REVIEW OF ADEQUACY OF ENVIRONMENTAL MITIGATION IN THE ESIA FOR THE EAST AFRICA CRUDE OIL PIPELINE IN UGANDA

ENVIRONMENTAL AND SOCIAL IMPACT ASSESEMENT

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I. Summary

The ESIA should be revised to incorporate the following recommendations:

Issue	Recommendation
Construction ROW width - general	International best practices for pipeline construction right-of-way (ROW) is 15 m. Maximum construction ROW width for EACOP should be 15 m.
- protected area	Maximum construction ROW in protected areas should be 10 m.
Waterbody crossings	Utilize horizontal directional drilling (HDD) to traverse the floodplains of the ten major watercourses to be crossed by the pipeline. See Table 6.4-18). The ESIA basis for preferring open-cut trenching, simplicity and low cost, does not equate to international best practices for these crossings.
Impeding flow at waterbody crossings	The ESIA must describe the suite of options available for watercourse crossings, the basis for selecting a crossing technique that will temporarily impede flow at each crossing where this will occur, the degree to which flow will be impeded, and the duration that flow will be impeded.
Location of block valves	Block valves should be installed on both sides of the ten major water crossings identified in the ESIA (Table 6.4-18), in addition to the block valves already included in the project design.
Crossing seasonally wet locations	The ESIA at p. 2-45 should be modified to read "seasonal watercourses and wetlands will only be crossed during the dry season."
Hydrotest	No hydrotest section should exceed 10 km in length, and a plan must be developed (and described in the ESIA) to treat hydrotest water that is not in compliance with IFC water discharge limits.
Contingency planning	Integrity testing using smart pigging should occur at intervals not exceeding 7 years.
Geotechnical studies	The mitigation plans for the geotechnical hazards identified by Total East Africa Midstream along the final EACOP route, after all small-scale adjustments are resolved, should be reviewed and verified by an independent auditor prior to the initiation of construction activities.
Management plans	Management plans should be reviewed and approved by independent auditors representing stakeholders before the field work begins.
Revegetation of ROW	Irrigation of seeds must be conducted as long as necessary to assure the seeds germinate and establish a self-sustaining grassland, and the natural drainage contours present prior to construction must be re-established prior to the application of seeds.
Pump station alternatives	There is no analysis in the ESIA of the cost-benefit of eliminating the second pump station by utilizing a larger pipe diameter. A summary of this alternative should be included in the ESIA.

II. Introduction

The Environmental and Social Impact Assessment (ESIA) for the Uganda portion of the East Africa Crude Oil Pipeline (EACOP) was issued in December 2018. The purpose described for the EACOP project in the ESIA is to transport crude oil from the Lake Albert development area in Uganda to the Tanzanian coast, a distance of over 1,400 kilometers, for export to international markets. A portion of Uganda's domestic crude oil demand will also be met by the project. Total East Africa Midstream is the developer of the EACOP project. The Lake Albert development area consists of oil deposits along the eastern shoreline of the lake, in highly sensitive environments, along with deposits in Murchison Falls National Park. The ESIA describes the route of the EACOP pipeline in Uganda in the following manner:[1]

> The export pipeline originates at the Pump Station 1 located at the future Kabaale Industrial Park, in Hoima District. Initially, it crosses relatively low terrain with undulating topography characterised by widespread cropland, settlement and transport infrastructure between Hoima and Mubende districts. The RoW also traverses gently undulating grass and farmland, hills with open plateaus, open grassland, wetlands in Gomba and Ssembabule Districts and a relatively flat landscape towards Mutukula near the border with Tanzania.
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> In Hoima District, the corridor passes in between Wambabya and Bugoma Forest Reserves, and traverses through a modified section of Taala Forest Reserve in Kyankwanzi District, and crosses near the eastern border of Kasana-Kasambya Forest Reserve in Mubende District. There are watercourse crossings including the Kafu River between Hoima and Kakumiro Districts, Nabakazi River between Mubende and Gomba Districts, Katonga River between Gomba and Ssembabule Districts, and Kibale and Jemakunya Rivers in Kyotera District. On the approach to the Tanzania border, and the north-western corner of Lake Victoria, the corridor crosses a substantial zone of wetlands in a high average rainfall zone . . . for approximately 90 km.

The purpose of this assessment of the EACOP ESIA is to determine the:

a. Extent to which EACOP, as it is currently designed, does not meet international best practices and whether the project, is likely to have a serious and irreversible impact on the environmental and social health of communities along the pipeline route.

b. Extent to which the avoidance and mitigation strategies proposed in the ESIA are adequate to address the environmental and social impacts identified.

c. Additional conditions for strengthening the ESIA to meet international best-practices that should be imposed on the project to minimize environmental risks.

[1] **EACOP ESIA, December 2018, Volume 1, p. ES1 and p. ES2.**

The December 2018 ESIA states that the IFC's Environmental, Health, and Safety Guidelines for Onshore Oil and Gas Development applies to the EACOP project.[2] The IFC's Onshore Oil and Gas guidelines are used in this review as the principal point of reference to determine if the EACOP pipeline design and construction elements are consistent with international best practices. The term "international best practices" in this review means that multiple oil and gas projects have used, or have proposed to use, a specific technique that most effectively avoids or mitigates the environmental or safety challenge being posed.

In addition to the EACOP ESIA and the IFC's Onshore Oil and Gas Guidelines, I relied on the following documents in the course of my review:

E-Tech International, Best Practices: Design of Oil and Gas Projects in Tropical Forests, 2012 and 2015 editions.

PennState Extension (U.S.), Negotiating Pipeline Rights-of-Way in Pennsylvania, 2015.[3]

CNOOC, ESIA: CNOOC Kingfisher Oil Project, Uganda, Volume 1, January 2019.

Toyota Tsusho Corporation, Hoima-Lokichar-Lamu Crude Oi l Pipeline - Final Report, 2015.

www.plosone.org, Potential of Best Practice to Reduce Impacts from Oil and Gas Projects in the Amazon, PLOS One, Volume 8, Issue 5, May 2013.

Society of Petroleum Engineers, Methods to Establish Canopy Bridges to Increase Natural Connectivity in Linear Infrastructure Development, prepared by Smithsonian Conservation Biology Institute, 12LAHS-P-157-SPE, 2013.

Exponent, Inc., Integrity Analysis of the Camisea Transportation System, Peru, S.A., prepared for Inter-American Development Bank, June 2007.

E.W. McAllister, Pipeline Rules of Thumb Handbook, 2005.

A challenging aspect of this project, from a monitoring and enforcement standpoint, is that the Government of Uganda is a junior partner in the EACOP consortium. As a result, the government is not a neutral party to the application and enforcement of the requirements described in the ESIA. It is Ugandan civil society and the environment that will be impacted by the disruptions and environmental impacts during construction, as well by impacts, such as oil spills, that may occur during pipeline operation. This is a situation where there must be independent auditors working on behalf of civil society interests monitoring EACOP compliance with the conditions of the ESIA. This is necessary to assure that the monitoring and enforcement function is perceived as transparent and legitimate by the Ugandan public and the international community.

