OYO STATE

IBADAN
CITY MASTERPLAN

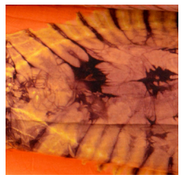
June 2018

FINAL MASTERPLAN











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PREFACE

Ibadan has always been a precedent-setting city. Now, for the first time in its history, the city will have a comprehensive plan to guide planning and development into the future. A masterplan is more than a set of maps; it is an agreed vision which guides decision-making and shapes the future form of the city.

As the population of Ibadan grows, the city faces new challenges and opportunities. The Ibadan City Masterplan plans for urban growth and regeneration, infrastructure provision and transport upgrades. Perhaps the greatest challenged faced by the city is increasing flood risk. The masterplan responds to this with proposals for drainage and strategic land use designations. Maximising on the city's strengths, the existing built heritage of Ibadan is protected and tourist sites are identified. The important natural features of Ibadan are identified for conservation.

Alongside a physical planning framework, the Masterplan proposes institutional arrangements to ensure its successful implementation. This is accompanied by a phasing and implementation strategy. This reflects the will for the Ibadan City Masterplan to be realised.

The city-wide masterplan is supported by three Detailed Urban Plans. These provide a higher level of guidance on interventions in the Core Area, Flood Prone Areas and the Circular Road development corridor. These are presented in a separate Detailed Urban Plans report, and should be considered alongside the main Masterplan document.

A major part of the success of the Ibadan City Masterplan is the extensive stakeholder engagement process which was undertaken throughout its preparation. Through meetings, exhibitions and presentations, the Masterplan has been communicated to everyone from State Ministries to local residents in all eleven LGAs. Their responses and aspirations have been considered and incorporated into the Masterplan, making this document a true representation of shared vision.

Tpl. (Alhaji) Waheed Adeshina Gbadamosi

Director General/ Special Adviser

FOREWORD

Ibadan, the capital of Oyo State, is a city of great opportunity. It embodies the 'pacesetter' virtues of the state, being one of the few remaining indigenous cities in the region and home to many firsts: Africa's first skyscraper, Nigeria's first university, the first TV station and radio, to name a few. This masterplan is another first for Ibadan: the first plan to provide a clear strategy for the development of the city over the next two decades.

Ibadan's resilience has been challenged. The flooding that affects the city must be addressed. This masterplan addresses these concerns by providing a strategy to directly tackle the dangers this brings up.

This comprehensive masterplan will achieve economic growth that will benefit not only our great city but the whole of Oyo State, with improvements to social conditions affecting all existing and future residents.

It provides areas to create new homes in conjunction with new jobs, explains how we can create first class utility and social infrastructure for all residents, will enable people to move easily around the city and overcome the transport congestion faced today, and will help to preserve those existing areas of natural beauty and the fine examples of our historic built environment.

I am immensely proud of the work that has gone into this masterplan, which has involved hundreds of people over many months. I am extremely grateful to the ongoing participation of the various State Ministries, Departments and Agencies, Local Governments, Community Development Associations, academics and the residents of Ibadan. I urge you to continue your participation as we work together to implement this masterplan and create a better Ibadan for today's generation and those of the future.

