4 *BASELINE INFORMATION*

This *Chapter* provides a *basic* description of the environmental and social baseline of the proposed Batoka HES, focussing on the proposed Project Area, as described in *Section 3.2*. This baseline is based primarily on a review of available secondary information, more specifically:

- The 1993 and 1998 ESIA studies previously undertaken for the Project;
- The Joint Integrated Management Plan for the Mosi-oa-Tunya/Victoria Falls World Heritage Site (2014);
- The SP Options Assessment Report (2015);
- The SP Seismic Hazard Assessment Report (2015);
- The Livingstone Structure Plan (Final Report, 2005);
- The Kalomo District Council Strategic Plan (2011-2015);
- The Kazungula District Situation Analysis (2005);
- The Kazungula Strategic Plan (2013-2017);
- Zambia's Sixth National Development Plan (2011-2015);
- Livingstone City Profile (2009); and the
- Zimba District Situation Analysis (2013).

The baseline presented in this Scoping report will be updated during the Impact Assessment (IA) phase once detailed baseline surveys have been conducted, and will be reported in detail in the ESIA report.

It is important to gain an understanding of the physical, biological and socio-economic attributes of the Project Area and surrounds, as this will allow for a better understanding of the environment in which the project is being considered. Consideration of the receiving environment is a prerequisite for the identification of potential environmental and social impacts, and for the applicable mitigation of such impacts.

4.1 *PHYSICAL ENVIRONMENT*

4.1.1 *Climate*

The Zambezi River Basin is subjected to one of the most variable climates of any major river basin in the world, experiencing extreme conditions across the catchment through time (1).

Temperature variation across the Basin across seasons is not high (i.e. estimated to be in the region of 4 °C) (2). The coolest temperature is experienced in July, and winter temperatures range from 13 °C (higher

(1) Beilfuss, Richard. 2012. A risky climate for southern African hydro: Assessing hydrological risks and consequences for Zambezi river basin dams. International Rivers.
(2) Schlosser, C. Adam; Strzepek, Kenneth (2013): Regional climate change of the greater Zambezi River Basin: A hybrid assessment, WIDER Working Paper, No. 2013/040.

elevation areas to the south) to 23 °C (lower elevation areas in the delta) [(1)]. Mean daily temperatures in the summer months range between 23 °C in the highest elevation areas, to 31 °C for the lower parts of the Zambezi valley [(2)]. Temperatures are warmest along the border of Zambia and Zimbabwe.

Average annual rainfall in the Basin is approximately 950 mm/year, although this average is unevenly distributed with the northern and eastern portions of the Basin receiving the highest proportion of rainfall [(3)]. For example, annual rainfall varies from more than 1600 mm in the northern highland areas to approximately 550 mm in the southern portion of the basin [(4)].

The Zambezi River Basin experiences robust seasonality with regards to precipitation, with a dry season from June to August (average precipitation of less than 0.05 mm/day), and a wet season from December to February (average precipitation of more than 5 mm/day) [(5)].

4.1.2 *Geology*

The development of the Zambezi valley was probably initiated in the late Palaeozoic and the developing depression was partly infilled with the Karoo sediments and finally the Karoo basalt. A thin cover of recent alluvium has developed close to the river, particularly downstream of Kariba and southwest of Victoria Falls.

The basalts are of Jurassic age and between 5,00-1,000 m thick. They form a very low plateau incised by steep-sided gorges of the Zambesi River and its tributaries (1993, Feasibility Report). The underlying Karoo sediments, which thin out towards the centre of Zimbabwe, are of Permo-Triassic age. These mainly comprise sedimentary rocks composed of mixed minerals of igneous origin and differentiated sediments such as sandstones, quartzites, shales, slates, coal, limestones and dolomites. The general geology is white and red sandstone overlain by basaltic lavas.

The Zambezi River flows through a deep gorge eroded in basalts. There are 13 basalt flows which constitute the dam site, between 350 and 850 m amsl, that are nearly horizontally bedded and are continuous throughout the project area[(6)].

Each flow displays the following zoning, from top to bottom (*Figure 4.1*):

- Auto brecciated basalt (ABB);

(1) SADC/SARDC and others 2012. Zambezi River Basin Atlas of the Changing Environment. SADC, SARDC, ZAMCOM, GRID-Arendal, UNEP. Gaborone, Harare and Arendal.
(2) Ibid.
(3) Ibid.
(4) Beilfuss, Richard. 2012. A risky climate for southern African hydro: Assessing hydrological risks and consequences for Zambezi river basin dams. International River.
(5) Schlosser, C. Adam; Strzepek, Kenneth (2013): Regional climate change of the greater Zambezi River Basin: A hybrid assessment, WIDER Working Paper, No. 2013/040, ISBN 978-92-9230-617-5.
(6) (SP, 2014: Draft Options Assessment Report).

- Amygdaloidal basalt (AB, slightly, moderately and highly amygdaloidal); and
- Non-amygdaloidal basalt (NAB)

It is important to note that not all the layers are present and/or continuous in the all flows.

Weathering and alteration have had little overall effect on the rock matrix and generally the rock mass may be considered to be strong, hard and of low permeability.

4.1.3 Seismicity

The preliminary data on seismicity of the project area has been extracted from Studio Pietrangeli (SP)'s report, entitled Phase III feasibility: Seismic hazard assessment of June 2015.

In terms of regional tectonics, the African plate, on which Batoka is situated, includes southern Africa and the East African Rift System (EARS) which ends in the Indian Ocean. Plate boundaries in both the continental and oceanic lithosphere (including the African wide-plate boundary) are hundreds and thousands of kilometres wide. In fact, plate boundaries cover roughly 15% of Earth's total surface area. The African plate is considered one of the most tectonically stable areas in the world.

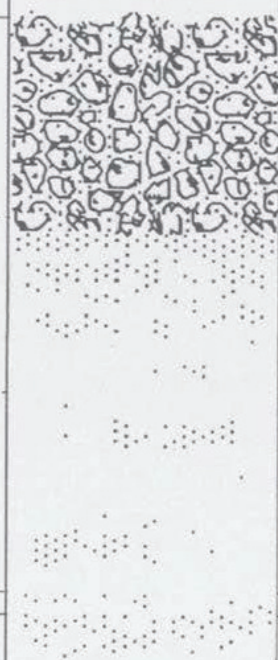
The African wide-plate boundary is characterised by belt-like zones of seismicity surrounding relatively aseismic blocks. The seismicity in Southern Africa appears to portray the same spatial style and supports the notion that the wide-plate boundary extends into South Africa. The rift between the Nubia (west section) and the Somalia (east section) plate, south of 20° S off the coast of Mozambique, is along the southwest Indian Ridge. These two plates are extending in at a slow rate and are commonly known as the East African Rift System (EARS). Seismicity is observed in the EARS as far as the southern part of Mozambique.

Regional seismicity was examined by SP (2015), who analysed data for a total of approximately 7, 700 events within a radius of 500km from the proposed project site, including information related to magnitude, date, latitude, longitude, depth and station name. This data included both a pre-instrumentally recorded seismicity data set, and instrumentally recorded seismic events database selected from:

- The catalogue provided by the Council for Geosciences, Pretoria;
- the International Seismological Centre in the UK (ISC, On-line Bulletin (www.isc.ac.uk); and
- the United States Geological Survey (USGS) database.

Data on these events is provided in summary form in *Figure 4.2.*

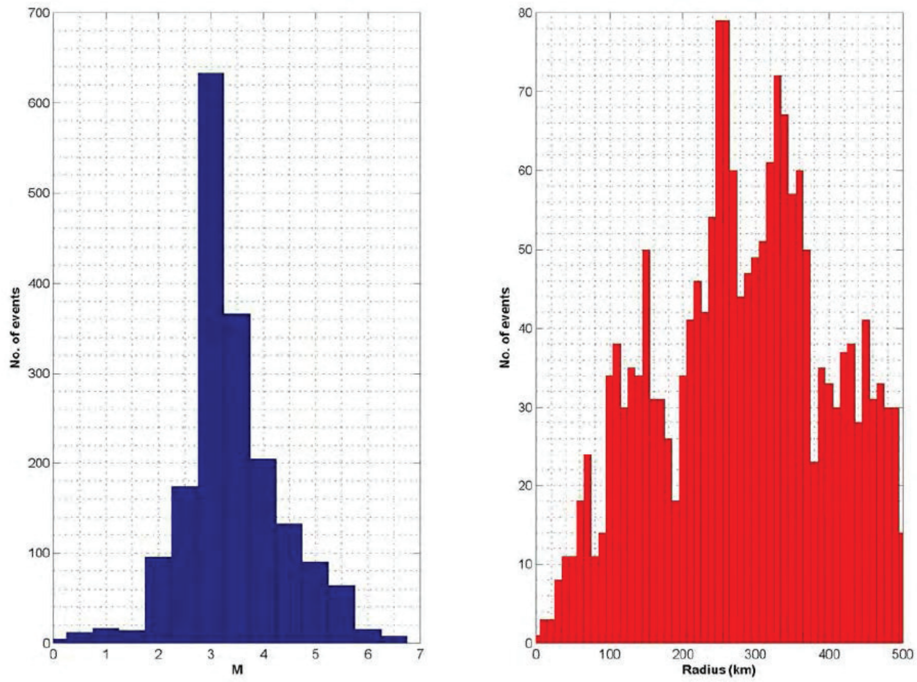
Figure 4.1 General morphology of a Batoka lava flow

