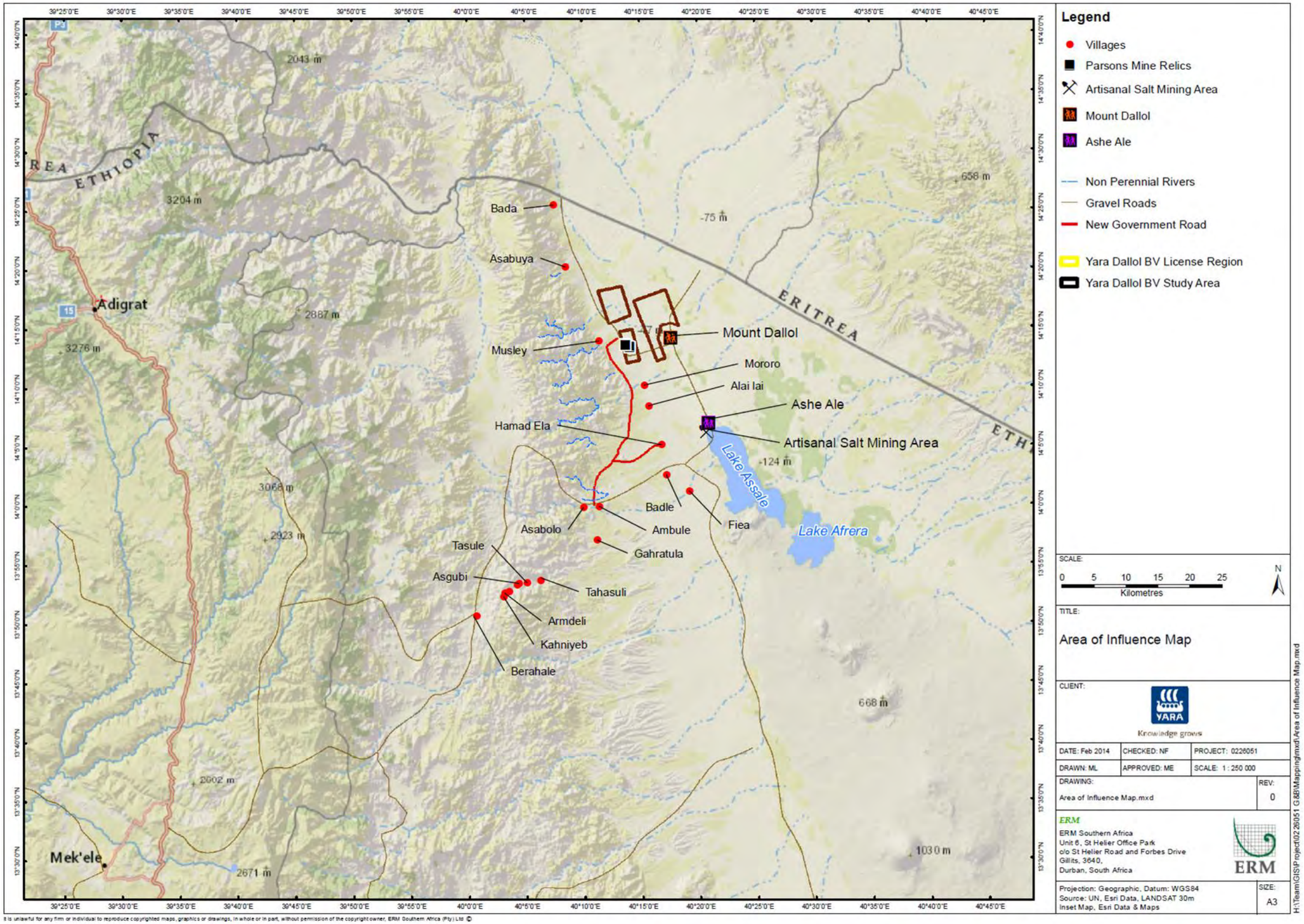
9 THE RECEIVING ENVIRONMENT – SOCIO-ECONOMIC CHARACTERISTICS OF THE PROJECT AREA

This *Chapter* presents a description of the socio-economic receiving environment within the Project Area. The secondary information contained herein was sourced from a variety of data sources and augmented where possible, by information gathered during the pre-scoping site screening assessment (as described in *Chapter 6*). However, pending input from a full specialist study, the data herein should be considered as a preliminary account of the social characteristics within the Project Area. The results of the full social baseline survey will be presented in the draft ESIA Report.

The proposed Project is located in Dallol Woreda, Zone 2 of the Afar region. *Figure 9.1* identifies the key settlements in the Project Area, as well as the Social Area of Influence (1).

(1) This has been preliminarily identified, and includes the geographical extent of potential social impacts of the proposed Project. The extent of the Social Area of Influence will be confirmed during the Baseline Data Collection phase.

Figure 9.1 *Social Area of Influence*



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9.1 SOCIO-ECONOMIC AND HEALTH ENVIRONMENT

9.1.1 Demographics

This *Section* provides a summary of the demographic conditions in Ethiopia at the federal and regional level. Furthermore, a summary of the demographic conditions specific to the Project at the local level; Dallol Woreda is also provided below.

Federal and Regional Profile

In 2013 the total population of Ethiopia was estimated to be 86.6 million, which ranked it as the second most populated country in sub-Sahara Africa. Approximately 34.7 million of the population are male and 42.9 million are female. The last official population and housing census, conducted in 2007 reported the Afar population as 1,411,092 people and predicted that it would fall to 917,999 people in 2013. The Afar region has a young population with approximately 43% aged 15 years or younger. Men outnumber women; with 786,338 men (55.7%) and 624,754 women (44.3%). The majority (86.6%) of the region's inhabitants are rural dwellers (Central Statistics Agency, 2007).

The dominant ethnic group in the region is the Afar, who make up 91.8% of the population. Other ethnic groups that live in the region include the Amhara (4.5%) and smaller numbers of Argoba, Tigray, Oromo, Wolaita and Hadiya (Central Statistics Agency of Ethiopia, 2008). The Afarigna language is the predominant language in the region, spoken by 90.8% of the population. Islam is the main religion practiced; and 96% of people identify themselves as Muslims. Other religions practices include Christianity and traditional religions.

The average household size is 5.7 persons; rural households are larger with an average of 6.1 persons compared to 3.9 persons for urban households. The population density of the Afar region is 14.6 people per square kilometre (km^2).

Local Profile

The projected population for Dallol Woreda in 2013 was 94,439, slightly higher than the neighbouring Woreda of Berahale at 90,517. A summary of local demographics is provided below in *Table 9.1*.

Table 9.1 Outline of Local Demographics

Demographic Indicator	Details
Dallol Woreda population	94,439
Total number of households	15,000
Woreda area coverage	2,291.18km²
Population density	44.2 per km²
Population of Adaquwa (administrative centre)	2,569
Gender composition	56% male; 44% female

Source: The Central Statistics Agency, 2008

Bada, the closest settlement to the license area has a population of 4,927 people with a total of 1,900 households (Mekele University, 2013).

Migration Patterns

The majority of the settlements across the Woreda typically have homogenous ethno-linguistic characteristics, and belong to the Afar group. The seasonal salt trade results however, in the in-migration of ethno-linguistic groups from the highlands of Ethiopia (mainly Amhara and Tigray) largely into the village of Hamad Ela. Ethnic diversity is also evident in the town of Bada, situated on the Ethiopia-Eritrea border. Historically the Ethiopia-Eritrea conflict led to the displacement of people on both the Ethiopian and Eritrean sides of the border. Although the border is now reportedly controlled, previous studies indicate that the migration of people between Ethiopia and Eritrea is still common, with stakeholders indicating that Bada is important for the movement of goods and people between Eritrea and Ethiopia.

Anecdotal evidence indicates that the majority of non-Afar groups have migrated from the neighbouring highland areas and are involved in a variety of activities including small-scale trade, working as local government employees and construction. In-migration of non-Afar groups has been particularly documented in the southern Zones of the Afar region where large commercial farms have been established. Non-Afar groups mainly reside in the major urban centres, and small towns in the region.

In the local area, young men report that they will migrate towards urban centres seeking work; however this is also dependent on their education and completion of secondary school. Furthermore, it is not uncommon for local stakeholders to comment on family members migrating to the Middle East seeking employment as labourers and domestic workers.

Movement across the local area is also common, mainly for grazing of livestock. Local community members have reported that it is common to travel up to 1 month to access pasture areas; an activity carried out by men while women remain looking after the household and children. Children will also graze livestock but in areas in closer vicinity to their respective settlement.

9.1.2 Governance and Administration

This S*ection* explains the governance and administrative structure relevant to the proposed Project, including informal and formal leadership structures.

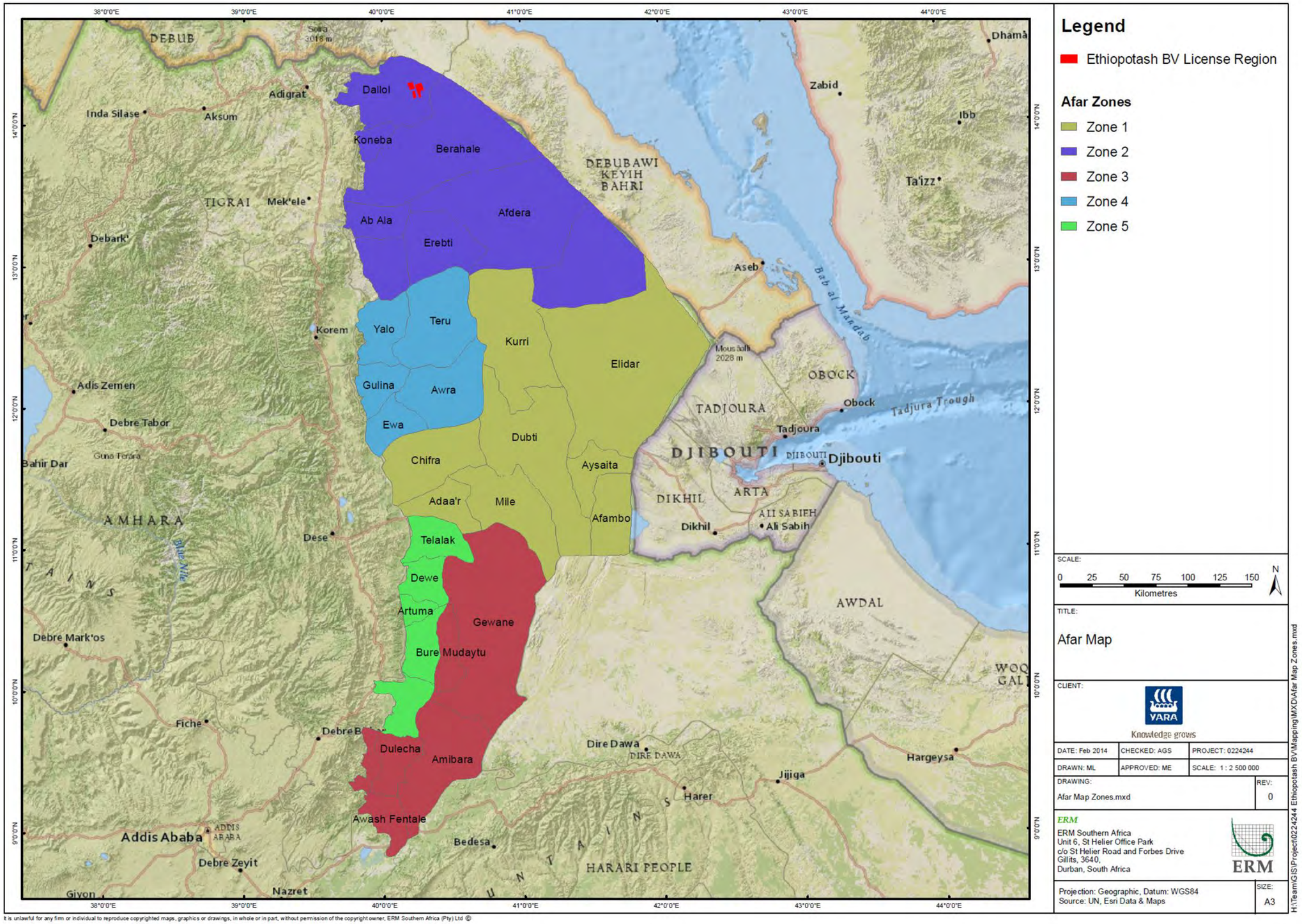
Federal and Regional Profile

As is also mentioned in *Chapter 5*, Ethiopia has a federal system of government which was established in the early 1990s, in accordance with the Charter of the Transitional Government adopted in 1991. Prior to this, the country was ruled by monarchs until 1974 when the Provisional Military Administrative Council (known locally as the Derg) overthrew Ethiopia's last monarch, Emperor Haile Selassie. The Derg established a one-party communist state fronted by Colonel Mengistu Haile Mariam. In 1974 Mengistu was ousted by the military and a coalition of rebel groups, known as the Ethiopian People's Revolutionary Democratic Front (EPRDF). The EPRDF assumed state power and still continues to govern the country. It developed the constitution in 1995 which established the Federal Democratic Republic of Ethiopia (FDRE) with a pluralist political system. The country is headed by a Constitutional President, currently Mulatu Teshome Wirtu and the government is headed by an Executive Prime Minister, who is elected by parliament. Parliament is divided into two houses; the House of People's Representatives and the House of the Federation.

Ethiopia is made up of nine ethnic regional states and two city administrations. The nine states are divided into 103 zones, 800 Woredas (districts), and 1,500 Kebeles (lowest administrative units). Each level of administration has an elected head, a council with an executive committee and a sector bureau however; some zonal governance structures vary and do not always have a council. Zonal administrators oversee Woreda activity; they provide technical assistance to Woredas and are responsible for development activities and the provision of public services.

The Afar region has its own regional government. It is divided into five administrative zones (sub-regions), 32 Woredas (administrative districts), 28 towns, and 401 rural and urban Kebele administrations as well as the eight Woredas in Zone 2. *Figure 9.2* shows the location of the Yara license area in Zone 2 of the Afar region, as well as the eight Woredas in Zone 2.

Figure 9.2 Zones and Woredas in the Afar Region



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Local Profile

Woredas are responsible for planning and implementing their own development activities. They oversee the role and function of Kebele administrations that come under their jurisdictions.

