www.ijarp.com ISSN 2456-9992 Page: 01-19

International Journal Advanced Research Publications

Research Article

Volume: 01
Issue: 03

MAP PRODUCTION OF LARGE-SCALE NIGERIA SHEET 9904 FOR SUSTAINABILITY

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Article Received: 19 November 2025, Article Revised: 09 December 2025, Published on: 29 December 2025

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DOI: https://doi-doi.org/101555/ijarp.2734

ABSTRACT

Maps have been used to portray information about the earth's surface Navigators, land surveyors, town planners, military, architects, etc., use maps to show spatial distribution of important geographic features. This study focuses on the production of large-scale Nigerian sheet N0 9904 map that employs the use of high-resolution satellite imagery data of the area. The objectives were to convert from imperial to system international, to re-project the coordinate system from NTM to UTM, to digitize the details features of the study area and to produce the digital large-scale map of the study area. Method entailed geo-referencing of the local map, satellite imagery classification of the features, and ground truthing data. Others were GPS facilitated points, administrative boundary of the study area, secondary data (OSGOF imagery, 2023), ArcGIS 10.7.1, Excel, AutoCAD, Franson Trans converter 2.3 for coordinate conversion, remote sensing and GIS were used to produce digital map sheet of the study area. Results showed that buildings (2.670%), land cover (96.87٪) and roads (0.46%) as seen in the map document and the study recommended that the map should be updated periodically to reflect changes in land use, infrastructure, and environmental conditions.

KEYWORDS: Map Production, Remote Sensing, Geographic Information System, GNSS, Physical Planning

1. INTRODUCTION

Maps have been used to portray information about the earth's surface Navigators, land surveyors, town planners, military architects, etc. use maps to show spatial distribution of important geographic features (Menno-jan & Ferjan, 2021). Besides, high and accelerating rate of urban changes and township area extensions, that leads to construction of new roads particularly in a developing country such as Nigeria, calls for an efficient and fast technique that will meet mapping standards and accuracy for mapping and regular updating of these changes.

Later in the nineteen century, aerial photographs were used to extract data for producing and revising maps. These methods proved to be time consuming and inefficient for large study areas and limited in the ability to conduct frequent updating and revision (Ndukwe, 2001). Fortunately, remote sensing, a fast means of acquiring data about the environment without physical contact with the features has made significant advances over the past twenty years in providing cost effective data for mapping.

The recent availability of high-resolution satellite imagery has led to increased interest in the use of satellite data for large scale mapping applications and detailed land use assessments (Amuyunzu & Bijl, 1999). This growing interest not only emanates from the fact that satellites provide a synoptic coverage, have a high repetitive cycle, and carry multispectral band sensors that provide information beyond the ordinary ability of the human eye, but also because they offer a cost- effective source of data that enables timely detection of changes to the land use and land cover, the monitoring and mapping of urban development, assessment of deforestation extents, evaluation of post fire vegetation recovery, the revision of topographic maps among numerous other environmental assessments.

Mapping involves carrying out observation for the natural and artificial features on the earth surface and representing them in form that is understandable to the end user either as a chart, map or plan. Aliyu (2013) observed that mapping involves various stages of production which includes: reconnaissance, field observation, office work and production of the final map. Reconnaissance involved going round the entire field project area to be map to know the nature of the terrain and the type of equipment to be used with proper reconnaissance, GPS receiver instrument was used. Field observation involves the actual distances and angular measurement, heights measurement depending on the types of instruments used. The instrument could be total station, smart station, theodolite, level instrument and global positioning system (GPS) receiver.

According to Karam and Ali (2021), digital mapping is the process by which a collection of data from a location is compiled and formatted into a virtual image. The primary function of this technology is to produce maps that give accurate representation of a particular area and detailing all features of interest that would be valuable to a user. However, as digital map has grown with expansion of GIS technology in the past decade, live traffic update, point of interest and service location have been added to enhance digital map to be more “user conscious”. Conventional mapping techniques in Africa are still pegged on the use of black and white aerial photographs and extensive fieldwork exercises. This method is both slow and cumbersome and is also very costly to the extent that continuous national mapping remains far beyond the realms of affordability for the countries. No wonder, most national maps in Africa are very old and out dated and thus unsuitable for planning and navigation purposes.

Given the diversity and heterogeneity of the natural and human- altered landscape, it is obvious that the time and laborious method of ground inventory is inappropriate for mapping over large areas. A more synoptic vantage point, such as provided by remote sensing is required for effective detection, identification, classification, delineation, and analysis of landscape features. Satellites equipped with high resolution sensors thus provide a platform for wide area mapping. This research entails the process of mapping Nigerian sheet number 9904 on a large-scale using Google earth satellite imagery so as to achieve a more rapid and cost-effective result.

1.2 Statement of the Problem

Research shows that the map sheet no 9904 is missing in the national coordinate system of Rivers State extraction, map plays a vital role economic and social development of a country. For the sake of Umusoya/konko in Oyigbo L.G.A., earth features such as building information system, contours and land management becomes a critical issue within the community, construction industry who are involved in drainage, housing and road become perplexed because of flooding due to inadequate housing planning and variative undulation of the road system. These gaps identified can be overcome by creating up-to-date map that will serve as a check and also to aid planners within the conferment of space in a given geographical region.

1.3 Aim of the study

The aim of this study is to produce a large-scale Nigerian sheet 9904 map of Umusoya/Konkon in Oyigbo and accurate representations of small geographical areas for effective planning and decision making.

1.4 Objective of the study

The objectives of the study are to.

1. convert the imperial measurement into system international
2. reproject the coordinate system from NTM (local) to UTM
3. digitize the details features in the study area
4. produce the digital large-scale map of the study area

2. **Literature Review**

Bello, Chigbu, and Agbaje (2017) studied large scale mapping an empirical comparison of pixel-based and object-based classifications of remotely sensed data for Aba city in southeastern Nigeria. The study compared two methods of classifying high-resolution satellite images such as pixel-based and object-based with the use of ENVI 4.8 and eCognition software for classification, and ArcGIS 10.1 for map composition. The results finally showed the true picture of the study area that comprised built up, bare land, thick vegetation, light vegetation, road and water body.

