Kampala-Jinja Expressway PPP Project
Phase 1
Environmental and Social Impact Assessment

Volume D: Water Management Plan

prepared for

Ugandan National Roads Authority (UNRA)

by

Earth Systems and Atacama Consulting

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CONTENTS

FIGURES

TABLES

ACRONYMS / ABBREVIATIONS

Acronym	Full Term
AfDB	African Development Bank
BMP	Best Management Practice
CEMP	Construction Environmental Management Plan
ESC	Erosion and Sediment Control
ESCP	Erosion and Sediment Control Plan
ESIA	Environmental and Social Impact Assessment
ESMMP	Environmental and Social Management and Monitoring Plan
IFC	International Finance Corporation
IFC PS	International Finance Corporation Performance Standard
KJE	Kampala-Jinja Expressway
NEMA	National Environment Management Authority
UNRA	Uganda National Roads Authority

1. INTRODUCTION

1.1 Background

This Water Management Plan for Phase 1 of the Kampala-Jinja Expressway PPP (KJE) Project (hereafter 'the Project') has been prepared by Earth Systems on behalf of Uganda National Roads Authority (UNRA). It forms part of the update of the Environmental and Social Impact Assessment (ESIA) documents for the Project.

1.2 Project Overview

UNRA is proposing to construct a limited access 76 km tolled expressway between Kampala and Jinja to relieve the current congestion and reliance issues on the radial routes out of Kampala city and on the existing Kampala to Jinja highway to cater for future growth. This infrastructure development is part of the Northern Corridor – a vital international highway connecting the port of Mombasa in Kenya to the landlocked countries of Uganda, Rwanda, Burundi and the Democratic Republic of Congo.

The Project also includes the Kampala Southern Bypass which will provide a bypass to the capital city of Kampala, linking to the Kampala Entebbe expressway and the Northern Bypass to form a complete ring road around the city. The overall KJE Project is planned to be undertaken in two phases as follows (Figure 1-1):

- **Phase 1 –** development of the first section (35 km) of the Kampala-Jinja Expressway (KJE) from Kampala to Namagunga and the Kampala Southern Bypass (KSB) (18 km) which is expected to be completed by 2023; and
- **Phase 2** - development of the second section of the Kampala-Jinja Expressway (KJE) from Namagunga to Njeru (41 km) at the new Nile bridge. Works for the second phase are anticipated to be completed by 2030.

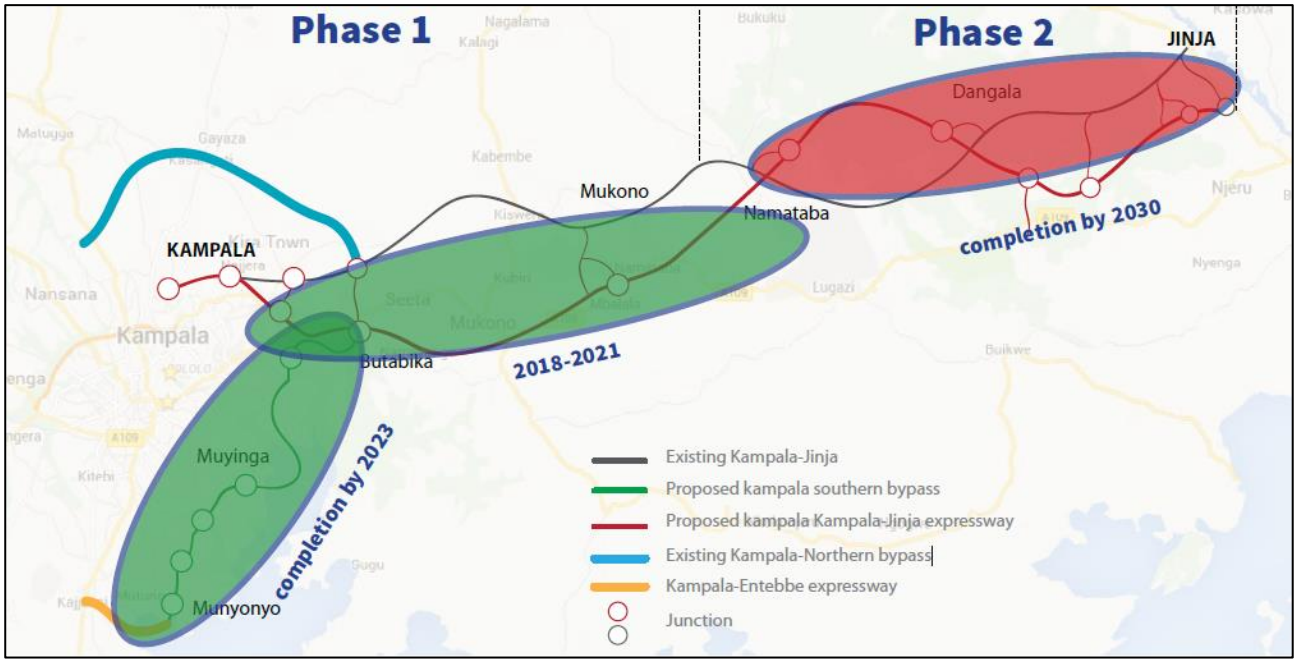

Figure 1-1: Kampala-Jinja Expressway Project Phases with indicative construction schedules (UNRA 2016c).

The Concession Period for the Project is currently planned for a 30-year term, inclusive of the construction period, after which Project facilities will be transferred to UNRA.

The Project is expected to generate up to 1,500 jobs during construction and 250 jobs during operations, most of which will be taken up by Ugandans. Once operational, the expressway is expected to save up to 70 minutes of journey time between Kampala and Jinja.

1.3 Purpose

The purpose of this Water Management Plan is to detail how potential surface and groundwater impacts from Phase 1 of the KJE Project should be minimised and managed during the construction and operational phases.

1.4 Management Objectives and Scope

The key objectives of this Water Management Plan are to:

- Ensure appropriate measures are implemented to comply with Ugandan regulatory and other requirements;
- Source water for construction purposes in a manner that minimises environmental and social impacts;
- Provide best practice management measures to avoid or mitigate potential impacts on downstream water quality and hydrology; and
- Protect aquatic habitat, aquatic and terrestrial fauna, and beneficial uses of water downstream.

The Pre-Construction Phase of the Project is not covered by this Water Management Plan, as no activities with significant potential for water quality or hydrology impacts will occur during this phase. The decommissioning phase is also not covered by this plan as the Project is not expected to be decommissioned.

2. RELEVANT LEGISLATION, STANDARDS AND GUIDELINES

2.1 Ugandan Regulatory Requirements

The Project will comply with Ugandan regulatory requirements. A summary of the key laws and regulations relevant to the management of surface and groundwater resources for the KJE Project is provided in Table 2-1.

Table 2-1: Relevant policies, laws and regulations

Instrument / Legislation	Overview	Relevance to Project
National Policies		
Draft National Environment Management Policy (NEMP), 2014	The National Environment Management Policy (1994) provides a framework for the management of environmental resources. The NEMP outlines national strategies for protecting riverbanks and lakeshores, conserving biodiversity and generating sustainable and renewable energy.	The Proponent is required to undertake an ESIA prior to commencement of works in line with the relevant legislation. The proposed Project will traverse wetlands (Munyonyo, Bukasa, Nakivubo, Kansanga, Kito, Kinawataka and Namataba among others) and Namanve Central Forest Reserve. The traversed wetlands and forest reserve are also habitats for wildlife. Under the Guiding Principles of Environmental Impact Assessment (EIA) in Uganda, this Project should be environmentally sound and sustainable; the EIA should consider the social, economic, and cultural impacts of the Project as well as the environmental ones; EIA should be prepared for all activities and where a negative environmental threshold is determined in the EIA; Environmental Audits will also be required.
The National Water Policy, 1999	This policy aims to manage and develop the water resources of Uganda in an integrated and sustainable manner. The water policy requires an integration of the water and hydrological cycle concerns in all development programmes.	
National Policy for the Conservation and Management of Wetland Resources, 1995	This policy ensures the sustainable use of wetland resources through conservation of key species, maintenance of ecological functions and promoting equitable access to resources. The policy also implements the Ramsar Convention on Wetlands of International Importance and other requirements for planned development in protected wetland areas.	
The National Wetlands Policy, 1995	This Policy promotes the conservation of Uganda's wetlands to sustain their ecological, social and economic functions for the present and future generations.	Development of the Project will need to take into consideration the conservation of the wetlands along the proposed route.
The Uganda Wildlife Policy, 2014	This policy requires all new development and interventions within critical habitat areas are subject to appropriate environmental impact assessments.	The proposed Project will traverse wetlands and a CFR which could be critical habitat areas as defined in the policy.
The Fisheries Policy, 2000	The policy requires that adverse environmental impacts on fisheries are to be minimised, and mechanisms established to protect fisheries and aquatic ecosystems from adverse environmental impacts.	The Project will traverse wetlands that are habitats for fish and wetlands that drain into Lake Victoria.
Local Policies/Plans		
Kampala, Wakiso and Mukono District Development Plans (DDPs)	These are planning documents for each district. The DDP is a minimum standard that environmental issues be incorporated in the development plan.	All Project activities should be conducted in line with the requirements of the respective DDPs.
Laws/Acts of Parliament		
The National Environment Act, Cap. 153	The National Environment Act, Cap 153, is the most important legal instrument in Uganda with respect to environmental management. It specifies management measures, addresses pollution control and stipulates mechanisms for enforcement of the law. A draft bill will introduce new provisions for oil and gas, chemicals management, and climate change and adaptation.	The Act provides for environmental audits and inspections by NEMA's environmental inspectors and Lead Agencies. This Act requires project operators to maintain records and make annual reports to NEMA to demonstrate environmental compliance.
The Public Health Act, Cap 281	This Act aims at preventing pollution of environmental resources. The Act gives local administrative units authority (Section 103) to prevent pollution of watercourses in interest of public good. Section 54 provides a general	This Act will be relevant for affected watercourses along the proposed road and on land where Project facilities will be located, such as workers camps, equipment yards and quarries.

