ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA) SUMMARY Project Title: Kariba Dam Rehabilitation Project Project Number: P-Z1-FA0-075 Country: Multinational Zambia Zimbabwe Department: ONEC Division: ONEC.2 Project Category: Category 1 1. INTRODUCTION The Kariba Dam is a double curvature concrete arch dam located in the Kariba Gorge of the Zambezi River Basin between Zambia and Zimbabwe. The arch dam was constructed between 1956 and 1959 and supplies water to two underground hydropower plants located on the north bank in Zambia and on the south bank in Zimbabwe. Water is released from the reservoir through six sluice gates. In the first 20 years after the dam was constructed there were sustained heavy spillage episodes resulting in erosion of the bedrock to 80 m below the normal water level. This has resulted in instability of the plunge pool making the dam wall unstable and unsafe. Moreover, the six sluice gates that make up the spillway have been distorted over the years due to an advanced alkali-silica reaction in the concrete. Without functional sluices, the reservoir level cannot effectively be maintained to take into account the flood regime of the Zambezi River. The proposed Project involves rehabilitation work to the plunge pool (anticipated to take 4 years to complete – i.e. 2015 to 2018) and rehabilitation of the six sluice gates (anticipated to take 8 years to complete – i.e. 2015 to 2022). The Zambezi River Authority (ZRA), a corporation jointly and equally owned by the governments of Zambia and Zimbabwe, is the project proponent for the proposed Kariba Dam Rehabilitation Works. ZRA was formed by the Zambezi River Authority Act of 1987 (Act No. 17 and 19 Zambia and Zimbabwe respectively) and is governed by a Council of Ministers consisting of four members: two are Ministers in the Government of the Republic of Zambia; and two are Ministers in the Government of Zimbabwe. The Ministers are those holding portfolios of Energy and Finance in the respective countries. The functions of ZRA (amongst many others) include operating, monitoring and maintaining the Kariba Complex ("Kariba Complex means: the Kariba Dam and reservoir, all telemetering stations relating to the Kariba Dam, any other installations owned by the Authority"). The ZRA have initiated the Kariba Dam Rehabilitation Project, which is required to rehabilitate the plunge pool and the spill way to allow for safe operation of the dam and avoid possible catastrophic dam failure in the future. Such failure, if it were to occur, would result in a major loss of life (approximately three million people). In addition to human fatality risks, dam failure would result in significant downstream environmental damage and a loss of a main source of power to the SADC region. Therefore, timely rehabilitation is required in order to prevent further degradation of dam safety features. In light of the above, the Zambezi River Authority (ZRA) proposes to improve the stability of the plunge pool through reshaping its profile. This will limit the preferential erosion towards the foundations of the dam wall along zones of weak rock and allow for the safe operation of the dam and continued generation of electricity from the hydropower plants. The second objective of the project is to rehabilitate the six sluice gates of the spillway, enabling the ongoing use of the spillway function to safely manage the reservoir levels.

环境和社会影响评估（ESIA）

概要

项目名称：Kariba大坝修复项目

项目编号：P-Z1-FA0-075国家：多国赞比亚津巴布韦

部门：ONEC部门：ONEC.2

项目类别：1类

1.引言

Kariba水坝是一个双曲率混凝土曲拱水坝位于赞比西河的Kariba峡谷

赞比亚和津巴布韦之间的流域。拱坝建于1956年和1959年之间

并向位于赞比亚北岸的两个地下水电站供水

津巴布韦的南岸。水通过六个闸门从水库中释放。在第一

大坝建成20年后，有持续的大量溢出事件导致

侵蚀基岩到正常水位以下80米。这导致了不稳定

跳水池使水坝不稳定和不安全。此外，组成的六个闸门

溢洪道多年来由于在混凝土中的先进的碱 - 二氧化硅反应而扭曲。

没有功能性水闸，不能有效地维持储层水平以考虑

赞比西河的洪水制度。

拟议的项目涉及到跳水池的恢复工作（预计需要4年）

完成 - 即2015至2018年）和六个闸门的修复（预计需要8年）

完成 - 即2015至2022年）。

赞比西河管理局（ZRA），一家由政府共同拥有的公司

赞比亚和津巴布韦，是拟议的Kariba水坝修复工程的项目倡议者。

ZRA由1987年赞比西河管理局法案（第17号和第19号赞比亚和

津巴布韦），由一个由四名成员组成的部长理事会管理：两个

是赞比亚共和国政府的部长;两个是政府部长

的津巴布韦。部长们分别持有能源和金融投资组合

国家。 ZRA的功能（包括许多其他功能）包括操作，监控和

维持卡里巴综合体（“卡里巴复合体”是指：卡里巴大坝和水库，全部

与Kariba水坝有关的遥测站，管理局拥有的任何其他设施“）。

ZRA启动了Kariba水坝恢复项目，该项目需要恢复

跳水池和溢出的方式，以允许大坝的安全运行，并避免可能的灾难性

大坝失效在未来。这种失败，如果发生，将导致生命的重大损失

（约300万人）。除了人类的死亡风险，大坝失败会导致

重大的下游环境损害和对南部非洲发展共同体的主要电力来源的损失

地区。因此，需要及时恢复以防止大坝安全的进一步退化

特征。

鉴于上述情况，赞比西河管理局（ZRA）建议提高其稳定性

通过重塑其配置文件跳水池。这将限制对其的优先侵蚀

沿着弱岩石带的坝体基础，允许大坝的安全运行

继续从水电站发电。该项目的第二个目标是

以恢复溢洪道的六个闸门，使得能够继续使用溢洪道功能

安全管理水库水位。

As part of the proposed rehabilitation Project, the ZRA have committed to comply with international guidelines and standards, and as such are required to undertake a full Environmental and Social Impact Assessment (ESIA) for the Project. The Kariba Dam Rehabilitation Works Project is not a scheduled activity under the Zambian and Zimbabwean Environmental Legislation (the legislation does list activities associated with the construction of dams; however, not with the rehabilitation/refurbishment of dams). This said, the ESIA will conform and meet the environmental regulatory requirements for both Zambia and Zimbabwe and international standards such as the World Bank and African Development Bank. In accordance with the Zambian and Zimbabwean Environmental Management Acts, there is a legal requirement for the Project proponent to respectively submit an Environmental Scoping Report and an Environmental Prospectus report as part of the overall ESIA process. As per the agreed outcomes in a meeting held with the Zambian and Zimbabwean Environmental Management Authorities (dated 24 November 2014, held at the ZRA Administrative Block in Kariba), in which the implementation of a harmonized ESIA process was discussed, a joint Scoping/Prospectus Report (this report) was submitted to both Environmental Authorities for review. This Scoping/Prospectus Report fulfilled the Zambian requirements for a Scoping Report and Zimbabwean requirements for a Prospectus report, and has since been approved by the Zambian Environmental Management Agency (ZEMA) on 27 February 2015 (reference number: ZEMA/INS/101/04/1) and the Zimbabwean Environmental Management Agency (EMA) on 02 March 2015 (reference number: 17/1/1/3A). The ESIA study has been the second and final phase of the overall ESIA process being undertaken in support of the proposed Project, and forms the basis on which the environmental license/approval is issued. The ESIA process undertaken has identified and assessed a range of potential environmental and social impacts associated with the proposed Kariba Dam Rehabilitation Project and is the subject of this ESIA Summary. The ESIA study proposes that provided that the social and environmental mitigation/management measures provided in the ESIA are implemented, the majority of the impacts identified will be reduced to a minor to negligible level of significance. 2. POLICY LEGAL AND ADMINISTRATIVE FRAMEWORK The Kariba Dam Rehabilitation Works Project is not a scheduled activity under the Zambian and Zimbabwean Environmental Legislation (the legislation does list activities associated with the construction of dams; however, not with the rehabilitation/refurbishment of dams). That said, the ESIA Report fulfils both the Zambian and Zimbabwean requirements. In addition to Zambian and Zimbabwean legal requirements, the ESIA conforms to international standards and best practices, in particular the requirements of the African Development Bank, the World Bank Group, the International Finance Corporation (IFC) and the Equator Principles. The ESIA also conforms with other international guidelines and standards directly applicable to dam-building and hydropower projects such as the World Commission on Dams (WCD), the International Hydropower Association (IHA) guidelines and the Southern African Power Pool (SAPP) environmental and social impact assessment guidelines. For Zambia this includes the Environmental Management Act (Act 12 of 2011) and the Environmental Impact Assessment Regulations (No. 28 of 1997), and for Zimbabwe this includes the Environmental Management Act (Chapter 20:27), No. 13 of 2002 and the Environmental Management (Environmental Impact Assessment and Ecosystem Protection) Regulations No. 7 of 2007. As per the agreed outcomes in a meeting held with the Zambian and Zimbabwean Environmental Management Authorities (dated 24 November 2014, held at the ZRA Administrative Block in Kariba), in which the implementation of a harmonized ESIA process was discussed, a joint ESIA Report must be submitted to both Environmental Authorities for review. The African Development Bank’s Integrated Safeguards System were reviewed. The Dam rehabilitation works are considered high risk activities and the power generation out of the Dam exceeds the Bank threshold of 30MW hence Operational Safeguards (OS) 1 on Environmental Assessment is triggered. OS2 on Involuntary Resettlement is not triggered since the rehabilitation works will not cause resettlement of communities that live within the area. During the rehabilitation of the plunge pool, there is likely to be some disturbance to the aquatic life downstream of the dam hence OS 3 on Biodiversity is triggered. OS 4 on Pollution Prevention and Hazardous Substances is triggered since construction will involve use of fuels and possibly some hazardous materials in the sensitive environment around the dam and the Zambezi River. OS 5 on Labour, Working Conditions, Occupational Health and Safety is triggered since the construction will involve a significant number of construction workers. On Climate Change, the project was classified as Category 1 according to the Bank’s Climate Safeguards System. A review of the Climate Change Scenarios was done by the World Bank and the following conclusion was arrived at. Climate-change adaptation requires adoption of an iterative approach to water management. Monitoring and evaluation systems are an essential element of this strategy. The monitoring and evaluation system would help the Zambezi River Basin communities and dam operators to understand clearly whether current water management practices are climate smart. Successful adaptation in a highly vulnerable region such as the Zambezi River Basin requires a major shift in thinking, planning and designing water investments for the future. The design and operation of the Batoka Gorge dam now under consideration for the Zambezi illuminate these concerns. An alternative pathway, focused on climate-smart investments that explicitly factor in financial risk and the ecological functions and the values of river systems, is critical. It was therefore agreed that ZRA shall prepare a Climate Change Action Plan during Project Implementation.

作为拟议的恢复项目的一部分，ZRA致力于遵守国际标准

准则和标准，因此需要承担全面的环境和社会影响

项目评估（ESIA）。卡里巴大坝修复工程项目不是预定的

赞比亚和津巴布韦环境立法下的活动（立法确实清单

与大坝建设有关的活动;然而，不是与康复/翻新

的水坝）。这说明，ESIA将符合并满足环境监管要求

赞比亚和津巴布韦以及世界银行和非洲等国际标准

开发银行。

根据赞比亚和津巴布韦环境管理法案，有一个法律

要求项目倡议人分别提交环境概况报告和

环境招股说明书报告作为整体ESIA过程的一部分。根据a中的商定结果

与赞比亚和津巴布韦环境管理当局举行会议（日期：24

2014年11月，在Kariba的ZRA行政区举行），其中执行a

讨论了协调一致的环境与社会影响评估过程，一份合作范围界定/招股说明书报告（本报告）

提交给环境单位审查。

此范围界定/招股说明书报告符合赞比亚对范围界定报告的要求

津巴布韦对招股说明书的要求，并自那以后得到赞比亚的批准

环境管理署（ZEMA）于2015年2月27日（参考编号：

ZEMA / INS / 101/04/1）和津巴布韦环境管理署（EMA）

2015（参考编号：17/1/1 / 3A）。

ESIA研究是正在进行的整个ESIA过程的第二个也是最后一个阶段

支持拟议项目，并形成环境许可/批准的依据

发行。所进行的环境与社会影响评估过程确定和评估了一系列潜在的环境

以及与拟议的Kariba水坝修复项目相关的社会影响，并且是主题

的ESIA摘要。 ESIA研究提出，只要社会和环境

减缓/管理措施在ESIA中得到落实，大部分影响

确定将被减少到轻微到可忽略的水平的重要性。

2.政策法律和行政框架

卡里巴大坝修复工程项目不是赞比亚和以色列的计划活动

津巴布韦环境立法（该立法确实列出了与“

建设水坝;然而，不是与水坝的恢复/翻新）。也就是说，ESIA

报告满足赞比亚和津巴布韦的要求。除了赞比亚和

津巴布韦的法律要求，ESIA符合国际标准和最佳做法

特别是非洲开发银行，世界银行集团，国际组织的要求

金融公司（IFC）和赤道原则。 ESIA也符合其他

直接适用于建坝和水电工程的国际准则和标准

例如世界水坝委员会（WCD），国际水电协会（IHA）

准则和南部非洲电力池（SAPP）的环境和社会影响评估

指南。

赞比亚包括“环境管理法”（2011年第12号法案）和“环境法”