Jordi, Arthur, Marcela, Benjamin, David, and Isabel (2017) also operationalized High Resolution Land Cover Map Production at the Country Scale using Satellite Image and time Series in France. The paper aimed at presenting a scalable approach to land cover mapping using satellite image time series data. Different images were used for the study and supervised classification algorithm were followed to achieve the result. The study emphasized automation and accuracy in national-scale mapping, with applications in environmental monitoring and policy.

Obot (2005) examined map production in Nigerian Universities using topographic map series of Opobo (Sheet 335) and dye-line prints of Ikot Abasi. Hard map was scanned, digitized and geo-referenced, in addition to ground truth information such as rivers, coastlines, marsh, road, boundary lines, path, towns, and villages were incorporated to the study. Result revealed or exposed the cartographic state of the place. The study revealed poor cartographic standards and advocated for professional techniques such as proper scale selection, feature generalization, and layout design.

Oluwadare, Salimon, and Abidoye (2022) worked on Map revision of Obafemi Awolowo University, Ile-Ife, Osun State, Nigeria. The study focuses on updating the existing map of Obafemi Awolowo University using digital techniques which involved ground survey and remote sensing. Digitization and extraction of features and creation of database and analysis of spatial changes in the University using GIS tools. Further results showed significant changes in land use and infrastructural development.

3. **Methodology**

3.1 Introduction

This chapter presents the detailed methodology adopted for the production of a large-scale map of Umusoya/konko, Oyigbo Local Government Area of Rivers State. It outlines the procedures involved in data acquisition, georeferencing, digitization, spatial data processing and analysis, and final map design using ArcGIS techniques.

3.2 Hardware/ Software used

Laptop, printer, handheld GPS receiver

- ArcGIS 10.7: Used for digitizing, spatial analysis, and map production.
- Excel: Used for tabular data formatting and percentage calculations

3.3 Data Acquisition

Data acquisition involved collecting all the spatial and non-spatial data required for the mapping process. The following data sources and instruments were used:

3.3.1 Primary Data

1. Ground control points (GCPs): These were obtained through field surveys using a Global Navigation Satellite System (GNSS) receiver. The GCPs served as reference coordinates for accurate georeferencing of the Google Earth imagery.
2. Field observation: Site verification survey was conducted to identify physical features such as roads, buildings, vegetation, and water bodies within the study area.

3.3.2 Secondary Data

High-resolution satellite imageries were gotten from the office of the Surveyor General of the Federation (OSGOF), which provides near-real-time global imagery sensor Franson coordinate trans 2.3 was used to Convert from Nigeria Traverse Mercator (feet) to Universal Transverse Mercator (meter).

3.3 Materials and Data Sources

Table 3.1: The materials and data used in this study.

Material and Source	Description/Purpose
OSGOF	Google Earth Engine (GEE): High-resolution imagery (0.3m) used as base data for mapping
Omitted Map sheet no 9904, Survey Department, Rivers State	Used as reference map sheet for large scale production
GPS Field Data	Field observation: Ground control points (GCPs) and ground truthing

3.4Data Preparation

3.4.1Coordinate Systems

The coordinate system of a dataset this used to define the positions of the mapped phenomena in space. It furthermore acts as a key to combine and integrate different datasets based on their location. This enables the performance of various integrated analytical operations, such as overlaying or merging data layers from different sources. The easting and Northings were used to project our coordinate system from geographical coordinate system to projected coordinate system. The projected coordinate system defined how the original curve surface model (spheroid) was pinned to the earth and geometrically project points from that curve surface onto a flat. A Projected Coordinate System (PCS) was based on a GCS that was transferred into a flat, two-dimensional surface.

3.4.2 Ortho-rectification

The satellite imagery captures; it isn’t always looking straight down. The sensor has an angle, the Earth’s surface has hills and valleys, and the planet itself curves away from view. These factors introduce distortions that shift objects away from their true ground position. Image data acquired by satellite are affected by a systematic sensor and platform-induced geometry errors, which introduce terrain distortions when the sensor is not pointing directly at the Nadir location of the sensor.

3.4.3 Georeferencing

The purpose of Georeferencing the satellite imageries is to assign real-world coordinates to satellite imagery, to ensure accurate alignment of imagery with field-acquired control points, to make the imagery suitable for digitization, measurement, and spatial analysis, to facilitate integration with other spatial datasets such as cadastral or topographic maps. The approach in georeferencing of the study depended on the input data and control information which include: Image-to-Map Georeferencing: This involves aligning an unreferenced image (e.g., Google Earth imagery) to a map or dataset that already has a known coordinate system (e.g., UTM shapefile or topographic map). It's the most common approach in GIS for mapping and analysis. The steps used in achieving the phase is as follow:

3.4.4 Step-by-step processing using ArcGIS 10.7.1

1. Create a folder/add raster image

Launch ArcGIS 10.7.1 → go to catalog and navigate to the saved folder in desktop project. In the Contents pane, right-click the Map → **Properties** → **Coordinate Systems** → set the map to your target CRS, e.g., UTM Zone 32N, WGS 84. **(**Coordinate Reference System) It defines how spatial data (like your maps, imagery, or GPS points) relate to real locations on the Earth's surface — essentially the **mathematical framework** that tells the computer: "Where exactly is this point, and in what units (meters, feet, and degrees) it is measured.

2. Add reference data

High-accuracy (resolution) basemap as Geo-tiff (already in the image CRS) was further added to the working environment. This layer aided the layer of the control points and later clicked to select the raster to enable Georeferenced tools and the raster layer in ArcGIS 10.7.1.

3 Add control points

Control Points tool were zoomed-in to the highest of visualization and clicked on the boundary intercession points on the reference layer (target), a pane showing X and Y would also pop up to add GCPs. Four **(4)** GCPs were added to study, the points from the curve surface onto a plane surface and saved as **rectified map** (tiff).

