

CHOBE AGRIVISION LIMITED



Parklands and Whispering Hope Farms

Environmental Impact Statement

April 2011



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Acknowledgements

Mr Fred Wallis and staff at Chobe Agrivision's Parklands and Whispering Hope Farms are thanked for their provision of information and support in difficult circumstances at the beginning of the farming season and in the middle of a process of ownership transfer. The Environmental Council of Zambia is thanked for their technical support and advice.

Executive Summary

Zambia has four months of effective rainfall. In order to increase agricultural production and improve national food security, extending irrigated agriculture is a national priority. The Munshiwemba River irrigation project in the Mkushi farm block was set up by a consortium of commercial farmers to construct two earth dams to expand crop irrigation and secure livestock watering. Dam construction started in 2005 and continues, with progressive height increments to the dam wall.

The Munshiwemba River Irrigation Company manages the upper (Masebe) dam through a consortium of farmers and serves a potential 2,000 ha of irrigated farmland, of which 990 ha are currently under irrigation.

Chobe Agrivision Limited owns two adjoining farms holdings on the right (north) bank of the Munshiwemba River close to the Masebe Dam that have access to the water provided by Mushiwemba River Irrigation Company:

- Parklands Farm (783.874 ha), a recent sub-division of Wheatlands Farm; and
- Whispering Hope Farm (1,720.000 ha).

Chobe Agrivision intends to extend its existing irrigated crop area by 380 ha from 660 ha to a total of 1,040 ha (slightly less than 50% of the total area of the two farms). The project will be implemented in two phases. The first phase will establish two centre pivot irrigation systems on Whispering Hope Farm (1x80ha and 1x70 ha respectively). The second phase intends to establish four centre pivots (2x60 ha and 2 x 50 ha) on Whispering Hope and 1 x 30 ha pivot on Parklands.

The irrigation infrastructure will involve extending the existing pumping mains on the two farms drawing on the existing water rights from the Masebe Dam and a new night storage dam of 900,000 m³. The extension will require some minor woodland clearance (approximately 180 ha) on Whispering and Parklands Farms and the replacement and relocation of existing small pivots on Whispering Hope Farm.

Other works will include changes to the farm roads, construction of additional farm housing and the drilling of two boreholes on Whispering Hope Farm for potable water supplies (see the project objectives in Annex 1).

The project is situated within the Mkushi farming block in Mkushi district in Central Province of Zambia. The Mkushi farming block is nearly 300 km from Lusaka and lies at an altitude of 1,300 m to 1,350 m on rolling plateau terrain.

Parklands Farm does not have a riparian location, but the Munshiwemba River and the Masebe Dam form the southern boundary to Whispering Hope Farm. Both farms occupy parts of the north valley slope of the Munshiwemba River. Parklands Farm is now largely cleared of woodland vegetation, but Whispering Hope Farm still retains a significant level of woodland cover (see Figure 3)¹.

¹ The woodland cover shown on Parklands Farm has been largely removed in the last two years since the capture date of the satellite image.

This EIA was carried out in stages: 1) a review of development plans, 2) an initial field assessment (in October 2010), 3) a desk study of available information, supported by use of currently available Google-sourced remote sensing imagery, 4) detailed fieldwork and consultation with management and staff on site, 5) analyses, and 6) report writing.

General Conclusions

None of the negative environmental or social impacts related to the Chobe Agrivision Parklands and Whispering Hope Farm Irrigation Project are considered diverse, irreversible or unprecedented. Therefore the overall environmental and social risks are considered insignificant. We note that the farms are being purchased by Chobe Agrivision in an acquisition that is completing as this report was compiled. The Developer acquires brown field sites and intends to replace existing farming practices and improve soil quality through such techniques as conservation tillage and crop rotation. Their business plan for the two farms addresses the risks identified in this report, and implementation of the plan commences in January 2011 as they take over the existing business.

Principal social impacts relate to:

- 1) the influence of casual, migrant labour on HIV/AIDS conditions on the farms and then subsequently on mortality, morbidity and general productivity;
- 2) the condition of housing stock, water supply and sanitation services for employees, again contributing to absenteeism, water-borne disease transmission and reduced performance;
- 3) limited employee representation, contributing to poor performance and the continuation of key employment difficulties;
- 4) difficult access to health and schooling facilities for employees, with similar impacts on productivity and family coherence.

Four environmental impacts have been identified of varying impact severity:

- 1) the extensive replacement of Miombo woodland with open arable land, leading to loss of biodiversity and related natural pest control mechanisms, as well as reduced ambient humidity and soil moisture buffering effects and a significant reduction in organic matter contribution from leaf litter and sub-surface microbial, earthworm and other animal-soil interactions;
- 2) inadequate controls on toxic chemicals, safety equipment and practices and cleaning and solid waste disposal that will impact negatively on aquatic and soil biodiversity, encourage the flow of persistent organic

pesticides into surface and groundwater systems and pose health risks to the local population;

- 3) impounding, cultivating and otherwise interfering with the natural sponge drainage function of dambos and the natural drainage functions of the Munshiwemba valley slopes is also anticipated to create negative downstream response conditions leading to flood exacerbation, increased gullyng, as well as peaking of the hydrograph in the Munshiwemba River;
- 4) use of traditional plough, harrow and planting techniques that increase soil surface temperatures and soil surface compaction, encourage hardpan formation and thus reduce natural moisture and nutrient flow through the soil profile, and increase wind and rainfall-induced soil erosion.

Mitigation of all of these elements is relatively simple and relatively low in cost including:

- a) Work place programmes and reduced employment of casual labour;
- b) incremental improvements to housing stock, domestic water supplies and sanitation facilities;
- c) the introduction of employee representation systems;
- d) incremental improvement of health and education services, initially through linkages with mobile health services and improved transport support;
- e) retaining or re-introducing woodland belts around all arable blocks or centre pivots and dambo margins;
- f) establishing a more secure chemical store with associated personal and container washing facilities with absorption drainage systems, insisting on the proper use of control systems and protective equipment and establishing solid waste disposal systems for toxic and non-toxic solid waste;
- g) avoiding the damming, cultivation or drainage channelization in dambo areas and retaining and maintaining existing field drainage systems; and
- h) replacing traditional ploughing and planting techniques with zero tillage practices.

In general social impacts are anticipated to be of a short-term nature, while environmental impacts will be longer lasting

Limitations to the Study

A baseline survey was conducted on Parklands and Whispering Hope Farms in late November and early December 2010 after the first rains had fallen. It was only possible to derive dry season conditions from discussions with farm employees, management and neighbouring farmers.

Physical, biological and social investigations were completed that included an assessment of installed infrastructure, available equipment and agricultural inputs that were on site at the time of the fieldwork.

A limited assessment was made of farm management systems but a detailed investigation of systems was not possible.

It was also not possible to call a formal meeting of the stakeholders because of on-going planting activities and the delicate nature of the transfer of management authority on the farms. Bilateral and small group discussions were used as an alternative mechanism for exploring issues and possible mitigations.

1. Introduction

1.1 Total Project Cost

1.2 Ownership and Objectives of Project

Parklands (Farm 3283) and Whispering Hope (Farm 2380) Farms are owned by Chobe Agrivision Limited. Chobe Agrivision Ltd forms part of an investment company whose vision is to create world-class farming operations and integrated businesses across the agricultural value chain, and to leave a legacy of responsible commercial agricultural practices in the region.

The company's goals are to:

1. Achieve economies of scale through the creation of service businesses along the value chain;
2. Improve exports of food cross-border within Africa,
3. Build infrastructure throughout the region;
4. Acquire brown field sites and significantly increase productivity, by using a) a combination of farming techniques that improve soil quality such as conservation tillage and crop rotation, and b) irrigation;
5. Create jobs and improve conditions for the farming workforce and their families;
6. Provide skills transfer at the local level, by offering a source of training within communities through outreach programmes, on the job training and formal education, thereby cultivating the next generation of farm management from within the local communities; and
7. Provide small scale farmers routes to market and access to improved infrastructure such as storage and milling.

1.3 Proposed Project Implementation Date

The project has commenced implementation through the process of land acquisition and transfer as well as the planning of intended developments.

1.4 Brief Description of the Project

Chobe Agrivision Limited owns two adjoining farms holdings on the right (north) bank of the Munshiwemba River close to the Masebe Dam that have access to the water provided by Mushiwemba River Irrigation Company:

- Parklands Farm (783.874 ha), a recent sub-division of Wheatlands Farm; and
- Whispering Hope Farm (1,720.000 ha).

Chobe Agrivision intends to extend its existing irrigated crop area by 380 ha from 660 ha to a total of 1,040 ha. The project will be implemented in two phases.

The first phase will establish two centre pivot irrigation systems on Whispering Hope Farm (1x80ha and 1x70 ha respectively). The second phase intends to establish four centre pivots (2x60 ha and 2 x 50 ha) on Whispering Hope and 1 x 30 ha pivot on Parklands (see Annex 1.3).

The irrigation infrastructure will involve extending the existing pumping mains on the two farms drawing on the existing water rights from the Masebe Dam and a new night storage dam of 900,000 m³.

The extension will require some minor woodland clearance (approximately 180 ha) on Whispering and Parklands Farms and the replacement and relocation of existing small pivots on Whispering Hope Farm.

Other works will include changes to the farm roads, construction of additional farm housing and sanitation facilities and the drilling of two boreholes on Whispering Hope Farm for potable water supplies (see the corporate and project objectives in Annex 1.1 and 1.2).

Irrigation developments on Parklands and Whispering Hope will leverage existing water rights from the Masebe Dam on the Munshiwemba River. The water resources of Masebe Dam serve a potential 2,000 ha of irrigated farmland, of which 990 ha are currently under irrigation. A consortium of riparian farmers known as the Munshiwemba River Irrigation Company, manage these water resources.

The origins of the Munshiwemba River irrigation project in the Mkushi farm block lie in the limitations of the four months of effective rainfall that are characteristic in Zambia. In order to increase agricultural production and improve national food security, extending irrigated agriculture is a national priority.

The consortium constructed two earth dams to expand crop irrigation and secure livestock watering. Masebe Dam is the upper impoundment (see Figure2), where construction started in 2005 and continues, with progressive height increments to the dam wall.

2. Project Area and Study Objectives

2.1 Project Area

The project is situated within the Mkushi farming block in Mkushi district in Central Province of Zambia (see Figure 1). The Mkushi farming block is nearly 300 km from Lusaka and lies at an altitude of 1,300 m to 1,350 m on rolling plateau terrain.



Figure 1 Location of Mkushi District in Zambia

Parklands Farm does not have a riparian location, but the Munshiwemba River and the Masebe Dam form the southern boundary to Whispering Hope Farm (see Figure 2).

Both farms occupy parts of the north valley slope of the Munshiwemba River. Parklands Farm is now largely cleared of woodland vegetation, but Whispering Hope Farm still retains a significant level of woodland cover (see Figure 3)².

The Munshiwemba River forms the southern boundary of Whispering Hope Farm and the Masebe Dam extends eastward from the south-eastern boundary of Whispering Hope Farm. Figure 4 illustrates the key features of both farms.

² The woodland cover shown on Parklands Farm has been largely removed in the last two years since the capture date of the satellite image.

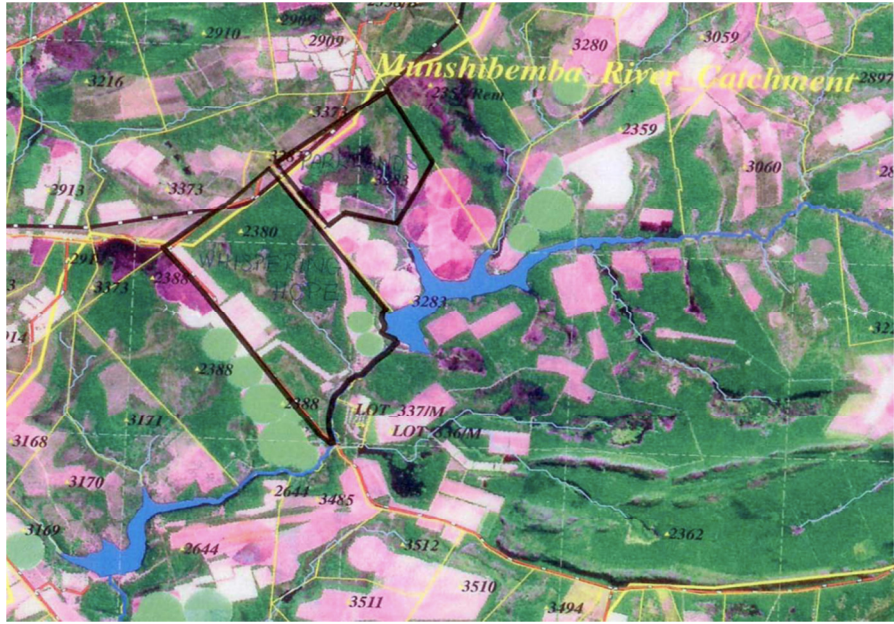


Figure 2 Munshiwemba River Irrigation Project and Parklands and Whispering Hope Farms

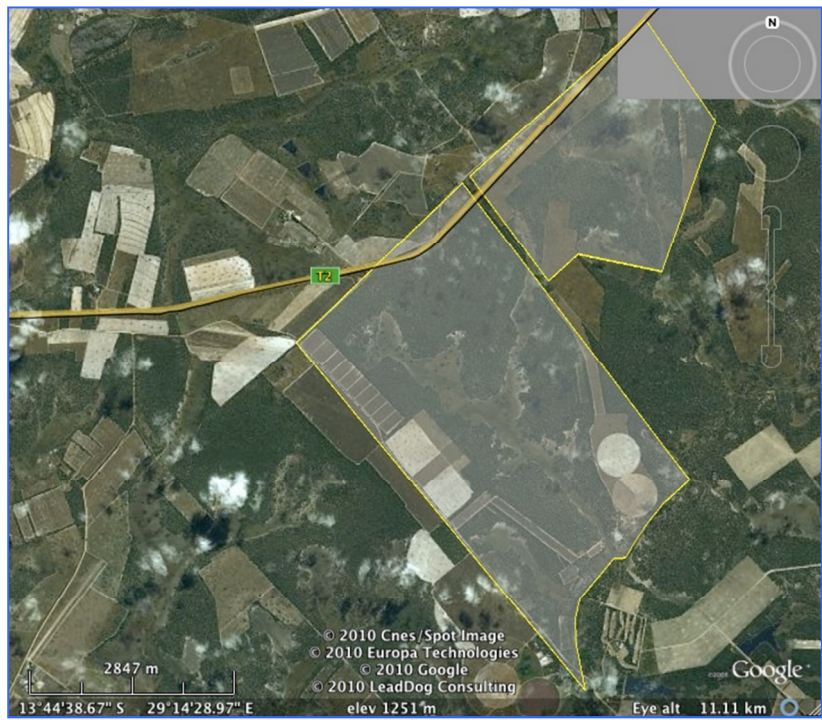


Figure 3 Parklands (to the East) and Whispering Hope Farms, showing Levels of Forest Cover.