影响评估规则（1997年第28期），对于津巴布韦，这包括环境

管理法（第20:27章），2002年第13号和环境管理

（环境影响评估和生态系统保护）2007年第7号法规

在与赞比亚和津巴布韦环境管理举行的会议上商定了成果

当局（2014年11月24日，在Kariba的ZRA行政区域举行）

讨论了协调的环境与社会影响评估过程的实施，必须提交一份联合环境评估报告

以便两个环境当局审查。

审查了非洲开发银行的综合保障制度。大坝

康复工程被认为是高风险活动和发电出坝

超过世界银行的30MW阈值，因此环境行动保障（OS）1

触发评估。 OS2对非自愿移民自从康复以来没有触发

工程不会造成居住在该地区的社区重新安置。康复期间

的跳水池，可能对水坝下游的水生生物造成一些干扰

因此触发生物多样性的OS 3。 OS 4关于污染防治和有害物质

触发，因为建设将涉及使用燃料和可能的一些危险材料

围绕大坝和赞比西河的敏感环境。 OS 5劳动，工作条件，

职业健康和安全被触发，因为建设将涉及大量

的建筑工人。

在气候变化方面，根据世行气候，该项目被列为第一类

保障制度。世界银行和世界银行对气候变化情景进行了审查

得出以下结论。气候变化适应要求采用迭代

水管理方法。监测和评价系统是这方面的一个基本要素

战略。监测和评价系统将有助于赞比西河流域社区

和大坝运营者清楚地了解当前的水管理实践是否是气候

聪明。在高度脆弱的地区如赞比西河流域的成功适应需要

思想，规划和设计未来水务投资的重大转变。设计和

正在考虑为赞比西照明这些的巴托戈峡谷大坝的操作

关注。另一种途径，侧重于明确考虑的气候智能投资

财政风险和生态功能以及河流系统的价值，是至关重要的。因此

同意ZRA应在项目实施过程中制定气候变化行动计划。

3. PROJECT DESCRIPTION AND JUSTIFICATION The Kariba arch dam was constructed between 1956 and 1959 across the Zambezi River. It supplies water to two underground hydropower plants located on the north (left) bank in Zambia and on the south (right) bank in Zimbabwe. Both power stations were constructed in 1975 with a combined capacity of 1200 MW later upgraded to 1266 MW and recently increased to 1470 MW. The Kariba dam evacuates excess water from the lake through its spillway made of 6 sluices located approximately 80 m above the river level downstream of the dam (Figure 1 ) Figure 1: Photo of Kariba dam showing 1 of the 6 sluices spilling The Zambezi River Authority (ZRA) intends to carry out the rehabilitation of the Spillway (the six sluice gates) and the reshaping of the Plunge Pool. The proposed rehabilitation which require works in situ on existing infrastructure will be done to avoid potential catastrophic failure of the dam and secure operations in accordance with international dam safety standards. Spillway Rehabilitation: The spillway is located in the arch dam. It is made of six sluices equipped with downstream gates yielding a total capacity of 9000 m3/s. A reservoir rule curve is imposed to create a buffer volume of 23.2 km3 in order to safely pass the 10 000 year return period flood. To date, the sluices can be inspected or repaired in the dry when closed by a set of stop beams in still water (downstream gates closed). Considering the distorting effects of the concrete swelling on the geometry of the spillway (Alkali-Aggregate Reaction) and the ageing of the hydro-mechanical equipment (now operated for 50 years), planned and unplanned maintenance operations in the dry should become more frequent if no rehabilitation is undertaken. In addition the upstream grooves are in poor condition and need refurbishing. To address the need for maintenance and to be able to close the sluices in any circumstance (including cases where a downstream gate is jammed partially or fully opened), the ZRA plans to equip the spillway with an emergency gate. This new gate will be operated by a new gantry and will slide into the rehabilitated upstream grooves. The new emergency gate shall close by its own weight against full water flow if one of the downstream floodgate is jammed in a semi-opened position. It is handled by a gantry and lowered or lifted as a whole. It slides into the refurbished upstream grooves. The new gantry located on the dam crest will be able to lift or to lower the gate as a whole. It is mounted on rails and transfers the emergency gate from one sluice to another (Figure 2). Installing the new emergency gate involves rebuilding the grooves, the sills, the lintels, the surrounding concrete and partly the top of piers. The refurbishment works within the sluices (grooves, sill, and lintel) will be done after dewatering the sluices to perform the works in dry condition. A specially designed temporary cofferdam facility will be built for this operation. It will be placed on the upstream face of the spillway in front of one sluice before dewatering it. The works involve a significant amount of underwater works consisting in grouting of construction joints and cracks, anchoring of rebars, control by divers during cofferdam installation and uninstallation.

3.项目说明和准则

卡里巴拱坝建于1956年至1959年，横跨赞比西河。 它供应

水到位于赞比亚北部（左）岸的两个地下水电站和在

南（右）银行在津巴布韦。 两座发电站都是在1975年建造的

容量为1200兆瓦后升级到1266兆瓦，最近增加到1470兆瓦。

卡里巴大坝通过其位于6个水闸的溢洪道从湖泊排出多余的水

大坝下游河流大约80米（图1）图1：Kariba坝的照片，显示6个水闸中的1个溢出

赞比西河管理局（ZRA）打算执行溢洪道的修复（六个

闸门）和水池的重塑。建议的康复需要工程

在现有基础设施上进行原位，以避免大坝的潜在灾难性故障

安全操作符合国际水坝安全标准。

溢洪道康复：

溢洪道位于拱坝。它由六个水闸配备下游门

总容量为9000 m3 / s。施加储层规则曲线以产生缓冲体积

23.2公里3，以安全通过10 000年回程洪水。

迄今为止，在由静止的一组止动梁关闭时，可以在干燥中检查或修理闸门

水（下游闸门关闭）。考虑到混凝土膨胀的扭曲效应

几何形状的溢洪道（碱聚集反应）和老化的水力机械

设备（现在运行了50年），在干燥的计划和计划外维护操作

如果不进行康复，应该更频繁。此外，上游槽是

在恶劣的条件，需要翻新。

以满足维护的需要，并能够在任何情况下关闭闸门（包括

下游门被部分或完全打开的情况下），ZRA计划装备

溢洪道与紧急门。这个新的门将由一个新的门架操作，并将滑入

修复的上游槽。

新的应急闸门应通过其自身重量关闭，如果其中一个下游处于全流量水位

水闸堵塞在半打开位置。它由门架处理，并作为一个降低或提升

整个。它滑入翻新的上游槽中。

位于坝顶的新门架将能够提升或降低门的整体。它被安装

并将应急门从一个闸门转移到另一个闸门（图2）。安装新

紧急门涉及重建槽，门槛，门楣，周围混凝土和

部分是码头的顶部。在水闸（凹槽，基石和楣石）内的翻新工程将是

在脱水后进行干燥处理。 A专门设计 将为这一行动建立临时围堰设施。 它将被放置在上游面

在一个水闸前面的溢洪道在脱水它之前。

工程涉及大量的水下工程，包括建筑灌浆

接缝和裂缝，钢筋锚固，潜水员在围堰安装和卸载期间的控制。

These works will take place after the Plunge Pool reshaping works in order to spill through possibly adjacent gates without deepening further the existing Plunge Pool. 7 The main works regarding the spillway refurbishment includes the assemblage and transport of a floating cofferdam for the dewatering of sluice gates 1 and 3 to 6. The existing stopbeams will be used to create a cofferdam for sluice gate 2, due to the different geometry associated with its waste disposal function. For sluice gate rehabilitation, built-in-parts within the sluices need to be replaced and refurbished. The outer layer of concrete will be removed, after which the new stainless steel sills and lintels will be installed, and established with new high strength concrete. Grooves need to be rebuilt to adapt to the new emergency gate. New concrete will be anchored and reinforced on the old concrete to resist the load of new built-in-parts, and control cracking. Plunge Pool Reshaping: In the course of the first 20 years of sustained heavy spillage episodes, the river bedrock was scoured down to 80 m below the normal water level and resulted in what is now known as the “Plunge Pool”. There is a major concern over its natural development in the future, if an intense spillage episode were to occur in case of exceptional Zambezi floods. In order to control its future development and avoid dam toe weakening, the studies came to the conclusion that the best solution would consist in an enlargement of the plunge pool, mainly downstream but also on both banks. This reshaping should indeed facilitate the evacuation of spillage flows downstream, and avoid the concentration of turbulence in a restricted and confined area. The primary aim of reshaping the plunge pool profile is to improve the stability of the plunge pool, limiting preferential erosion towards the foundations of the dam, along zones of weak rock. In order to arrive at the solutions described below the engineering team undertook; Multi-beam Bathymetric Survey of the Pool; Plunge Pool Geotechnical Investigations; and Plunge Pool Hydraulic Modeling. Generally, the rehabilitation of the plunge pool will include a number of activities: (i) The construction of a cofferdam just downstream of the plunge pool, which will block off the plunge pool from the downstream river. (ii) The pumping/dewatering of the plunge pool. (iii) The excavation of the plunge pool. (iv) The deposition of excavated rock material in the existing quarry on the north bank. (v) The reshaping of the excavated plunge pool into terraced steps. Excavation and pumping will be carried out simultaneously. While excavations are being carried out on one of the plunge pool steps, the pumps will keep lowering the water level underneath. The objective is to be able to excavate continuously even when switching from one step to the next one situated below it. An estimated 295,000 m³ of rock will be carefully excavated due to the excavation depth below the current Tail Water Level (TWL). The reshaping of the plunge pool into terraced steps will reduce dynamic pressures in the pool and reduce flow recirculation towards dam toe. As a result, it is estimated that the power density will be reduced from 25 kW/m3 to 7.5 kW/m3. Trial blasts will be carried out, whereby increasing charges of explosives will be fired and the impacts of the vibrations on the surrounding sensitive structures will be measured. The choice of explosives to be used will be considered very carefully. While ammo-nitrate fuel oil (ANFO) is commonly used as it is inexpensive and has sufficient strength, its water sensitivity is high. It is therefore recommended that surface bulk emulsions are used. Blasting will take place for approximately six months.

这些作品将在Plunge Pool重塑作品之后进行，以便可能溢出

相邻的门没有进一步深化现有的水池。

7

关于溢洪道翻新的主要工作包括a的装配和运输

浮动围堰用于将闸门1和3至6的脱水。将使用现有的止动梁

由于与其废物处理相关的不同几何形状，为闸门2创造了一个围堰

功能。

对于闸门修复，需要更换和翻新闸门内的内置部件。的

混凝土外层将被去除，之后新的不锈钢门槛和楣石将

安装，建立与新的高强度混凝土。沟槽需要重建以适应

新应急门。新的混凝土将在旧混凝土上锚固和加固以抵抗

新的内置部件的负载，以及控制开裂。

跳水池重塑：

在头20年的持续大量溢出事件的过程中，河床基岩被蚀

比正常水位低80米，导致现在被称为“跳水池”。

如果一个剧烈的溢出事件，对未来的自然发展有一个主要的关注

在例外的赞比西河洪水的情况下发生。

为了控制其未来的发展和避免大坝削弱，研究来了

结论是最好的解决方案将主要是扩大跳水池

下游，但也在两岸。这种重塑确实有助于疏散溢出

向下游流动，并且避免在受限和受限区域中的湍流的集中。

重塑倾泻池配置文件的主要目的是提高倾泻池的稳定性，

沿着弱岩石带限制对大坝基础的优先侵蚀。为了

以达到工程团队承诺的下述解决方案;多光束测深

水池调查;潜水池岩土勘测;和液压池液压建模。

一般来说，跳水池的恢复将包括一些活动：（i）建设

的一个围堰正下游的跳水池，这将阻止跳水池从

下游河流。 （ii）小水池的泵送/脱水。 （iii）挖坑的挖掘

池。 （iv）开采的岩石材料沉积在北岸的现有采石场。 （v）

将挖掘的水池重新塑造成梯形台阶。

同时进行挖掘和泵送。正在进行挖掘

在其中一个小池步骤，泵将继续降低下面的水位。的

目标是即使在从一个步骤切换到下一个步骤时也能够连续挖掘

位于它下面。由于挖掘，估计约有295,000立方米的岩石将被小心挖掘

深度低于当前尾水位（TWL）。将水池重新塑造成梯形台阶

将减少池中的动态压力并减少朝向坝趾的流动再循环。结果是，

估计功率密度将从25kW / m 3降低到7.5kW / m 3。试验爆炸将

从而增加爆炸物的费用，并且振动的影响

对周围的敏感结构进行测量。

将非常仔细地考虑使用的爆炸物的选择。而硝酸铵燃料油

（ANFO）由于其便宜且具有足够的强度而通常使用，其水敏性高。

因此，建议使用表面本体乳液。爆破将发生

约六个月。

The Project Documents states that after 50 years of operation serving the southern African region, the Kariba Dam now requires a series of rehabilitation works for its continued safe operation. A failure to invest in the timely rehabilitation of the dam will result in the gradual degradation of key safety features associated with the structure to a level that is not acceptable in accordance to international standards. The rehabilitation on the Spillway will be financed by the African Development Bank and the World Bank and includes: i) the design, fabrication and installation of emergency gates and a new gantry to prevent uncontrolled loss of water in the event of floodgate failure; ii) refurbishment of the upstream stop-beam guides and replacement of secondary concrete to prevent failure during operation of stopbeams. Failure of both of the above operations would result in water levels dropping below the minimum operational levels and interrupting power production. The spillway comprises six sluices on the dam wall as illustrated in Figure 3. The rehabilitation on the Plunge Pool will be financed by the EU and includes i) reshaping of the plunge pool to limit erosion and wearing away of the pool which has a current depth of 80 meters below the river bed. Further scouring of the pool could undermine the dam foundations, leading to dam failure with catastrophic results. The plunge pool is located approximately 50 m downstream of the dam wall, in the Zambezi riverbed, and some 50 m upstream of the two powerhouses’ outlets as shown in Figure 4.