Rectification in georeferencing is correction of distortion which is geometrically represented as

$$RMSE = \sqrt{\frac{1}{n}\sum_{i=1}^{n}[(x_i - x_i^!)^2 + (y_i - y_i^!)^2]} \quad 3.1$$

n = Number of control points

$x_i y_i =$ Actual coordinates

$x_i^! y_i^! =$ Transformed coordinates

3.5 Data processing

On-screen digitizing was done by digitizing tablet. This method, the operator manually traced all the lines from his hard-copy map (e.g. Toposheet) using a pointer device. It took a lot of time, but also of high accuracy.

Step-by-Step Guide to Digitizing in ArcGIS 10.7.1

- Prepare the Workspace
- Open ArcGIS and load your base map or satellite imagery
- Ensure your data frame has the correct coordinate system

-. Create a New Shapefile or Feature Class

- Go to ArcCatalog or the Catalog window
- Right-click your folder, select New, select Shapefile
- Choose: Geometry type: Point or Polyline (for roads), Polygon (for building)
- Set the coordinate system (e.g., WGS 1984)

-. Add the Shapefile to ArcMap

- Drag the new shapefile into your map
- Right-click → Open Attribute Table → Add fields as needed (e.g., Road Type, Length)
- Start Editing
- Go to Editor Toolbar → Click Editor → Start Editing
- Select your shapefile in the construction layer
- Start Digitizing
- Use Create Features window to select your geometry type
- Use tools like:
- Line Tool for roads
- Polygon Tool for areas
- Point Tool for landmarks
- Click along the feature's shape to trace
- Double-click to finish each feature or right click and select finish sketch

-. Add Attribute Data

- After each feature is created, open the Attribute Table
- Fill in fields like Road Type, Name, and Length

-. Save and Stop Editing

- Click Editor → save Edits → then click Stop Editing

3.6 Data analysis

The analysis was conducted using ArcGIS 10.7.1 and Microsoft Excel, focusing on each feature with relevant fields such as: feature ID, feature name, type, length, coordinates and the confidence of the features digitized such as road, building and land covers were added to the table.

3.6.1 Cartographic design

Clarity, unity, colouring, contrast and order were done as a product of cartographic balancing before map documentation and legendary.

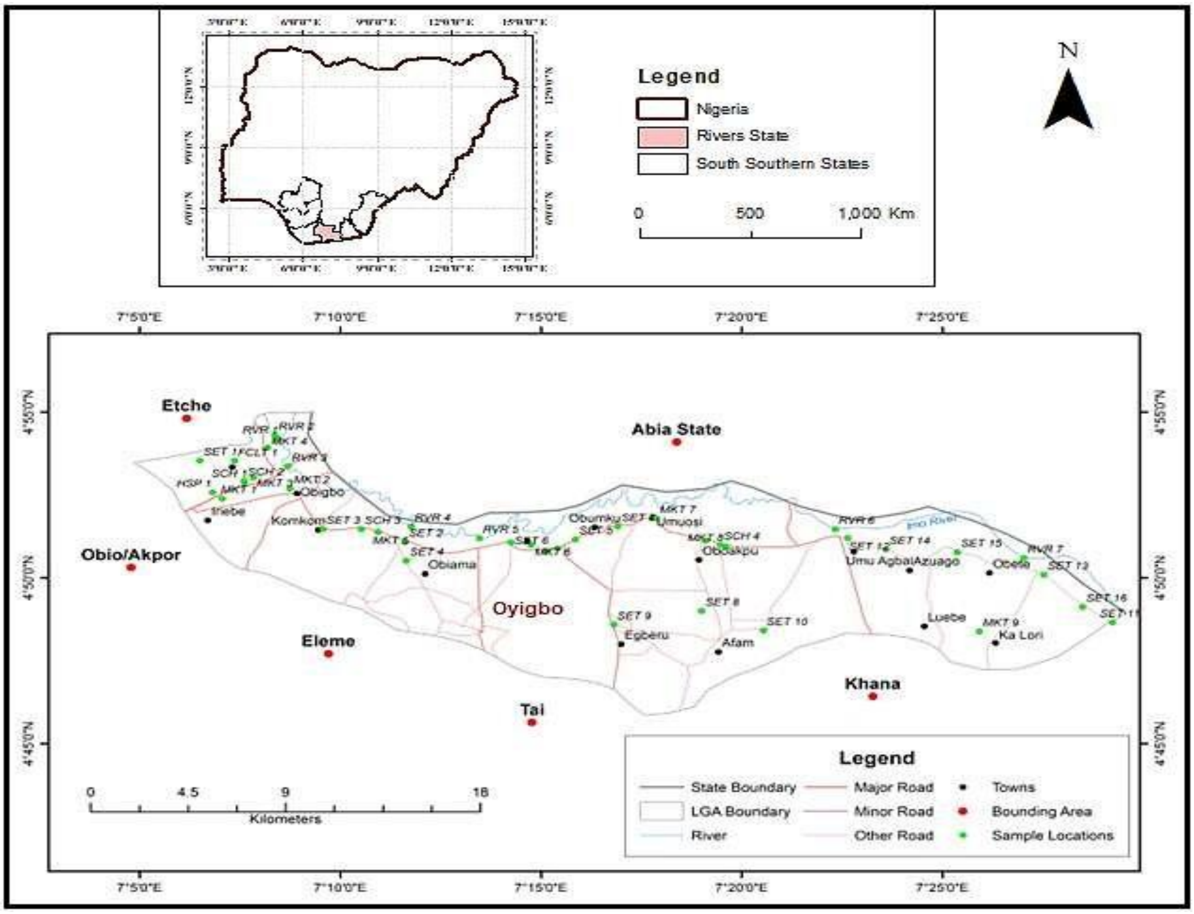
3.7 Study Area

The study area is Umusoya/Konko sheet number 9904 area of Port-Harcourt, Rivers State which covers a total of 8.95 square kilometers. Its position lies between Latitude 04°50’11.09“N to 04°51’30.34“N and Longitude 007°07’13.37“E to 007°09’12.26“E.