[2] Ibid, p. 4-84. The document also notes that a draft update to the 2007 Onshore Oil and Gas Guidelines is in develop by the IFC. The draft update, published in April 2017, expands on the content included in the 2007 Onshore Oil and Gas Guidelines.

[3] See: https://extension.psu.edu/negotiating-pipeline-rights-of-way-in-pennsylvania.

III. Extent to which current EACOP design does not meet international best practices

A. Pipeline right-of-way (ROW) width

1. General

The IFC Onshore Oil and Gas Guidelines include the following requirements related to the width of the ROW:

Page	Paragraph	2017 (draft) IFC Onshore Oil and Gas Guideline Requirements[4]
20	88	Minimize areas to be cleared. Use hand cutting where possible, avoiding the use of heavy equipment such as bulldozers, especially on steep slopes, water and wetland crossings, and forested and ecologically sensitive areas.
21	88	Minimize the width of a pipeline right-of-way or access road during construction and operations as far as possible.
21	88	Install appropriate erosion and sediment control measures, slope stabilization measures, and subsidence control and minimization measures at all facilities, as necessary.

The ESIA at p. 3-10 states "The following environmental constraints were applied during FEED – reduce project footprint (including the RoW, aboveground installations [AGIs], work sites, access roads). Consistent application of this criteria has been of paramount importance while narrowing the study corridor from 2,000 m down to a 30-m construction RoW with pipeline centreline."

The 30-meter construction ROW proposed in the ESIA is an industry typical ROW width,[5] and not representative of international best practices. A pipeline construction ROW width as narrow as 13 meters has been demonstrated-in-practice in sensitive tropical environments. A maximum pipeline construction ROW width of 15 meters (50 feet) is a general requirement in some parts of the U.S. This includes the state of Pennsylvania, a shale gas production region that has undergone intensive pipeline development in recent years.

Pipeline construction is a specialized industry with relatively few companies. These companies are accustomed to applying a similar conventional approach on every project. Priority is placed on maintaining the pace of pipeline installation, which imposes its own conditions of construction, including: ROW width, disposal of soils and debris, contouring of ROW slopes, and the equipment that is used in each construction stage. These are unchanging elements for conventional pipeline ROW builders. These accumulated habits and routines, which have evolved over the years among pipeline construction firms, constitute a major source of resistance to innovative ROW construction techniques.

[4] The draft 2017 guideline elements include the elements in the 2007 Environmental, Health, and Safety Guidelines for Onshore Oil and Gas Development final document, as well as additional elements.

[5] See Attachment A for the graphic of a typical 30-meter construction ROW presented in the ESIA at p. 2-72.

The "narrow ROW" technique puts primary emphasis on manual LABOUR and less emphasis on heavy machinery to open and close the ROW. The narrow ROW technique emphasizes having the ROW follow the natural terrain, as well as the manual logging of trees and bushes (instead of using heavy machinery) to further reduce impacts, especially on steep slopes. See E-Tech International, Best Practices: Design of Oil and Gas Projects in Tropical Forests, October 2012 for examples of pipelines and flowlines built in narrow ROWs in tropical environments.[6]

Manual clearing creates opportunities for short-term employment during pipeline construction, an additional social benefit in contexts where expectations for jobs are high. Figures 1a and 1b show LABOUR crews opening and closing a 13-meter ROW in Peru for a 20-inch diameter flowline.

Figures 1a and 1b. Opening and closing narrow ROW using LABOUR intensive technique[7]

The standard 15-meter pipeline construction ROW in Pennsylvania is shown in Figures 2a and 2b. The 15-meter ROW is the space between the two temporary plastic orange fences.

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[6] **See:** https://static1.squarespace.com/static/52d71403e4b06286127a1d48/t/531cf8bce4b04c1bc67a1768/1394407612599/E-Tech.2012_BestPracticesHydrocarbonProjects.pdf

[7] **INMAC Peru, Comparaciones de calidad y costo entre un gasoducto verde y una construcción tradicional, presented at E-Tech Independent Monitoring Forum, Cusco, Peru, 2010.**

Figures 2a and 2b. typical Pennsylvania 15-meter pipeline ROW (25 feet on either side of centerline),[8] and clearing of ROW for 20-inch diameter Mariner East Pipeline[9]

International best practices for a pipeline construction ROW is 15 meters. The maximum allowable construction ROW for EACOP should be 15 meters.

2. Protected areas

The proposed EACOP route will pass through or near three protected forest areas: between Wambabya and Bugoma Forest Reserves, the Taala Forest Reserve in Kyankwanzi District, and near the eastern border of Kasana-Kasambya Forest Reserve. The ESIA map showing the locations of these protected forest areas relative to the EACOP route is provided in Attachment B.

Figure 3. 8-meter construction ROW[10]

The maximum width of the construction ROW in protected forests should be no more than 10 meters. The primary reasons for this width restriction is to: 1) minimize the amount of ground-level disturbance in the protected area, and 2) maintain canopy bridges at regular intervals along the ROW to allow for the passage of forest animals that live primarily or exclusively in the tree canopy. Figure 3 is a photograph of a construction ROW cross-section limited to 8 meters in the Peruvian jungle. Canopy bridges were maintained at regular intervals along this ROW.

[8] Penn State Extension, Tips for Negotiating Pipeline Rights of Way [in Pennsylvania], video, 2019. Screenshot showing ROW measuring 25 feet on either side of ROW centerline (50 feet total).

[9] State Impact Pennsylvania, Mariner East: A Pipeline Project Plagued by Mishaps and Delays, March 2019. See: https://stateimpact.npr.org/pennsylvania/tag/mariner-east-2/.

[10] Society of Petroleum Engineers, Methods to Establish Canopy Bridges to Increase Natural Connectivity in Linear Infrastructure Development, prepared by Smithsonian Conservation Biology Institute, 12LAHS-P-157-SPE, 2013.

B. Crossing technique to be utilized at rivers and streams

Page	Paragraph	2017 (draft) IFC Onshore Oil and Gas Guideline Requirements
21	88	Carefully consider all of the feasible options for the construction of pipeline river crossings including horizontal directional drilling.

The ESIA at p. 2-44 identifies the following waterbody crossings "Perennial Rivers, 4, 506 m., Perennial Streams, 2, 91 m., Ephemeral Streams, 28, 1,387 m. (2 km total)." At p. 3-32 states "For river, wetland and stream crossings in Uganda, the open-cut technique is the preferred option owing to its simplicity and minimal construction footprint. Other techniques such as HDD, direct pipe and micro-tunnelling were discounted during FEED owing to requirement for a much larger construction footprint and increased Capex (capital expense)."