Kebeles are the smallest unit of local government; however, alongside Woredas, local stakeholders commonly identify the Kebele Administration (KA) as one of the most important decision makers and institutions for local settlements. Each KA has an elected leadership that includes a council, a cabinet and a court. Kebeles customarily act as mediators between local government authorities and local villages and are responsible for:

- Communicating government programs and policies to villagers;
- Mobilising community members for development works (such as road construction);
- Submitting community requests to formal government institutions (e.g. district administration); and
- Enlisting the support of clan or traditional leaders to recognise customary law.

Traditional Governance Structure

In the local area and across the Afar region, traditional governance systems remain a strong and respected parallel administrative structure. Traditionally, the Afar society is structured in a series of sultanates; tribes, clans, lineages and families. The various sultanates located across Djibouti, Ethiopia and Eritrea have generally been recognised as centres and providers of political and spiritual leadership.

Whilst the powers of traditional leaders are reported to have declined in recent years, they still hold sway, especially at the local level. Local community members report that it is clan leaders and elders that provide the strongest and most effective leadership structures at the village level, and the majority of Afar community members will defer to their elders for any important matters. It is however worth noting that local stakeholders have expressed concern in the past, that mining developments, and the direct as well as indirect changes that they may bring about, will challenge traditional governance structures.

In Afar society the clan is the most important political and social unit. A clan is formed by an extended group of families, and serves as a nucleus for administration and cooperation to conduct social activities among clan members. The clan is also the lowest social unit to which communal property rights over land and other natural resources are defined. Clan leadership is composed of a three tiered systems composed of:

1. Clan leaders (*makabans*);
2. Councils of elders (*daar-edola*); and
3. A sanction-executing unit (*fimaa/finna*).

Clans and lineages are graded according to their age, size and seniority. Senior lineages of clans are tasked with political leadership whilst more junior linages provide ritual leadership and oversee the *daar-edola*.

Governance and Women

The Afar are a patriarchal society; leadership roles are largely assigned to men and women are generally confined to primary care or domestic tasks such as childcare, cooking and fetching water.

Access to land and physical possessions are maintained and controlled by the men; in the event of a marital of separation the man therefore acquires both land and possessions. From previous studies conducted in the broader Project Area, women claimed that men control the allocation of resources, with the patriarchal system of inheritance perpetuating this phenomenon, even in the event of death. Whilst land is owned by the village (as opposed to by the individual) plots of land are titled to men as opposed to women and it is men (often elders) who decide how it is used, e.g. for construction or farming purposes. A widowed woman is potentially able to inherit the family property for the wellbeing of her children only if she agrees to remain unmarried. However the closest male relative to the deceased (son or brother) is still able to make decisions concerning her resources and physical possessions. Men are recognised as the chief income generators, and a woman's dependence on a man is widely recognised in the Project Area.

The role of women in the household and involvement in livelihood activities is discussed in *Section 9.1.6*.

Land Tenure and Ownership

In Ethiopia all land belongs to the State; whilst land can be leased to private individuals, they cannot own it. The Constitution provides for equal access, use, transfer and administration over land. It grants access to agricultural land for rural residents, and allows all inhabitants to utilise the land for farming. Farmers and pastoralists are granted lifetime 'holding rights' giving them rights to the land except for its sale and mortgage.

Land tends to be governed by common property regimes in pastoral areas. In the Afar region, whilst land tends to be allocated by the Kebele, it is administered at the clan level. Furthermore, each clan customarily manages it resources collectively. Afar traditional institutions allow for two types of resources users: clan members with primary rights (*Waamo*) and neighbouring pastoralists who have secondary rights (*Isso*) (Hundie, 2008). *Waamo* defines exclusive and inalienable rights of a member of a specific Afar clan or lineage. *Waamo* rights bestow a given clan or lineage with primary rights to a specified

territory, whereas *Isso* defines secondary inalienable rights which are granted to non-members. As well as imposing certain restrictions on to holders, *Isso* (literally meaning 'lease') are limited in scope and in time. For example, right holders are prohibited from cutting down certain trees and are only entitled to a defined grazing land for a specified time period.

9.1.3 Social Infrastructure and Services

This *Section* discusses the quality and availability of social infrastructure, resources and basic services for stakeholders at a federal, regional and local level. Educational and health infrastructure and services are also discussed in Sections *9.1* and *9.1.5*.

Federal and Regional Profile

Access to and availability of infrastructure is a key indicator of the general welfare and socio-economic condition of a population. This section discusses the standard of infrastructure and services at a federal and regional level.

A comparison of infrastructure and services across the federal and regional level are included in *Table 9.2*. Information presented for the Afar region does not include data on rural areas unless stated in *Table 9.2*, as the 2008 census only provides information on urban areas in the Afar region.

The information collected illustrates that the standard of infrastructure and services in the Afar region falls below federal levels. At the local level (Zone 2 and Dallol Woreda) the availability of infrastructure is even more limited. The limited access to basic services and infrastructure has resulting implications on the health status and wellbeing of people in the region, and furthermore within Dallol Woreda.

Table 9.2 Infrastructure and Services at the Federal and Regional Level

Indicators for Infrastructure and Services	Federal (%)	Regional (Afar) (%)
Access to electricity	41.2	72.2 (urban) 2.3 (rural)
Cooking fuel	• Wood 77, • Charcoal 7.7, • Animal dung 7.0	• Wood 89.7, • Charcoal 19.4, • Animal dung 10.0
Water		
Access to improved drinking water	53.7	31.7
Source of improved drinking water	• Public tap 23.3 • Tap in compound 10.1, • Protected spring /well 9.0 (1)	• Public tap 14.7, • Protected spring / well 8.2, • Tap in compound (shared) 4.3
Waste Management		
Improved toilet facilities (1)	• Pit latrine with slab	• Pit latrine with slab

(1) The spring is typically protected from runoff, bird droppings and animals by a "spring box", which is constructed of brick, masonry, or concrete and is built around the spring so that water flows directly out of the box into a pipe or cistern.

Indicators for Infrastructure and Services	Federal (%)	Regional (Afar) (%)
	(shared) 6.3, • Composting toilet (private) 3.0, • Pit latrine with slab (private) 2.5	(shared) 4.3, • Pit latrine with slab (private) 1.9, • Ventilated pit latrine (shared) 1.3
Non-improved toilet facilities	• Open pit 43.5, • Bush /field 38.3, • Flush not to septic tank / pit latrine 0.1	• Bush / field 90.7 (2)
Telecommunications (household possession)	• Mobile phone 24.7, • Telephone 4.5	• Telephone 9.2
Household possessions	• Radio 40.5, • Television 10.4, • Refrigerator 3.7	• Radio 51.1, • Television 22.0
Household characteristics - flooring material	• Earth / sand 50.7, • Dung 34, • Vinyl / asphalt 6.2	• Mud 81.7, • Cement 15.6, • Tiles 1.6

Source: Central Statistics Agency, 2008 and 2011

Local Profile

Infrastructure and basic services such as sanitation, water, electricity, waste management, telecommunication, police and emergency services are largely absent in the Danakil Depression. Of the services and infrastructure available the majority provide a low level of service for the local population's needs. An outline of the status of social infrastructure and services in the Project Area is provided in *Table 9.3*.

(1) A household is classified as having an improved toilet if it is used only by members of one household (that is, it is not shared) and if the facility used by the household separates the waste from human contact.
(2) Identified in the 2007 Census as 'no toilet facility'. Therefore inferred as open field / bush.

Table 9.3 Summary of Local Level Infrastructure and Services

Infrastructure and Services	Details
Electricity	• The majority of households do not have access to electricity, including Bada. • However a few shops and residents are reported to have access to electricity through the use of generators in Bada.
Water	• Local settlements customarily access water through hand dug wells, and any seasonal streams. However certain settlements have previously reported this varies depending on the seasonal availability of water from these sources. • Access to potable water is one of the largest challenges reported by local stakeholders, as consumption of water from existing sources results in numerous health problems. • In Bada it is reported that the main source of water is from Ragele River resulting in high cases of dysentery water borne diseases.
Waste management facilities	• Waste Management facilities or services are largely absent across the local area, which is evident in locations such as Bada. Here the higher population means increased levels of waste and litter dumped in open areas.
Telecommunications	• Bada has access to the national mobile telephone network. Access in other settlements is variable; however it is increasingly common for local residents in all villages to have mobile phones. Residents note however, that the network is not always reliable, and there is frequent loss of signal in settlements. • It is common to observe the use of radios across the Danakil, and residents often use them to receive information. In larger settlements such as Berahale and Bada there is a higher concentration of restaurants and hotels with televisions.
Education	• Bada has one school teaching children up to grade eight. • The closest secondary school is in Adaquwa (reported to be 12 hours by foot).

Infrastructure and Services	Details
Health	• Healthcare infrastructure in Bada includes a health centre and clinic, however both are semi-functional. During Screening local government officials reported that both the health centre and clinic do not have electricity, and are unable to store medication. Furthermore it was reported both are under staffed. • Stakeholders reported that other larger urban centres such as Adaquwa and Berahale are commonly visited in order to make use of health services • Health posts should and do in some cases exist in more rural areas; however community members reported these are rarely functional.

9.1.4 Health

This *Section* describes the federal and regional health profile. This includes an analysis of the current health context and prevalent diseases, as well as a discussion on the standard and availability of health infrastructure.

Federal and Regional Health Profile

Healthcare Services and Facilities

Healthcare services are delivered through a network of primary (health centres and health posts), secondary (general hospitals) and tertiary (specialised consultative centres) facilities. Primary health care services are typically formed of one health care centre and five satellite health posts. Ethiopia has 116 hospitals, 2,142 health centres and 14,192 health posts.

Health infrastructure in the Afar region is undeveloped. As *Table 9.4* highlights, the ratio of healthcare facilities and healthcare professionals per capita is consistently lower in the Afar region compared to the federal average. This is most notable in terms of the number of nurses (185 at the regional level versus 26,423 at the federal level) and the number of hospital beds (122 at the regional level versus 15,111 at the federal level). The health service utilisation rate is also lower for the Afar region; outpatient attendance per capita at health facilities is 0.17 at the regional level and 0.29 at the federal level. This suggests that the Afar population utilise healthcare services to a lesser extent than the wider Ethiopian population and / or have inferior access to it. Traditional healthcare services are also used at the federal and regional level; however, there is a lack of secondary data to illustrate this.

Table 9.4 Healthcare Services and Infrastructure

	Ethiopia	Afar Region	Dallol Woreda
Number of Healthcare Facilities			
Hospitals	114	4	0
Health Centres	2142	28	1
Health Posts	14192	251	7
Number of Healthcare Personnel			
Physicians (general practitioners and specialists)	1421	15	13 Certified Health Professionals (CHPs)
Health Officers	3096	25	1
Nurses (Diploma and BSc holders)	26423	185	22
Pharmacy Professionals	3624	63	2
Medical Laboratory Professionals	3672	40	3
Community Health Workers (Health Extension Worker - HEW)	30995	572	16
Hospital Beds	15,111	122	Unknown

Source: Afar Regional Bureau of Health, Ministry of Health, 2011, and Ministry of Health, 2009

Healthcare Status

The main causes of mortality and morbidity for both Ethiopia and the Afar region are pneumonia, tuberculosis, violence and other intentional injuries and other or unspecified effects of external causes and HIV. Whilst malaria is the leading cause of hospital and health centre morbidity at both the federal and regional level, it is more significant at the regional level and accounts for 36% of deaths in the Afar region as opposed to 9% at the federal level (Ministry of Health, 2009).

The leading causes of morbidity amongst children aged five years and under are (Ministry of Health, 2009):

1. Pneumonia;
2. Malaria;
3. Acute upper respiratory infections;
4. Diarrhoea; and
5. Helminthiasis.

Nationally, 75% of children have been immunised compared to only 26% at the regional level and 34% within Zone 2.

The largest disease outbreak in Ethiopia from 2009 to 2010, affecting 20,908 people and causing 190 deaths, was diarrhoea. In the Afar region 1,200 cases were reported, with 25 deaths. Outbreaks of measles were recorded to total 4,496 cases and have caused 12 deaths throughout the country; 36 cases (but no deaths) were recorded in the Afar region. There were 1,105 cases and five deaths due to meningitis at the federal level; however, none of these were recorded at the regional level (Ministry of Health, 2009).

Prevalence of sexually transmitted infections (STIs) is recorded to be 6% for both the federal and regional level. Approximately 2.4% of Ethiopian adults aged over 15 years have HIV/AIDS; 2.2% have HIV/AIDS at the regional level. The use of modern contraception methods by women of reproductive age is 61.7% at the federal level compared to only 6.4% at the regional level, and 7% within Zone 2.

The federal number of households recorded as having malaria who are located in areas prone to epidemic outbreaks is 8,250,388, in comparison to the Afar region where 204,077 households lie within malaria epidemic prone zones.

Female Genital Cutting (FGC), a form of female circumcision, is practiced in the Afar region; however, its prevalence has reduced in recent years as a result of NGO and government campaigns (Mekele University, 2013).

Local Health Profile

Healthcare Services and Facilities

Whilst there are no hospitals in Dallol Woreda, there is one health centre and seven health posts. The Woreda's healthcare professionals include 13 certified health professionals, 22 nurses and 16 community health workers (Afar Regional Bureau of Health and Ministry of Health, 2011). Due to a lack of electricity and clean water, laboratory and medical testing services (e.g. blood testing) are limited. People have to travel to Mekele to access treatment for serious health issues (Mekele University, 2013).

Healthcare Status

The key diseases in Dallol Woreda include the following:

- Respiratory diseases;
- Malaria;
- Tuberculosis;
- Sexually transmitted disease; and
- Water borne diseases such as diarrhoea.

Reported prevalence rates HIV/AIDS are low with only 15 reported cases; however, during previous studies women have indicated that the facilities to test for HIV are absent. The majority of women (90%) in the Woreda give birth at home; with 5% of women reported to die during childbirth. Furthermore, approximately 7% of children die before they reach their fifth birthday (Mekele University, 2013).

9.1.5 Education

This *Section* describes the standard of educational infrastructure and level of attainment within Ethiopia at a federal, regional and local level.