Instrument / Legislation	Overview	Relevance to Project
	prohibition of nuisances or conditions liable to be hazardous to health on any land.	
The Water Act, Cap 152	The objective of the Act is to enable equitable and sustainable management, use, and protection of water resources of Uganda through supervision and coordination of public and private activities that may impact water quantity and quality. Section 18 requires that before constructing or operation of any water works, a person should obtain a permit from Water Resources Management Directorate (WRMD). Construction is herein defined to include alteration and improvement of bridges. The Act also aims to control pollution of water resources. Section 19 provides that subject to guidelines established by the Minister from time to time, the Director (of water resources management) may exempt a public authority or a class of persons or works from requirements in Section 18 on such conditions as he or she may deem fit. Since this decision is reached upon evaluation of an application submitted to the Directorate, Section 19 does not automatically preclude works by public agencies from applying for permits prescribed by this Act. Section 20 has provisions for the standard conditions under which a holder of a permit should use a water resource.	All construction and operation works will comply with this Act. This Act will be applicable to three aspects of the proposed road Project: - Water abstraction for road construction and camp use. - Activities associated with construction of bridges and viaducts across rivers. - Discharge of construction and associated waste water in water courses.
The Fish (Amendment) Act, Cap 197, 2011	The Act makes provision for the control of fishing, the conservation of fish, the purchase, sale, marketing and processing of fish and matters connected therewith. Section 12, subsection (4) stipulates that 'except where otherwise expressly provided by any written law, no person shall divert the waters of any lake, river, stream, pond or private waters in which fish, their eggs or progeny have been introduced with the consent of the chief fisheries officer, unless the ditch, channel, canal or water pipe conducting the water is equipped at or near the entrance or intake with a screen or a filter of a design approved in writing by the chief fisheries officer, that is capable of preventing the passage of fish, their eggs or progeny into the ditch, channel, canal or water and where the chief fisheries officer so directs there is also provided a by-pass.	The proposed Project will comply with this Act since it will traverse sensitive ecosystem (wetlands) that may be breeding grounds for fish. Also, the wetlands traversed by the proposed Project drain into Lake Victoria, which is a breeding ground for fish.
Petroleum Supply Act 2003	This Act provides for the supervision and monitoring of transportation, supply, storage and distribution of petroleum products for road construction works. The Act regulates licensing and control of activities and petroleum installations for protection of public health and safety and control of environmental pollution.	Construction of road projects require considerable amounts of petroleum products thus the proposed Project will be subject to this Act for onsite fuel storage facilities.
National Regulations		
The Water Resources Regulations, 1998	The Regulations apply to motorised water abstraction from boreholes or surface watercourses or diverting, impounding or using more than 400 cubic meters of water within a period of 24 hours. Part II, Regulation 3 requires a water permit for operation of motorised water pump from a borehole or waterway. Under Regulation 6, application for permit may be granted on conditions of projected availability of water in the area, existing and projected quality of water in the area and any adverse effect which the facility may cause among other considerations.	The Project will need to comply with provisions of this Law regarding water abstraction for construction activities, dust suppression during works and domestic use at the camps among others.
The National Environment (Wetlands, River Banks and Lake Shores Management) Regulations, 2000	These Regulations require the Proponent to undertake annual audits and monitoring of any activities that could significantly affect the river bank due to the nature of the development (Section 34).	Considering the Project will cross some streams, rivers and wetlands, the development will have to consider: - ESIA mandatory for all major activities on riverbanks and lakeshores (e.g. bridges).

Instrument / Legislation	Overview	Relevance to Project
	Under Section 23 of these Regulations, the Proponent will be required to make an application in Form A of the First Schedule of the Regulations for construction and operation activities on the river bank.	- Measures to prevent soil erosion, siltation and water pollution, and to protect the riverbanks. - Due attention for construction works in wetlands.
The National Environment (Standards for Discharge of Effluent into Water or on Land) Regulations, 1999	Section 4 of this Regulation requires facilities to install pollution control equipment for onsite management of waste, effluent and emissions. These Regulations will influence management of effluent generated at workers camps, equipment yards and work areas near surface water courses. Section 6 (2) of the Regulations specifies maximum permissible discharge limits for 54 contaminants, that must not be exceeded before effluent is discharged into water or onto land. Through limits on over 54 pollutants, these Regulations control discharges in surface watercourses.	All discharge related to the proposed Project shall conform to the standards specified in these Regulations. The Proponent is also required to maintain records of discharge that will be periodically submitted to NEMA and relevant authorities.
The Water (Waste Discharge) Regulations, 1998	Regulation 4 prohibits any person from discharging effluent or waste on land or into the aquatic environment contrary to set standards. In the circumstances that there is an exception, a permit is to be issued by the Directorate of Water Resources Management.	This Regulation applies to discharges likely to result from workshops, vehicle wash bays, bitumen preparation areas and workers' camps and as such this regulation should be adhered to.
The National Environment (Waste Management) Regulations, 1999	These Regulations apply to hazardous and non-hazardous waste and to their storage and disposal or movement into and out of Uganda. The Regulations require waste disposal in a way that shall not contaminate water, soil, and air or impact public health. This includes for onsite storage, haulage and final disposal. All waste handling operations (including storage, haulage and disposal) should be done by licensed entities. The Regulations promote cleaner production methods and require waste minimization by eliminating use of toxic materials; reducing toxic emissions and recovering and reuse of waste.	The Regulations require the Project to promote cleaner production methods that enable the recovery and reuse of wastes, reclamation and recycling. The Regulations also require hazardous waste to be stored in specifically designed facilities and obtain licenses from NEMA. The Regulations are expected to apply to management of solid waste at workers camps, equipment yards and road construction site.
National Environment (Mountainous and Hilly Areas Management) Regulations, 2000	These Regulations provide for the sustainable management of mountainous and hilly areas, and prescribe rules for soil conservation.	Requires the Proponent to apply appropriate measures necessary to prevent soil erosion in hilly areas.
National Environment (Audit) Regulations, No. 12 of 2006	The Audit Regulations operationalise Section 3 (3) c of the National Environment Act, Cap 153 in which it is a requirement for ongoing activities which are likely to have environmental impacts to be subjected to an environmental audit in accordance with Section 22 of the Act. The Regulation also operationalises the Environmental Impact Assessment Regulation, in which it is a requirement to follow up projects that carried out an EIA with an Audit at least three years after the commencement of the Project.	Audits shall be carried out once the Project commences in line with this Act and in line with the EIA Certificate of Approval conditions.
The National Environment (Minimum Standards for Management of Soil Quality) Regulations, 2001	These Regulations emphasise the need to: maintain and restore the minimum soil quality standards as well as enhance the inherent productivity of the soil in the long term; maintain minimum standards for the management of the soil for specified agricultural practices; follow the criteria and procedures for the measurement and determination of soil and apply the prescribed measures and guidelines for soil management.	Project planning and execution should ensure that the quality of the soils within the proposed Project area is not compromised, and if it is, that it is restored to as close to its original state as possible.

2.2 International Standards and Guidelines

In addition to compliance with Ugandan regulatory requirements, UNRA is committed to developing and managing the KJE Project in a manner consistent with international industry best practice with a focus on minimisation of environmental and socio-economic risks and sustainable development.

UNRA will continue to engage with stakeholders using a participatory approach throughout the life of the Project from planning and design to decommissioning. The Project will aim to align with IFC Sustainability Framework (2012) and AfDB Integrated Safeguards Systems (2013) to achieve this. Key safeguards and guidelines for the Project development are as follows:

- IFC/World Bank Performance Standards and Guidelines; and
- African Development Bank Operational Safeguards.

2.2.1 IFC Performance Standards

The IFC Performance Standards were introduced to provide guidance for IFC clients to manage and improve their environmental and social performance through a risk and outcomes-based approach. Direction to IFC's clients and staff on the application of the Performance Standards is provided in the IFC Guidance Notes, a companion document to the Policy on Environmental and Social Sustainability. The updated IFC Performance Standards (PS) comprise the following:

- PS 1: Assessment and Management of Environmental and Social Risks and Impacts;
- PS 2: Labour and Working Conditions;
- PS 3: Resource Efficiency and Pollution Reduction;
- PS 4: Community Health, Safety and Security;
- PS 5: Land Acquisition and Involuntary Resettlement;
- PS 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources;
- PS 7: Indigenous Peoples; and
- PS 8: Cultural Heritage.

Implications of the above performance standards for the Project are discussed in the ESIA Report (Volume B, Chapter 3).

2.2.2 AfDB Operational Safeguards

The African Development Bank's Integrated Safeguard System (2013) sets out five Operational Safeguards supported by Environmental and Social Assessment Procedures and Integrated Environmental and Social Impact Assessment Guidance Notes, which contain provisions for environmental and social safeguards and compliance aspects. The Operational Safeguards consist of:

- Operational safeguard 1: Environmental and social assessment
- Operational safeguard 2: Involuntary resettlement: land acquisition, population displacement and compensation
- Operational safeguard 3: Biodiversity, renewable resources and ecosystem services

- Operational safeguard 4: Pollution prevention and control, hazardous materials and resource efficiency
- Operational safeguard 5: Labour conditions, health and safety.

The Integrated Safeguards System Policy Statement and Operational Safeguards (2013) is a tool for identifying risks, reducing development costs and improving project sustainability, thus benefiting affected communities and helping to preserve the environment. The Safeguards promote best practices and encourages greater transparency and accountability, especially for the most vulnerable communities, to express their views by providing project-level grievance and redress mechanisms.

Of relevance to the KJE Project is the ESAPs and IESIA Guidance Notes providing technical guidance on standards regarding roads and highways, and the Operational Safeguards.

2.3 International Conventions, Treaties and Agreements

The Project will adhere to the international conventions ratified by Uganda. Key conventions and treaties relevant to water management and water quality are outlined in Table 2-2.

Table 2-2: International Treaties, Conventions or Agreements relevant to the Project

Treaty, Convention, Agreement	Overview	Relevance to the Project
Convention on the Conservation of Migratory Species of Wild Animals. (Bonn Convention) 1979	It aims to conserve terrestrial, marine and avian migratory species throughout their range.	Project planning should ensure that impacts on biodiversity arising from development of the proposed Project are minimised.
Agreement on the Conservation of African-Eurasian Migratory Water birds (AEWA), 1995	The Agreement provides for co-ordinated and concerted actions to be taken by the Range states throughout the migration systems of the water birds to which it applies. It also requires them to investigate problems that are posed or are likely to be posed by human activities and endeavour to implement remedial measures, including habitat rehabilitation and restoration, and compensatory measures for loss of habitat.	The proponent should mitigate any impacts on migratory birds.
Bamako Convention, 1991	Requires party states to use legal, administrative and other measures to prevent the import of hazardous waste into Africa from non-contracting parties. All signatories to the Convention are required to impose strict, unlimited liability as well as joint and several liabilities on hazardous waste generators; ensure that environmentally sound treatment and disposal facilities for hazardous wastes are located, to the extent possible, within its jurisdiction; and ensure that persons managing hazardous wastes take all actions necessary to prevent pollution arising from the management of such wastes.	All the hazardous waste generated during the development of the proposed Project will comply with the requirements of this Convention.
Basel Convention, 1989	The objective is to protect human health and the environment against the adverse effects of hazardous wastes. Under Article 4, it requires each member state to take the appropriate measures to ensure that the generation of hazardous wastes and other wastes is reduced to a minimum, taking into account social, technological and economic aspects among other requirements.	Any hazardous waste generated during the development of the proposed Project should be handled by a licensed waste handler.
Conservation of Nature and Natural Resources, 2003	The convention aims at enhancing environmental protection, conservation and sustainable use of natural resources. The convention further identifies water as a critical resource which needs to be maintained at quantitative and qualitative levels	The KJE traverses many wetlands which act as critical filter points for water in the southern Kampala section and as such, the ecological functionality of wetlands traversed will have to be maintained.