The ESIA at p. 6-65 provides more context to the waterbody crossing descriptions, stating "The pipeline route crosses many minor tributaries. These are characterised by indistinct channels when viewed on satellite imagery and small catchment areas. The route crosses 10 major watercourses, a tributary of the Wambabya River, the Kafu River, two tributaries of the Kafu River, two tributaries of the Nabakazi River, the Nabakazi River, the Katonga River, the Kibale River and the Jemakunya River. These major rivers are the focus of this report (Figure 6.4-7)." All ten of these waterbodies have year-round flow, as shown in the ESIA in Table 6.4-17 at p. 6-70, with maximum flows in the spring and fall. The map showing the location of rivers along the EACOP pipeline route in Uganda, along with ESIA Table 6.4-18 describing each the ten crossings, is provided in Attachment C. The total additive crossing width of these ten crossings, including the floodplain of each crossing, is about 2 km.[11]

The ESIA basis for selecting open-cut trenching, simplicity and low cost, does not equate to international best practices for pipeline crossings of perennial rivers and streams. Two primary options are available for buried pipelines to cross waterbodies: 1) open-cut, or 2) HDD. At Table 3.8-2 at p. 3-33 of the ESIA, the cost of open-cut is identified as "lowest," and the cost of HDD as "low."

With the open-cut technique, the streambed where the pipeline trench will be located is physically isolated to allow laying of the pipeline in dry conditions. Pipes pass through the temporary barriers to allow water from the waterbody to continue to flow. However, the open-cut technique has the potential for substantial negative environmental impacts on aquatic fauna in perennial rivers and streams due to the disruption to natural flow. A photograph of this technique, with river/stream water flowing in pipes above the pipeline trench, is shown in Figure 4.

[11] See Attachment C. The total additive crossing length of the ten crossings, including floodplains, is 2,160 meters.

Figure 4. Open-cut river crossing, horizontal flume pipes above pipeline for water flow[12]

Open-cut trenching of pipelines in streambeds carries operational risks. A major rupture on the Camisea liquids pipeline in Peru occurred sixteen months after the pipeline began operation at a point where the pipeline had been placed under the streambed of the Paratori River using open-cut trenching.[13] The river is less than 10 meters across where the rupture took place. The pipeline was exposed due to scouring of the streambed during a period of heavy rain.[14] It had been buried 2.1 meters below the stream bed.[15]

The automatic leak detection system did not register that a leak had occurred. The pressure reduction caused by the rupture "was not sufficiently large to activate the automatic rupture detection mechanism of the block valves upstream and downstream of the rupture."[16] The rupture was detected when control room operations staff identified a reduction in flow at the downstream pump station. The nearest block valves were ultimately closed about one hour after the rupture occurred. Approximately 4,600 barrels of liquid hydrocarbons were spilled into the stream.[17] Figure 5 shows the damaged pipe section and the pipeline bridge that replaced the pipeline section that had been buried under the streambed.

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[12] CNOOC, ESIA: CNOOC Kingfisher Oil Project, Uganda, Volume 1, p. 2-78.

[13] Exponent, Inc., Integrity Analysis of the Camisea Transportation System, Peru, S.A., prepared for Inter-American Development Bank, June 2007, p. 21.

[14] Ibid.

[15] Ibid.

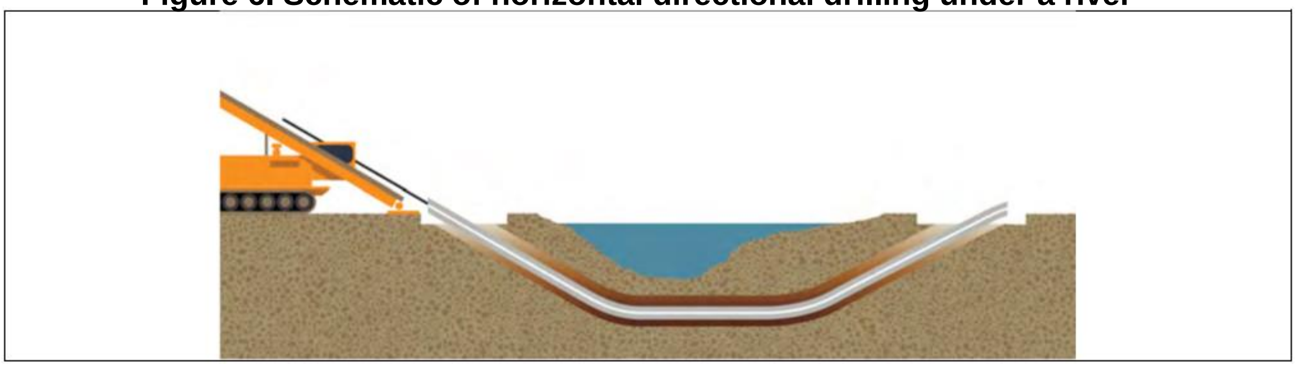
[16] Ibid.

[17] (736 m^3 × 35.31 ft^3/m^3 × 7.5 gallons/ft^3)/(42 gallons/barrel) = 4,641 barrels.

Figure 5. Photographs of the open-cut buried pipe section that ruptured and the replacement pipeline bridge[18]

The HDD technique involves drilling under the waterbody and avoiding any disruption to the waterbody itself. See Figure 6.

Figure 6. Schematic of horizontal directional drilling under a river[19]



It is important to underscore that HDD must be done properly to achieve the intended environmental and water quality protection purposes. There will be strong pressure in the field to keep laying pipe sections as fast as possible. A clear, detailed and sufficient work plan must be developed for each HDD crossing, and onsite independent inspection must verify that the work plan is being followed.

A recent 500 km pipeline project in the U.S. includes over 100 HDD crossings.[20] The pipeline company chose the best practices HDD technique to speed environmental approvals and begin construction sooner. However, due to restrictions on the auditing authority of the state in this case, government authorities were not permitted to independently assess the adequacy of the HDD crossing designs planned by the pipeline company. The results in some cases were not

[18] Exponent, 2007, pp. 23-24.

[19] Pittsburg Post-Gazette, The lessons of Mariner East 2, October 23, 2018: https://newsinteractive.post-gazette.com/mariner-east-2-pipeline-horizontal-directional-drilling/.

[20] Ibid.

acceptable, either because the HDD contractor had not drilled the pipeline bore at sufficient depth under the water body, or the contractor was under time pressure to keep moving at a fast pace and cut corners to stay on schedule. The problems encountered on this project underscore the need for independent review and approval of HDD work plans prior to the commencement of field work.

In summary, HDD is best practices for traversing the ten major waterbody crossings along the pipeline route in Uganda. As noted, the total width of these ten waterbody floodplains is approximately 2 km. HDD has no construction footprint on the waterbody itself. HDD has no construction footprint on the waterbody itself. In contrast, open-cut has a large and negative footprint, at least temporarily, on the waterbody. Therefore about 2 km of HDD will be necessary to traverse these ten waterbody floodplains.