Figure 4: Layout of the Kariba dam Justification of the Project: Failure to implement remedial measures to the plunge pool will result in the failure to operate the reservoir as expected (i.e. at a reduced capacity) or required under extreme flood events, and an increase in the risk of dam wall failure. A scenario where the dam wall fails will release a flood event of a total 273 km³ resulting in: (i) Major loss of life as the flood plain is home to approximately three million people; (ii) Loss of livelihoods (socio-economic activities); (iii) Environmental degradation; and (iv) A loss of main source of power to the SADC region. Catastrophic dam failure of the Kariba Dam would result in significant downstream environmental damage reaching into the Mozambique delta. However, arguably the most important motivating factor of the proposed Kariba Dam Rehabilitation Works is the potential resultant human fatality risks that would result from a catastrophic dam failure event. There are an estimated three million people who live downstream of the Kariba Dam that may be impacted should the dam fail. Therefore, it is imperative that the Kariba Dam is maintained in safe working condition. North PP D A M South PP Plunge Pool Spillway 10 Moreover, the Kariba Dam Hydro-Electric Scheme significantly contributes to the security of energy supply to the SADC region and specifically to Zambia and Zimbabwe over the last 50 years. This region has an increasing demand for energy supply, placing even greater significance to the existing energy supply by the Kariba Dam Hydro-Electric Scheme. Loss of this supply as a result of dam failure would significantly adversely impact the socio-economic status of the region. Therefore, timely rehabilitation is required in order to prevent further degradation of dam safety features, and to uphold Kariba Dam’s status of functioning to meet international standards.

项目文件指出，在为南部非洲地区服务50年后，

Kariba水坝现在需要一系列的恢复工程，以便其继续安全运行。失败

投资于大坝的及时恢复将导致关键安全特征的逐渐退化

与该结构相关联的水平达到根据国际标准不能接受的水平。

溢洪道的恢复将由非洲开发银行和世界资助

银行并包括：i）应急门的设计，制造和安装以及新的门架

防止在水闸故障的情况下不受控制的水损失; ii）上游的翻新

停止梁导轨和更换次级混凝土，以防止停止梁运行期间的故障。

上述两种操作的失败将导致水位下降到低于

最小操作水平和中断电力生产。溢洪道包括六个水闸

在坝壁上，如图3所示。跳水池的恢复将由欧盟资助，包括i）重塑

跳水池限制侵蚀和磨损的水池，目前的深度为80米

在河床下面。 池的进一步冲刷可能破坏大坝基础，导致

大坝失效带来灾难性后果。 跳水池位于下游约50米处

在赞比西河床上的坝壁，以及两个动力出口上游约50米

如图4所示。图4：Kariba大坝的布局

项目理由：

如果不对落水池采取补救措施，将导致无法操作

或者在极端洪水事件下需要的储层，以及a

增加坝墙破坏的风险。坝墙失效的情况将释放洪水事件

总共273公里，导致：（i）洪水泛滥平原的居民大约三分之一，造成重大生命损失

百万人; ㈡生计损失（社会经济活动）; （iii）环境退化;

和（四）失去南共体区域的主要电力来源。

卡里巴大坝的灾难性水坝破坏将导致显着的下游环境

进入莫桑比克三角洲的损害。然而，可以说是最重要的激励因素

的Kariba水坝修复工程是潜在的人类死亡风险

将导致灾难性的大坝失效事件。估计有三百万人

居住在卡里巴大坝的下游，如果大坝失效，可能会受到影响。因此它是

必须保证卡里巴大坝保持安全的工作状态。

北方PP

D

一个

M

南PP

潜水池溢洪道

10

此外，卡里巴坝水电计划大大有助于能源的安全

在过去50年里向南部非洲发展共同体区域，特别是赞比亚和津巴布韦供应。这个

地区对能源供应的需求越来越大，对现有能源供应的重要性越来越大

卡里巴坝水电计划的能源供应。由于大坝失效，这种供应的损失

将对该区域的社会经济地位产生重大不利影响。因此，及时

需要恢复，以防止大坝安全特征的进一步退化，并维护

Kariba水坝的功能达到国际标准的地位。

4. DESCRIPTION OF THE PROJECT ENVIRONMENT Physical Environment Hydrology: The existing flows on the Zambezi River reflect a large digression from reference flow conditions, and remain the major driver of the altered habitat and cover units for instream aquatic communities noted. Similarly, channel widening has laterally impacted on the riparian zones, downslope floodplains and swamp areas, causing a loss of these habitats due to loss of inundation in these zones. Water Quality: Water quality fell within threshold values for sustaining aquatic ecosystems. Results from both the September 2014 (low flow) and February 2015 (high flow) field assessments were consistent with the water quality data provided by the Zambezi River Authority. Water from this reach was characterised by circumneutral pH values and relatively low electrical conductivities. Conversely, water sampled within the old disused Sinohydro Quarry Site (the preferred site for the waste rock dump) reflected a high alkalinity and salt loads. This water is contaminated and should remain isolated from aquatic environments. River Erosion and Sedimentation: The Zambezi River channel bed has lowered since the construction of Kariba Dam and the channel has widened in places downstream of the gorge. The rate of channel widening has decreased in subsequent years, inferring stable condition under current bed load capacity. This along with the altered flow regime and the dam obstruction resulted in sediment and nutrient deprivation. The gorge itself is well armoured by basement rock and unlikely to be affected by erosion although additional sediment inputs may result in changes in water quality and the existing habitat template. Biophysical Environment Aquatic Environment: Sites on the Kariba Dam and the Zambezi River downstream of the dam were in a good and moderate ecological state according to the diatom community. The community at sites reflected slightly alkaline, fresh-brackish, oxygenated waters with moderate pollution. The macroinvertebrate assemblage is considered largely modified due to a knock-on effect from flow regulation from the dam on habitat, connectivity and water quality. A decrease in diversity and a large loss of macroinvertebrate families with requirements for various flow conditions were noted. Although all metrics show a change from reference conditions, the major driver of change in the system is hydrology, which has a subsequent impact on habitat, connectivity and water quality. Baseline fish assemblages reflected a moderate to large variation from reference assemblages. The most notable cause for this change is alteration in the natural flow regime and a change in velocity depth constituents from the reference conditions. A longitudinal improvement in fish assemblage was noted. Terrestrial Habitat: The broad habitats on the Zimbabwean side of the border are largely natural, whereas modified habitats are widespread on the Zambian side. The natural habitats of the valley floor are widespread and do not support many endemic or threatened species. The Kariba Gorge has been classified as a Critical Habitat however the upper extent in the vicinity of the dam is heavily impacted by previous construction works and long term operation of the Kariba Hydropower Scheme. The project site is located within the Lower Zambezi Transfrontier Conservation Area (TFCA), which qualifies as a protected area. This protected area extends over both sides of the border incorporating parts of Zambia and Zimbabwe. Waste materials from excavation of the plunge pool will be dumped into an existing quarry site on the north bank (Zambian side) which qualifies as a modified habitat of little known ecological value. The slipway that will be used to assemble and launch the floating cofferdam within Lake Kariba is already used as a boat jetty, while the shores of Lake Kariba have not developed a riparian fringe and have a low biodiversity value. Terrestrial Species of Conservation Concern: The baseline assessment states that Cyclantheropsis parviflora (a Vulnerable plant species) occurs in the Kariba Gorge. Various threatened mammal species may occur in the greater area such as Endangered Wild Dogs and other predators, but these species are mobile and typically avoid active work zones. A large elephant population occurs within the Zimbabwean side of the Ecological Area of Influence but are not expected within the Kariba Gorge, the slipway or quarry sites. Bird species of concern include Southern Carmine Bee-eater (Merops nubicoides), African Skimmer (Rhynchops flavirostris) and Rock Pratincole (Glareola nuchalis). The latter species is a migrant that depends on emergent rocks within fast-flowing rivers and is expected to occur within the downstream reaches of the Zambezi River during the low flow season. These birds may be displaced by rehabilitation activities within the plunge pool, but the area of displacement represents a small area of their available habitat. Large colonies of Southern Carmine Bee-eaters (not threatened) exist in the exposed sandbanks and are vulnerable to disturbance. Large crocodiles occur in Lake Kariba many individuals were observed downstream of the wall during aquatic studies in Sept 2014. Some individuals may be displaced, however the crocodile population in the area has grown substantially over the past three decades and this species is not considered to be at risk. Protected Areas: The area downstream of the dam up to the Mozambique border consists of National Parks and extensive transfrontier conservation areas, including the Lower Zambezi TFCA. The Mana Pools National Park and adjacent conservation areas are recognised as a UNESCO World Heritage Site and the Zimbabwean side of the lower Zambezi River is also recognised as an Important Bird Area. The wildlife areas on both sides of the river are popular tourist destinations. Flow releases from the Kariba Dam are controlled and the regular flooding of the downstream habitats no longer occurs. Extensive riparian habitats on the downstream floodplain have been affected, and germination recruitment of the dominant canopy trees is inhibited. These conservation areas are important tourist destinations with international recognition but the habitats are in a gradual state of decline.

Social Environment 12 Tourism: An unintended consequence of the construction of the Kariba Dam has been the emergence of a thriving tourism industry, especially at the wall. Visitors are attracted to the water body and the surrounding rural/natural environment. A variety of activities such as safaris, boating, fishing, sunset cruises, canoeing, water sports, bird watching, cultural village tours and visiting look-out points are sought after. The tourism industry also supports a large informal trade sector whose customers are mainly tourists. The majority of the mentioned activities happen upstream from the dam and adjacent to the lake on both sides of the river/lake. The wall itself was constructed in a narrow gorge and thus blends in well with the landscape. Downstream of the wall, there are two look-out points facing the wall which are popular tourist stops (i.e. at the Zimbabwean Tourism Authority Offices (ZTA) and at the wall itself). Fisheries-Based Livelihoods: Commercial and artisanal fishing occurs on Lake Kariba and in the river, downstream of the dam. Commercial fishing activities are mainly focussed upstream of the wall and limited artisanal fishing upstream and downstream of the wall. Fishing methods (lake and river) include gillnets, dip nets (especially for kapenta) and lines and hooks. On both sides of the river, a significant number of people derive their livelihoods from fishing. People from other parts of Zimbabwe and Zambia migrate to the Kariba and Siavonga districts to pursue fishing as a means to make a living. The presence of tourism operators and activities in the AoI plays a big role in supporting the survival of the fishing industry. Sexually Transmitted Infection including HIV/AIDs: The prevalence of HIV/Aids is slightly lower in Zambia compared to Zimbabwe at 13 percent and 15 percent respectively. It is reported that condom use as a means of HIV/Aids prevention as well as comprehensive knowledge of HIV/Aids is lower in Zambia than in Zimbabwe. In the Mashonaland Province of Zimbabwe, the top five causes of mortality (amongst others) is HIV/AIDS. In the Southern Province of Zambia, HIV/Aids infection rate is estimated at 14.5 percent. Of those with HIV/Aids, 17.4 percent receive antiretroviral treatment. The population between 15 and 24 years remains at a higher risk than other age groups to be infected with HIV/AIDs

