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Policy Change: From Borrow Pits to Water Pans in Kenya's Arid and Semi-Arid Lands

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Abstract

Arid and semi-arid lands (ASALs) are characterized by unfavourable rainfall distribution with frequent drought and flood events. In Kenya, these are coupled with unsustainable water management practices leading to water scarcity. These challenges are rooted in the existing policies, which do not encourage taking advantage of available opportunities to harness water resources in ASALs. For example, Kenya's policy on managing borrow pits after a road construction dictates that the road contractor must return the borrow pits to their original state. This study explored the alternative use of turning borrow pits into water pans for improved water resources management in ASALs. Borrow pits that can be transformed into water pans along Rumuruti-Maralal Road were mapped. The study used secondary data sources, Cook's methods for surface water determination, personal observations, focus group discussions, ArcGIS, and key informants' interviews. This information was analysed using frequencies, cross-tabulation, descriptive ratio statistics, and volumetric computation of collectible waters in the borrow pits. Results show that there is potential for turning borrow pits into water pans. For instance, the 14 borrow pits mapped have the potential to hold 1,237,157 cubic meters of water. Out of the 14 borrow pits, 10 had a total of 110,156.5 cubic meters of water during the study period between February 2019 and April 2020. At this time, 81 percent of the residents along the Rumuruti-Maralal Road were using the borrow pit water for domestic purposes, watering their animals, and a few had attempted irrigating small plots of horticultural crops. Therefore, there is a need for a policy change to guide infrastructure development, especially roads, to turn borrow pits into water pans, where possible, instead of filling them up back to their original state, as the current policy dictates.

Keywords: Arid and semi-arid lands (ASALs), borrow pits, policy change, road construction, water pans

Introduction

Water is one of the most important commodities that determine the quality of life of people and their ecosystems. According to UNESCO (2023), 3.6 billion people (46%) and 2 billion people (26%) worldwide do not have access to properly maintained sanitation facilities or clean drinking water. Water scarcity affects two to three billion people annually for at least one month, which puts their livelihoods, particularly those related to food security and access to electricity, in serious danger. According to projections, the number of urban people facing water scarcity worldwide is expected to quadruple by 2050, from 930 million in 2016 to 1.7–2.4 billion. These locations' limited water resources have serious socioeconomic and environmental ramifications.

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In Kenya, environmental management responsibility is assigned to the National Environmental Management Authority (NEMA) through the Environmental Management and Coordination Act (GoK, 1999). This Act and accompanying regulations have given NEMA powers to issue a restoration order for a destroyed or tampered environment whereby the environment should be restored as near as it may be to the state in which it was before the implementation of a project, action, or activity. In addition, the Kenya Roads Act, 2017, 48 (9) states that '… any pit or quarry made, be filled up or, fenced, at the expense of the road authority, when the road authority abandons such pit or quarry GoK (2017, p. 39). For the country to use borrow pits as water pans, these requirements need to be revised to allow the turning of such facilities into water storage amenities.

Kenya is a water-scarce country with about 80 percent of its land mass classified as Arid and semi-arid lands (ASALs). Though climate change affects water sources, the country has an average annual runoff of about 20 billion cubic meters (National Disaster Management Authority, 2022). The Kenyan government wishes to harvest and store this for various uses. In this endeavour, the country has developed The National Water Master Plan 2030, which proposes to construct about 17,860 small dams and water pans. To contribute to this proposition, the study explored the option of converting selected borrow pits under construction along the Rumuruti-Maralal road into water pans as a pilot project to inform future road construction in the country. One of the challenges in this effort is the environmental policy guiding road contractors on what to do with borrow pits. They are required to return them to their original state.

The study findings proposal is that those that can be turned into water pans and small dams be made so in order to ease the burden of water scarcity, provide sinks for floods, and sources of underground aquifer recharge that will contribute to the National Water Master Plan 2030. Such facilities could also be used to take care of road runoff. Preliminary findings suggest that a policy change from the conventional restoration of the abandoned pits into their original state to water pans or small dams can provide sustainable water sources for domestic use, small-scale irrigation, livestock, and wildlife needs (Steenbergen, 2017). Besides the policy change, it is also imperative to have a multi-sectoral approach to road construction plans, with water harvesting as one of the outputs of a road project. In this endeavour, the water agencies, road authorities, and National Environment Management Authority must work together for the proposed policy change.