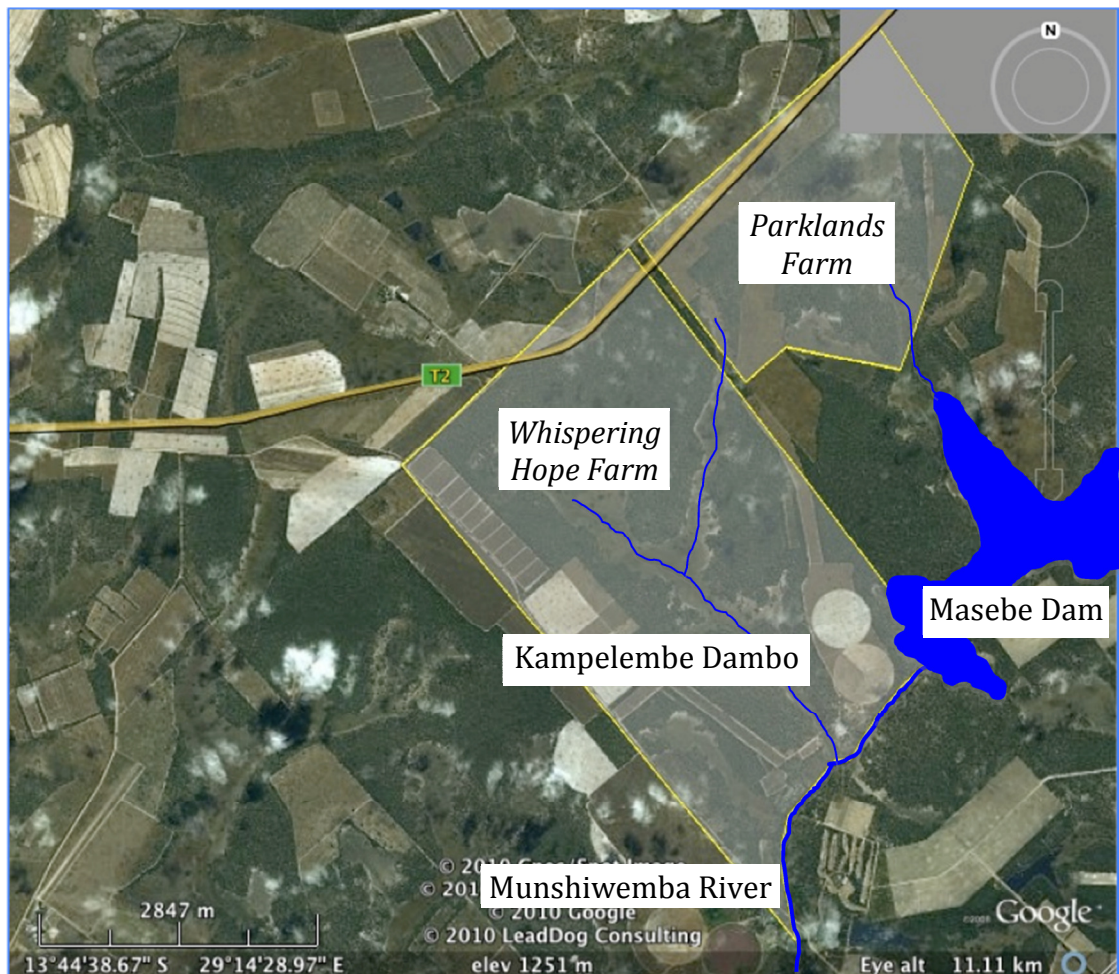


Figure 4 Parklands (to the East) and Whispering Hope Farms, Showing Key Features of Both Farms

2.2 Study Objectives

The objectives of this Environmental Impact Assessment (EIA) are to:

- Identify and record the baseline situation pertaining to environmental and socio-economic issues that might impact on the Project;
- Assess the positive and negative environmental and social impacts of these issues on the Project;
- Identify mitigation measures to be implemented, in the form of an Environmental and Social Management Plan.

2.3 Methods and Process of Study

This EIA has followed the methodology outlined by General Guidelines set out by the International Finance Corporation (IFC) for Environmental Health and Safety (EHS)³,

³ IFC, April 30, 2007

the Performance Standards on Social and Environmental Sustainability⁴ as well as specific EHS Guidelines for Annual Crop Production⁵, and Water and Sanitation⁶.

The requirements of the Zambia's Environmental Protection and Pollution Control Act (EPPA) No.12 of 1990 and its attendant regulations⁷ guided the procedure and process in a national perspective, together with commonly accepted work methods.

The following procedure was followed:

- review the project scope for possible impacts in order to define the assessment focus;
- acquire baseline information for the study;
- examine the proposed project from the viewpoint of possible impacts during planning, construction and subsequent operations;
- define mitigation measures that may be appropriate;
- project the anticipated impacts by magnitude, significance and duration;
- propose environmental monitoring and management measures that will minimise and mitigate negative project impacts and optimise positive impacts;
- prepare the Environmental Impact Statement;
- present the accepted draft to a public meeting; and
- finalise the EIS and Environmental Management Plan (EMP).

This EIA was carried out in stages: 1) a review of development plans, 2) an initial field assessment (in October 2010), 3) a desk study of available information, supported by use of currently available Google-based remote sensing imagery, 4) detailed fieldwork and consultation with management and staff on site (in November/December 2010), 5) analyses, and 6) report writing.

Reference is made to an Environmental Impact Assessment for Munshiwemba River Dam Project, undertaken in 2005 by Envols Consult⁸. Other supporting documentation and statistics have been incorporated from a variety of sources to up-date, supplement and verify information.

2.4 Definitions

The definitions used are those in standard practice and are listed in Annex 2, incorporating due appreciation of the significance of the impact as measured by: frequency, duration, severity, spatial extent and sensitivity.

2.5 Limitations to the Study

A baseline survey was conducted on Parklands and Whispering Hope Farms in late November and early December 2010 after the first rains had fallen. It was only

⁴ IFC, April 30, 2006.

⁵ IFC, April 30, 2007

⁶ IFC, December 10, 2007

⁷ Statutory Instrument No. 28 of 1997 and amended in 1999.

⁸ Envols Consult, 2005: Environmental Impact Assessment for Mushiwemba River Dam Project Prepared by Mushiwemba River Project Mkushi.

possible to derive dry season conditions from discussions with farm employees and neighbouring farmers.

Physical, biological and social investigations were completed that included an assessment of installed infrastructure, available equipment and agricultural inputs. A limited assessment was made of farm management systems but a detailed investigation of systems was not possible.

The farms were being purchased by Chobe in an acquisition that was completing as this report was compiled. The Project was therefore in a state of transition. The new owners are addressing many of the issues discussed in this study.

It was also not possible to call a meeting of the stakeholders because of on-going planting activities and the delicate nature of the transfer of management authority on the farms. Bilateral and small group discussions were used as an alternative mechanism for exploring issues and possible mitigations. Since then a public meeting has been called and the minutes are attached in Annex 8.⁹ No significant comments were raised, but there were concerns about immigrant impacts on sexually transmitted diseases and HIV/AIDS and on the need for improved educational facilities for local children.

3. Review of Existing Policy and Legislation

3.1 General Legal Framework

Zambia's environmental legislation is based around the Environmental Protection and Pollution Control Act 12 (EPPCA) of 1990. This Act brought together a plethora of environmentally-related legislative elements and created the mandate for and established the Environmental Council of Zambia (ECZ). It also sets out the framework and procedures for environmental impact assessments (EIA) through Statutory Instrument (SI) No. 28 of 1997 (the Environmental Impact Assessment Regulations). The Act was amended in 1999 to introduce clarifications, increase harmonisation and otherwise improve the Act. Other legislations are progressively being harmonised with the EPPCA.

The EPCCA and its regulatory framework determine the legal obligations for developers wishing to implement projects, and the procedures they are required to follow. Sections 3 to 7 of Statutory Instrument 28 of 1997 to the EPCCA - the Environmental Impact Assessment Regulations - set out the requirements and procedures for Environmental Project Briefs (EPB). Section 3 (1) of the regulations states that "a developer shall not implement a project for which a project brief or an environmental impact statement is required under these regulations, unless the project brief or an environmental impact statement has been concluded in accordance with these regulations and the ECZ has issued a decision letter".

The expansion of an existing irrigation scheme falls within these categories and for the ECZ requires an Environmental Project Brief (EPB). In this case the EPB is established to highlight the significant social and environmental issues pertaining to

⁹ The meeting had to be postponed by a day and there was no attendance from the district council.

the expansion of the irrigation system and the mitigation measures to be taken. The requirements of the World Bank/MIGA funding are for a full environmental and social impact assessment.

3.2 Specific Legislation Influencing this Project

The several pieces of legislation that are relevant to this project are discussed below, together with legislative material of secondary importance. Each act supports a policy framework, the most important of which is the umbrella National Policy on the Environment issued in 2006.

The Environmental Protection and Pollution Control Act, 12 of 1991

This is the principal Act that regulates environmental issues in Zambia. The Act provides for the monitoring and protection of the environment; the control of pollution; and the promotion of sustainable and environmentally responsible use of natural resources that will create a healthy and clean environment for humans and animals.

The Act provides the environmental regulatory framework for the project.

The Local Government Act, CAP 474 of 1991

Local Authorities are mandated under this Act to monitor the application of environmental regulations and to ensure control and protection of the environment in general. The Mkushi District Council has local responsibilities to ensure the Chobe Agrivision project meets acceptable environmental and social standards.

The Town and Country Planning Act CAP 283 of 1995

The Act provides for the appointment of planning authorities whose main responsibilities are the preparation, approval and revocation of development plans. It also provides for the control of development and subdivision of land.

The Land (Conversion of Title) Act of 1995 (CAPs 292, 289, 288)

The Department of Lands in the Ministry of Lands administers the Lands Acquisition Act, 1995, for the allocation and alienation of land under statutory leaseholds. The department is also responsible for the administration of lands and deeds registration and for the regulation of land surveys and mapping, hence administering the transfer of the property titles for the Parklands and Whispering Hope Farms.

The Water Act of 1948, Cap 198

The Water Act of 1948 is the foundation of Zambia's water legislation and deals with ownership, allocation and regulation of the nation's surface water resources. It currently excludes groundwater and transboundary aspects. To address these shortcomings, reforms have been undertaken including the adoption of the National Water Policy in 1994 and the Water Supply and Sanitation Act in 1997. A new Water Resources Management Bill remains under consideration that provides a comprehensive framework for all water resources in Zambia. The Act also provides for the Water Development Board that has approved a water right for Whispering Hope farm of 3,000 m³ per day from the Munshiwemba River.

The National Irrigation Policy and Strategy and National Irrigation Plan to Combat Desertification were developed under the Fifth National Development Plan (2006).

Agricultural Acts

There are a number of acts related to agriculture. In addition to the Noxious Weeds Act (see below), the Plant Variety and Seeds Act, Cap 236 and the Pests and Diseases Act (Cap 233). The former has relevance in the control of non-certified agricultural and genetically modified organisms (GMOs) and seeds and the retention of plant seed diversity. The Pests and Diseases Act sets out requirements for the control of agricultural pests and diseases and the prevention of cross-farm transmission.

The Agricultural Marketing Act of 1969 and Proposed New Act

Government intends to create a new Agricultural marketing Act. The objective of the Act will be to:

- a) Increase market access to all market participants,
- b) Promote the efficiency of the marketing of agricultural commodities,
- c) Optimize export earnings from agricultural commodities,
- d) Enhance the viability and sustainability of the agricultural sector, and
- e) Make marketing of agricultural commodities competitive both regional and international.

An Agricultural Commodity Exchange and Agricultural Marketing Information Centre are two institutional objectives of the proposed Act. Both should substantially enhance the management of agricultural enterprises.

The Noxious Weeds Act of 1953 Cap 231

This Act provides for the control and eradication of aquatic weeds. Under this Act, Chobe Agrivision Ltd will be responsible for preventing the introduction and/or controlling the spread of common aquatic weeds in the dams (*Pistia stratiotes*, *Salvinia molesta*, *Eihcornia crassipes*) and the downstream reaches of the Mushiwemba River. The Act is now largely incorporated into the EPPCA and the ECZ have an active project seeking to eliminate alien and invasive species

The Zambia Wildlife Act No. 12 of 1998

The Wildlife Act established the Zambia Wildlife Authority (ZAWA) and provides the enabling legislation for the sustainable management of wildlife in Zambia. The Act and its Policy are currently under review. It includes provisions for the regulation of the keeping, ranching, harvesting, hunting, and export of animals (including birdlife, museum specimens and the like) and their products. The adjacent Masebe Ranch manages wildlife populations and any animals transferring onto the Chobe properties will be subject to the same legislation.

The Fisheries Act Cap 200 of 1974 and the Fisheries Amendment Act of 2007

This Act legislates the conservation, management and exploitation of fish resources in Zambia and under the 2007 amendment it provides for fisheries management areas and the expansion of aquaculture.

The Mushiwemba River is not a major fishery but contributes nutrient flows into the artisanal fishery in the downstream Mita Hills Dam and Lunsemfwa River and may

become subject to the revised Act through the development of Fisheries Management Areas. The new Ministry of Fisheries and Livestock (2009) is seeking a substantial expansion of small-scale fisheries in Zambia.

The National Heritage Conservation Act, CAP 173 of 1989

The Act provides for the conservation of ancient, cultural and the natural heritage, relics and objects of aesthetic, historical, pre–historical, archaeological or scientific interest under the National Heritage Conservation Commission (NHCC).

This Act will have little direct relevance to the project as there are no known artefacts of archaeological or cultural significance in the Project area, nor have recent cultural or burial sites been identified on the property.

Nevertheless, should such sites be identified the developers will be responsible for notifying the NHCC and following their procedures. In the event no sites were located.

The Employment Act Cap 268

The Employment Act provides legislation relating to the employment of persons and makes provision for the engagement of persons on contracts of service and for the enforcement of contracts. It also makes provision for the protection of wages of employees.

The Employment Act has added a chapter on HIV and AIDS which will compel employers to respond to HIV and AIDS in the workplace, recognising that HIV and AIDS is a disease that undermines production. The Chapter also makes it mandatory by law for companies to formulate comprehensive HIV/AIDS Workplace Policies.

The Employment of Young Persons and Children’s Act regulates the employment of young persons and children (see also Multilateral Agreements).