C. Impeding flow at waterbody crossings

The ESIA at p. 8-92 states that "During the construction of watercourse crossings, the contractor may need to temporarily impede flow." This is insufficient information in the ESIA to determine whether the selected watercourse crossing techniques represent international best practices. Floating crossings would not impede flow. Elevated crossings would not impede flow. The ESIA fails to describe the suite of options available for watercourse crossings. The ESIA must describe the suite of options available for watercourse crossings and upon what basis a crossing technique has been selected that will temporarily impede flow, the degree to which flow will be impeded, and the duration that flow will be impeded.

D. Location and number of block valves

The ESIA states at p. 2-13 that "main line block valves (MLBVs) are installed: 1) at each pump station, 2) on each side of wetlands, 3) at each watercourse that is more than 30 m wide, and 4) at each watercourse that is less than 30 m wide if it meets one or more of the following criteria, having direct or downstream flow to: a populated area, a reservoir holding water intended for human consumption, a navigable waterway, an environmentally sensitive area," and at p. 3-18 stating "The optimisation for EACOP Uganda pipeline resulted in elimination of 8 block valves, total of 19 block valves in the RoW. The primary function of block valves is to isolate sections of the pipeline and the number and location of block valves is based on ASME B31.4 (434.15)."

Best practice is to install block valves on either side of perennial rivers and streams, not just on either side of rivers greater than 30 m wide. A spill into a perennial river or stream less than 30 m in width will have major environmental consequences regardless of what is downstream of the point of the spill. Block valves should be installed on both sides of the ten major waterbody crossings identified in the ESIA (Table 6.4-18), in addition to the block valves already included in the project design.

E. Crossing seasonal streams and wetlands

The ESIA at p. 2-45 states that "seasonal watercourses will be crossed during the dry season where practical." This is insufficient and does not represent international best practices. This statement in the ESIA should be modified to read "seasonal watercourses and wetlands will only be crossed during the dry season." A definitive statement to this effect will allow a field inspector to readily determine whether or not this condition is being adhered to.

F. Hydrotesting

Page	Paragraph	2017 (draft) IFC Onshore Oil and Gas Guideline Requirements
11	51	Following hydrotesting, the disposal alternatives for test waters include injection into a disposal well if one is available, or discharge to surface waters or land.
11	51	Hydrostatic test water quality should be monitored before use and discharge and should be treated to meet the discharge limits in Table 1 of Section 2.1 of this Guideline.
21	88	Limit the amount of pipeline trench left open during construction at any one time. Safety fences and other methods to prevent people or animals (livestock or wildlife) from falling into open trenches should be constructed in sensitive locations and within 500 m of human populations. In remote areas, install wildlife escape ramps from open trenches (typically every 1 km where wildlife is present).

The ESIA at p. 2-60 states that "The pipeline will be hydrostatically tested to confirm pipeline integrity and strength. Pipeline sections of approximately 35–50 km will be cleaned and gauged using several large batches of approximately 16.000 m3 of water separated by pigs. The water will be released to the environment when analysis indicates that the water parameters comply with water discharge regulations."

Hydrotest section length: Hydrotest pipe sections 35 – 50 km in length are far too long to be considered best practices. Leaving 35 – 50 km of open trench in order to conduct a single hydrotest would conflict with the IFC guideline to limit the amount of trench left open during construction. Covering the pipeline before conducting the hydrotest would complicate addressing deficiencies revealed by the hydrotest. Best practices also require that the elevation difference across a pipeline segment undergoing testing not exceed 300 feet (~90 meters).[21] Shorter hydrotest section also means less hydrotest water will be discharged to the environment at a single point. For these reasons, no hydrotest section should exceed 10 km in length.

Hydrotest water quality: There is no indication in the ESIA as to what Total will do in the field to bring the hydrotest water into compliance prior to discharge to the environment if the water does not meet IFC water discharge limits in Table 1 of Section 2.1 of the IFC Onshore Oil and

[21] **E.W.** McAllister, Pipeline Rules of Thumb Handbook, 2005, p. 140.

Gas Guideline. The IFC water discharge limits are provided as Attachment D. Total East Africa Midstream's plan to address hydrotest water that is not in compliance with the IFC water discharge limits must be explicitly described in the ESIA.

G. Contingency planning

Page	Paragraph	2017 (draft) IFC Onshore Oil and Gas Guideline Requirements
23	97	Conduct a spill risk assessment for the onshore facilities.
23	97	Ensure adequate corrosion allowance for the lifetime of the facilities and/or installation of corrosion control and prevention systems in all pipelines, process equipment, and tanks.
23	97	On pipelines, consider measures such as telemetry systems, Supervisory Control and Data Acquisition systems, pressure sensors, shut-in valves, and pump-off systems, including at normally unattended installations and unmanned facilities to ensure rapid detection of any loss of containment.
24	97	For flowlines and pipelines, maintenance programs should include regular pigging to clean the line, and intelligent pigging should be considered as required.
24	97	Implement adequate personnel training and field exercises in oil spill prevention, containment, and response.
24	98	A Spill Response Plan (SRP) should be prepared, and the capability to implement the plan should be in place.
32	134	Incidents related to land transport are one of the main causes of injury and fatality in the oil and gas industry.

EACOP oil spills will occur over the lifetime of the project.[22] It is imperative that periodic testing be conducted to assure the integrity of the pipeline, that block valves be positioned to minimize spills into waterways and/or critical habitat, and that effective contingency planning is adequate to rapidly clean and remediate the spills that do occur.

The ESIA states at p. 2-11 that "Pigs sweep the pipeline by scraping the sides of the pipeline and pushing debris ahead of the pig to the pig receiver where the debris and the pig are recovered without interrupting the flow. Smart pigging for pipeline Integrity purposes will be conducted periodically." Best practices would an explicit interval, no more than every 7 years, for integrity testing using smart pigging. This maximum interval should be explicitly stated in the ESIA.

H. Adequacy of geotechnical studies and geotechnical mitigation measures

The ESIA at p. 2-22 and p. 2-23 states that "Geological, geotechnical and geophysical surveys were undertaken to: 1) identify potential geological hazards in the pipeline route corridor, 2) determine the need for rock blasting, fault-line crossing, engineered retaining, and 3) structures and unrestrained pipe sections. . . Geological and geophysical surveys are being undertaken to

[22]Toyota Tsusho Corporation, Hoima-Lokichar-Lamu Crude Oi l Pipeline - FINAL REPORT, 2015, p. 213. "Oil pipelines have a risk of spills as a primary concern. Historically, pipelines lead to some number of oil spills over the course of their operating life regardless of design, construction and safety measures."

evaluate soil conditions and to assess potential geohazards (e.g., faulting) on the pipeline route," and p. 3-15 "The base case route is shown in Figure 2.3-1. However, as investigations are ongoing at the time of writing this ESIA, e.g., geophysical and geotechnical surveys, small-scale adjustments may still be made."