3.7.1 Geology and Topography

Umusoya/Konko, located in Port Harcourt, Rivers State, Nigeria, is situated in a region characterized by:

1. Alluvial Sedimentary Basin: The geology of Oyigbo, where Umusoya/Konko is located, is primarily composed of alluvial sedimentary basin and basement complex.
2. Lowland Region: The area is a lowland region with an average elevation below 30 meters.
3. Geological Features: The region's geology is influenced by its proximity to the Niger Delta, with characteristics such as dense mangroves, raffia palms, and moderate rainforest.
4. Elevation: Umusoya has an elevation of approximately 22 meters (72 feet) above sea level.
5. Location: The area is situated near the Otamiri River, which flows through the region and plays a crucial role in shaping the local environment.



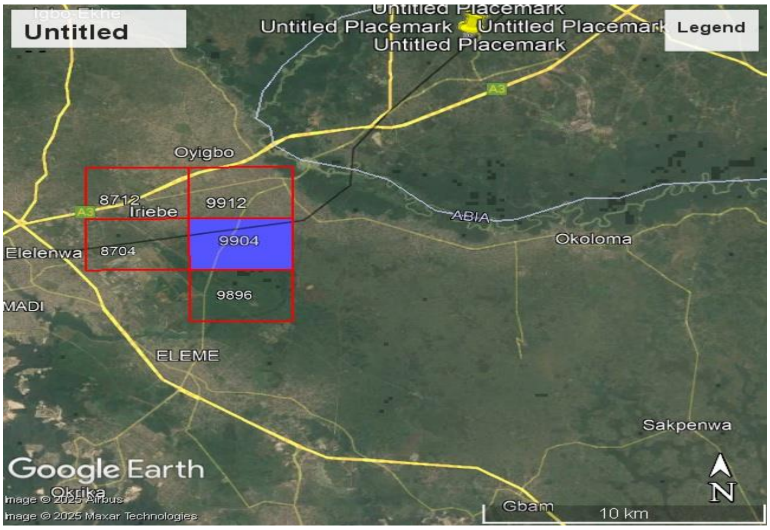


Figure 1: Map of the Study Area.

4. RESULTS AND DISCUSSION

4.1 Result for objective 1

1696000ft *0.3048 = 516940.8mN

3120000ft*0.3048 = 950976.00mE

1710000mE*0.3048 = 521208.00mN

304000mN*0.3048 = 92659.2mE

Using Franson coordinate Trans 2.3

291554.910mE, 537306.140mN

295212.510mE, 537306.140mN

295212.510mE, 534867.740mN

291554.910mE, 534867.740mN

4.2 Result for objective 2

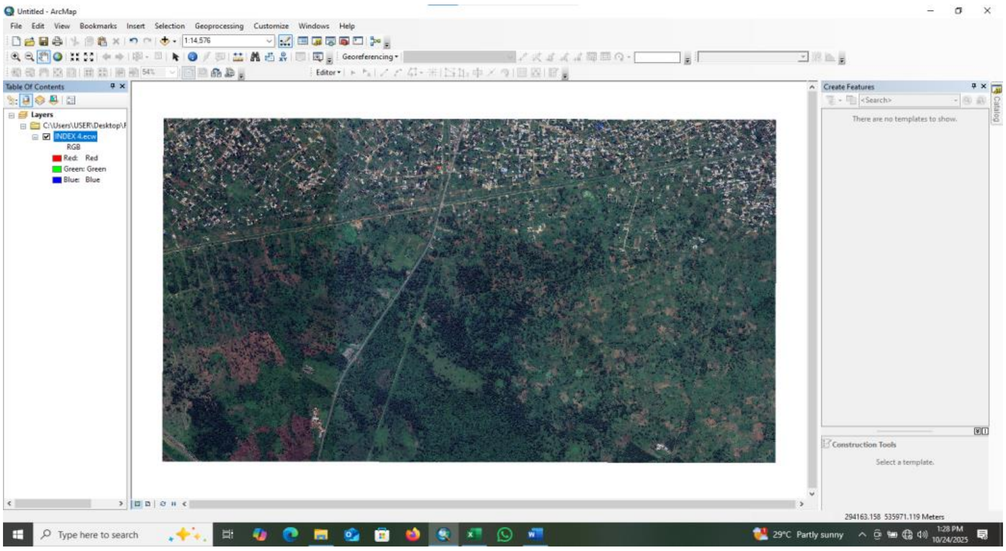


Figure 2: Base image of Umosoya/Konkon.

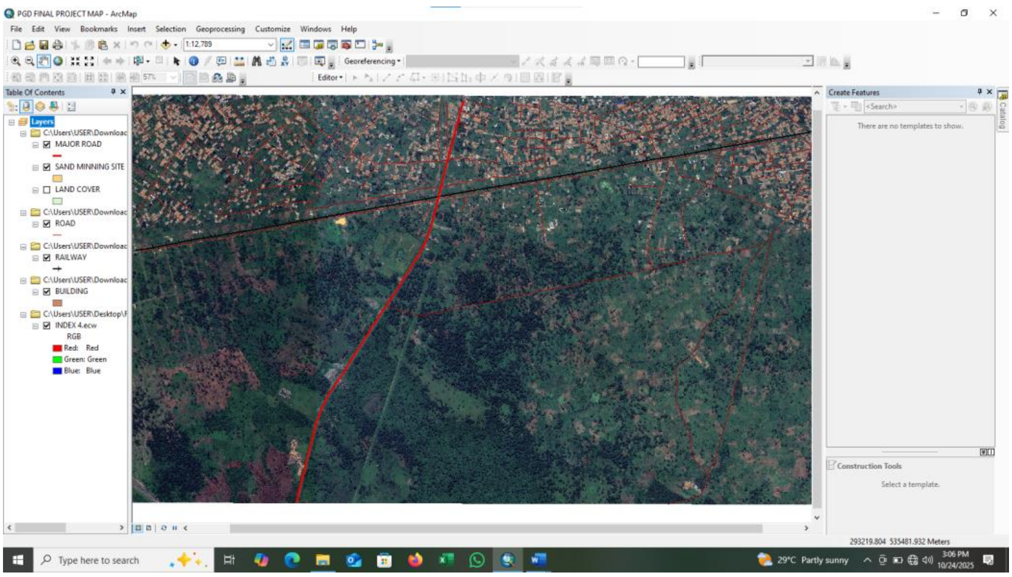


Figure 3: Digitizing features of part of Umosoya/Konkon.

