there are no fuel spills or leaks to ground during the operation of the fuel storage facility and generator sets and any major leaks can be contained and thus treated in a safe and acceptable manner to all regulatory authorities.

4.2.2.7 Workshop Utility Works

This will include:

- Compressed-Air System
- Cooling Water Supply System (for Engine Cooling)
- Exhaust System for Production
- Drainage Water System for production
- High Pressure Washing

4.2.2.8 Fire Protection and Preparedness

The development will be equipped with all necessary smoke and fire detection systems and alarms and will also have installed fire fighting equipment to satisfy and/or exceed Local Building Regulations. Specific fire extinguishing equipment to be installed will include:

1. Electrical Transformer:
 - 1 x 9kg DCP Fire extinguisher
 - 1x 5kg CO₂ fire extinguishers
2. Bulk Fuel Tanks (each 5,000 litre tank):
 - 1x 50litre foam units
 - 1x 20litre sand buckets
3. Generator Plant Room:
 - 2x 9kg DCP fire extinguishers
 - 1x 20 litre sand bucket
 - 1x 25kg foam unit
 - 1x 5kg CO₂ fire extinguishers
4. Office Building:
 - 2x 9kg DCP Fire extinguishers; maximum walking distance 20m
 - 2x water Fire extinguishers; maximum walking distance 20m
 - 1x 5kg CO₂ fire extinguishers (for server room)
5. Workshop:
 - 16 x DCP Fire extinguishers; maximum walking distance 20m.

Fire fighting equipment such as fire extinguishers will be checked and serviced regularly to ensure that they are always in full working order.

In addition:

- An external Fire-Hydrant System will be provided to NFPA Standard.
- Lightening Protection System will be provided by two independent truss pillars with upper needles to be installed on open ground to the north and south of the buildings. The building is included by 120m.
- All building structures will be semi fire proof

- As described, all electrical glands will be flameproof and all electrical installations will be carried out in accordance with Institute of Electrical Engineers regulations and ZABS standards ZS 402.

4.3 Raw Materials during Construction

The raw materials that are expected to be used in construction of the project and their sources are summarised in Table 4 below:

Table 4: Raw materials for construction

	Raw Material	Source	Mode of Delivery
1.	River and building sand	Local established suppliers	Road truck
2.	Aggregates and laterite	Local ECZ approved quarries and borrow pits	Road truck
3.	Cement	Local suppliers	Road truck
4.	Paint	Local suppliers	Road truck
5.	Asphalt	Local ECZ approved suppliers	Road truck
6.	General building materials (e.g. concrete blocks, timber for shuttering, door frames, etc)	Local ECZ approved suppliers	Road truck
7.	Water	LWSC main initially; supplemented by borehole when drilled (demand < 1 l/s)	Water reticulation system
8.	Electricity	ZESCO	Power mains / builder's connection
9.	Diesel for operation of plant and machinery	Local ERB approved supplier – on site storage 5x 210 litre drums	Road truck (self delivery from service station)
10.	Finished products and equipment (e.g. Structural steel sections, IBR roofing sheets, gypsum board, uPVC and HDPE piping, light fittings, switches, aluminium window frames, sanitary ware, brass ware and finishes, ceramic floor tiles, air conditioners, geysers, booster pumps, etc.)	Imported ensuring compliance with Zambian standards and regulations	Road truck / container
11.	Specialised workshop mechanical equipment (e.g. lathes, presses, grinders, reamers, etc.)	Imported ensuring compliance with Zambian standards and regulations	Container

4.4 Activities during Construction

The main activities envisaged during construction will include:

1. **Preparation of the site.** This will include:
 - Stripping of topsoil and vegetative material
 - Basic earthworks to establish required finished levels and falls. This will entail filling of areas with laterite and aggregates.
 - Drilling and equipping of on-site borehole
2. **Excavation and foundations:**
 - Piling to create sub-structure foundation supports
 - Excavation of trenches for foundation strips, oil interceptors, soak-aways etc.
 - Compaction of underside of foundation trenches
 - Mixing, pouring and compaction of concrete
3. **Sub-structural works and floor slab:**
 - Block work
 - Mixing, pouring and compaction of concrete
 - Backfilling and compaction of material according to specifications
4. **Super-structural works:**
 - Construction of various buildings including placing of hollow concrete blocks, fixing of structural steel components, fixing of roofing sheets and cladding, etc.
5. **Road and drainage construction:**
 - Stabilization of the base with the piling, spreading and compaction of gravel and aggregate.
 - Spreading and compaction of aggregates and tar materials on the road for bitumen surface and preparation, pouring and compaction of concrete for concrete surfaced areas.
 - Excavation and shaping of drains
6. **Installation of mechanical equipment / engineering services:**
 - This will involve installation of the mechanical equipment for the factory workshop and installation of electric power supply, cables, lighting, etc.
7. **Materials Storage**
 - Materials such as blocks, sand, gravel and aggregate, which are not required for immediate use, may be stockpiled in limited quantities in a designated area on the site.

4.5 Waste Products during Construction

The following waste and by-products are expected to be generated during the project construction cycle:

- **Vegetative waste:** A limited amount of vegetative waste, mainly small trees and shrubs will be generated from site preparation.
- **Topsoil:** Topsoil resulting from scarifying of the site.
- **Building rubble:** This will include sub-soil removed during excavation of trenches / drains and other spoil such as rejected concrete, broken blocks and tiles, etc.

- **Solid waste:** other solid construction waste will include material such as scrap timber and various off cuts and refuse such as discarded packaging (e.g. plastic, cement bags), workers garbage and domestic waste from workers canteen etc.
- **Hazardous waste:** A small amount of hazardous waste is expected to result from construction activities; this will comprise mainly of empty paint and chemical (e.g. termidan) containers.
- **Sewage:** Sanitary waste generated by the construction workforce.
- **Runoff:** Stormwater runoff from the site
- **Dust:** Dust will be generated on the site from delivery of material and various construction activities.
- **Exhaust emissions:** from operation of vehicles and machinery on site.

4.6 Raw Materials during Operation

The primary raw materials during operation will be:

Table 5: Raw materials for operation

	Raw Material	Purpose	Source
1.	Water; maximum demand 11.4 m ³ per day	<ul style="list-style-type: none"> • Ablution and sanitary • Washing of machinery and parts • Irrigation • Fire water 	LWSC main and on-site borehole
2.	Electricity	<ul style="list-style-type: none"> • Powering of mechanical equipment • Lighting, air conditioning, etc 	11 kV ZESCO main
3.	Diesel fuel; on-site storage 2x 5,000 litre	<ul style="list-style-type: none"> • Generator set • Vehicles (forklift and truck) 	Local ERB approved supplier
4.	Coolants	<ul style="list-style-type: none"> • Generator set • Vehicles (forklift and truck) 	Local ERB approved supplier
5.	Lubricants	<ul style="list-style-type: none"> • Generator set • Vehicles (forklift and truck) • Test stand • Hydraulic components • Lathe • Painting booth 	Local ERB approved supplier