Approximately 89 percent of the land mass in Kenya, classified as ASALs (Government of Kenya, 2004), includes Northern and Eastern regions, which support up to 20 percent of the country's population (Ngigi, 2003). These regions are characterized by water scarcity in terms of both quality and quantity (GoK, 2005). This water limitation can be attributed to low and erratic rainfall, typically ranging from 250-750 mm per annum, high temperatures resulting in high evaporation rates, and poor water harvesting and management strategies (Ngigi et al., 2005).

The Kenya Government's national policy (2005) for the sustainable development of ASALs recognizes that ASALs have the potential to spur economic development if the scarce resources are utilized maximally. Therefore, the government and other international and local development agencies have initiated infrastructural projects, such as the construction of roads, to open up and promote development in the ASALs. However, road construction and improvement often have positive and negative impacts (Shisiali, 2017). Some of the negative impacts include vegetation clearing, landscape alteration, and ecosystem disruptions (Duan et al., 2008). Rapid and fast road construction and rehabilitation across Kenya has increased demand for stones, murram, and limestone, among other raw materials. These have led to increased quarry and borrow pits that have the potential to become sustainable water storage facilities (Shisiali, 2017). Depending on

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the contractor's commitment, these borrow pits are often abandoned or rehabilitated to their original state. These pits and quarries can be turned into water storage facilities, but policy changes may be needed to guide road contractors in turning borrow pits into water pans.

The Kenya National Highways Authority (KeNHA) has explored the option of converting borrow pits into water pans at the request of communities where roads are being constructed. The best example is the Modogashe-Samatar-Wajir Road project. The project area is generally water-scarce, with acute water shortages experienced during the dry season. The road project cuts across three counties whose water sources are as indicated in Table 1.

Table 1: Garissa, Isiolo, Wajir County Common Water Sources in numbers

Sources	Garissa	Isiolo	Wajir
Shallow wells	25	17	1100
Boreholes	65	58	178
Water pans	177	-	230

Source: KNBS County Abstract, 2014
(copied from Modogashe–Samatar Road Final Environmental and Social Impact Assessment Report-NETIP 2019)

The Environmental Social Impact Assessment report for Modogashe-Samatar-Wajir Road advocates restoring its original state or converting borrowed pits to water pans. However, during citizen participation, communities requested that the borrowed pits be turned into water storage facilities where possible. KENHA requested the contractor do so as a pilot to see if this would be helpful. This study proposes that the same be piloted on the Rumuruti-Maralal road in both Laikipia and Samburu counties.

Study Methods

A combination of several research methods and data analysis were used in this study. These included a purposive sampling of the general population, where a standard questionnaire was administered. This was coupled with a checklist to guide purposely selected key informants for discussions. In addition, the study also used Cook’s methods (one of the approaches used to estimate the maximum or peak runoff rate of a particular 87 watershed) of surface runoff computations, GPS positioning, and mapping of studied borrow pits. Finally, volumetric calculations of the identified borrow pits with water collection potentials in the study area were done.

Personal observation of borrow pits’ presence on either side of the road was done. The sampled pits were designed to collect surface runoff from the roads or were situated on the lower side of the road. In addition, catchment characteristics of area vegetation, soil type, drainage, and land slope were considered. Three hundred and ninety-two questionnaires (392) were targeted for administering with room for eight (8) spoilt or unfilled to various water users. While administering the questionnaire, it was ensured that fourteen (14) were filled by females while the other fourteen (14) were filled by males in all the fourteen (14) borrow pits. This was purposively done to ensure uniformity and representation of gender roles by the community members.

Key informants’ interviews were conducted with various government and county officials in the roads and water sectors. Individual interviews were carried out using structured questionnaires with both men and women community members found in the active borrow pits fetching water or

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having brought livestock for water. Participant observation was used to observe how the borrow pits were being used by the community members.

