

**APPLICATION OF GEOSPATIAL TECHNIQUES IN SITE SELECTION FOR  
COMMUNITY SMALL EARTH DAMS IN OL KEJUADO RIVER BASIN, KAJIADO  
COUNTY, KENYA**

**KARANJA FRANCIS M.**

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Applied Sciences of Kenyatta University**

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**DECLARATION**

I declare that this thesis is my original work and has not been presented for award of degree to any other University/Institution for consideration of any certificate.



Signature

**Karanja Francis M.**

Department of Geography

20/5/2023

Date:

**Supervisors**

We confirm that the work reported in this thesis was carried out by the candidate under our supervision.



Signature:

**Dr. Mary Makokha**

Department of Geography

Kenyatta University

5/6/2023

Date:



Signature:

**Dr. Kennedy Obiero**

Department of Geography

Kenyatta University

35/5/23

Date:

## ABSTRACT

Over-exploitation of groundwater in Arid and Semi-Arid (ASAL) Counties of Kenya has been related to poverty where the communities undergo routine social and environmental pressure which cascade with sharing of water points. Though Kajiado County has exploited groundwater more than any other water resource, residents travel on average 5.8km to fetch domestic water. Kajiado Town which adds up as the County Headquarters is located close to a large but seasonal Ol Kejuado River but is served by a number of boreholes which are expensive to operate. In identifying alternative water sources that could serve larger communities and more economically, making concrete decisions come with various challenges which consume both time and finances. This study was conducted in Ol Kejuado River Basin which was delineated from a Digital Elevation Model, upstream of the confluence of Rivers Ol Kejuado and Selengai close to Lengesim Market at coordinates 37<sup>o</sup>, 17' 43.96'' E; -2<sup>o</sup> 26' 15.15''S using ArcGIS 10.8.1. The study area occupies an area of 2,651 square kilometres and had an estimated population of 125,511 excluding Kajiado Town which has an urban population. The study addressed the following specific objectives: (i) To establish the existing community water resources; (ii) To determine the community management set-up of the existing water resources; (iii) To identify the criteria for suitable site location of community small earth dams; (iv) To map out potential sites for locating community small earth dams, all in Ol Kejuado River Basin. To address specific Objectives (i) and (ii), the study adopted both qualitative and quantitative methodologies. Methods of data collection included questionnaires, key informant interviews, direct observation and the application of Google Earth. The study engaged 63 respondents from the community members and key informant persons. The respondents' turnout was rated as acceptable. From the 64 water resources enumerated, 38 were water pans, 24 boreholes, one rock catchment and one protected spring. Except for the boreholes which turned out to be the most expensive to manage, all the other water resources were seasonal and unreliable. A much cheaper and more reliable source of water was required. The water resources were managed by elected community leaders who were rated by 90% of the respondents as either good or very good. They were recommended as capable of managing larger water projects if they were initiated. To address specific objective (iii) and (iv), geospatial techniques were applied. For Objective (iii) a desk review was conducted where eight variables were identified to create a criteria for analysis of suitable dam site location. These variables included stream order, precipitation, soil texture, normalized difference vegetation index (NDVI), topographic wetness index (TWI), ground slope, existing market centres and road network. Using ArcGIS 10.8.1, the variables were converted into thematic maps. Precipitation and soil texture thematic maps were not suitable for overlay due to their discriminative distribution but they met the minimum requirements for dam site selection. Geospatial techniques were found to be fast and economical in site selection for community small earth dams. To address specific objective (iv), the remaining six thematic maps created in specific objective (iii) were weighted and standardized such that in overlaying, where all the most suitable features of the six maps lay on the same point, the program would display them. After the maps were overlaid, fifteen potential small earth dam sites were enumerated. The sites distribution were capable of serving 75 per cent of the communities in the study area. Results from the Area-Volume-Elevation Curves analysis subjected to four dam sites revealed that all the sites had a much larger capacity at low embankment than the projected community water demand confirming their potentiality. It was thus recommended that the county government consider developing at least one of the identified sites.