	Raw Material	Purpose	Source
6.	Kerosene	<ul style="list-style-type: none"> • Washing bay 	Local ERB approved supplier
7.	Oxygen and Acetylene gas	<ul style="list-style-type: none"> • Welding 	Local ERB approved supplier
8.	Paints and thinners	<ul style="list-style-type: none"> • Paint booth 	Local supplier or Imported ensuring compliance with Zambian standards and regulations

4.7 Activities during Operation

The main activities that will take place during operation of the remanufacturing plant will include:

- Bulk delivery of diesel as required by registered and licensed fuel tanker or bowser.
- Storage of diesel oils and lubricants
- Metal machining processes such as drilling, milling, turning, cutting, honing, grinding, etc
- Cleaning and degreasing of work pieces
- Painting
- Electroplating
- Welding and soldering

In addition, other activities will include:

- Training and Capacity Building: Comprehensive training programmes will be undertaken for company employees as well as internship students from local technical colleges on a continuous basis.
- Routine office administration

4.8 Waste and By-products during Operation

Waste and by-products resulting from various activities during operation will include:

- **Sewage:** From ablution and sanitary facilities; sewage return estimated at 7.4 m³/day.
- **Waste water:**
 - Storm water from the fuel storage area(s) and out door paved areas may contain some hydrocarbons minor leaks occurring from vehicles, pump seals, etc. or due to spillage during offloading.
 - Waste water will be generated from the external and internal washing bays which will contain oils and lubricants
- **Used oil and Lubricants/coolants:** From machinery under repair and workshop mechanical equipment
- **Metal Chafing:** this includes metal chafing, dust and shavings from various machining processes such as drilling, milling, turning, cutting, honing, grinding etc.
- **Scrap metal:** Damaged and rejected used parts and components
- **Emissions:**
 - Aerosols may be produced from various machining processes using lubricants and coolants
 - Aerosols will result from painting operations
 - Some exhaust emissions will result from the operation of diesel combustion engines (forklifts, generator set)
- **Waste paper:** Paper towels and waste paper (very limited) from the office

5.0 Project Alternatives

5.1 Site Location

The proposed site was identified as being suitable and allocated to the developer for the purposes of the project by the Zambian Government through the Zambia development Agency and Ministry of Science and Technology. As such, alternative sites have not been considered by the developer. Advantages of the proposed site include:

- The site is centrally and strategically located in Zambia to service the Company's operations on the Copperbelt and Mozambique, and in future Angola, Botswana and Zimbabwe.
- The site offers excellent access by road as well as by air.
- The site is well serviced by other existing infrastructural services including water and electricity mains.
- The site has good ground water potential
- The flat terrain of the site is suitable for the project
- The site represents a prominent position offering very good visibility and exposure for the company. This is deemed an important factor to ensure the success of the Company's future expansion plans within the Country and the region, and to promote the Company's capacity building programmes.

5.2 Building Construction

In terms of raw construction materials, technologies most suitable for the local climate and conditions have been adopted for construction of the buildings i.e. concrete block, reinforced concrete, structural steel and metal roof cladding and sheeting.

5.3 Raw Materials and Process Technology

In terms of operation, Hitachi Construction Machinery have standard equipment and processes developed over many years to ensure the best efficiency, sustainability and operation of their workshops. Thus the technologies to be employed comply with Hitachi worldwide standards.

6.0 Assessment of Environmental Impacts

6.1 Positive Impacts

A number of important benefits and advantages are expected to result from implementation of the project:

- The establishment of the Reman plant will allow for the supply of high quality reconditioned parts and components at a far more economical cost than the importation of new components. This will reduce maintenance costs and provide an economic boost to industrial sectors employing heavy duty earth moving machinery.
- The establishment of the development as HCMZ's strategic headquarters in Lusaka will help the company to consolidate its operations in Zambia and the region. This will contribute to promoting Zambia as a prime regional hub for business in Southern Africa.
- The new plant will provide direct permanent employment opportunities for up to 30 skilled Zambian personnel which will be a welcome development for the local labour market.
- The new project and multiplier effects such as increased employment and increased investment in the industrial and mining sectors will result in increased public revenues such as taxes (PAYE, VAT, corporate tax) to ZRA, increased revenue to the council in terms of rates and increased contributions to NAPSA from formally employed persons.
- Capacity building and technology transfer: Training will be provided on-the-job for permanent employees and as a part of HCMZ's corporate social responsibility the Company is also committed to providing industrial internships on a continuous basis for students from the Country's various technical colleges (e.g. Nortech).

6.2 Negative Impacts during Construction

6.2.1 Impacts on Air Quality and Noise Environment

Due to the nature of construction processes, it is expected that there will be a general increase in dust and noise pollution on the site resulting from the use of heavy machinery during earthworks, the delivery and offloading of materials, use of compressors and compactors, etc. Dust may be raised from exposed worksites and surfaces especially during windy conditions. However, there are no immediate neighbouring residential areas or other developments surrounding the site, and the area down wind of the site (to the west) comprises open agricultural land. Therefore dust raised will pose mostly a nuisance to construction workers, although effects are expected to be intermittent. In addition, the access road to the project area is paved all the way to the site and therefore dust raised by construction traffic travelling to and from the site is expected to be insignificant.

6.2.2 Impacts on Surface and Ground Water

Preparation of the site and construction is not expected to affect any existing natural drainage courses and gradients on the site are very flat so there is limited risk of soil erosion occurring during earthworks which could result in siltation and contamination of

down stream drainage features. However there is the potential for blocking the existing storm drain structure that currently traverses the north-western corner of the site. This in turn could result in the flooding of the Airport Road reserve.

Potential sources of soil and ground water (as well as surface water) contamination on the site, especially during periods of rainfall, include improper facilities for fuel storage and dispensing, leakages of oil and hydraulic fluids from badly maintained machinery, building waste and garbage and improper sanitary facilities for workers.

6.2.3 Impacts on Vegetation and Habitat

It is expected that most existing vegetation on the site will be removed for the purposes of site preparation and construction. However, as the site has previously been cleared and hosts largely scrub vegetation, the impact of loss of vegetation and habitat is considered insignificant. In addition, as no evidence of flora or fauna which is rare or of scientific value was found on the site, the project will not impact on biological diversity.

6.2.4 Impacts on Traffic and Road Safety

As a medium scale construction works, the project will involve a certain amount of construction traffic travelling to and from the site; however it is expected that any significant traffic will occur in phases such as during the haulage and delivery of materials. As the main contractor will be largely self-contained on site traffic is generally expected to be limited to light vehicles, including sub-contractors vehicles and workers' transportation. In addition the Airport Road is at present moderately trafficked, therefore, additional impacts on general traffic congestion or road safety in the project vicinity are considered to be moderate to low.

6.2.5 Impacts on Occupational Health and Safety

Although the scope of works is relatively small, construction will involve activities and procedures with potentially high risk levels to the occupational health and safety of workers and personnel. These include:

- Movement of construction traffic and machinery around the site
- Working in confined spaces (e.g. trenches)
- Work with open flames (e.g. welding) and cutting operations
- Work in dusty environment
- Work at height (e.g. scaffolding and roofs)

Strict adherence to safety measures and procedures will minimise (or eliminate) risks of accidents or hazardous developments occurring.

6.2.6. Impacts on Public Health and Safety

During construction, there is the potential for accidents occurring involving members of the public who may inadvertently gain access to the project site, although the site is located some distance away from any significant settlement.