4.项目环境描述

物理环境

水文：赞比西河上现有的流量反映了参考流量的大量偏离

条件，并且仍然是改变的栖息地的主要驱动力并且覆盖单位水生水生

社区注意。类似地，沟道拓宽已经横向影响河岸带，

下坡洪泛区和沼泽地区，造成这些栖息地的丧失，由于淹没的损失

这些区域。

水质：水质落在维持水生生态系统的阈值以内。结果

从2014年9月（低流量）和2015年2月（高流量）现场评估

与赞比西河管理局提供的水质数据一致。水从这个到达

其特征在于中间pH值和相对低的电导率。反过来，

水是在旧废弃的中水电站采石场（废石的首选场所）

倾倒）反映了高碱度和盐负荷。这种水被污染，应该保持隔离

从水生环境。

河流侵蚀和沉积：赞比西河河床自建设以来已经下降

的Kariba水坝，渠道在峡谷下游的地方扩大。通道速率

拓宽在随后的几年中已经减少，推断在当前床负载能力下的稳定状态。

这与改变的流态和水坝阻塞导致沉积物和营养物

剥夺。峡谷本身是由地下室岩石装甲，不太可能受到侵蚀

尽管额外的泥沙投入可能导致水质和现有栖息地的变化

模板。

生物物理学

水环境：大坝下游的Kariba水坝和赞比西河上的场地

在根据硅藻社区的良好和中等的生态状态。社区在网站

反映轻微碱性，新鲜微咸，氧化水中度污染。的

大型无脊椎动物组合被认为主要由于来自流动的敲击效应而被修饰

从大坝对栖息地，连通性和水质的监管。多样性下降和大

注意到对各种流动条件有要求的大型无脊椎动物家族的损失。虽然

所有指标显示与参考条件的变化，系统变化的主要驱动力

水文，随后对栖息地，连通性和水质产生影响。

基准鱼组合反映了参考组合的中等到大的变化。的

这种变化的最显着的原因是自然流动状态的变化和速度的变化

深度成分从参考条件。鱼类组合的纵向改善

注意。陆地栖息地：边境津巴布韦一侧的广大栖息地主要是自然的，

而改良栖息地在赞比亚一侧普遍存在。谷底的自然栖息地

是广泛的，不支持许多地方性或濒危物种。卡里巴峡谷一直

分类为关键栖息地，但是大坝附近的上限受到严重影响

通过以前的建设工程和长期运行的卡里巴水电计划。的

项目地点位于下萨姆贝齐外围保护区（TFCA）内，

有资格作为保护区。该保护区域延伸到边界的两侧

赞比亚和津巴布韦的部分地区。

来自挖掘池的废物将被倾倒在现有的采石场上

北岸（赞比亚一侧），其被认为是具有鲜为人知的生态价值的改良栖息地。的

将用于装配和发射卡里巴湖内的浮动围堰的滑道已经

用作小船码头，而卡里巴湖的岸边没有发展出河岸边和有

低生物多样性价值。

陆地物种保护关注：基线评估指出了Cyclantheropsis

花楸（一种脆弱的植物物种）发生在卡里巴峡谷。各种受威胁的哺乳动物

物种可能发生在更大的区域，如濒危野狗和其他捕食者，但这些

物种是移动的，并且通常避免活动工作区。一个大象群出现在内

生态影响区的津巴布韦方面，但不预期在卡里巴峡谷，

滑道或采石场。

关注的鸟类包括南部胭脂红蜂虎（MEROPS nubicoides），非洲撇油器

（Rhynchops flavirostris）和Rock Pratincole（Glareola nuchalis）。后者是一个移民

取决于快速流动的河流中出现的岩石，预计在下游发生

在低流量季节到达赞比西河。这些鸟可能被流离失所

在跳水池内的康复活动，但是流离失所地区代表了一小块地区

他们可用的栖息地。

南部胭脂红大群体（不受威胁）存在于暴露的沙洲和

容易受到干扰。大型鳄鱼发生在卡里巴湖，观察到许多个体

在2014年9月的水生研究期间，在墙的下游。一些个人可能会流离失所，

然而该地区的鳄鱼种群在过去三十年中大幅增长

这个物种不被认为有风险。

保护区：大坝下游到莫桑比克边境的地区包括国家

公园和广泛的跨界保护区，包括下赞比西TFCA。法力

池国家公园和相邻的保护区被公认为联合国教科文组织的世界遗产

场地和赞比西河下游的津巴布韦一侧也被认为是重要的鸟

区。河两岸的野生动物区是受欢迎的旅游目的地。

卡里巴坝的流量控制受到控制，下游栖息地的定期洪水

不再发生。在下游洪泛区广泛的河岸栖息地受到影响，

显性冠层树的萌发补充被抑制。这些保护区是

重要的旅游目的地与国际承认，但栖息地

处于逐渐衰退的状态。

社会环境

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旅游：卡里巴大坝建设的一个意想不到的后果就是出现

的蓬勃发展的旅游业，特别是在墙上。游客被吸引到水体和

周围的农村/自然环境。各种活动，如狩猎，划船，钓鱼，日落

游船，划独木舟，水上运动，观鸟，文化村游和观光景点

被）追捧。旅游业还支持其客户所在的大型非正式贸易部门

主要是游客。

大多数提到的活动发生在大坝的上游和毗邻湖

河两岸的湖泊。墙壁本身被建造在一个狭窄的峡谷，因此混合在井里

与风景。在墙的下游，有两个面向墙的观察点

受欢迎的旅游胜地（即在津巴布韦旅游局（ZTA）和隔离墙本身）。

渔业生计：商业和手工捕鱼发生在卡里巴湖和河流，

下游坝。商业捕鱼活动主要集中在隔离墙的上游

上游和下游的有限手工捕鱼。钓鱼方法（湖泊和河流）

包括刺网，dip网（特别是对于kapenta）和线和钩。在河的两边，a

相当数量的人从渔业中获得生计。来自其他地区的人

津巴布韦和赞比亚移居到Kariba和Siavonga地区，以捕鱼为手段

生活。旅游经营者的存在和AoI中的活动在支持中起着重要作用

渔业的生存。

性传播感染包括艾滋病毒/艾滋病：艾滋病毒/艾滋病的流行率略低

赞比亚与津巴布韦分别为13％和15％。据报道，避孕套

用作艾滋病/艾滋病预防手段以及对艾滋病毒/艾滋病的全面了解较低

赞比亚比津巴布韦。在津巴布韦的Mashonaland省，死亡率的前五大原因

（除其他外）是艾滋病毒/艾滋病。在赞比亚南部省，艾滋病毒/艾滋病感染率是

估计为14.5％。在艾滋病毒/艾滋病患者中，17.4％接受抗逆转录病毒治疗。的

15至24岁的人口仍然比其他年龄组感染的风险高

艾滋病毒/艾滋病

5. PROJECT ALTERNATIVES The No-Go Alternative: The No-Go Alternative is the option of not undertaking the Kariba Dam Rehabilitation Works Project. As described, water is released from the reservoir through six sluice gates. In the first 20 years after the dam was constructed there were sustained heavy spillage episodes resulting in erosion of the bedrock to 80 m below the normal water level. This area is known as the ‘Plunge Pool’. The plunge pool represents a risk to the stability of the dam wall and therefore risk of a flood event and reduced operating capacity of the dam. Furthermore, there is also a need to rehabilitate the six sluice gates that make up the spillway. The work needed within the sluices is associated with the refurbishment of the concrete surface of all sluices which have been distorted over the years due to an advanced alkali-silica reaction. Without functional sluices the reservoir level cannot effectively be maintained to take into account the flood regime of the Zambezi River. Without the ability to release water from the reservoir, there is a danger of the reservoir being too full prior to a flood event, and the subsequent flood event causing over topping of the dam wall which could lead to dam failure. Failure to implement remedial measures to the plunge pool and spillway will result in the failure to operate the reservoir as expected (i.e. at a reduced capacity) and an increase in the risk of dam wall 13 failure. A scenario where the dam wall fails will release a flood event of a total 273 km3 resulting in a major loss of life as the flood plain is home to approximately three million people; loss of livelihoods (socio-economic activities); environmental degradation; and a loss of main source of power to the region. Therefore, the No-Go alternative is not a reasonable alternative and it is necessary to implement the remedial action to avoid such an event. Waste Rock Dump Site Alternatives: Four alternatives for disposal of waste rock were considered and analysed. Accordingly the preferred order of the alternatives assessed is, from most preferred to least preferred, as follows: Alternative 1: Old Disused Sinohydro Quarry Site; Alternative 3: Old ZRA Quarry Site; Alternative 4: Area East of the Sinohydro Quarry Site and Alternative 2: Site on Northern River Bank. Alternative 1 is the preferred alternative as the Sinohydro quarry is the most suitable site for dumped waste rock (it will have the least visual and terrestrial ecology impacts). Moreover, the site is in close proximity to the plunge pool. Slipway Site Alternatives: The slipway will allow assembly of the floating cofferdam on the reservoir bank above water level and launching of the floating cofferdam onto the reservoir. During feasibility studies, the possibility was examined to use a dry-dock instead of a slipway. However, due to the reservoir level fluctuation range, this solution was found not feasible. Two engineering site visits were undertaken in December 2011 and April 2012, resulting in the identification of three possible sites for the construction of a slipway. Accordingly, the preferred order of the alternatives assessed is as follows: Alternative 1: DDF – most preferred; Alternative 2: Wild Site – next most preferred (based on its proximity to the spillway [~1.2km]); Alternative 3: ZPC Sports and Social Club – least preferred (based on the fact that the slipway site would be situated ~6.8km from the spillway). The preferred slipway site (Alternative 1: DDF Site) is located about 2.0 km south west from the Kariba Dam wall, and is currently owned and operated by the Zimbabwean District Development Fund (DDF). This site has been selected as the preferred site for the following reasons: (i) The site has an existing slipway which can be upgraded; (ii) The site is flat and large enough to cater for the construction of the floating cofferdam; (iii) There is an existing road to the site; and (iv) The site is a short boat distance (2.0km) to the spillway. Plunge Pool Coffer Dam Alternatives: Alternative 1 – a cofferdam built from one bank to the other, i.e., continuous, built at the start of the works and demolished at the end. However, removal at the end of the works is costly and time-consuming. Alternative 2 - Installing a sheet pile cellular cofferdam at the beginning of the works and removed at the end of each dry season. This is however not a possible option as the removal and reconstruction time is too long before and after each spillage episode. Alternative 3, the preferred alternative would consist of the establishment of a cofferdam at the beginning of the works, removed at the end of the dry season and then reinstalled at the beginning of the following dry season. This cofferdam design allows for easier mobilization and demobilization between potential flood events, and allows for a three phase work program. The cofferdam will comprise of 10 piers spaced 13 m apart, with nine stoplogs in between. Alternative 3 is the preferred alternative as the cofferdam can be quickly mobilised and de-mobilised once constructed. Reservoir Management Alternatives: As the rehabilitation works associated with the plunge pool are located right under the spillway gates, the reshaping works can only be done during a period that will not require spillage, i.e. a “non-spillage period”. Normal spillage usually occurs from January to the end of August, leaving a reduced time window for works (i.e. September through to December). The non-spillage period can be increased by lowering the reservoir level and creating a storage volume that 14 will be used as a buffer volume against a flood. This volume allows storing of the flood inflows while the reservoir level is rising. Simulations were undertaken by Tractebel (2012) to find an optimised scenario that increases the non-spillage period, and limits consequences on energy production and water availability during and after works. Three alternative scenarios, based on a series of assumptions, have been retained depending of the duration made available for works: Alternative Scenario 1: Allows 16 months for works, and the cofferdam and the excavation works can be done in the same non-spillage period. Alternative Scenario 2: Allows 11 months for works, and the cofferdam can be partly constructed in advance, and completed just before the excavation works. Alternative Scenario 3: Allows 7 months for works, and the cofferdam will be rapidly mobilized and demobilized to leave enough time for excavation works. The preferred alternative is Alternative Scenario 3, where the works can be carried out in the plunge pool for 7 months, after which time all materials and equipment will have to be dismantled to allow for the 5 months spillage period, before the works can be resumed for another 7 months. The results of the Reservoir Management Scenario Modeling indicate that Alternative Scenario 1 would result in a significant loss of power generation during rehabilitation works (22.2 km3 of water would not run through the turbines). Alternative Scenario 3 (preferred alternative) would require the lowest maximum reservoir level drawdown (1.9m), which is beneficial to the hydropower facility for future power generation. Alternative Rock Blasting Technologies: A critical aspect that needed to be considered as part of the Project design is the explosive material to be used. Generally, for rock extraction inside large open pits, bulk explosive ANFO (ammo-nitrate fuel oil) is used because it is a cost effective option and has sufficient blasting strength. Nevertheless, the water sensitivity of ANFO is very high, which ultimately means that the risk of frequent misfires, as a result of predictable water seepages are during works, is large. As a result, a more effective solution is using modern adequate explosives materials (such as surface bulk emulsions) was deemed as the preferred blasting technique. These explosives have a good water resistance and have a velocity of detonation (strength) better than that of ANFO

5.项目替代

No-Go选择：No-Go选择是不承担Kariba水坝的选择

康复工程计划。如所述，水通过六个闸从储层释放

门。在大坝建成后的头20年里，有持续的大量溢出事件

导致基岩的侵蚀至低于正常水位80米。这个区域被称为

“跳水池”。跳水池代表了对坝墙稳定性的风险，因此存在风险

洪水事件和大坝的操作能力降低。

此外，还需要修复组成溢洪道的六个闸门。的

在水闸内需要的工作与所有的混凝土表面的翻新相关联

这些年来由于先进的碱 - 二氧化硅反应而变形的水闸。没有

功能性水闸不能有效地维持水库水位以考虑洪水

赞比西河的政权。没有从水库中释放水的能力，就有危险

的水库在洪水事件之前太满，随后的洪水事件导致

坝顶的顶部，可能导致大坝失效。

未能对跳水池和溢洪道实施补救措施将导致失败

如预期的那样操作储存器（即，以降低的容量）和增加坝壁的风险

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失败。在坝墙失效的情况下，将释放总共273 km3的洪水事件，导致a