THICKNESS OF UNIT (metres)	SCHEMATIC SECTION THROUGH BASALT LAVA FLOW	ZONE N°	ZONE NAME (ROCK TYPE)	BRIEF DESCRIPTION OF ROCK TYPES
0-25 m Average 15 m		A	AUTO BRECCIATED BASALT	Slightly to moderately occasionally highly altered, massive, red/brown, coarse grained, AUTO BRECCIATED BASALT of angular sand to gravel size fragments of highly vesicular basalt, cemented by a pink/white crystalline matrix (mainly zeolites), which also infill most of the vesicles.
0-20 m Average 10 m		B	Vesicular/ HIGHLY to MODERATELY AMYGDALOIDAL BASALT	Slightly to moderately occasionally highly altered, massive, red/brown-grey/green, fine grained, porphyritic and vesicular BASALT; most of the vesicles are partially to completely infilled with pink/white crystalline material (mainly zeolites).
0-60 m Average 30 m		C	Massive BASALT	Fresh occasionally slightly altered, massive, dark grey/ green, fine grained, porphyritic, rarely vesicular, BASALT, occasional thin (0.20 m) zones of highly vesicular basalt. Most of the vesicles are partially to completely infilled with pink/white crystalline material (mainly zeolites) (normally 2 % by volume)
1-2 m		D	Chilled Bottom	Fresh occasionally slightly altered, massive, dark grey/ green, very fine grained, BASALT, with small spherical vesicles infilled with dark green material.

Notes: 1) All boundaries are gradational
2) Upper and lower surfaces are irregular

Source: SP (2014) Draft Options Assessment Report

Figure 4.2 ***Number of Events of Different Magnitude and Distance from Site***



Source: SP (2015): Seismic Hazard Assessment report

In terms of reservoir triggered seismicity (RTS) [1], the Kariba Dam has triggered a seismic event of a maximum of 6.2, one of only four RTS cases worldwide above 6.0 [2].

The Kariba Dam wall lies about 360 km downstream of Batoka, and its reservoir, Lake Kariba, is the world's largest manmade lake by volume. The lake is about 280 km long and up to 40 km wide. It covers an area greater than 5'500 km^2 and it stores a volume of about 185'000 Mm^3 (at the maximum retaining level of 487.8 m amsl).

Impounding started in December 1958 and the lake was full for the first time in August 1963. The seismicity increased steadily after the water depth had reached about 30 m. However, in September 1963 a jump in energy release occurred with six shocks having magnitudes exceeding 5.0 on the Richter scale. The main event of magnitude 6.2 caused damage to the dam structure and some property damage in nearby settlements.

The seismicity induced by Lake Kariba, although more sporadic now than during the first 10 to 15 years after impounding, does not show a clearly

(1) RTS is defined as, "seismic events manifested during and after impounding, due to interaction of the added weight of the storage water and the pore pressure diffusion, with the critically stressed causative faults."
(2) Gupta, 2002 A Review of Recent Studies of Triggered Earthquakes by Artificial Water Reservoir with Special Emphasis on Earthquakes in Koyna, India. Earth-Science Reviews (58, 279-310); and www.zaraho.org.zm

defined decrease in intensity particularly for events within magnitudes greater than 4.0.

4.1.4 Soils

Most of the soils in the project area are regosols, characterized by deep and highly pervious fine to medium-grained sands formed on Aeolian Kalahari deposits. These soils have very low or non-existent reserves of weatherable minerals and a low silt/clay ratio, giving rise to a general absence of horizon development. This combination of a sandy soil and low rainfall has resulted in a high subsoil: topsoil ratio which favours woody species. Basalt-derived soils are of higher fertility and occur in exposures close to the Zambezi or in drainage lines [1].

4.1.5 Hydrology

The general hydrology of the upper Zambezi has been intensely studied by several authors in the past. The overall Zambezi catchment is depicted in *Figure 4.6.* SP (2015) state that the major contribution to the flows at the Batoka dam site derive from the upstream sub-catchments including: Kabompo, Lungwe Bungu, and especially the Upper Zambezi sub-catchments (located in the Northern highlands), together with Luanginga sub-catchment. These catchments upstream of the proposed Batoka Dam site are shown at the end of this *Chapter*.

The Livingstone / Victoria Falls hydrometric station has a long and reliable gauging record, with available records spanning the following period:

- Monthly average run-off flow - from 1908 to 1924; and
- Daily mean run-off flow - from 1925 to 2014.

Average annual flows for this record are depicted in *Figure 4.3* below. *Figure 4.4* illustrates the complete design time-series, from 1925 to 2014, of the average monthly flows at the proposed Batoka dam site, indicating the high and low flow seasons.

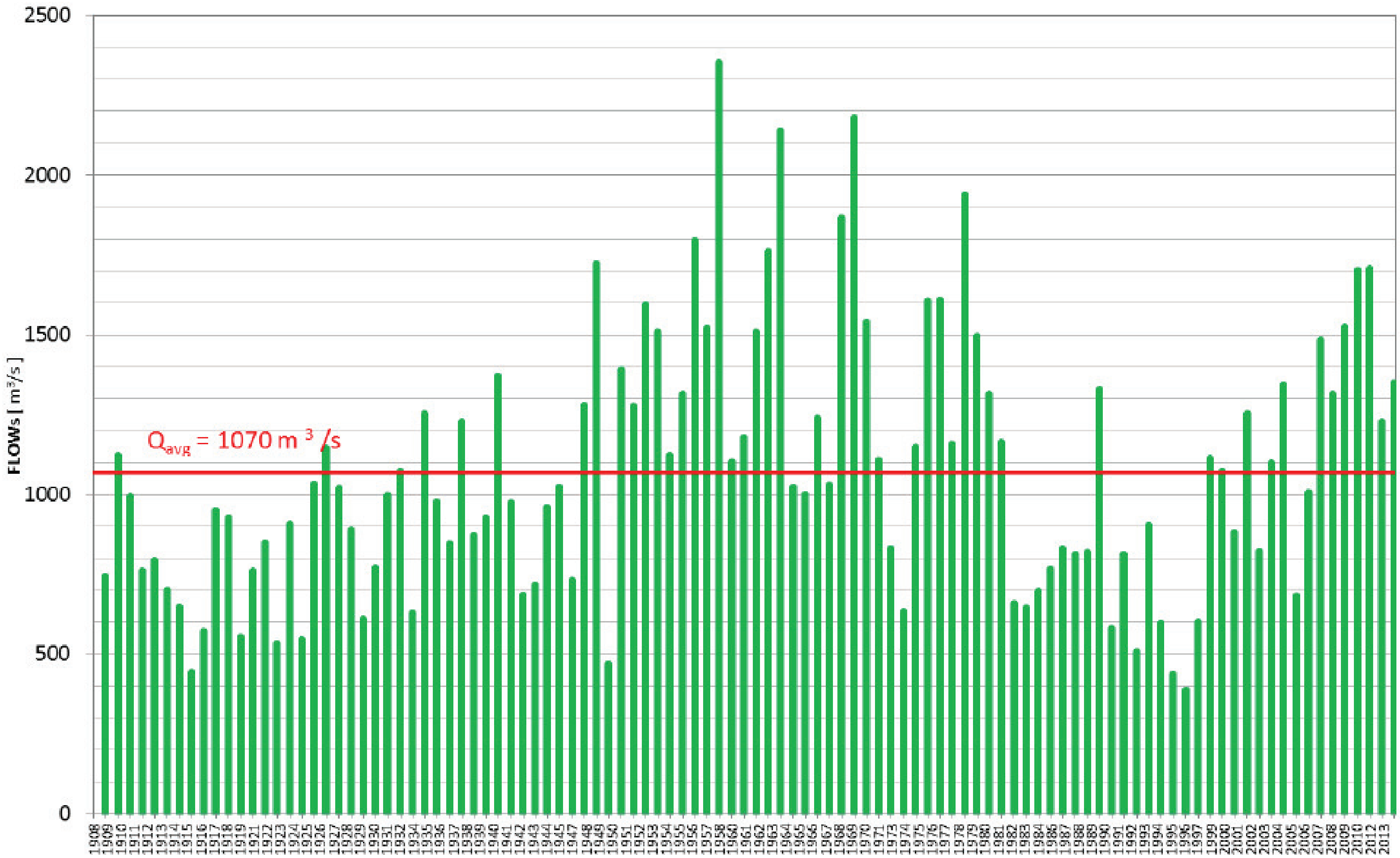
This natural variability of Zambezi River flows is highly modified by large dams, particularly by Kariba and Cahora Bassa dams on the main stem, as well as Itezhi- Tezhi and Kafue Gorge Upper dams on the Kafue River tributary. These dams have altered the hydrological conditions of the Zambezi River, especially the timing, magnitude, duration, and frequency of seasonal flood pulses.