Study Site

The study was carried out in Laikipia and Samburu Counties. The selected project site was Rumuruti-Maralal Road, which is under construction at a bitumen standard. The assumption is that surface runoff water from the road surface could be collected in the excavated borrow pits, thereby converting them into water pans. If it rains, the pits collect and store water.

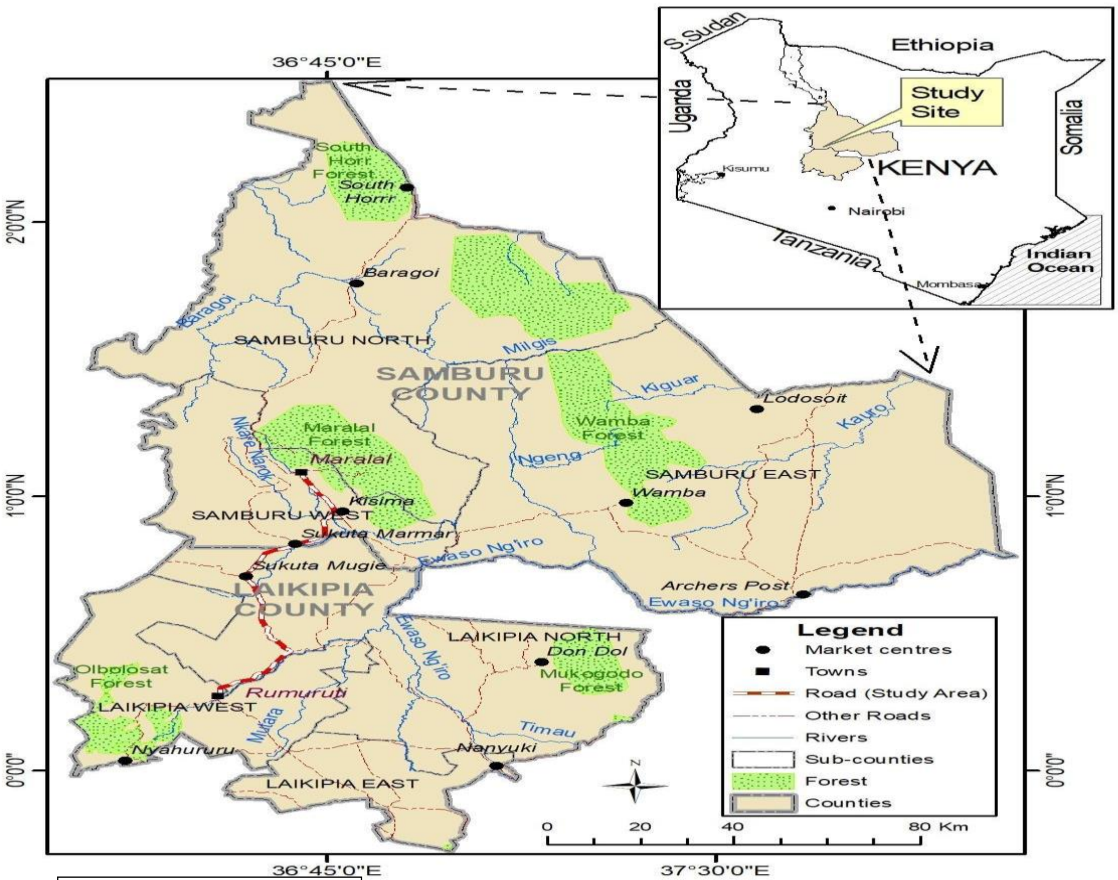

Figure 1: The Study Site

Note: Data was collected from Rumuruti to Suguta-Mugie because the road section from Suguta Mugie to Maralal had barely started.

Results and Discussion

The study mapped 14 active borrow pits. Ten had water when the researchers conducted the study in 2019-2020. Four of them had no water at the time; however, they had the potential to hold water, as indicated in Figure 2.