Potential contamination of water resources, as discussed above, can be of public health concern; however the project is relatively small in scope. The project will not employ a large migratory workforce and social and epidemiological factors commonly associated with this will not be relevant.

6.3 Negative Impacts during Operation

6.3.1 Impacts on Noise Environment

During operation it is not expected that any activities of the project will produce noise levels beyond the confines of the remanufacturing factory that will be of a nuisance to neighbours. In addition surrounding residential areas will be located a reasonable distance from the plant, the nearest being some 300m to the north. However, the use of high-speed mechanical equipment and the intensive use of machines in small spaces can give rise to potentially hazardous noise levels within the plant.

6.3.2 Impact on Air Quality

The production of aerosols is inherent to some of the activities to be undertaken in the workshop such as spray painting and various machining processes whereby lubricants and coolants are used to dose tools and work pieces in order to dissipate heat. Potential emissions to air outside the plant would be expected to be limited and much localised; however, implications on operator health and safety can be significant if proper precautionary measures are not implemented.

6.3.3 Impacts on Soils and Water Quality

There is a potential for surface and ground water pollution occurring due to contaminants emanating from various waste products generated by activities during operation entering the surface drainage regime and / or polluting the soil and infiltrating the underlying aquifer. Principal point and diffused sources of contaminants include:

- The storage of petroleum products (diesel) at the new plant presents the risk of contamination of surface or groundwater if accidental leaks occur in the fuel tanks and associated works. Fuel spillages from the bulk delivery and dispensing of fuel at the facility also present the risk of the contamination of surface run-off and subsequently ground water.
- Improper storage and disposal of used oil, coolants and hydraulic fluids from used machinery under rehabilitation and various machining processes.
- Waste water from the out door washing bay and indoor engine washing booth that will contain oils and greases
- Storm water run-off from the internal road and parking areas may contain liquid waste from accidental oil leaks from vehicles
- Improper storage and disposal of other hazardous wastes such as empty paint and chemical containers

- Sewage generated during operation if discharged into the aquatic environment without adequate treatment would result in the contamination of ground or surface water resources.

Oils and greases contain hydrocarbons and/or heavy metals such as lead, chromium and cadmium, which are known drinking water pollutants. Negative impacts of this are potentially significant if specific measures are not taken for on-site waste management.

6.3.4 Impact on Surface Water Flow

As described, the construction of the development will not disrupt any natural surface drainage courses and permanent drainage structures will be constructed as outlined in Section 4.2.2.5 to ensure adequate drainage of stormwater from the site. However if the existing storm water drain that currently traverses the northwestern corner of the site is disrupted such that proper drainage away from the culvert under the Airport Road is reduced, this could in the long term affect the structural integrity of the road.

6.3.5 Impacts on Occupational Health and Safety

The plant will employ efficient and modern process equipment and systems which will contribute to reducing risks to occupational health and safety during operation. Potential sources of hazardous development will include:

- Aerosols produced under various processes and procedures, as mentioned above, can give rise to respiratory and eye problems.
- Exposure to various paints, coolants and lubricants can lead to skin diseases
- Exposure to high noise levels in confined spaces over long periods can represent a significant hazard to workers
- Aerosols produced under various processes can be flammable and there is an inherent risk of explosions or fire occurring.
- The operation of mechanical moving equipment presents the risk of injury

Proper conditions of work place and equipment and the correct work procedures are vital principles in reducing risks to a minimum and/or completely avoiding industrial accidents.

6.3.6 Impacts on Public Health and Safety

The various sources of pollutants that can contaminate soils and water as outlined above (Section 6.3.3) represent a risk to public health by contaminating drinking water or entering the food chain through agricultural produce.

6.4 Evaluation of Potential Impacts

An appraisal of potential negative impacts that may result from the project during the construction and operational phases was given in the narratives in Sections 6.2 and 6.3 above. An attempt is made in this section to evaluate the overall significance of each identified impact by assigning values to a set of criteria as follows:

- **Type of Impact** (Direct / Indirect)
- **Duration** (Intermittent / Temporary / Short Term / Medium Term (construction phase) / Long Term / Permanent)
- **Intensity / Severity** (Negligible / Low / Moderate / High)
- **Spatial Extent** (Site / Local (area surrounding the site) / Regional)
- **Likelihood** (Uncertain / Improbable / Probable / Highly Probable / Certain)
- **Sensitivity** [of the receptor; degree of change effected on natural processes or peoples livelihoods] (Low / Moderate / High)
- **Overall Significance** (Insignificant / Low / Moderate / High)

The evaluation of impacts using these criteria is presented in Table 6 below:

Table 6: Evaluation of impacts

Impact	Type of Impact	Duration	Intensity / Severity	Spatial Extent	Likelihood	Sensitivity	Overall Significance
CONSTRUCTION PHASE							
Impacts on Air Quality and Noise Levels							
Dust releases due to exposed work sites – nuisance to neighbours	Direct	Intermittent-Medium term	Low	Local	Improbable	Moderate	Insignificant
Dust releases due to exposed work sites – nuisance to workers	Direct	Intermittent-Medium term	Low	Site	Probable	Moderate	Moderate - Low
Noise from construction machinery / traffic	Direct	Intermittent – Medium term	Low	Site	Probable	Low	Very Low
Impacts on Surface and Ground Water							
Erosion and siltation of downstream drainage system	Direct	Temporary	Low	Local	Improbable	Moderate	Insignificant
Disruption of surface drainage regime (NW corner of the site) and drainage away from the Airport Road	Direct	Medium term	Moderate	Local	Probable	High	Moderate
Contamination of surface and ground water due to accidental oil and fuel spillages and leakages from transport and dispensing of petroleum products and badly maintained construction machinery	Direct	Medium term	Low	Site	Probable	High	Moderate - Low
Contamination of run-off and ground water from solid waste and garbage	Direct	Medium term	Low	Site	Probable	High	Low
Contamination of surface and ground water by workers sanitary waste	Direct	Medium term	Low-Moderate	Site	Probable	High	Moderate
Impacts on Ecosystem							

Impact	Type of Impact	Duration	Intensity / Severity	Spatial Extent	Likelihood	Sensitivity	Overall Significance
Loss of vegetation / Habitat	Direct	Permanent	Moderate	Site	Certain	Low	Low- insignificant
Impacts on Road and Traffic Safety							
Reduced safety on public access roads due to construction traffic	Direct	Medium term	Low	Local	Probable	High	Moderate - Low
Impacts on Occupational Health and Safety							
Reduced occupational health and safety	Direct	Medium term	Moderate	Site	Probable	High	High
Impacts on Public Health and Safety							
Risk of accident involving members of the public	Direct	Medium term	Low	Site	Improbable	High	Low
Risk of water borne diseases due to various potential sources of pollution	Direct	Medium term	Low	Local	Improbable	High	Low
OPERATIONAL PHASE							
Impacts on Noise Levels							
Increased noise levels – nuisance to neighbours	Direct	Intermittent - Long term	Negligible	Local	Improbable	Moderate	Insignificant
Increased noise levels hazard to workers	Direct	Intermittent - Long term	High	Site	Certain	High	High
Impacts on Air Quality							
Air pollution outside plant due to emissions	Direct	Intermittent - Long term	Very low	Local	Probable	High	Low
Air pollution within plant hazard to workers	Direct	Intermittent - Long term	Moderate - High	Site	Probable	High	High
Impacts on Water Quality							
Contamination of surface / ground water due to accidental leaks or spillages in bulk fuel system	Direct	Long term	Low	Local	Improbable- Probable	High	Low