Senator Ishaq Abiola Ajimobi

Governor of Oyo State

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LIST OF ABBREVIATIONS

AAS	Annual Abstract of Statistics
AD	Anaerobic Digestion
AGR	Annual Growth Rate
ANFE	Agency for Non-Formal Education
BICSI	Building Industry Consulting Service International
BMO	Business Membership Organisations
BMP	Best Management Practices
BOTAVED	Board for Technical Education
BOD	Biochemical Oxygen Demand
BPPDC	Bureau of Physical Planning and Development Control
BRT	Bus Rapid Transit
BOD	Biochemical Oxygen Demand
BS	Booster Station
CAC	Citizens' Advisory Committee
CAGR	Compound Annual Growth Rate
CBR	Crude Birth Rate
CBO	Community Based Organisations
CCECC	China Civil Engineering Construction Company
CCTV	Closed-Circuit Television
CDA	Community Development Associations
CDC	Community Development Committee
CDR	Crude Death Rate
CEO	Chief Executive Officer
CFO	Certificate of Occupancy
CIPD	Commercial and Industrial Promotion Department
DC	Distribution Centre
DEM	Digital Elevation Models
DI	Ductile Iron
DMA	Disaster Management Agency
DO	Dissolved Oxygen
DSPP	Directorate of Strategic Physical Planning
DUP	Detailed Urban Plans
ELV	Extra Low Voltage
EMP	Environmental Management Plan
EPON	Ethernet Passive Optical Network
EST	Estimated
ET	Elevated Tank
EWR	Elevated Water Reservoir
ExCo	Executive Council
FAT	Fiber Access Terminals
FDT	Fiber Distribution Terminal
FO	Fiber Optic
FMITI	Federal Ministry of Industry Trade and Investment
FTTH	Fiber-To-The-Home
GDP	Gross Domestic Product
GIS	Geographic Information System
GMS	Galvanized Mild Steel
GR	Ground Reservoir
GRP	Glass Reinforced Plastic
GSM	Global System for Mobile Communications
GPON	Gigabit Passive Optical Network
GW	Gigawatt
GWR	Ground Water Reservoir
HA	Hectare
HCP	Housing Comprehensive Plan
HGV	Heavy Goods Vehicle
HV	High Voltage
IAIA	International Association for Impact Assessment
IAR&T	Institute of Agriculture, Research Training
ICM	Ibadan City Masterplan
ICT	Information and Communication Technology
IDA	Ibadan Development Authority
IEC	International Electro-technical Commission
IEEE	Institute of Electrical and Electronics Engineers
IFC	International Finance Corporation
IITA	International Institute for Tropical Agriculture
IMF	International Monetary Fund
ISO	International Standards Organisation
ISWM	Integrated Solid Waste Management
ITDP	The Institute for Transportation and Development Policy
ITE	US Institution of Transport Engineers
ITU	International Telecommunications Union
ITU-T	Telecommunication Standardisation Sector
IUFMP	Ibadan Urban Flood Management Project
IW	Industrial Waste
JICA	Japan International Cooperation Agency
JTS	Journey Time Surveys
KV	Kilovolt Amperes
LACP	Land Acquisition and Compensation Plan
LCC	Local Chamber of Commerce
LCDA	Local Community Development Association
LDSG	Lands Department and Surveyor General
LS	Lift Station
LG	Local Government
LGA	Local Government Area
LRT	Light Rail Transit
M	Meter
MAN	Metropolitan Area Network
MCC	Manual Classified Counts
MCM	Million Cubic Metres
MDA	Ministries Departments and Agencies
MFPB	Ministry of Finance Planning and Budget
MIN	Minute
MLHPP	Ministry of Lands, Housing and Physical Planning
MLG	Ministry of Local Government
MM	Millimetre
MoE	Ministry of Environment
MoH	Ministry of Health
MRF	Material Recovery Facility
MRT	Mass Rapid Transit
MSME	Micro Small and Medium Enterprises
MSW	Municipal Solid Waste
MoWASW	Ministry of Women’s Affairs and Social Welfare
MV	Medium Voltage
MVA	Megavolt Amperes