Treaty, Convention, Agreement	Overview	Relevance to the Project
Convention on Biological Diversity, 1992	Its objectives are to conserve biological diversity, promote the sustainable use of its components and the fair and equitable sharing of the benefits arising out of the utilisation of genetic resources, including by appropriate access to genetic resources and by appropriate transfer of relevant technologies, taking into account all rights over those resources and technologies, and by appropriate funding (Article 1).	Project planning should ensure that biodiversity along the proposed Project is protected.
Nile Basin Initiative, 1999	The Nile Council of Ministers (Nile-COM) agreed on a Shared Vision which states: 'to achieve sustainable socio-economic development through the equitable utilisation of and benefit from the common Nile Basin water resources'.	The proponent should put measures in place to ensure that the streams and wetlands that drain into Lake Victoria are protected.
Ramsar Convention, 1971	The Convention's mission is "the conservation and wise use of all wetlands through local and national actions and international cooperation, as a contribution towards achieving sustainable development throughout the world".	The proposed Project is in close proximity with Lutembe Ramsar site (approximately 10 km). Anticipated impacts may arise from unregulated clearing of the swamp at Munyonyo which acts as a critical water filter for water flowing from Zana and Makindye catchments.
The Lake Victoria Protocol, 2003	It requires the Party states to determine that a project is likely to have a significant trans-boundary effect on the resources of the Basin and such a State is required to avail to other Party States and the Secretariat, the environmental impact statement for comments and determine whether to approve an environmental impact statement for a project with trans boundary effects. The Party State in whose jurisdiction is the proposed Project, needs to take into account the comments of the other Party States.	The proposed project will traverse wetlands that drain into Lake Victoria and as such, the Protocol should be complied with. Also, the proposed project will be undertaken in districts of Kampala, Mukono, and Wakiso that are within the Lake Victoria basin.
The Treaty of the East African Community, (1999)	Articles 111 and 112 of the EAC Treaty provide for conservation and management of environmental and natural resources. They require member states to take measures to control trans-boundary air, land and water pollution arising from development activities and take necessary disaster preparedness, management, protection and mitigation measures especially for the control of natural and man-made disasters.	The proposed Project will comply with the principles document in this treaty.
The World Heritage Convention, 1972	Requires each State Party to recognise the duty of ensuring the identification, protection, conservation, presentation and transmission to future generations of the cultural and natural heritage, and to ensure that effective and active measures are taken for the protection, conservation and presentation of the cultural and natural heritage situated on its territory.	The integrity of cultural and natural heritage sites that will be traversed by and/or within the vicinity of the proposed Project should be protected.

2.4 Project Discharge Standards

The Project will consider and comply with:

- Discharge guidelines for off-site releases of water; and
- Ambient guidelines for the protection of environmental values (e.g. protection of aquatic fauna and fisheries, drinking water, etc.).

A summary of Project discharge standards identified in Ugandan legislation and regulations along with generally accepted international road guidelines is presented in Table 2-3. Where standards or limits do not exist in Ugandan Law, guidelines, standards or limits used by other countries (e.g. EU, USEPA, UK, Australia) or organisations (e.g. IFC, WHO) are adopted in lieu.

Table 2-3: Relevant water standards and guidelines for the KJE Project

Source	Relevant Guidelines	Year
WASTE / WASTEWATER DISCHARGE AND MONITORING		
Uganda	National Environment (Standards for Discharge of Effluent into Water or on Land) Regulations	1999
	National Environment (Waste Management) Regulations	1999
IFC	Environmental Health and Safety Guidelines – General – Environmental	2007
	General EHS Guidelines: Wastewater and Ambient Water Quality	2007
AQUATIC FAUNA / FRESH WATERS		
Uganda	n/a	n/a
United States	National recommended water quality criteria; republication. United States Environmental Protection Agency (USEPA)	2009
European Union	Directive 2008/105/EC of the European Parliament and of the Council of 16 December 2008 on environmental quality standards in the field of water policy, amending and subsequently repealing Council Directives 82/176/EEC, 83/513/EEC, 84/156/EEC, 84/491/EEC, 86/280/EEC and amending Directive 2000/60/EC of the European Parliament and of the Council.	2008
European Union	Directive 2006/44/EC of the European Parliament and of the Council of 6 September 2006 on the quality of fresh waters needing protection or improvement in order to support fish life (E.U., 2006).	2006
DRINKING WATER		
Uganda	Uganda Standard for Potable Water – Specification (US EAS 12:2014)	2014
WHO	Guidelines for Drinking Water Quality, fourth edition	2011
European Union	Council directive 98/83/EC of November 1998 on the quality of water intended for human consumption	1998

2.5 UNRA Environmental Commitments and Policies

UNRA is committed to international standards of good practice in the areas of environmental protection, social development, and health safety and security. In support of this commitment, UNRA has developed an Environmental and Social Safeguards Policy (2016), as part of its Environmental and Social Management System, which governs UNRA's operations.

Specifically, UNRA is committed to:

- Avoiding, preventing, reducing and mitigating environmental and social impacts of its activities, including road development, maintenance, and rehabilitation activities and wherever possible, to enhancing the positive impact, to the environment and people.
- Integration of Good International Industry Practice with respect to the environment and social requirements in all its operation, including in the planning, design, construction, and maintenance of roads, bridges and ferries. The Authority will seek to involve communities in project activities to enhance sustainable development, including activities such as tree planting, wetlands restoration and environment awareness campaigns for communities.

The Policy focuses on:

- Assessment and management of environmental and social impacts;
- Occupational and community health and safety;
- Gender, vulnerable people (including those with disabilities);

- HIV/ AIDS awareness and prevention;
- Stakeholder engagement and disclosure of information;
- Grievance redress mechanism;
- Labour and working conditions;
- Sensitive ecosystems and the sustainable development of the environment;
- Climate change;
- Land acquisition and involuntary resettlement; and
- Cultural Resources.

3. PROJECT COMPONENTS

The following components of the KJE Project are of relevance to this Water Management Plan:

- **Right of Way (ROW)** - Consists of the main road body from one embankment to another where land will need to be cleared and purchased. Most of the road's length will have a ROW of approximately 60 m in width requiring full clearance of all structures and vegetation within these boundaries. This width may vary up to 80-100 m at toll gates, slip-roads, embankments etc.
- **Project Footprint** – The Project Footprint includes the land area of all Project components, including ancillary infrastructure, quarries and borrow pits etc. The main component of the Project Footprint will be the tarmacked surface and dividing barriers of the expressway. This will vary depending on specific locations along the ROW.
- **Embankments** - The road will be raised at several locations above the ground level with embankments at either side of the mainline sloping down to ground level. At other locations, the road will be cut into the topography of the landscape with embankments sloping up from the side of the road to the original ground level. Embankments will also be formed at the location of interchanges where slip-roads will be required to link with bridges and underpasses developed at the junctions.
- **Other Infrastructure** - Other infrastructure that will form part of the Project Footprint include junctions/interchanges, slip-roads, access lanes, flyovers, viaducts, bridges and underpasses.
- **Plant Equipment and Accommodation Camps** - Sites will be required for the accommodation of workers and storage of plant equipment during the Construction Phase. Accommodation camps will include housing areas, catering areas and waste disposal facilities. The locations of these sites will be identified by the Concessionaire in the detailed design phase of the Project.
- **Quarries and Borrow Pits** - Several quarries and borrow pits will be required to obtain the materials necessary for the construction of the Project. These will be spread out at locations within and surrounding the entire length of the Project ROW.
- **Material stockpile areas** - During the construction process, it is likely that materials will be temporarily stockpiled in locations close to the main construction sites. This will include stockpiles of soil, sand, rocks and gravel.
- **Water Supplies** - Water supplies for construction processes are planned to be drawn from nearby surface water resources including rivers and wetlands.
- **Asphalt Plant** - A temporary asphalt plant will be developed as part of the Project. The asphalt plant will likely contain a crushing plant, batching plant and associated machinery. The site will also provide area for aggregate materials (e.g. gravel, sand, bitumen) to be stockpiled, warehouses, as well as waste disposal facilities.
- **Drainage works** will be conducted as part of the Project and will be a vital component of road design and construction. This will include the construction of bridges, viaducts, culverts, catch water drains, kerb drains, mitre drains and cut-off drains as well as the excavation of soil and rock materials required for their construction.

A design of drainage infrastructure has been developed for the alignment. This includes drainage ditches, culverts, channels and grates. Most of this infrastructure will fall within the Project ROW. Detailed designs are outlined in *ICS (2015) Kampala – Jinja Road Capacity Improvement Study Drawings Book 3 – Drainage & Fencing.* During the detailed design process, drainage designs will be finalised.

4. SUMMARY OF ENVIRONMENTAL ASPECTS AND IMPACTS

4.1 Existing Environment

Almost one sixth of Kampala, or 31 km^2, is covered by wetlands associated with Lake Victoria. Several rivers also pass through the Project Area, including Kinawataka, Kasokoso, Mola and Sezibwa Rivers. The KJE route also crosses and runs alongside several wetlands, some of which are in the process of being gazetted. These wetlands include Kinawataka, Nakivubo and Kansanga, which have significant ecosystem services values. The Mutungo, Makindye and Mbuya hills are also sources of water that support downstream communities. The wetlands and rivers drain to Lake Victoria.

Currently, many residential areas experience seasonal flooding in association with high rainfall events due to a lack of adequate drainage systems and the implementation of backfill of low-lying regions for urban development.

Rapid population growth, industrialisation and inadequate provision of waste and sewer management services have led to an increased volume of urban waste entering water in and around Kampala and degrading the water quality. Wetlands have previously served as a natural filter prior to drainage to Lake Victoria, however, the efficiency of wetlands to treat wastewater has been tremendously lowered due to large scale draining of wetlands over the years for agriculture or settlement. Surface water quality in the Project Area is highly affected by urban and vehicle pollution. Additionally, some locations are affected by agricultural operations such as the use of fertilisers.

Communities in rural Uganda depend on surface and groundwater for a range of beneficial uses (e.g. drinking and washing water, livestock drinking water, irrigation water). Surface waters support a host of aquatic species that are important from an ecological perspective and provide an important livelihood and subsistence for communities in the region.