Impact	Type of Impact	Duration	Intensity / Severity	Spatial Extent	Likelihood	Sensitivity	Overall Significance
Contamination of surface / ground water due to improper storage and disposal of used oil and hydraulic fluids	Direct	Long term	Low	Local	Probable	High	High
Contamination of surface / ground water by waste water from wash bays	Direct	Long term	Moderate - Low	Local	Probable	High	High
Contamination of surface and ground water from solid waste and garbage	Direct	Long Term	Very Low	Site	Probable	High	Low
Contamination of surface and ground water sanitary waste	Direct	Long Term	Moderate	Site	Probable	High	Moderate
Impacts on Occupational Health and Safety							
Risk to Occupational Health and Safety due to various sources of hazardous development	Direct	Long term	Moderate - High	Site	Probable	High	High
Impacts on Occupational and Public Health and Safety							
Risk of water borne diseases due to water contamination by various sources of pollution	Direct	Long term	Low	Local	Probable - Improbable	High	Moderate - Low

7.0 Mitigation Measures

7.1 Mitigation Measures during Construction

7.1.1 Impacts on Air Quality and Noise Environment

During site preparation and construction every effort will be made to reduce dust and noise pollution. This will include regular watering down of all work areas.

7.1.2 Impacts on Surface and Ground Water

Adequate temporary drainage structures will be put in place to ensure that drainage away from the Airport Road culvert at the north-western corner of the site is not impeded.

To prevent or avoid potential sources of water pollution, the following waste management protocols shall be observed by the Contractor(s):

- To ensure no leakage of petroleum products to ground or surface water, diesel on site will be stored in limited quantities in up to five 210 litre drums accommodated in a purpose built and bunded concrete hard surface.
- Spill kits will be provided that can be used to absorb and contain any potential spillages and to protect discharge to surface waters or the drains.
- Poorly maintained construction machinery will not be allowed to operate on site. Drip pans will be available on hand for the capture of any substance leaking from machinery.
- Construction waste and refuse will be disposed of at an ECZ approved dumping site in accordance with ECZ Waste Management Regulations (Statutory Instrument No. 71 of 1993 of EPPCA, 1990). Materials such as scrap timber and cement bags should be recycled as far as possible on the site.
- Construction workers shall be provided with adequate sanitary facilities in the form of a portable chemical toilets

These and other waste management protocols as outlined in Section 7.3 shall be observed by the Contractor(s).

7.1.3 Impacts on Vegetation and Habitat

A replanting programme for trees and other vegetation (including indigenous species) will form a part of the landscaping phase of the project which will have a positive impact by adding aesthetic value to the area and providing a new habitat for birds.

7.1.4 Impacts on Traffic and Road Safety

Designated access routes to the site for construction traffic shall be set and complied with by the contractor

7.1.5 Impacts on Occupational Health and Safety

All construction activities will be conducted in accordance with applicable Zambian construction Health and Safety Standards. These include provisions of the Factories Act and Workman's Compensation Act.

Specific safety rules shall apply to:

- Personal Protective Clothing (PPE) shall be issued and used as required by the various categories of the workforce.
- Barrier tape and warning signs will be put in place in relevant strategic places (e.g. around excavations) to prevent injury to construction workers as well as other staff or visitors.

7.1.6 Impacts on Public Health and Safety

During construction, site will be bounded by a security fence to prevent unauthorised access. Visitors will be required to sign a visitors log at the entrance to the site to ensure that there is no unauthorised access. Waste management protocols, as outlined in Section 7.3 will be implemented by the Contractor.

7.2 Mitigation Measures during Operation

7.2.1 Noise Environment

- The workshop plant will be fully cladded and enclosed which will ensure that noise levels outside the plant are low.
- Hearing protection will be provided to operators (Section 7.2.5).

7.2.2 Impacts on Air Quality

The necessary exhaust extraction and ventilation equipment will be installed in the plant to ensure a clean and comfortable work environment and to ensure that harmful discharges to air are prevented. This will include:

- Extraction fans for the painting and engine cleaning booths with all discharges to air screened through filters
- Mist extraction equipment close to the source of production of aerosols under various machining processes
- A displacement ventilation system for the workshop building (Figure 9)

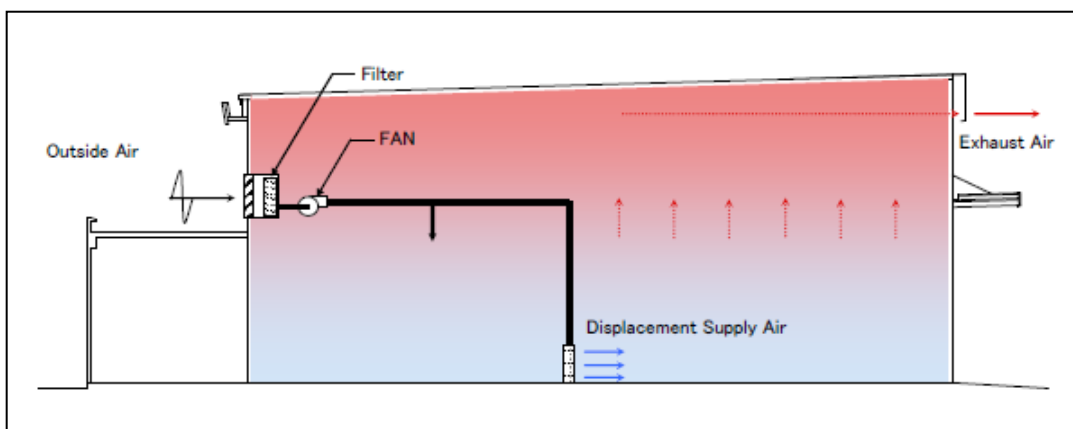


Figure 9: Workshop displacement ventilation system

7.2.3 Impacts on Soil and Water Quality

All petroleum products to or from this site will be transported, handled and stored in accordance with the applicable Acts and Statutory Instruments and other local laws, Zambia Bureau of Standards (ZS 392 Parts 2 and 3) and Energy Regulation Board Standards and Codes of Practice.

As described in section 4.2.2.6 bulk storage of diesel will be provided in two above ground steel tanks of capacity 5,000 litres each mounted on steel skids within a concrete containment bund of a capacity equivalent to 110% of the volume of the tank installed within it. The off-loading pump, fuel filters and supply and return feeds will also be located within the same bund. The generator plant room floor and one brick height (110mm) of the wall will be painted with diesel resistant epoxy paint and will be utilized as a bund wall for the generator. All bunded areas will drain to an oil interceptor to ensure that no fuel is discharged to the storm water drainage system.

Dedicated oil interceptors will be provided for the outdoor washing bay and workshop engine washing room through which all oil containing wastewater produced in these areas will be directed and treated prior to discharge to the site drainage system. A boundary oil interceptor will also be located at the outfall point of the site drainage system to the local road storm water drainage system along the northern boundary of the site to provide overall treatment of all stormwater / waste water runoff emanating from the site prior to discharge to the aquatic environment.