洪水泛滥平原是大约三百万人的家园，丧失生计

（社会经济活动）;环境恶化;和主要的电源损失

地区。因此，No-Go替代方案不是合理的替代方案，并且有必要实现

避免这种事件的补救行动。

废石倾倒场地替代方案：处理废石的四种替代方案被考虑

分析。因此，所评估的替代方案的优选顺序是从最优选到最不重要

首选，如下：备选1：旧废弃中水采石场;备选方案3：旧ZRA

石矿场;备选方案4：中水电站采石场东面的选择2：北方选址

河岸。备选方案1是首选的选择，因为中国水电采石场是最适合的场地

倾倒的废石（它将对视觉和陆地生态影响最小）。此外，网站

是靠近跳水池。

滑移场地替代：滑道将允许在储层上装配浮动围堰

在水位以上的堤岸和发射浮动围堰到水库。可行性

研究，检查了使用干坞而不是滑道的可能性。但是，由于

水库水位波动范围，这种解决方案被发现不可行。进行了两次工程现场考察

在2011年12月和2012年4月进行，从而确定了三个可能的地点

滑道的建设。

因此，所评估的替代方案的优选顺序如下：替代方案1：DDF最多

首选;备选方案2：野生站点 - 次优选（基于其接近溢洪道

[〜1.2km]）;选择3：ZPC体育和社会俱乐部 - 最不喜欢（基于事实

滑道地点将位于距溢洪道约6.8公里处）。

优选的滑道地点（备选1：DDF地点）位于距离西南约2.0公里处

Kariba坝墙，目前由津巴布韦区发展基金所有和经营

（DDF）。此网站已被选为首选网站，原因如下：（i）网站有

可升级的现有滑道; （ii）地盘平整，足够大，足以应付

建设浮动围堰; （iii）现有通往现场的道路;和（iv）该网站是a

短距离（2.0km）到溢洪道。

冲浪池保险箱坝替代：替代方案1 - 从一个银行到另一个银行建造的围堰，

即连续，在工程开始时建造并在结束时拆除。但是，在结束时删除

的工作是昂贵和耗时的。备选方案2 - 安装板桩蜂窝围堰

作品的开始，并在每个干燥季节结束时删除。然而这不是可能的

选项，因为删除和重建时间在每个溢出事件之前和之后太长。

备选案文3，首选备选方案将包括在南非设立一个围堰

开始作品，在旱季结束时取下，然后在开始时重新安装

以下旱季。这种围堰设计允许更容易的动员和遣散

在潜在洪水事件之间，并允许三阶段工作计划。围堰将

包括间隔13米的10个码头，其间有9个停止记录。备选方案3是优选的

备选方案，因为一旦建造，可以快速调动和去除围堰。

水库管理替代方案：由于与水池相关的恢复工程

位于溢洪道门下方，重塑工程只能在一段时间内完成

不需要溢出，即“非溢出期”。正常的溢出通常发生在1月到

八月底，从而缩短作品的时间窗口（即9月至12月）。的

非溢出期可以通过降低储层高度并产生储存体积来增加

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将用作抵御洪水的缓冲体积。这个体积允许存储洪水流入

水库水位上升。模拟由Tractebel（2012）进行，以找到一个优化

增加非溢出期的方案，并限制对能源生产的影响

工作期间和之后的水可用性。

根据一系列假设，保留了三种替代方案

持续时间可供工程：替代方案1：允许16个月的工程，

围堰和挖掘工程可以在同一非溢出期完成。备选场景

2：允许11个月的工程，并且可以提前部分建造围堰，并完成

就在挖掘工程之前。备选场景3：允许7个月的作品，

围堰将迅速调动和复员，留出足够的时间进行挖掘工程。

首选替代方案是替代方案3，其中工程可以在暴跌中进行

池7个月，之后所有的材料和设备都将被拆除允许

对于5个月的溢出期，在工程可以恢复另外7个月。结果

的水库管理情景建模表明替代情景1将导致

在恢复工程期间发电的显着损失（22.2km 3的水不会运行

通过涡轮机）。备选场景3（优选备选）将需要最低

最大油藏水位下降（1.9m），这对未来的水电设施是有利的

发电。

替代性爆破技术：一个关键方面需要考虑作为的一部分

项目设计是使用的爆炸材料。一般来说，对于大开放的岩石开采

坑，散装爆炸物ANFO（氨 - 硝酸盐燃料油），因为它是一种具有成本效益的选择

充分的爆破强度。然而，ANFO的水敏感性非常高，最终

意味着由于可预测的渗水在工程期间频繁发生失火的风险

大。因此，更有效的解决方案是使用现代充分的爆炸物材料（例如

表面本体乳液）被认为是优选的喷砂技术。这些炸药有好处

耐水性并且具有比ANFO更好的爆炸速度（强度）

6. POTENTIAL IMPACTS Creation of Employment Opportunities: Rehabilitation activities associated with the plunge pool and spillway will create an as yet unknown number of employment opportunities, which will be distributed over the duration of approximately 7 years. Rehabilitation activities of the plunge pool is planned for during dry seasons (7 months per year) over an estimated four year period and the spillway for a period of approximately 8 years. There are 2 factors that will influence the actual number of employment opportunities that will realistically be available to prospective employees in the AoI, namely skills levels and structuring of employment contracts by the Contractor. It is foreseen that due to the highly specialised nature of the rehabilitation works; a large number of the opportunities will be for highly skilled and skilled persons e.g. engineers, shutterhands, drillers and blasters, steel fixers, machine operators, concrete hands and drivers while a relatively small number of opportunities will be available for unskilled labour such as for security, housekeeping and catering staff. It is anticipated that the impact on employment creation on those seeking employment will be a Positive Impact pre-mitigation. Impacts on Hydrology: The rehabilitation of the dam, specifically referring to any of the three scenarios, can be considered to have little to no impact on the hydrology of the downstream river reach 15 when compared to the present state of the system, if the hydropower releases are made throughout the project duration. However, there is a low probability that these releases may not be possible due to a lack of inflows to the dam after the dam water level has been lowered (i.e. if reservoir management results in a sustained non-spillage of 16 or 11 months alternative scenario 1 and 2, which would have significant negative impacts on the downstream hydrological system in terms of flow volume for downstream users and for the downstream receiving environment. Decreasing flows below the Environmental Flow Requirements (EFRs) will have a Major Negative Impact pre-mitigation. Impact on Water Quality: An impact on water quality is considered the most likely of the potential impacts identified. Potential sources of impacts on water quality have been identified as: (i) dewatering of the plunge pool, (ii) the installation of the cofferdam and dewatering of the associated work area, (iii) dredging of the slipway, (iv) blasting activities and (v) construction and use of associated access roads. The perceived impacts are mainly related to rehabilitation where the deterioration of water quality will most likely be attributed to increased sediment loads (e.g. earth and rock moving activities), construction material (e.g. cement), hydrocarbons (e.g. oil and diesel), solvents and other hazardous substances via accidental spillage/leakage from construction machinery and equipment. The impact on water quality will be a Moderate Negative Impact pre-mitigation on the water quality of the receiving environment. The plunge pool reshaping and spillway dredging activities will require instream actions such as dewatering, blasting and sediment removal, which are likely to result in water contamination. Impacts of erosion and sedimentation: During rehabilitation works, the removal and disturbance of vegetation and soil as well as blasting activities poses a risk for erosion and sedimentation related impacts. Potential sources of impact related to sediment loads have been identified during: (i) the construction and operation of the temporary access roads, (ii) discharge from the plunge pool, (iii), blasting and rock removal activities, (iv) construction of the downstream cofferdam and (v) dredging of the slipway site. It is anticipated that the impact of erosion and sedimentation on the water quality and habitat template of the receiving environment will be a Minor Negative Impact pre-mitigation.

Impacts on Aquatic Environment: Rehabilitation activities relating to dredging, blasting and dewatering are likely to result in direct fish mortalities due to the proximity of these activities to the instream environment. It is anticipated that the impact of blasting, dewatering and other instream activities on the instream aquatic community of the receiving environment will be a Moderate Negative Impact pre-mitigation. Impacts on Terrestrial Habitat: Areas impacted by rehabilitation works activities will extend over both Zambia and Zimbabwe and will include a general construction site on the Zambian side of the river; widening and upgrading of existing access roads; the construction of an access road into the plunge pool below the dam; construction of the cofferdam; the deposition of waste rock in the existing disused Sinohydro Quarry Site in Zambia; access to the waste rock dumpsite and access to and the existing slipway in Zimbabwe. An area of direct terrestrial ecological influence has been defined as the general construction site on the Zambian side of the river, the temporary access road into the plunge pool area, the access road to the waste rock dumpsite, the dumpsite itself, access to the spillway on the Zimbabwean side of the river and the slipway area itself. It is anticipated that the impact on terrestrial habitat loss will be a Negligible Negative Impact pre-mitigation. Impacts on Terrestrial Species of Conservation Concern: Many of the rehabilitation activities are located within a protected area and there is a high likelihood that animals may become trapped or 16 unexpectedly cornered. Many animals can be dangerous when trapped or cornered (including snakes, carnivores, horned antelope, porcupines and others) and adequate training should be undertaken to handle a range of potential wildlife interactions. It is anticipated that the significance of the impact on species of conservation concern will be a Minor Negative Impact pre-mitigation. Impacts on Protected Areas: The Project is located within the Lower Zambezi TFCA. In Zambia this TFCA includes the Open Area around Siavonga down to Chirundu, Chiawa Game Management Area and Lower Zambezi National Park. In Zimbabwe the TFCA includes the Charara, Urungwe and Rifa Safari Areas between Kariba and Chirundu, Mana Pools National Park, Sapi and Chewore Safari Areas down to Kanyemba. It is anticipated that the significance of the impact to protected areas will be a Moderate Negative Impact pre-mitigation. Impacts on Tourism: Rehabilitation activities with the most likely impact on tourism are probably associated with blasting for rehabilitation of the plunge pool. It is anticipated that blasting activities will take place over a six month period. Depending on the safety risk linked to the blasting, it is possible that there will be temporary access restrictions to the wall when blasting occurs. It is, therefore, possible that rehabilitation activities may result in a slight disturbance to tourism activities in the area. It is anticipated that the impact on tourism will be a Negligible Negative Impact pre-mitigation. Impacts on Fisheries-Based Livelihoods: Sensitivity in this case relates to fragile livelihood strategies, income instability, lack of food security and poverty. The most sensitive receptors are downstream fishers who may lose an important source of nutrition and income if activities associated with the rehabilitation works change the water quality to such an extent that it negatively affects the fish population. It is unlikely that the fishers will be able to find an alternative source of nutrition and income easily. it is anticipated that the impact on fisheries-based livelihoods will be a Negligible to Moderate Negative Impact pre-mitigation

Impacts of STIs and HIV/AIDs: The proposed Project has the potential to increase the transmission of HIV and other STIs in the social AOI due to the following: (i) Transport drivers, who may typically have higher rates of HIV or STIs than the general population, may engage in casual sexual activity at their end destination, acting as a vector for the disease. (ii) A mainly male workforce with a comparatively larger disposable income may engage in sexual activities in local communities, acting as a vector for the disease. (iii) Existing stigma and taboos around STIs and HIV will make it challenging to negotiate safe sex practices such as the use of condoms (including the use of female condoms). Any increase in the prevalence of HIV or STIs in the SSA is a business risk for the proposed Project and may affect the health of the workforce and therefore their ability to do their job. There is little access to treatment for STIs in the social AOI; as such, these could also impact the long term health of those who suffer infections. The stigma and taboos around STIs may also affect people accessing treatment in a timely manner which may affect health outcomes. Women, young children, the elderly, those infected with sexually transmitted infections and their carers will be most vulnerable to increased transmission of HIV or STIs. The vulnerability in women will be linked to the potential of being infected by their partners and potentially passing the diseases onto their young children (especially HIV) and/ or having to care for the ill for long time. In turn, the elderly may end up having to care for the young children in case of the parents’ severe illnesses and deaths. Those infected by HIV or STIs are likely to endure long term stigmatisation by their peers. This impact has been assessed as a Major Negative Impact prior to mitigation. 17 Dam Safety: Given that Lake Kariba is the largest man-made reservoir in the world (at 181 x 109 m3), and has a spill capacity of 9,000m3/s, this Project constitutes a high risk to both downstream inhabitants and the environment in the event of dam failure. The downstream flood plain is currently home to more than 3 million people so potential loss of life could be catastrophic. Other impacts from a dam failure would include loss of livelihoods and loss of power, which will also negatively affect the economies of the region. Kariba Dam and Cahora Bassa Dam account for 40% of the South African Power Pool (SAPP) generation capacity (excluding South Africa). Impacts from Climate Change: When Kariba Dam was designed, the possibility of climate change was not considered and the reliability of this scheme was therefore assumed to be stationary. Studies have since shown that the climate is likely to change, which will cause a change in the reliability of the reservoir. If information about climate change was available during the design of Kariba Dam, it is likely that a larger safety factor could have been adopted when selecting the reservoir capacity. A larger capacity of the reservoir could have been selected in order to ensure that a high reliability level is maintained even under climate change conditions. Over the next century, climate change is expected to increase this variability, and the vulnerability of the basin –and its hydropower dams – to these changes. Results (World Bank, 2014) show that under the driest scenarios (see figure below) hydropower generation could decline by more than 60%, and unmet irrigation demand could decline by more than 25% in the Zambezi basin. The benefits of wetter scenarios in the Zambezi basin, in the upper right corner, suggest an increase of up to 25% in hydropower production and a few percent in irrigation water provision. The results vary dramatically by basin, but show overall climate change could be an important factor in water and power infrastructure performance in the Zambezi in particular.