The water table in the wetlands along the Project Footprint is relatively high. Boreholes, spring wells, tube wells and shallow wells have been drilled to harvest water for domestic supply. Groundwater quality is generally within acceptable potable water limits. It is probable that the deep wells used as point sources of water are currently not as severely impacted by the groundwater interaction with the local hydrology as the shallow springs and surface water sources of Lake Victoria.

The KJE Project will require the modification and stabilisation of the existing terrain within the Project corridor. Several areas have been identified as having high stormwater erosion and sedimentation risk based on the current land topography of the Project ROW and soils present. The soils of Kampala District are ferrallitic (FAO: ferralsols). Some “heavy clay "varieties may be found along the KJE route. The soils in the wetlands near Lake Victoria include grey sands with alluvium, grey coarse sand from lake deposits, and clays from river alluvium and peat sands. Along the ridges and hills, the most common soils are reddish and brown laterites and laterite gravels (ICS, 2015).

4.2 Construction Activities

Construction activities for the Project that may adversely impact on water and soils include:

- Water use/extraction;
- Waste management;
- Site access including temporary waterway crossings;
- Land clearance and topsoil removal;

- Material stockpiling and topsoil management;
- General earthworks;
- Culvert and drainage works;
- Bridge and underpass construction;
- Quarry operations;
- Borrow pit operations;
- Batch plant operation;
- Blasting operations;
- Pavement surfacing activities;
- Restoration of disturbed sites;
- Ancillary works;
- Facility operation including fuel and chemical storage, refuelling and chemical handling; and
- Application of herbicides for weed control.

4.3 Operations and Maintenance Activities

Operations and maintenance works for the Project that may adversely impact on water and soils include:

- Pothole patching;
- Cleaning of drainage facilities;
- Repairs of broken road items;
- Resurfacing;
- Waste management;
- Revegetation activities;
- Weed control; and
- Response to road accidents in collaboration with the emergency services.

4.4 Potential Impacts

The key potential impacts related to surface water hydrology, water quality and, erosion and sediment control for the KJE Project are as follows:

- The roadway will act as an obstruction to existing hydrology and groundwater interaction, causing a potential change of perennial and/or ephemeral flow both upstream and downstream of raised and cutting roadway sections;
- The introduction of new structures such as culverts, bridges and crossings to existing drainage networks could result in changes to existing pathways of hydrology and groundwater interactions leading to new undesired pathways;

- The alteration of the water table because of the change in hydrological and/or groundwater interaction can lead to localised flooding and may also activate acid sulphate soils, or contaminated groundwater plumes;
- The roadway has the potential to be flooded during significant rainfall events, which can endanger road users and result in damage to infrastructure;
- The roadway will introduce new materials sourced from external sites and has the potential to affect the water quality and can further result in possible failures of structural aspects of the Project;
- Road and vehicle derived pollutants such as copper, lead, zinc, hydrocarbons, oils and sediment can be transported by surface runoff into surface waters and infiltrate into the groundwater which can contaminate both surface and groundwater;
- Construction area pollutants such as spills or leaks of hydrocarbons, oils, greases, tar, asphalt, material waste and human rubbish can be transported by surface runoff into surface waters and infiltrate into the groundwater which can contaminate both surface and groundwater;
- Temporary disturbance and erosion of soils in the broader right of way during construction may contribute to the disruption of waterways and possibly reduce the capacity of existing drainage structures; and
- The roadway will have an adverse effect on the water point sources and piped network sources, causing a potential change in the accessibility, quality and overall supply to the communities with the ROW and further in the district.

Soil erosion is a key issue for the Project and robust management is required to ensure downstream water quality and water users are protected. Due to the combination of high intensity rains in the rainy season, varying topography, and the need to clear vegetation for ROW establishment, soils will be susceptible to erosion, and sedimentation input into neighbouring surface waters is possible. The cumulative impacts of erosion, suspended sediment and sediment deposition may include degraded aquatic habitats, impacts to beneficial uses of water, and loss of topsoil / soil quality.

In the absence of suitable management and mitigation, water quality downstream of the road alignment and construction sites may be impacted by discharge of hazardous materials following an accidental spill with potential consequences for aquatic biodiversity / beneficial uses of water. Significant sediment loading (as above) presents a less acute, but moderate level impact for aquatic habitat and water use.

Further details of the potential impacts during the construction phase are provided in the ESIA Report (Volume B).

5. MITIGATION AND MANAGEMENT MEASURES

Management and monitoring measures to be implemented for the Project are provided in this chapter for each of:

- Surface Water Management;
- Erosion and Sediment Control; and
- Groundwater Management.

5.1 Surface Water Management

5.1.1 Objectives

Surface water management objectives include:

- Minimise water use;
- Source water for construction purposes in a manner that minimises environmental and social impacts;
- Manage surface water flows of the Project during construction and operations;
- Provide adequate controls and monitoring to ensure that the quality of water discharged from Project areas is compliant with applicable legislative, licensing and financing commitments;
- Develop mitigation measures that avoid, minimise and mitigate potential impacts on downstream water quality; and
- Protect aquatic habitat, aquatic and terrestrial fauna, and beneficial uses of water.

5.1.2 Management Measures

Effective protection of downstream surface waters (receiving waters) requires stormwater management in combination with erosion and sediment control (ESC) measures and facilities. Stormwater management requires significant analysis and planning prior to designing primary facilities. This includes long term and temporary drainage channels and structures designed to isolate disturbed areas from upslope surface water runoff to minimise the potential for erosion and sediment transport from water, and provide a system that inhibits localized flooding, scouring and sedimentation.

General principles for stormwater management controls are summarised in Table 5-1. Data from ESIA studies should be used to determine the most applicable water management required on a site-specific basis throughout the Project area.

Table 5-1: General principles for surface water management controls

Control	General Principles
Long-term water diversion channels	Clean water diversion channels are comprised of a system of structures and measures that intercept surface water upstream of the Project Area, transport it around the Project footprint in a channel, and discharge it downstream. Where possible, all catchment flows should be retained in the original source sub-catchment to minimise impacts on local hydrology. Long-term clean water diversion should be armoured for scour protection in appropriate sections and have riprap applied through steep sections and at its discharge point for water velocity reduction. Where appropriate, vegetation should be planted / seeded at channel banks to promote ongoing stability. Dispersive clay soils should be avoided by stream diversion works, and if encountered should be removed or amended prior to commissioning the diversion and allowing water to flow.
Temporary water diversion structures	These structures intercept, divert and convey sheet flow from within the Project Footprint to a sediment control facility (sediment basin or sediment trap pending the water volume) for discharge to the receiving environment. These structures generally requiring associated ESC facilities, e.g. check dams, riprap, etc. to prevent scour and erosion in newly graded dikes, swales and ditches – particularly where high flow rates are anticipated.
Outlet protection	These devices, generally comprised of an apron of appropriately sized rock / riprap, are placed at culvert / pipe outlets (primarily) and culvert / pipe inlets to prevent scour and reduce the velocity and / or energy of stormwater flows. The riprap also works as a secondary sediment control device as it captures some of the coarser sediment in water travelling through it. Outlets on slopes steeper than 10% may require additional protection (e.g. jute netting, erosion control matting, etc.).
Water bars	Waterbars constructed with suitably clay rich material may be used to control stormwater runoff on unsealed roads, including site construction roads and access roads. Waterbars serve to direct runoff from compacted surfaces to vegetated buffer strips or sediment removal facilities (e.g. sediment traps or basins, riprap, etc.). Waterbars are generally placed on steeper sections of roads, with the distance between successive waterbars reducing with increasing road slope.
Culverts	Ditch culverts are placed regularly along access roads to convey water from upslope drainage ditches / swales to a discharge point (with outlet protection). Ditch relief culverts minimise the potential for erosion of roadside ditches by minimising concentration and velocity of flow in roadside drainages.

General stormwater Best Management Practices (BMPs) that are applicable for the Project during construction and operation are listed in Table 5-2.

Table 5-2: Summary of applicable surface water management measures for the KJE Project

Aspect	Mitigation and Management Measure	Schedule	Responsibility	
			Implementation	Checking / Monitoring
GENERAL				
Training / Awareness	Provide employee training and awareness programmes on water management that focuses on water pollution prevention and water efficiency, recycling and reuse strategies in place. Contractors will also be required to ensure water efficiency, recycling and reuse opportunities are maximised to the extent possible, and that they conform to water pollution prevention procedures.	Construction / Operation	Contractor[1]	UNRA
Waste Management	Clearly communicate to all employees and contractors that any dumping or discharging of potentially contaminated water (e.g. oily water, raw sewage, untreated waste water etc.) into the receiving environment is strictly prohibited: through employee training,	Construction / Operation	Contractor	UNRA

[1] 'Contractor' refers to the primary contractor/concessionaire for the Project. The Contractor will be responsible for ensuring all sub-contractors employed for the Project fulfil the requirements of this Plan.

Aspect	Mitigation and Management Measure	Schedule	Responsibility	
			Implementation	Checking / Monitoring
	mandatory induction, specific contract requirements, and procedures in place. Ensure there are no solid waste discharged into rivers.			
Hazardous materials	Store, handle and dispose of hazardous materials in accordance with IFC General EHS Guidelines and AfDB Operational Safeguards, including: - Store hazardous substances in appropriate locations with bunding and adequate secondary containment - Consider clay lining of bunded storage facilities for chemicals where located on land where groundwater is within 2 m of the surface - Train workforce on use, storage and handling of hazardous substances as well as spill preparedness and response procedures - Provide appropriate spill response kits on site at appropriate locations - Clean up spills immediately - During asphalt surface application (spraying of adhesive asphalt), prevent oil and solvent from entering waterways by only conducting this work on dry days when the road base is dry. If rain occurs during the works, cease the works and cover the fresh road surface with sand - Use bunded areas for refuelling and washdown activities - Design all permanent water quality basins to contain accidental fuel and chemical spills resulting from vehicle accidents on the KJE. - Design basins to accommodate a spill volume of up to 40,000 L	Construction / Operation	Contractor	UNRA
Water use	To prevent or minimise impacts to water sources where water for construction purposes is abstracted: - Implement water use efficiency to minimise the amount of water used - Consider harvesting storm/rain runoff where possible - Vary water sources along the alignment - Avoid water abstraction from wetlands (e.g. Nakivubo, Kansanga, Kinawataka, Namanve and Kasala wetlands) - Limit water abstraction to wet season - Reuse treated waste water in project design processes, where possible - Monitor water usage from workers facilities (e.g. workforce camps) - Ensure appropriate systems and measures are considered in the design for water collection, spill and leakage control	Pre-construction / Construction	UNRA / Contractor	UNRA
HYDROLOGY				
Hydrology	To prevent or minimise upstream flooding, the following should be conducted: - Hydrological studies/modelling (complete) - Construction of bridges or viaducts across major watercourses/wetlands - Construction of culverts at minor watercourses - Provision of adequate drainage - Consider bench cuttings to divert flow onto contours and surface flow drainage paths designed to spread flow at the	Design / Construction	UNRA / Contractor	UNRA