3.3 Other Legislation

Other local legislation that may be applicable includes the Factories Act of 1967 (through its health and safety requirements) and the Zambezi River Authority Act of 1987 (but only indirectly in the context of general water resource management policies).

3.4 Multilateral Agreements

Zambia is party to numerous multilateral agreements. Some have application to this project, although none are expected to significantly impact the project, or be impacted by it.

The Convention on Biological Diversity (CBD), the associated Catagena Protocol on biopiracy, and the African Forest Law Enforcement and Governance Agreement (AFLEG), are associated regulatory frameworks that have domesticated application through the Lusaka Agreement on Cooperative Enforcement Operations Directed at Illegal Trade in Wild Fauna and Flora (1994).

The Framework Conventions on Climate Change (UNFCCC) and to Combat Desertification (UNFCCC) set out policy and operational objectives for climate change monitoring and management and control of desertification. The UNFCCC will have implications for microclimate change around the project site and the promotion of climate adaptation measures that may impact on future land clearing and land and water management. The UNFCCC also has relevance to the mechanisms of land development and land use management.

Three international conventions control the use and movement of chemicals that are considered harmful to man, other organisms and the environment.

The Basle Convention of 1989, which entered into force in 1992, was established to control the transboundary movement of toxic wastes and their disposal. The convention is unlikely to have significance for the project, but the Developer should be aware of its existence and intent.

The Rotterdam Convention of 1998 (in force in 2004) was established to control the international trade of certain hazardous chemicals in order to protect human health and the environment from potential harm and to contribute to the environmentally sound use of those hazardous chemicals by information exchange and international import controls. It established 25 pesticides, 4 severely hazardous pesticide formulations and 11 industrial chemicals (see Annex 3.1 for a list of chemicals controlled under the Rotterdam Convention). Many of the chemicals are still in circulation in Zambia and the developer's attention is drawn to the requirements of this convention.

The Stockholm Convention of 2001 on Persistent Organic Pollutants (POPs) (entered into force in 2004) determines the list of acceptable organic chemicals that may be applied in the environment and set targets for the elimination of all Polychlorinated biphenyls (PCBs) and the restriction of other categories.

Persistent organic pollutants (POPs) are defined by the Convention as those that:

- remain intact for exceptionally long periods of time (many years);
- become widely distributed throughout the environment as a result of natural processes involving soil, water and, most notably, air;
- accumulate in the fatty tissue of living organisms including humans, and are found at higher concentrations at higher levels in the food chain; and
- are toxic to both humans and wildlife.

Annexes A, B and C to the Convention have since added chemicals to the list and established management arrangements for them. A full list of chemicals to be eliminated or severely restricted under the Stockholm Convention is in Annex 3.2.

All these global conventions have been ratified by Zambia and are now largely domesticated into Zambian legislation, including the requirement to comply with utilisation frameworks established by these conventions.

Zambia also ratified the Convention on the Worst Forms of Child Labour in 2000 and has domesticated this convention. Other elements of labour and employment policy, such as gender equality are now also well domesticated into local legislation.

3.5 Relevant International Finance Corporation Policy Guidelines

General Guidelines set out by the International Finance Corporation (IFC) for Environmental Health and Safety (EHS)¹⁰, the Performance Standards on Social and Environmental Sustainability¹¹ as well as specific EHS Guidelines for Annual Crop Production¹², and Water and Sanitation¹³ provide policy and investment guidelines. The IFC also provides an Exclusion List, which defines the types of projects that the IFC will not finance¹⁴.

The Project is involved in agribusiness and food production fund, which involves the use of agricultural chemicals and fertilisers. Only those products registered and approved for use for annual crop production by the Ministry of Agriculture and Cooperatives (MACO) will be used and use of these will be compliant with local guidelines. Where these might not exist, the IFC EHS Guidelines for Annual Crop Production are followed.

The IFC EHS Guidelines for Food and Beverage Processing also provide best practice in managing the environmental issues in food processing such as solid waste, wastewater, energy consumption and emissions to air. They also provide guidelines on employment policy and health and safety in the work place.

3.6 Institutional Responsibilities

Principal institutional responsibilities for this project will include the ECZ, the Mkushi District Council and the Water Development Board. However, the developer will remain the primary responsible party for the effective and compliant implementation of this project.

4. Project Description

4.1 Project Objectives

The company's goals for the project are stated above¹⁵. The specific project objective is to increase the area under sustained irrigated crops by 380 ha. This will require the construction of additional irrigation and road access infrastructure. Ancillary objective are to improve the operational staff accommodation conditions on the two farms .

¹⁰ IFC, April 30, 2007

¹¹ IFC, April 30, 2006.

¹² IFC, April 30, 2007

¹³ IFC, December 10, 2007

¹⁴ See Annex 1.1

¹⁵ See Company Objectives Annex 1.2

4.2 Principal Features of the Project

The principle objective of the project is to increase an existing irrigation system using the existing capacity of the Masebe dam managed by the Mushiwemba River Irrigation Company.

Chobe Agrivision Limited owns two adjoining farms holdings on the right (north) bank of the Munshiwemba River close to the Masebe Dam that have access to the water provided by Mushiwemba River Irrigation Company:

- Parklands Farm (783.874 ha), a recent sub-division of Wheatlands Farm; and
- Whispering Hope Farm (1,720 ha).

Chobe Agrivision intends to extend its existing irrigated crop area by 380 ha from 660 ha to a total of 1,040 ha.

4.3 Main Activities

4.3.1 Construction Phase

The Project will extend the irrigation infrastructure and pumping mains on the two farms drawing on the existing water rights from the Masebe Dam and also accessing water from a new night storage dam of 900,000 m³.

The Project will be implemented in two phases. The first phase will establish two centre pivot irrigation systems on Whispering Hope Farm (1x80ha and 1x70 ha respectively). The second phase intends to establish four centre pivots (2x60 ha and 2 x 50 ha) on Whispering Hope and 1 x 30 ha pivot on Parklands.

The extension of irrigable areas and changes to the irrigation technology will require some minor woodland clearance (approximately 180 ha) on Whispering and Parklands Farms and the replacement and relocation of existing small pivots on Whispering Hope Farm.

Other works will include changes to the farm roads, construction of additional farm housing and sanitation facilities and the drilling of two boreholes on Whispering Hope Farm for potable water supplies.

4.3.2 Operational Phase

Operations on the two farms will continue through the construction phase. These will include the seasonal cycle of input collection and storage, land preparation, seeding, weed and pest control, top dressing, border clearing, harvesting, drying, storage and off-site transport of the crop. The existing irrigation facilities may offer the possibility of increasing production to three crops per year on some of the land.

Post-construction the farms will have a total of 1,040 ha of irrigable land and will

continue with the existing farming system but on the enlarged area. It is assumed that additional cropping equipment and storage facilities will be required to support the 60% expansion in area.

4.4 Scoping Issues

A significant level of irrigation development is already completed on the two farms and the scale of proposed extensions to the irrigable area on Parklands and Whispering Hope Farms is relatively small and no irreversible environmental or social impacts are anticipated. There is however issues that will require addressing by the new owners so that best practices are followed.

The scoping issues are listed in Table 1.

Subject of Investigation	Action	Scoping Issue
Natural environment	Centre pivot preparation	Loss of woodland cover; Soil erosion; Loss or increase of biodiversity; Various impacts on wildlife, fish and bird populations including interruption of travel routes.
	Toxic and general fertilizer and chemical management	Pollution control – river, lake and soil contamination; Health and safety issues.
	Cultivation of dambos	Interfering with the natural sponge drainage function of dambos and effect downstream – e.g. floods, gulying, and the hydrograph in the Munshiwemba River.
	Cultivation methods	Increase soil surface temperatures; Soil compaction;
	Biodiversity	Maintenance of biodiversity per se and as a mechanism for integrated farm management
Socio-economic environment	Employment Issues	Positive employment opportunities; Improved training opportunities; Worker representation; Conscientious Employer.
	Service delivery	Water and sanitation; Housing; Access to education and health

	Inward migration	Impact on HIV and AIDS; Increased risk of breakdown in social behaviours; Increased illegal off-take of forest and animal products.
	Health and Safety Issues	Related to chemicals, and use of machinery.

Table 1 Environmental and Socio-economic Assessment Scoping Issues

4.5 Raw Materials

4.5.1 Construction Stages

The raw material being used for the two construction stages of this project are those required to install irrigation facilities, farmyard and farm housing infrastructure. They include:

- local lateritic gravels for roads, construction bases and dam embankments;
- cement, sand, stone and water for concrete;
- aluminium piping and connections for centre pivot structures;
- PVC pipework for pumping mains;
- Paints and paint-cleaning fluids;
- Tyres and tubes for construction plant;
- Filters and other disposable vehicle spares;
- Fuels and lubricants;
- Electrical cables;
- Steel for water tanks and farm storage structures.

4.5.2 Implementation Stage

During the implementation stage raw materials will include a variety of maize, soya and wheat seed varieties, as well as the fertilizers and other agricultural chemicals¹⁶ required to generate optimum crop yields. These products will yield substantial volumes of packaging material as well as potentially toxic and hazardous containers.

The farm infrastructure will also consume significant volumes of:

- diesel fuel,

¹⁶ Include: Artea (fungicide toxic to fish), Chlorimuron Ethyl (toxic herbicide), Corona (toxic, hazardous fungicide and pesticide), Cyrux (toxic, hazardous insecticide), Dual Magnum (toxic, hazardous herbicide), Fusilade (toxic herbicide), Gaucho (toxic, hazardous fungicide and insecticide), Gesaprim Super (toxic herbicide), Glyphosate (toxic herbicide), Gramoxone (toxic, hazardous herbicide), Karate (toxic, hazardous insecticide), Punch C (toxic fungicide), Pyrinex (toxic, hazardous insecticide), Servian (toxic herbicide), Ridomil (toxic, hazardous fungicide), Shavit (fungicide), Suprano (toxic, hazardous fungicide), Swift (toxic, hazardous herbicide), Touchdown (toxic herbicide and insecticide), Triger (herbicide).

- oils and lubricants,
- filters and other maintenance parts;
- tractor and other plant tyres,
- protective clothing,

Submissions for water rights have been made and provisional rights have subsequently been obtained for 3,000 m³ per day.

4.6 Products and By-products

4.6.1 Construction Stage

The construction stage will produce small levels of CO₂ and other greenhouse gas emissions, used lubricating oils, used plant tyres, cardboard and other packaging materials and small amounts of construction waste, including unused concrete waste, cable ends and other metal waste, paint containers and cleaning fluids.

4.6.2 Operational Stage

Farming operations will generate significant volumes of maize (in excess of 3,000 tonnes), soya (in excess of 1,800 tonnes) and wheat (variable depending on cropping patterns) grain. The operational phase will also produce a wide range of waste products, including packaging materials (some of which will be toxic), residual fertilizers and agricultural chemicals (some of which will be carried through the soil profile, or drifted by wind and into the surface and groundwater systems).

5. Project Alternatives

5.1 Without and With Project Alternatives

The existing farming operations on Parklands and Whispering Hope farms have been successful, developed large new irrigated areas in a short period of time and generated high farming yields. Continuing with the “without project” scenario, it is presumed, would continue this trend in the medium term.

The “with project” scenario is intended to provide the capital resources and skills to accelerate the development of a further 380 ha of irrigated land on the two farms within a period of two years (see proposed developments in Annex 4). It is also intended to improve the sustainability of farming operations by introducing improved tillage mechanisms and enhanced working and living conditions for staff.

Additional crop yields are expected to off-set these investments and return a profit for the new enterprise.

5.2 Alternative Irrigation Systems

The project intends to continue with the application of electrically-powered centre pivot irrigation systems of various sizes that will match the available cultivable areas. Current centre pivot technology on the farms utilizes dropper sprinklers, thus reducing evaporative losses, particularly later in the year when these losses are highest because of large humidity deficits and moderate wind speeds.

There are no appropriate, alternative irrigation systems within the current water and soil context, but it is assumed that nozzle design and other water droplet-delivery improvements will be applied incrementally as these technologies advance.

It is also assumed that fertigation mechanisms will be introduced as resources and technologies develop.

5.3 Alternative Irrigation Arrangements

The proposed developments are based on a combination of large (80 ha), medium (60 ha) and small (40 ha) pivot systems, arranged in accordance with available space, slopes and terrain. On Parklands Farm this is largely a default arrangement resulting from prior land clearing and development on the farm.

The situation on Whispering Hope Farm (see Annex 1.3) suggests that developments have been planned using four criteria:

- minimizing land clearing requirements;
- proximity to water sources;
- suitable slopes; and
- available space.

Land clearing in Miombo woodland is an expensive process, as is the cost of large diameter high-pressure PVC pumping mains.

It is possible that as efficiencies improve irrigation systems (especially pivot size), will standardise to offer more easily managed and flexible cropping, crop mixture and irrigation arrangements.

5.4 Material Options

The materials used for the project are either available on site (sands and gravels, stone and water), are readily available in Zambia (cement, cables), or have been specifically imported through a supplier that is able to offer post-installation product support (pumping and irrigation equipment).

5.4.1 Material Options – Impoundment

The impoundment wall on the Kampelembe Dambo is relatively small (approximately 8 m) and the most appropriate construction materials are local, or in situ gravels, sands and clays.

5.4.2 Material Options – Pumping stations

The pump station on Whispering Hope Farm matches a similar structure on Wheatlands Farm that was constructed at the same time. In each case pumps are electrically powered from a control point off an 11kV/380V transformer.

Pump technology options available in Zambia are limited and these installations have been professionally designed and assembled and have worked effectively for more than one year.

Pump stations are subject to periodic power failures, particularly in October, November and December when electrical storms are most frequent.

5.4.3 Material Options – Pumping mains

Pumping mains can be constructed in a variety of materials including steel and PVC. Pumping mains on both farms are of 250 mm high-pressure PVC, offering a cheaper alternative to steel in the relatively low pumping head conditions.

5.4.4 Material Options – Centre pivots

Centre pivot irrigation systems are of United States manufacture and supplied and installed by a regional irrigation supplier and product support network, with representation in Zambia.

Maintenance considerations suggest that wherever possible a single irrigation system supplier is used for all installations.

5.5 Water Management Options

The management of irrigation water is subject to the flows into and out of the Masebe Dam, the approved water right and the technology being used to apply the irrigation to and within the fields.

Extreme low rainfall years, flooding, reduction of water rights due to increased upstream and downstream demand and electrical power failure are all risks faced by the enterprise. These are discussed later in the report.

Few water management mitigation options exist in the context of the current technology framework.