A drawing showing standard installation layout and details for a 5,000 litre above ground steel skid tank is given in Appendix 8. A detailed drawing of the oil interceptor is given in Appendix 9.

Practical measures will include:

- As a matter of routine maintenance in order to detect any leaks in the system, bulk fuel tanks will be pressure tested once per year in accordance with The Petroleum Industry's The Energy Regulation Board's standard procedures and ZABS standards (ZS 392 Parts 2).
- All Oil Interceptors will be inspected weekly during the dry season and daily during the rainy season to ensure that discharge of Petroleum to the storm water drainage system does not occur. The outflow from the Boundary Oil Interceptor will be tested quarterly to ensure compliance with ECZ standards for the discharge of effluent to the aquatic environment (S.I. No. 72 of 1993). All Oil Interceptors will be emptied at least annually or more frequently as required. Emptying of the Petroleum separation chamber will be contracted out to an ECZ approved company for disposal in accordance with ECZ rules and regulations (The Hazardous Waste Management Regulations, SI No. 125 of 2001 of The Environmental Protection and Pollution Control Act, 1990).

- Inspection of drains – Open channel and underground drains, where constructed on the site, will be inspected quarterly and especially in the month prior to the on-set of the rains.

In addition:

- A dedicated storage room shall be provided for the oils, lubricants and paints in approved containers on a concrete hard standing surface with retention bund as per ERB standards (ZS 392 Part1).
- All used oils, lubricants, hydraulic fluids and coolants will be collected and stored in approved containers on a concrete hard standing surface with retention bund as per ERB standards (ZS 392 Part1) and disposed of in accordance with the Hazardous Waste Management Regulations (SI 125 of 2001 of EPPCA, 1990).
- All hazardous wastes including material soiled with hazardous wastes (e.g. metal chafing soiled with oils and greases) and empty containers of hazardous materials (e.g. oils, paints and solvents) shall be stored in a designated area on site for regular removal and disposal by a registered contractor in accordance with the Hazardous Waste Management Regulations, (SI No. 125 of 2001 of EPPCA, 1990)

Treatment and disposal of sewage will be provided for by septic tank and soak away as outlined in Section 4.2.2.2. A standard septic tank and soak away drawing is given in Appendix 7.

7.2.4 Impacts on Surface Water Flow

As part of the design of the permanent storm water drainage system, the existing storm drain traversing the northwestern corner of the site will be diverted around the boundary of the site or directed through a box culvert (to be determined under detailed design) to ensure that the existing drainage regime away from the Airport Road culvert is not affected or impeded in any way.

7.2.5 Impacts on Occupational and Health and Safety

All procedures and practices involved in the operation of the power generation plant will comply with the most stringent of:

- Hitachi Construction Machinery Zambia Co., Ltd Health and Safety Policy
- All applicable Zambian health and safety standards and regulations.

The company will ensure that all plant and equipment is in suitable condition and is able to operate without risks to health and safety, and that effective monitoring and maintenance is undertaken of the same.

All personnel responsible for operating and maintaining the facility will be specifically trained for the purpose and will be induced in the company's safety rules and regulations.

Personal Protective Clothing (PPE) shall be issued and used as required by the various categories of the workforce. This will include:

- Respiratory protection
- Hearing protection
- Eye protection
- Skin protection

The necessary extraction and ventilation systems will be installed in the plant as described in Section 7.2.2 to ensure a clean and comfortable working environment.

Emergency Fire Response:

Specific fire extinguishing equipment to be installed will include:

1. Electrical Transformer:
 - 1 x 9kg DCP Fire extinguisher
 - 1x 5kg CO₂ fire extinguishers
2. Bulk Fuel Tanks (each 5,000 litre tank):
 - 1x 50litre foam units
 - 1x 20litre sand buckets
3. Generator Plant Room:
 - 2x 9kg DCP fire extinguishers
 - 1x 20 litre sand bucket
 - 1x 25kg foam unit
 - 1x 5kg CO₂ fire extinguishers
4. Office Building:
 - 2x 9kg DCP Fire extinguishers; maximum walking distance 20m
 - 2x water Fire extinguishers; maximum walking distance 20m
 - 1x 5kg CO₂ fire extinguishers (for server room)
5. Workshop:
 - 16 x DCP Fire extinguishers; maximum walking distance 20m.

In the event of a fire, the fire extinguisher sited in each location will allow for immediate access to enable the staff to tackle the fire. All Fire Fighting Equipment will be checked and serviced regularly to ensure that they are always in full working order. The position of fire-fighting equipment will be clearly marked on a plan of the installation.

A list of key contacts that may be needed in case of an emergency will be displayed with names and phone numbers. Key contacts will include fire brigade, police, local clinic/hospital, ECZ and the Centre Emergency Response Coordinator.

All personnel will be trained on what action to take in the event of a fire. Which is:-

The person discovering the fire will:

1. Sound the alarm
2. Make sure no one is trapped in the immediate area of the installation

3. If safe to do so, tackle the fire with the fire equipment available

The person in-charge will conduct a quick investigation as to the type and size of the fire and:

1. Make sure the Fire Brigade has been called.
2. Instruct the trained fire team from the employees to tackle the fire.
3. Order all other staff away from the area.

7.2.6 Public Health and Safety

All procedures and waste management protocols to minimize or prevent possible sources of contamination of soils and the aquatic environment as outlined in Sections 7.2.3 and 7.3 will be strictly observed.

7.3 Waste Management Protocols

Waste and by-products expected to be generated during the construction and operational phases of the project were listed and discussed in Sections 4.5 and 4.8 respectively. Measures to be put in place for the management of this waste have been discussed under the relevant headings in Mitigation Measures above (Sections 7.1 and 7.2). For ease of reference, waste management protocols for the construction and operational phases of the project are summarized in full in Table 7 below.

Table 7: Summary of Waste Management Protocols

Ref. No	Type of waste / By-product	Waste Management Measures
CONSTRUCTION PHASE		
WM1	Vegetative Material	<ul style="list-style-type: none"> Vegetative material cleared from the site will be disposed of off-site at an approved landfill.
WM2	Topsoil	<ul style="list-style-type: none"> Topsoil generated by scarifying of work areas will be stockpiled for re-use in landscaping
WM3	Construction rubble (clean rubble)	<ul style="list-style-type: none"> Material such as concrete spoil / broken blocks and excess sub-soil from trench excavations will be stockpiled in a designated area on site and recycled as backfill and hardcore for new slabs / substructures and/or aggregate for road construction
WM4	Other Solid Waste	<ul style="list-style-type: none"> Solid waste such as packaging, workers garbage, etc. will be collected in a skip on site, and then collected regularly by an approved company for disposal at an ECZ approved dumping site in accordance with ECZ Waste Management Regulations (Statutory Instrument No. 71 of 1993 of EPPCA, 1990). Materials such as scrap timber and cement bags should be recycled as far as possible on the site. There shall also be no burning of waste materials on site.
WM5	Hazardous waste	<ul style="list-style-type: none"> All hazardous wastes including material soiled with hazardous wastes and empty containers of hazardous materials shall be stored in a designated area on site for regular removal and disposal by a registered contractor in accordance with the Hazardous Waste Management Regulations, (SI No. 125 of 2001 of EPPCA, 1990).
WM6	Sanitary waste	<ul style="list-style-type: none"> Adequate temporary sanitary facilities will be provided on site for all construction workers (including casuals) in the form of chemical toilets
WM7	Dust	<ul style="list-style-type: none"> All exposed work surfaces on the site will be watered down on a regular (daily) basis
WM8	Exhaust emissions / oil & fuel leaks (Construction Machinery)	<ul style="list-style-type: none"> Badly maintained construction equipment will not be allowed to operate on the construction site to avoid smoke emissions and oil leaks. Drip pans will be available on hand for the capture of any substance leaking from machinery.
OPERATIONAL PHASE		
WM9	General	<ul style="list-style-type: none"> Proper housekeeping will ensure that the all parts of the facility are at all times clean and tidy.