Aspect	Mitigation and Management Measure	Schedule	Responsibility	
			Implementation	Checking / Monitoring
	source rather than conveying the flow for treatment further downstream - Consider constructing rock or earthen platforms for driving piles / girder erosion to minimise impacts on direct water channel			
Flow alteration	- Where possible, all catchment flows should be retained in the original source sub-catchment to minimise impacts on local hydrology. - Ensure adequate drainage measures are implemented to approximate natural flow including pool/riffle channel design, temporary construction access roads and especially for sections of the road crossing wetlands (box culverts or viaducts recommended) - Ensure temporary construction access roads that are no longer required are removed in a timely manner - Phased-construction in flow sensitive areas such as wetlands to minimise flow disturbance - Plan construction over flow sensitive areas during low flow to minimise flow disturbance - All construction infrastructure (e.g. access roads) built in wetland areas should be removed after the completion of construction to allow the wetland to recover and water to flow through drainage infrastructure / underneath bridges and viaducts - For Sezibwa River, design and construction of a river crossing that does not significantly alter or impair river flow and hence the hydrological behaviour of Sezibwa Falls upstream of the Project. - Wetlands should be monitored for water depth and available water. If required, treated or clean water should be diverted to maintain appropriate wetland water levels.	Design / Construction	UNRA / Contractor	UNRA
Localised flooding	- Drainage close to residential areas to be re-routed to appropriate existing natural water course that can adequately deal with flows - Consult with relevant Government authorities such as the Directorate Water Resources Management (DWRM) regarding proposed changes to drainage and hydrology resulting from the Project. Changes to drainages should be linked to other existing or foreseen urban planning programmes where appropriate. - Implementation of temporary flood control measures during the construction phase to safeguard from any unpredicted rainfall events - Flood mapping to be completed to assist with the production of inundation maps for localised area and consequently used for urban planning - Implement sediment control mechanisms such as mulching and silt traps around construction areas as well as trenches to control excessive flooding - Embankments, trenches and outfalls should be strengthened - Limited areas of fill and drainage culverts will limit potential increased groundwater recharge effects - Effective stormwater treatment systems will remove pollutants a prevent ground recharge	Design / Construction	UNRA / Contractor	UNRA

Aspect	Mitigation and Management Measure	Schedule	Responsibility	
			Implementation	Checking / Monitoring
	- Stormwater drainage and channels will need to be adequately designed to be able to effectively control flow on a regular basis during operations - Stormwater drainage and channels will need to be regularly cleared of rubbish and other debris - Construction of overflow drainage systems to adequately deal with irregular high rainfall events	Operations	UNRA / Operator	UNRA
SURFACE WATER QUALITY				
In-stream works (see also for erosion and sediment controls)	For any in-stream works carried out (e.g. for bridges, culverts), the worksite should be operated as a closed system to the extent possible to avoid pollution of surrounding surface water with appropriate erosion and sediment control measures employed.	Construction	Contractor	UNRA
Construction materials	- Construction materials, equipment and chemicals should be stored away from flood prone waterways/drainage lines and inundation areas during the rainy season to avoid accidental release to the natural environment. - Geochemical assessment of the source materials. The assessment must investigate all new sources and the interaction with existing conditions. Geochemical reactivity of road base and construction materials tested and reactive soils treated before use. - Limit areas of fill and for and use of clean fill, replacement of in-situ soils to recreate pre-excavation conditions - Implementation of regularly updated monitoring systems for major domestic point sources downstream for wells/springs and associated wetlands - Minimise and clean up immediately spillages from construction activities in accordance with best practice	Construction / Operation	Contractor	UNRA
Hazardous materials	Primary sources of hazardous material contaminated water should be identified (e.g. vehicle workshops, asphalt plant) and equipped with appropriate facilities for the containment / controlled release of spills and stormwater, including bunding, sump collection, provision of grease and sediment traps.	Construction	Contractor	UNRA
Surface water quality	Ensure all wastewater discharges from the Project are compliant with applicable standards prior to entering the natural environment. If treatment is needed, employ techniques to reduce the load of contaminants prior to discharging.	Construction	Contractor	UNRA
Soil contamination by construction vehicles and equipment and transportation into waterways	- Vehicle re-fuelling and maintenance should be conducted in designated areas with appropriate bunding and containment, any contaminated soils removed and disposed of appropriately at the end of construction. - Clearly delineate the roadway footprint and avoid the expansion of construction activities into adjacent areas to be returned to original use where practical. - Development and implementation of comprehensive erosion and sediment measures for each construction zone, including construction of drainage controls and sedimentation ponds, deployment and maintenance of sediment control devices such as silt fences and jute netting.	Construction	Contractor	UNRA
Soil contamination from road users and transportation into waterways	- Construction of a verge and drainage channel or other appropriate containment structure (e.g. viaduct wall) along the length of the Phase 1 to contain pollutants. - Construction of vegetated swales on the edges of verges where practical to rapidly attenuate heavy metal and oil/grease pollution. It is expected that these will be able to be	Construction/ Operation	Contractor	UNRA

Aspect	Mitigation and Management Measure	Schedule	Responsibility	
			Implementation	Checking / Monitoring
	constructed within the existing ROW as assessed in the ESIA. If additional land outside the ROW is required for swales the land required will need to undergo due diligence environmental and social studies by the contractor (or concessionaire) to the satisfaction of NEMA and in accordance with international standards (e.g. IFC Performance Standards and AfDB's Operational Safeguards).			
Workforce camps and sanitation	- Provide adequate sewage treatment plants and sanitation facilities at all construction sites for the workforce.	Construction	Contractor	UNRA
Water pollution from vehicles	- Construct a verge and drainage channel or other appropriate containment structure (e.g. viaduct wall) along the length of the KJE to contain pollutants - Construct vegetated swales on the edges of verges where practical to rapidly attenuate heavy metal and oil/grease pollution - Use effective stormwater treatment systems to remove pollutants and prevent ground infiltration - Implement regularly updated monitoring systems for major domestic point sources downstream for waterbodies	Construction / Operation	Operator	UNRA
ROW Maintenance	- Training of personnel to apply herbicides - Compliance with international restrictions on pesticide use - Restriction of herbicide use to those that are manufactured under license, and registered / approved by the appropriate authority and in accordance with the Food and Agriculture Organization's (FAO) International Code of Conduct on the Distribution and Use of Pesticides - Use only of herbicides that are labelled in accordance with international standards and norms, such as the FAO Revised Guidelines for Good Labelling Practice for Pesticides - Application of herbicides based on criteria (e.g. field observations, weather data, time of treatment, and dosage) and maintenance of a pesticide logbook to record such information - Selection of application technologies and practices designed to reduce unintentional drift or runoff - Maintenance and calibration of herbicide application equipment in accordance with manufacturer's recommendations - Establishment of untreated buffer zones or strips along water sources, rivers, streams, ponds, lakes, and ditches to help protect water resources - Preventing contamination of soils, groundwater or surface water by spills during transfer, mixing, and storage of herbicides, by following the hazardous materials management practices in the General EHS Guidelines	Construction / Operation	Contractor	UNRA

5.1.3 Monitoring Measures

Adequate monitoring plays a critical role in successful surface water management. A combination of visual inspections, field measurements and laboratory testing will be required throughout construction and operational phases.

Table 5-3: Summary of priority surface water monitoring measures for the KJE Project

Aspect / Impact	Monitoring Measure	Construction	Operations	Method	Parameters	Frequency	Location
Diversion channels	Monitor long-term and temporary diversion channels			Visual observation	Bed scour, bank failure, maintenance requirement for erosion / sediment control	Weekly during construction and following high rainfall events / quarterly during operations	Diversion channels
Ambient Water Quality	Surface water quality monitoring			Ambient water monitoring	Field water parameters (pH, Redox potential (ORP), Dissolved Oxygen (DO), Electrical conductivity (EC), Total Dissolved Solids (TDS), Turbidity and temperature) Laboratory testing for pH, EC, Total Dissolved Solids (TDS) & Total Suspended Solids (TSS), Total alkalinity (or acidity), bicarbonate alkalinity, carbonate alkalinity & total hardness as $CaCO_3$, Nutrients, Cations & anions, and Total & Dissolved metals	Monthly during construction / Quarterly during operations	Rivers, creeks and wetlands upstream and downstream of construction areas (suggested locations in Figure 5-1 and Table 5-4)
Construction Water Quality	Site inspections			Visual checks for sedimentation, oils and grease at construction area discharge points	Visual signs of sedimentation, oils and grease	Weekly	Construction area discharge points
Wastewater and effluent	Discharge monitoring			Monitoring of treated effluent and wastewater from water treatment plants	Field measurements. Laboratory analyses: Total and faecal coliforms, total nitrogen, total phosphorous, COD, and BOD	Monthly	Water treatment plant discharge points
Water related incidences	Investigative monitoring			Investigative water quality monitoring at key locations in response to applicable complaints received through the Project grievance management system. Provide or adapt additional mitigation if required.	As required	As required	As required

Table 5-4: Proposed Phase 1 ambient surface water monitoring locations

Site Name	Upstream (US) / Downstream (DS)	Coordinates*	
		Easting	Northing
Kansanga 1	DS	457636	31036
Kansanga 2	US	456290	30957
Kasala 1	DS	480597	39188
Kasala 2	US	480003	37448
Kinawataka 1	DS	462073	36194
Kinawataka 5	US	458400	37500
Mayanja 1	DS	456805	26192
Mayanja 2	US	455887	27408
Nakivubo 3	DS	459000	33000
Nakivubo 7	US	457700	33633
Namanve 4	US	464751	37069
Namanve 5	DS	465612	35903
Sezibwa 1	DS	484761	40461
Sezibwa 2	US	484749	39283