MW	Megawatt
NASME	Nigerian Association of Small and Medium Enterprises
NASSI	Nigerian Association of Small Scale Industrialists
NEMA	National Electrical Manufacturing Association
NCC	Nigerian Communications Commission
NDHS	National Demographic and Health Survey
NFPA	National Fire Protection Association
NGO	Non-Government Organisations
NHF	National Housing Fund
NIHORT	Nigeria Horticulture Research Institute
NITP	Nigerian Institute of Town Planners
NMT	Non-Motorised Transport
NOA	National Orientation Agency
NPA	Natural Protected Areas
NPC	National Population Commission
NTDA	New Town Development Association
O&M	Operation and Maintenance
OLT	Optical Line Terminal
ONU	Optical Network Unit
OSBS	Oyo State Bureau of Statistics
OSEMA	Oyo State Emergency Management Agency
OSMEWR	Oyo State Ministry of Environment and Water Resources
OSMOH	Oyo State Ministry of Health
OSMTIC	Oyo State Ministry of Trade, Investments and Co-operatives
OSMOEd	Oyo State Ministry of Education
OSMoWT	Oyo State Ministry of Works and Transport
OSP	Outside Plant
OYOWMA	Oyo State Solid Waste Management Authority
P&R	Park and Ride
PA	Public Announcement
PCCP	Prestressed Concrete Cylinder Pipes
PCU	Passenger Car Unit
PDD	Peak Day Demand
PDD	Physical Planning Directorate
PE	Polyethylene
PEI	Performance Efficiency Index
PHCN	Power Holding Company of Nigeria
PHD	Peak Hourly Demand
PIU	Project Implementation Unit
PLC	Private Limited Company
PLAD	Planning and Land Administration Department
PM&E	Planning Monitoring And Evaluation Units
PON	Passive Optical Network
PPP	Public Private Partnership
PS	Pump Station
PT	Public Transport
PUMD	Public Utilities Management Department
QTY	Quantity
RA	Residential Area
RAP	Resettlement Action Plan
RCC	Reynolds Construction Company
RfP	Request for Proposal
RNI	Rate of Natural Increase
ROW	Right of Way
RSI	Road Side Interviews
RTR	Restoration, Transformation and Repositioning
RUWASSA	Rural Water Supply and Sanitation Agency
SESA	Strategic Environmental and Social Assessment
SDG	Sustainable Development Goals
SPPD	Strategic Physical Planning Directorate
SMEDAN	Small and Medium Enterprises Development Agency of Nigeria
SME	Small Medium Enterprise
SMU	Specialist Monitoring Unit
SQM	Square Meter
SS	Suspended Solids
SUBEB	State Universal Basic Education Board
SWM	Solid Waste Management
TAZ	Traffic Analysis Zone
TESCOM	Teaching Service Commission\
TOD	Transit Oriented Development
TS	Transfer Station
TSE	Treated Sewage Effluent
UCH	University College Hospital
UN	United Nations
UNDP	United Nations Development Programme
UNIDO	United Nations Industrial Development Organisation
UPA	Urban and Peri-Urban Agriculture
uPVC	Unplasticised Poly Vinyl Chloride
UREC	Urban Recreational Green Spaces
US-EPA	United States Environmental Protection Agency
VOL	Volume
WC	Water Closet
WCOS	Water Corporation of Oyo State
WHO	World Health Organisation
WMS	Watershed Modelling System
WtE	Waste to Energy
WTP	Water Treatment Plant
WTW	Water Treatment Works
WWTP	Wastewater Treatment Plant

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INTRODUCTION

1

1 INTRODUCTION

1.1 THE IBADAN CITY MASTERPLAN

Oyo State Government, represented by the Project Implementation Unit (PIU) (the Client), commissioned Dar (the Consultant) to prepare a masterplan for the city of Ibadan, comprising its 11 Local Government Areas (LGAs). The area covered by the masterplan extends from Igbokandi in the north-west to Oguro in the north-east, Araromi in the south-east to Ogunmakin in the south-west. The rivers Osun and Ogun form the western and eastern boundaries to the masterplan, respectively. Figure 1.2 identifies the extent of the area covered by the strategy.

The strategic masterplan, covering an area just under 315,000 hectares, provides a vision for the future of Ibadan to the year 2036. It is a comprehensive, sustainable and implementable framework for urban development, taking the form of a spatial plan supported by policies identifying not only development sites but also the quantum of growth for different land uses to meet future needs. The masterplan is also an important tool for achieving Oyo State's vision for Ibadan, which is a *"…re-positioning [of] Ibadan city as a competitive, open and socio-economically inclusive and equitable city in the sub region."*

The Masterplan was developed over several stages and is structured on the findings identified in the Ibadan City Masterplan Diagnostics Report.[1]

The preparation of the Masterplan report has involved a wide range of stakeholders, who have contributed significant amounts of time and local knowledge to support the Consultant in putting together the document. The input of all stakeholders has been invaluable in formulating and agreeing a way forward for the future of Ibadan.