Federal and Regional Education Profile

The education system in Ethiopia is divided into eight years of primary school which is further divided into two cycles; grades one to four form the first cycle and grades five to eight the second. Secondary schooling is provided for four years; two years of junior secondary school (grades nine to ten) and two years of senior secondary school (grades 11 to 12).

Students are required to pass national examinations at grade eight and grade ten; the results of the Eighth Grade National Examination determine secondary school placement and the results of the 10th Grade National Examination determine whether students can proceed to the second cycle of secondary education. Those who fail the 10th Grade National Examination tend to go to technical or vocational training colleges, which offer education in a variety of areas including health, agriculture, teaching, engineering, catering and Information Technology (IT). The second cycle of secondary education

culminates in the Ethiopian Higher Education Entrance Examination (Ministry of Education, 2012).

Approximately 66% of females and 48% of males have never been to school. Literacy rates for those aged 15 years and above in 2011 were 38% for females and 65% for males. Education attainment in rural areas is notably poorer than urban areas (Central Statistics Agency - Demographic and Health Survey, 2011). Due to the Government's initiatives to improve the educational system, younger generations are more likely to have received an education and tend to be more literate than older generations. For example, the average annual growth rate for primary school enrolment since 2008 has been 2.8%, and 8.9% for secondary school; however, school dropout rates are still high and almost a quarter of students leave school following the first grade. At the federal level the teacher to pupil ratio at the federal level is 1:49 for primary schools, and 1:29 for secondary schools. In the Afar region this is slightly improved at 1:41 and 1:24 respectively.

Literacy and education levels in the Afar region are poorer compared to the federal averages; 61.3% have never received an education and the literacy rate is 45.5% (38.4% for females and 52.5% for males). The pastoralist and semi-mobile lifestyle of the Afar people is the main factor that prevents children from attending school; however, poor infrastructure, early marriage, domestic duties and poverty also affect attendance (Central Statistics Agency, 2011). Nevertheless, as per federal level trends, school enrolment is increasing; the average annual growth rate for primary school enrolment since 2008 to 2013 was 15.3%, and 6.2% for secondary school enrolment (Ministry of Education, 2013).

Local Education Profile

Dallol Woreda has one primary school and one secondary school. The primary school is located in Bada; those who wish to attend secondary school have to travel to Berahale. Local residents also reported that a secondary school exists in Adaquwa; however, this is reportedly a 10 hour walk from Bada.

Dallol Woreda has 194 teaching staff and 8,334 primary school students and 280 secondary school students. Less than 5% of the Woreda population receive a secondary education (Mekele University, 2013).

Local community members often comment on the value of education as a channel through which to obtain higher paid employment positions in both government and non-government offices. In addition, it is reported that livestock production is no longer as viable as it had been previously; recurrent climatic shocks, degradation of pasture resources and spread of livestock diseases have led to increased vulnerability to food shortages. As a result, youth are seeking additional income streams, with education viewed as such one path to access further opportunities. It is reported that the youth (men) are increasingly migrating to others areas in the region as well as elsewhere in

Ethiopia, seeking work and better education. Women on the other hand rarely complete secondary school due to family disapproval, the pressure to get married and look after the household.

9.1.6 Livelihoods and Socio-Economics

Federal and Regional Profile

Economic activity in Ethiopia is dominated by agriculture, which accounts for almost half of the country's Gross Domestic Product (GDP) and employs approximately 80% of the working population (World Bank, 2012).

Over the past six years the Ethiopian economy has been on a high growth trajectory, continuing strongly. Growth has been broad-based, with the services and the manufacturing sectors growing at faster rates than any other sector. Ethiopia's five year Growth and Transformation Plan (GTP) focuses on agricultural transformation and industrial development as being the key drivers of economic growth (African Economic Outlook, 2012). Nevertheless, Ethiopia still displays some of the lowest economic productivity figures in the world with per capita gross national income (GNI) in 2012 of USD 380 (1).

The Afar region is predominantly pastoral with approximately 90% of people depending on subsistence livestock production. Most households rear cattle, camel, sheep and goats for their daily subsistence. Little natural pasture exists in the area due to the dry environment, repeated droughts and heavy grazing. Furthermore livestock productivity is reported to be rapidly declining due to recurrent droughts and land degradation, particularly in Zones 1, 2 and 4 (Philbott *et al.*, 2005).

Camels and goats are more resilient to harsh environmental conditions and these are reported to be more common in the particularly drought ridden and unproductive areas. In the highlands, people also rear browsers (goat and camel) which are adapted to the harsher and drier environments.

In the southern Zones of the Afar region, agro-pastoralism (after traditional mobile pastoralism) is increasingly significant. The Awash River basin and the Mile River basin have been used for large scale mechanised farming, predominantly by the Ethiopian government and individual private investors. Common crops include cotton, sorghum and vegetable production. Although large-scale farms have created employment opportunities, the involvement of the Afar is reported to be low and much of the workforce and profits are reported to leave the area.

(1) World Bank, 2014 - GNI per capita is calculated using the Atlas method. GNI calculated in national currency is converted to USD. To smooth fluctuations in prices and exchange rates, a special Atlas method of conversion is used by the World Bank. This applies a conversion factor that averages the exchange rate for a given year and the two preceding years.

Almost all households engage in the rearing of livestock, especially goats, for their livelihood. In Bada crops are grown, namely sorghum, but also maize and barley are irrigated along the Regale River. However, due to the persistent food crisis in the Wordea, a significant proportion of the local population rely on the Government's Productive Safety Net Programme, which provides food aid, to meet their dietary needs (Mekele University, 2013). The salt trade (including artisanal salt mining and the cutting, transport and sale of salt) provides a significant income source for the Afar population and is also important in Dallol Woreda. Those who are not directly engaged also benefit economically through renting accommodation and camels and selling food and salt packing materials to traders. Petty trading is also undertaken by households however, few have formal employment.

Across the local area typical household expenditure is on food, healthcare and clothes. In the past stakeholders have indicated that very little of a household's expenditure is allocated towards savings or remittances, with the majority of households using income to purchase basic households requirements (i.e. food and clothing).Local community members have also reported that they borrow money from family or friends particularly for health related expenses. This practice is an indication of the lack of savings for a household, in addition to their restricted ability to withstand any type of shock or pressure to the household, including illness. Some households however have reported that they receive remittances from relatives working abroad, mainly in the Middle East.

Further details on the different livelihood activities practiced in the area are outlined in *Table 9.5*.

Table 9.5 Key Livelihood Activities in the Project Area

Livelihood Activity	Details
Formal employment	The majority of people engaged in formal employment will be local government workers either based in the Woreda offices or in the local Kebeles. Other sources of formal employment include the mining and road construction companies operating in the Danakil.
Palm collection and processing	Many of the settlements in the proposed Project area are involved in palm collection and processing. It is the primary livelihood for local Afar women, and is the principal means through which Afar women gain access to income and are able to contribute towards the support of their household. In addition to the collection of palms, the products are transported and sold across a network of settlements within and beyond the Danakil.
Artisanal salt mining	Artisanal salt mining is based on the salt flats located north of Lake Assale, and is one of the most important livelihoods of the Danakil Depression. Artisanal salt mining is also important due to its cultural value for the local Afar people. The distances that people travel to be involved in the salt trade is a reflection of its significance in the northern Ethiopian salt industry, with salt cutters and diggers coming from a range of areas including the Woredas of Afdera, Dallol, Koneba, Berahale, Erebti etc., as well as the Tigray and Amhara regions. Maintaining the use of donkeys and camels for transport to and from the salt plains is a conscious decision by the Afar people. Small scale salt collection is also conducted on the northern sections of the salt flats, as well as its peripheries both for household consumption and sale to people travelling through the area.
Livestock rearing	Livestock are a key source of financial capital for the Afar, and generate a considerably higher cash income than other activities. They are also viewed as the only form of savings available for many households. Specific grazing areas exist across the proposed Project area according to different vegetation types. Livestock graze towards the alluvial fans and along the palm fringe. It is common for men to travel up to two weeks or more for livestock to graze including up to areas surrounding Bada which is identified as an important grazing area.
Crop cultivation	The cultivation of crops is not a common livelihood observed elsewhere in the Danakil particularly for those settlements located close to the salt flats. The settlements involved in the cultivation of crops are Asabolo and Ambule, located next to the Sabah River, and Bada. Bada exhibits the most developed and largest extent of agricultural activity with cultivation of sorghum, maize and watermelon.
Tourism	To date tourism is not reported as a key primary livelihood; however, local stakeholders have reported that tourism is a secondary occupation providing an additional source of income. Key tourist attractions include salt column formations, the hot springs on Mount Dallol, Mount Dallol, Parson Mining Camp, Lake Assale and the salt plains. Local people earn some income from tourists who visit the area by renting out houses or rooms, selling tea and coffee, and serving as guides to the tourists.

The Role of Women

As identified in *Table 9.5* women are typically involved in palm collection and processing into a variety of products. In some areas women are also involved in small scale trade and the small scale salt collection. From previous studies it is evident that women tend to work longer hours than men (with women working up to 13 hours a day in comparison to an average of seven hours for men). Longer hours for women are due to carrying out domestic duties, in addition to involvement in palm collecting and processing.

Typically, to a lesser degree in urban centres, women rely on palm collection as their principal source of income. A woman's reliance on this source of income greatly increases in female headed households (FHH) where there is often only one income stream coming into the house. Previous studies conducted in Berahale Woreda indicated that approximately 94% of FHH are food insecure, a likely representation of the limited income generating opportunities they are offered and limited subsistence food sources. Further information will be conducted during baseline data collection to understand the status of women and FHH specifically in Dallol Woreda, and the proposed Project area.

In the household women are responsible for food preparation activities in the household. Men do not prepare food but typically will buy larger food items, such as bags of wheat, from Bada, Adaquwa and Berahale market (and in some cases Hamad Ela). The woman is responsible for the vast majority of primary care duties; purchasing the remaining household items, looking after children, elderly and the sick, in addition to fetching water occasionally. Women are also accountable for the livestock as they oversee the children who herd the livestock (closer to settlements areas) on a daily basis.

9.2 CULTURAL HERITAGE

Broadly speaking, archaeological resources within the larger region of the Project Area include Palaeolithic sites, early states, empires and civilizations. Located in north-eastern Ethiopia, the Project Area resides within the Danakil Depression. This region's cultural importance can be, in part, tied to its location at the northern extent of the Great Rift Valley, which is an important natural corridor through which early hominids migrated out of Africa. For example, a one-million-year-old hominid cranium was recently discovered approximately 20 kilometres north of Mount Dallol. The presence of Early and Middle Stone age tools, dating between 2.6 million years ago and 10,000 BC, are documented along adjacent mountain slopes and alluvial fans to both the east and west of the Project Area.

Evidence of Late Stone Age occupations in the northern Afar and adjacent parts of Eritrea dating between 10,000 and 1,000 BC suggest the climatic conditions at that time were more humid. A number of Late Stone Age site complexes have been identified on the shores of Eritrea's Buri Paleolake and

the Bay of Zula. The Buri Paleolake sites are composed of a dense and expansive cluster of various types of stone cairns. Similar, but larger stone cairns are also known to exist within the northern Danakil Depression in the immediate vicinity of the Project Area. Given these observations about the long history of human settlement within and adjacent to the Danakil Depression, the location of the proposed Project is considered to be within a very high sensitivity area.

A preliminary pre-scoping cultural heritage site screening assessment was undertaken in select locations in the Project Area. The objective of this screening assessment was to establish the likely range of cultural heritage resources that might exist. Specifically, portions of each of the three concessions were investigated - Crescent, Musley and North Musley concessions – in addition to several areas further towards the west along the foothills and wadi systems of the Ethiopian Plateau. The screening assessment also visited select locations in the greater Project Area in order to investigate regional cultural patterns, which included the settlements of Asabuya and Bada, both located to the north of the Study Area. The most northern point reached by the cultural heritage assessment was the area of the Regali River, which forms the modern border with Eritrea. The analysis addressed graves and other sites or structures constructed by, or of interest to local traditional Afar people. It also addresses earlier archaeological remains, including Pleistocene remains, although none of the latter was found by the field reconnaissance.

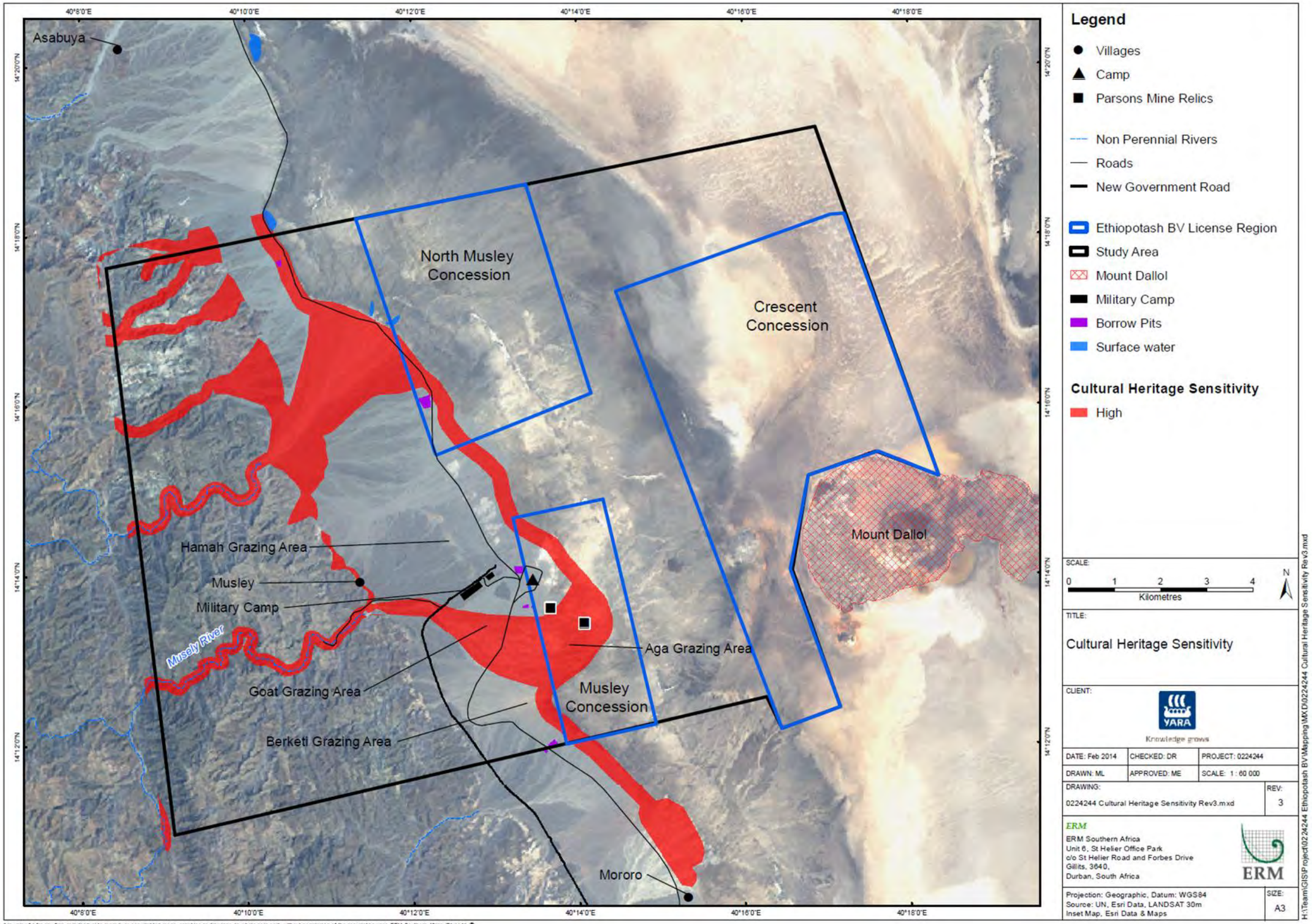
The results of the cultural heritage sensitivity analysis indicate that 12% of the Project Area is High Sensitivity (refer to *Figure 9.3*). High Sensitivity areas contain all recorded living or archaeological resources and also represent terrain categories that are attractive to both modern and earlier populations.