Table 7: Summary of Waste Management Protocols

Ref. No	Type of waste / By-product	Waste Management Measures
WM10	Sewage	<ul style="list-style-type: none"> • Sewage arising of the site will be treated and disposed of via septic tank and soak away facilities designed to accommodate the expected return flows as described in section 4.2.2.2. • Sewer lines will be checked routinely for leaks and damage and necessary maintenance carried out. • Sewer line maintenance will include routine rodding and flushing of the sewer mains, service calls on potentially blocked lines and repair of damaged lines.
WM11	Waste water	<ul style="list-style-type: none"> • For the treatment of waste water containing oils and hydrocarbons, dedicated oil interceptors will be provided for: <ul style="list-style-type: none"> – All bunded fuel and oil storage areas – Out door washing bay – Workshop engine washing room
WM12	Used oil and lubricants / coolants	<ul style="list-style-type: none"> • All used oils, lubricants, hydraulic fluids and coolants will be collected and stored in approved containers on a concrete hard standing surface with retention bund as per ERB standards (ZS 392 Part1) and disposed of in accordance with the Hazardous Waste Management Regulations (SI 125 of 2001 of EPPCA, 1990).
WM13	Other hazardous waste	<ul style="list-style-type: none"> • All hazardous wastes including material soiled with hazardous wastes (e.g. metal chafing soiled with oils and greases) and empty containers of hazardous materials (e.g. oils, paints and solvents) shall be stored in a designated area on site for regular removal and disposal by a registered contractor in accordance with the Hazardous Waste Management Regulations, (SI No. 125 of 2001 of EPPCA, 1990)
WM14	Scrap metal	<ul style="list-style-type: none"> • Scrap metal will be stored in a dedicated scrap metal yard for collection by an approved scrap metal dealer
WM15	Emissions	<ul style="list-style-type: none"> • The necessary exhaust extraction and ventilation equipment will be installed in the plat to ensure a clean and comfortable work environment and to ensure that harmful discharges to air are prevented. This will include: <ul style="list-style-type: none"> – Extraction fans for the painting and engine cleaning booths with all discharges to air screened through filters – Mist extraction equipment close to the source of production of aerosols under various machining processes – A displacement ventilation system for the workshop building
WM16	Solid Waste	<ul style="list-style-type: none"> • A skip will be provided on site for un-recyclable waste solid waste (e.g. office waste). Waste from refuse skips shall be collected on a regular basis by for disposal in accordance with ECZ Waste Management Regulations (Statutory Instrument No. 71 of 1993 of EPPCA, 1990).

8.0 Environmental Management and Monitoring Plan (EMMP)

An Environmental Management and Monitoring Plan is laid out in Table 9 below. Many of the environmental issues related to the project have been considered in the design phase, thus they form part of the mitigation measures. As such, these form part of the EMMP, and are summarised in Table 8.

Ultimate responsibility for Environmental Management at all project phases will be that of the Managing Director of HCMZ. Compliance with relevant Health, Safety and Environmental standards during construction will be the prime responsibility of the Contractor. During operation, Senior HCMZ Management will be fully responsible for the implementation of Environmental Management and Monitoring activities and ensuring full compliance with Health, Safety and Environmental standards.

Table 8: Environmental Design Features

Ref. No	Affected Environment	Objective to Address Impact	Environmental Design Feature
D1.	Noise Environment	To minimise noise nuisance	The workshop plant will be fully cladded and enclosed which will ensure that noise levels outside the plant are low.
D2.	Air Quality / Occupational Health and Safety	To ensure a clean and comfortable work environment and to ensure that harmful discharges to air are prevented.	The necessary exhaust extraction and ventilation equipment will be installed in the plat This will include: <ul style="list-style-type: none"> • Extraction fans for the painting and engine cleaning booths with all discharges to air screened through filters • Mist extraction equipment close to the source of production of aerosols under various machining processes • A displacement ventilation system for the workshop building (See Figure 9)
D3.	Storm water Drainage	To ensure adequate drainage from the site and that the local drainage regime is not disrupted	<ul style="list-style-type: none"> • Storm water drainage will be by closed lined drains (covered by grating or concrete slab) to both the front and rear of the site and will tie into an open lined perimeter drain surrounding the boundary of the site. • This will discharge to the existing drainage system in the road reserve along the northern boundary of the site. • All drains will be lined • As part of the design of the permanent storm water drainage system, the existing storm drain traversing the northwestern corner of the site will be diverted around the boundary of the site or directed through a box culvert (to be determined under detailed design). • See Drawing No. 1027-A-15 (External Works), Appendix 6.
D4.	Soils / Ground Water Quality / Public Health	To prevent contamination of water resources with hydrocarbon fuels / lubricants from point or diffused sources	<ul style="list-style-type: none"> • Bulk fuel storage will be provided in accordance with Energy Regulation Board regulations and the standards set by The Zambian Bureau of Standards: ZS 392: Part 2 (Zambian Standards for The Storage and Handling of Liquid Fuels: For large consumer installations exceeding 1,500 litres in the case of a liquid fuel having a flash point not lower than 38°C). • Bulk storage of diesel will be provided by two 5,000 litre above ground fuel storage tanks (i.e. a total of 10,000 litres) for the generator and for forklift trucks/machinery testing respectively. • In line with ZABS standards, the tanks and pipe work will be constructed within concrete containment bunds with a reinforced concrete slab and solid concrete block walls to prevent any egress of hydrocarbon fuels and/or lubricants outside the bund and thus to ground. • Each containment bund will have a capacity equivalent to 110% of the volume of the largest tank installed within it. All bunds will have a drainage sump with a valve fitted to the outside of the bund and a piped drain to a common oil interceptor constructed in accordance with the calculated flows of storm water anticipated. This valve will enable normal flow off the bund during wash downs and rain into the oil interceptor. However, in the event of a major leak/spill the valve can be closed to contain the fuels for pumping out into another tank or vehicle. • The entire generator plant room floor and one brick height (110mm) of the wall will be painted with diesel resistant epoxy paint and will be utilized as a bund wall for the generator. This bund will also have a drainage sump with a valve fitted to the outside of the bund and a piped drain to the oil interceptor.