Flooding in the Basin occurs nearly every decade. Between 1997 -2001, the Basin has experienced extreme floods during the rainy seasons of 1999 – 2000, 2005 - 2006 and 2007 [2]. Tropical cyclones originating in the Indian Ocean are

(1) BJVC, 1993.
(2) SADC/SARDC and others 2012. Zambezi River Basin Atlas of the Changing Environment. SADC, SARDC, ZAMCOM, GRID-Arendal, UNEP. Gaborone, Harare and Arendal.

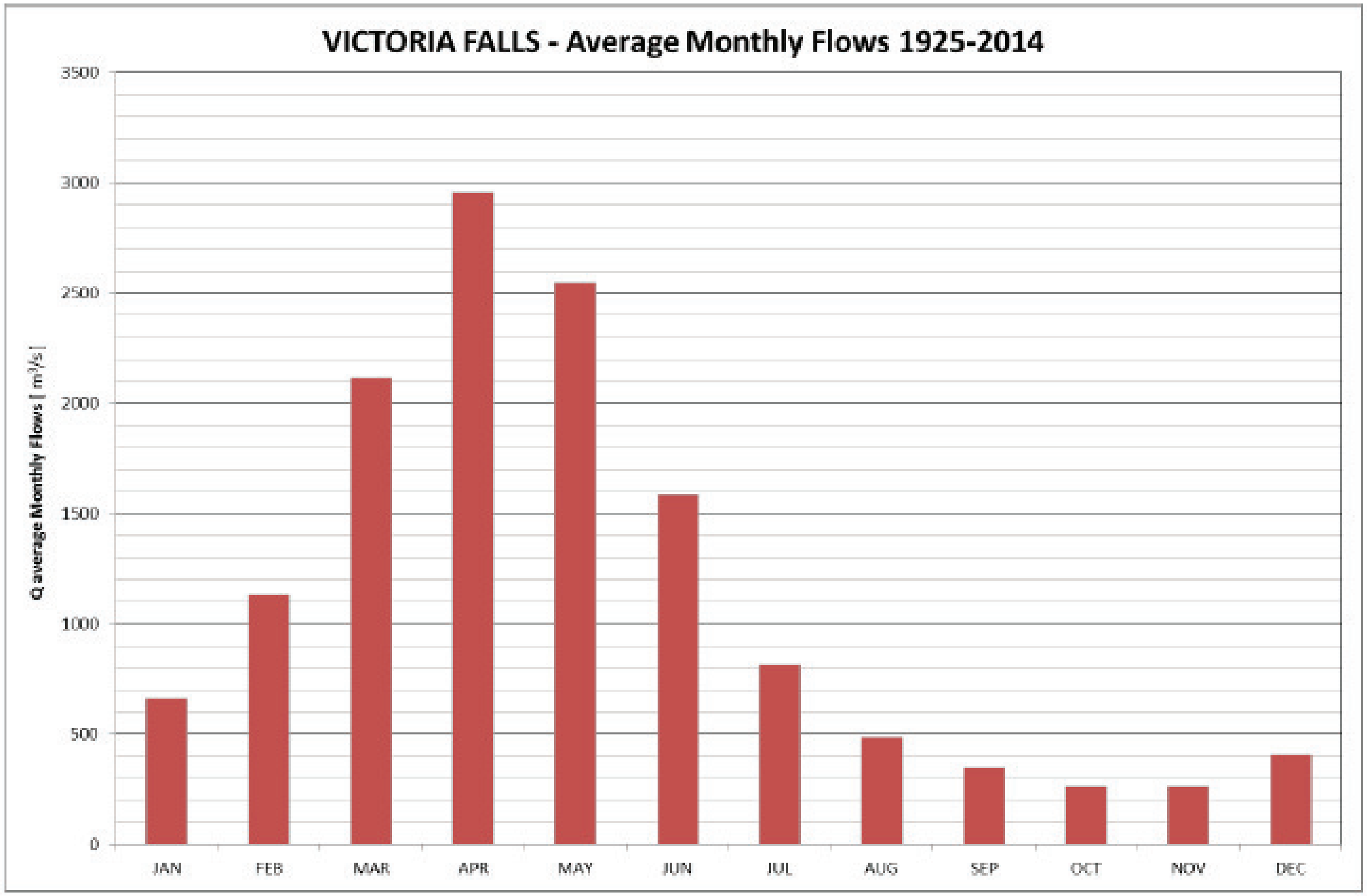
the main driver behind the flood cycles. The areas of the Basin flooded between 1997 and 2007 are shown in *Figure 4.5* below.

Figure 4.3 *Victoria Falls Station: Flows from 1908 to 2013*



Source: SP Options Assessment Report, 2015

Figure 4.4 *Victoria Falls Station: Monthly average flows 1925 - 2014*



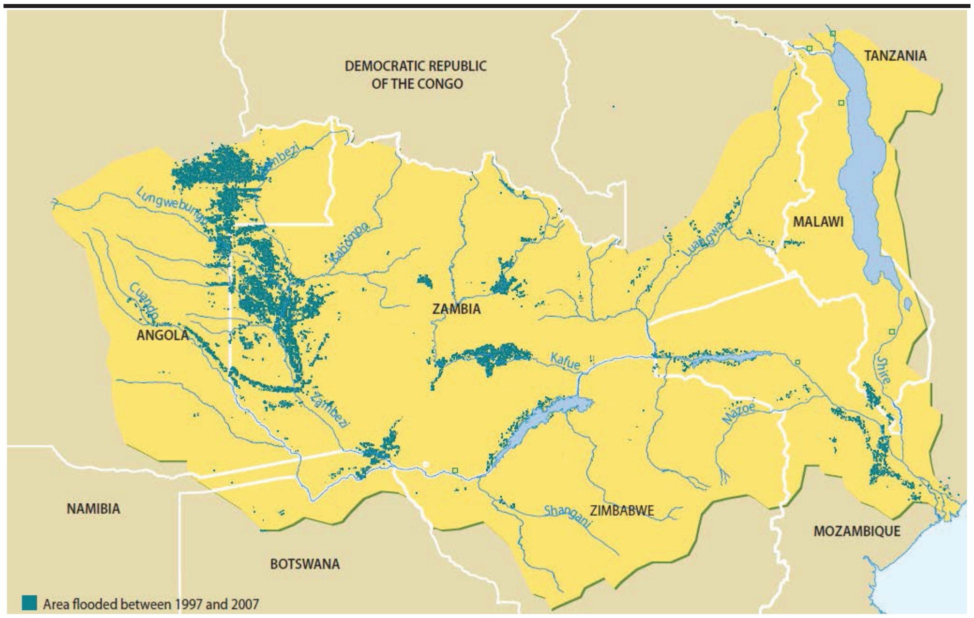
AVERAGE MONTHLY FLOW 1925 - 2014													
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MEAN
(m^3/s)	660	1130	2112	2958	2545	1585	814	484	345	262	264	402	1130
(Mm^3)	1769	2733	5657	7668	6817	4109	2180	1297	896	701	684	1076	2966

Source: SP Options Assessment Report, 2015

Multi-year droughts are also observed in the Basin, with implications for river flows and hydropower production.

Climate change studies indicate that the Zambezi will experience drier and more prolonged drought periods, and more extreme floods. Such studies predict a significant warming trend of 0.3–0.6 ºC (resulting in an increase in open-water evaporation), a decrease in rainfall across the basin by 10–15 %, and changes in the seasonal pattern of rainfall across the basin are predicted, including delayed onsets, as well as shorter and more intense rainfall events. Multiple studies estimate that Zambezi runoff will decrease by 26–40 % by 2050.