Other areas within the Study Area (excluding the Salt Pan) in the Study Area do not contain recorded cultural resources, but *may have* been attractive to earlier populations. Although ranked as having a low sensitivity, these areas may contain chance finds. No cultural resources were recorded in the salt pan and it represents an area that would not have been attractive as a settlement location for earlier populations, and has negligible risk.

Furthermore, a baseline study was completed by Mekele University for Musley Concession (1). As part of the Mekele University baseline study, the culture and tradition of the Afar people was assessed. This study will be used to inform the detailed cultural heritage assessment for this ESIA and efforts will be focused on addressing any gaps identified in this study.

(1) Mekele University, Department of Earth Sciences & Environmental Geosciences Team. (2013). *Baseline Study for the Environmental Impact Assessment (ESIA) - Musley Potash Project.*

Figure 9.3 *Cultural Heritage Sensitivity in the Project Area*



9.3 VISUAL

The Project Area is dominated by lowland saline plains with a minimum altitude of 120m below sea level. The majority of the land in the surrounding area is open bare land with sparse vegetation, particularly to the east of the Project Area. The only area observed to be significantly more vegetated is the salt pan fringe running along the west of the saline plains where palms and Acacia trees are the dominant floral species. Small shrubs are also evident in the alluvial fans to the west of the Project Area (*Figure 9.4*).

Figure 9.4 Salt Pan Fringe showing Palms, Acacias and Small Shrubs



Tectonically and morphologically, the Danakil Depression represents a typical graben structure and is characterized by the rugged and dissected rift scarps in the west (*Figure 9.5*), flat lying plains in the centre (*Figure 9.6*) and the tertiary Danakil volcanic ridges in the east. The graben structure is oriented north-north-west/south-south-east. The depression increases in width from the north.

Figure 9.5 Rift Scarps to the West of the Project Area



Figure 9.6 Flat Lying Plains to the East of the Project Area



The immediate surroundings to the site are:

- Open bare land to the north, east and west;
- Highlands to the west, relief peaks to the east and maritime hills to the north east;
- Ashe Ale to the south east;
- Lake Assale and the salt flats to the south and east; and

- Mount Dallol within the concession (*Figure 9.7*).

Figure 9.7 View of Mount Dallol from the South East



Furthermore, as is mentioned in *Chapter 8*, the Danakil Depression is the hottest inhabited place on earth. Extreme heats cause 'heat shimmer' resulting in lower visibility at further distances, even though the landscape is flat and sparsely vegetated in most areas. This is often worsened by the presence of dust during windy conditions.

10 IDENTIFICATION OF POTENTIAL IMPACTS

The scoping phase of any given ESIA process is aimed to identify those impacts that are most likely to be significant and which need to be assessed as part of the ESIA process.

Through the scoping process, the main activities associated with all the phases of the proposed Yara Dallol Potash Project are generally well understood as well as a preliminary understanding of what impacts are likely to be significant. This *Chapter* describes the ***perceived*** environmental effects associated with the proposed Project. The determination of anticipated impacts associated with the proposed Project is a key component to the ESIA process and perceived environmental effects will be discussed in a way that outlines how the proposed Project will potentially affect the environment.

It must be noted that in this *Chapter* the potential impacts identified will form the basis of the Environmental and Social Impact Assessment and the associated development of appropriate mitigation/management measures for the proposed Project.

Furthermore, this section will discuss how physical, biological and social environmental attributes may influence and potentially impact on the proposed Project. The issues identified stem from those aspects investigated and presented in *Chapters 8 and 9* of this document. Each significant issue identified will be investigated further during the impact assessment (IA) phase of this Project.

It should be noted that impact identification during the scoping process will not attempt to predict or assess the magnitude or significance of potential impacts. This process is reliant on rigorous baseline data acquisition and as such, the impact assessment process will be completed at a later stage of the ESIA. However, based on current information, the pre-scoping fieldwork and ERM's professional judgement, the following sections will highlight those potential impacts likely to be considered significant, prior to mitigation.

10.1 ENVIRONMENTAL AND SOCIAL RESOURCES AND RECEPTORS

For this Project, the following main receptor/resource types were identified.

- *Physical environment:* including the atmosphere, soils, surface and ground water.
- *Biological environment:* including habitats, flora and fauna; both aquatic and terrestrial.
- *Infrastructure:* including roads/tracks, water supplies and the built environment (households, settlements and villages).

- *Land based livelihoods:* including land ownership, pastoralism and artisanal salt mining.

- *Socio-economics:* including tourism, the wider salt trade industry, waged based employment, provision of goods, road users, education and demographics.

- *Health:* including sanitation, healthcare, health and well-being, safety and security.

- *Heritage:* including physical archaeological and cultural sites and cultural events.

10.2 POTENTIAL PHYSICAL ENVIRONMENTAL IMPACTS

10.2.1 Climate

Climate will influence, in particular, the dispersion of air pollutants, the extent of noise impacts and the degree of groundwater recharge in the Project Area. In this ESIA, climatic inputs are therefore used as inputs into the various models used to quantify the nature and extent of such impacts. Furthermore, a large amount of diesel (approximately 1,700 l/hr) will be required for wheel-tractor scrapers, fluid bed product driers, drilling operations and miscellaneous activities. This will potentially result in Greenhouse Gases (GHG) been emitted to the atmosphere.

Further Studies Required in the ESIA Phase

No climatology specialist studies are deemed necessary for the ESIA phase of the study; however, global impacts such as climate change and the impacts associated with Greenhouse Gas (GHG) emissions into the atmosphere will be undertaken as per *Chapter 11, Section 11.1.1.* Climatic data will, however be analysed from the on-site meteorological station, and used in the air quality, noise and hydrological models, used to quantitatively assess impacts to air, noise and surface/groundwater.

10.2.2 Topography and Geomorphology

Local topography and geomorphology will influence a wide range of environmental and social aspects, such as visual obtrusiveness, the dispersion of noise impacts, air pollutants, and surface and groundwater levels and flows. The topography and geomorphology of the Project Area will be considered as input into the various models used to quantify the nature and extent of such impacts.

Further Studies Required in the ESIA Phase

No topographic or geomorphologic specialist studies are deemed necessary for the ESIA phase of the study.

10.2.3 Geology and Soils

Geology and soil characteristics will influence hydrological flows and quality. These characteristics will be considered and included into various models used to quantity hydrological and geohydrological impacts.

Further Studies Required in the ESIA Phase

As part of the engineering feasibility studies currently underway, a comprehensive hydrogeological assessment (outside of the ESIA process) is being undertaken. As part of this assessment, the geology in the Project Area will be considered. As such, no geological specialist studies are deemed necessary for the ESIA phase of the study.

10.2.4 Air Quality

Construction activities (*viz.* the construction of access roads; transport of materials to the site by truck; earthworks to prepare the site for construction and the construction of Project infrastructure required for the operational phase of the proposed Project) have the potential to result in significant emissions of dust, PM_{10} and $PM_{2.5}$ to atmosphere, and significant emissions of combustion gases. This effect is greatly exacerbated by the high wind speeds, high temperatures and the extreme arid conditions, which rapidly dries any friable material and lifts dust from exposed surfaces and stockpiles.

With regards to the operational phase, airborne emissions are anticipated from the handling of final product and transportation of final product away from the Project Area.

As a result of the local meteorological and physical environmental conditions, construction activities and the handling and transportation of final product has the potential to be significant downwind to sensitive receptors; however, the nature and severity of the impact will be determined by the volumes of emissions generated, the spatial distribution of emissions, the location of sensitive receptors and prevailing wind conditions.

Further Studies Required in the ESIA Phase

Given that air quality impacts are likely to occur as a result of the proposed Project, an Air Quality Impact Assessment will be undertaken as per *Chapter 11, Section 11.1.1.*

10.2.5 Noise

Noise levels in the Project Area are considered to be low. As a result of the anticipated lower baseline noise levels in the Project Area, noise generating activities during the construction and operational phases of the proposed Project have the potential to be significant, should these activities occur in the vicinity of noise-sensitive receptors. The nature and severity of the impact will ultimately be determined by construction/operational activities, the machinery/tools used during these phases, the volume of traffic to and from the Project Site, and the location of noise-sensitive receptors.

Further Studies Required in the ESIA Phase

Given the presence and location of sensitive receptors in the Project Area, coupled with the current low ambient noise levels, it is highly likely that the proposed Project will have a noise impact. As such, a full Noise Impact Assessment will be undertaken as per *Chapter 11, Section 11.1.2.*

10.2.6 Water (Surface- and Groundwater)

Potential impacts of the proposed Yara Dallol Potash Project are listed below and will mainly be related to large scale groundwater abstraction for solution mining from boreholes drilled into the alluvial fans.

Groundwater Drawdown in the Alluvial Fan Aquifers as a Result of Groundwater Abstraction

Large scale groundwater abstraction from the alluvial fan aquifers will result in groundwater level drawdowns in these aquifers. This may result in a decrease of fresh-water flow to the Salt Pan Fringe, which maintains an interaction between ecology and people and is of high importance with respect to ecosystem services.

Furthermore, a drawdown of groundwater levels in the alluvial fan aquifers could lead to the lowering of groundwater levels in community wells and their drying up, as well as the drying up of springs in the river valleys used as a source of water for the communities and the Ethiopian Military. This could lead to the loss of water supply to local communities and the Ethiopian Military.

Groundwater Quality as a Result of Groundwater Abstraction in the Alluvial Fan Aquifers

Large scale groundwater abstraction from the alluvial fan aquifers will result in groundwater level drawdowns in these aquifers. This may result in reduced fresh-water discharge toward the salt pan and in a shift of the fresh-saline groundwater interface further upstream, which will result in a decrease of groundwater quality due to saline intrusion.

This potential saline intrusion from the salt pan westwards could negatively impact on groundwater users and the ecologically important Salt Pan Fringe.

Groundwater Abstraction on other Aquifers in the Project Area

The aquifer present in the weathered and fractured basement complex rocks underlying the alluvial fan aquifers is believed to be extremely faulted and folded. This aquifer could be connected to the alluvial fan aquifers through faults and could therefore be impacted by large scale groundwater abstraction from the alluvial fan aquifers and related groundwater drawdown.

Further Studies Required in the ESIA Phase

Hydrogeological parameters including groundwater recharge to the alluvial fan aquifers targeted for proposed Project water abstraction are currently being quantified and a solid hydrogeological conceptual model will be compiled.

However, it is recommended that the groundwater baseline conditions including groundwater quality and levels be established for the area under investigation. Furthermore, groundwater users (communities, Ethiopian Military and ecology) must be identified in terms of location, water use etc. to establish the presence and requirements of these sensitive receptors.

Furthermore, groundwater impacts need to be quantified using numerical groundwater modelling and suitable mitigation measures need to be proposed to mitigate Project impacts to an acceptable level.

It is further recommended that a groundwater monitoring plan be compiled as part of the overall Environmental Monitoring Plan to monitor the impacts of the future project on the groundwater resource. The groundwater monitoring plan should include specifics concerning monitoring locations, parameters to be monitored and monitoring frequency
The scope of this assessment is presented in *Chapter 11*, *Section 11.1.3*.

10.3 BIOLOGICAL ENVIRONMENT

10.3.1 Degradation of Important Habitats

The Project Area is located in an extreme desert environment, and habitats such as the Fringe and the Seepage Zones listed in *Chapter 8* are completely dependent on groundwater. A reduction in groundwater resources through extraction for the mining process could cause either a loss or degradation of these habitats.

Further Studies Required in the ESIA Phase

It is important to gain an understanding of the groundwater hydrology and develop an effective model that will predict the responses of the groundwater resource to planned extraction rates, and thereby predict what the possible effects of groundwater extraction on the Fringe habitats. This prediction will be included in the detailed Biodiversity Impact Assessment that will be undertaken as per *Chapter 11*, *Section 11.1.4*.

10.3.2 *Loss of Habitat and Ecosystem Fragmentation due to the Development of the Proposed Project the Development of the Proposed Project*

Infrastructure development for operation of the proposed Project, such as the processing plant, staff accommodation, roads and other supporting infrastructure could cause a loss of natural habitat, and siting of these developments should be considered. The fringe habitats exist in a linear formation along the edge of the salt pan, yet are expected to be important for the spread of a variety of terrestrial species restricted to those habitats.