* WGS84 UTM Zone 36

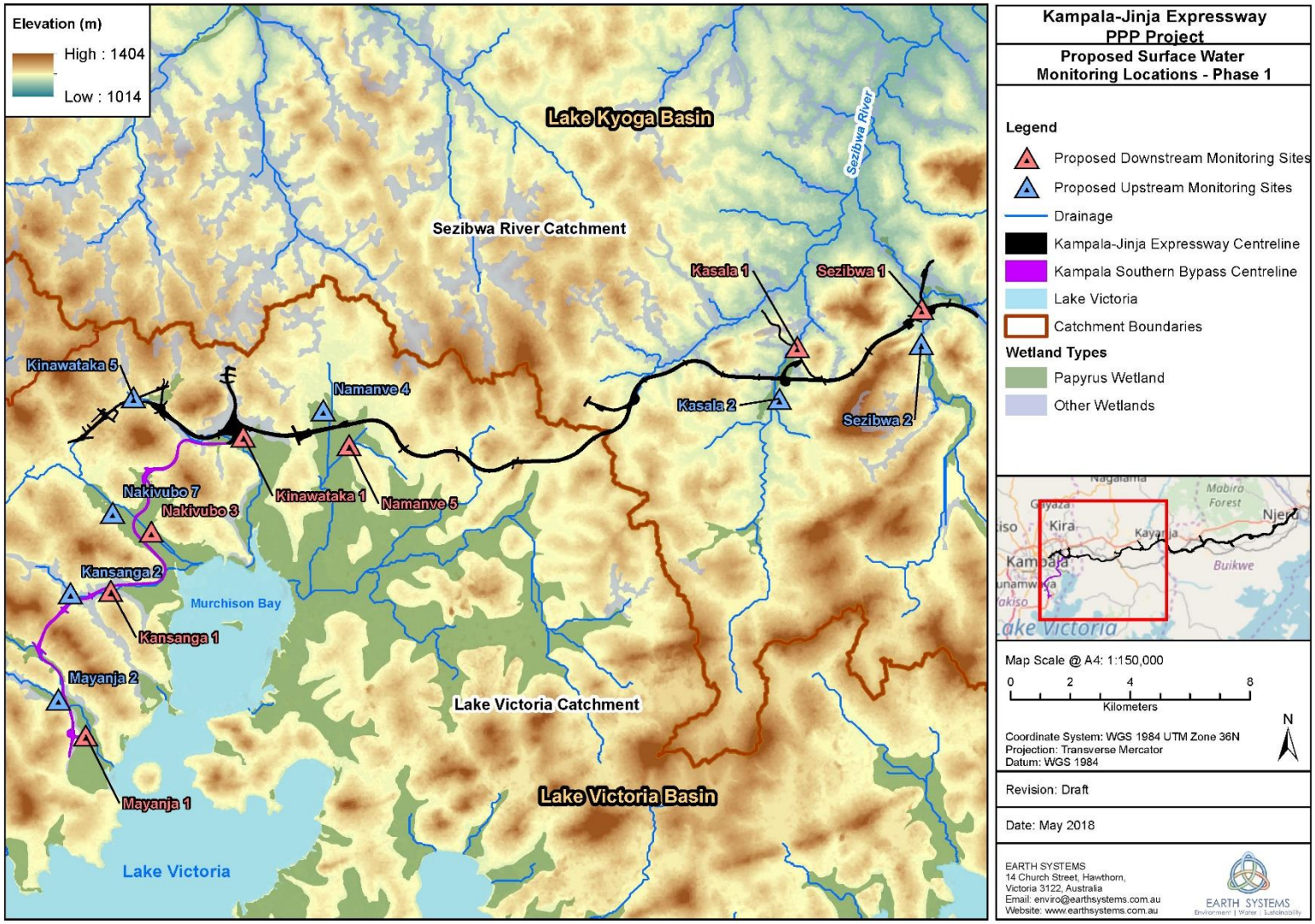

Figure 5-1: Proposed Phase 1 ambient surface water monitoring locations

5.2 Erosion and Sediment Control

5.2.1 Objectives

Management and monitoring of erosion and sediment control (ESC) is required to minimise losses of topsoil / subsoil and subsequent transport of material to receiving environments throughout the life of the Project. ESC will include:

- **Erosion control measures** to prevent or minimise soil erosion caused by the impact of rainfall and surface water flows.
- **Sediment control measures** to trap and mitigate sediment transport.
- **Drainage control measures (stormwater management)** to prevent or minimise soil erosion, manage the movement of flows within and around the Project Footprint, and convey potentially 'contaminated' water (i.e. sediment laden) into suitable treatment facilities.

5.2.2 Management and Mitigation Measures

This section outlines the general ESC BMPs for implementation pending site-specific measures for Project facilities prone to erosion or near sensitive receptors. This information is based on recommendations provided by the International Erosion Control Association. Several stormwater, erosion, and sediment control facilities (e.g. sediment basins, rip-rap aprons, culverts) will require engineering and detailed surface water hydrology assessment during the final design process. Stormwater slope risk modelling (considering current land topography of the Project ROW only) has identified three (3) high risk areas for stormwater erosion and sedimentation in the Project corridor (see Chapter 15 of the ESIA Report for details) which should inform more detailed assessments.

Table 5-5: Chainages for stormwater sediment and erosion slope high risk areas in KJE Phase 1 (Earth Systems)

Area	Alignment	Chainage from	Chainage to
1	KSB	9+300	15+900
2	KSB	0+000	6+800
	KJE	2+300	7+500
3	KJE	27+300	34+800

General principles for erosion and sediment controls are summarised in Table 5-6. Data from ESIA studies should be used to determine the most applicable ESC required on a site-specific basis throughout the Project Area.

Table 5-6: General principles for ESC

Control	General Principles
Vegetation	Vegetation, particularly where cover exceeds 70%, can serve as the best erosion control measure available and as a sediment control facility where buffer strips (e.g. along riparian corridors) are preserved to filter suspended sediment from sheet flow. Existing vegetation should be preserved in areas where no construction or operations activities will occur.

Control	General Principles
Grass/vegetated swales	Grass swales should be used for water quality treatment in flood plains and other locations with minimal changes in gradient.
Mulch	Mulch is applicable for disturbed areas that require temporary protection until permanent vegetation is established. Cleared vegetation debris can be reused as mulch for this purpose.
Hydroseeding	Hydroseeding entails application of a mixture of vegetation growth media, seed, fertiliser and stabilising emulsion with hydroseeding / hydro mulching equipment. Hydroseeding temporarily protects exposed soils from erosion by water and wind, and may be used in conjunction with a soil binder or mulching for more effective control
Soil binder	Soil binders are materials applied to soils surfaces to temporarily prevent water-induced soil erosion of exposed soils in construction areas. Soil binders also provide temporary dust, wind and soil stabilisation from raindrop and sheet flow erosion. It may be applied on soil stockpiles to prevent water and wind erosion. Site-specific soil types dictate the appropriate soil binder to be used
Erosion control blankets / mats	Erosion control blankets, geotextiles, mats, etc. aim to stabilise disturbed soil areas and protect soils from wind or water erosion, particularly on steep slopes or areas where erosion potential is high. They should be made of biodegradable products based on local supply and manufacture. Blankets may be applied over topsoil and seeded landforms or mulched areas and is commonly applied with jute rolls spaced at uniform intervals down the slope for sediment control and to slow water velocity.
Riprap	Riprap may be used for erosion control for a number of applications (and serves as sediment control to an extent). The advantages of riprap are that it is highly durable, riprap structures are easily constructed and repaired, and the material (rock) is often readily available.
Sediment basin	A sediment basin is a temporary basin formed by excavating and / or constructing an embankment so that sediment laden runoff is temporarily retained, allowing sediment to settle out before discharged. Sediment basins should be designed to capture runoff and other pollutants from disturbed soil areas, with diversion channels implemented to divert upstream water from undisturbed areas. Accumulated sediment should be removed regularly.
Sediment traps	Sediment traps are small temporary ponding areas with gravel / riprap outlets used that allow sediment in collected storm water to settle out during infiltration or before runoff is discharged through a stabilised spillway. Sediment traps are implemented by excavating or constructing an earthen embankment across a waterway or low drainage area to collect and store sediment from work areas cleared and / or graded during construction.
Silt fencing	A silt fence is a temporary linear sediment barrier of permeable fabric designed to intercept and filter on a slope the flow of sediment-laden construction runoff before water leaves the site.
Level spreader	Level spreaders are used to convert erosive, concentrated flow into sheet flow.
Check dam	A check dam is a small device constructed of rock, gravel bags, sandbags, fibre-rolls, etc. placed across a natural or built channel / drainage ditch. Rock check dams may be used across swales and diversion channels to reduce the velocity of flow, thereby reducing erosion of the channel bed and trapping sediment. This control should be avoided for permanent streams.
Fibre rolls (jute rolls), straw bale barriers, sand bag	These controls are generally placed during construction on the toe and face of slopes to intercept runoff, reduce its flow velocity, release the runoff as sheet flow, and remove sediment from the runoff. Fibre rolls etc. may also be used for inlet and outlet protection or as check dams.

General ESC BMPs that are applicable for the KJE Project during construction and operation are listed in Table 5-7.

Table 5-7: Summary of applicable ESC measures for the KJE Project

Aspect	Mitigation and Management Measure	Schedule	Responsibility	
			Implementation	Checking / Monitoring
Site-specific Erosion and Sediment Control Plan (ESCP)	Develop a site-specific Erosion and Sediment Control Plan by a qualified specialist in advance of construction. The Plan should identify appropriate controls to prevent erosion and sediment transport with consideration of the following aspects:	Pre-construction	Contractor	UNRA

Aspect	Mitigation and Management Measure	Schedule	Responsibility	
			Implementation	Checking / Monitoring
	- Site preparation earthworks (soils stockpiles, etc.) - Riverbanks adjacent to site drainage and bridge works - Details of specific erosion and sediment controls to be implemented e.g. diversion drains, sediment traps, settlement ponds, silt fences, etc. Site-specific ESCPs should be updated as required.			
Erosion and sediment transport due to potential dispersive soils	- Jar and Emerson Testing of both surface and subsurface soils to ensure that erosion and sedimentation controls are designed and implemented adequately. - Construction of vegetated swales where practical to attenuate flow velocities and minimise erosion. - Newly exposed subsurface soils should be vegetated with appropriate grasses, scrub and shrubs to reduce the impact of significant runoff. - Development and implementation of comprehensive erosion and sediment measures for each construction zone, including construction of drainage controls and sedimentation ponds, deployment and maintenance of sediment control devices such as silt fences and jute netting.	Construction / Operation	Contractor	UNRA
Modification and stability of terrain	- Design of cutting and embankment slopes and bench intervals in consideration of site-specific geotechnical properties and maximum slope angles with a standard engineering safety factor. - Development and implementation of comprehensive erosion and sediment measures for each relevant road section, including construction of drainage controls and sedimentation ponds, deployment and maintenance of sediment control devices such as silt fences and jute netting, and planting and maintenance of stabilising vegetation.	Construction	Contractor	UNRA
Earthworks	- Identify drainage lines and install erosion and sediment measures suitably designed for site conditions to accommodate for expected peak water flows, where appropriate; - Install drainage structures and additional sediment control facilities prior to the commencement of the wet season; - Employ temporary drainage systems including sediment traps / settlement ponds prior to discharge points to control volume of discharge; - Line drainage channels and install dissipation structures or rock / concrete flow barriers at regular intervals for slopes greater than 1%, to reduce water velocity (if appropriate); - Mulch to stabilise exposed areas. - Keep to a minimum time exposed surfaces, and revegetate or stabilise exposed areas as soon as possible after works are completed; - Use cleared vegetation as mulch for temporary erosion control and temporary stabilisation of disturbed areas, where possible; - Rehabilitate exposed areas progressively when feasible, with priority rehabilitation and revegetation in high risk areas such as steep slopes and sites close to rivers, creeks and wetlands; and - Construct embankments with suitable materials to ensure geotechnical stability and minimise failure due to erosion.	Construction	Contractor	UNRA
In-stream works and bridge construction	For any in-stream works (e.g. for bridges, viaducts, culverts), ensure works are conducted as follows: - Stream bank stabilisation is provided through planting of vegetation on slopes or construction of stone embankment;	Construction	Contractor	UNRA