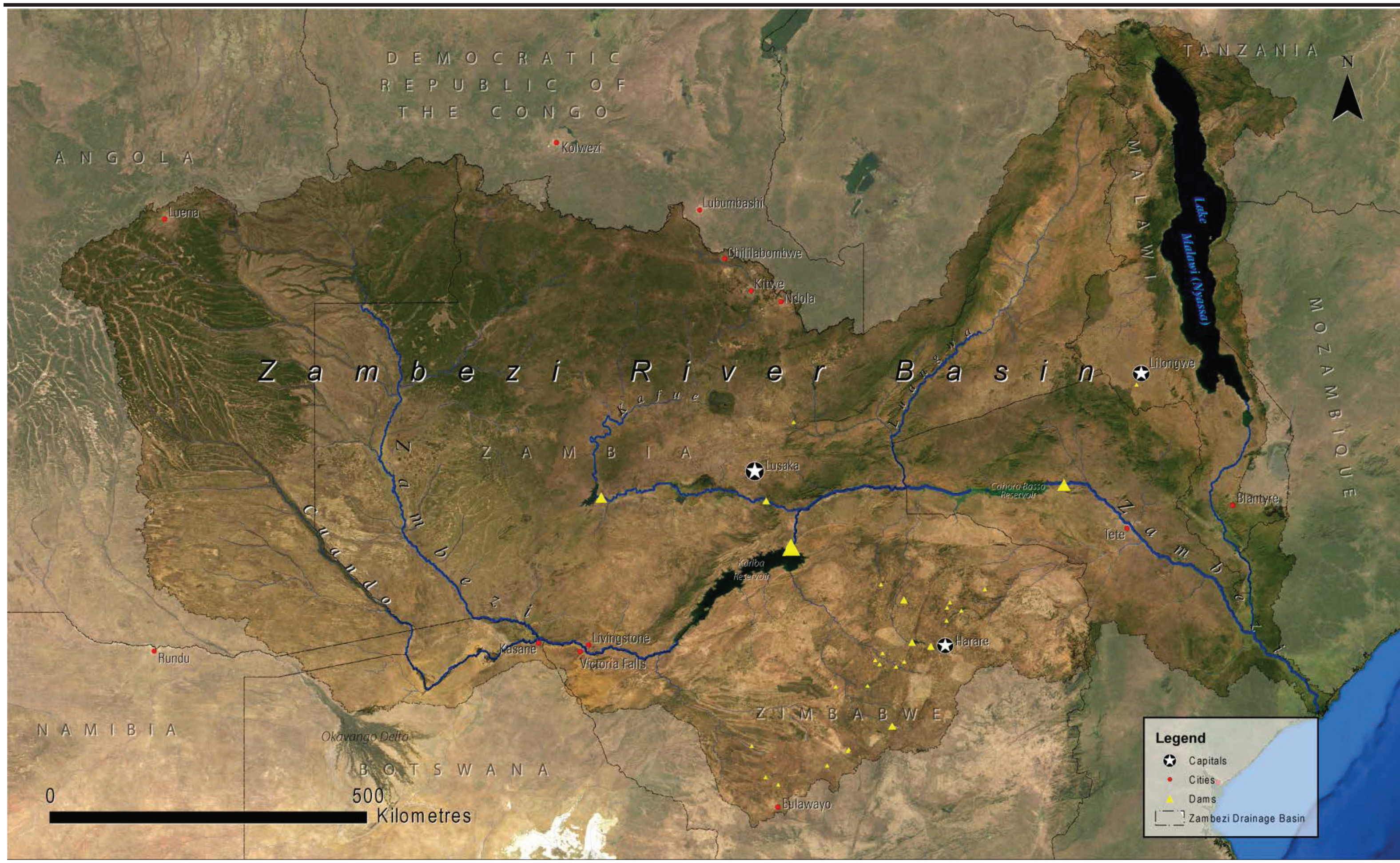
Figure 4.5 Flooding in the Zambezi River Basin between 1997 and 2007 [(1)]



Source: SADC and ZRA (2007)

(1) SADC and ZRA 2007. Rapid Assessment Report: Integrated Water Resources Management Strategy for the Zambezi River Basin. SADC Water Division. Gaborone.

Figure 4.6 ***Batoka Catchment***



Source: www.na.unep.net/atlas

4.2 *BIOLOGICAL ENVIRONMENT*

4.2.1 *Flora*

Flora within the Project Area

The project falls within the Sudano-Zambezian phytogeographic Region. This area is florally rich and characterised by a range of species with a very wide range of distribution which extends beyond southern Africa. It also contains many endemic species. Arid savannas, generally with eutrophic soils, extend to the drier hotter lowland valleys whereas the moist savannas are associated with leach soils of the central African plateau.

There are five main vegetation types with the principal determinants being characterised as distance from the river and slope as follows:

- Zambezi riparian vegetation, which is confined to a narrow band (50 metres) between the upper flood level of the Zambezi River and the elevation at which soil moisture becomes insufficient to support the high proportion of broad-leaved evergreen trees (ref *Box 4.1*);
- *Colophospermum mopane* woodland on the upper gentler slopes of the gorge, the gorge rim and immediate catchment area (ref: *Box 4.2*);
- *Commiphora*/mixed species woodland on steep, dry scree slopes (25 ^{o}-30 ^{o}) extending from the riverine fringe to the base of the basalt cliffs, above the Zambezi riparian vegetation (ref *Box 4.3*);
- Tributary riparian vegetation from the Zambezi riparian fringe, up several tributary side gorges and well developed in the shades of the cliffs and along perennial; streams such as the Daoma and Songwe (ref *Box 4.4*); and
- *Acacia nigrescens*/open scree woodland, found along the same topographic unit as the *Commiphora*/mixed species woodland, but usually on slopes with a southern/eastern aspect.

Modification of vegetation in the area has occurred through deforestation as a result of logging and due to grazing and browsing mainly by elephants.

Box 4.1 Zambezi Riparian Vegetation

Characteristic tree species (sometimes very large) are as follows:
Diospyros mespiliformis (Jackal berry), *Garcinia livingstonei* (African Mangosteen), *Searsia quartiniana, Ficus ingens* (Red-leaved Rock Fig), *Ficus abutifolia* (Large-leaf Rock Fig), *Combretum imberbe* (Leadwood), *Manilkara mochisia* (Lowveld milkberry), *Trichilia emetica* (Natal Mahogany), *Philenoptera violaceae* (Apple Leaf), *Berchemia discolour* (Red Ivory), *Mimusops zeyheri* (Red Milkwood) and *Strychnos potatorum* (Clearing Nut Tree).

Other common trees, shared with adjacent communities are:
Diospyros quiloensis (Crocodile-bark jackal-berry), *Gyrocarpus americanus* (Propeller tree), *Triplochiton zambesiacus* (Zambezi Oak), *Acacia nigrescens* (Knobthorn), *Pleurostyla africana* (Coffee Pear), *Cassine matabelica, Ximenia caffra* (Sour Plum), *Strychnos madagascariensis* (Monkey Orange), *Erythroxylum zambesiacum, Markhamia zanzibarica* (Bell Bean Tree),*Afzelia quanzensis* (Lucky Bean*), Olax dissitiflora (Small-fruited Olax), Zanha africana* (Velvet Fruit) and *Excoecaria bussei* (Pepper Seed).

Shrub species and other elements of the ground cover commonly include the following:
Gardenia resiniflua (Gardenia), *Canthium frangula* (Bride's Bush), *Steganotaenia araliacia* (Carrot Tree), *Margaritaria discoidea, Ehretia oppositifolia* (Puzzle Bush), *Phyllanthus reticulatus, Pavetta gardeniifolia* (Christmas Bride's Bush), *Bridelia cathartica* (Blue Sweetberry),*Sansevieria pearsonnii, Combretum obovatum* (White-leaved Bushwillow) ,*Vepris zambesiaca, Tricalysia junodii, Ximenia americana* (Sour Plum), *Mundulea sericea* (Cork Bush), *Grewia flavescens* (Donkey Berry), *Carphalea pubescens, Ehretia obtusifolia, Fluggea virosa* (Snowberry Tree), *Nuxia oppositifolia, Jasminum stenolobum, Megalochlamys hamate, Combretum mossambicense* (Knobbly bushwillow), *Diospyros squarrosa* and *Friesodielsia obovata* (Northern Dwaba-berry).

Scramblers and lianes, often extending into the upper canopy include:
Artabotrys brachypetalus, Combretum paniculatum (Forest Flame Creeper), *Jasminum fluminense, Tiliacora funifera* and *Hippocratea africana* (African Paddle-pod).

Box 4.2 Colophospermum mopane woodland species

Characteristic tree species include:
Colophospermum mopane (Mopane), *Kirkia acuminata* (White Syringa), *Combretum apiculatum* (Jessebush), *Acacia nigrescens* (Knobthorn), *Diospyros quiloensis, Cassia abbreviata* (Sjambok Bean), *Terminalia prunioides* (Purple-pod Terminalia), *Erythroxylum zambesiacum, Terminalia stuhlmannii, Sterculia africana, Commiphora pyracanthoides, Lannea discolour, Commiphora mossambicensis, Sclerocarya birrea* (Marula) and *Commiphora mollis* (Corkwood Commiphora)

Common shrub species are:
Combretum elaeagnoides, Croton gratissimus (Lavender Croton), *Croton menyhartii, Carphalea pubescens, Mundulea sericea* (Corkwood), *Grewia bicolor* (White Raisin), *Gardenia resiniflua* (Gummy Gardenia) and *Ximenia americana* (Sour Plum)

Box 4.3 Commiphora/mixed species woodland

Characteristic tree species are:
Commiphora caerulea, Commiphora marlothii, Commiphora mollis (Corkwood Commiphora), *Entandrophragma caudatum, Markhamia zanzibarica* (Bell Bean Tree), *Acacia nigrescens, Acacia Senegal, Terminalia prunioides* (Purple-pod Terminalia), *Diospyros quiloensis* (Crocodile-bark Jackalberry), *Kirkia acuminata* (White Syringa), *Sterculia africana, Sterculia quinquiloba, Boscia angustifolia* and *Albizia brevifolia*

The understorey, often thicket-like, includes:
Steganotaenia araliacia (Carrot Tree), *Grewia flavescens* (Donkey Berry), *Grewia bicolor* (White Raisin), *Croton menyhartii, Hippocratea buchananii* (Velvet Paddle-pod), *Vitex mombassae* (Smelly-berry Fingerleaf), *Olax dissitiflora, Strophanthus kombe, Friesodielsia obovata* (Northern Dwaba-berry), *Gardenia resiniffua, Combretum elaeagnoides, Combretum mossambicensis* (Velvet-leaf Bushwillow), *Combretum albopunctatum, Acacia eriocarpa, Acacia schweinfurthii* (River Climbing Acacia), *Tricalysia junodii* and *Fockea multiflora* (Python Vine)