The ESIA indicates small-scale adjustments to the EACOP route are ongoing. The mitigation plans for the geotechnical hazards identified by Total East Africa Midstream along the final EACOP route, after all small-scale adjustments are resolved, should be reviewed and verified by an independent auditor prior to the initiation of construction activities.

The failure to incorporate adequate geotechnical mitigation measures at the design stage was a primary cause of subsequent pipeline ruptures and spills on the Camisea Pipeline in the Peruvian Andes.[23] Timely independent review of the proposed geotechnical mitigation measures along the final pipeline route in the Camisea case would likely have identified some of the design weaknesses that subsequently led to pipeline rupture and associated spills.

I. Independent auditing of each phase of pipeline design, construction and operation

Page	Paragraph	2017 (draft) IFC Onshore Oil and Gas Guideline Requirements
21	88	Construction areas no longer needed by a project development should be appropriately reclaimed, including by appropriate revegetation using native plant species and establishing/re-establishing appropriate drainage contours. Where applicable, accommodate requests of the local population regarding the reclaimed state of the disturbed land.
37	151	Environmental monitoring programs for this sector should be implemented to address all activities that have been identified to have potentially significant impacts on the environment during normal operations and upset conditions.
37	152	Monitoring should be conducted by trained individuals following monitoring and record-keeping procedures and using properly calibrated and maintained equipment.

The ESIA at p. ES29 indicates that "A suite of management plans will be prepared prior to the commencement of construction and operation activities to support implementation of the environmental and social management plan (ESMP). The minimum content of these management plans are the mitigation commitments developed throughout the ESIA." There is no statement in the ESIA that independent auditor review or approval will be required prior to the implementation of the management plan(s).

Total East Africa Midstream assigns the role of independent auditing to its contractor in the ESIA at p. 10-7. A contractor working for the consortium building EACOP is not an independent auditor. However, the ESIA at p. 10-2 implies that the Total East Africa Midstream will actively seek outside stakeholder input, stating "Stakeholder consultation has been ongoing and will

[23] Exponent, Inc., Integrity Analysis of the Camisea Transportation System, Peru, S.A., prepared for Inter-American Development Bank, June 2007, p. xviii.

continue during all project phases with lead agencies, local leaders and communities. The aim of continuous stakeholder consultation is to provide ongoing project information and receive feedback regarding the effectiveness of project mitigation. Received feedback will inform responsive and adaptive management of environmental and social impacts." Transparently independent auditing of project mitigation is essential to maintain the ongoing trust of stakeholders.

The lack of transparently independent auditing underscores the need for: 1) review and approval of management plans by independent auditors representing stakeholders before the field work begins, and 2) independent onsite monitoring by monitors representing stakeholders to assure adequate time is allowed, per the time interval described in the approved plan, to do the work properly.

J. Revegetation of right-of-way

Page	Paragraph	2017 (draft) IFC Onshore Oil and Gas Guideline Requirements
21	88	Construction areas no longer needed by a project development should be appropriately reclaimed, including by appropriate revegetation using native plant species and establishing/re-establishing appropriate drainage contours. Where applicable, accommodate requests of the local population regarding the reclaimed state of the disturbed land.

The ESIA at p. 2-22 states that "On completion in agricultural areas, the (RoW) corridor will be reinstated with commercially available seed of local species, potentially supplemented by locally collected seeds, and maintained as grassland.". The description of this seeding commitment should be expanded to make clear that temporary irrigation of seeds will be conducted as long as necessary to assure the seeds germinate and establish a self-sustaining grassland, and that the natural drainage contours present prior to construction will be re-established prior to the application of seeds.

IV. Extent to which avoidance and mitigation strategies proposed in the ESIA for EACOP are adequate

A. Use of onsite solar energy to power main line block valve (MLBV) stations

The ESIA at p. 2-14 states that "A series of photovoltaic solar panel arrays, and batteries with six days autonomy, will provide the low power supply required at the MLBV, with a 1.1 kV total power consumption estimated." This is an adequate measure to meet block valve station power requirements. Use of solar power and battery storage to meet pump station requirements, and future pipeline heating element power demand, should also be considered to eliminate reliance on electric power from the upstream power station at Tilenga**.**

B. Adequacy of proposed pipeline welding standards

The ESIA states at p. 2-4 states that the pipeline technical design is based on ASME B31.4 – 2016, Pipeline Transportation Systems for Liquids and Slurries, and ASME B31.3, Gas Transmission and Distribution Piping Systems. These American Society of Mechanical Engineers (ASME) codes are the accepted international standard for pipeline construction and are adequate.

C. Pipeline trench exit ramps for workers, people, and animals planned

Page	Paragraph	2017 (draft) IFC Onshore Oil and Gas Guideline Requirements
21	88	Limit the amount of pipeline trench left open during construction at any one time. Safety fences and other methods to prevent people or animals (livestock or wildlife) from falling into open trenches should be constructed in sensitive locations and within 500 m of human populations. In remote areas, install wildlife escape ramps from open trenches (typically every 1 km where wildlife is present);

The ESIA at p. 2-40 states "Consistent with pipeline construction best practices, the trench will be excavated complete with escape ramps, or side cuts into the trench wall, to allow a safe exit from within the trench. The slope of the escape ramps should not exceed 45°. The ramps should be excavated every 500–1000 m (terrain dependent) to provide an escape route for any personnel working or animals that may become trapped in the trench." This condition partially meets the IFC guideline. However, there is no mention in the ESIA of installing safety fences to protect people and animals from falling into the open trench.

IV. Additional conditions for strengthening the ESIA to meet international best practices that should be imposed on the project

The ESIA should quantify the indirect air emissions associated with the project, specifically the 1) greenhouse gas emissions associated with the Ugandan crude oil being transported over EACOP, and 2) the air emissions associated with upstream combustion of field gas and crude oil to provide electric power for the pipeline pump stations and pipeline heating elements.

A. Indirect Uganda greenhouse gas emissions will increase 57 percent

The ESIA states at pp. ES17-ES18 that "Since 1960, mean annual temperatures have risen by 1.3°C and annual and seasonal rainfall has decreased considerably across Uganda. Rainfall has also become more unpredictable and evenly distributed over the year. Uganda is vulnerable to increased climate variability and climate change. For example, the severity and frequency of extreme events such as droughts and floods is projected to increase. . . Uganda has absolute emissions (in 2014) of 59.9 $MtCO_{2e}$."