5.5 Pollution Control

Polluting effects of the proposed farm developments will be created through four principal mechanisms:

- poor sanitation practices introducing pathogens into irrigation and domestic water supplies;
- poor control of agricultural chemical waste disposal, introducing toxic chemicals and heavy metals into surface and groundwater systems;
- poor control in the application of agricultural fertilizers and chemicals, introducing toxic, polluting chemicals, heavy metals and residual nitrates and nitrites into the soil profile, baseflow and groundwater systems, surface water resources and local ecosystems (possibly with bio accumulating and eutrophic effects), through over-application, application under heavy rainfall conditions, spray drift in moderate and high wind conditions, poorly maintained spraying equipment, poorly trained operators, use of excessively steep slopes, poorly maintained drainage; and
- poor controls on vehicle maintenance operations and waste disposal, introducing petroleum products and other hydrocarbons into the surface and groundwater systems.

The proposed technologies and systems under the new management arrangements should reduce these risks through improved sanitation systems, better toxic chemical washing and waste disposal mechanisms, enhanced controls on the use of agricultural fertilizers and chemicals through appropriate reduced tillage, integrated nutrient management and crop rotation systems and the use of pest-resistant crop varieties.

6. Baseline Description of the Project Area

6.1 The Socio-economic Setting

6.1.1 The General Population

The project area is situated in Mkushi District in Central Province. Mkushi District has a total population of just over a million. The population is predominantly rural (76%) with some peri-urban settlements around Mkushi district centre (some 25 km away from the two farms).

The rural population of the district is mostly located along the major roads (M3, M1, T2), with very small population densities away from a 5km corridor along these roads. Most of the population are involved in small-scale rain-fed subsistence agriculture, charcoal burning and small-scale manufacturing. Some formal employment is located in Mkushi, which also supports increasing levels of informal economic activity, principally trading.

The general socio-economic conditions of the rural population of Zambia are poor nutrition, food insecurity, illiteracy and poor education attainment, high maternal, infant and child mortality, unemployment-related poverty, and diseases such as

HIV/AIDS, tuberculosis, typhoid and malaria. Social statistics from rural central Zambia generally show static or increasing trends in these parameters.

Poverty related factors increase pressures on the environment and the unsustainable management of natural resources is increasingly important as coping strategies of the poor, including unregulated logging for the charcoal and hardwood timber trades, and deforestation in support of chitemene and other forms of transient small-scale agriculture.

Long distances to and poor quality of water sources is common for rural populations. Growing populations, combined with poor sanitation practices exacerbate water related problems. Access to and availability of education and health services are also generally inadequate in the rural areas of Zambia.

There are few traditional rural settlements within the Mkushi commercial farming block. A review of the historical establishment of the farming block and its impact on traditional settlements is not a focus of this study, but the proposed Project is not likely to impact on traditional settlement patterns currently pertaining in the area and there will be no resettlement of indigenous communities.

6.1.2 Project Population

The local population residing within the Project site are either employed or they are the dependants of those employed by the Project. They provide skills and labour to the commercial farming activities. There are a total of 46 permanent employees, 44 are male and 2 are female (see Table 2). Most of those employed are skilled or semi-skilled (sub-managers, accountants, machinery drivers, pivot operators, mechanics, and security guards). There were 59 casual seasonal workers employed in December 2010 – 51 male and 8 female – mostly as general workers.

Most of those employed originate from the nearby Tanzania Zambia Railway Authority village at Ngambwa, or from villages in Mkushi, Kapiri Mposhi, and Serenje districts. More highly qualified staff members such as managers and accountants originate from Lusaka or the Copperbelt. Ngambwa is outside the project area and the adjacent land is being considered for a silo and agricultural input depot development that will provide additional employment opportunities. No relocation is anticipated as the village is adjacent to the farms and belongs to TAZARA.

Designation	Nos. of People	Level of Training
Managers	3	Trained
Accounts	3	Trained
Warehouse	2	Trained in use and storage of chemicals and first aid.
Workshop Metal fabricators, and electrician	3	Trained
Foreman	3	Trained

Tractor drivers	10	Trained
Silo Operators	1	Trained
Pivot Operators	6	Trained
Gardeners	3	
Security Guards	6	
House staff	2	
General Workers	4	
Total	46	

Source: Whydah Consulting field survey 2010

Table 2 Current Employment Status

There are approximately 230 children in the three housing compounds on the two farms (Parklands, and Wheatlands and Beckett that are both on Whispering Hope Farm). Most children are under ten years old.

6.1.3 Housing Stock

There are a total of 136 houses situated in the three compounds. At Parklands, there are six managers' houses currently being constructed, 21 newly constructed brick and tin roofed houses for permanent employees and 38 temporary houses.

There are 36 traditional mud and thatch houses at Whispering Hope and 41 at Beckett.

A building project to provide permanent improved housing has commenced and is to be expanded further by the new owners. Temporary housing accommodates periodic, casual, seasonal labourers or permanent employees waiting for permanent housing. Currently the temporary housing is similar to the traditional housing found in Zambia and is mostly of basic mud and thatch structures, although a number of unsatisfactory lean-to structures of plastic also exist.

6.1.4 Water and Sanitation

Water is pumped into water tanks from boreholes on both Parklands and Whispering Hope Farms. Potable water for the Beckett compound is supplied by an open well.

Sanitation in all three compounds is provided by pit latrines with one latrine being shared by two families for some housing, while some of the newer housing is served by piped water, electricity, geysers and dedicated latrines (see photographs in Annex 4).

The Whispering Hope borehole water test results showed strong positive faecal and total coliform levels (35 and 75/100ml). The Parklands borehole sample shows zero coliforms. The Whispering Hope village well on Beckett compound also showed

high levels of faecal coliforms (96/100ml) and the water turbidity exceeded World Health Organisation (WHO) standards when visited.

6.1.5 Education and Health Services

The nearest primary schools are Katuba Primary School and Kasakota Primary School 15 km and 9 km from Parklands farm, respectively. The farms are both bordered by public rail and road transport routes, but few children or employees families have access to transport and there is no on-site pre-school. One option for improved community schooling is the use of the derelict Ngambwa Railway Station.

Most school-age children are sent back to their traditional villages in order to attend school and/or to assist on the family smallholding.

The nearest Under 5 and Maternity clinic is in Mkushi, which is some 25 km away. There are no mobile health services provided to the Parklands or Whispering Hope Farms, but they do have access to transport facilities provided by the farm in the case of an emergency.

The nearest markets are Mkushi (approximately 25 km) or Kapiri Mposhi (100 km). Currently, there is little evidence of income generating activities such as vegetable production, craftwork, or small-scale livestock on the farms. There are no worker's organisations or women's clubs.

6.2 Physical Environment Setting

6.2.1 Geology and Geomorphology

The geology underlying the Parklands and Whispering Hope Farms would appear to comprise moderately basic steeply dipping metasediments with quartzitic and granitic intrusions. Weathering is generally deep and uniform, except where quartzite or granite intrusions exist and provide surface exposure.

The Munshiwemba River has eroded a series of terraces through the plateau surface that are visible as one descends the catena from the northern watershed (see photograph in Annex 4). The most recent terrace has a steep valley slope, suggesting that there has been a geologically recent cycle of down cutting in the area.

Apart from the terrace-edge slopes most terrain facets in the project area are gentle rectilinear or slightly convex slopes.

6.2.2 Soils

Eight trial pits were opened to depth between 105 cm and 180 cm, the soil profiles recorded and samples of the various soil horizons collected. Pits were located to test changes in profile and characteristics both down the catena (upper, mid and lower slope), on different subsurface lithologies and in old and new cultivated areas, and under Miombo woodland.

The University of Zambia Soil Survey Department tested samples from the eight soil pits (see Annex 5.1).

Profile Characteristics

The developed soil profiles are generally undifferentiated orange to yellow-brown sandy loams to sandy clay loam continuing over several metres to the weathering profile. Clay content generally increases with depth as is common in high rainfall areas. The soils on Whispering Hope have a higher sand-size fraction than those on Parklands suggesting that the underlying lithology is derived more from granite weathering on Whispering Hope and from more clay-rich metasediments on Parklands. The acidity of soils on Whispering Hope is slightly higher as one would expect from soils derived from granites.

Porosity of the soils appears to be moderate, increasing where soils are sandier on Whispering Hope and higher on the slope. One bulk density sample from a Whispering Hope Farm field had a value of 0.97g/cm^3 , which indicates some degree of compaction.

Much of the cultivated area on Parklands has been cleared from Miombo woodland within the last 2 to 5 years and evidence still exists of a thin, dark brown organic horizon.

The soils are moderately erosive but there are few indications of gullying and sheet wash erosion is not excessive. This is probably due to the extensive contouring and field drainage that Cropit have put in place.

Control soil profiles dug under remnant Miombo woodland showed a deeper organic horizon, approximately three times the organic matter content of other surface horizons and a deeper wetting profile after the recent rainfall.

Soils in the upper valley dambo areas showed a moderate level of mottling a 70cms and deeper, indicating poor oxygenation and high water saturation levels.

Annex 4 includes photographs of typical soil profiles.

Soil Chemistry

Soils are acid (average pH of 4.7, but still moderately fertile (average cation exchange capacity of 5.4, ranging between 3.3 and 7.3emol/kg), but there are high levels of Iron on localised areas in the upper soils profile (see soils analyses in Annex 5.1). This suggests that laterization may exist within 2m to 3m of the surface (although no laterization was found in any of the soil profiles down to 1.8m). This may create localised nutrient deficiencies and/or impeded drainage.

Potassium is unusually low in all profiles (averaging only 0.16 emol/kg and ranging between 0.11 and 0.32), but Phosphorus levels are relatively high, averaging 11.8 emol/kg and Calcium levels also high (average 1.00 emol/kg). Trace elements (Zinc, Boron, Sulphur are all present at moderate levels.

The Zambian Bureau of Standards tested a dambo soil and the Masebe Dam water for persistent organic pesticides (POPs). Both exhibited positive results for several banned and not recommended persistent chemical pollutants (see Annex 5.3). These are discussed further under impacts.

6.2.3 Topography and Drainage

The country in the vicinity of the two farms comprises gently rolling Central African plateau landscapes. Both the Parklands and Whispering Hope Farms occupy catenary positions on the interfluvium between the Lunsemfwa River (to the north and west) and the Munshiwemba River (to the south). Valley slopes average 2° to 5°. Both farms are drained by small seasonal or semi-perennial streamlines and headwater dambos.

Two river terraces appear to exist marked by: a) a distinct break of slope some 400m from the existing Munshiwemba River alignment and b) a more recent, lower terrace within 200m of the Munshiwemba. The latter exhibits alluvial gravels at various soil depths.

6.2.4 Landscape factors

Miombo woodland originally dominated landscapes on the two farms. This woodland has been extensively cleared on Parklands Farm within the last five years. The result is open agricultural land sloping gently southwards, interrupted only on the eastern and southern margins by small patches of woodland surrounding the farm headquarters.

Landscapes on Whispering Hope farm are still largely wooded, especially on the lower riverside slopes. However, new irrigation will remove some of this cover.

Woodland

As noted, both Parklands and Whispering Hope farms were originally under undifferentiated Miombo woodland, interrupted by dambo headwaters and seasonal or semi-perennial streamlines closer to Munshiwemba River.

Much of the original woodland still exists on Whispering Hope, but Parklands Farm has been cleared. The implications of the woodland clearing on Parklands Farm are discussed below.

The Miombo woodland occupies the upland interfluvium soils, which are well-drained, acid, and of moderate fertility. Towards the dambo margins where the clay content is higher, the floral richness also increases, with woodland of greater diversity. The general ground surface under the woodland canopy contains a rich assemblage of coppice, sub-shrubs and herbs.

All areas studied had been burnt during the dry season, but fire damage is not severe as the grass is low growing, and in spite of evidence of disturbance, the level of eutrophication (enrichment) remains low.

Termite Mounds

There are relatively few termite mounds, but the mound population increases towards the dambo margins, and these tend to have an evergreen forest cover. In contrast, the vegetation of woodland mounds is more deciduous.

Termite mounds are primary sites for floral biodiversity. The most species-rich mounds are well protected from fire, and these may have many fire-sensitive species, which would not survive in the woodland, although the higher pH and nutrient status of the mound soils also affect the colonization of species. Because of the optimum growing conditions for many tree species, these termitaria are also more readily colonized by bird- and bat-dispersed plant species. These are forest communities with a dense canopy and numerous climbers, which are virtually absent in undisturbed Miombo.

Annex 6 provides a plant species list. None of the plants identified are listed as threatened, vulnerable or endangered, but retaining a diverse woodland and grassland

Dambos

The upper margin of the dambo marks the highest level reached by the water table. The Kampelembe Dambo on Whispering Hope has a central channel, which usually flows perennially, while the sides are generally perennially wet. This is classified as a wet dambo. Dry dambos, with margins that dry out for much of the dry season, have a better potential for cropping and grazing than wet dambos.

Dambos are extremely efficient at absorbing chemical nutrients and toxins, and by the time the water seeping from the high ground reaches a stream channel it is usually low in both inorganic minerals and toxic chemicals. In nutrient and clay-deficient areas this water may have a dark colouring, called 'black water' from dissolved tannins leached from plants. The filtering function of dambos is affected if too much of the dambo is flooded (for example by damming). Pollution of river systems then increases.

6.2.5 Climate

Climatic influences on the two farm properties mirror those over much of the central plateau of Zambia. Sunshine hour, temperature, humidity, moisture and airflow regimes are conducive to the cultivation of a wide range of tropical and sub-tropical arable, fruit and silvicultural crops.

Climate Parameters

Mean annual temperature in the Mkushi area is 20.4°C with mean maximum in October of 23.6°C and a mean minimum in July of 15.8°C. Mean annual rainfall is 1,100 mm, with heaviest falls in the period December to February. Winds are generally light to moderate north-easterly in the range of 1.5 to 2.2 m/sec during the dry season, reversing to blow from the north-west in the wet season. Minimum average wind speeds are in the wetter months, although thunderstorm activity may produce short duration, high intensity wind flows. Gusting winds in July and August and "dust devils" in October may be significant causes of soils erosion and soil nutrient export unless surface cover is maintained.

The two farms falls within Zambia's agro-ecological zone 2, with a mean annual rainfall of 800 to 1,000 mm/annum and generally acid soils. There is a significant annual soil moisture deficit in the zone.

Zambia's National Adaptation Plan of Action (NAPA) against the impacts of climate change recognises that central Zambia may see increases or decreases of average annual rainfall, depending on the future development of air mass convergence patterns¹⁷. Nevertheless, overall temperatures in the region and the frequency of extreme weather events are expected to increase.

6.2.6 Air Quality

Air quality in central Zambia is good for most of the year, with steady easterly winds during the dry months (May to October), and a generally weaker, north-westerly air stream during the wet months.