Box 4.4 Tributary riparian vegetation

Characteristic tree species are:
Trichilia emetica (Natal Mahogany), *Garcinia livingstonei* (African Mangosteen), *Diospyros mespiliformis* (Jackal Berry), *Strychnos potatorum* (Clearing Nut Tree), *Mimusops zeyheri* (Red Milkwood), *Cleistochlamys kirkii, Pappea capensis* (Jacket Plum), *Philenoptera violaceae* (Apple Leaf), *Syzygium cordatum* (Water berry), *Ficus ingens* (Red-leaved Rock Fig), *Ficus capensis* (Common Fig), *Ficus sur* (Broom Cluster Fig) and *Olea europaea africana* (Wild Olive)

Common understorey species, forming dense thickets in sections of the gorges, include:
Acacia ataxacantha (Fire-thorn Acacia), *Cordia pilosissima* (Woolly Saucer-berry), *Nuxia oppositifolia* (Water Elder), *Flueggea virosa* (Snowberry Tree), *Phyllanthus reticulatus, Bauhinia petersiana* (White Bauhinia), *Mimosa pigra* (Sensitive Plant), *Pavetta gardeniifolia* (Christmas Bride's Bush), *Friesodielsia obovata* (Northern Dwaba-berry), *Rhus tenuinervis, Feretia aeruginescens, Bridelia cathartica* (Blue Sweetberry), *Grewia flavescens* (Donkey Berry), *Tricalysia junodii*, and *Euclea racemosa*

Box 4.5 Acacia nigrescens/open scree woodland

Characteristic tree species are:
Acacia nigrescens(Knobthorn), *Kirkia acuminata* (White Syringa), *Combretum adenogonium* (Three-leaved Combretum), *Combretum apiculatum* (Jessebush), *Sclerocarya birrea* (Marula), *Ziziphus mucronata* (Buffalo Thorn), *Diospyros mespilformis* (Jackal Berry) and *Diospyros quiloensis* (Crocodile-bark Jackalberry)

Common shrub species include:
Dalbergia melanoxylon (African Blackwood), *Croton gratissimus* (Lavendar Croton), *Carphalea pubescens, Combretum mossambicensis* (Velvet-leaved Bushwillow), *Mundulea sericea* (Corkwood), *Pavetta gardeniifolia* (Christmas Bride’s Bush), *Stereospermum kunthianum*, *Philenoptera violaceae* (Apple Leaf), *Markhamia zanzibarica* (Bell Bean Tree), *Pterocarpus rotundifolius* (Round-leaved Bloodwood), *Diplorhynchus condylocarpon* (Horn Pod), *Crossopteryx febrifuga, Erythroxylum zambesiacum, Bauhinia petersiana* (White Bauhinia), *Grewia flavescens* (Donkey Berry), *Grewia bicolor* (White Raisin), *Ximenia americana* (Sour Plum) and *Hippocratea buchananii* (Velvet Paddle-pod).

4.2.2 *Fauna*

The proposed project lies within the sphere of influence of the Kavango-Zambezi Transfrontier Conservation Area (KAZA TFCA), formerly known as the Four Corners TFCA. The TFCA forms part of a regional initiative from the governments of Angola, Namibia, Zambia, Botswana and Zimbabwe; the primary objective of which is to link the fragmented wildlife habitats into an interconnected mosaic of protected areas and trans-boundary wildlife corridors, to facilitate and enhance the free movement of animals across international boundaries. Wildlife studies conducted in the 1998 study, however, revealed little wildlife on both banks of the river, apart from small game. With respect to the issue of wildlife corridors, the 1998 study found no evidence of these, citing increased human settlements in the area, especially in Zimbabwe, which has interfered with wildlife movement into the area (BJVC 1993).

Previous ESIA studies have established that due to the rugged terrain of the Batoka Gorge, the species diversity of resident mammals is relatively low. Within the gorge are large mammals adapted to rocky terrain such as vervet monkeys (*Cercopithecus pygerythrus*), chacma baboons (*Papio ursinus*) and klipspringers (*Oreotragus oreotragus*). Larger mammals including kudu (*Tragelaphus strepsciceros*) and buffalo (*Syncerus caffer*) are occasionally seen within the gorge along the Zambezi shoreline where access is possible through minor side-gorges. Some large predators such as leopard (*Panthera pardus*) and hyena (*Crocuta crocuta*) are also occasionally spotted and lion (*Panthera leo*) are known to pass through the area. Various bat species have also been found within the numerous crevices and overhangs of the Gorge. Elephants (*Loxodonta africana*) frequently move through the greater area and there is abundant evidence of their presence in the form of broken trees, paths and feaces.

The Batoka Gorge is listed as an Important Bird Area (IBA) of continental significance (Childes & Mundy 2001) based on the presence of breeding Taita Falcons (*Falco fasciinucha*), a threatened (Vulnerable) and range restricted species. This bird survives in small populations but populations have experienced a recent decline. If this trend continues, the species may be endangered in the near future.

The Batoka Gorge also contains an important breeding population of the White collared or Rock Pratincole (*Glareola nuchalis*), and Black Stork (*Ciconia nigra*), both of which are not threatened species but are regionally important populations. There is also a high diversity of raptors which include a variety of vulnerable and near threatened species.

4.3 *PROTECTED AREAS*

The location of the protected sites in the project area are depicted in *Figure 4.7*. These include the Victoria Falls or *Mosi-oa-Tunya* (the smoke that thunders), a UNESCO world heritage site on the Zambezi River.

The Falls extends over 6,860 ha and comprise 3,779 ha of the Mosi-oa-Tunya National Park (Zambia), 2340 ha of Victoria Falls National Park (Zimbabwe) and 741 ha of the riverine strip of Zambezi National Park (Zimbabwe) (1), located upstream of the Falls. The Mosi-oa-Tunya National Park is approximately 66 km^2 and the Victoria Falls National Park, 23 km^2.

4.4 *SOCIAL ECONOMIC ENVIRONMENT*

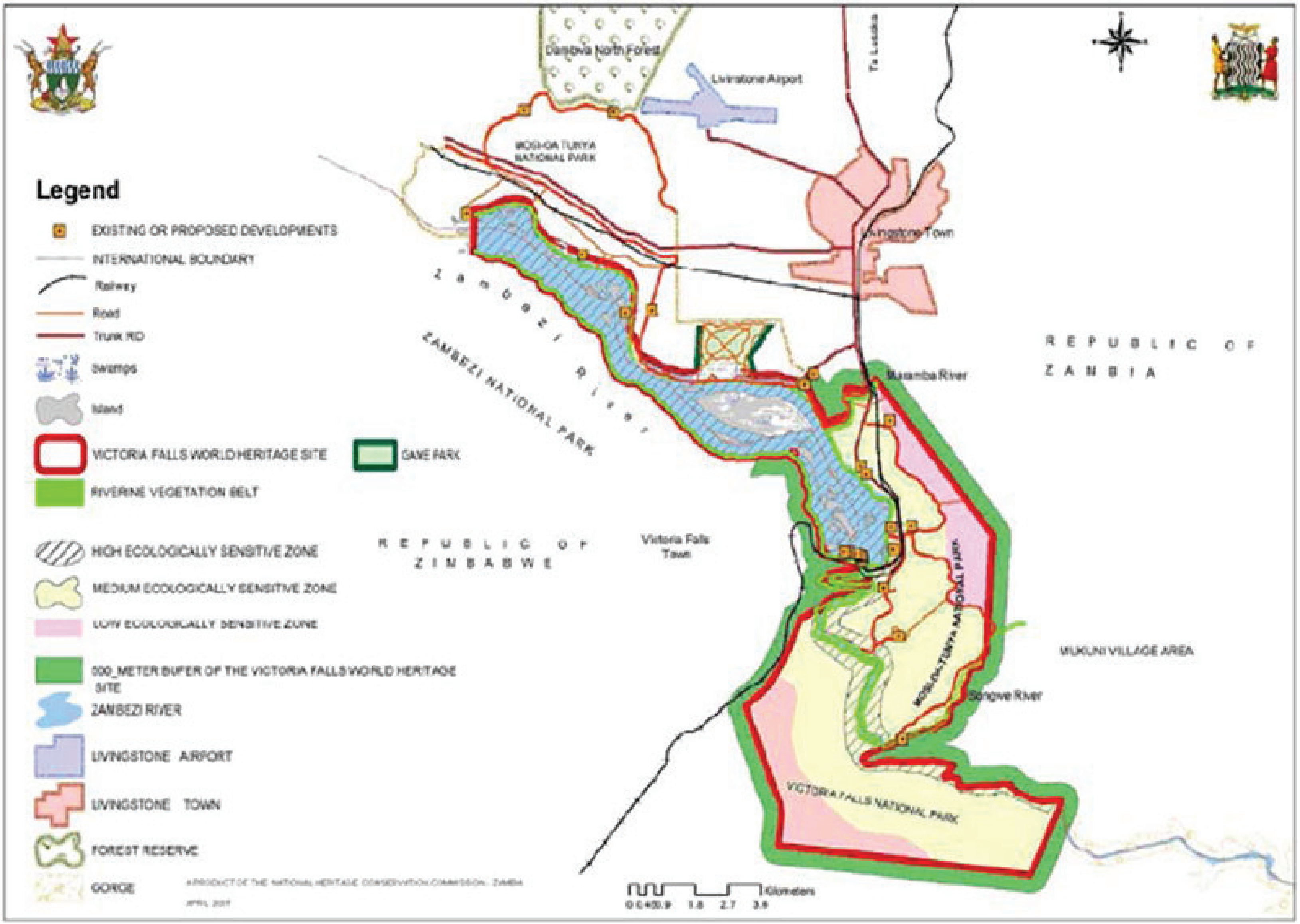
The following section details the local socio-economic environment for both Zambia and Zimbabwe, of the Project Affected Area.