Uganda GHG emissions in 2014 are estimated at 59.9 million metric tons per year at p. ES18 of the ESIA. The U.S. EPA indicates that there are 0.43 metric tons CO_2 per bbl crude oil combusted.[24] The yearly CO_2 emissions from combustion of EACOP crude oil at full production = 216,000 bbl/day x 0.43 metric tons CO_2/bbl x 365 day/yr = 33.9 million metric tons CO_2/yr.

Therefore, the combustion of the crude oil originating in Uganda that will be transported over EACOP, if attributed to Uganda, would increase Uganda's annual greenhouse gas emissions footprint by approximately 57 percent.[25]

B. Air emissions from Tilenga power generation project and bulk heaters

The ESIA states at p. 2-4 that "Centralised power generation to be provided by the Tilenga Project CPF for PS1 and 2, resulting in no additional equipment for power generation required for the Uganda section of the EACOP pipeline." It is E-Tech's understanding that the power plant will burn oilfield produced gas initially until it is depleted, and will then switch to crude oil combustion. The ESIA also states at p. 2-64 that the project will utilize "oil-fired bulk heaters using heating medium heaters (later in the project life)," and at p. 8-135 that "The project will design (bulk heater) combustion plant to comply with national regulations and project emission standards." There is no information in the ESIA on what emission controls will be utilized on the power generation units or bulk heaters when they are firing crude oil, or what emission standards will be met. These omissions should be rectified.

C. Evaluation of options for reducing the number of pump stations

The ESIA states at p. ES26 that "The project has completed a Technological Risk Assessment (TRA) during front end engineering design (FEED) in accordance with the EACOP Project HSE risk assessment methodology."

Two pump stations are planned along EACOP in Uganda. There is no analysis in the ESIA of the cost-benefit of eliminating the second pump station by utilizing a larger pipe diameter.[26] Such an analysis was likely included in the FEED. A summary of this alternative, the elimination of the second pump station by utilizing a larger pipe diameter, should be included in the ESIA. This alternative would reduce power requirements and associated upstream air emissions at Tilenga.

V. Summary of Recommendations

It is my opinion the ESIA should be revised to incorporate the following recommendations:

Issue	Recommendation
Construction ROW width - general	**International best practices for pipeline construction right-of-way (ROW) is 15 m. Maximum construction ROW width for EACOP should be 15 m.**
- protected area	**Maximum construction ROW in protected areas should be 10 m.**
Waterbody	**Utilize horizontal directional drilling (HDD) to traverse the floodplains of**

[24]See: https://www.epa.gov/energy/greenhouse-gases-equivalencies-calculator-calculations-and-references.
[25]33.9 million metric tons per year ÷ 59.9 million metric tons per year = 0.566 (56.6 percent increase).
[26]Toyota Tsusho Corporation, Hoima-Lokichar-Lamu Crude Oi l Pipeline - FINAL REPORT, 2015, Section 7.1.1 Pre-selection of pipeline diameter, p. 93.

crossings	the ten major watercourses to be crossed by the pipeline. See Table 6.4-18). The ESIA basis for preferring open-cut trenching, simplicity and low cost, does not equate to international best practices for these crossings.
Impeding flow at waterbody crossings	The ESIA must describe the suite of options available for watercourse crossings, the basis for selecting a crossing technique that will temporarily impede flow at each crossing where this will occur, the degree to which flow will be impeded, and the duration that flow will be impeded.
Location of block valves	Block valves should be installed on both sides of the floodplains of the ten major water crossings identified in the ESIA (Table 6.4-18), in addition to the block valves already included in the project design.
Crossing seasonally wet locations	The ESIA at p. 2-45 should be modified to read "seasonal watercourses and wetlands will only be crossed during the dry season."
Hydrotest	No hydrotest section should exceed 10 km in length, and a plan must be developed (and described in the ESIA) to treat hydrotest water that is not in compliance with IFC water discharge limits.
Contingency planning	Integrity testing using smart pigging should occur at intervals not exceeding 7 years.
Geotechnical studies	The mitigation plans for the geotechnical hazards identified by Total East Africa Midstream along the final EACOP route, after all small-scale adjustments are resolved, should be reviewed and verified by an independent auditor prior to the initiation of construction activities.
Management plans	Management plans should be reviewed and approved by independent auditors representing stakeholders before the field work begins.
Revegetation of ROW	Irrigation of seeds must be conducted as long as necessary to assure the seeds germinate and establish a self-sustaining grassland, and the natural drainage contours present prior to construction must be re-established prior to the application of seeds.
Pump station alternatives	There is no analysis in the ESIA of the cost-benefit of eliminating the second pump station by utilizing a larger pipe diameter. A summary of this alternative should be included in the ESIA.

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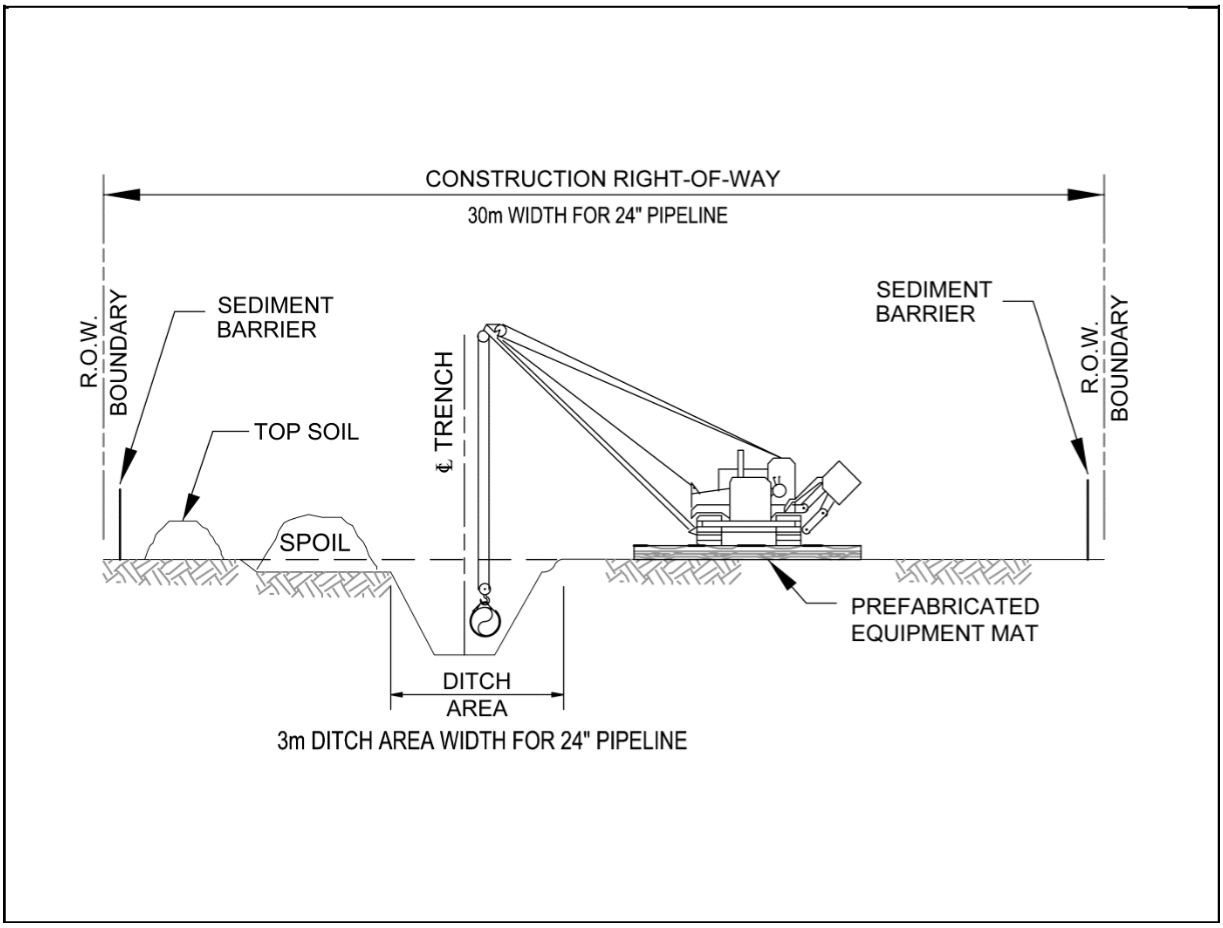