4.3 Result for objective 3

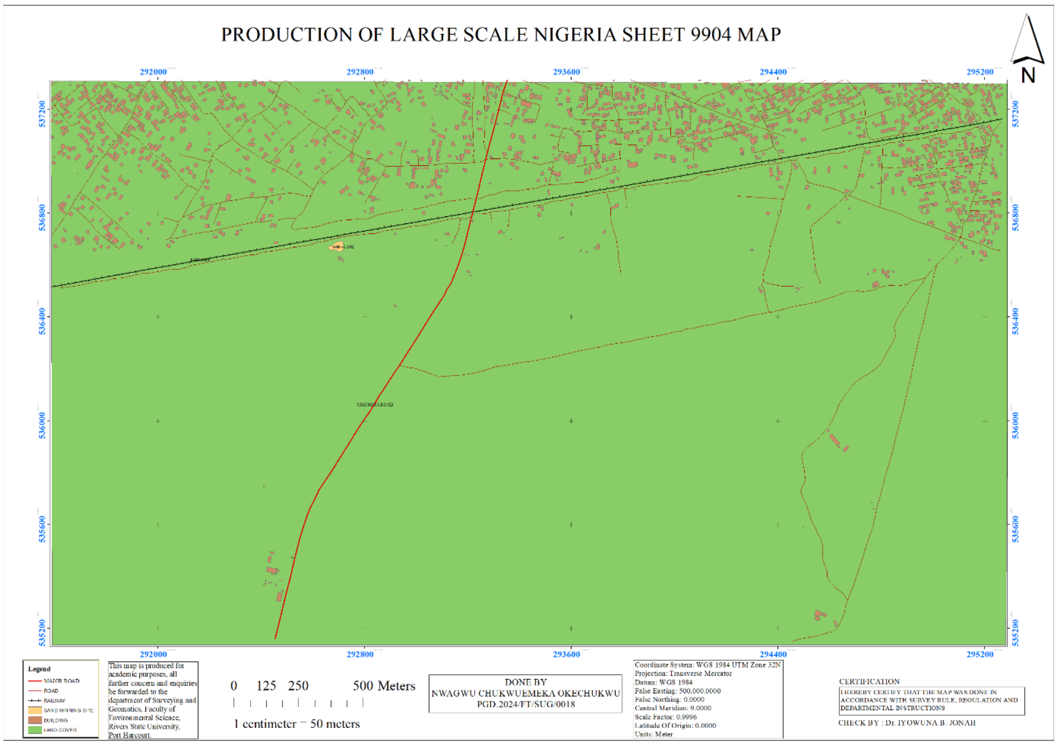


Figure 4: Classified Map of the Study Area.

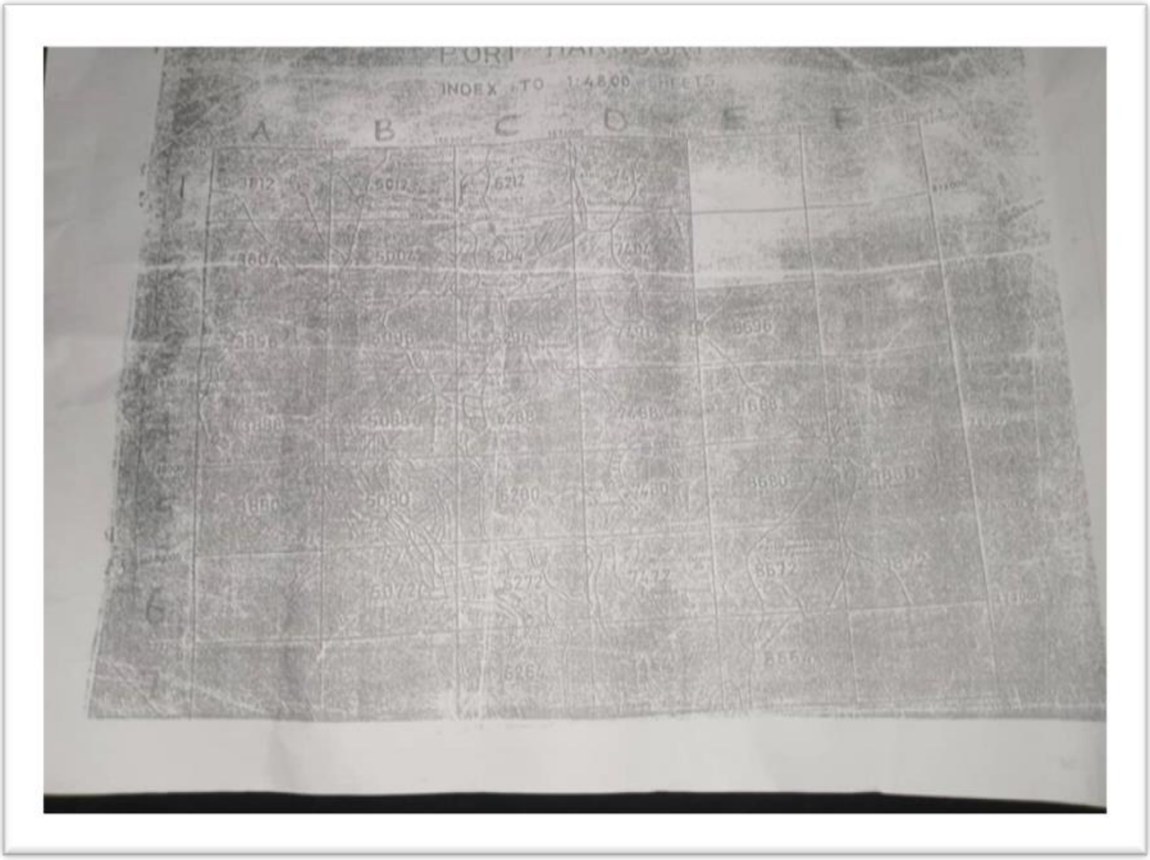


Figure 5: Comparison of Old Map Sheet No. 9904.