Table 8: Environmental Design Features

Ref. No	Affected Environment	Objective to Address Impact	Environmental Design Feature
			<ul style="list-style-type: none"> • The off-loading pump, fuel filters and supply and return feeds will also be located within the same bund in order to prevent any fuel or lubricant leaks to ground due to pipe leaks or pump seal failure. • The loading / off loading point to and from vehicles will comprise a hard standing surface with drainage to the oil interceptor. • A drawing showing standard installation layout and details for a 5,000 litre above ground steel skid tank is given in Appendix 8. A detailed drawing of the oil interceptor is given in Appendix 9. • Dedicated oil interceptors will be provided for the outdoor washing bay and workshop engine washing room through which all oil containing wastewater produced in these areas will be directed and treated prior to discharge to the site drainage system. • A boundary oil interceptor will also be located at the outfall point of the site drainage system to the local road storm water drainage system along the northern boundary of the site to provide overall treatment of all stormwater / waste water runoff emanating from the site prior to discharge to the aquatic environment. • A dedicated storage room shall be provided for oils, lubricants and paints in approved containers on a concrete hard standing surface with retention bund as per ERB standards (ZS 392 Part1). • All used oils, lubricants, hydraulic fluids and coolants will be collected and stored in approved containers on a concrete hard standing surface with retention bund as per ERB standards (ZS 392 Part1). • All hazardous wastes including material soiled with hazardous wastes (e.g. metal chafing soiled with oils and greases) and empty containers of hazardous materials (e.g. oils, paints and solvents) shall be stored in a designated area
D5.	Ground Water Quality / Public Health	To prevent contamination of water resources by sewage	<ul style="list-style-type: none"> • Sewage arising of the site will be treated and disposed of via septic tank and soak away facilities designed to accommodate the expected return flows. A standard drawing showing standard septic tank and soakaway details is given in Appendix 7.
D6.	Fire Protection / Occupational and Public Health and safety	To minimise potential risks of fire	<ul style="list-style-type: none"> • The development will be equipped with all necessary smoke and fire detection systems and alarms and will also have installed fire fighting equipment to satisfy and/or exceed Local Building Regulations. • Specific fire extinguishing equipment to be installed will include: <ol style="list-style-type: none"> 1. Electrical Transformer: <ul style="list-style-type: none"> - 1 x 9kg DCP Fire extinguisher - 1x 5kg CO₂ fire extinguishers 2. Bulk Fuel Tanks (each 5,000 litre tank): <ul style="list-style-type: none"> - 1x 50litre foam units - 1x 20litre sand buckets

Table 8: Environmental Design Features

Ref. No	Affected Environment	Objective to Address Impact	Environmental Design Feature
			<p>3. Generator Plant Room:</p> <ul style="list-style-type: none"> - 2x 9kg DCP fire extinguishers - 1x 20 litre sand bucket - 1x 25kg foam unit - 1x 5kg CO₂ fire extinguishers <p>4. Office Building:</p> <ul style="list-style-type: none"> - 2x 9kg DCP Fire extinguishers; maximum walking distance 20m - 2x water Fire extinguishers; maximum walking distance 20m - 1x 5kg CO₂ fire extinguishers (for server room) <p>5. Workshop:</p> <ul style="list-style-type: none"> - 16 x DCP Fire extinguishers; maximum walking distance 20m. <ul style="list-style-type: none"> • An external Fire-Hydrant System will be provided to National Fire Protection Agency Standard. • Lightning Protection System will be provided by two independent truss pillars with upper needles to be installed on open ground to the north and south of the buildings. The building is included by 120m. • All building structures will be semi fire proof • All electrical glands will be flameproof and all electrical installations will be carried out in accordance with Institute of Electrical Engineers regulations and ZABS standards ZS 402.

Table 9: Environmental Management and Monitoring Plan (EMMP)

Ref. No	Affected Environment	Objective to Address Impact	Mitigation Measures	Responsibility	Due Date / Frequency	Monitoring Activity	Frequency
Construction Phase							
C1	Air Quality	To minimise dust nuisance	All work areas will be regularly watered down by water bowser	Site Officer SHE	Daily	Routine inspection of worksites	Daily
C2	Surface Water Flow	To ensure that drainage away from the Airport Road culvert at the north-western corner of the site is not impeded.	Adequate temporary drainage structures will be put in place	Site Officer SHE	4 th Quarter 2010	Routine inspection of worksites	Daily
C3	Surface and Ground Water Quality	To prevent contamination of water resources from point or diffuse sources	To ensure no leakage of petroleum products to ground or surface water, diesel on site will be stored in limited quantities in up to five 210 litre drums accommodated in a purpose built and bunded concrete hard surface.	Site Officer SHE	4 th Quarter 2010	Routine inspection of worksites	Daily
C4	Surface and Ground Water Quality	To prevent contamination of water resources from point or diffuse sources	Spill kits will be provided that can be used to absorb and contain any potential spillages and to protect discharge to surface waters or the drains.	Site Officer SHE	4 th Quarter 2010	Records of procurement; incidence reports	Construction programme
C5	Surface and Ground Water Quality	To prevent contamination of water resources from point or diffuse sources	Poorly maintained construction machinery will not be allowed to operate on site. Drip pans will be available on hand for the capture of any substance leaking from machinery.	Site Officer SHE	At all times	Maintenance records for all construction vehicles and plant equipment engines.	Ongoing
C6	Surface and Ground Water Quality	To prevent contamination of water resources from point or diffuse sources	Construction waste and refuse will be disposed of at an ECZ approved dumping site in accordance with ECZ Waste Management Regulations (Statutory Instrument No. 71 of 1993 of EPPCA, 1990).	Site Officer SHE	As required	Records of collection and disposal of all solid waste	Ongoing
C7	Surface and Ground Water Quality	To prevent contamination of water resources from point or diffuse sources	Construction workers shall be provided with adequate sanitary facilities in the form of a portable chemical toilets	Site Officer SHE	4 th Quarter 2010	Routine inspection of worksites	Daily
C8	Surface and Ground Water Quality	To prevent contamination of water resources from point or diffuse sources	Waste management protocols as outlined in Section 7.3 shall be observed by the Contractor(s).	Site Officer SHE	Ongoing	Log of materials brought to or removed from site	Daily
C9	Traffic and Road Safety	To minimise disruption to traffic / maximise road safety	Designated access routes to the site for construction traffic shall be set and complied with by the contractor	Site Officer SHE	Daily	Determined in contract documents	Construction programme
C10	Occupational Health and safety	To ensure Health and Safety on the construction site	All construction activities will be conducted in accordance with applicable Zambian Construction Health and Safety Standards.	Site Officer SHE	Ongoing	Joint site inspection by relevant authorities	Monthly
C11	Occupational Health and safety	To prevent injury to construction workers and Other personnel.	Barrier tape and warning signs will be put in place in relevant strategic places (e.g. around excavations)	Site Officer SHE	As required	Visual inspection	Twice daily
C12	Public Health and safety	To prevent accident or injury to members of the public / visitors	Visitors will be required to sign visitors log at the main visitors entrance to the construction site	Site Officer SHE	All visitors	Visitors registration log	Daily

Table 9: Environmental Management and Monitoring Plan (EMMP)