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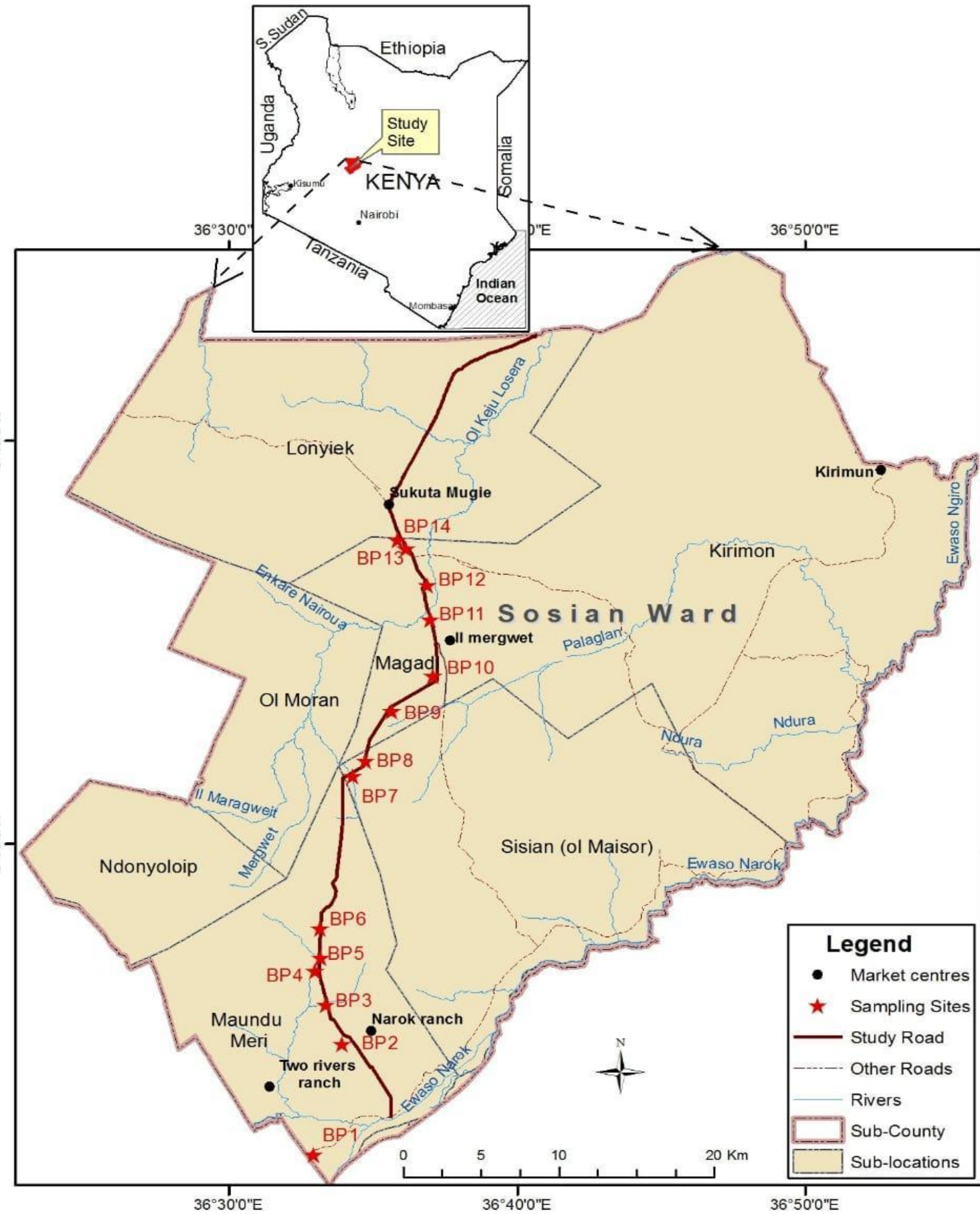

Figure 2. Mapped Borrow Pits

The respective borrow pits had the following water capacity, as seen in Table 2.