Jurisdiction of the Project Affected Area

In Zimbabwe, the proposed scheme falls within the province of Matabeleland North and in the Hwange Rural District. It includes the wards of Matetsi, Chidobe, Katchecheti, Nemanhanga, Mbizha, Jambezi, Sidinda, Mashala and Simangani. The traditional authorities in the area of impact in Zimbabwe include chief Shana, Bishop Matata Sibanda (who is Acting Chief for Mvutu who has recently deceased) and Chief Hwange. In Zambia, the main area of direct impact falls under the Southern Province in the Kazungula District, most notably the wards of Mukuni Ward and Katapazi, which fall under Chief Mukuni's jurisdiction. However, impacts will also be felt in Livingstone District, Zimba District and Choma District and downstream impacts are likely to be experienced in the District of Kalomo. This is depicted in *Table 4.1* below.

(1) UNESCO World Heritage Centre (2014) Mosi-oa-Tunya/Victoria Falls http://whc.unesco.org/en/list/509

Figure 4.7 Location of the Protected Areas



Source: UNESCO (2014), Joint Management Plan for the Mosi-oa-Tunya/Victoria Falls World Heritage Site

Table 4.1 Areas Falling within the Project Footprint

	Province	District	Ward	Traditional Authority
Zimbabwe				
Dam inundation area and associated infrastructure	Matabeleland North	• Hwange Rural	• Chidobe • Katchecheti • Nemanhanga • Jambezi	• Chief Shana
Transmission line infrastructure	Matabeleland North	• Hwange Rural	• Matetsi • Nemanhanga • Mbizha • Jambezi • Sidinda • Mashala	• Chief Shana • Bishop Matata Sibanda (Acting Chief for Mvutu) • Chief Hwange
Zambia				
Dam inundation area and associated infrastructure	Southern	• Livingstone • Kazungula • Kalomo •	• To be verified.	• Chief Mukuni • Other chiefs to be confirmed
Transmission line infrastructure	Southern	• Kazungula • Zimba • Choma	• Mukuni • Katapazi	• Chief Mukuni • Possibly the following (as identified in the Kafue/ Livingstone EIA and remaining to be confirmed): o Syanjalika o Musokotwane o Sipatunyana o Simwatachela o Singani o Hamaundu o Hanjalika o Chikanta o Chona o Naluwama o Mweenda

The socio-economic baselines for the project affected areas are described for both countries below. Both areas share many similar characteristics and to avoid repetition, a general overview has been provided. Where differences exist, references are made within the body of the text.

Demographics

The project area is historically a location which has been a meeting ground for various tribal groups. This can still be seen through the cultural and ethnic groupings. On the Zimbabwean bank of the Zambezi, the Valley Tonga are still represented by the Dombe clusters in the villages located within the project area. A Shona-speaking offshoot of the Great Zimbabwe culture, the Nambiya, who settled in the area in the 18th and early 19th century are still a prominent ethnic group. There are also large populations of Ndebele, who relocated into the area in the 1950's (BJVC 1993, PVT 1998). Accordingly the languages spoken in the social area of influence include Shona, Nambya, Ndebele and English. On the Zambian side, the Toka-Leya, whose origins are to the north in the Kabwe area, are the predominant ethnic group (BJVC 1993, PVT 1998). Consequently, the predominant language spoken in the region is Toka-Leya. These peoples live under communal tenure conditions (BJVC 1993, PVT 1998).

Population densities are higher on the Zimbabwean side. Data from 2012 records a population of 13,061,239 people in Zimbabwe. Matebeleland North Province, which covers a land area of 75,025 km² has a population of 749, 017, representing 5.7 % of the national population. Hwange District, which incorporates Hwange Urban and Hwange Rural, as well as the town of Victoria Falls has the largest land area in comparison to other districts in the province and has a population of 133,940; of which 65,442 are male and 68,498 are female. Hwange Rural District has 15488 households, and an average of 4 persons per household. Hwange Urban, which houses the local municipality and administrative, business and commercial centres in the province, has a population of 37,522people, made up of 9,992 households. Victoria Falls has a population of 33,748, made up of 9,262 households (Zimstats, 2012).

The 2010 census recorded a population of 13,092,666 in Zambia. However, the Government and the United Nations Population Fund predicted that the population would reach 15.5 million by 2015 (1). The Southern Province has a population of 1,589,926 representing 12.1 % of the national population. It is made up of 779,659 males and 810,267 females. The majority of people within the province live in rural as opposed to urban areas (1,197,751 people versus 392,175). Kazulunga district has a population of 104,731 people and covers a land area measuring 16,835 km² (Zambia, Central Statistical Office, 2010).

Governance & Administration

The project area in Zimbabwe falls under the local administrative authority of the Hwange Rural District Council (HRDC). The HRDC is managed by a technical management team that is led by a Chief Executive Officer. The council also has an elected Council Chairperson, who provides oversight to the elected councillors that represent the administrative wards within the District.

From a customary land ownership perspective, wards are made up of a number of villages that are administered by a traditional leader or village headman, who oversee the management of village issues and report to traditional chiefs whose areas of jurisdiction cut across villages and wards. Village heads and chiefs traditionally handle land and cultural issues and are empowered to do so by the Traditional Leaders' Act. They are also registered and acknowledged by the Ministry of Local Government. The Hwange Local

(1) Country Programme Action Plan 2011 – 2015 of the Government of the Republic of Zambia and the United Nations Development Programme

board that represents the Hwange town and the Victoria Falls Municipality are local authorities that have a stake in the project.

In Zambia, the project area falls under the local administrative authority of the Kazungula District Council, which is divided into 14 wards. The District Commissioner (DC) is the most senior government official in the district. In addition to general district administration, the DC coordinates all district developmental activities, such as those related to education, health and agriculture, etc. To discharge these functions, the DC heads the District Development Coordinating Committee (DDCC), whose composition encompasses district government departments, the Council, major companies in the district, community based organizations (CBO's) and Non-Governmental Organizations (NGO's). The District council has elected officials ie councillors who represent the wards. Villages are administered by a traditional leader or village headman, who are under the jurisdiction of the chief.

Livelihoods

Site observations confirmed literature reports that household economies in both Zambia and Zimbabwe are characterised by dryland cropping, livestock rearing (notably cattle, but also goats), collection and sale of grass (for the construction of roofs for homesteads), curios and some wage labour (BJVC 1993, PVT 1998). The Zambezi National Park sometimes provides transport to communities to facilitate their access to grass collection sites in their areas of administration. Crops grown in the project area in both countries were observed to include sorghum, maize and vegetables; however, agriculture is noted to be limited by infertile land and the rocky terrain. Conversations with wildlife experts on the site visit revealed that human animal conflict is a problem on both the Zambian and Zimbabwean side of the river and hampers agricultural and livestock activities; wild animals in the area (eg elephants, hyena etc) have killed and eaten livestock and trampled crop gardens. As a result, there is currently a pilot training programme being run in a few rural settlements in the Zimbabwean project area aimed to provide education to local women on how to enhance agricultural productivity on smaller parcels of land. This is based on the notion that smaller land areas will be easier to protect from wildlife threats. It is not yet known if similar training programmes are also being implemented in Mukuni, Zambia however, there are many NGOs that are active in the area that will be consulted during the data collection phase to identify if they also administer such training programmes. Aside from livestock and agricultural activities, household food needs are also met by hunting for bush meat, including kudu, impala, eland, and buffalos. Animals are also poached for their tusks. This, as well as the poaching of trees for curios, has led to the establishment of the Anti-Poaching Units in both Zambia and Zimbabwe.

The biggest source of wage income for the communities in the Project area is the sale of curios and engagement in the tourist industry (BJVC 1993, PVT 1998). Markets for the sale of curios, including intricately carved wooden animals, baskets and jewellery, sold largely to tourists, were observed in both Livingstone and Mukuni village in Zambia and Victoria Falls in Zimbabwe. Informal conversations with local wildlife experts revealed that the cutting of trees to make curios is a threat to forest areas in both countries. Trees cut tend to be hardwood varieties which take a long time to grow (about 100 years) and as a result, some tree species are now under threat. Some of the tree species affected include *Dalbergia melanoxylon* (African Blackwood), *Combretum imberbe* (Leadwood), *Berchemia discolor* (Red Ivory) and *Diospyros mespiliformis* (Jackal berry). Carvings made from the wood of these trees for sale to tourists were observed in markets in Victoria Falls and Livingstone. Whilst the forestry departments in both Zambia and Zimbabwe require the possession of a license which permits the cutting of a limited number of trees, many involved in the curio trade either do not obtain such licenses or, flout the rules. In addition, in Zimbabwe local wildlife experts reported that reported that the Forest Commission lacks the capacity to ensure that such regulations are followed.