1.2 STRUCTURE OF THE REPORT

This report is divided into 9 chapters and 10 appendices.

- Chapter 1 – introduces the report and provides the context to the masterplan.
- Chapter 2 – provides an overview of the city's context and its history.
- Chapter 3 – describes the overall spatial and development strategy for the city to the year 2036.
- Chapter 4 – provides a strategy for addressing the impacts of flooding and drainage.
- Chapter 5 – summarises the proposed transport networks within the city.
- Chapter 6 – sets out the socio-economic context of Ibadan, which considers population and demographics, economic activities and employment.
- Chapter 7 – identifies the city's needs in terms of utility infrastructure provision including solid waste, fresh water, waste water and sewage, power and telecommunications.
- Chapter 8 – proposes a new institutional and legal framework for Ibadan to ensure that the masterplan is implemented.
- Chapter 9 – concludes the report.

1.3 PURPOSE OF THE IBADAN CITY MASTERPLAN

On 26 August 2011, a rainfall downpour of 187.5mm occurred in about 5 hours, resulting in the overflow of the Eleyele reservoir, causing the death of more than 120 people and inflicting serious damage to infrastructure (many bridges collapsed, roads were washed away, and substantial property was lost).[2] Following the floods, The Executive Governor of Oyo State, his Excellency, Senator Ishaq Abiola Ajimobi, set up a task force on flood prevention and management.

The outcome was a report containing short, medium and long term recommendations to the state government, which included the proposal to prepare three masterplans for the city:

- Ibadan City Masterplan (this project).
- Solid Waste Masterplan.
- Drainage Masterplan.

Oyo State Government, with technical and financial assistance from the World Bank, established the Ibadan Urban Flood Management Project (IUFMP) to oversee the preparation of these plans.

The lack of a land use plan for the city was considered a significant contributor to the damage caused by the flooding. At the stakeholder workshop held on 20 July 2016, during the data gathering process, many of the participants expressed a similar view that the lack of a strategic plan for the city is an impediment to the managed and safe growth of Ibadan.

This Masterplan therefore sets in motion a process to address the needs of the city today and into the future. The strategies and proposals put forward are intended to benefit all residents and visitors in Ibadan, whether in the Core Area, periphery, Growth Centres, or rural community.

The Masterplan is not intended to just show the final state of the city in 2036. To be relevant to local needs, it must be flexible and adaptable and above all implementable. It is a process undertaken in stages and one in which everyone has a role to play. It is your masterplan for your city, use it to transform Ibadan into the successful city it deserves to be.

Sensitisation of the masterplan to the wider community is critical to its success. The wider understanding and acknowledgement of the strategy by the community in Ibadan will ultimately be the judge as to its successful implementation.