Air quality deteriorates in the late dry season (August to October) due to an accumulation of particulates in the lower atmosphere (dust and fire ash and other aerosols). In rural areas there may be local deterioration of air quality in the vicinity of bush fires, but this is of a temporary nature.

6.2.7 Hydrology and Hydrogeology

Historically water for crops on Parklands and Whispering Hope Farms was dependent on rainfall. Parklands Farm now has three large (70 – 80 ha) centre pivots. Two smaller pivots on Whispering Hope are currently being replaced. All north bank irrigation water is pumped via 250 mm PVC pipelines from the Masebe Dam pump stations on Wheatlands and Whispering Hope farms.

Hydrology

The Masebe Dam now largely controls the hydrology of the Munshiwemba River until additional large dams are constructed further upstream. A new dam has also been constructed on the Kampelembe Dambo that drains the centre of Whispering Hope Farm. The Kampelembe Dam is intended to act as a "night storage" facility for the Whispering Hope Farm centre pivot water supply. The possible hydrological impacts of the construction of the Kampelembe Dam are discussed further later in this report.

Historical hydrograph records from the nearby Johnsen's Farm Weir indicate that the peak monthly hydrograph in the Munshiwemba River may be as much as 8 times the mean monthly values. Caution is required with spillway design and some consideration of a downstream risk assessment may be warranted for all impoundments in the catchment.

Failure of the Kampelembe Dam would discharge downstream of the Masebe Dam and a considerable distance upstream of the Munshiwemba Dam 2, thus reducing flood routing risks.

Water Rights and Demands

¹⁷ Northern Zambia is expected to experience an increase in mean annual rainfall while the south of the country may show a significant reduction in mean rainfalls.

The total water demand of existing centre pivots is currently 325 l/sec, which will rise to 507 l/sec (657m³/hr or 5,256 m³/8 hour day) once the irrigation expansion has been completed. A Water Development Board meeting in September 2010 approved a water right from the Munshiwemba River of 3,000 m³/day for Whispering Hope Farm, presumably for both farms.

The total irrigation peak demand for the farm is approximately 45,000m³ assuming a 7mm irrigation application per cycle. Over a 22-hour day this is equivalent to an hourly standard irrigation application rate of 2,070 m³, which is within the water right provision, even making allowance for a 25% peak factor.

Risks with such a substantial area of irrigated cropping lie in extreme dry years or a series of dry years when it may not be possible to extract the full water right in the late months of the year. A risk assessment based on rainfall return period analysis is recommended.

Groundwater

Little information is available on the groundwater underlying the two farms. Three boreholes are being used with yields ranging from less than 1.0 l/sec to over 4 l/sec. Significant yields in excess of 5 l/sec are unlikely. Groundwater quality appears to be correlated closely with the level of management of the area around the boreholes. Well-managed sanitation and effluent control generally supports groundwater of a high quality (Parklands). Where there is little control of sanitation practices contamination levels is much higher, suggesting that the permeability of the surface horizons and the depth of weathering are high (Whispering Hope).

6.2.8 Water Quality (Surface and Groundwater)

Water from the Masebe Dam and from the borehole and well sites were tested. Most chemical characteristics of both the raw and borehole water samples are well within World Health Organisation (WHO) limits for human consumption (see Annex 5.3).

Dam Water

Dam water was reasonably turbid following significant rainfall before and during the fieldwork for this study (in early December). Water turbidity is expected to reduce in the dry season¹⁸. Water quality is generally good with a surprisingly high pH (7.41 to 7.90) given the granitic bedrock over much of the area, although expectedly higher than those in the river before impoundment.

Boreholes

There are three existing boreholes on the farms, one on Parklands and two on Whispering Hope. These have low to moderate yields (0.8 l/sec to 4.1 l/sec) and are used for potable, domestic and general use around the farm headquarters. Borehole water is more basic than river water (pH 8.01 on Parklands and pH 7.79 on Whispering Hope) suggesting carbonate-rich metamorphic geology. The second Whispering Hope borehole has water with a much lower pH (7.19), suggesting that it is drilled in granitic bedrock.

¹⁸ The pre-construction turbidities in the river were in the range of 4.0 compared to 5.9 and higher when tested in December 2010.

Exceptions to acceptable water quality are iron concentrations in the Parklands borehole (probably due to iron bacteria infestation), turbidity in the dam raw water (probably higher than normal following recent rainfall), and surprisingly also in the Whispering Hope borehole 2 (possibly related to borehole collapse). Zinc levels are also above World Health Organisation (WHO) limits in the Masebe Dam raw water, the Parklands borehole and the Whispering Hope well, suggesting that a widespread geological influence exists, but outside the granitic areas in which the Whispering Hope boreholes are drilled.

Coliform counts (both total coliforms and faecal coliforms) for all water sources except the Parklands borehole were positive (in the range 88 to 128 total coliforms/100ml and 35 to 100 faecal coliforms/100ml).

There are some concerning issues in the test results that suggest the need for further checks and future water quality controls. Both the Whispering Hope borehole water samples showed strong positive faecal (35 and 75/100ml) and total coliform levels (although the Parklands borehole sample shows zero coliforms). This suggests the need for improved controls on sanitation.

Of similar concern is the high level of faecal coliforms (96/100ml) in the Whispering Hope village well that serves as a primary potable water supply to one farm compound.

These matters are being addressed by drilling new boreholes, installing water filters and using UV lights where necessary. This will be carried out over the short term and water samples will be tested annually.

6.2.9 Land Use and Settlement

Crops

The crops that are currently grown on the farms (maize, seed maize, soya beans and wheat) reflect current market conditions, but form useful and practical rotations.

Historical cropping patterns are not known, but anecdotal information and satellite imagery suggest that maize, seed maize, soya bean, wheat, tobacco and tomatoes may all have been grown on Whispering Hope and Parklands.

Future cropping options will be driven by a combination of corporate strategies and market conditions, but maize, seed maize, soya bean and wheat are all likely major crops.

Currently a total of 660.32 ha of irrigated crops are under cultivation on the two farms. Parklands Farm has 268.54ha of Soya Beans and 65ha seed maize with a total of 333.54ha.

Whispering Hope Farm has planted 49.6ha of Soya Beans, 197.18ha of commercial Maize and 80ha of Seed Maize, totaling 326.78 ha.

Livestock

Beef cattle and sheep are reared on some of the surrounding farms, but not on Parklands or Whispering Hope. Future corporate policies may result in the introduction of livestock as part of an integrated farming system.

6.2.10 Ecology

Plant Ecology

The woodland canopy where it remains is strongly dominated by just two Caesalpinoid species, *Julbernardia paniculata* (mutondo) and *Brachystegia longifolia* (musamba). Locally, near the Munshiwemba Dam *Brachystegia spiciformis* (muputu) and *Julbernardia globiflora* (mpasa) appear as co-dominants.

Animal Ecology

Few large wild mammal species exist on the two farms (with the possible exception of small antelope such as Common Duiker and Grysbok). Gradual removal of Miombo woodland cover and large working populations resident on the farms will progressively diminish small mammal, reptile and amphibian populations unless conservation targets are established, supported by a simple conservation education programme. No threatened or vulnerable animal species are recorder from the area.

Avifauna

Avian diversity is high and evidence of Osprey and several Sandpipers suggests that the newly constructed Masebe Dam has already increased that diversity. It is proposed that woodland belts are re-establishing that will increase the opportunities for “bird parties” (feeding and interaction parties of several passerine bird species moving together) and the retention of bird genera and species diversity in other animal orders – with their positive impacts on pest control. A wide range of bird genera were noted during fieldwork, including several small raptors, owls, francolin, waders, martins, orioles, wood hoopoes, shrikes, flycatchers, sunbirds and waxbills. Annex 7 provides a full list of species known to exist in the quarter degree square bounding the two farms. There are no vulnerable or threatened species on the list. These suggest that although there has been a significant level of woodland removal on the farms (see photograph in Annex 4), a reasonably robust woodland environment still exists with well-structured trophic levels.

7. Impact Assessment and Mitigation

7.1 General Considerations

This section assesses the project for environmental and social impacts by type. None of the negative environmental or social impacts related to the Chobe Agrivision Parklands and Whispering Hope Farm Irrigation Project are considered diverse, irreversible or unprecedented. Therefore the overall environmental and social risks are considered insignificant.

We note that Chobe Agrivision is purchasing the farms in an acquisition that is completing as this report was compiled. The new owners acquire brown field sites

and intend to replace existing farming practices and improve soil quality through such techniques as conservation tillage and crop rotation. Their business plan for the farms addresses the risks identified in this report, and implementation of the plan commences in January 2011 as they take over the existing business.

The expansion of the irrigation system by 380 ha will result in a number of both positive and negative environmental impacts. But it is also envisaged that the project will result in a number of positive social impacts that are likely to outweigh any negative environmental impacts – as long as mitigation, monitoring and management measures are implemented that will address both negative environmental and social impacts.

The assessment of impacts has been conducted considering source-pathway-receptor and stressor-response framework concepts (although insufficient data determined that it was not possible to apply toxicity measures or full ecological risk assessments). Nevertheless, these frameworks provide the foundation for examining how the impacts could occur and suggests the identification of the potential target areas of impact as a key element to the process. This approach is in accordance with ISO 14001, the International Standard on Environmental Management.

All potentially significant bio-physical environmental impacts, both positive and negative are rated using a basic environmental impact system, firstly classifying the aspect as generating a positive or negative impact and then determining the significance of the impact as: low, medium or high.

7.2 Positive Impacts

7.2.1 Assessment of Positive Socio-Economic Impacts

National and International Level Impacts

The project is expected to produce overall positive socio-economic impacts and benefits (see Table 3). The main positive impact will be the increased farm production thereby improving national food security and enhancing the export potential of crops-contributing directly to gross domestic product (GDP) and the foreign exchange reserves. At the national level improved food security will also create import-substitution benefits through reduced reliance on imported food crops. The sale of surplus production will generate significant foreign exchange, political leverage for improved trade and other benefits to Zambia.

Agriculture is the most important source of employment and livelihoods to rural populations. There is also well-documented evidence of the multiplier effects of commercial agriculture in Zambia, including a virtuous cycle whereby agricultural growth stimulates an increase in industrial output.

Commercial farming impacts on staple food prices, whereby increased and more efficient production results in more competitive prices. This has a positive pro poor outcome because food is a major part of urban and rural poor expenditure. Improved availability of food in areas that are otherwise difficult to reach (i.e. more than 5km from line of road) also has a marked impact on food security.

Provincial Impacts

Similar benefits will accrue at the provincial and district levels in central Zambia. Improved production and employment opportunities will result in improvements in availability and access to services. The decentralisation of the economy away from the Lusaka-Copperbelt areas will also be facilitated – thus creating considerable regional economic multiplier possibilities. A continued inward flow of human and other resources – more recently electricity and agriculture related industries – are likely.

Local Impacts

Local people will benefit from improved employment opportunities, including unskilled, semi-skilled and skilled employment both permanent and seasonal. Improved opportunities for training in various agricultural-related occupations such as store managers; skilled tractor, combine and heavy equipment drivers; persons employed in the management and application of chemicals; pivot operators; and mechanical engineering exist. People, both local and those from elsewhere, benefit from secure and consistent incomes.

Impacts	Significance of Impact	Level of Impact
Improved food security	Positively High	National Provincial Local
Diversification of economy	High	National
Inward flow of resources	High	Provincial Local
Increased income and employment opportunities;	High positive	National Provincial Local
Increased training for skills required by commercial agricultural;	High positive	Local
Increases in seasonal employment.	Highly positive	Local

Table 3 Positive Socio-economic Impacts of the Project

Management Systems and Records

A detailed audit of management systems was not possible for this project but documentation received, visible management and recording processes and the quality of farm staff suggest that management efficiency is high relative to similar operations in Zambia. For example, stock control, accounting, human resources, cropping operations and timing records were all available and up-to-date. These services indicate that efficiency impacts on farm operations should be well placed for further improvement.

7.2.2 Assessment of Positive Impacts on the Physical Environment

Climate Change

A minor degree of negative climate change impact will have been created through methane emissions from recent land clearing, especially on Parklands Farm. However, with improved land management practices proposed by the Developer, including the restoration of woodland belts, limited tillage and appropriate integrated nutrient management methods climate change impacts could be reversed. Improved adapted farm management will also mitigate the anticipated local effects of climate change in the form of uncertain or increasing rainfall and more intense meteorological events.

Biodiversity

In a similar vein appropriate land management practices that restore woodland belts and interconnectivities, protect steeper slopes and dambos and retain wet grasslands, positive biodiversity impacts may be created. These could incur benefits for all biological groups from larger mammals and avifauna, to soil biota and plant diversity. While no species on the farms was identified from the IUCN threatened, vulnerable or endangered lists, improved biodiversity practices will enhance sustainable agricultural production through soil improvement and natural controls on pests and diseases.

Technology Impacts

The impacts of new technologies may be positive or negative. Considerable positive impacts are anticipated for this project, ranging from improved farming practices, incorporating modern limited tillage, integrated/site specific nutrient management and integrated pest control mechanisms, low impact and reduced emission tractors and more water-efficient irrigation and fertigation systems.

Impacts on working conditions should also improve with latest generation protective equipment, safer plant and machinery, enhanced management systems, and improved housing, water supply, sanitation and energy designs for built habitats.

7.3 Negative Impacts

7.3.1 Negative Socio-economic Impacts

General Management Issues

Two issues may have relevance to the effectiveness of future operations on the two farms.

Firstly, Parklands Farm has no riparian frontage on the Munshiwemba River or the Munshiwemba upper (Masebe) dam. The continued cooperative functioning of the Munshiwemba River Irrigation Company will be critical to any irrigated developments on Parklands Farm that is dependent on a raw water pump station on Wheatlands Farm for its irrigation supplies.

Secondly, Parklands and Whispering Hope Farms have been operated as largely independent entities thus far. Improving road access between the farms could enhance future efficiencies (and plans to do so are already underway) and possibly relocating the core farm infrastructure in a more central position (see Figure 4). Both farms do, however, have easy entrance and egress with plans to develop access between farms. As there are significant portal frame shed and silo developments at the Parklands headquarters this will require careful analysis.

Should the efficiency of the TAZARA Railway improve, it would also be advantageous to develop facilities at the nearby TAZARA siding, adjacent to the Parklands Farm northern boundary.

Migration and Temporary Employment Effects

Negative impacts on local populations may be created as a result of increased inward migration to the Project site. The presence of transient labour, the presence of men and women migrant labour without their families, coupled with the temporary housing, and availability of immediate cash incomes may increase the likelihood of multiple sexual partners, thus increasing the risk of HIV and AIDS. The negative impacts of HIV and AIDS include loss of productivity due to absenteeism of employees, illness or care of dependents who are ill; loss of skilled and trained staff due to death; increased costs of death and funeral benefits, and time off for co-workers to attend funerals; and lower productivity due to loss of unskilled labour.