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Table 2: Geographical Locations, Capacities, and Status of Mapped Borrow Pits

Borrow pits	Volume Capacity	Status as at the time of the study (2019-2021)
BP1 (0.3003969N,36.5462261E)	375m^3	Has water
BP2 (0.3078083N,36.5484598E)	2,000m^3	Has water
BP3 (0.3756709N,36.5654028E)	90,000m^3	It has water. Villagers use one side of the pan for drinking and washing and the other for watering animals.
BP4 (0.4290489N,36.553461E)	785.5m^3	It has little water, which can dry at any time.
BP5 (0.4471866N,36.5529369E)	1,250m^3	Has water
BP6 (0.5418621N,36.571848E)	2,000m^3	Has water
BP7 (0.5512098N,36.5793447E)	1,800m^3	Has water used for irrigation purposes in a private farm
BP8 (0.582036N,36.5942493E)	3,846.5m^3	Has water
BP9 (0.601699N,36.6150071E)	375,000m^3	No water
BP10 (0.6038317N,36.6182953E)	7,500m^3	Has water
BP11 (0.6389149N,36.6165416E)	4,000m^3	It does not currently have water; however, it can collect water from the upper catchment as it is along the flood drain.
BP12 (0.6601699N,36.6150071E)	600m^3	Has water. Sits along the culvert storm drain
BP13(0.6828585N,36.602401E)	28,000m^3	It has no water; however, with storm drain training, water can collect inside.
BP14(0.6880811N,36.5976149E)	720,000m^3	It has no water; however, with storm drain training, water can collect inside.

The collectible water in borrow pits BP3, BP5, BP6, and BP8 have made the pastoral Samburu community sedentary around them year-round due to water availability. This supports the policy changes for borrow pits to be turned into water pans, which seems a welcome idea by all the research teams contacted across the study area.

The majority of stakeholders contacted, such as Focus Group Discussion (FGD), road resident engineer, County Commissioner Laikipia, Water Resource Authority (WRA) representative from Rumuruti, and regional KWS officer, all agreed that road construction could contribute to the provision of water and sustainable rural transformation in Africa. The resident engineer advocated for the siting of the borrow pit to be done with the rehabilitation procedure in mind to ensure maximum surface water is collected.

Although appreciating the good work of borrow pits, the county commissioner complained of increased water use conflicts between the pastoral communities migrating around the borrow pits with water year-round. The WRA representative appreciated the increased water availability potential from the borrow pits. She said the excess water could improve hygiene and kitchen garden irrigation. Finally, the KWS representative supported the establishment of borrow pits in

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private ranches, which he said could provide alternative water sources for wildlife away from humans and their livestock, thereby reducing human-wildlife conflicts.

Overall, the findings may, therefore, be used to direct changes in policy about the rehabilitation of borrow pits excavated during road construction. What is required is a few pilot projects like Modogashe-Samatar *Road* backed by sound scientific studies as has been done with Rumuruti-Maralal Road to generate scientific data to support a national policy change that will contribute to new ways of using road construction for water solutions in the ASALs.

Below are a few photographs showing active borrow pits still mined for road construction materials from which communities are sourcing domestic water needs.

Plate 1: A dog drinking from one of the active borrow pits on Rumuruti-Malaral Road.

Plate 2: A local woman drawing water from one of the potential borrow pits. Looking on is one of the researchers.

Plate 3: Women fetching water from one of the active borrow pits as goats and sheep are driven to the same pit for watering.

Plate 4: A herdsman watering animals at one of the active borrow pits.

Alternative water sources can revitalize the economic potential of the ASALS in Kenya. Water collection in the borrow pits along roads provides alternative water sources, changing local land use habits. Herders were invading road construction areas due to water availability from active borrow pits as they provided alternative water sources. This indicates that reverting them to their original state after the road construction will not benefit the community that is already using the pits in their raw form when the contractor still collects building materials from them. Though

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the discussion here focuses on borrow pits as an aspect of policy change, we are aware of the Green Roads initiative being advocated as a holistic approach to road construction. However, the borrow pit policy change can be a good place to begin regarding the Kenyan situation. This is because all the 14 mapped borrow pits could be potential water pans with a holding capacity of 1,237,157 cubic meters.