6.潜在影响

创造就业机会：与跳水池相关的康复活动

溢洪道将创造一个尚未知的就业机会数量，将分配

在大约7年的时间。计划提供小型游泳池的康复活动

在干旱季节（每年7个月）在预计四年期间和溢洪道一段时间

约8年。

有两个因素将影响实际的就业机会数量

现实地为AoI中的潜在雇员提供，即技能水平和结构化

雇佣合同。可以预见，由于高度专业化的性质

康复工程;大量的机会将是高技能和熟练的人

例如工程师，快门，钻机和爆破，钢制固定器，机器操作员，混凝土手和

而相对较少的机会将可用于非熟练劳动力，例如

为安全，家政和餐饮工作人员。预计对就业创造的影响

那些寻求就业的人将是一个积极影响前缓解。

对水文的影响：大坝的恢复，具体指三者中的任何一个

情景，可以认为对下游河流水文的水文几乎没有影响

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当与系统的当前状态相比时，如果在整个过程中进行水力发电

项目持续时间。然而，由于a，这些释放可能不可能的概率很低

在大坝水位降低后（即如果水库管理），没有流入大坝

导致16或11个月的替代方案1和2的持续不溢出

在流量方面对下游水文系统的重大负面影响

下游用户和下游接收环境。减少流量低于

环境流量要求（EFR）将具有主要负面影响预减轻。

对水质的影响：对水质的影响被认为是最有可能的潜力

影响确定。对水质的潜在影响来源被确定为：（i）脱水

，（ii）安装围堰和相关工作区域的脱水，

（iii）疏浚滑道，（iv）爆破活动和（v）建造和使用相关通道

道路。感知的影响主要与水的退化的恢复有关

质量将最有可能归因于增加的沉积物负荷（例如土和岩石移动

活性），建筑材料（例如水泥），烃（例如油和柴油），溶剂和其它

通过意外泄漏/泄漏从工程机械和设备的有害物质。的

对水质的影响将是对水质的一种中度负面影响预减轻

接收环境。倾泻池重塑和溢洪道清淤活动将需要

内流作用如脱水，爆破和沉积物去除，其可能导致水

污染。

侵蚀和沉积的影响：在恢复工程，清除和扰动

植被和土壤以及爆破活动造成侵蚀和沉积相关的风险

影响。与沉积物荷载相关的潜在影响来源包括：（i）

临时通道的建设和运行，（ii）从小水池排放，（iii）

爆破和岩石清除活动，（iv）建造下游围堰和（v）疏浚

的滑道站点。预计侵蚀和沉积对水质的影响

和接收环境的栖息地模板将是次要负面影响预缓解

对水环境的影响：与疏浚，爆破和

脱水可能导致直接鱼死亡，因为这些活动接近

内河环境。预计爆破，脱水等污染物的影响

在接收环境的水上社区的活动将是一个中等的负面

影响预缓解。

对陆地栖息地的影响：受恢复工程活动影响的地区将扩大

赞比亚和津巴布韦，并将在该河的赞比亚一侧包括一个一般建筑工地;

扩大和升级现有通道;建设进入通道的通道

水坝下面的水池;建造围堰;废石在现有废弃物中的沉积

赞比亚中国水电站进入废石倾倒场和进入和现有的

津巴布韦的滑道。

直接陆生生态影响的区域被定义为一般施工现场

赞比亚一侧的河流，临时通道进入跳水池区，通路通往

废石倾倒地，倾倒物本身，进入津巴布韦一侧的溢洪道

河流和滑道区域本身。预计对陆地生境丧失的影响将是a

可忽略的负面影响预减轻。

对养护关注的陆生物种的影响：许多恢复活动是

位于保护区内，并且动物可能被捕获的可能性很高

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意外地角。许多动物在被困或陷害时可能是​​危险的（包括蛇，

食肉动物，有角的羚羊，豪猪等），并应进行适当的培训

处理一系列潜在的野生动物互动。预计影响的意义

保护关注的物种将是次要负面影响预减轻。

对保护区的影响：该项目位于赞比西下部TFCA内。在赞比亚

TFCA包括围绕Siavonga的开放区域到Chirundu，Chiawa游戏管理区域

和赞比西河下游国家公园。在津巴布韦，TFCA包括Charara，Urungwe和Rifa

Kariba和Chirundu之间的Safari地区，Mana池国家公园，Sapi和Chewore Safari地区

下到Kanyemba。预计对保护区的影响的重要性将是a

中度负面影响预缓解。

对旅游业的影响：可能对旅游业产生最可能影响的恢复活动

与爆破池的修复相关联。预计爆破活动

将在六个月内进行。根据与爆破相关的安全风险，这是可能的

当爆破发生时，将对墙壁进行临时进入限制。因此，

复兴活动可能会对该地区的旅游活动造成轻微干扰。

预计对旅游业的影响将是一种可忽略不计的负面影响预减缓措施。

对渔业生计的影响：这种情况下的敏感性涉及脆弱的生计策略，

收入不稳定，缺乏粮食安全和贫困。最敏感的受体是下游

渔民如果与活动有关，可能失去重要的营养和收入来源

复原工程会改变水质，使其对鱼类产生不利影响

人口。渔民不太可能找到另一种营养来源

收入容易。预计对渔业为基础的生计的影响将是可以忽略不计的

中度负面影响预缓解

性传播感染和艾滋病毒/艾滋病的影响：拟议的项目有可能增加传播

艾滋病毒和其他性传播感染在社会AOI由于以下原因：（i）运输司机，通常

具有比一般人群更高的艾滋病毒或性传播感染的比率，可以从事随意的性活动

它们的终点目的地，作为疾病的载体。 （二）主要为男性的劳动力

相对较大的可支配收入可能在当地社区从事性活动

作为该疾病的载体。 （iii）围绕性传播感染和艾滋病毒的现有耻辱和禁忌将使之成为现实

挑战性谈判安全性行为，如使用避孕套（包括使用女性

避孕套）。

SSA中艾滋病毒或性传播感染的流行率的任何增加都是拟议项目的商业风险

并可能影响劳动力的健康，从而影响他们完成工作的能力。有很少

在社会AOI中获得性传播感染的治疗;因此，这些也可能影响的长期健康

那些遭受感染的人。 STI的污名和禁忌也可能影响人们的访问

及时的治疗可能影响健康结果。

妇女，儿童，老年人，感染性传播感染者及其家属

照顾者将最容易受到艾滋病毒或性传播感染的传播的增加。妇女的脆弱性

将与被其合作伙伴感染并潜在地传播疾病的潜力相关联

对他们的幼儿（特别是艾滋病毒）和/或长期照顾病人。反过来，

老人可能最终在父母的严重疾病的情况下照顾幼儿

死亡。那些感染了艾滋病毒或性传播感染的人可能会忍受同龄人的长期污名。

这种影响被评估为减缓之前的主要负面影响。

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大坝安全：

考虑到卡里巴湖是世界上最大的人造水库（181×109立方米），并有一个

泄漏能力为9,000m3 / s，本项目对下游居民构成高风险

在大坝失效的情况下的环境。下游洪泛平原目前是家庭以上

300万人，所以潜在的生命损失可能是灾难性的。大坝失效的其他影响

包括丧失生计和丧失权力，这也将对经济造成不利影响

地区。 Kariba水坝和Cahora Bassa水坝占南非电力池（SAPP）的40％

（不包括南非）。

气候变化的影响：

当Kariba水坝被设计时，没有考虑气候变化的可能性

因此假定该方案的可靠性是稳定的。后来的研究表明

气候可能发生变化，这将导致储层可靠性的变化。如果信息

关于气候变化是在Kariba水坝的设计过程中可用的，它可能具有更大的安全性

选择储层容量时可以采用因子。容器的容量更大

可以被选择以确保即使在气候下也保持高可靠性水平

变化条件。

在下个世纪，气候变化预计会增加这种变异性和脆弱性

该盆地及其水电大坝 - 对这些变化。结果（世界银行，2014）显示，

最干旱的情况（见下图），水电发电量可能下降60％以上

未满足的灌溉需求在赞比西盆地可能下降超过25％。润湿的好处

在赞比西盆地的情景中，在右上角，建议增加高达25％

水电生产和灌溉水供应的百分之几。结果不同

但显示总体气候变化可能是水和电力的一个重要因素

特别是赞比西的基础设施业绩。

7. MITIGATION MEASURES AND COMPLIMENTARY INITIATIVES Mitigation Measures Enhancement Measures for Employment: The following management measures are proposed to enhance this impact: (i) The development of Project specific Recruitment Policies by the Project Proponent, the Engineer as well as the Contractor. (ii) The setting of targets to maximise the number of Zambian and Zimbabwean nationals, to consider the gender balance for available local jobs. Consideration of targets for disabled, unskilled, skilled and highly skilled employees from the AoI. (iii) Targets to become part of Conditions of Contract with Engineer and Contractor. (iv) Preparation of monthly and cumulative employment statistics reports for submission to Project Proponent. (iv) Conduct an annual audit of employment statistics based on which an incentive for achieving employment targets can be considered. (v) Public advertising of employment opportunities in all newspapers, public libraries, the District Office and in all relevant languages. (vi) The establishment of a Recruitment Office by the Contractor with the purpose of keeping a record of available prospective employees, their skills levels and contact details. Registration of job seekers with the Recruitment Office will be free of charge. 18 Mitigation and Management for Impacts on Hydrology: The implementation of the preferred reservoir management scenario, and the use of a cofferdam structure that can allow for spill events as, and when they are required, are the main mitigations for impacts pertaining to hydrology. Although it is recognised that any spill is likely to have a positive effect on the downstream ecology and channel processes, the risks associated with not enough discharge, for any period of time, are greater. Mitigation for Impacts on Water Quality: Water quality monitoring during rehabilitation works should monitor pH, EC, TDS, temperature, turbidity and dissolved oxygen on a weekly basis. For the rehabilitation of the plunge pool, these measurements can be taken from the river bank at 200m, 500m and 1km intervals downstream from the instream activities. Measurements at the 1km monitoring point should remain below threshold values as provided in the water quality monitoring plan. Hydrocarbons, major ions (Sulphates, Chlorides, Calcium, Magnesium, Sodium, Carbonates/ Bicarbonates) and nutrients (total Nitrogen and total Phosphates) should be monitored in line with the water quality monitoring plan. Other mitigation measures include; (i) No dumping of any building rubble, soil, litter, organic matter or chemical substances should occur within watercourses; (ii) As dewatering takes place the water quality within the plunge pool may deteriorate further at greater depths. (iii) The dewatering systems should be designed to accommodate as much sediment trapping as possible. (iv) The total suspended solid levels downstream of the dewatering point should not vary with more than 15% that of background levels. (v) A detailed course of action for accidental spills or surface water contamination should be provided for all sites where such contaminates are stored/used. (vi) Construction equipment should not be serviced or refuelled near the river or dam. In cases where there is no option but to refuel near the water, suitable preventative and responsive actions should be taken. Mitigation for erosion and sedimentation: Erosion and silt control mechanisms should be in place prior to the onset of rehabilitation within any watercourse. This includes (i) the elimination of surface flow through the active work site. (ii) Silt fences or hay bales need to be placed near the base of an exposed slope in order to limit the amount of sediment entering the watercourse. (iii) Depending on the silt load suspension within the plunge pool, it may be necessary to delay dewatering until sediment has settled or until turbidity levels downstream of the discharge point do not vary with more than 10-15% to that of background values. (iv) The erection of silt barriers along all affected drainage lines should be undertaken to curb any sediment and silt run-off in the preparation of rehabilitation activities. (v) Ideally, the amount of land that will be disturbed should be kept to an absolute minimal. Mitigation on Aquatic Environment: Most impacts expected to affect aquatic biota have been discussed under previous sections. Implementing recommendation and mitigation measures for impacts related to water quality, hydrology, erosion and sedimentation, will also mitigate most expected impacts on aquatic biota. Aquatic biota may further be impacted by mortalities directly associated to instream activities such as blasting and dewatering. Local literature on mitigating blasting impacts on instream biota is limited, but international literature suggests that blasting induced over pressure should not exceed a 100 kPa and peak particle velocity should not exceed 13mm/s.