Migration and temporary employment may also increase the misuse of alcohol, especially spirits available cheaply in small sachets which often results in gender based violence

Water and Sanitation

Poor water and sanitation has a direct impact on staff health status and productivity. Water is pumped into water tanks from boreholes on both Parklands and Whispering Hope Farms. Potable water for the Beckett compound on Whispering Hope Farm is supplied from an open well. Water analyses from the boreholes and well on Whispering Hope all showed faecal coliform contamination. Waterborne diseases (dysentery, Schistosomiasis, and typhoid) are a likely outcome of the poor water supply to these compounds. During power failures residents of Parklands and Whispering Hope Farms draw water from the Masebe Dam, which also has moderate levels of faecal coliforms. A process of hygiene sensitisation is required together with community water management to ensure that these water-collecting strategies are not required.



Picture 1 Children Drawing Water from a Small Dam at Parklands

Workforce Representation

The workforce is a valuable asset and a sound worker-management relationship is a key ingredient to the sustainability of the enterprise as well as maintaining productivity. There are currently no worker organisations and it is not clear what grievance mechanisms exist.

Conscientious Employer

Unusually in Zambia, there was no evidence of child labour on the farms. But there is currently a high percentage of the work force employed on a casual basis that can be discharged anytime, without warning, without penalty and their position is precarious. This casualisation of labour is a direct outcome of Zambia's current labour regulations, but it is considered that continuing a system of casual labour, except for exigencies, may be unproductive in the longer term.

Education and Health Services

Negative indirect impacts may be created by poor access to and availability of education facilities for employees' children – from pre-school to secondary levels. There are about 230 children mostly under the age of 10 currently living on the three farm compounds. None of these children attend a formal school. Improved education facilities would encourage staff to remain on the project for longer, possibly for generations, safeguarding investments made in staff development.

Likewise, poor access and availability of maternal and child health care services (for example, midwifery care, nutrition monitoring and vaccination programmes), family planning and other health services has a significant impact on morbidity, mortality, nutrition and the general health status of the working population. While these impacts may be indirect to the project but they may be severe, and persistent – for example, poor nutrition for children under 5 years old has lasting impact on their development, in particular their cognitive skills. Evidence from elsewhere suggests that improved on-site health care will also reduce morbidity and enhance productivity.

Emergency Preparedness and Response Capacity

No evidence was found for a formal emergency preparedness and response system on either farm. These facilities are strongly recommended given the number of large items of agricultural plant, medium voltage electrical installations and the presence of toxic and potentially hazardous agricultural chemicals. Appropriate emergency contact point lists and first aid facilities, procedures and training should be essential components.

7.3.2 Negative Environmental Impacts

General

The scale of proposed extensions to the irrigable area on Parklands and Whispering Hope Farms is relatively small and no irreversible or significant environmental or social impacts were noted, or are anticipated.

That having been said a significant level of proposed irrigation development is already completed, or is on-going without prior regulatory approvals from the Environmental Council of Zambia (all centre pivot areas on Parklands and current work on irrigation infrastructure, centre pivots and the Kampelembe Dam on Whispering Hope). Submissions for water rights have been made and provisional rights have subsequently been obtained.

Discussion with the new Developer indicate that although this may not necessary have been the case under the previous owner, all future land developments will, follow best practices in accordance with their corporate charter.

Workplace Health and Safety

Silos and similar confined space structures may create negative impacts on personnel working in them, particularly from inhalation of biotic dust and silica particles. Appropriate safety mechanisms for venting such areas and the use of protective breathing equipment should follow laid down procedures, similar to those applied to other management operations.

Storage, Management and Disposal of Toxic Agricultural Chemicals

Appropriate facilities and security exist for agricultural seeds and fertilizers in well-design and constructed steel portal frame and blockwork structures. However, security, handling, ventilation, washing and disposal facilities for other agricultural chemicals are less satisfactory.

While no proscribed chemicals were noted in the chemical inventory of the two farms, many of the herbicide and fungicide chemicals have significant toxic and hazardous impacts, particularly on aquatic ecosystems. Furthermore, soil water testing on Parklands Farm detected significant traces of Aldrin, Dieldrin, Heptachlor, Heptachlor epoxide (all banned or Category A chemicals) and Lindane (alpha BHC) suggesting that these chemical was used in the recent past (see Annex 5.4). Water samples from various sources on the farms. The results reflect that traces of Dieldrin have been found and that Aldrin has also been found in water from the office area.

Concentrations in the Masebe Dam water were 1/500th of these in the soil analyses and only Dieldrin and Heptachlor were identified, suggesting that the movement of these chemicals through the soil profile is happening gradually, but that there may be some up-take into biotic systems creating long-term bioaccumulation and other persistent effects.

Pesticides are presently applied by tractor-drawn boom sprayers, which increase the risk of operator exposure and, in the absence of formal procedures, likely also disperse the sprayer washing procedure.

Quantities and types of chemicals used are recorded and all current and used chemical containers are controlled. But there are no chemical washing and effluent disposal systems, nor personal safety systems.

At the time of our fieldwork, numerous fertilizer and agro-chemical containers were piled in disposal heaps. The consultants were informed that a procedure is followed where containers are detoxified by washing and then buried, or removed from the premises. This method of disposal is not sustainable and poses a high risk of ground water contamination and solid waste pollution as well as creating a health risk to children and others on the farm.

Ideally containers should be recycled, but this would involve the chemical suppliers who at the moment are not providing any disposal options for their clients. For some chemicals controlled incineration for burnable materials is therefore the best option, with a properly designed incinerator. For chemicals where incineration is not recommended, containers should be washed and buried in a charcoal-lined pit with tight access security.

Air Quality

In the short term air quality will be reduced during the drier months in the vicinity of construction areas, particularly roadworks, dam construction and land clearing and preparation.

Air quality on the Chobe Agrivision farms in the longer term may be increasingly impacted by dust from exposed soil areas, particularly during August when wind speeds tend to be higher than other dry season months.

Any appropriate incineration processes will also reduce air quality and location of incineration facilities and the design of flues should take due cognisance of prevailing wind directions in both the dry and wet seasons (usually from opposite directions) in order to avoid populated working and living areas.

Noise Pollution

During the construction phase a limited noise pollution footprint will be created by construction equipment.

Noise pollution was not identified as a key impact area during this EIA, but there were few indications that noise reducing headphones and other equipment are regularly used by plant operators. Normally accepted ambient noise levels are 50 dB (A) in the vicinity of populated areas.

Water Pollution from Agricultural Chemicals

Parklands and Whispering Hope Farms have stocks of a wide variety of herbicides, fungicides and pesticides. Most herbicides in particular are water soluble and often highly toxic to fish and other aquatic life. Significant negative impacts on aquatic life in Masebe Dam and the Munshiwemba River and its north bank tributaries will occur if strict controls are not placed on herbicide spraying.

Soil and water samples from Parklands Farm also indicate the presence of a range of POPs that are either scheduled for elimination from markets completely, or provided for restricted use under the Stockholm Convention. Conscientious agricultural practices by Chobe Agrivision should remove these products from use on their farms.

The introduction of integrated pest management systems will offer significant benefits to the development of soil flora and fauna that are both conducive to enhanced soil fertility, structure and drainage that are all negatively impacted by excessive use of agricultural chemicals, especially POPs.

The impacts of agricultural fertilizers¹⁹ may also be negative, especially on aquatic systems, where eutrophic explosions of phytoplankton may create toxicity and reduce available oxygen should surplus fertilizing compounds enter surface water bodies.

Dambos and other wetland habitats offer significant pesticide and fertilizer attenuation services, but only within limits of their absorptive capacity. Cultivation of wetlands, cultivation on steep slopes, insufficient contouring and field drainage will all accelerate the flow of foreign chemicals through the ecosystem and limit their absorptive capacity.

Impacts on Geomorphic Process, Soils and Land Use

Geomorphic processes on Parklands and Whispering Hope Farms are reasonably stable, with little indication of current downgrading of streamlines and only limited indications of erosion. Good soil and water management practices on the farms have reduced the risk of soil erosion, but large exposed cultivated areas now exist, particularly on Parklands Farm. Furthermore, pressure to increase cultivated area has resulted in areas on steep lower valley slopes being put under irrigation that may initiate a process of soil erosion and gullyng with an up-slope progression.

It would appear that new centre pivot locations on Whispering Hope Farm have moved away from most of these steeper sloped areas but further caution and effective erosion control measures are required.

On the eastern boundary of Whispering Hope Farm a storm drain has been excavated into the top of an arm of the Kampelembe Dambo. This drain is now gullyng and is likely that this will extend upslope into Parklands Farm. Excavation in dambos has major negative impacts on their drainage characteristics and should not be permitted.

Soils on both farms are largely undifferentiated and have limited structure. One soil profile examined indicated incipient hardpan formation and most soils, especially on Parklands Farm showed little crumb structure and a propensity for sheet erosion. Cultivation equipment used on the farms mostly has double tyre or wide bearing/low pressure tyre characteristics, indicating sensitivity to soil compaction. However, there was little evidence of reduced tillage practices.²⁰

Land Use and Woodland Clearing development and farming operations by the previous owner have now also removed 70% of woodland cover from the central and western parts Parklands Farm. The photograph in Annex 4 illustrates the extent of this exposed and moderately sloping area. Wind and water vectors of erosion work most actively in exposed circumstances where fetch distance is usually directly related to the transporting capacity of the vector. Approximately 75% of natural woodland and dambo cover remains on Whispering Hope Farm. In total 660ha are already under cultivation and Chobe Agrivision are clearing an additional 180ha of woodland on

¹⁹ Nitrogenous compounds and phosphorus are the main “culprits” with nitrogenous compounds (often Ammonium nitrate and Urea) transforming into water soluble and mobile nitrites supporting protein formation and phosphates fueling energy flows.

²⁰ Although there are stock holdings of Indian hemp, suggesting that a degree of crop rotation using green manures is practiced or intended.

both farms. Remedial action in re-establishing woodland belts across the contours is recommended on Parklands Farm.

Impacts on Hydrological and Hydrogeological Systems and Water Quality

Hydrology Transforming Miombo woodland into arable land removes, or truncates many of the ecosystems services that stabilize ecological and hydrological processes. Alternative controls are therefore required to ensure that rainfall is captured and enters the soil profile and that surface and sub-surface runoff do not have accumulating impacts. Contouring, field and storm drainage are required on the valley slopes on this farm to ensure that runoff is distributed and not accumulated.

It has been noted earlier that the effectiveness of drainage systems will also contribute to reducing the polluting effects of agricultural chemicals.

Hydrogeology The underlying lithologies of the two farms are not conducive to extensive groundwater voids. Nevertheless, uninterrupted movement of water through the soil profile into and through quartzite and weather granite aquifers forms an essential part of the maintenance of base flow in the Munshiwemba River and its tributaries. Woodland offers an excellent mechanism for this process as rainfall capture and transfer is high and surface soils horizons have a higher absorption and transfer rate by virtue of their higher organic matter and soil biota status. Extensive land clearing thus impacts significantly on groundwater recharge.

Water Quality The sandy clay soils on the farms have a higher adsorption capacity than sandier soils elsewhere in the Mkushi area, but the concentrated nature of agricultural chemical storage, handling and washing, farm maintenance and housing an associated washing and sanitation arrangements reduces the capacity of these soils to filter toxic and pathogenic compounds. Some risk therefore exists for the pollution of groundwater sources in high-use areas by a range of hydrocarbon, toxic chemicals, persistent polluting substances and coliform pathogens. Evidence from water analyses suggests that this is already occurring and suggests improved controls on wastewater and sanitation.

Water quality of surface sources is equally, or more impacted by poor waste controls and the discharge of chemicals and human excreta into the Munshiwemba River system is occurring. As farming operations and settlement increase in the catchment, these polluting effects will increase unless improved controls are put in place. The cycling of dam water through irrigation systems may exacerbate the accumulation of pollutants.

Impacts on Climate

Parklands and Whispering Hope Farms are moderately large, but have a limited extent in a regional setting. The insularity in thinking along these lines does not remove the small cumulative, negative impacts that this farming operation will have on global warming processes, through emissions from vehicles, refrigeration and drying processes, land clearing, the use of ozone depleting chemicals, and the thermal and gaseous flux differentials of exposed land surfaces.

Corporate social responsibilities are increasingly recognising the importance of small incremental contributions to reducing carbon footprints. Some evidence also suggests that the extensive removal of forest cover and its replacement by open cropping has

impacts on the flux of moisture through the adjacent air mass. Combined with increased wind speeds associated with uninterrupted fluid flows, this may have incremental negative effects on soil moisture stress and overall humidity in the ambient air masses.

Technology impacts

Likely negative impacts of technology are anticipated because of the increased impact areas they may create, not because of the technologies themselves. Conscientious and sustainable management practices will be essential adjuncts to the application of new technologies.

7.4 Impact Evaluation Mechanisms

Evaluating the impacts of project development permits an objective mechanism with which to assess and predict the impacts, and thus to develop appropriate mitigating measures, or project re-design. The assessment has used standard processes required by integrated environmental management procedures that are listed in Annex 2.

The key elements include: the nature of the impact; its duration; severity (measured by intensity, spatial extent and probability) and thus its significance.

7.4.1 Nature of Impact

This is an appraisal of the type of effect the proposed activity would have on the affected environmental component. What is being affected and in what way? This may include **direct impacts** – that appear immediately as a result of an activity of the project (for example, the loss of ecological habitat during the site preparation and clearing); and **indirect impacts** -that are related to the project but are of a secondary nature (for example in-migration of people seeking temporary or permanent work, or being supported by employed relatives).

7.4.2 Duration of Impact

This criterion provides a measure of the time footprint of the impact, with those that are long-term being generally more important and less easily mitigated than those of a short-term nature, where natural ecosystems services may be able to restore prior ecological processes once the impact has stopped.

7.4.3 Severity of Impact

Severity of impact is usually measured through evaluation of the intensity, extent and probability of the impact. Is it likely to occur, and if it does what will be the spatial footprint of that impact and how intensive will it be? High intensity impacts are those with major negative impacts on the environment or social context that cannot be mitigated and should require careful cost/benefit evaluation, or a re-design of the project to reduce or avoid it. By comparison a low intensity impact is anticipated to

have insignificant environmental or social impacts.

7.4.4 Significance of Impact

The significance of an impact defines the cumulative measure of its nature, duration and severity. A negligible impact is not significant and requires no mitigating measures. On the other extreme the existence of a highly significant impact may jeopardize the viability of the project.