Figure 2.4-14 Crossing of Seasonal Wetland

Major Road and Railroad Crossings

Auger boring requires the excavation of access pits on either side of a crossing so that boring equipment can be lowered to the depth of the bore. Figure 2.4-15 is a photo of an auger bore. The auger will bore horizontally under the crossing emerging in the access pit on the other side.

ATTACHMENT B

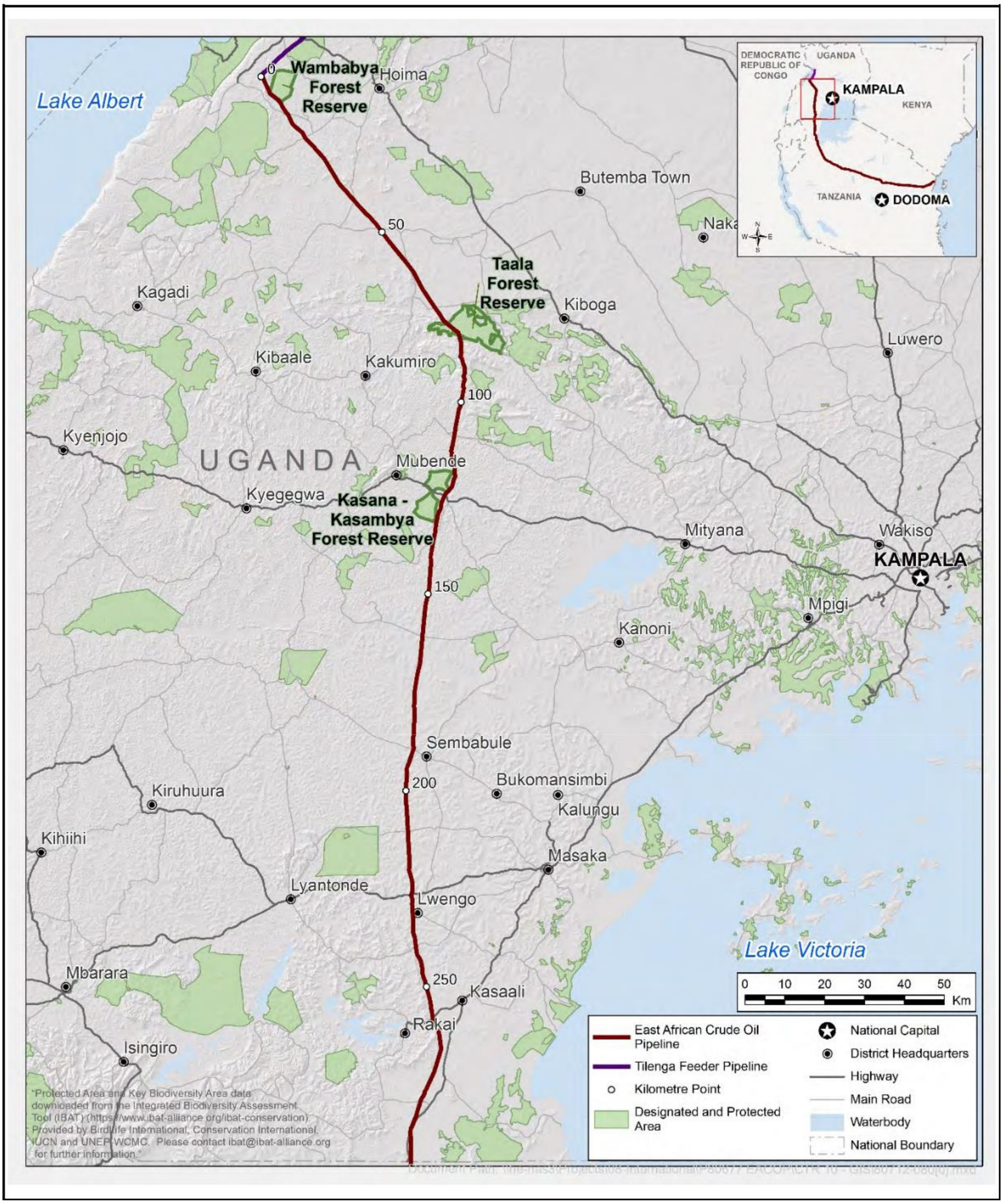

Figure 6.4-1 Protected Areas in the Area of Influence

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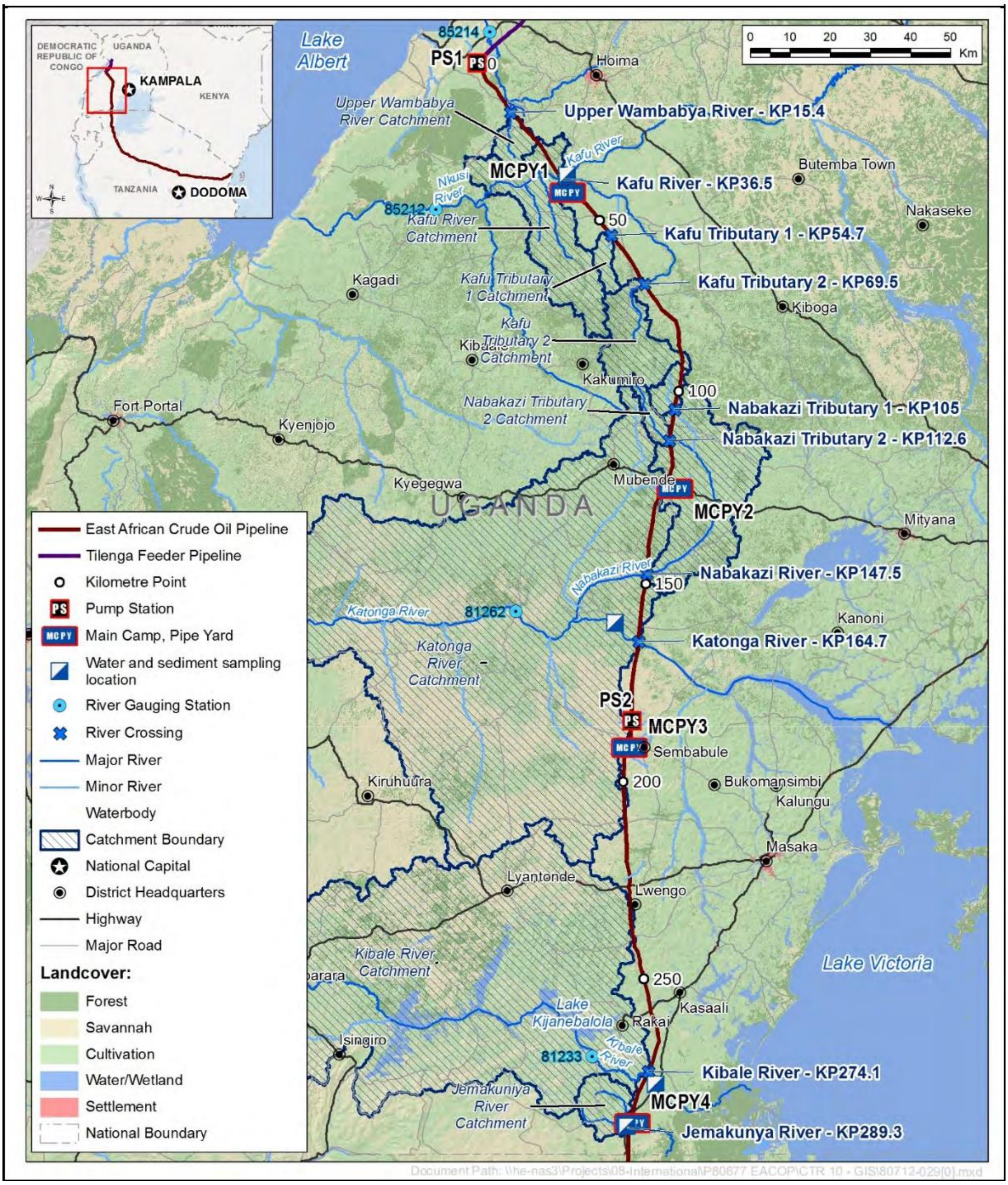

Figure 6.4-7 Main Watercourse Crossings and Catchments

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Table 6.4-18 Main Pipeline Crossings - River Channel Morphology and Stability

Watercourse	KP	Stream Power (W/m) [1]	Estimated Floodplain Width (m)	Channel Bankfull Width (m)	Channel Planform[2]	Channel Bed Materials	Channel Bank Materials	Riparian Vegetation	Stable or Unstable Channel
Upper Wambabya	15.4	521	180	ND	Sinuous (floodplain)	Sand, silt	Sand, silt	Swamp vegetation	Stable
Kafu	36.5	85	500	ND	Sinuous (floodplain)	Sand, silt	Sand, silt	Swamp vegetation	Stable
Kafu tributary 1	54.7	7	100	ND	Straight (floodplain)	Sand, silt	Sand, silt	Swamp vegetation	Stable
Kafu tributary tributary2	69.5	276	100	ND	Straight (floodplain)	Sand, silt	Sand, silt	Swamp vegetation	Stable
Nabakazi tributary tributary1	105	125	250	ND	Straight (floodplain)	Sand, silt	Sand, silt	Swamp vegetation	Stable
Nabakazi tributary tributary2	112.6	45	100	ND	Straight (floodplain)	Sand, silt	Sand, silt	Swamp vegetation	Stable
Nabakazi	147.5	32	300	ND	Sinuous (floodplain)	Sand, silt	Sand, silt	Swamp vegetation	Stable
Katonga	164.7	56	200	ND	Straight (floodplain)	Sand, silt	Sand, silt	Swamp vegetation	Stable
Kibale	274.1	187	30	15	Sinuous (floodplain)	Silt, clay	Silt, clay	Riparian vegetation	Stable
Jemakunya	289.3	64	400	4	Meandering	Silt, clay	Silt, clay	Riparian vegetation	Potentially unstable

NOTES: [1]Stream power is calculated at the mean annual flood (see Appendix A6, Attachment A6.4). ND – no data