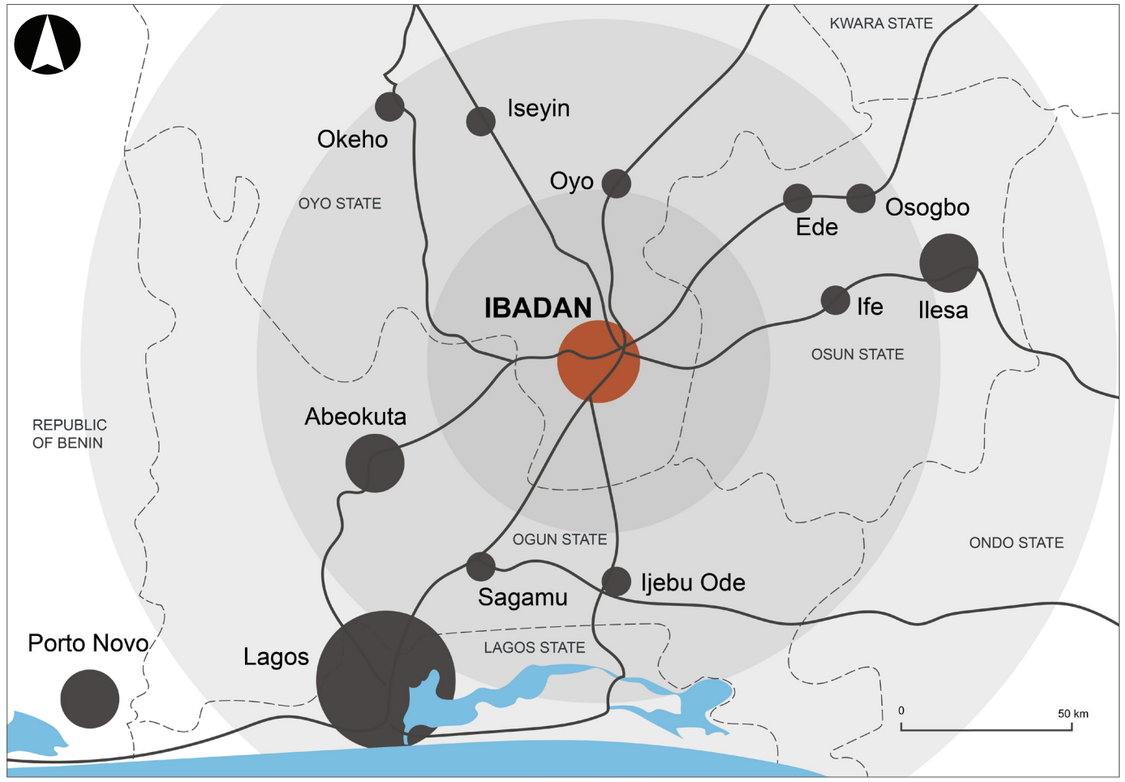

Figure 1.1: Ibadan in its Regional Context

1 Dar, 2017.

2 Ibadan Urban Flood Management Project: Environmental and Social Management Framework Final Report, January 2014.

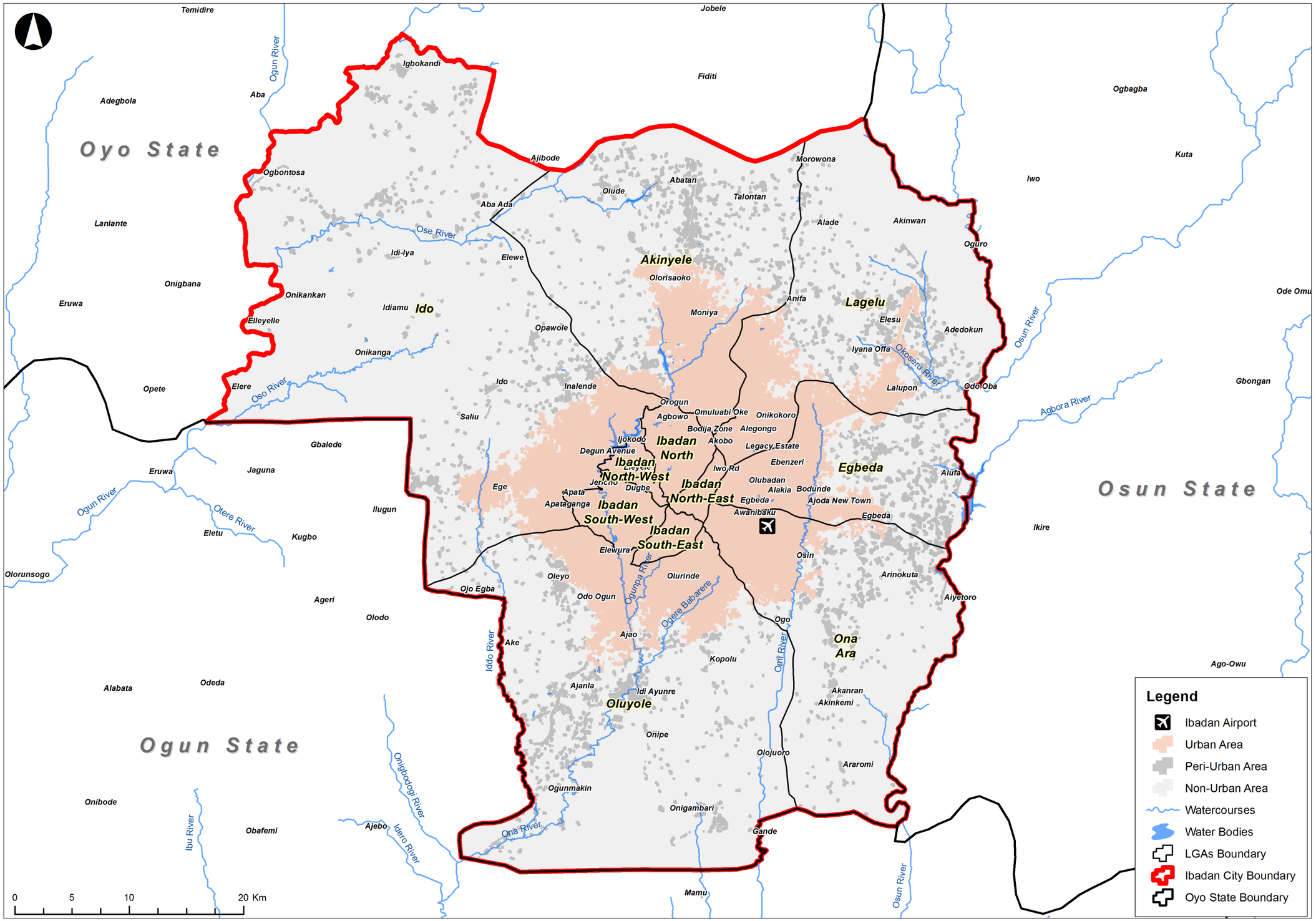

Figure 1.2: Ibadan Masterplan Area

1.4 STAKEHOLDER ENGAGEMENT

Stakeholder engagement has been defined as "*a two-way, continuous process of communication between a project and each of its stakeholders which continues throughout the life of the project.*"[3] In accordance with this definition, a continuous process of stakeholder engagement was developed for the Ibadan City Masterplan as shown in Figure 1.3.

This essential process of stakeholder engagement has been adopted for the development of the Ibadan City Masterplan to help build a consensus for the strategy with support from all stakeholders, while also complying with requirements of international bodies.

By way of holding a series of interviews, workshops, presentations and exhibitions during the process, valuable information and feedback has been gained from those who live and work within Ibadan. The opportunity was given at all stages of the plan's development to share debate and discuss the ideas that emerged while also providing wider updates on the masterplan's progress.

The Masterplan has been developed over an 18 month period running from mid 2016 to late 2017 and fully engaged stakeholders to help build agreement and support.



Figure 1.3: Stakeholder Engagement Process

3 Reddy, G.,Smyth, E. and Steyn, M. (2015) Land Access and Resettlement A Guide to Best Practice.

1.4.1 Consultation Undertaken to Date