Further Studies Required in the ESIA Phase

Mapping of the habitats based on their levels of transformation and sensitivity is needed to provide a tool to guide the infrastructure layout plan. This will be developed as part of the detailed Biodiversity Impact Assessment that will be undertaken as per *Chapter 11, Section 11.1.4.*

10.3.3 *Impacts to Conservation Important Species*

Various Conservational Important (CI) faunal species are presented in *Chapter 8*, which could potentially be impacted by the proposed Project to varying extents.

Further Studies Required in the ESIA Phase

General biodiversity surveys are needed to determine the occurrence and approximate abundance of CI species. Species other than those listed in *Chapter 8* may occur in the Project Area and could potentially be impacted. Potential impacts to these species need to be assessed based on knowledge of the ecology and behaviour of the relevant species. This will be included in the Biodiversity Impact Assessment that will be undertaken as per *Chapter 11, Section 11.1.4.*

10.3.4 *Disruption of Ecosystem Services*

Various beneficiaries, primarily communities depend on ecosystem services provided by the natural environment within and around the Project Area. These services have been prioritised based on the dependence by communities and potential for impact by the proposed Project.

Further Studies Required in the ESIA Phase

An understanding is needed of the importance of the ecosystem services to local communities, and determined in conjunction with social assessments / community engagement activities. Impacts as a result of the proposed Project that may disrupt these Ecosystem Services need to be considered. This will be included in the Biodiversity Impact Assessment that will be undertaken as per *Chapter 11, Section 11.1.4.*

10.4 SOCIAL ENVIRONMENT

10.4.1 Socio-economic

In-migration

The construction and operation of the proposed Project may trigger in-migration, by those seeking employment, benefits and economic opportunities associated with the proposed Project, particularly for settlements located in the Area of Influence of the mine site. In-migration may also occur at other sites where significant infrastructure is installed, or at locations where economic opportunities are anticipated for example Bada. Bada is important due to its livelihood activities, presence of infrastructure compared to neighbouring settlements, and the frequent movement of people and goods through Bada.

In-migration can result in a range of other risks and impacts including:

- Pressure on social amenities and infrastructure;
- Pressure on land;
- Impacts on community health;
- A potential increase in crime and anti-social behaviours;
- Deterioration of traditional social structures and networks; and
- Increased competition between migrants and local community members.

Further Studies Required in the ESIA Phase

It is recommended that further studies are undertaken as part of the ESIA to enhance understanding around the likely extent of influx, likely key locations or hotspots, as well as the risks associated with it. Findings from other projects in the area will be drawn upon and baseline data on demographics, infrastructure and services and natural resources will be collected. The anticipated number of employees (local and from further afield), as well as numbers of opportunity job-seekers will also be estimated. This will form part of the full Socio-economic Assessment that will be undertaken as per *Chapter 11, Section 11.1.5*.

Reduced Availability of Water

Abstraction of groundwater may reduce the availability of water to community users. This includes settlements located along the Balakiya escarpment, as well as any settlements located on the alluvial fans that primarily access water through community wells. Furthermore communities have reported that they use surface water bodies as watering holes for their animals that are located between the alluvial fans and salt pans.

Other impacts to livelihoods, income generation and community health may compound this impact. Effects may be cumulative with impacts to community livelihoods and health profile.

Further Studies Required in the ESIA Phase

The probability and nature of the impact suggests that a detailed study is necessary. The results obtained from groundwater hydrocensus and specialist studies will be utilised to understand the scale of reduction of water availability, the potential impacts to water quality and associated potential impacts to health. This will form part of the full Socio-economic Assessment that will be undertaken as per *Chapter 11, Section 11.1.5*.

Interaction between Communities and Workforce

The introduction and expansion of the proposed Project workforce is likely to result in regular interaction with local people, particularly in Bada (due to it being the largest settlement in closest proximity to the exploration camp). Berahale also serves as a stop-off point on the journey between Mekele and the Danakil Depression, and may also result in interaction with local people.

Community-workforce interactions in the mining sector have a history of frequently including the use of sex workers by a predominantly male remote and isolated workforce. Due to the prevalence of sexually transmitted infections (STIs) in Ethiopia, and by proxy in the Social Area of Influence, this may cause an increase to STI related vector borne and communicable diseases. Furthermore, in the event of an outbreak of an airborne (e.g., tuberculosis) or food-borne illness among project workers, the home villages of the local workers, and any settlement visited by project workforce may also become susceptible to these infectious diseases.

The proposed Project may also attract influx of opportunistic job seekers into the area, in addition to migrants hired to provide services and act as Yara's workforce. This influx has the potential to change the way that the local community function and increase the practice of activities that maybe considered taboo in the Afar area, but more widespread across the rest of Ethiopia. The presence of mine workers, including nationals from outside the local Afar area, may also disrupt community cohesion and traditional ways of life, potentially creating stress and anxiety for some residents and weakening existing social bonds.

Further Studies Required in the ESIA Phase

As part of the ESIA the local health profile will be assessed. This will include visiting local health facilities in the area to collect data where this is available. If data is limited, potential impacts will have to be assessed qualitatively and through interviews with health professionals, traditional healers and local settlements. Non-intrusive data will also be collected on community health and infrastructure from primary and secondary sources (Government reports, stakeholder interviews etc.) and compared according to approximate predictions for demographic changes. It is recommended that influx and changes to the demographics of the area, and the relative effects on social cohesion will be assessed qualitatively using comparable information from other projects (both in the Danakil and elsewhere in the Afar region). This will also be supported through consultation with local leaders and community members. Qualitative data collection techniques such as community network mapping and relationship Venn diagrams will also be used to understand the relationship links within and between communities. This will form part of the full Socio-economic Assessment that will be undertaken as per *Chapter 11, Section 11.1.5*.

Reduced Productivity of Palm Related Livelihood Activities

The doum palms are an important resource for local Afar communities. In particular palm collection and processing is a significant livelihood activity for Afar women, and forms their primary source of income. Alternative livelihoods, particularly for women, are absent in the Danakil indicating the significance of this livelihood to local communities. The doum palms are also important from an ecological perspective. The multiple dimensions of potential impacts to the doum palm resource will be further analysed through the various specialist studies, during baseline data collection and in the Impact Assessment.

Proposed Project activities and infrastructure may cause a decline in the doum palm resource through a variety of mechanisms including:

- The abstraction of groundwater for solution mining activities;
- Potential land take for infrastructure including evaporation ponds, pipes, worker camps etc.;
- Disturbance from the construction of internal access roads and pipework; and
- Increased vehicle movement.

In a context of very low agricultural productivity, reduced income from palm collection and processing, as an alternate source of livelihood may cause resultant effects such as poorer standards of living and issues with food security, particularly for FHH that primarily rely on this livelihood activity to generate income.

Further Studies Required in the ESIA Phase

To enhance understanding of this potential impact, further studies will be undertaken to determine levels of dependency on palm collection and processing. Further studies will also assess additional ecosystem services provided by the doum palm resource, including an assessment of their potential supporting and cultural services. In addition, an analysis of income derived from the resource, and any seasonal patterns in this, as well as general expenditure levels will be performed through a variety of participatory techniques. This will form part of the full Socio-economic Assessment that will be undertaken as per *Chapter 11, Section 11.1.5*.

Reduced Productivity of Livestock and Livelihoods Reliant on Livestock

Livestock rearing is an important and common livelihood in the Danakil. The escarpment and alluvial fans are priority areas used for grazing. Any impacts to these areas from groundwater abstraction or other disturbance may cause disruption to this livelihood activity, and further loss of productivity. Consequences of this may include impacts to household health through loss of income and food derived from livestock, reduced ability to deal with shock

and increased competition (and conflict) for pasture elsewhere. This effect is likely to be compounded by drought in an area where quality of grazing and agricultural productivity is already extremely low, and there is a high reliance on food aid in many settlements.

Further Studies Required in the ESIA Phase

Further studies will be required to understand the extent and level of dependency on this livelihood. In assessing this impact particular attention will be given to baseline vulnerabilities associated with drought, low productivity and reliance on food aid. The studies will also ascertain the multiple uses of livestock. As mentioned in *Chapter 9*, livestock is used to gain income, for household consumption and are the most common form of savings for many households. This will form part of the full Socio-economic Assessment that will be undertaken as per *Chapter 11, Section 11.1.5*.

Increased Income Generation Opportunities through Local Employment and Local Procurement of Goods and Services

The proposed Project may result in a number of impacts related to economic issues including macro-economic impacts associated with payment of tax revenues etc. at the federal level. At the local level the proposed Project is likely to provide employment opportunities both directly and indirectly as well as opportunities for procurement of goods and services. The nature and extent of these benefits is currently unknown and may be limited due to the lack of skills and experience. Conversely increased income levels in the local region may cause price inflation and consequently, poorer standards of living for the most vulnerable. Once the construction phase is over, the workforce is likely to be reduced and the opportunity for income-generation from the procurement of goods and services may be lower.

Further Studies Required in the ESIA Phase

It is recommended that further studies are undertaken to fully understand the levels of skills and experience within the local area, the anticipated numbers of employees required (for both construction and operation), as well as the associated goods and services requirements. This will form part of the full Socio-economic Assessment that will be undertaken as per *Chapter 11, Section 11.1.5*.

Traffic Accidents and Disruption to Local Transport Routes

Bada is important for the trade and import of goods both from the Tigray region and Eritrea. The movement of people and transportation of goods frequently occurs between Bada and to the areas south and west of the Bada. Stakeholders have reported that goods purchased in Bada will be transported to other settlements, including Musley and Asabuya identified as some of the settlements located closest to the license area.

Goods are normally transported via people, vehicle and animals; (common destinations for goods are Hamad Ela and Berahale). Community members

also regularly travel to Bada to access the market, visiting friends and family along the way, as well as grazing their livestock along this route.

The interaction between community members using these areas as local transportation routes, with potentially increasing Project traffic from the construction phase onwards may increase the risk of traffic accidents. Land take and / or disturbance to the area, through potential construction of access roads, pipes etc. may also result in disruption to these routes.

Further Studies Required in the ESIA Phase

It is recommended that further studies are conducted to understand the extent of movement of people thorough the broader Project Area. It will also be important to understand the type of goods that are transported through the Project Area, their livelihood value/importance and their destination. In order to understand the potential impact associated with traffic accidents, further studies should also be undertaken to identify the key transport routes/nodes and crossing points, and traffic related accident 'hotspots' or high risk areas. This will again include consultation with community members and relevant Kebele officers. Yara Dallol BV policies on the use of vehicles and driving will also be analysed. This will form part of the full Socio-economic Assessment that will be undertaken as per *Chapter 11, Section 11.1.5*.

Potential for Conflict between Private and Public Security Providers and the Local Community

There is the potential for interactions between community members and private security contractors for the proposed Project to result in confrontations. In some instances armed Government security forces may become involved. There is a risk that the use of security personnel who are not trained or sensitised appropriately in community relations management, or awareness of human rights could result in such confrontations and incidents. These could, in extreme cases result in community unrest or protest, or even violence and conflict.

Further Studies Required in the ESIA Phase

Further investigation should be undertaken to understand the terms for the use of public and private security forces by the private sector in the Woreda. Yara Dallol BV policies and internal standards applied to training of security staff in community engagement and human rights awareness should also be reviewed to assess the potential areas of risk. This will form part of the full Socio-economic Assessment that will be undertaken as per *Chapter 11, Section 11.1.5*.

Increased Exposure to Poor Labour Standards in Supply Chain

Labour and working conditions in Ethiopia are generally not in line with international best practice. Yara Dallol BV will need to employ workers for both construction and operation phases, directly and through subcontractors. Without adequate management controls the workforce may be exposed to unacceptable labour standards.

This impact should be considered not only for Yara Dallol BV staff but also for primary and secondary subcontractors. Typically the lower down in the 'subcontractor hierarchy' a supplier is, the greater the potential for exposure of workers to poor labour standards, due to challenges associated with direct control and monitoring. Furthermore, working in a remote area such as the Danakil Depression, and in a country with less stringent and frequently poorly enforced labour laws using primary and secondary subcontractors may result in contractors and suppliers being underprepared to meet national and international requirements, placing employees at risk.

Further Studies Required in the ESIA Phase

It is recommended that a high level assessment of construction related labour issues within Ethiopia be undertaken. In addition the proposed Project's labour standards, and procedures and policies on health and safety, procurement and the supply chain will be reviewed in order to ensure monitoring and enforcing of standards is applied by primary and secondary subcontractors. Recommendations will be made to address any potential risks or shortfalls identified. This will form part of the full Socio-economic Assessment that will be undertaken as per *Chapter 11, Section 11.1.5*.

Potential Impacts to the Artisanal Salt Trade

Artisanal salt mining is one of the most important livelihood activities in the Danakil Depression. It is a key income generator both for settlements located in the Danakil, as well as community members that travel from the Tigray and Amhara region to partake in the salt trade. Artisanal salt mining is also important due to its cultural value for the local Afar people.

During preliminary screening engagement the artisanal salt trade did not feature as such a significant livelihood activity compared to areas located south of the proposed Project Area; however, stakeholders did acknowledge the importance of the salt trade, both from a socio-economic and cultural perspective. In addition local stakeholders reported small scale salt collection as a common activity.

The following activities may cause impacts to the artisanal salt trade:

- Higher levels of project traffic may increase the risk of accidents between animals used for the transportation of salt (camels and donkeys) and project vehicles.

- The abstraction of groundwater by Yara, in addition to the cumulative effect of other mining companies abstracting water, may cause changes to the hydrological flows and salt replenishment process.

- Increased construction activities, including the development of any access roads and other infrastructure may cause disturbance to areas used to access and produce salt (both artisanal salt mining and small scale salt collection).

If artisanal salt mining features as a key income generator, and if the productivity or access to this livelihood is impacted this may have ongoing impacts for standards of living and food security for those engaged in this activity.

Further Studies Required in the ESIA Phase

To enhance understanding of this potential impact, further studies will be undertaken to determine the extent to which settlements located north and west of the proposed Project Area are involved in artisanal salt mining. As is mentioned earlier in this *Section*, further studies will also be undertaken to identify the key transport routes/nodes and crossing points used by the salt caravans to reduce the risk of accidents with project vehicles. This will form part of the full Socio-economic Assessment that will be undertaken as per *Chapter 11, Section 11.1.5*.