Ref. No	Affected Environment	Objective to Address Impact	Mitigation Measures	Responsibility	Due Date / Frequency	Monitoring Activity	Frequency
C13	Public Health and safety	To minimise risk of water borne diseases	Waste management protocols, as outlined in Section 7.3 will be implemented by the Contractor (as per Requirement C 8).	Site SHE Officer	Ongoing	Log of materials brought to or removed from site	Daily
Operational Phase							
O1	Air quality / Health and Safety	To ensure a clean and comfortable work environment and to prevent harmful discharges to air	All extraction and ventilation equipment shall be properly maintained to ensure operational efficiency.	HCMZ SHE Officer	As required / routine service	Routine inspection and routine maintenance records	Weekly inspection
O2	Water Quality / Health and Safety	To prevent contamination of surface and ground water / To implement operating practices to ensure Health and Safety	All petroleum products to this site will be transported, stored and dispensed in accordance with the applicable Acts and Statutory Instruments and other local laws, Zambia Bureau of Standards (ZS 392 Parts 2 and 3) and Energy Regulation Board standards and Codes of Practice (See requirement D4).	HCMZ SHE Officer	As required	Routine maintenance and inspection records	As per procedures
O3	Water / Soil Quality	To detect potential leaks and prevent contamination of surface and ground water with hydrocarbon oils/fuels	Bulk fuel tank and fuel lines will be pressure tested routinely in accordance with The Petroleum Industry's The Energy Regulation Board's standard procedures and ZABS standards (ZS 392 Parts 2).	HCMZ SHE Officer	Annually	Records of testing	Annually
O4	Water / Soil Quality	To prevent contamination of surface and ground water with hydrocarbon fuels	The outflow from the Oil Interceptors will comply with ECZ standards for the discharge of effluent to the aquatic environment (S.I. No. 72 of 1993).	HCMZ SHE Officer	Ongoing	<ul style="list-style-type: none"> Regular inspection and testing of interceptor outflow Regular testing of soil samples (see parameters, Appendix 5) 	<ul style="list-style-type: none"> Weekly inspection Quarterly testing interceptor Annual testing soil
O5	Water / Soil Quality	To prevent contamination of surface and ground water with hydrocarbon oils/fuels	The Oil Interceptor will be emptied and cleaned by an ECZ approved company for disposal in accordance with ECZ rules and regulations (SI No. 125 of 2001 of EPPCA, 1990)	HCMZ SHE Officer	Annually	Regular inspection, records of collection of waste	Weekly, as required
O6	Water / Soil Quality	To prevent contamination of surface and ground water with hydrocarbon oils/fuels	Open channel and underground drains, where constructed on the site, will be cleaned routinely	HCMZ SHE Officer	As required	Regular inspection	Quarterly
O7	Water / Soil Quality	To prevent contamination of surface and ground water with hydrocarbon oils/fuels	All used oils, lubricants, hydraulic fluids and coolants will be collected and stored in approved containers on a concrete hard standing surface with retention bund as per ERB standards (ZS 392 Part1) and disposed of in accordance with the Hazardous Waste Management Regulations (SI 125 of 2001 of EPPCA, 1990).	HCMZ SHE Officer	Ongoing	Regular inspection, records of collection of waste	As required

Table 9: Environmental Management and Monitoring Plan (EMMP)

Ref. No	Affected Environment	Objective to Address Impact	Mitigation Measures	Responsibility	Due Date / Frequency	Monitoring Activity	Frequency
O8	Water / Soil Quality	To prevent contamination of surface and ground water with hazardous materials	All hazardous wastes including material soiled with hazardous wastes (e.g. metal chafing soiled with oils and greases) and empty containers of hazardous materials (e.g. oils, paints and solvents) shall be stored in a designated area on site for regular removal and disposal by a registered contractor in accordance with the Hazardous Waste Management Regulations, (SI No. 125 of 2001 of EPPCA, 1990)	HCMZ SHE Officer	Ongoing	Regular inspection, records of collection of waste	As required
O9	Occupational Health and Safety	To maximise Health and Safety in plant work environment	All procedures and practices will comply with all applicable Zambian safety standards and regulations.	HCMZ SHE Officer	Ongoing	Routine inspection as per Company procedures	As per Company procedures
O10	Occupational Health and Safety	To maximise Health and Safety in plant work environment	All procedures and practices will comply with all Hitachi Construction Machinery Zambia Co., Ltd Health and Safety Policy	HCMZ SHE Officer	Ongoing	Routine inspection as per Company procedures	As per Company procedures
O11	Occupational Health and Safety	To maximise Health and Safety in plant work environment	Personal Protective Clothing (PPE) shall be issued and used as required by the various categories of the workforce. This will include: <ul style="list-style-type: none"> • Respiratory protection • Hearing protection • Eye protection • Skin protection 	HCMZ SHE Officer	As required	A Personal Protective Clothing issued to the work force.	Ongoing
O12	Occupational / Public Health and Safety	To minimise fire risk	As per Requirement O2	HCMZ SHE Officer	As per O2	As per O2	As per O2
O13	Occupational / Public Health and Safety	To minimise fire risk	All Fire Fighting Equipment will be checked and serviced regularly to ensure that they are always in full working order.	HCMZ SHE Officer	Bi-annually	Routine maintenance and inspection records to be maintained and extinguishers to be clearly labelled.	As per procedures
O14	Occupational / Public Health and Safety	To minimise fire risk	Fire Emergency Response Procedures will be followed as outlined in Section 7.2.5	HCMZ SHE Officer	At all times	Incidence reports	As required
O15	Public Health and Safety	To prevent risks to public health due to potential sources of pollution	All waste management protocols as outlined in Section 7.3 shall be observed	HCMZ SHE Officer	Ongoing	As per procedures	Ongoing

9.0 Conclusion

It is our professional opinion that the proposed development as described above is approved to operate on the basis that:

1. A number of social and economic benefits are expected to result from the project which will include providing an economic boost to industrial sectors employing heavy duty earth moving machinery by offering cost effective maintenance solutions, technology and skills transfer through the Company's training programmes and promotion of Zambia as a regional business hub.
2. All steps to prevent fuel, oil and waste water contamination to ground and the aquatic environment will be incorporated in the design, construction and operation of the facility.
3. Safe working practices and adherence to safety regulations will be given high priority during both construction and operational phases of the project.

We are also of the opinion that the project proposals for the construction operation of the remanufacturing facility will satisfy the laws and regulations of Zambia.

APPENDICES

Appendix 1:
Certificate of Incorporation

Appendix 2:
Application for Planning Permission

Appendix 3:
Letter to ECZ from NISIR Dated 1 November,
2010

Appendix 4:
Geotechnical Report

Appendix 5:
Soil Testing Results

Appendix 6:

Project Layout and Design Drawings

- 1027-A-06: Site Plan
- 1027-A-07: Ground Floor Plans
- 1027-A-08: 1st Floor Plans
- 1027-A-09: Roof Plans
- 1027-A-10: Elevations
- 1027-A-11: Sections
- 1027-A-15: External Works

Appendix 7:
Standard Septic Tank and Soakaway Details

Appendix 8:
**Standard installation layout and details for a
5,000 litre above ground steel skid tank**

Appendix 9:
Standard Oil Interceptor Details