Aspect	Mitigation and Management Measure	Schedule	Responsibility	
			Implementation	Checking / Monitoring
	- During no or low water flow events (e.g. during dry season) avoiding periods critical to biological cycles of aquatic flora and fauna (e.g. migration, spawning, etc.); - Appropriate erosion and sediment control measures are implemented to protect streambeds from damage and minimise sediment transport from construction; - Consider using isolation techniques such as berming or diversion to limit the generation of turbid water. - During high rainfall events, employ temporary mud screens around excavation foundation pits. The screen should be checked to ensure it is clear of mud daily. - All drilling mud (if appropriate) should be appropriated contained and transferred to a temporary storage after use. - Prevent construction solid waste from entering water bodies to the extent possible. - Install suitable drainage system and plant on the slope of the road at the head of bridge to prevent erosion (where possible). - All work potentially affecting wetlands will be undertaken in consideration of biodiversity conservation requirements identified in the Biodiversity Action Plan (Volume D).			
Soil storage and management	Soil stockpiles should be constructed and managed as follows (where appropriate): - Locate stockpiles within designated soil stockpile areas where movement of vehicles and equipment are excluded and up-slope (at least 20 m away) from local waterways and flood inundation areas; - Form soil stockpiles with as little compaction as possible in mounds generally no more than 2 m high (for topsoil) and 5 m high (for subsoil) to minimise losses to erosion. These stockpiles should be formed on flat ground, surrounded by low bunds and/or additional erosion and sediment control facilities that should be constructed prior to the onset of the rainy season; - Allow slope ratios of no more than 2:1 (horizontal/vertical); - Stabilise stockpiles with vegetation, grass matting or other appropriate controls if they are to remain bare for more than 3 months, particularly in the rainy season; - Map and geo-reference location of soil stockpiles and batters in a GIS database with details on type of material and duration of stockpiling recorded; - Install diversion structures up-slope of stockpiles and sediment controls (e.g. silt fence) downslope, to limit the generation of turbid water; - Remove immediately upon identification any material overflowing from stockpile / storage areas onto residential or agricultural land. Also compensate adequately affected persons for any damage to agricultural/residential land caused by sedimentation. - Potential acid sulphate soils should be evaluated prior to disturbance and managed in accordance with an Acid Sulphate Soils Plan to be developed. - Stabilise active work areas at the end of each day or just prior to rainy weather e.g. by installing temporary catch drains to capture sediment. - Remove soil, debris and loose rock from road surfaces (through sweeping of road).	Construction	Contractor	UNRA
Material extraction for road construction	Ensure extraction activities are in accordance with IFC EHS Guidelines for Construction Materials Extraction, including the following measures:	Construction	Contractor	UNRA

Aspect	Mitigation and Management Measure	Schedule	Responsibility	
			Implementation	Checking / Monitoring
	- Construct an appropriate drainage system on site that manages storm water runoff - Employ settlement ponds, sediment traps, lagoons, sumps that are designed to allow adequate retention time - Install sediment traps along drainage lines (e.g. silt fences, vegetation, etc.)			
Structural stability of cut and in-fill slopes	- Design and installation of safety measures for road sections with potential for rockfall or slope stability issues, such as drainage controls, rock bolting, concrete reinforcement and gabions. - Geotechnical monitoring may be required to ensure that all potential risks are minimised and that the risk of landslides or collapses are minor.	Construction	Contractor	UNRA
Batching plant, plant equipment washdown and dewatering of excavations	- Treat and recycle wastewater from the batching plant - Treat water from dewatering works in settling ponds prior to discharge or reuse - Capture and treat wastewater used for washing down equipment and plant in a settling pond prior to discharge or reuse - Divert clean runoff around sites as required.	Construction	Contractor	UNRA

5.2.3 Monitoring Measures

Table 5-8: Summary of priority ESC monitoring measures for the KJE Project

Aspect / Impact	Monitoring Measure	Construction	Operations	Method	Parameters	Frequency	Location
Rehabilitation	Monitor vegetation and rehabilitation			Monitor implementation and efficacy of rehabilitation works	Site stabilisation Establishment / die-off Vegetation cover %	Monthly during construction / Quarterly for operations	Rehabilitated areas
Soil storage	Monitor soil stockpiling			Site inspection	Soil stockpile records; Stockpile location, size/height; Presence/ absence of sediment & erosion control structures; presence / absence of erosion or turbid water	Monthly	Stockpile sites
Erosion and Sediment Control facilities / structures	Monitor erosion and sediment control devices			Visually inspect all facilities for determination of efficacy and maintenance requirements, e.g. clearing channels of sediment and replacement of bed scour protection	Condition of facility; Condition of vegetation and planting areas to inform rehabilitation requirements; Maintenance requirements; Volumes of sediment that should be removed from facility and site where sediment should be disposed	Weekly and following all significant rainfall events during construction / monthly during operations	Erosion and sediment control devices
Sediment basins / traps	Surface water quality monitoring			Discharge water monitoring	Turbidity and / or TSS; in-situ with field water quality monitoring sensor	Quarterly	Constructed sediment basins

Aspect / Impact	Monitoring Measure	Construction	Operations	Method	Parameters	Frequency	Location
				Operational monitoring	Measure siltation deposition to identify excavation requirements (visual observation or 'measuring stick')		

5.3 Groundwater Management

5.3.1 Objectives

The key objectives of groundwater management will be to:

- Avoid or minimise adverse impacts to groundwater resources and associated impacts to the receiving environment and beneficial uses of water resources; and
- Ensure that the Project activities comply with applicable guidelines, legislative and licensing requirements for groundwater management.

5.3.2 Management and Mitigation Measures

General groundwater management BMPs that are applicable for the KJE Project during construction and operation are listed in Table 5-9.

Table 5-9: Summary of applicable groundwater management measures for the KJE Project

Aspect	Mitigation and Management Measure	Schedule	Responsibility	
			Implementation	Checking / Monitoring
Groundwater management	Review and update the groundwater strategy for the Project in advance of construction.	Construction	Contractor	UNRA
	Discharge any groundwater flows into grassed swales for infiltration back to the groundwater source (after adequate treatment) or via the sedimentation basins into natural waterways.	Construction	Contractor	UNRA
Seepage	Employ engineering measures for seepage water downstream. Standard practice is to collect the seepage from the cut face in the drainage system of the expressway, then divert into water quality basins before discharge.	Construction	Contractor	UNRA
	Design major embankments to enable distributed flow of surface waters.	Pre-construction	Contractor	UNRA
	Ensure no groundwater intrusion occurs at sites used for batch plants, refuelling and chemical storage.	Construction	Contractor	UNRA
Impacts to wells/springs and associated wetlands	Implementation of regularly updated monitoring systems for major domestic point sources downstream for wells/springs and associated wetlands.	Construction	Contractor	UNRA

5.3.3 Monitoring Measures

Monitoring measures for groundwater management include a combination of field measurements and laboratory analysis to ensure effective management and mitigation of potential groundwater impacts.

Table 5-10: Summary of priority groundwater monitoring measures for the KJE Project

Aspect / Impact	Monitoring Measure	Construction	Operations	Method	Parameters	Frequency	Location
Ambient groundwater quality	Groundwater quality monitoring			Ambient water quality monitoring	Field water parameters (pH, Redox potential (ORP), Dissolved Oxygen (DO) – if open to atmosphere, Electrical conductivity (EC), Total Dissolved Solids (TDS), Turbidity and temperature) Laboratory testing for pH, EC, Total Dissolved Solids (TDS) & Total Suspended Solids (TSS), Total alkalinity (or acidity), bicarbonate alkalinity, carbonate alkalinity & total hardness as $CaCO_3$, Nutrients, Cations & Anions, and Total & Dissolved metals	Monthly during construction / Bi-annually during operations	Springs, bores and wells adjacent to (within ~100 m) construction activities / alignment (suggested locations in Figure 5-2 and Table 5-11)
Groundwater levels	Groundwater level monitoring			Ambient water level monitoring	Groundwater level (distance from ground surface to water surface)	Weekly if abstracting for use during construction otherwise monthly during construction / Bi-annually during operations	Bores and wells adjacent to (within ~100 m) construction activities / alignment (suggested locations in Figure 5-2 and Table 5-11)

Table 5-11: Proposed Phase 1 ambient groundwater monitoring locations

Site Name	Type	Coordinates*	
		Easting	Northing
GWP1-3	Spring	459984	36635
GWP1-6	Spring	456350	26955

Site Name	Type	Coordinates*	
		Easting	Northing
GWP1-10	Spring	463773	35913
GWP1-11	Spring	462893	36372
GWP1-15	Spring	459912	36005
GWP1-16	Spring	459903	36091
Mukono	Bore	472400	39250