The 1998 studies reported the occurrence of fishing in the gorge by locals on both sides of the river (PVT 1998). Whilst no fishing was observed on the site visit, local informants noted that it still takes place. Fishing surveys undertaken in 1997 and 1998 revealed that at that time, around ten part-time local fishermen used the gorge. No professional fishermen were noted. Methods of fishing were hand nets and rod lines and it was reported that fishermen walked up to 15km to get to the gorge to fish and camped for up to one to two weeks in the valley until they had caught an adequate supply. Conversations with locals confirmed that fishing still takes place at the gorge and that fisherman dry and smoke their catch to preserve it. The 1998 studies revealed that whilst most catch was used for consumption purposes, some was also sold in Victoria Falls and Livingstone. Fish catches are highest during high flow, and more fishermen are engaged in fishing at this time. The 1998 studies estimated that there could be a tenfold increase in fishing yields if the Project is developed, as a result of increased accessibility. It was also noted that there are potentials for a commercial fishery to be established after impoundment (PVT 1998).

Fish species caught by fishermen in the Batoka Gorge during the 1997 and 1998 surveys included (roughly in order of importance) *Hydrocynus vittatus* (Tiger Fish), *Synodontis zambezensis* (Brown Squeaker), *Distichodus schenga* (Chessa), *Labeo cylindricus* (Red-eyed Labeo), *Labeo altivelis* (Sailfin Mudsucker), *Distichodus schenga* (Chessa), *Distichodus mossambicus* (Nkupe), *Oreochromis mortimeri* (Kariba Tilapia), *Tilapia rendalli* (Northern Red-breasted Tilapia) and *Clarias gariepinus* (Common Catfish).

Tourism

The tourism industry in Zimbabwe has gone through a number of significant changes over the last few decades. During the period 1980 – 2000 tourism was amongst the fastest-growing sectors in the country, contributing significantly to GDP (Karambakuwa *et al.* 2011) and providing high quality reliable tourism products. However, political instability starting in 2001/02 and the global recession in 2008 saw tourism in Zimbabwe decrease substantially over this period, with travel bans and negative international media coverage impacting heavily on the tourism sector (Karambakuwa *et al.* 2011). International arrivals started to recover in 2010 but then pre-election violence and instability in 2012 resulted in a 25% reduction in total tourist arrivals. Numbers have started recovering again, and a total of 1,832,570 international arrivals were recorded in Zimbabwe in 2013. The direct contribution of travel and tourism to GDP in 2013 was USD 420.1 million, 5.6% of total GDP in Zimbabwe (WTTC 2014a). This was forecast to rise by a further 4.4% in 2014 (WTTC 2014a).

In Zambia tourism is one of the fastest-growing sectors and has been identified by government as a priority growth area for the national economy (Zambian Development Agency 2014). Many believe tourism to potentially be one of Zambia's best prospects for economic growth and diversification (Banda & Cheelo 2012, Rogerson 2004). The tourism sector is still relatively small but has been growing steadily over the last decade and has huge potential to develop even further (Dixey 2005, Chaunga *et al.* 2013). The tourism sector has, and still is to an extent, faced with a number of challenges and inhibitors to development (Pope 2005, Chaunga *et al*. 2013). These include inadequate investment and budgetary allocations, poor management and coordination between the public and private sectors, lack of research, data and inadequate statistical collection databases, lack of infrastructure and high destination costs when compared to other countries in the region (Pope 2005, Chaunga *et al*. 2013).

Tourism is a key income source in the Project area (BJVC 1993, PVT 1998) and there are few other income generating opportunities in the area. Activities offered to tourists that make use of the Zambezi River and / or Batoka Gorge include white water rafting, Jet Extreme Boating, birding, angling, hiking and scenic flights. Although these activities employ fewer people than the rafting industry, they are popular activities amongst nature- and adventure-based tourists that are visiting the area specifically for a high quality birding, angling or hiking experience and contribute to direct tourism expenditure [(1)]. In addition, there are a few accommodation establishments that have excellent strategic points for viewing the raptors and the dramatic Batoka Gorge scenery. These include the Victoria Falls Hotel, Gorges Lodge and Taita Falcon Lodge.

Rafting downstream of the Victoria Falls is considered to be one of the best white water rafting experiences in the world because of the number of high grade rapids in succession over a short stretch of river as well as the wild, untouched nature of the Zambezi River.

White water rafting is offered as a half-day, full-day or up to five day activity which includes camping in the Batoka Gorge for tours longer than the standard one day excursion. Half-day rafting includes rapids 1 – 10 and full-

(1)Anchor Environmental Consultants (2015) Batoka Gorge Hydro-Electric Scheme Environmental and Social Impact Assessment: Economic Assessment day includes rapids 1 – 18 (Zimbabwe) and 1 – 25 (Zambia). White water rafting is seasonal and dependent on the level of water. Rafting businesses rely on full-day and multi-day trips from August to December to make up for periods of the year when rafting is limited or non-operational. During December to May water levels are high and only certain rapids can be rafted. From August to December water levels are low and all rapids are open.

There are 11 rafting companies that operate on the Zambezi River. Although not substantiated by concrete data, informal conversations with those working in the tourist industry on the site visit hinted that white water rafting has not met with the projected income streams noted in the previous EIA studies. It was claimed that lion walking may now be one of the key tourist attractions in the area. Further research will be required to validate this claim.

Health

In 2011, Zimbabwe had a total of 1,539 health facilities. This included seven provincial hospitals, 1,339 clinics and rural health centres, 179 district mission and rural hospitals and 13 healthcare facilities that provided tertiary care (Zimstat 2011). In 2010, Zambia had a total of 1,882 health facilities, including six specialised hospitals, 21 General hospitals, 84 District hospitals, 1,496 Urban and Rural Health Centres and 275 Health Posts (Ministry of Health, 2011).

Victoria Falls and Livingstone both have government hospitals. There is also Lukosi Rural Hospital, a missionary hospital (St Patricks) and a private hospital (at Hwange Colliery) in Hwange in Zimbabwe. Some rural settlements also have clinics. In the Zimbabwean project area, health facilities include Chisuma clinic, Jambezi clinic, Ndlovu Clinic and the Sacred Heart Mission. These serve a catchment area of up to 32km. In the Zambian Project area, there is a rural health centre in Mukuni, which serves a catchment area of up to 30km and a catchment population of over 10,000. Informal conversations with local residents revealed that these health facilities often lack modern equipment and are constrained by limited staff numbers. In the communities, people tend to use the community clinics and only access the hospitals when they have more serious health problems that cannot be treated by the clinics.

In the 1993 studies, the health of communities was reported to be poor, with the main health issues noted being malnutrition, malaria, helminthiasis and diseases associated with poor sanitation (BJVC 1993). Health workers in Hwange Rural District (Zimbabwe) and in Livingstone and Kazungula District (Zambia) noted that rates of malaria in the area have reduced due to the effectiveness of preventative measures such as spraying and use of mosquito nets. In Kazungula, malaria has decreased from 150 cases per 1,000 people in 2005 to 34 cases per 1,000 in 2014 (1).

(1) http://akros.com/news/zambia-commemorates-world-malaria-day/

In Zimbabwe, HIV prevalence rate at the national level is 15 %, compared to 18 % for Matebeleland North Province (Zimbabwe Demographic and Health Survey, 2010-2011). In Hwange Town the 'National Behaviour Change' sex work programme supports sex workers to reduce transmission of STIs. This has included sensitisation as well as the distribution of condoms; it has been reported that men pay sex workers a higher fee for unprotected sex thus contributing to the spread of infection. Their research found that in 2012 Hwange District had the highest prevalence of STIs in Matabeleland North Province (1). The National AIDS Council has attributed Hwange Rural District's high prevalence rates as a result of the presence of miners and transport drivers (truckers), who are predominantly male, have a relatively good income and are often spend time away from their wives and are therefore more likely to engage in extramarital sex.

In 2013, approximately 13 % of the Zambian population was recorded as being HIV positive. A health worker at Mukuni Clinic health reported that rates of HIV/AIDs in the local area were as high as 30%, significantly above the district average of 14% and 31% in Livingstone town. Relevant district health officers noted rates of 8% in Zimba and 16% in Kalomo and Choma. High prevalence os attributed to multiple sexual partners, and the occurrence of unprotected sex, as well as limited recreational and livelihood opportunities available for youth. The latter is perceived to have fostered alcoholic consumption and high risk sexual activity. In Choma, Kalomo and Zimba it was also noted that mother to child transmission was a common route of infection, either through pregnancy, childbirth or breastfeeding.
The infant mortality rate in Zambia is 45 deaths per 1,000 live births while the maternal mortality ratio is 398 per 100,000 live births (Zambia Demographic and Health Survey, 2013).