The involvement of stakeholders in the development of the Ibadan City Masterplan has been invaluable in agreeing a way forward for Ibadan. From the initial stages of the masterplan, stakeholders contributed their time and local knowledge to provide an understanding of the baseline conditions of Ibadan. Stakeholder feedback has provided a key part of masterplan development. Details on the stakeholder engagement undertaken have been provided in the Stakeholder Engagement Activity Report (Ref: N16011-0100D-RPT-PM-05 REV2), which can also be found in Appendix 7.



Figure 1.4: Stakeholders reading about the Masterplan



Figure 1.8: Sharing the masterplan ideas



Figure 1.12: LGA Meeting - Project Banner



Figure 1.5: Consultant Stakeholder conversations



Figure 1.9: Structured Data Gathering Meeting



Figure 1.13: Consultation - Hand painting



Figure 1.6: Visioning Scenario Workshops



Figure 1.10: Mobile Exhibition - outside Mapo Hall



Figure 1.14: Open House Sessions



Figure 1.7: Engaging Stakeholders - Pebble Painting



Figure 1.11: His Excellency Abiola Ajimobi, Governor of Oyo State



Figure 1.15: Engaging Stakeholders - Exhibition

Stakeholder Engagement Timeline

2016

JUNE
Initial data request letters sent

JULY
Technical Data Gathering Workshop

Semi-structured Data Gathering Meetings

OCTOBER
Semi-structured data gathering meetings with LGAs & CDAs

NOVEMBER
Workshop with LGA representatives and CDA Committee

Presentations with State Ministries and Academic Institutions

2017

JANUARY
Presentations to:
- Technical Committee
- Academics & Professional Bodies
- LGA Chairmen
- Heads of Local Administration
- MDA Commissioners
- The World Bank