Importantly, environmental and social impact assessments are a key tool in determining the viability of a project – to be used alongside financial and economic analyses and other evaluation tools. Projects that are environmentally and socially friendly frequently also have lower long-term operating and overhead costs - and importantly unanticipated outcomes and their attendant costs

7.5 Impact Matrices

The following tables provide the evaluation of project impacts in the form of impact matrices.

Table 4 Socio-economic Impact Matrix

Cause	Negative Impact on Project	Duration	Severity	Extent	Probability	Significance
Inward migration of seasonal and casual workers	Multiple sexual partners, increasing the risk of HIV and AIDS and STDs resulting in loss of productivity and skills retention; high turnover of staff.	Long term	High	Site, local, regional, national	Certain	Moderate
Inadequate housing and poor temporary housing for seasonal workers	Social problems such as alcohol abuse, gender based violence, insecurity and theft.	Short – medium	Moderate	Site, local	Probable	Low
Poor water potable sources and sanitation	Likelihood of water borne diseases has a direct impact on productivity.	Long-term	Moderate	Site, local	Probable	Moderate
Employment conditions, casualisation of labour and employee representation	No grievance mechanisms results in high turnover of staff; loss of skills. Loss of cultural mores and behaviours as workers come from different areas, resulting in poor security.	Long-term	Moderate	Local	Certain	Moderate
Poor access and availability of education and health facilities	Direct impact: increasing staff turnover and threatening retention of skills base, absence due to sickness higher. Indirect impact: Poor (or no) education, especially for girls. High maternal and child mortality; poor post natal child nutrition; increasing childhood diseases; limited use of family planning.	Long-term	Moderate	Site, local	Highly probable	Low
Lack of an emergency preparedness and response strategy	Lower chance of mitigating on-site injuries and other emergencies	Long term	High	Site, local	Highly probable	Moderate

Table 5 Environmental Impact Matrix

Cause	Negative Impact on Project	Duration	Severity	Extent	Probability	Significance
Poor on-site health and safety procedures and facilities	Higher incidence of accidents and injuries	Long term	High	Site, local (especially plant areas)	Probable	Moderate
Inadequate storage, management and disposal of toxic agricultural chemicals	Accidental contamination of employees, community and water systems	Long term	High	Site, local (toxic chemical stores, washing areas)	Probable	Moderate
Inadequate solid waste disposal	Solid waste accumulates and creates threats to local health and poor quality living environment	Long term	Moderate	Site, local (storage and handling areas)	Certain	Low
Reduced air quality	Project activities reduce air quality during construction and operational phases, particularly for employees working in confined spaces	Short to medium	Low	Site, local (construction sites and fields)	Certain	Low to moderate
Hearing impairment and nuisance from noise pollution	Construction and operator staff suffer hearing impairment and community nuisance by noise from plant and equipment	Long-term	Low	Site, local (plant and equipment operators)	Probable	Low to moderate

Cause	Negative Impact on Project	Duration	Severity	Extent	Probability	Significance
Water and soil pollution from effluent agricultural chemicals	Excess agricultural chemicals running off and leached through the soil profile create toxic and eutrophic impacts in water bodies and damage soil biota	Long term	High	Site, local and downstream regional	Certain	Moderate
Farming impacts on geomorphic process, soils and land use	Poor land use and farming practices result in reduction in effectiveness of ecosystems services, increased erosion and reduced fertility of soils	Long term	High	Site, local	Probable	Moderate
Polluting impacts on hydrological and hydrogeological systems and water quality	Effluent pollutants enter the water system and created negative impacts on water quality and potability	Long term	Moderate	Site, local but regional riparian impacts	Certain	Moderate
Deforestation and farming operations impact on climate	Direct impacts of global climate change on rainfall variability, intensity of storms and flooding	Long term	High	Site, local, regional, national	Probable	Moderate

7.6 Mitigation Measures

7.6.1 Socio-economic Impact Mitigation

Migration and Temporary Employment Impacts

Mitigating migration and temporary employment impacts will be most easily addressed by investment in systems and skills that reduce the requirement for temporary employment.

In the medium term and given the high level of unemployment in Zambia, other measures are also required, especially including an effective HIV/AIDS Work Place programme, improved education and awareness facilities for children and especially girl child education and improved conditions for a smaller number of migrant workers. The critical elements of a Work Place programme are as follows:

- Creation of a company policy on HIV/AIDS, its dissemination to all employees, its implementation and its occasional updating;
- Provide information on HIV/AIDS, ways of preventing transmission, places to seek further information and services and ongoing company and union support for responsible sexual behaviour, using trained peer educators;
- Condom distribution at readily accessible points around the workplace;
- STD diagnosis and treatment, whether within the company, in community clinics or in other centres where employees receive healthcare;
- Treatment for HIV and associated diseases, such as tuberculosis;
- Counselling and testing for HIV on a voluntary and private basis, with means to provide support for employees and/or family members who are HIV-positive;
- Mitigation services designed to provide such follow-up activities as counselling, community support and home-based care.

There are many non-governmental organisations that can assist in establishing a Work Place programme. It is recommended that the management contact the Ministry of Health in Mkushi district and receive guidance on local resources available.

Features of an Effective HIV/AIDS policy:

- Sets a foundation for HIV/AIDS prevention and care programs;
- Offers a framework for consistency of practices within a business;
- Expresses the standards of behaviour expected of all employees;
- Informs all employees what assistance is available and where to get it;
- Guides supervisors and managers on how to manage HIV/AIDS in their work groups;
- Assures consistency with relevant local and national laws and statutes.

It is also recommended that the programme to improve housing is continued. The management may also consider the provision of provision of appropriate housing for casual and seasonal workers.

It is suggested that management gradually de-casualise their employment, except where specific seasonal employment is necessary. Casual labour may be used during the development stage, but it is likely that management will be less dependent on casual labour as the operations become more established.

Water and Sanitation Impacts

Water quality tests on bulk and groundwater sources indicate high levels of contamination by organic and coliform pollutants, but also of base metals (particularly iron and zinc). Improved and sufficient safe, potable water supply (WHO standards are in the range of 150 to 250 l per head per day) will reduce morbidity/loss of productivity impacts of disease from contaminated open water sources. Boreholes with iron bacterial infection should be treated.

Improved sanitation (through ventilated improved latrines and eventually water-borne septic tank systems), coupled with appropriate sanitary regulations and awareness will reduce coliform contamination. It is recommended that all boreholes have stricter sanitation regimes, both for water collection and the nearest proximity of pit latrines and washing facilities. All boreholes on Whispering Hope should be treated for coliform infestation and increased water storage facilities provided.

Testing and treatment of employees for Schistosomiasis would help to break the cycle of infection from this parasite.

Separation of agricultural chemical washing facilities from habitation will help to reduce organic compound (including toxic hydrocarbons) contamination of groundwater sources.

Workforce Representation

Developing a workforce representation system and using it to reduce workforce issues and increase productivity has been found to be a successful strategy elsewhere in the Zambian agricultural sector. This strategy may also help to reduce and manage the necessary level of temporary employment. The existence of an effective workforce representative body that forms part of routine management processes may also enhance the flow of important health and safety, sanitation and disease control information, as well as the identification of solutions to health and education issues.

Access to Health and Education Services

Mitigating the negative impacts of limited health and educational services for employees is problematic. The improvement in provision of these services requires a considerable initial investment as well as consultation with government to secure long-term sustainability. However, given the distances to both primary health and basic education services (all exceed a 5 km walking radius), it is recommended that a medium-term task of the Developer is consultation with employees and local health and education services to develop appropriate and mutually affordable solutions. The outcomes are anticipated to be highly positive in improved employee productivity and

the retention of key management and operational staff, future recruitment, family wellbeing, and the sense of contribution and corporate identity among staff.

Emergency Preparedness and Response Capacity

Accidents are inevitable in any process industry and it is recommended that the Developer mitigate impacts of this eventuality by establishing an emergency preparedness and response strategy. This should include the necessary associated facilities (an emergency room with first aid equipment and emergency contact numbers/persons) and training for identified emergency preparedness staff.

7.6.2 Environmental Impact Mitigation

Workplace Health and Safety

As the Developer introduces improved farm management systems appropriate workplace health and safety procedures should be formulated and applied. Particular importance should be attached to safety breathing equipment and clothing for those handling toxic chemicals, for sprayer operators and assistants, staff working in confined silo spaces. Construction staff working on elevated steel structures and with heavy equipment and materials should also have protective hard hats and boots. Appropriate washing facilities should be available to all staff working with toxic materials and with hydrocarbons.

Awareness training to employees operating or working with and around farm equipment is recommended, together with audible and visible warning systems on plant.

A workplace HIV/AIDS programme is recommended.

Storage, Management and Disposal of Toxic Agricultural Chemicals

It is recommended that the Developer subscribes to an internationally recognised environmental management standard for agricultural produce (MPS-GAP or similar). This would enhance environmental standards and also simplify environmental health and safety in the field, thereby reducing the number of people exposed to toxic chemicals and increasing control on their use. In compliance with international environmental regulations the farms should attempt, as much as possible, to use chemicals that are coded green (those being the most environmentally friendly/biodegradable) following IFC guidelines and avoid chemicals listed by the Stockholm and Rotterdam Conventions.

As part of this process the farms should establish formally designed chemical stores with necessary ventilation and lighting requirements, storage for chemicals according to their toxicity, specific used container and sprayer washing facilities and empty container storage, incinerator facilities, and sprayer staff emergency washing facilities. All effluent from these facilities should be directed to a charcoal-lined chemical filtration pit.

Mitigation of accumulating piles of chemical containers on the farms should follow best practices with the incineration of non-toxic paper, cardboard and related containers in an approved incinerator and the washing and chemical pit disposal of toxic chemical containers, unless suppliers have a system for empty container returns. The disposal of waste engine oils and lubricants should be done by application to wood treatment, burning off or disposal off-farm to recycling organisations. In all cases possible local accumulation of these products (including around diesel storage tanks) should be minimised.

Solid Waste Disposal

A solid waste disposal system for non-toxic waste should be developed that includes recycling, incineration, compacting and burial, or use in appropriate locations. The proximity of some staff housing on Parklands and Whispering Hope Farms to existing farm storage and handling areas should be considered in designing mitigating solutions.

Air Quality

Mitigation of low air quality impacts can be achieved during the construction phase by watering dust generating areas, ensuring roads, borrow areas and other dust producing sites are downwind of habitation.

Applying good farming methods will mitigate poor air quality during the operational phase. These may include minimising the period when soils are exposed, introducing indigenous plant windbreaks/biodiversity corridors and the application of minimum tillage practices.

Noise Pollution

Noise pollution is not a significant impact factor but employees working with equipment that generates high decibel noise outputs should wear ear protectors.

Water and Soil Pollution from Agricultural Chemicals

Chobe Agrivision should consider reviewing its pesticide, herbicide and fungicide stocks with a view to replacing non-biodegradable and toxic products with more environmentally sensitive, “green label” products. Other mitigating measures should include the constant monitoring and maintenance of in-field and field boundary drainage, irrigation applications and the timing and application rate and efficiency of agricultural chemical applications to minimise effluent discharge into streams, rivers and dams and into the soil profile.

The requirement for a toxic waste disposal pit has been discussed earlier to reduce flows of toxic products from sprayer and container washing into hydrological systems.

Impacts on Geomorphic Process, Soils and Land Use

Minimising soil erosion and its negative impacts on land productivity and water body pollution is best achieved through avoidance of steeply sloping areas, erosive soils, excessive clearing of ground cover, excessive open land areas and the absence of suitable drainage systems. Mitigation of current land use patterns and soil impacts may be achieved by reintroducing woodland belts on Parklands Farm (these will often self-reintroduce), maintain and extend the excellent systems of contours and in-field

and boundary storm drains on the farms, in-filling the drainage gully in the upper Kampelembe Dambo and moving increasingly to minimum tillage systems and the inclusion of green manure crop rotations.

Impacts on Hydrological, Hydrogeological Systems and Water Quality

Mitigation measures already discussed will contribute to reducing impacts on hydrological systems and water quality. To be successful these measures will also require a monitoring and management response system.

Impacts on Climate

It is recommended that Chobe Agrivision adopts an adaptive and climate-friendly approach to its farming operations in response to changing climatic patterns and in accordance with current global industry low carbon charters. This approach will require incorporation into the management systems of the company and integration of appropriate applications into day-to-day farming operations.

8. Environmental and Social Management and Monitoring Plan

8.1 Introduction

The Developer is required to prepare, agree, monitor and manage an Environmental and Social Management and Monitoring Plan (ESMP) for the project. The ESMP should include attention to all anticipated environmental and social impact areas and be sufficiently flexible to permit adjustments over the life of the project.

The ESMP developed under the environmental and social impact statement (ESIS) will form the basis for environmental and social monitoring and management during implementation the Project. The intention of an ESMP is to guide the optimisation of the various components of a project; anticipate possible future environmental and social risks and shocks; and provide the framework for the collection of data and the analysis of those data in a format that is compatible with and useable by management systems. As such the ESMP forms part of the project's monitoring, evaluation and reporting systems and requires suitable decision-making structures and procedures to be in place to ensure that it is applied and useful. Linkages to systems such as ISO 14001 will offer advantages in management efficiencies in these areas.

If fully applied, the ESMP will ensure that the Project remains compliant with regulatory standards and procedures, as well as contributing to optimising operations for the Developer. To clarify the key environmental and social management issues we suggest that the Developer re-formulates the ESMP to identify the sensitivity of anticipated impacts, the functions required in mitigation and the responsible parties – which will also enhance its value as a management tool.

In particular, it is recommended that the ESMP is linked more specifically to the project's management structure and systems, using best practice standards and guidelines, especially to the requirements of the IFC Performance Standards on Social

and Environmental Sustainability. As soon as quantifiable data are available on potentially impacting factors these should be incorporated into the ESMP and further analysed for possible changes to the impact profiles identified to date.

We reiterate the following issues will have core relevance to the Chobe Agrivision Irrigation Project:

- maintaining high levels of community and corporation occupational and general health and safety as a strategy to minimise morbidity and loss of productivity through accidents, ill health and household social costs;
- mechanisms that will ensure that equitable working arrangements are maintained and monitored between the corporate management and the labour;
- monitoring and managing the security, sustainability and safe use of domestic and irrigation water resources, including effluent and drainage controls;
- the use of agronomic practices that will sustain soil structure, fertility and productivity and avoid compaction, loss of organic matter and soil loss;
- the appropriate, optimised, safe and systematic use and management of pesticides and other agricultural chemicals, with due avoidance of banned and restricted substances;
- maintaining and managing biodiversity as a strategy to optimise the sustainable productivity of the land and reduce the requirement for chemical control of pests and diseases; and
- being mindful of the increasing impacts of changing climatic patterns and of corporate responsibilities to contributing to minimising those impacts.