10.4.2 Cultural Heritage

Broadly speaking, archaeological resources within the larger region of the Project Area include Palaeolithic sites, early states, empires and civilizations. This region's cultural importance can be, in part, tied to its location at the northern extent of the Great Rift Valley, which is an important natural corridor through which early hominids migrated out of Africa.

A preliminary cultural heritage sensitivity analysis has indicated that 12% of the Project Area is high cultural heritage sensitivity and can potentially contain all recorded living or archaeological resources and also represent terrain categories that are attractive to both modern and earlier populations.

Further Studies Required in the ESIA Phase

Given these observations about the long history of human settlement within and adjacent to the Danakil Depression, the location of the proposed Project is considered to be within a very high sensitivity area. As such, a cultural heritage assessment will be undertaken as per *Chapter 11, Section 11.1.6*.

10.4.3 Visual

Visual changes are expected to potentially impact the *status quo* characteristics of the Project Area. The Project Area is flat and at present is relatively undeveloped with the exception of the Yara Dallol Potash Project and other mining camps and associated facilities and sparse rural villages. These attributes have the potential to result in the proposed Project being readily visible from long distances.

Both residents and visitors (particularly tourists) may react negatively to visual changes in the area and to the change in 'sense of place'.

Further Studies Required in the ESIA Phase

Given that visual impacts may occur as a result of the proposed Project, a Visual Impact Assessment will be undertaken as per *Chapter 11*, *Section 11.1.7*.

In summary, the following specialist studies are required –

- Air Quality (including climate and Greenhouse Gas emissions)
- Noise;
- Water (surface- and groundwater);
- Biodiversity (aquatic and terrestrial);
- Socio-economic (including health);
- Cultural Heritage; and
- Landscape and Visual.

The technical approach to these studies is detailed in *Chapter 11*.

11 TERMS OF REFERENCE FOR THE ESIA

As per *Chapter 10*, it is expected that the following key environmental and social aspects will be impacted on by the proposed Project:

- Air Quality (including climate and GHG emissions)
- Noise;
- Water (surface- and groundwater);
- Biological Environment (aquatic and terrestrial);
- Socio-economic (including health);
- Cultural Heritage; and
- Visual.

These aspects will be further investigated and assessed within the ESIA phase through specialist studies. The ESIA will suitably identify, investigate and address all environmental and social issues in order to provide Yara Dallol BV, the authorities and the investors with sufficient information to make an informed decision regarding the proposed Project.

11.1 TERMS OF REFERENCE FOR SPECIALIST STUDIES

A preliminary review of available secondary data together with some primary data collected during pre-scoping visits provided an overview of the environmental and socio-economic aspects of the Project Area. The objective of specialist input at this scoping stage is to validate the secondary data obtained, to identify any gaps in data, and to suggest a terms of reference and technical approach for the ESIA. These terms of reference is aimed at addressing any data deficiencies that exist so that comprehensive specialist studies may be carried out to properly assess and address those environmental and social impacts identified.

This *Section* details the specialist studies proposed during the ESIA phase of the proposed Project.

11.1.1 Air Quality (including Climate and GHG Emissions)

The air quality assessment will involve the following:

- A description of the regional climate and local meteorology using the existing monitoring already undertaken at the Project Site.

- Design and implementation of a baseline air quality monitoring survey.

- Development of a comprehensive inventory of atmospheric emissions for the proposed Project.

- Prediction of ambient concentrations of pollutants arising from the construction and operational phases of the proposed Project using dispersion modelling, and considering committed 'built in' mitigation and control measures.

- An assessment of the overall impact of the construction and operational phases of the proposed Project, using national and international Air Quality Standards and Guidelines (i.e. as set out in IFC guidance) to describe the impacts in terms of their nature, duration and frequency of occurrence and the severity of the impact in the ambient environment.

- Identification of mitigation measures in light of any significant negative impacts identified.

- An assessment of the cumulative impacts to air quality as a result of additional potash mining operations in the broader Project Area.

- Compilation of an Air Quality Management Plan, taking into consideration built in and committed mitigation.

Key Emission Sources and Pollutants of Interest

With reference to *Chapter 2*, the key potential impacts associated with air quality will be associated with:

- Emissions of particulate matter (as PM_{10} and $PM_{2.5}$) and airborne and deposited dust arising from:

    - Construction activities;
    - The mining, processing and handling of product; and
    - Vehicle movements around the site and on unpaved roads.

- Emissions of oxides of nitrogen (NO_x), nitrogen dioxide (NO_2) (a component of NO_x), sulphur dioxide (SO_2), and particulate matter (as PM_{10} and $PM_{2.5}$) from combustion sources, including:

    - Mobile machinery used in the mining operations;
    - Any static diesel powered plant (if applicable), including the product dryers; and
    - Trucks used to haul product from the mine to the port.

Based upon previous experience in the Danakil Depression, emissions of dust, PM_{10} and $PM_{2.5}$ from the movement of vehicles over unpaved roads are a particular issue of concern. This arises as material from alluvial fans is typically used in road construction and the unpaved surface is particularly dusty.

It is expected that a relatively significant amount of diesel (approximately 1,700 l/hr) will be required for wheel-tractor scrapers, fluid drying beds,

drilling operations, transportation and miscellaneous activities. This will potentially result in greenhouse gases been emitted to the atmosphere.

Baseline Air Quality Monitoring Survey

A baseline air quality monitoring survey will be designed and implemented. The baseline monitoring will seek to capture existing air quality at sensitive receptors in the vicinity of the proposed mine and access and haul road.

The baseline survey will quantify existing airborne pollution concentrations at relevant sensitive receptors for the pollutants of interest, namely dust, PM_{10}, $PM_{2.5}$, NO_2 and SO_2. In the absence of sensitive habitats, it is anticipated that monitoring of NO_x will not be required. The survey will identify baseline conditions both due to man-made and natural sources.

The key deployment locations are around the mine and processing facility, and the road. With regards to locations alongside the road, particularly critical locations are where the road is unpaved, receptors are in close proximity to the roadside and where there is substantial existing traffic.

Assessment of the Construction and Operation of the Proposed Project

The construction phase will involve a range of activities required to develop the solution mining infrastructure, evaporation ponds and processing plant to the point where operations can commence. Early exploratory works will not be considered as these have been undertaken, and typically impacts are not significant. The potential impacts of activities including ground preparation, construction of infrastructure, transport of materials to site and provision of temporary power supply will be assessed.

In terms of construction activities, the key emissions will be PM_{10} and dust as a result of dust raised by vehicles moving over open surfaces and disturbance of surface materials. The potential impacts of these activities will be assessed in a qualitative manner, and mitigation measures developed on the basis of the risk of significant impacts to arise. It is anticipated that with the correct implementation of mitigation, effects should remain acceptable. Exhaust emissions of site based vehicles and plant during construction is expected to be negligible, and is therefore unlikely to require detailed assessment.

The operation of the mine and the processing facility will involve: the solar evaporation of the salt bearing brine; the harvesting, processing, stockpiling and loading of product; and disposal of waste salts. These activities are potential sources of dust, PM_{10} and $PM_{2.5}$ both from fugitive sources and point sources in the processing plant itself. In addition, there will be emissions of combustion products from the use of diesel powered vehicles around the site (approximately 72 plant vehicles), and from diesel powered dryers.

On the basis of the understanding of the sources set out above, an emissions inventory will be developed. Where specific point sources of emissions are

identified, for example the dryers and, if required, diesel powered electricity generation, the emission characteristics will be derived from manufacturer specifications. Where sources of emissions arise from vehicles or are fugitive, for example the movement of vehicles over unpaved surfaces, product harvesting and waste stockpiling, emissions will be derived on the basis of anticipated activities and using emissions developed from guidance set out in NPi (National Pollutant Inventory) produced by the Australian Government and USEPA AP-42 emissions database.

On the basis of the emissions inventory, dispersion modelling will be utilised to quantify the magnitude of impacts arising from the key sources of emissions. This approach is utilised to ensure robust quantification of impacts; in addition dispersion modelling can be used to ascertain the effectiveness of mitigation and emissions controls. The USEPA AERMOD dispersion model will be utilised. This model is widely recognised as being appropriate for this type of scheme by several agencies including the IFC, USEPA and international lenders. In addition to consideration of emissions, the model also considers local meteorology (including wind conditions and precipitation), local topography, and the locations of nearby receptors.

The dispersion model requires a range of specific meteorological inputs, in the form of hourly sequential data for a five year period. This data range ensures that short term and long term variations are captured. This approach ensures a complete and robust data set is available for use in the dispersion modelling.

Greenhouse Gas Emissions

A high-level estimation of the expected annual greenhouse gas emissions will be undertaken based on the following:

- Fuel usage by internal combustion engines for vehicles, plant and non-road mobile machinery;
- Fuel usage for local heat and power supply, if any;
- Emissions from remote fossil-fuelled electricity generation, if any; and
- Emissions of nitrous oxide, methane, refrigerants and sulphur hexafluoride, if any.

Estimates will be assessed for significance with IFC Guidelines for recommended and mandatory disclosure (25 and 100 kilotonnes CO_2 equivalent per annum).

Climate Change

Climate change projections from the Intergovernmental Panel on Climate Change (IPCC) will (at a high level) be assessed. These projections are based on numerous global and regional climate models. The assessment will discuss historic weather patterns and projected changes in temperature and precipitation, and how the impact of these changes may affect the proposed Project.

Definition of Significance

The identification of significance will be based upon the comparison of the magnitude of impacts against air quality standards as set out by the IFC, these being based upon those set out by the World Health Organisation (WHO). The significance is defined upon the basis of the magnitude of impacts as a percentage of the air quality guideline, with due consideration of the existing baseline conditions, as following the IFC guidance.

The understanding of the baseline conditions is critical in both understanding whether air quality standards and guidelines are likely to be exceeded, and defining the sensitivity of the existing airshed if the baseline conditions are already elevated (which is likely, given the environment).

Air Quality Management Plan

It is anticipated that the proposed Project will require a detailed Air Quality Management Plan. In terms of air quality the action plan is designed to ensure that:

- The identified and committed mitigation and control measures are implemented appropriately across the scheme.

- Appropriate monitoring is undertaken and reviewed to ensure that no unacceptable impacts occur. In the event that unacceptable impacts are identified, suitable measures can be implemented to mitigate these impacts.

- Reporting of environmental monitoring data is undertaken in a timely and appropriate manner.

The management plan will be developed out of the mitigation identified within the impact assessment. There will be a number of committed 'built in' mitigation measures that will need to be implemented. In addition, there may be additional mitigation measures relating to specific aspects of the proposed Project or triggered at specific times (for example in specific meteorological conditions). The management plan will set out those measures that are required to be implemented, and under what circumstances.

In addition, the management plan will also set out an operational monitoring programme to ensure that any unacceptable impacts are identified. The monitoring programme will be designed based upon the baseline monitoring. However additions and amendments will be made as required to ensure adequate air quality data capture. In addition, the design will be finalised on the basis of final mine design and location. The monitoring programme will identify suitable monitoring techniques, exposure and sampling periods, and monitoring locations.

The management plan will constitute a detailed 'working document'. On this basis, it will identify responsible persons, for example, by role or job title. In addition, the management plan will set out a reporting and monitoring schedule, detailing what monitoring is to be undertaken and when the results should be reported.

11.1.2 Noise

The following approach will be undertaken to conduct the noise assessment:

- Determine the location and nature of any noise sensitive receptors in proximity to noise emitting activities;
- Quantify the pre-Project baseline noise environment at identified receptors;
- Determine suitable noise goals for the proposed Project with consideration to appropriate guidance and receptor type;
- Conduct predictive noise modelling for the various Project phases;
- Compare predicted noise emissions with relevant Project specific noise goals to determine potential noise impacts;
- Investigate potential noise mitigation measures where predicted impacts may occur;
- Evaluate residual and cumulative impacts after the application of feasible and practicable mitigation options;
- Develop a Noise Management Plan (NMP).

Baseline Noise Surveys

Baseline noise surveys will be undertaken to determine the existing (pre-development) noise environment at strategic and key locations in the vicinity of works associated with the proposed Project that has the potential to generate adverse noise impacts. It is envisaged that the baseline surveys will include approximately 3 to 4 long term monitoring locations across the Project Area, which will be supplemented by short-term attended monitoring. A detailed baseline methodology will be developed identifying the monitoring locations required prior to undertaking the site visit, although specific monitoring locations will be finalised when on-site and with consideration to the local environment and access.

Measurements will only be carried out in dry conditions (i.e. not when it is raining or when roads are wet if road noise is a dominant source) and when wind speeds are below 5 m/s.

Operational Noise Assessment

The objective of the noise assessment is to quantify noise emissions from activities emanating from during all phases of the proposed Project (as well as any other activities identified as having the potential to create noise impacts) at nearby noise sensitive receptors, and assess these against existing measured or representative noise levels at that location. To do this the following scope of work will be undertaken:

- All existing Project data and/or information relevant to the assessment will be reviewed, including Project site plans and proposed operational scenarios.

- Identification of the closest and/or potentially most affected noise sensitive receiver locations in proximity to the proposed Project. These locations will be adopted as the Project-specific assessment locations. These locations will be identified as part of the socio-economic assessment (refer to *section 11.1.5*).

- A project-specific noise model (refer '*Noise Modelling*' below) to accurately quantify operational noise level contributions at the noise assessment locations will be developed.

- The resultant noise levels will be compared to the Project-specific noise criteria and the magnitude of potential impacts at the closest and/or potentially most affected noise sensitive receiver locations will be qualified.

- Relevant noise mitigation measures and monitoring actions will be recommended, and considered by Yara Dallol BV for the design of the proposed Project and for development of the NMP.

- There will be ongoing communication with the social team to understand the information collected regarding existing noise impacts that are being felt by local communities during the social baseline data collection activities. These will feed into the noise assessment. Details of the noise assessment will be included in the stakeholder consultation and social engagement process. It will also assist the social team in assessing overall social impacts related to noise disturbance, including the identification of areas where potential resettlement may be required if there is no alternative mitigation strategy.

Noise Modelling

Brüel & Kjær's Predictor 7810 (Version 8.0) noise modelling software package will be used to calculate noise levels using the ISO 9613.1 industrial noise propagation algorithms (international method for general purpose, 1/1 octaves). The Predictor software package allows topographic details to be combined with ground regions, water, grass, significant building structures etc. and project specific assessment locations, to create a detailed and accurate representation of the site and surrounding area. Noise emission sources

deemed representative of worst-case operating conditions under each scenario can be placed at locations within the Project Area.