4.4 Result for objective 4

Table 4.1: Attribute Area Analysis

Feature Type	Total	Total Area (km^2)	Total Length (km)	Percentage (%)
Buildings	1897	0.2392402782 km^2		2.670%
Roads	71		2556km	0.46%
Land cover	1	8.670759 km^2		96.87%

Table 4.2: Attributes Information of Buildings.

37	1	93603	4.856742	7.144552	84.0019	0.8338	0	0
38	1	96121	4.855407	7.133314	184.9465	0.8465	0	0
39	1	97353	4.856455	7.128719	60.3645	0.7377	0	0
40	1	97821	4.853514	7.126522	184.9691	0.8645	0	0
41	1	99464	4.858341	7.152524	117.2526	0.8588	0	0
42	1	102363	4.855558	7.125724	189.5108	0.8156	0	0
43	1	103535	4.840985	7.128223	12.2673	0.6966	0	0
44	1	105858	4.851902	7.147321	10.5572	0.6873	0	0
45	1	105869	4.857984	7.137011	18.0028	0.7406	0	0
46	1	108731	4.855731	7.150867	162.7729	0.9204	0	0
47	1	111229	4.857937	7.133496	53.9624	0.8353	0	0
48	1	111725	4.85689	7.138807	28.6226	0.7549	0	0
49	1	113458	4.855381	7.131666	184.1101	0.9056	0	0
50	1	115904	4.858366	7.132249	50.8228	0.6987	0	0
51	1	121611	4.857294	7.124617	49.3941	0.8402	0	0
52	1	121948	4.858215	7.123987	7.7271	0.7023	0	0
53	1	122324	4.857067	7.127741	152.1218	0.9247	0	0
54	1	124492	4.85791	7.13617	11.0868	0.7711	0	0
55	1	125782	4.845745	7.14843	279.1853	0.9184	0	0
56	1	128182	4.856899	7.151032	16.4423	0.7147	0	0
57	1	129468	4.856604	7.141922	152.1918	0.9172	0	0
58	1	134295	4.855187	7.124567	87.835	0.8826	0	0
59	1	134944	4.854156	7.151003	123.8029	0.8967	0	0
60	1	135531	4.855617	7.136787	175.9129	0.9211	0	0
61	1	138660	4.857932	7.149765	78.6973	0.8952	0	0
62	1	140021	4.853754	7.126103	230.9973	0.9289	0	0
63	1	142470	4.856237	7.15151	126.4178	0.8845	0	0
64	1	142719	4.858291	7.152592	56.0535	0.8198	0	0
65	1	143588	4.856917	7.150429	12.1868	0.7698	0	0
66	1	143835	4.855967	7.153104	193.4069	0.8226	0	0
67	1	145734	4.858481	7.150432	289.9309	0.9266	0	0
68	1	147247	4.857935	7.138697	146.4405	0.9129	0	0
69	1	155291	4.858004	7.136209	60.7198	0.7559	0	0
70	1	156058	4.841108	7.128725	28.8794	0.756	0	0
71	1	156108	4.856542	7.144445	119.3933	0.9013	0	0
72	1	157783	4.856897	7.139851	152.4738	0.8915	0	0
73	1	161202	4.857836	7.150605	118.2197	0.8862	0	0
74	1	162250	4.85827	7.126026	61.9559	0.7853	0	0

75	1	163264	4.85851	7.136702	186.3677	0.9147	0	0
76	1	168275	4.857977	7.136126	36.3358	0.8541	0	0
77	1	170078	4.858467	7.14617	96.8108	0.8785	0	0
78	1	173450	4.858382	7.126636	155.5163	0.9112	0	0
79	1	175549	4.857326	7.150633	149.1486	0.9197	0	0
80	1	175799	4.852482	7.135129	24.0318	0.7454	0	0
81	1	177417	4.858369	7.12368	190.7523	0.9371	0	0
82	1	177592	4.855815	7.138603	133.2617	0.7119	0	0
83	1	179586	4.85617	7.124183	206.7524	0.895	0	0
84	1	180078	4.856921	7.14131	83.2018	0.7222	0	0
85	1	180585	4.854217	7.152509	116.351	0.859	0	0
86	1	186153	4.855832	7.139684	237.0241	0.9385	0	0
87	1	192150	4.857376	7.144697	170.6192	0.9128	0	0
88	1	193006	4.857974	7.130272	112.3131	0.8963	0	0
89	1	193756	4.858397	7.140194	60.4802	0.8757	0	0
90	1	195262	4.854155	7.14036	310.0125	0.9076	0	0
91	1	201203	4.85681	7.144813	91.0732	0.7128	0	0
92	1	204859	4.857394	7.147091	180.6278	0.9151	0	0
93	1	210802	4.853806	7.128341	188.6962	0.9125	0	0
94	1	212514	4.857493	7.14834	31.5525	0.7765	0	0
95	1	213150	4.857426	7.129521	43.681	0.7771	0	0
96	1	213474	4.857107	7.151464	41.097	0.8582	0	0
97	1	215178	4.855713	7.131567	13.4928	0.6864	0	0
98	1	215595	4.855019	7.151845	95.6126	0.9062	0	0
99	1	216995	4.855447	7.138065	115.0028	0.8865	0	0
100	1	218163	4.854465	7.122667	257.1363	0.849	0	0
101	1	218482	4.855401	7.153209	10.176	0.6639	0	0
102	1	219504	4.85726	7.145539	130.6378	0.864	0	0
103	1	227075	4.858378	7.150037	93.3768	0.8521	0	0
104	1	232349	4.855853	7.141778	69.7494	0.8772	0	0
105	1	233378	4.857554	7.14006	241.0452	0.9343	0	0
106	1	234276	4.858281	7.146449	43.6186	0.849	0	0
107	1	236708	4.857353	7.124704	151.2366	0.9303	0	0
108	1	238753	4.85585	7.145379	53.5944	0.6916	0	0
109	1	241382	4.853428	7.15321	201.2812	0.9457	0	0
110	1	243495	4.855696	7.139297	79.842	0.9088	0	0
111	1	244843	4.857537	7.144961	195.6866	0.8816	0	0
112	1	246072	4.857009	7.145895	108.686	0.9164	0	0
113	1	255325	4.857977	7.137427	237.201	0.9167	0	0
114	1	256460	4.853336	7.122974	149.8218	0.8172	0	0
115	1	257593	4.858168	7.137069	183.1954	0.8964	0	0
116	1	258980	4.857935	7.152562	9.0372	0.7075	0	0
117	1	260210	4.853282	7.153022	122.1694	0.928	0	0