Table 1. Emissions, Effluent and Waste Levels from Onshore Oil and Gas Development

Parameter	Guideline Value
Drilling fluids and cuttings	Treatment and disposal as per guidance in Section 1.1 of this document.
Produced sand	Treatment and disposal as per guidance in Section 1.1 of this document.
Produced water	Treatment and disposal as per guidance in Section 1.1 of this document. For discharge to surface waters or to land: ○ Total hydrocarbon content: 10 mg/L ○ pH: 6 - 9 ○ BOD: 25 mg/L ○ COD: 125 mg/L ○ TSS: 35 mg/L ○ Phenols: 0.5 mg/L ○ Sulfides: 1 mg/L ○ Heavy metals (total)[a]: 5 mg/L ○ Chlorides: 600 mg/l (average), 1200 mg/L (maximum)
Hydrotest water	Treatment and disposal as per guidance in section 1.1 of this document. For discharge to surface waters or to land, see parameters for produced water in this table.
Completion and well work-over fluids	Treatment and disposal as per guidance in Section 1.1 of this document. For discharge to surface waters or to land: : ○ Total hydrocarbon content: 10 mg/L. ○ pH: 6 – 9
Stormwater drainage	Stormwater runoff should be treated through an oil/water separation system able to achieve oil & grease concentration of 10 mg/L.
Cooling water	The effluent should result in a temperature increase of no more than 3° C at edge of the zone where initial mixing and dilution take place. Where the zone is not defined, use 100 m from point of discharge.
Sewage	Treatment as per guidance in the General EHS Guidelines, including discharge requirements.
Air Emissions	Treatment as per guidance in Section 1.1 of this document. Emission concentrations as per General EHS Guidelines, and: ○ H_2S: 5 mg/Nm^3

Notes:
[a] Heavy metals include: Arsenic, cadmium, chromium, copper, lead, mercury, nickel, silver, vanadium, and zinc.

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OXFAM

For more information, please contact

OXFAM Plot No.3459, Tank Hill Road, Muyenga.
P.O Box 6228, Kampala, Uganda
Tel: +256 414 390500
Fax: +256 414 510242
E-mail:KampalaOffice@oxfam.org

https://uganda.oxfam.org