The noise model shall allow quantification of noise levels from multiple sources, based on sound pressures or sound pressure levels emitted from the key plant components, as defined in the Project design. The model shall compute the noise propagation in the Project Area of influence and specifically quantify A-weighted decibels, dB(A) in the computational domain.

All data inputs (including noise source coordinates, elevations, geometry, sound pressures/sound pressure levels at 1 meter, noise barriers considered) shall be discussed and summarized in tabular format. Site terrain shall be taken into account and modelled using available topographical data and maps. The results of the model shall be discussed with reference to the plant site boundaries, property boundaries and closest residential receptors and noise levels shall be presented in tabular form and using maps showing noise level contour lines in the computational domain.

Standards and Guidelines

Noise impacts will be assessed using national and international Noise Standards and Guidelines (i.e. as set out in IFC guidance) to describe the impacts in terms of their nature, duration and frequency of occurrence and the severity of the impact in the ambient environment using a standardised impact rating system.

11.1.3 Water (Surface and Groundwater)

This *Section* details the Terms of Reference for the groundwater study including baseline data collection and impacts assessment.

Baseline Studies

ERM groundwater baseline studies include (i) hydrocensus survey, (ii) seasonal baseline groundwater quality monitoring and (iii) monitoring of groundwater levels. The hydrocensus survey, including the first round of groundwater monitoring, was carried out during the Site Screening and Early Baseline Data Collection site visit carried out in November 2013. During this visit a number of automated groundwater level loggers were installed in selected boreholes to continuously monitor groundwater levels (hourly measurements).

The second round of groundwater monitoring is provisionally scheduled for February 2014 so as to include the 'wet' season as well as to fit within the timeframe of the Early Works program. The first download of continuous water level monitoring data will also be carried out during the second site visit in February 2014.

Additionally, MWH (1) is conducting a mine water supply feasibility study. Relevant tasks included in their scope are summarised as:

- Field monitoring programme, including:
  - Surface water features (wadi and water features) survey (levels and quality);
  - Determination of spring locations, spring discharge rates and spring discharge water quality;
  - Inspection of selected geological features exposed in the wadis that discharge onto the Musley, Gehertu and Northern Fans (and if necessary the Bacarti fan wadi);
  - Temperature and conductivity logging of existing wells; and
  - Periodical monitoring of spring, lake and piezometer water quality and levels.

- Drilling and testing programme, including:

  - Evaporation trial pits;
  - Evaporation piezometers;
  - Excavation and soakage testing; and
  - Drilling and testing of wells in the Precambrian Phylite Formation, Jurassic Sandstone Formation, Jurassic Limestone Formation and Northern Fan.

The complete surface- and groundwater quality baseline data, including additional data collected by MWH, will be interpreted and a conceptual model will be compiled in collaboration with MWH. The deliverable from the baseline groundwater study will be the baseline groundwater section for the proposed Project, which describes baseline groundwater characteristics and presents the conceptual hydrogeological model, to be included in the overall baseline report.

Impact Assessment

During this phase, ERM will review new and existing groundwater baseline data and available surface- and groundwater information, including the mine water supply feasibility study to be completed by MWH.

From discussions with MWH, ERM believes that the MWH study will include determination of important hydraulic/hydrogeological parameters (e.g. transmissivity, hydraulic conductivity, storage coefficients and groundwater recharge) and numerical groundwater modelling. The modelling scenarios will be discussed and agreed between ERM and MWH to meet the needs of

(1) MWH is carrying out a hydrogeology study to quantify groundwater recharge and hydrological impacts due to the proposed Project, including distributed catchment modelling, steady-state, single phase groundwater flow model and density dependent groundwater flow and transport model. Furthermore, MWH will also compile a catchment water balance.

the impact assessment. Further, MWH will make the modelling results available to ERM to conduct the impact assessment.

ERM will collaborate fully with MWH and will provide inputs where required to assist in the development of the regional hydrogeological model to be developed by MWH.

The deliverables from the ERM surface- and groundwater impact assessment will be the surface- and groundwater impact assessment section to be included in the overall impact assessment report. This section will include the assessment of potential future impacts caused by the proposed Yara Dallol Potash Project, proposed mitigation measures and surface- and groundwater monitoring plan.

11.1.4 Biological Environment

The following approach is proposed for completion of the Biological Baseline and development of an impact assessment to meet the standards of the IFC Performance Standard 6:

- An ecological sensitivity analysis of the Project Area based on a sound approach will be undertaken. This sensitivity assessment requires an understanding of the importance of the habitat for supporting CI species. Much of the available data on the diversity of floral and faunal species included in the baseline study prepared by the Mekele University Department of Earth Sciences (Mekele University, 2013) will be used. The Mekele Universities baseline study covered two different seasons (March and July). ERM have conducted a Gap analysis on this baseline, which has indicated that the seasonality of the environment had been well covered; however, additional studies of the vegetation and the aquatic ecology need to be undertaken. These additional studies will improve the representation of the environmental seasonality.

- Additional data has been collected through site visits by an ERM and local ecologists and limited camera trapping. Some additional opportunistic surveys associated with other visits will also be collected.

- The sensitivity assessment will be placed into a regional perspective, and will thus involve an international ecologist with some biodiversity planning experience.

- A site assessment will be undertaken to obtain a first-hand understanding of the habitats.

- Consultation with national conservation authorities (EWCA), regional and local authorities will be undertaken. This consultation exercise will involve members of the core ecological team.

- Engagement with local communities and other stakeholders will be initiated in collaboration with the social assessment. The objective of these engagement activities will be to assess the nature and importance of ecosystem services to communities.

- An Ethiopian-based aquatic ecologist will assess the aquatic habitats within the Project Area.

Data collected through the above data reviews, field assessments and consultations will be used to compile a detailed baseline description of the Project Area and impacts to the ecology as a result of the proposed Project. Following an understanding of impacts, a Biodiversity Management Plan will be developed in an attempt to minimise the adverse impacts.

11.1.5 Socio-economic (Including Health)

Baseline Data Collection

Suitable publicly available baseline data exists for the areas and settlements south of Mount Dallol, which will be used in the compilation of the baseline report. In-country baseline data collection will however be required to assess the areas to the north and west of Mount Dallol. Information in these areas will be required on the following topics outlined in *Table 11.1*. In particular, it has been identified that there is potential variation in the socio-economic and livelihood profiles in the areas to the north and west of Mount Dallol, compared to the areas south of Mount Dallol. Therefore baseline data collection will be focused on capturing differences and closing any gaps in this regard.

Table 11.1 Baseline Data Collection Requirements

Social Study	Geographic Scale	Data Collection Requirement
Political, Governance & Administrative Data	Local	Local governance and administration data on villages located to north of the concessions.
Demography	Local	Demographic data on villages located to north and west of the concessions.
Social and Natural Infrastructure and Services	Local	Social infrastructure and services data to be expanded on for villages located to north of the concessions.
Land Tenure and Access	Local	Information regarding land tenure and use will be need to be expanded upon in the areas north and west of Mount Dallol, to confirm trends observed towards the south of the proposed Project Area, and to identify any key differences.
Education	Local	Education data to be expanded on for villages located to north and west of the concessions.
Health	Local	Health data on villages located to north of the concessions.
Archaeology and cultural heritage (tangible and intangible)	Local	Considerable cultural heritage data on villages located to north and west of the concessions.

Social Study	Geographic Scale	Data Collection Requirement
Socio-Economics & Livelihoods	Local	Substantial data required in area located to the north and west of the concessions (current livelihood survey data is not disaggregated by community. Absence of tourist and palm livelihood information). Absence of sufficient information on key livelihoods practiced in the area, in addition to knowledge of routes and practices of pastoralist groups).
Ecosystem Services	Local	Substantial information will be required on the environment located to the north of the proposed Project Area (around Bada) given the varied vegetation and habitats that exist compared to the rest of the Danakil.
Socio-cultural Information; Gender Issues, Vulnerability and Human Rights	Local	Additional data required on villages located to north and west of the concessions.

ERM will utilise a toolkit of complementary qualitative and quantitative methodologies that we have successfully deployed on similar social assessment assignments in Ethiopia. Primary data collection will include the following activities:

- **Key Informant Interviews (KII)**: Interviews with individuals who have knowledge of a specific subject or are informed members of the community, such as government representatives, local leaders, religious leaders etc.

- **Inclusive Focus Group Discussions (FGDs)**: Semi-structured meetings with selected social groups including men, women, youth and traditional elders (village elders, religious leaders and clan leaders) to understand their social issues, including vulnerability and perceptions of the Project. A mixture of Participatory Rural Appraisal (PRA) techniques will be used to capture information in an interactive and participatory manner. Furthermore within some of the FGDs semi-structured questionnaires will be used to gather supplementary quantitative information on a number of focused topics including: livelihoods and gender differences/the role of women within the Study Area. These techniques will also be used to capture specific information on the movement of people across the area and on the routes and practices of pastoralist groups.

- **Ground Truthing**: whilst in the field the team will use a GPS device to map social receptors and social sensitivities in the Social Area of Influence area of influence including sites of interest (archaeology, cemeteries), community amenities such as schools, health centres, places of worship, etc. Key resource areas (for instance areas used to collect salt, water, palms etc.) will be identified during community consultation and ground truthed whilst in the field.

ERM will also look to compare socio-economic characteristics and livelihoods patterns in settlements that have been previously studied against the newly identified settlements. This will allow the ESIA team to understand whether there have been any changes in key socio-economic indicators in the area over the past two years.

All data collection personnel will pay specific attention to potential differences in the ways that impacts will be experienced by potentially marginalised and vulnerable groups such as pastoralists groups, women, the elderly and the youth.

Development of GIS and Preparation of Social Base Maps

A comprehensive Geographic Information System (GIS) allowing storage, manipulation and presentation of data about the proposed Project Area will be a key tool for this ESIA. The themes will include all social facilities and infrastructure, settlements, surface and groundwater water points, cultural history, graves and sites of spiritual significance, terrestrial flora and fauna information, and land use. These will be populated with data from pre-existing sources, and all information collected during our additional baseline work.

The environmental and social mapping will be continued during the following phases of the study, creating a detailed resource of up to date and accurate information on all aspects of importance for the study.

Social Impact Assessment

ERM will commence the impact assessment using the previous studies as the basis and incorporating the results of the new baseline work as it is completed.

The prediction and evaluation of impacts will be undertaken in accordance with current international good practice in impact assessment, using appropriate modelling and other methods to provide quantitative predictions and qualitative descriptions of impacts. It will cover the positive and negative, planned and unplanned, permanent and temporary, long term and short term, direct, indirect and induced, and cumulative impacts of the development on all aspects of the physical natural, social-economic and cultural environment affected by the proposed Project.

ERM will complete a first round of assessment to predict impacts and evaluate their likely significance, so that mitigation of significant impacts can be developed with the Sub-consultants and Client during the on-going design studies and at the Mitigation workshop. This will be an iterative process of identifying options for mitigation, exploring their costs and benefits and deciding what is reasonably necessary, practicable and affordable for the proposed Project.

The assessment of social, cultural and economic impacts and development of mitigation measures will be undertaken in an inclusive manner with community representatives and leaders' participation. Visual aids will be used to show impacts from the proposed mining operation or other direct impacts likely to occur when the mine infrastructure is developed. Maps will be used to show how mining is likely to affect homesteads, cultural heritage features, salt mining activities and sites of specific spiritual importance. The various potential indirect impacts of the proposed Project will also be explored.

Once the initial assessment is complete, the areas in which significant impacts on the social, economic and cultural environment of the Proposed Project's area of influence, are likely to occur will be clearly identified with an evaluation of their severity. The evaluation of significance will take into account the scale, geographic extent and distribution, duration and frequency, reversibility, and probability of occurrence of changes in environmental and social conditions, and the value, sensitivity and ability to adapt (resilience) of affected resources and receptors. It will also explicitly take account of the perception of the importance of the impact by local communities. The criteria for evaluation of significance will be clearly explained in relation to each type of impact.

Where there is the potential for significant adverse impacts, options for mitigation will be explored. These will include measures to prevent or reduce impacts where possible, and where impacts are unavoidable, to remedy them or to provide compensation or offsetting. Options for delivering or enhancing benefits from the Project will also be identified.

Specific care will be needed to understand issues of compensation and relocation of homes, livelihoods and cultural sites. From previous experience it is understood that relocation of sites of cultural and spiritual significance may be problematic because of the deep rooted relationship between the living and their forefathers and the perceived influence that forefathers have on the current living conditions and wellbeing of the community. Other approaches to mitigation by compensation or offsetting for loss of sites of cultural and spiritual significance may therefore need to be investigated.

The Social Impact Assessment and Mitigation phase will be structured into a number of key tasks including:

- Impact Assessment and Mitigation;
- Final Assessment and Draft Environmental Study Report;
- Stakeholder Engagement and Consultation;
- Finalisation of Environmental Study Report; and
- Guidelines for Social Management Plans.

11.1.6 Cultural Heritage

Baseline Data Collection

The baseline study prepared by the Mekele University Department of Earth Sciences (Mekele University, 2013) for the proposed Project does not adequately address the issue of cultural heritage resources according to recognized international practice. Key considerations including the archaeological, historical and living cultural heritage resources of the Project Area were not evaluated.

ERM's prior experience in the Project region coupled with preliminary research indicates that there are a variety of cultural resources to be found, including several known prehistoric archaeological sites. These gaps can be adequately addressed through a focused baseline field survey and background research pursuant to the requirements of the International Finance Corporation's (IFC) Performance Standard 8 on Cultural Heritage.

The data gathered during the baseline field survey and background research will be analysed and a comprehensive gazetteer of sites of cultural heritage significance identified by the baseline survey, including photographs, site coordinates and site dimensions will be detailed. This baseline will be accompanied by a geospatial database of recorded cultural resources that fall within the Project Area.

Impact Assessment

An impact assessment will be compiled that specifically identifies any potential direct or indirect impacts on known cultural resources. The identification of impacts will rely on the cultural heritage geospatial database over which will be mapped the location of Project components. Project components that overlap known resources, that fall in close proximity to those resources, or that restrict user access to living heritage resources will be considered as having a potential impact to cultural heritage.