By the time of data collection in 2019-2020, ten of the 14 borrow pits were holding an estimated 110,156.5 cubic meters of water. Given that the population is using the borrow pits as they are now, many benefits can be gained if they are rehabilitated to water pan standards. The proposal to turn borrow pits into water pans is modest because there is always a budgetary provision for rehabilitation work in the Environmental Social Impact Assessment (ESIA) for projects of these magnitudes. The only additional costs envisaged could include securing the land where the borrow pits are located permanently as public land by the county government and the process of doing so.

In ASAL areas, it is more beneficial that a contract converts the viable borrow pits into sustainable water pans for the communities and the wildlife as was proposed in Modogashe–Samatar Road. This policy change contributes to the government's commitment to providing sustainable water to all communities, including those in ASAL areas. This will also contribute to the National Water Strategy 2030, article 43 of the Kenyan constitution (2010), and SDG 6 on providing clean water and sanitation to all by 2030.

Proposed Policy Changes

Table 3 gives an overview of current policy statements by different government agencies and institutions that this paper sought to review. The proposed reviews will draw more benefits from informed rehabilitation measures, which will provide the desired road networks and water, which is sometimes scarce in the ASALs.

Table 3: Current Policy Statements and Proposed Changes

Institution	Current Policy Statement	Proposed Policy Change
NEMA-EMCA 1999 (Revised 2015) Section 108. Issue of Environmental Restoration Orders.	An environmental restoration order shall be issued to— (a) require the person on whom it is served to restore the environment as near as it may be to the state in which it was before taking the action which is the subject of the order…	In the case of borrow pits and quarries, an environmental restoration order be issued to— (a) require the person on whom it is served to identify suitable alternative land uses for the disused pits, e.g. …exploitation of the pits as water reservoirs.
KENHA 2017 Kenya Roads Act, 2017, 48 (9) *pg. 39.*	… any pit or quarry made, be filled up or fenced, at the expense of the road authority, when the road authority abandons such pit or quarry.	Any pit or quarry made must be assessed for its potential to be a water storage facility, and those found viable must be improved to state-of-the-art water pans or dams by the road authority or its contractors.

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KENHA-ESS 2019: 3.1.5 pg.	Policy	Immediately after the extraction of materials, all borrow pits and quarries shall be backfilled to the satisfaction of the Engineer. Borrow pits near the project road shall be backfilled so that no water collects.	Immediately after materials are extracted, all borrow pits and quarries shall be reviewed to determine which can be improved as water pans/small dams for various uses. These could include storage for road runoff and recharge of underground aquiver, domestic use, small-scale irrigation, livestock, and wildlife watering points, especially in Arid and Semi-Arid areas.

Conclusion

The National Environment Management Authority 2011 published the Integrated National Land Use Guidelines for Sustained Societal Attributes – Infrastructure, Environmental Resources, and Public Safety. In this document, NEMA states that:

> The after-use plan should identify suitable alternative land uses for the disused pits e.g. …**exploitation of the pits as water reservoir…** among others**.** Phasing or "blocking" of the quarry site for progressive quarrying operations and therefore progressive restoration and/or reclamation should be practiced' (NEMA, 2011, p. 26).

This 'exploitation of pits as water reservoirs' should be taken up to the policy level and the regulations because road construction often changes the hydrology and runoff patterns, causing negative effects… on farmlands, infrastructures, and the environment. In many cases, roads cause flooding and water logging along the way, whereas the more concentrated runoff from roadside drains, culverts, and bridges leads to land degradation and sedimentation. This negative effect can be turned around by using roads as instruments for water harvesting (Green Roads for Water, 2016, pg. 1).

Policy Recommendations

1. EMCA and KENHA restoration orders to provide for alternative land uses of borrow pits and quarries for water storage and management options.
2. Implement road water harvesting as a requirement in road engineering processes, especially on roads in Arid and Semi-Arid Areas.
3. Coordinate road, water, environment, and agriculture agencies in the road designs and construction.
4. Guide road engineering to water harvesting from roads instead of road engineering concentrating on evacuating water from the roads.

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