In addition to blasting, fish may become isolated and trapped within the plunge pool area during dewatering activities. This may provide a good opportunity to further the taxonomic resolution of fishes of the middle Zambezi River. Fish trapped within the dewatered area can be removed via gill and seine netting. The latter is the preferred method and released within the downstream area. A representative sample of the fish community may be preserved appropriately and provided to local and international institutions for curation. A bio monitoring regime, before during and after rehabilitation should be instated. 19 Mitigation for Impacts on Terrestrial Habitat: (i) Appoint and Authorise an Environmental Officer – a qualified and competent Environmental Officer should be appointed with sufficient authorisation to ensure protection of the environment is prioritised. (ii) Incorporate Ecological Awareness into Induction Programmes – induction programmes for staff, contractors and site visitors should emphasise that many of the active work areas are inside protected areas and should include the importance of minimising the disturbance to the environment. (iii) Avoid Footprint Creep – measures should be taken at the planning stage to determine the minimum required area for all rehabilitation works, equipment laydown sites, construction vehicle parking, erection of staff toilet facilities, construction viewing sites and other activities. Mitigation for Terrestrial Species of Conservation Concern: Implement an Animal Rescue Plan – Wildlife authorities are present in both Zambia and Zimbabwe and private veterinary skills are available. Arrangements should be put in place with relevant persons of authority or with appropriate capacities to be on call and able to react. Their contact details should be appropriately circulated amongst rehabilitation work teams and included in induction programmes for use in the event of an incident involving a dangerous or potentially dangerous animal. Recognise Threatened and Protected Species and Translocate Appropriately – various threatened and protected species of plants and animals are present in the Project AOI and surrounds. An Environmental Officer, or a member of his/her staff should be able to recognise these species and scan areas prior to the start of rehabilitation activities to determine if present or potentially present (in the case of animals), and take appropriate steps based on the species involved. Mitigation for Impacts on Protected Areas: Maintain Dialogue and Collaboration with Protected Area Authorities – an open communication should be maintained with conservation authorities to ensure that they are familiar with future plans, activities taking place and are provided with opportunity to advise on day-to-day measures to minimise possible impacts. Their advice and support should be considered regarding an animal rescue plan and translocation of species. Responsibilities should be delegated (e.g. to the Environmental Officer) for ensuring regular communication occurs with conservation authorities. Mitigation for Impacts on Tourism: The following mitigation and management measures are proposed: (i) Installation of project information boards, which provide a brief description of rehabilitation works, Project timeframes as well as the blasting schedule. (ii) Sharing of Project description and rehabilitation schedule with tourism operators. (iii) Implementation of noise and dust abatement measures as required. Mitigation of Impacts on Fisheries-Based Livelihoods: The management of water quality during the drawing down of the plunge pool and subsequent rehabilitation activities will be challenging. The following mitigation and management measures are proposed regarding the down-stream fishers: An aquatic monitoring program should be implemented that will enable an early identification of a decline in fish numbers and associated fish catches downstream. If changes are observed, the ZRA should working with NGOs and Government to develop a mitigation and compensation plan. Mitigation for Impacts of STIs and HIV/AIDs: As a means to mitigate impacts related to the increased incidences of HIV/AIDS and other STIs: (i) In partnership with local health officials and relevant NGOs, Contractors should undertake information, education and communication campaigns around safe sexual practices and transmission of STIs and HIV/AIDS. (ii) Contractors should engage with an independent entity such as an NGO to develop and implement an HIV/AIDS Prevention Programmes for its workforce. The NGOs mandate shall cover the workers and communities in the Project Area. (iii) ZRA should develop and implement a Workforce Code of Conduct for appointed Contractors. The key health and safety elements of the code should include: Zero tolerance of illegal activities by all personnel; Forbidding the use of prostitution; Forbidding the illegal sale or purchase of alcohol; Forbidding the sale, purchase or consumption of drugs; and Forbidding gambling and fighting. (iv) The Workforce Code of Conduct should be adhered to by all Contractors. Any Contractor found in violation of the Code should face disciplinary hearing which should potentially result in dismissal. (v) Contractors should ensure that they have sufficient capacity and capability to care and treat any HIVpositive employees. (vi) Contractors should ensure there is access to free condoms (including female condoms) at the worker camp to promote safe sexual practices. Mitigation for Dam Safety: ZRA have an existing Emergency Preparedness Plan: Kariba Dam and Reservoir Standing Operations Procedure dated Jan 2013. Apart from this Dam Safety Inspection Reports are periodically compiled on. The overall rehabilitation of the Kariba Dam plunge pool and sluices is inherently a dam safety issue that needs to be carefully considered as part of the overall Kariba Dam Emergency Preparedness Plan (included in the ZRA Kariba Dam and Reservoir Standing Operations Procedure dated Jan 2013). The updating the preparedness plan will be the highest priority. The key to such an update is a welldeveloped communication plan that has been thoroughly vetted and tested. In addition to the above, the ZRA will ensure that the updating of the existing Kariba Dam Emergency Preparedness Plan be done in a way that – (i) The plan is updated in consultation with the relevant stakeholders (stakeholder mapping and identification to be done as part of the updating process). (ii) The contact details of those individuals included in the chain of command and communication procedure should be provided in the plan and kept up to date. (iii) Downstream communities affected by such an emergency should be identified and contact details for applicable community heads should be provided and kept up to date. (iv) Clarifies the need to put a national disaster response mechanism in place for downstream reaches in the event of a catastrophic incident. Moreover, copies of the final amended Kariba Dam Emergency Preparedness Plan should be made available to – The Offices of the President; The Disaster Management and Mitigation Unit; The Civil Protection Unit. Periodically undertake Kariba Dam emergency preparedness drills to test the emergency plan. Mitigation for Climate Change Impacts: Currently there are several hydrological and climate change and climate variability studies being undertaken on the Zambezi River Basin. The studies results shall be used by ZRA to develop a Climate Change Action Plan for the management of Kariba Dam.

7.减缓措施和诉讼措施

缓解措施

加强就业措施：提出以下管理措施

增强这种影响：（i）项目特定项目招聘政策的制定

支持者，工程师以及承包商。 （ii）制定目标以最大化数量

的赞比亚和津巴布韦国民，考虑可用于当地工作的性别平衡。

考虑来自AoI的残疾人，非技术人员，熟练技术和高技能雇员的目标。

（iii）与工程师和承包商成为合同条件一部分的目标。 （iv）制备

的月度累计就业统计报告，以提交给项目参与方。 （iv）

对就业统计进行年度审计，根据这些审计激励实现

可以考虑就业目标。 （v）公开宣传所有就业机会

报章，公共图书馆，民政事务处和所有有关语文。 （vi）设立

的招聘办公室，目的是保持可用的预期的记录

员工，他们的技能水平和联系方式。求职者注册

办公室将是免费的。

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减缓和管理对水文的影响：优先水库的实施

管理情景，以及使用可以允许溢出事件作为和时间的围堰结构

它们是需要的，是对与水文有关的影响的主要缓解。虽然是

认为任何溢出都可能对下游生态和渠道产生积极影响

过程中，与任何时间段不足的排放相关的风险更大。

减轻对水质的影响：在恢复工程中进行水质监测

每周监测pH，EC，TDS，温度，浊度和溶解氧。为了

修复跳水池，这些测量可以从河岸取200米，500米

和内河活动下游1公里间隔。在1km监测点进行测量

应保持低于水质监测计划中规定的阈值。烃，

主要离子（硫酸盐，氯化物，钙，镁，钠，碳酸盐/碳酸氢盐）和

营养物质（总氮和总磷酸盐）应根据水质进行监测

监测计划。

其他减缓措施包括： （i）不得倾倒任何建筑废墟，土壤，垃圾，有机物质

或化学物质应发生在水道内; （ii）当水脱水时

跳水池内的质量可能在更大的深度进一步恶化。 （iii）脱水系统

应设计成尽可能多地容纳沉积物捕集。 （iv）被暂停

脱水点下游的固体水平的变化不应超过15％

背景水平。 （v）意外泄漏或地表水污染的详细行动过程

应提供给存储/使用这些污染物的所有场所。 （vi）建筑设备

不应在河流或大坝附近进行维修或补给。在没有选择，但加油的情况下

在水附近，应采取适当的预防和响应行动。

减缓侵蚀和沉积：侵蚀和淤泥控制机制应在之前建立

到任何水道内的复原的开始。这包括（i）消除表面流动

通过活跃的工作现场。 （ii）需要将围栏或干草捆放置在暴露的基底附近

以限制进入水道的沉积物的量。 （iii）取决于淤泥负荷

悬浮池内，可能有必要延迟脱水，直到沉积物沉降

或直到放电点下游的浊度水平相对于其不超过10-15％变化

的背景值。 （iv）沿所有受影响的排水管线安装淤泥屏障

承诺遏制任何沉积物和淤泥径流在准备恢复活动。 （v）

理想情况下，将被干扰的土地数量应该保持在绝对最小。

缓解水生环境：已经讨论了影响水生生物的大多数影响

在以前的章节。实施相关影响的建议和减缓措施

水质，水文，侵蚀和沉积，也将减轻对预期的最大影响

水生生物群。水生生物群可能进一步受到与河道直接相关的死亡的影响

活动如爆破和脱水。减轻爆炸对局部影响的当地文献

生物群是有限的，但国际文献表明，爆破诱导过压不应

超过100 kPa，峰值粒子速度不应超过13mm / s。除了爆破，鱼可能变得孤立和困在跳水池区域内

脱水活动。这可能为进一步的分类分析提供了良好的机会

中间赞比西河的鱼。捕获在脱水区域内的鱼可以通过鳃去除

和围网。后者是优选的方法并且在下游区域内释放。一个

鱼类社区的代表性样本可以适当保存并提供给当地和

国际管理机构。修复前后的生物监测制度

应该保持。

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减缓对陆地栖息地的影响：（i）任命和授权环境官员 -

应任命具有资格的合格环境官员，并获得充分授权

确保对环境的保护优先。 （ii）将生态意识纳入

入职课程 - 员工，承包商和网站访客的入职培训计划

强调许多积极的工作领域都在保护区内，应包括

最小化对环境的干扰的重要性。 （iii）避免足迹蠕变 - 措施

应在规划阶段确定所有复原所需的最低面积

工程，设备堆放场地，建筑车辆停车场，设置职员厕所设施，

建筑观景点等活动。

减轻陆地物种的保护关注：实施动物救援计划 -

野生动物当局在赞比亚和津巴布韦都有，私人兽医技术

可用。应与相关权力人员或适当人员进行安排

能力在呼叫和能够反应。他们的联系方式应适当分发

在康复工作队中，并包括在使用的归纳计划中

涉及危险或潜在危险动物的事件。

承认受威胁和保护的物种，并适当移居 - 各种受威胁和

受保护的植物和动物物种存在于项目AOI和周围。一个

环境官员或他/她的工作人员应该能够识别这些物种并扫描

区域，以确定是否存在或潜在地存在（在

动物的情况），并根据所涉及的物种采取适当的步骤。

减缓对保护区的影响：保持与保护区的对话和合作

当局 - 应与保护当局保持开放的沟通，以确保

他们熟悉未来的计划，正在进行的活动，并提供机会

建议日常措施以尽可能减少可能的影响。他们的建议和支持应该是

考虑了动物拯救计划和物种移动。职责应该是

授权（例如向环境官员）确保与其进行定期沟通

保存当局。

减缓对旅游业的影响：提出以下缓解和管理措施：

（i）安装项目信息委员会，简要介绍恢复工程，

项目时间表以及爆破计划。 （ii）共享项目描述和

康复计划与旅游经营者。 （iii）实施噪音和除尘

措施。

减缓对渔业生计的影响：水质管理

下沉的游泳池和后续的康复活动将是具有挑战性的。的

提出了关于下游渔民的以下减缓和管理措施：

水资源监测方案应该得到实施

及早确定鱼类数量下降和相关鱼类捕捞量的下游。如果更改

ZRA应与非政府组织和政府合作，制定缓解措施

补偿计划。

减轻性传播感染和艾滋病毒/艾滋病影响：作为减轻与增加有关的影响的手段

艾滋病毒/艾滋病和其他性传播感染的发病率：（i）与当地卫生官员合作并相关

非政府组织，承包商应开展信息，教育和宣传活动

安全性行为和性传播感染和艾滋病毒/艾滋病的传播。 （ii）承包商应与独立实体如非政府组织制定和实施艾滋病毒/艾滋病预防方案

为其劳动力。非政府组织的任务将覆盖项目区的工人和社区。

（iii）ZRA应为指定承包商制定和实施劳动力行为准则。的

守则的关键健康和安全要素应包括：所有人对非法活动的零容忍

人员;禁止使用卖淫;禁止非法销售或购买酒精;

禁止销售，购买或消费毒品;禁止赌博和战斗。 （iv）

所有承包商应遵守“劳动力行为守则”。在中找到的任何承包商

违反“守则”应面临纪律审讯，应可能导致解雇。 （v）

承包商应确保他们有足够的能力和能力照顾和治疗任何艾滋病毒阳性

雇员。 （vi）承包商应确保有免费安全套（包括女性）

避孕套）在工人营地促进安全性行为。

减轻水坝安全：

ZRA有一个现有的应急准备计划：卡里巴大坝和水库站立作业

程序日期为2013年1月。除此之外，还定期编制大坝安全检查报告

上。卡里巴大坝跳水池和水闸的整体修复本质上是大坝安全

这个问题需要认真考虑，作为整个卡里巴大坝应急准备的一部分

计划（包括在2013年1月的ZRA卡里巴大坝和水库常设行动程序中）。

更新备灾计划将是最高优先级。这种更新的关键是一个发达的

通讯计划已经过全面审查和测试。除了上述之外，

ZRA将确保更新现有的Kariba水坝应急准备计划

（i）该计划在与相关利益相关者（利益相关者）磋商后更新

映射和识别作为更新过程的一部分来完成）。 （ii）这些文件的联系方式

应该提供包括在指挥和通信程序链中的个人

计划和不断更新。 （iii）受这种紧急情况影响的下游社区

应提供适用的社区领导的确定和联系详情，并保持最新。

（iv）澄清需要为下游地区建立国家灾害响应机制

在灾难性事件的情况下。

此外，应制定最后修改的Kariba水坝应急准备计划的副本

可用于 - 总统办公室;灾害管理和减灾单位;民事

保护单元。定期进行Kariba水坝应急准备演习

应急计划。

减缓气候变化影响：

目前有几个水文和气候变化及气候变率研究

在赞比西河流域进行。研究结果将被ZRA用于开发气候

改变卡里巴大坝管理的行动计划。

8. CUMULATIVE IMPACTS AND ENVIRONMENTAL HAZARD MANAGEMENT The cumulative impacts that would result from a combination of the proposed Kariba Dam Rehabilitation Project and other developments in the broader Project Area include: (i) Impacts on Surface Water Hydrology and Aquatic Environment; (ii) Employment; (iii) Increased Risk of Road Accidents; and (iv) General Construction Impacts (dust and noise emissions). Each of these potential cumulative impacts is described below. 21 Impacts on Surface Water Hydrology and Aquatic Environment: Cumulative impacts affecting the aquatic integrity of the Kariba gorge include the historic construction of the Kariba dam and the associated hydroelectric power stations, both current and proposed, all of which have irreversibly altered the hydrological regime operational within the gorge. Current downstream activities involving the deposition of large volumes of coarse aggregate, resulting in steep unstable slopes which are vulnerable to erosion and threaten the current water qualities through increased turbidity, are likely to further add to the cumulative impacts affecting the receiving aquatic environment. Subsequently, proposed activities directly downstream of the dam involving localized decanting, blasting and potential short-term alteration of existing flow regime, are unlikely to add significantly to the overall cumulative impact affecting the aquatic system downstream of the dam. Employment: Although development in the AOI provides employment opportunities and contributes to households having more disposable income to contribute to improved livelihoods, it also has the potential to result in unfair and unsafe working conditions. During in-field engagement with local stakeholders, concerns related to labour and conditions of employment for existing/previous projects (viz. the North and South Bank Kariba Power Station extensions) were raised. It was reported that contractors associated with such projects do not adhere to basic conditions of employment as set out in the countries’ legislation. Such conditions include low remuneration packages, poor treatment, long working hours, poor workforce accommodation and poor health and safety standards. Should mitigation/management measures included be implemented, it is unlikely that the proposed Kariba Dam Rehabilitation Project will add to negative impacts around inadequate labour and poor employment conditions. Increased Risk of Road Accidents: Baseline vehicle traffic volumes are low in the Project AOI. Existing upgrade works at the Kariba South Bank Power Station and the proposed Kariba Dam Rehabilitation Project will increase light and heavy vehicles using the local roads throughout the duration of works. The combined volumes of road traffic will place both human and livestock in danger of being injured or killed throughout the life of these projects. Close communication and coordination between both project teams and effective signage and traffic management will be required to avoid significant cumulative impacts. General Construction Impacts (Dust and Noise) Dust Emissions: Rehabilitation activities associated with the proposed Kariba Dam Rehabilitation Project together with construction activities from other developments have the potential to create negative cumulative impacts associated with the generation of total dust, PM0 and PM2.5. The magnitude of these potential impacts may be minor, moderate or major, depending upon how the impacts from other projects will combine with impacts arising from the proposed Kariba Dam Rehabilitation Project and the respective timing of each project. There will be some overlap of rehabilitation/construction works between the proposed Project and works associated with the upgrading of the Kariba South Bank Power Station, which may result in additional dust generation. This may be worsened by elevated wind speeds, increasing the potential for cumulative impacts during periods of adverse weather. Implementation of dust management actions by both construction projects will be required. Noise Emissions: As is mentioned previously, there will be some overlap of rehabilitation/construction works between the proposed Project and works associated with the upgrading of the Kariba South Bank Power Station. As such, it is possible that the cumulative noise impact of activities carried for these two projects may result in a nuisance to noise sensitive receptors in the vicinity of the Kariba 22 Dam. This is however dependent on how the impacts from the other development combine with the impacts from the proposed Project, and the respective timing of these impacts.