118	1	262390	4.858517	7.14647	75.5767	0.8536	0	0
119	1	266102	4.857367	7.153381	78.9603	0.9024	0	0
120	1	268533	4.857122	7.131858	153.4217	0.7688	0	0
121	1	270260	4.84052	7.128674	523.2245	0.9506	0	0
122	1	270509	4.857623	7.132245	69.8957	0.8262	0	0
123	1	270513	4.857209	7.136999	7.9811	0.7267	0	0
124	1	272149	4.85692	7.153205	16.581	0.6704	0	0
125	1	278629	4.855455	7.12192	113.0579	0.8702	0	0
126	1	279140	4.857352	7.125268	199.136	0.9292	0	0
127	1	279358	4.85709	7.140905	125.4103	0.9286	0	0
128	1	280354	4.85268	7.123789	125.8351	0.9264	0	0
129	1	281016	4.858313	7.148739	89.9507	0.8828	0	0
130	1	281439	4.858437	7.142025	22.1026	0.6717	0	0
131	1	282544	4.855839	7.12739	67.3371	0.8496	0	0
132	1	285124	4.856162	7.145155	207.3251	0.8889	0	0
133	1	286843	4.857718	7.139694	53.7728	0.7065	0	0
134	1	291286	4.853785	7.128095	148.5802	0.94	0	0
135	1	291409	4.857689	7.143489	62.7862	0.8359	0	0
136	1	297340	4.853842	7.121356	194.0402	0.8499	0	0
137	1	302604	4.856469	7.141948	195.7323	0.8556	0	0
138	1	302764	4.856699	7.144191	196.0806	0.8465	0	0
139	1	305383	4.85682	7.149795	174.7463	0.9306	0	0
140	1	305509	4.854698	7.152266	144.417	0.9276	0	0
141	1	309950	4.857934	7.152047	53.218	0.8144	0	0
142	1	311120	4.856341	7.129926	315.3855	0.8961	0	0
143	1	311832	4.85412	7.121107	266.5943	0.9102	0	0
144	1	312392	4.857776	7.147281	128.0136	0.903	0	0
145	1	312428	4.857144	7.127136	117.4716	0.8182	0	0
146	1	315774	4.857804	7.123463	141.6335	0.9167	0	0
147	1	316086	4.85423	7.151407	19.7205	0.6611	0	0
148	1	317312	4.856378	7.122988	25.1234	0.7686	0	0
149	1	321259	4.856857	7.121767	182.5511	0.9069	0	0
150	1	327283	4.855137	7.131932	246.6464	0.9404	0	0
151	1	331263	4.855652	7.136707	79.4692	0.8913	0	0
152	1	332627	4.857471	7.121174	55.5146	0.888	0	0
153	1	332905	4.857732	7.15025	130.0191	0.8757	0	0
154	1	335114	4.857208	7.122159	188.5186	0.9311	0	0
155	1	335121	4.857134	7.143453	201.7969	0.914	0	0
156	1	344086	4.852995	7.124051	45.6166	0.8829	0	0
157	1	344987	4.857648	7.128674	157.1853	0.9372	0	0
158	1	345893	4.856712	7.122458	203.2891	0.9363	0	0
159	1	347756	4.858407	7.147635	166.5322	0.8503	0	0
160	1	349590	4.851943	7.149412	129.1886	0.9417	0	0
161	1	351812	4.858247	7.150468	60.687	0.8862	0	0
162	1	352616	4.854844	7.147045	192.3473	0.9366	0	0