Education

The number of primary schools recorded in Zimbabwe in 2008 was 5,690 and secondary schools totalled 2,182 (2). In 2010, Zambia had 9,137 schools; 1,239 of which were located in the Southern Province. Choma District has the greatest number of schools (188 in total) reflecting its larger population and accordingly, great number of students (3). Zimba has the lowest at 63, including two secondary schools (one being grant aided), 31 state primary schools and 30 community schools (4). There is currently a focus on transforming some of the community schools into formal secondary schools in the District.

Literacy rates in Zimbabwe are reported to be 97 %, amongst the highest in Africa (Zimstat 2012). In Zambia, the literacy rate was 70.2 % in 2010. Literacy rates are higher in urban than rural areas (84 % and 61 %

(1) http://www.herald.co.zw/hwanges-sex-horror/ Accessed 15.03.2015
(2) National Report on the Status of Education by Zimbabwe. 2008. Available at http://www.ibe.unesco.org/National_Reports/ICE_2008/zimbabwe_NR08.pdf
(3) http://www.muzoka.com/page7muzoka.html. Accessed 29.01.2015
(4) The District Planning Unit. Zima District Council. 2013. Zimba District Situation Analysis, The Republic of Zambia.

respectively). Males also have a higher literacy rate (73 %) than females (67 %) (Zambia, Central Statistical Office, 2010).

Infrastructure

Houses observed in rural settlements on both sides of the river were mainly constructed from mud walls and grass thatched roofs. However, a few houses were observed to be made from bricks and asbestos roofs, especially those located close to the chief's residences.

Infrastructure in the rural communities consists of churches, primary schools, clinics, boreholes and wells and cattle dips, as well as kraals. In Zimbabwe, a number of shops were also noted, mainly selling foodstuffs. The area also has a number of business centres, such as Jambezi rural centre, which accommodates a cluster of retail outlets. Gravel roads connect settlements with the two towns upriver at Victoria Falls and Livingstone. Access to communities requires the use of robust 4 x 4 vehicles. Public transport is virtually non-existent and the majority of community members either walk or rely on private taxis.

The airport at Victoria Falls is currently undergoing expansion to allow for a new international terminal building and access roads. This development was not referenced in the literature made available and will be considered as part of the cumulative impacts for the Project.

Access to Water and Sanitation Facilities

On average, approximately 70 % of rural households in Zimbabwe in 2013 had access to drinking water from improved sources [(1)]; Matabeleland North province had one of the highest coverage rates in the country at 77 % (ZimVAC, 2013). In Zambia, use of improved drinking source since 2011 was reported to be 64% (UNICEF 2014). The Zimbabwean Rural Livelihoods Assessment, undertaken in 2013, reported that 48 % of households in the country use improved sanitation facilities. Matabeleland North province however, has one of the poorest levels of access to such facilitates, with 70 % of residents practicing open air defecation compared to the national average of 39 % (ZimVAC, 2013). Use of improved water drinking sources in Zambia in 2011 was estimated to be 64 % and use of improved sanitation facilitates at 42 % (UNICEF 2014).

4.5 *CULTURE AND HERITAGE*

There are 63 sites of archaeological interest currently known in and around the proposed Batoka Gorge HES. These are presented in *Table 4.2*. Cultural

(1) An improved water source is defined by the World Health Organisation (WHO) as one that, by nature of its construction or through active intervention, is protected from outside contamination, in particular from contamination with faecal matter. Improved water sources include piped, borehole, protected well, protected spring, rainwater harvester, water trucking and bottled water.

heritage field work in Zambia is due to take place in January 2015; this may identify further sites of archaeological interest. *Table 4.2* shows that archaeological remains are present from as early as 400,000 years ago to the period just prior to colonisation. Even earlier remains are probable given that they have been found on the Zambia side of the River.

Most sites in Zambia and Zimbabwe derive from the Stone Age and are associated with the extensive colluvial and perched alluvial deposits that line the crest of the gorge and along the waterways (Armstrong & Jones 1936; Clark 1975). From the reports it is difficult to know if these sites are intact and well preserved with value to archaeological research, or whether they are in secondary (mixed) contexts where archaeological remains from different periods are mixed together, and therefore are of limited interest.

There are probably locally important sites used for ritual activity, especially rainmaking. Known as malende, they are often associated with large trees such as baobabs, but also river pools, hot springs, mountains and waterfalls (Huffman 1989; Ncube 2004). These intangible cultural heritage sites are common through the Nambya and Tonga communities.

To date no fossil remains have been recovered in the area, but as the 1998 report clearly states, the possibility is there. The sandstone lenses with the basalt flows have been found elsewhere to contain important dinosaur remains. In order to protect physical cultural resources that are found unexpectedly during project implementation, a Chance Finds Management Plan will be developed.

Table 4.2 shows the sites of tangible cultural heritage known in the Project area.

Table 4.2 Sites of Known Tangible Cultural Heritage in the Project Area

	Source of information	UTM reading	Cultural Association	Site name
Zambia				
1	1998 survey	042-188	Early Stone Age	Chibongo
2	1998 survey	901-199	Middle Stone Age	Mukuni
3	1998 survey	899-198	Early & Middle Stone Age	Mukuni
4	1998 survey	897-197	Multi-component	Mukuni
5	1998 survey	911-192	Early & Middle Stone Age	Singangu
6	1998 survey	934-187	Middle Stone Age	Singandu
7	1998 survey	932-188	Early Iron Age	Singandu
8	1998 survey	948-185	Early Iron Age	Singandu
9	1998 survey	964-186	Early & Middle Stone Age	Singandu
10	1998 survey	975-186	Early Stone Age	Kabozya
11	1998 survey	001-182	Early & Middle Stone Age	Kabozya
12	1998 survey	001-196	Late Stone Age	
13	1998 survey	993-194	Late Iron Age	
14	1998 survey	993-192	Late Stone & Iron Age	
15	1998 survey	014-203	Late Stone Age	
16	1998 survey	044-207	Late Iron Age	Lombelombe
17	1998 survey	051-208	Middle & Late Stone Age	Lombelombe

18	1998 survey	019-205	Late Stone Age	
19	1998 survey	043-195	Early Stone Age	Chibonga
20	1998 survey	951-185	Late Iron Age	Kanbozya
21	1998 survey	026-182	Late Iron Age	Momba Highlands
22	1998 survey	990-168	Early & Middle Stone Age	Momba
23	1998 survey	994-166	Middle & Late Stone Age	Momba
24	1998 survey	010-166	Middle and Late Stone Age	Momba Flood Plain
25	1998 survey	967-114	Middle Stone Age	Kabozya
Zimbabwe				
1	Arch survey	739-104	Stone Age	
2	Arch survey	774-194	Middle Stone Age	Big Tree
3	Arch survey	770-187	Late Stone Age	
4	1993 survey	897-102		Chemapato Hill
32	1993 survey	895-083	Middle Stone Age	Chisuma I
6	1993 survey	894-086	Middle or Late Stone Age	Chisuma II
7	1993 survey	898-088	Middle Stone Age	Chisuma III
8	1998 survey	089-114	Late Farming Community	
9	1998 survey	074-114	Middle Stone Age	
10	1998 survey	075-115	Middle Stone Age	
11	1998 survey	075-119	Middle & Late Stone Age	
12	1998 survey	086-112	Middle & Late Stone Age	
13	1998 survey	107-126	Multi-component site	
14	1998 survey	106-125	Late Farming Community	
15	1998 survey	094-124	Multi-component site	
16	1998 survey	093-128	Multi-component site	
17	1998 survey	087-127	Late Stone Age	
18	1998 survey	076-130	Middle Stone Age	
19	1998 survey	092-134	Middle Stone Age	
20	1998 survey	074-067	Multi-component site	Ncube Muuyu
21	1998 survey	070-085	Farming Community site	Mpinami
22	1998 survey	074-087	Late Farming Community	
23	1998 survey	076-088	Late Farming Community	Mpinami
24	1998 survey	138-148	Middle & Late Stone Age	
25	1998 survey	137-149	Middle Stone Age	
26	1998 survey	129-135	Middle Stone Age	
27	1998 survey	885-101	Middle Stone Age	Gorges Lodge
28	1998 survey	092-139	Middle Stone Age	
29	1998 survey	108-129	Multi-component site	
30	1998 survey	082-107	Middle Stone Age	
31	1998 survey	078-092	Late Stone Age	Mpinami
32	1998 survey	921-091	Late Stone Age	Ayelukwa
33	1998 survey	992-093	Middle Stone Age	Ayelukwa
34	1998 survey	930-098	Middle & Late Stone Age	Shearwater
35	1998 survey	939-098	Late Stone Age	
36	1998 survey	122-987	Middle Stone Age	
37	1998 survey	962-121	Late Farming Community	
38	1998 survey	954-121	Late Stone Age	

Source: PVT 1998

One site given prominence in the BJVC (1993) report, is the Chemapato Hill site, which is an isolated hillock on the Zimbabwean side of the Batoka Gorge. Although no grid reference is given, the site is correctly mapped and a brief description of the cultural remains is provided. The sacred nature of the hill and its artefacts and their importance to the nearby residents of Chimusa village is highlighted in this report.

The consultants who undertook the 1993 and 1998 studies reaffirmed the observation that most heritage sites lie above the level of water of the proposed Batoka HES, and are thus not likely threatened by the construction of the Batoka Gorge HES.