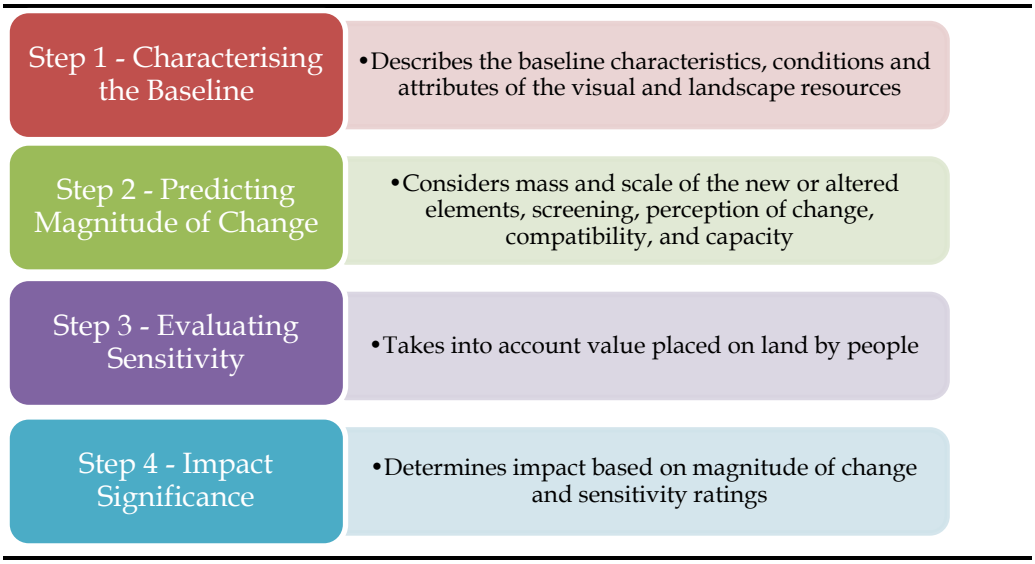
Cultural Heritage Management Plan

A Cultural Heritage Management Plan (CHMP) will be developed, which will specifically identify on-site mitigation (i.e. avoidance, potential excavation, recording and artefact conservation) that would be required to mitigate against impact in a manner that is in alignment with international standards. If further fieldwork is necessary in order to establish archaeological sensitivity in any portion of the site, it will be clearly stated. Cultural heritage mitigation recommendations will include sufficient detail to support costing and planning of any mitigation efforts required. Both the scientific and local community value of any identified sites will be taken into consideration.

11.1.7 Visual

Visual impacts will be assessed by reference to changes in the landscape as seen from a key observation points (KOPs) from which individuals or groups of people can see the proposed Project. These impacts will occur during all phases of the proposed Project (construction, operational and decommissioning and closure phases). The general approach that will be used in the visual assessment is described in *Figure 11.1* and presented in this *Section*.

Figure 11.1 Approach to VIA



Step 1 – Characterising the Baseline

The baseline characteristics, conditions and attributes of the visual and landscape resources and KOPs will be identified on site.

The most important KOP is likely to be Mount Dallol, given this site's potential as a tourist attraction, and the sites proximity to this location and the villages.

Step 2 – Predicting Magnitude of Change

Determining magnitude of change requires an understanding of how the human eye perceives objects within a static horizontal and vertical central field of vision. The magnitude of change in a landscape or view will depend on a number of factors:

- The mass and scale of the new or altered elements in the view.
- The likelihood that the new elements will be screened by intervening features such as vegetation, hills or buildings.

- The perception of change, that is, how far away receptors are from the proposed Project; if the proposed Project can be viewed in the foreground, middle ground and background, or seen above or below a person's normal line of sight.

- Compatibility of proposed Project components with the existing landscape character, taking into account whether the landscape is natural, modified or built, the characteristics of the landscape and the importance of each to its value. This will allow for an understanding of how well the proposed Project components fit with these characteristics with regard to size, form, colour, material.

- The capacity or ability of the foreground, middle ground and background of the landscape to accommodate or assimilate the change bought about by the proposed Project.

Step 3 – Evaluating Sensitivity at KOPs

KOPs will be identified by:

- Calculating the zone of theoretical visibility (ZTV) of the proposed Project components throughout the Project Area of influence using GIS software;

- Identifying KOPS within the ZTV;

- Assessing the sensitivity of the KOP.

The sensitivity of a KOP will be evaluated taking into account the type of location, (for example, if there are houses, transport routes, etc.), whether the locations of future mine components will be in the foreground, middle ground or background, the number of people who will typically be present, what they will be doing there, how long they will be present, and the value placed on the existing landscape by those affected. The evaluation of sensitivity at KOPs therefore will take into account a range of factors and will be illustrated by a photomontage.

Step 4 – Impact Significance

The magnitude of change and sensitivity of the KOPs will include embedded controls and management measures aimed at reducing landscape and visual impacts to determine the level of landscape and visual impact. These will be included in the appropriate social management plans.

As is mentioned in *Chapter 3*, the proposed Project will produce a potash type known as Sulphate of Potash (SOP), which has certain agronomic advantages (such as a low chlorine concentration) that are more advantageous for certain crops when compared to its counterpart and most common form of potash, MOP. Estimated global consumption of potash in 2013 was 56 million tons, of which only 8% (~ 4.5 million tons) was SOP. The reason for this is that the production of SOP is secondary to that of MOP – essentially SOP is produced by dissolving MOP in sulphuric acid, a much more costly process. It is estimated that the demand and consumption of SOP will be approximately 7million tons by 2020 (an annual growth rate of ~7%). The potash resource in the Danakil Depression has been known for decades and is, from a resource perspective, considered to represent an interesting potential for production of potash.

Furthermore, large proposed mining projects are a major potential contributor to Ethiopia's economic development targets, and will be an important source of foreign currency inflows and taxes, as well as creating significant direct and indirect employment in regions such as the Afar National Regional State (ANRS). Also, large mining projects in the ANRS will require a wide range of competencies presently not available in the region. As such, should large mining projects in the region go ahead, they will act as a catalyst for development of the regions educational system.

In light of the above, Yara International (a leading global fertilizer company with sales of fertilizer to about 150 countries globally), is proposing to develop a potash mine in the Danakil Depression, north-eastern Ethiopia. The proposed potash mine (known as the Yara Dallol Potash Project) will compliment one of the main objectives of Yara International's strategy, which is to develop a raw material source that can be used as input in to Yara Internationals fertilizer production process.

As part of the proposed Yara Dallol Potash Project, Yara Dallol BV are required by the Ethiopian Environmental Impact Assessment (EIA) Proclamation (No. 299/2002) to obtain environmental authorisation from the Environmental Protection Authority (EPA), prior to the construction and operation of the proposed mine. As such, Environmental Resources Management (Pty) Limited (ERM) were appointed as the independent Environmental Assessment Practitioner to facilitate the environmental approval process, in compliance with in-country laws, as well as to the requirements of World Bank Safeguard Policies and the IFC performance standards, which are recognised as benchmarks of international good practice.

It must however be noted that although the EPA is mandated to drive environmental impact assessment processes in Ethiopia, the MoM has within its department, EPA representatives. As the proposed Project is mining

related, the EPA has delegated review and decision making authority to the EPA delegates within the MoM.

The environmental scoping study (this report) is the first phase of the overall ESIA process being undertaken in support of the proposed Project. The purpose of the scoping study is to identify potential environmental and social impacts resulting from the proposed Project, and to prepare a detailed Terms of Reference and plan of study for the ESIA study.

Based on this scoping exercise, key issues identified that require further study in the ESIA phase include potential impacts associated with:

- Air emissions, in particular dust;
- Noise emissions, in particular at the villages in close proximity to the Project Site and along transport routes;
- Significant mining and processing water requirements (including the cumulative impacts of other mining companies planning potash mines in the Danakil Depression, and their associated water needs), resulting in regional impacts to existing ground and surface water reserves as a result to groundwater draw down in the alluvial fan aquifers;
- Risk of contamination of surface and sub-surface water sources;
- Risk of disturbance or damage to important habitats, such as the salt pan fringe and seepage zones;
- Risk of loss of habitat and ecosystem fragmentation;
- Risk of impacts to conservation important species;
- Risk of disruption of ecosystem services;
- In-migration of people into the Project Area and immediate surrounds;
- Risk of reduced availability of water to community users;
- Regular interaction between communities and workforce;
- Risk of reduced productivity of palm related livelihood activities;
- Risk of reduced productivity of livestock and livelihoods reliant on livestock;
- Increased income generation opportunities through local employment and local procurement of goods and services;
- Risk of traffic accidents and disruption to local transport routes;
- Potential for conflict between private and public security providers and the local community;
- Increased exposure to poor labour standards in supply chain;
- Risk of disruption to the artisanal salt trade;
- Risk of disturbance of grave sites or areas of archaeological or cultural heritage significance; and
- Visual intrusion.

Based on the initial assessment of potentially significant issues, it has been concluded that there are no environmental or social fatal flaws which inhibit this ESIA study from progressing into the impact assessment phase. The potential environmental and social sensitivities highlighted in this report will need to be further investigated and assessed during the impact assessment

phase before any recommendations can be made regarding the socio-environmental feasibility of the proposed Project.

The ESIA will suitably present and describe the residual impacts of the proposed Project, together with their significance. This will culminate in the preparation of various social and environmental management plans for those key issues identified. These plans will comprise requirements for on-site management of environmental and social aspects during the construction phase, and for the ongoing management and monitoring of environmental and social aspects during the operational and closure phases of the Project.

Afar Regional Bureau of Health (2011). *Annual Health Report*. The Afar Regional Bureau for Health.

The African Development Bank Group (2012). *Ethiopia*. Available from: http://www.afdb.org/en/countries/east-africa/ethiopia/ [Accessed 20 June 2012].

Barberi, F., G. Ferrara, R. Santacroce, J. Varet (1975). *Structural evolution of the Afar triple junction, In: Afar Depression of Ethiopia*, Pilger A., Rosler A. eds., Stuttgart, 1, 39-54.

Central Statistical Authority (CSA) (2004). *Welfare Monitoring Survey Analysis Report.*

Central Statistics Agency (2005). *Ethiopia Demographic and Health Survey.*

Central Statistics Agency (2005). *National Instrument 43-101, Canadian Securities Administrators*, 30 December 2005.

Central Statistics Agency (2008). *Summary and Statistical Report of the 2007 Population and Housing Census: Population Size by Age and Sex*.

Central Statistics Agency (2007). *Population and Housing Census Report of Ethiopia.*

Central Statistics Agency (2011). *Ethiopia Demographic and Health Survey Preliminary results.*

Garland, R.C (1980). *Geology of the Adigrat Area*. Ministry of Mines, Energy & Water Resources. Geological Survey of Ethiopia.

Hundie, B and Padmanabhan, M (2008). The Transformation of the Afar Commons in Ethiopia – State Coercion, Diversification and Property Rights Change Among Pastoralists, *Collective Action and Property Rights*, Working Paper No. 87.

Mekele University (2013). *Baseline Study for the Environmental and Social Impact Assessment (EIA) - Musley Potash Project*. Mekele University.

Mengesha Tefera, Tadiwos Chernet & Workineh Haro, (1996). *Explanation of the geological map of Ethiopia. Scale 1:2.000.000*. 2nd Edition, Ethiopian Institute of Geological Survey, 80 pp. 2nd ed. EIGS, Addis Ababa.

Ministry of Education (2012). *General and vocational education*. Available from http://www.moe.gov.et/English/Information/Pages/Genedu.aspx

[Accessed 13 July 2012].

Ministry of Health (2009). *National Strategic Plan for Malaria Prevention, Control and Elimination in Ethiopia 2010 – 2015*.

Ministry of Health (2011). *Health Sector Development Programme (HSDP IV), Woreda Based Core Plan*.

Philbott *et al*., (2005). *Livelihoods / Emergency Assessment in the Afar Region*. Oxfam International.

Tesfaye Cherenet (1982). *Hydrology of the Lake Regions, Ethiopia.* Ministry of Mines & Energy, Ethiopian Institute of Geological Surveys. Addis Ababa, Ethiopia.

The United Nations Development Programme (1973*). Geology, Geochemistry and Hydrology of Hot Springs of the East African Rift System within Ethiopia. Investigation of Geothermal Resources for Power Development*. United Nation: New York.

US Geological Survey (USGS) (2006). *National Field Manual for the Collection of Water-Quality Data. Chapter A4 - Collection of Water Samples*. Book 9 Handbooks for Water-Resources Investigations. Revised 2006 (Version 2.0, 9/2006).

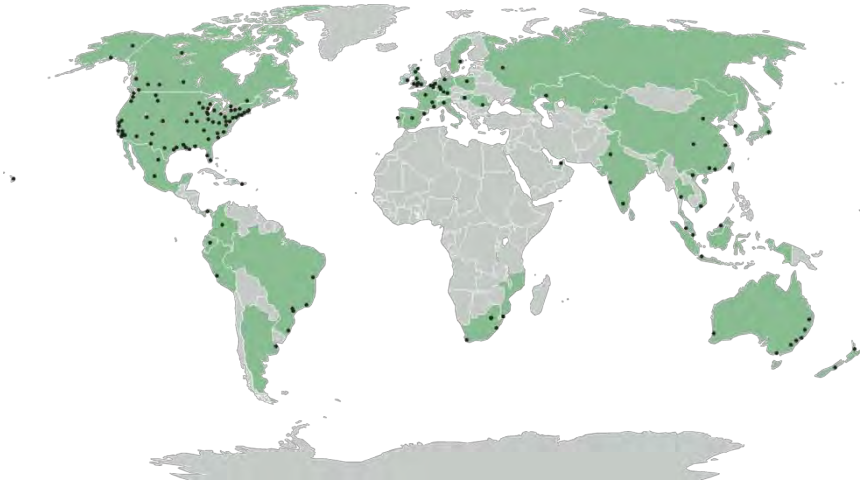
The World Bank (2012). http://databank.worldbank.org/country/ethiopia. Accessed 24 January 2012.

The World Bank (2014). http://databank.worldbank.org/data/views/reports/tableview.aspx Accessed 16 January 2014.

World Health Organization (WHO), (2011). *Guidelines for Drinking Water Quality*. Forth Edition.

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