163	1	354984	4.857536	7.123247	107.1901	0.8841	0	0
164	1	355964	4.855577	7.152774	163.6534	0.9309	0	0
165	1	356968	4.857615	7.140941	116.84	0.901	0	0
166	1	357133	4.856279	7.130203	57.1005	0.8302	0	0
167	1	363695	4.856632	7.145591	146.0764	0.8476	0	0
168	1	369560	4.856416	7.129792	135.1433	0.8375	0	0
169	1	371141	4.857241	7.152706	85.7419	0.7806	0	0
170	1	375137	4.856871	7.14495	36.0892	0.772	0	0
171	1	378703	4.857985	7.122799	50.895	0.7403	0	0
172	1	381620	4.857944	7.147687	159.6624	0.8351	0	0
173	1	383977	4.857464	7.122558	177.8079	0.7608	0	0
174	1	384935	4.855826	7.121594	314.2409	0.9482	0	0
175	1	386302	4.857057	7.124325	241.4366	0.9013	0	0
176	1	388849	4.857312	7.14451	6.9514	0.6651	0	0
177	1	388861	4.858143	7.12262	142.1323	0.8717	0	0
178	1	392810	4.853981	7.152576	30.5941	0.6912	0	0
179	1	394085	4.856918	7.148828	136.9716	0.8711	0	0
180	1	398166	4.852574	7.13936	28.413	0.8159	0	0
181	1	398691	4.854976	7.131485	237.2167	0.8281	0	0
182	1	400550	4.852968	7.134088	15.5389	0.7607	0	0
183	1	400923	4.85819	7.15119	123.6981	0.7869	0	0
184	1	403998	4.856376	7.146001	110.9933	0.9011	0	0
185	1	406813	4.85787	7.145631	165.3112	0.8409	0	0
186	1	407249	4.857516	7.132005	150.5703	0.816	0	0
187	1	409088	4.857991	7.132437	108.9326	0.7648	0	0
188	1	419104	4.856581	7.139752	138.1545	0.9248	0	0
189	1	420077	4.857717	7.140497	217.7072	0.9353	0	0
190	1	420214	4.852329	7.151322	39.1097	0.8287	0	0
191	1	420379	4.855843	7.13701	152.5826	0.9126	0	0
192	1	433207	4.851242	7.145436	137.651	0.7947	0	0
193	1	434734	4.855733	7.152434	192.9263	0.8146	0	0
194	1	443592	4.858076	7.124207	203.5212	0.8805	0	0
195	1	443642	4.858077	7.153358	75.3499	0.8335	0	0
196	1	446484	4.839946	7.147705	179.5988	0.9195	0	0
197	1	446765	4.855472	7.130421	10.6099	0.7483	0	0
198	1	447217	4.857425	7.141153	165.3926	0.905	0	0
199	1	447808	4.857717	7.131471	108.218	0.8965	0	0
200	1	458346	4.85754	7.152633	67.463	0.8846	0	0
201	1	459623	4.85747	7.141384	6.3713	0.7024	0	0
202	1	459949	4.856107	7.127987	173.8059	0.8904	0	0
203	1	461409	4.858086	7.142366	18.9411	0.7069	0	0
204	1	461452	4.857775	7.142138	31.909	0.8304	0	0
205	1	467668	4.856843	7.142636	113.785	0.9213	0	0
206	1	473606	4.858478	7.151975	158.5863	0.8658	0	0
207	1	474214	4.857632	7.127367	175.0365	0.9337	0	0

4.5 DISCUSSION

The study employed model expression that was used in converting the local coordinate system to system international with the aid of Franson coordinate converter 2.3 which helped to geolocate the particular feature of the earth. Mathematical quantity below shows the direct relationship between letters of A and C that defined the datum transformation from one surface to another within the limit of space. However, A is independent variable (feet), 0.3048 (constant) while C is the new state of the variable (dependent) that depicts the feature in a given environment. This can be in latitude and longitude or Universal Traverse Mercator (UTM) system.

$$A * 0.3048 = C \quad (1)$$

Furthermore, the global positioning system (GPS 72H) was also used during the field survey to capture different features of the earth depending on their location. Four corner positions were obtained with the use of the instrument to calculate the area. This was achieved using cross coordinate method that is widely use in surveying and Geomatics. Equation 2 shows the model for the calculation of the area.

$$AREA = \frac{1}{2}[(x_1y_2 + x_2y_3 + x_3y_4 + x_4y_1) - (y_1x_2 + y_2x_3 + y_3x_4 + y_4x_1)] \quad (2)$$

Georeferencing was carried out with refence to the hard or old map and this process converted it to digital-based map (Figure 5). To achieve this process of digitizing, shapefiles such as roads, building, railway, and vegetation were created using feature class for each feature to enable digitizing tool effective (Figure 3). Each feature class created in layer, appeared in the table of content for quick access. Hence, selection of shapefile in the digitizing tool enables the procedure for assessment and classification of the feature. This process of analysis was consistently done one after the other as given in the feature classes and at the end of the exercise, a detailed thematic base map was produced at a scale of 1:10,000 using high-resolution satellite imagery and field GPS data.

In addition, the study area was classified into five major land use and land cover types such as residential, vegetation, rail way, road, and water bodies. Vegetation cover was sparse due to urban expansion and industrial activity (Figure 4), infrastructure mapping, transportation routes and vegetations within Umusoya were inherently achieved. Analysis of the buildings showed (2.670%), land cover (96.87٪) and roads (0.46%) as seen in Table 4.1.

Consequently, the earth information extracted from the field survey would assist the Urban and Regional planners in terms of physical development, engineering and construction services that will overcome issues of flooding within the circumference of neighbourhood in the study area. Also, spatial content of the study will expose infrastructural state of the area and the location at which they are found or positioned for visibility for needed study.

The findings of the study are also in agreement with Menno-Jan and Ferjan (2011) who made a significant contribution to the cartographic literature. It explored the role of visualization and map production, highlighted how maps serve as powerful communication tools. The authors discuss various visualization techniques, including static, interactive and accessible maps. Digital platforms, such as ArcGIS and QGIS, have made it easier for users to manipulate maps for specific purposes, such as analyzing traffic patterns, urban development, or disaster response. The integration of user-friendly tools for non-experts has democratized map production, allowing a broader audience to engage in geographic analysis. The integration of remote sensing data with GIS platform has also enhanced the mapping of dynamic phenomena, such as vegetation cover, land-use changes, and climate patterns, as noted by (Turner et al., 2002). These advancements support real-time monitoring and facilitate better decision-making in areas like disaster management and conservation planning.

5. RECOMMENDATION AND CONCLUSION

The following recommendation were made:

5.1 Regular Updates: The Sheet No. 9904 map should be updated periodically to reflect changes in land use, infrastructure, and environmental conditions

Adoption of GIS Nationwide**:** Government agencies and mapping institutions should adopt GIS-based workflows for all future mapping projects to enhance efficiency and data quality

5.2 CONCLUSION

This study successfully achieved its objectives by producing a digital large-scale map of Nigerian Sheet No. 9904. The application of GNSS technology and ArcGIS software showcased the potential of digital mapping in improving spatial data accessibility and accuracy. The study underscores the importance of adopting modern geospatial techniques in national mapping efforts.

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