* WGS84 UTM Zone 36

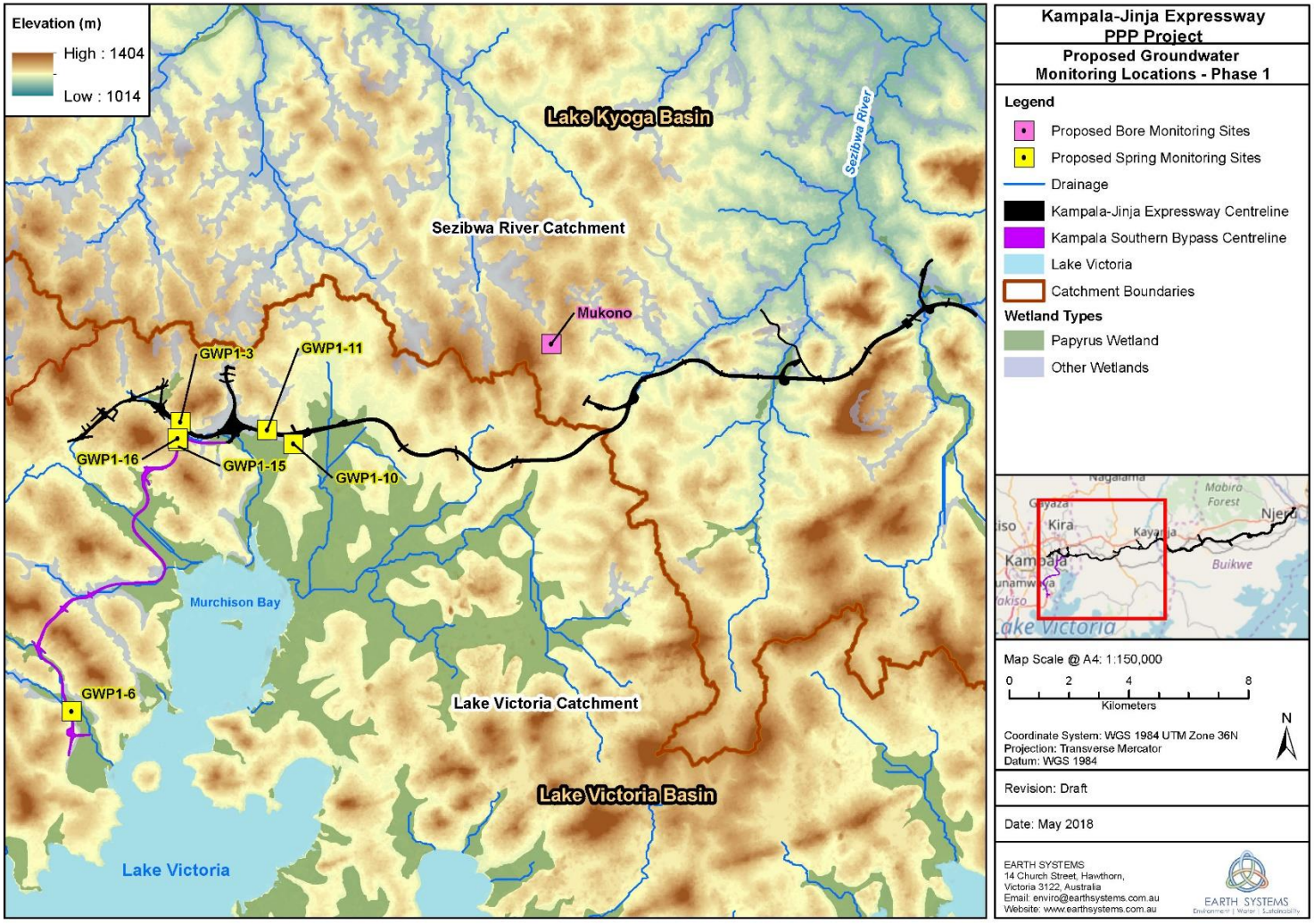

Figure 5-2: Proposed Phase 1 ambient groundwater monitoring locations. Note: additional relevant monitoring sites should be added if identified during Project development.

6. MONITORING AND MAINTENANCE

6.1 Monitoring Program

Specific water quality targets, objectives and standards should be set (i) to evaluate water quality for both surface and groundwater along the KJE; (ii) to characterise ecological status (for surface waters); and (iii) to establish satisfactory condition for intended uses of aquifer(s). The laboratory data will define whether these standards are being met, and whether the water is at acceptable quality for aquatic ecology or drinking.

UNRA will undertake regular monitoring and inspections during the construction and operational phases as per the monitoring requirements detailed in Section 5 at appropriate locations identified. Monitoring and inspections should include, but not be limited to:

- Surface water quality monitoring at identified locations both upstream and downstream of the Project corridor;
- Groundwater monitoring, including for water levels and quality at identified locations;
- Monitoring of environmentally sensitive sites such as wetlands to ensure the ecosystems health and biodiversity is conserved;
- During construction, monitoring of construction sediment basin water quality prior to discharge; and
- Weekly and post rainfall inspections to evaluate the effectiveness of erosion and sediment control measures and to manage accidental spills requiring immediate response.

Water quality data collected from laboratory and field studies should follow standard operating procedures as well as rigorous field and laboratory quality assurance/quality control (QA/QC) criteria set out in a *Training Manual for Data Management* which should be developed for the Project.

Records of water monitoring and ESC inspections should be kept by the Contractor for review by UNRA via a database.

6.2 Maintenance Program

The findings of routine construction and operation monitoring will inform maintenance requirements. The maintenance program should consider ongoing modification to this Water Management Plan as development progresses, if shortcomings in controls are identified, or where Project plans are updated / modified to the extent that additional / different BMPs are required.

The need for the following maintenance requirements should be informed through monitoring results:

- Replace degradable products as required;
- Remove sediment / mud if the design capacity in the settling zone can no longer hold intended water volumes;
- Ensure inlets / outlets are preventing channel scour and basin banks / receiving channels are stable / not eroding.
- Ensure drainage channels are clear of mud, particularly after heavy rainfall;

- Ensure erosion and / or sediment control facilities achieve desired protection until all earthwork activities are completed and the site rehabilitated, including removal of captured sediment and repair of various facilities;
- Repair eroded areas identified during monitoring immediately. Qualified personnel should determine requirements to prevent recurrence of future erosion in the location and assess whether further mitigation is required; and
- Planting of rehabilitated / revegetated areas where significant die-off has occurred, or vegetation has yet to establish.

The above conceptual program should be further refined to ensure measures are effective and well maintained, with improvements applied where appropriate. Detailed standard operating procedures (SOPs) should be prepared to guide implementation.

7. COMPLIANCE MANAGEMENT

7.1 Roles and Responsibilities

The roles and responsibilities of implementing this Water Management Plan is outlined in Section 3 of the ESMMP. Specific responsibilities for the implementation of various management and monitoring measures are detailed in Section 5.

7.2 Training

A site induction should be conducted for all employees and contractors working on site. The training should cover soil, erosion control, and water management issues such as the following:

- Regulatory and other environmental requirements;
- Roles and responsibilities for soil, erosion control and water management;
- Location and management practices for environmentally sensitive sites, e.g. wetlands;
- Water quality and management control measures; and
- Contaminated land and spill response procedures.

Targeted training should also be provided to relevant personnel with a key role in water and soil through specific training and tool box meetings on aspects such as:

- Implementation of best practice erosion and sediment controls;
- Sediment basin construction, operation and maintenance requirements;
- Watercourse works;
- Works near or in drainage lines, watercourses and wetlands;
- Emergency preparedness and response procedures for high rainfall events;
- Stockpiling and soil management; and
- Contaminated land and spill response.

Further details should be specified in the Construction Environmental Management Plan (CEMP) to be developed by the contractor/concessionaire prior to the construction phase (and OEMP for the Operations Phase).

7.3 Audits and Facility Inspections

Routine site inspections of all Project facilities should be undertaken on a regular basis during the construction and operations phases using a visual inspection form to record observations onsite. During the inspection, key water management aspects should include:

- Effectiveness of erosion and sediment controls and water quality protection facilities;
- Management of water related issues on site;
- Workforce awareness, competence and compliance with the Water Management Plan and associated procedures; and

- Suitability of allocated resources, equipment and budget for implementation of the Water Management Plan.

The frequency of inspection should be informed by risk but will typically be monthly. KPIs should be developed to enable environmental performance to be assessed objectively and quantitatively across the operation.

Internal and external audits of the implementation of the WMP should also be conducted in line with the audit program outlined in the ESMMP (Volume D).

Appropriate corrective actions should be implemented for any potential impact identified during the audits or facility inspection in line with the ESMMP, CEMP and OEMP.

7.4 Reporting

Reporting requirements and responsibilities are documented in the ESMMP for the Project. Computer based databases should be developed and maintained to capture and analyse water related information collected from the water quality monitoring program.

Supporting forms and templates used to capture relevant information for database recording should be prepared to ensure data is captured consistently, accurately, and meaningfully.

Significant findings from the monitoring program should be discussed in quarterly and annual reports as appropriate, along with recommendations to address any issues identified. Key information to be reported should include:

- Number of monitoring / audits / surveys / inspections conducted;
- Summary of the significant findings and results of monitoring, audits, surveys, and inspections; and
- Remedial actions planned or implemented for potential issues identified.

7.5 Reviews and Updates

This Water Management Plan should be considered a dynamic document for the Project and be reviewed and updated annually during the Construction and Operations to reflect changes to Project activities, commitments, environmental and social conditions, regulatory requirements, and potential optimisation of best management practices. The Water Management Plan should also be reviewed if any significant changes are made to the Project design or proposed implementation.

7.6 Continuous Improvement

Continuous improvement of this Plan should be achieved through the 'Plan-Do-Check-Act' model as per the ESMMP. The model broadly follows an iterative process for continuous improvement as follows:

- ***Plan***: Identify an opportunity and plan for change.
- ***Do***: Implement the change on a small scale.
- ***Check***: Use data to analyse the results of the change and determine whether it made a difference.
- ***Act***: If the change was successful, implement it on a wider scale and continuously assess your results. If the change did not work, begin the cycle again.

8. PRIORITY ACTIONS

Priority Action	Responsibility	Implementation timeframe
SURFACE WATER AND GROUNDWATER MANAGEMENT		
Review and update strategies for surface water and groundwater management based on the outcomes of the final detailed design.	UNRA	Pre-construction
Ensure appropriate consultation and engagement with relevant Government authorities such as the Directorate Water Resources Management (DWRM) regarding proposed changes to drainage and hydrology resulting from the Project	UNRA / Contractor	Pre-Construction
Develop and implement a Construction Environmental Management Plan (CEMP) for the Project. The objectives, management and mitigation requirements, and monitoring / reporting methodologies of this Plan should be included in the CEMP to ensure Project compliance.	Contractor	Pre-construction
Conduct inductions and training for Project staff in relation to surface water and groundwater management.	Contractor	Pre-construction
As part of the CEMP, prepare detailed procedures for water quality and hydrology monitoring for the Construction Phase. Continue monitoring of hydrology and water quality aspects upstream and downstream of the Project to evaluate for potential impacts and continual performance improvements.	UNRA / Contractor	Construction
Formalise procedures and designs for aspects related to water quality pollution and management, erosion and sediment control, emergency preparedness and response, waste (hazardous and general), hazardous substances, and construction materials handling.	Contractor	Construction
EROSION AND SEDIMENT CONTROL MANAGEMENT		
As part of the CEMP, develop and implement site-specific Erosion and Sediment Control Plans (ESCPs) in advance of Project construction commencing, including detailed procedures for implementing erosion and sediment control management and monitoring measures.	Contractor	Pre-construction
Conduct inductions and training for Project staff in relation to erosion and sediment control	Contractor	Pre-construction
Conduct regular site inspections (at least weekly) and water quality monitoring for compliance and continual performance improvements.	Contractor	Construction
Progressively rehabilitate disturbed areas as soon as possible during the Construction Phase.	Contractor	Construction
Develop a routine maintenance and repair program for erosion and sediment control structures.	Contractor	Construction

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