Table 6is a monitoring and management matrix, which indicates key ESMP issues that have been raised in this ESIS, alongside the possible mitigation actions, objectives and responsibilities.

8.2 Social Management Plan

8.2.1 Migration and Temporary Employment Effects

Increased Risk of HIV and AIDS

Inward migration of seasonal and casual workers increases the likelihood of multiple sexual partners increasing the risk of HIV and AIDS and sexually transmitted diseases (STD). A Work Place programme is strongly recommended.

Staff Housing

The Developer should continue the on-going improvement of staff housing as resources permit. Where possible this process should include improved arrangements for casual labour.

Casualisation of Labour

Where possible Chobe Agrivision should attempt to reduce the level of casual employment.

8.2.2 Water and Sanitation

On-going processes of improving water supply and sanitation should continue with appropriate regulatory arrangements for access to borehole areas and open water sources.

8.2.3 Workforce Representation

An effective workforce representation system, possibly with a position of responsibility in the management system is considered a useful evolution of management-employee relationships on the farms with strongly positive outcomes for farm operations and productivity if effectively structured and implemented.

8.2.4 Access and Availability of Health and Education Services

Improved education facilities would encourage staff to remain on the project for longer, possibly for generations, safeguarding investments made in staff development. It is recommended that a community school be established that will provide pre and primary school facilities.

Evidence from other farm projects suggests that improved on-site health care will also reduce morbidity and enhance productivity. Increased provisions for on-site first aid through training regimes, first aid stations and general health and safety target setting and training are all recommended, and are consistent with the plans of the new owners. In addition, the new owners plan to establish a midwife support group which will assist in educating the farm community on general healthcare, encourage families to provide their children with education as well as assist and foster saving habits amongst farm labourers.

8.2.5 Emergency Preparedness and Response Strategy

An appropriate emergency preparedness and response strategy is strongly recommended, together with associated investments in equipment and training.

8.3 Environmental Management Plan

8.3.1 Workplace Health and Safety

Workplace health and safety procedures should be strengthened and formalised into management systems and procurement cycles.

8.3.2 Storage, Management and Disposal of Toxic Agricultural Chemicals and Solid Waste Disposal

A specific toxic chemical store, washing facilities and disposal system is required as a priority, with associated training. The present security arrangements for agricultural chemical storage reflect a lower priority than that for seeds and fertilizers (see photograph in Annex 4).

An effective set of disposal arrangements is required for solid waste.

8.3.3 Air Quality and Noise Pollution

Air quality measure should reflect design issues such as the location of incinerators and major dust producers and working and living areas. Farming systems should be mindful of the benefits of maintaining ground cover on farmed lands.

Noise pollution effects are most serious for employees operating plant and equipment with high decibel outputs. Protective equipment should be supplied and used in accordance with corporate health and safety procedures.

8.3.4 Water and Soil Pollution from Agricultural Chemicals

Optimum application of fertilizers and agricultural chemicals, careful location and management of chemical handling and washing facilities and regular monitoring of water quality for the presence of agricultural chemicals should be implemented.

8.3.5 Impacts on Geomorphic Process, Soils and Land Use

Sound soil and water management practices should be continued to reduce the impacts of wind and water vectored soil erosion, build soil structure and fertility and ensure the soil-water and biodiversity impacts of woodlands and dambos are sustained and re-introduced in clear-felled areas.

8.3.6 Impacts on Hydrological, Hydrogeological Systems and Water Quality

Land use, irrigation and water management mechanisms should incorporate design features and management systems that secure and sustain hydrological systems on and below the farms and the quality of water flowing through them. Regular monitoring of water quality and appropriate responsive treatments should be routine.

8.3.7 Climate Change

Climate change impacts are still poorly understood, but would appear to be increasing the intensity of climatic phenomena and the uncertainty of rainfall patterns. Chobe Agrivision will be impacted by these changes, requiring both an adaptive approach to managing these changes and a corporate responsibility for contributing to reducing global warming influences.

Table 6 Environmental and Social Management and Monitoring Plan

Impact	Objective	Mitigating Measure	Risk rating	Action	Timeframe	Indicator and Frequency of Monitoring	Responsible Party
Social impacts							
1. Migrant and transient labour	Reduce HIV/AIDS impacts on the farms and improve employment efficiency	1.1 De-casualise workforce where possible	4	1.1 Workforce are employed on a permanent basis with two exceptions: workers are employed for 6 weeks on a contract basis as a trial period before being made permanent where infrastructure and development is conducted on the farms.	1.1 With the recency of the acquisition, it will take a period of 6 months before this process is fully operational. A large portion of the workforce is in the process of being assessed and upon success will be made permanent. At the end of the September 2011, we expect 70 and 25 (Parklands and Whispering Hope respectively) to be permanent.	1.1 Currently there are 169 casual workers of a total workforce of 220.	Farm manager will manage the process and the administration function of ensuring the contracts are in place would fall under HR manager.
		1.2 Improve and formalise housing		1.2 Beckett housing compound will be relocated in consultation with the community. Improvements to the sanitation, access to water, general living conditions and improved housing facilities will be carried out.	1.2 The aforementioned development will be carried out over the next 18 months with regular feedback and progress to be reported at the monthly management meetings.	1.2 Monthly meetings will be conducted by senior farm management with progress reports prepared. A management pack will be sent to Chayton Africa and Atlas Farming team. The findings and progress will be discussed at the external management meetings.	Management committee
		1.3 Institute Work Place programme		1.3 A formal workplace programme will be developed over the next two years. The programme would be initiated by Chobe, with a qualified health worker running the clinic. This has already been effected. Provision of condoms, information pamphlets and general advice will be obtainable from the Clinic. Weekly trips are also currently being scheduled into Mkushi for workers to visit the hospital for check-ups.	1.3 The workplace programme will be established over the next two years, to be firmly established by March 2013. The Clinic has been set-up but does not address the HIV/AIDS risk. Informational brochures. This will be implemented by September 2011.	1.3 Reduction in casualty rate linked to HIV/AIDS.	The Health worker, recently employed, will be in charge of the clinic. The HR manager will oversee the progress.

3. Workforce representation	Increasing productivity and job creation	3.1 Develop appropriate workforce representation and responsibilities	2	3.1 Organised body to be established comprising Chobe management representation, general workforce representation and community representation.	3.1 This will be implemented over the next 18 months (September 2012) with a formal meeting held on a quarterly basis. Currently all grievances are escalated to farm supervisors and if unable to address this is escalated to the assistant farm manager and/or farm manager. This however, is not the long term solution.	3.1 The number of incidence/grievances to be monitored at meetings. This will be conducted quarterly. For the short term, any issues will be reported at the monthly management meeting	Farm managers will chair meetings and manage outcome
4. Access to and availability of health and education facilities	Improved productivity and long-term recruitment of educated personnel	Incremental introduction of improved on-farm health services and access to basic education for employees children	2	4.1 Basic farm clinic established supplying over-the-counter medication.	4.1 Already in existence, ongoing service provided	4.1 Success of system will be monitored via the quarterly workforce meetings (3.1 above)	Management committee
				4.2 Weekly trips to public Hospital in Mkushi.	4.2 Already in existence, ongoing service	4.2 Demand and success of system will be monitored via the quarterly workforce meetings	Management committee
				4.3 Day care to be run by midwives for pre-schooling aged children	4.3 Over the next two years the community centre will be established, staffed with midwives	4.3 Progress of establishment of Community Centre to be discussed quarterly at management meetings and progress to be reported to Chayton Africa and Atlas Farming.	Management committee
				4.4 Discussions to be held with Health and Education Ministries to determine the sustainability of establishing initiatives on farms	4.4 Ongoing	4.4 Feedback to be provided to Management Committee on a quarterly basis.	Management committee
5. Emergency preparedness and response strategy	Improved ability to deal with emergency situations and improved casualty outcomes	Implement emergency preparedness and response strategy	3	5.1 Emergency response strategy completed	Immediate and ongoing training and assessment	5.1 Strategy to be assessed and monitored on quarterly basis at Management Committee meetings	Farm manager and Administration manager
				5.2 Training of senior farm workers to be rolled out; inventory list to be compiled documenting emergency supplies		5.2 Monitored regularly	
				5.3 Evacuation plan documentation on site with procedures relating to field operations		5.3 Assessed quarterly	
				5.4 Development of Material Safety Data Sheet (MSDS) file		5.4 Quarterly assessment of MSDS file and reported at Management Committee meeting	

5. Emergency preparedness and response strategy	Improved ability to deal with emergency situations and improved casualty outcomes	Implement emergency preparedness and response strategy	3	5.1 Emergency response strategy completed	Immediate and ongoing training and assessment	5.1 Strategy to be assessed and monitored on quarterly basis at Management Committee meetings	Farm manager and Administration manager
				5.2 Training of senior farm workers to be rolled out; inventory list to be compiled documenting emergency supplies		5.2 Monitored regularly	
				5.3 Evacuation plan documentation on site with procedures relating to field operations		5.3 Assessed quarterly	
				5.4 Development of Material Safety Data Sheet (MSDS) file		5.4 Quarterly assessment of MSDS file and reported at Management Committee meeting	
Environmental Impacts							
1. Workplace health and safety	Safer workplace with fewer accidents and few serious accidents	Formalise and implement health and safety procedures and equipment requirements	3	1.1 Documenting and training workers as to use of equipment	Immediate and ongoing training and assessment	1.1 Controls to be monitored at monthly management meetings	Farm manager and Administration manager
				1.2 Issue of protective gear where required		1.2 Line managers to monitor condition of protective gear and report to senior management	
				1.3 Warning signs erected		1.3 Regular health and safety site visits to be conducted	
2. Storage, management and disposal of toxic chemicals and solid waste	Safer and more secure working space, facilities and improved management for toxic chemicals and solid wastes	Construct secure, ventilated, partitioned chemical shed and associated facilities and train employees in toxic chemical and solid waste handling and management	2	2.1 New storage for chemicals to be constructed away from main warehouse or shipping container to be installed for the purpose.	Immediate and ongoing	2.1 Existence of properly designed chemical shed and facilities;	Farm manager and Administration manager
				2.2 Educating and training employees in toxic management and disposal methods		2.2 Monitor number of employees trained	
				2.3 Maintain and update list of banned and restricted chemical substances. Internal audit of list and ensure that not being utilised.		2.3 List to be provided to quarterly Management committee meeting marking changes	
				2.4 Incinerators been established for incinerating contaminated chemical containers		2.4 Condition of incinerators to be monitored on health and safety site visits	
						2.5 Quarterly tests on water quality	

3. Air quality and noise pollution	Better health and safety standards for operating in poor air quality and noise environments	Improve health and safety arrangements for operating in confined and noisy areas and reduce dust and smoke impacts by appropriate siting	1	3.1 Enclosed workshops with proper ventilation to be constructed	3.1 Within the next 12 months	3.1 Use of health and safety equipment	Farm manager and Administration manager
						3.2 Regular use of filtered breathing and noise suppression equipment	
4. Water and soil pollution from agricultural chemicals	Reduced costs, improved environmental conditions and achieve more sustainable agricultural environment	Regulated and optimised use of fertilizers and agricultural chemicals under integrated nutrient and pest management plans	2	4.1 Adhere to policies	Immediate and ongoing	4.1 Existence of integrated nutrient and pest management plans;	Farm manager and Administration manager
				4.2 Application of zero tillage techniques to mitigate runoffs		4.2 Improvement in water and soil water quality test results conducted bianually	
				4.3 Ongoing engagement with consultants and experts to implement modern farming techniques		4.3 Farming techniques and types of agricultural chemicals being used	
5. Impact on geomorphic and soil-forming processes	Reduced soil erosion, improved soil management and crop productivity, and maintenance and local re-establishment of biodiversity	Continued emphasis on soil and water management structures, minimising soil impacts and optimising benefits of woodlands and dambos	3	Introduction of Conservation Activity Plan (CAP)	Immediate and ongoing	5.1 Bi-annual testing of soil and water reported at Management meeting 5.2 Implementation of soil and water management plans reported and reviewed at management meetings 5.3 Re-establishment of woodlands/windbreaks in accordance with Conservation Activity Manual	Farm manager and Administration manager

6. Impacts on hydrological systems and water quality	More sustainable water resources and improved water quality	Improved management of water resources (particularly considering possible drought impacts)	3	6.1 Zero/minimum tillage and soil erosion management	Immediate and ongoing	6.1 Surface and groundwater quality test results conducted and reported annually at management meetings	Farm manager and Administration manager
				6.2 Apply water irrigation according to soil moisture content		6.2 Performed in accordance with CAP monitored at monthly management meeting	
				6.3 Avoid ponding of irrigation water		6.3 Performed in accordance with CAP monitored at monthly management meeting	
				6.4 Record(River & Dam) and testing water quality		6.2 River and dam level records recorded monthly and reported at management meetings	
7. Climate change	Reduced global warming impacts and better capacity to adapt to changes	Improved land use and farming practices to minimise greenhouse gas emissions and corporate responsibility towards reducing carbon footprints	3	7.1 Zero/Minimum tillage techniques	Immediate and on-going	Rainfall, temperature and humidity records	Farm manager and Administration manager
				7.2 Reduced fuel usage via application of modern farming therefore reduced carbon emissions		Regular Board meeting topic Daily/Biannual	

8.4 Environmental Monitoring Plan

Environmental and social impact monitoring ensures that anticipated impacts have been accurately predicted and that appropriate mitigation measures are being implemented as planned, that they remain appropriate and that they are having the expected effects. Environmental and social impact monitoring is often a difficult process to sustain in a working environment where these costs are often seen as unnecessary and damaging to cash flows and the conclusion of more important jobs.

For this reason it is important to embed the ESMP in routine management systems and budgets and to ensure that key indicators are presented at Board meetings least twice in each year, or more frequently if required at the outset of the project. Board reports should include both:

- compliance with the monitoring commitments in the ESMP; and
- the quality and relevance of the impact monitoring data.

It may be necessary to adjust the monitoring plan as circumstances change, but only to improve the quality and relevance of information collected. Where the significance of the anticipated impacts is high a regular reporting interaction with the ECZ will be required. This will offer the opportunity to evaluate alternative mitigation options should difficulties arise.

Impact monitoring should establish benchmark values at the outset so that progress can be measured. These benchmarks should be calibrated against internationally recognized minimum standards (for example, see the WHO water quality standards in Annex 5.2).

Measures of ecological change are more difficult to benchmark, but may (and should) use photographic evidence from specific sites, or population counts. Photographic records from specific sites, use of sample plots, or turbidity measurements are frequently used techniques to measure soil erosion impacts.

In order to ensure the direct comparison of monitoring results monitoring points should be specifically described (and if necessary marked). This particularly applies to stream and dam water sampling, soil and soil erosion monitoring.