8.累积影响和环境危害管理

提出的Kariba水坝的综合影响

康复项目和更广泛的项目领域的其他发展包括：（i）

地表水水文与水环境; （二）就业; （iii）道路风险增加

事故;和（iv）一般施工影响（灰尘和噪声排放）。每个这些潜力

累积影响如下所述。

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对地表水水文和水环境的影响：累积影响

卡里巴峡谷的水生完整性包括卡里巴大坝的历史建筑和

相关水电站，目前和拟议，所有这些都不可逆转

改变了峡谷内运行的水文制度。当前下游活动涉及

沉积大量粗骨料，导致陡峭的不稳定斜坡

易受侵蚀，并通过增加浊度威胁当前水质，很可能

进一步增加了影响接收水生环境的累积影响。后来，

直接在大坝下游进行的建议活动涉及局部倾析，爆破和

潜在的短期改变现有流量制度，不太可能显着增加总体

影响大坝下游水生系统的累积影响。

就业：虽然AOI的发展提供了就业机会和贡献

对有更多可支配收入的家庭有助于改善生计，它也有

可能导致不公平和不安全的工作条件。在现场与当地的接触

利益相关者，与现有/以前项目的劳动和就业条件有关的关切

（即南北岸卡里巴电站延伸）。据报道

与这些项目有关的承包商不遵守所规定的基本就业条件

在国家的立法。这些条件包括薪酬低的一揽子计划，治疗不善，时间长

工作时间，劳动力不足，健康和安全标准差。应该

减缓/管理措施，但建议的Kariba不太可能

水坝修复项目将增加对劳动力不足和贫困的负面影响

就业条件。

道路交通事故风险增加：项目AOI的基准车辆交通量低。现有

在卡里巴南岸电站和拟议的卡里巴大坝升级工程

康复项目将使用当地道路增加轻型和重型车辆

作品的持续时间。道路交通的总量将使人类和牲畜处于危险之中

在这些项目的整个生命中受伤或死亡。密切沟通和协调

在两个项目团队之间和有效的标志和交通管理将需要避免

显着累积影响。

一般建筑影响（粉尘和噪音）

尘埃排放：与拟议的Kariba水坝修复相关的恢复活动

项目与其他开发项目的建设活动一起有可能创造

与总粉尘PM0和PM2.5的产生相关的负累积影响。的

这些潜在影响的程度可能轻微，中度或重大，取决于如何

其他项目的影响将与拟议的Kariba水坝产生的影响相结合

康复项目及每个项目的时间安排。会有一些重叠

拟建项目与相关工程之间的恢复/建造工程

升级Kariba南岸电站，这可能导致额外的粉尘产生。

这可能由于高的风速而恶化，增加了累积影响的可能性

恶劣天气的时期。两个施工项目实施扬尘管理行动

将需要。

噪声排放：如前所述，修复/建设会有一些重叠

拟议项目与与卡里巴南部升级相关的工程之间的合作

银行电站。因此，可能对所进行的活动的累积噪声影响

这两个项目可能对卡里巴附近的噪声敏感的接收器造成麻烦

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坝。然而，这取决于如何从其他发展的影响与

拟议项目的影响，以及这些影响的相应时间。爆破活动和相关水坝安全：Kariba水坝恢复项目和

卡里巴南岸电厂建设活动涉及爆破。 在这个阶段是不确定的

如果这些活动会重叠。 如果他们这样做，可能是爆破活动的组合

这两个项目都会对水坝安全产生累积影响。 卡里巴水坝修复

将按照OP / BP 4.37与旨在确保的项目开展项目

实施适当措施，并提供足够的资源，以确保持续的安全

的大坝。 根据OP / BP 4.37，将任命一个独立专家小组审查

调查，设计和实施恢复工程。 小组应考虑

爆破可能产生的累积影响。9. PUBLIC CONSULTATION AND DISCLOSURE The key principle of consultation is to ensure that the views of stakeholders are taken into account and reported throughout the ESIA process. The objective is to ensure the assessment is robust, transparent and has considered the full range of issues or perceptions, and to an appropriate level of detail. Detailed public participation started during the scoping phase and continued throughout the assessment ensuring that legislative requirements and Project standards were met, that stakeholder concerns were addressed in the assessment and that sources of existing information and expertise were identified. The overall public participation process was designed to slot in with typical ESIA Phases; namely Scoping, draft ESIA and announcement of ZEMA and EMA’s approval or rejection (i.e., Environmental Authorization) regarding the Project. Stakeholder identification took place through a social scan followed by stakeholder recording and categorization. During the stakeholder identification, individuals, groups and local communities that may be interested and affected by the Project, as well as the broader stakeholders who may be able to influence the outcome of the Project, were identified. Elected and non-elected community representatives and leaders were also identified. Care was taken to consult with vulnerable groups such as the elderly and women during this process. The ESIA stakeholder database consists of approximately 600 stakeholders representing the different sectors of society. The stakeholder contact details were captured on an electronic database and categorized. Each stakeholder’s attendance of consultation activities were recorded. During the Scoping Phase, stakeholder consultations were focused on achieving the following outcomes: (i) To meet key stakeholders and introduce them to the Project and ESIA process; (ii) To identify the issues, needs and expectations of the interested and affected stakeholders; (iii) To provide opportunity for stakeholders to contribute to the debate with their local knowledge and experience; (iv) To refine the terms of reference of specialist work on the basis of stakeholder comment received; (v) To gather issues of concern and through this identify a list of potential impacts; (vi) To gather primary data informing the social impact assessment; (vii) To verify that stakeholders’ issues and concerns have been captured; and (viii) To assist ZRA in strengthening its relationships with existing and future stakeholders. The ESIA public participation team announced the opportunity to participate in the Project widely and via a range of communication methods such as site notices, radio communication, print media, 23 dedicated webpage, social media distribution of Background Information Documents (BIDs) in the three languages. Communication with stakeholders (including consultation materials) were usually undertaken in three languages, namely English, Shona (Zimbabwe), and Tonga (and sometimes in Bemba or Nyanja) in Zambia. Local facilitators were used during all community meetings. A total of 1,500 BIDs were distributed (of which 1,000 in English, 250 in Shona and 250 in Tonga). During the Scoping Phase, the meeting Attendance Registers show that 580 people attended the public meetings. This number does not account for engagements through ad hoc face-to-face meetings, focus group discussions and people who took BIDs without completing the attendance register. Various size site notices were posted in public places in Zambia and Zimbabwe. The issues and concerns raised by stakeholders were captured in the Issues Log. The Issues Log is used to inform the social baseline study, as well as the impact identification and assessment process. An analysis of the Issues Log indicates that issues and concerns related to employment opportunities and working conditions dominated the consultation process (25 percent). This was followed by concerns related to the plunge pool rehabilitation works at 20 percent. Health and safety concerns linked to the alleged potential collapse of the Kariba Dam wall and enquiries linked to the availability of the emergency response procedures for the downstream users follows with 16 percent of the 10. ESMP

Kariba康复项目的ESMP已被编译为ESIA的第三卷。 ESMP

包括一系列计划和组件，概述了解决不同的管理措施

在项目的整个生命周期中的影响。每个单独的管理计划大纲提出

根据拟议的绩效标准，对规定的可接受水平采取减缓措施

的环境和社会绩效。管理计划确定：（i）环境和

管理计划旨在实现的社会目标; ㈡负责执行的人;

（iii）绩效标准; （iv）减缓战略; （v）相关监测要求;和（vi）

报告和纠正措施要求。

包括在ESMP的管理计划包括：（a）噪声和振动管理

计划; （b）空气质量和粉尘管理计划; （c）土壤侵蚀和沉积物控制管理

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计划; （d）废物管理计划; （e）危险货物和有害物质管理计划

（包括爆炸物储存）; （f）地表水水质管理计划; （g）水生生态学

管理计划; （h）陆地生态管理计划; （i）重建和恢复

管理计划; （j）社会价值管理计划; （k）货物和服务采购

管理计划; （l）道路安全管理计划; （m）社会基础设施管理计划; （n）

社区健康与安全管理计划; （o）交通运输管理计划; （p）

工人健康和安全管理计划; （q）就业和培训管理计划; （r）

旅游管理计划;文化遗产管理计划; （t）申诉管理和

事件报告计划; （t）环境诱导和培训管理计划; （u）爆破

管理计划; （v）应急准备计划; （w）大坝安全计划。

在康复工作期间，为环境和社会目的的关键角色

网站管理，包括但不限于：（i）开发者（ZRA）; （ii）工程师;

（iii）主要承建商（直接委任包括土木工程承建商，建筑承建商，

景观承包商等）; （iv）环境管制干事（ECO）; ㈤代表

相关的赞比亚和津巴布韦当局;和（vi）任何贷款人提供资金

项目。

执行环境和社会管理承诺的估计费用总额

（包括监测）估计为2,225,000.00美元。

issues.

11. CONCLUSION The Kariba Dam Rehabilitation Works Project is not a scheduled activity under the Zambian and Zimbabwean Environmental Legislation (1); however, the ZRA has committed to comply with international guidelines and standards, and as such were required to undertake a full ESIA for the Project. In addition to international guidelines and standards, the ESIA has conformed and met the environmental regulatory requirements for both Zambia and Zimbabwe. The ESIA report is the second and final phase of the overall ESIA process being undertaken in support of the proposed Project, and forms the basis on which the environmental license/approval is issued. The purpose of the ESIA report is to: (i) Present a detailed baseline review of the physical, biophysical and social characteristics of the Project Area of Influence and surrounds; (ii) Assess the impacts (including cumulative impacts) of the physical, biophysical and social environments related with the different phases of the proposed Project; and (iii) Provide mitigation measures and an associated environmental and social management plan that aims to avoid /minimise/manage the severity of identified impacts. The ESIA process undertaken has identified and assessed a range of potential environmental and social impacts associated with the proposed Kariba Dam Rehabilitation Project; however, provided that the environmental and social mitigation/management measures provided in the ESIA and associated environmental and social management plan are implemented, the majority of the impacts will be reduced to a minor to negligible level of significance. Provided that all the mitigation/management commitments provided in the environmental and social management plan are implemented, it was the opinion of ERM that there are no environmental or social fatal flaws which inhibit authorization of the proposed Kariba Dam Rehabilitation Project.

11.结论

卡里巴大坝修复工程项目不是赞比亚和以色列的计划活动

津巴布韦环境立法（1）;然而，ZRA已经承诺遵守

国际准则和标准，因此需要对其进行全面的ESIA

项目。除了国际准则和标准，ESIA已经符合并满足

赞比亚和津巴布韦的环境监管要求。

ESIA报告是正在进行的整体ESIA过程的第二个也是最后一个阶段

，并构成发布环境许可/批准的依据。

ESIA报告的目的是：（i）对物理，生物物理学进行详细的基线审查

和项目影响区及周边的社会特征; （ii）评估影响

（包括累积影响）与物理，生物物理和社会环境相关

拟议项目的不同阶段;和（iii）提供缓解措施和相关的措施

环境和社会管理计划，旨在避免/最小化/管理的严重性

确定的影响。

所进行的环境与社会影响评估过程确定并评估了一系列潜在的环境和社会

与拟议的Kariba水坝修复项目相关的影响;但是，

环境和社会缓解/管理措施

环境和社会管理计划得到落实，大多数影响将是

降至轻微至可忽略的程度。

只要在环境和社会方面提供的所有缓解/管理承诺

管理计划的实施，企业风险管理的意见是没有环境或

社会致命缺陷，禁止对拟议的Kariba水坝恢复项目的授权。