MARCH
Presentations to:
- The Governor of Oyo State
- NGOs, CBOs, MDAs
- Local Government Management
- Professional Bodies
- Academics
- Traditional Rulers
- Political Leaders

Open Houses, Stationary Exhibition and Mobile Exhibition to the general public

JULY
Presentations to:
- The Governor of Oyo State
- Executive Council
- The IUFM PIU
- Various stakeholder groups

SEPTEMBER / OCTOBER
Presentations to:
- Sub-Technical Committee and State MDAs
- Local Government Senior Management
- Academics and Professional Bodies
- Representatives of Local Government, Religious Leaders, NGOs and Community Organisations

Exhibitions

Figure 1.16: Stakeholder Engagement Timeline









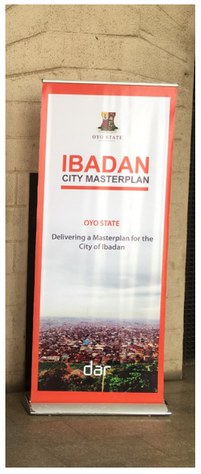

Figure 1.18: Project Leaflets





Figure 1.17: Stakeholder Engagement Events



Figure 1.19: Project Website



Figure 1.20: Twitter Account

CONTEXT OF THE MASTERPLAN

2

2 CONTEXT OF THE MASTERPLAN

2.1 INTRODUCTION

The section provides a summary of the regional and historical context of Ibadan. It identifies aims and objectives for guiding development of the Ibadan Masterplan, while also addressing the constraints and opportunities. These form the basis for developing alternatives to the spatial development of the city.

2.2 IUFMP MASTERPLANS

The Ibadan City Masterplan is part of a set of three masterplans which are being developed for the city as part of the Ibadan Urban Flood Management Project (IUFMP) (Figure 2.1). The Drainage Masterplan is being developed in parallel to the City Masterplan. It provides strategic and detailed interventions for flood mitigation throughout Ibadan.

The Solid Waste Masterplan is being undertaken by a separate Consultant and has the following goals:

- Defining strategic objectives and quantifiable targets for the municipal solid waste (MSW) sector in Ibadan;
- Identifying and evaluating options and alternatives to modernise the existing systems;
- Preparing action plans to achieve the defined strategic objectives and quantifiable targets;
- Defining monitoring and evaluation procedures for proper implementation of the master plan;
- Providing relevant capacity building and training.

2.3 REGIONAL CONTEXT

With a population of over 6 million, Ibadan, the capital of Oyo State, is the most populous city in the state, and the third most populous city in Nigeria, after Lagos and Kano. It is the country's largest city with an area of 315,000 ha (the urban area and surrounding countryside), which covers almost 11 per cent of the state.

The city is strategically well connected to the national road and rail networks. Located in the south-eastern part of Oyo State, it is approximately 119 kilometres north-east of Lagos and 120 kilometres east of the border with the Republic of Benin. It is a prominent transit point with trading routes between the coastal regions and the neighbouring states and contains major transport arteries linking Lagos with the Federal capital, Abuja, the northern metropolis of Kano and other important cities.

The Lagos-Ojo Expressway, part of the Trans-African Highway network, passes through the city along with the Lagos-Nguru railway line. A number of inter-urban bus routes also serve the city while domestic flights to Abuja and Lagos operate from Ibadan Airport.

The Federal Government of Nigeria is promoting the construction of Lagos-Abuja and Lagos-Ibadan high speed rail lines. The proposed high speed line from Lagos is an opportunity to open up Ibadan to further investment and increase commercial activity between the two cities.

Ibadan lies within the tropical forest zone but close to the boundary between the forest and the savannah. It is characterised by rugged terrain with steep slopes creating a dense network of streams with wide valley plains. The city ranges in elevation from 150 metres in the valley area, to 275 metres above sea level on the major north-south ridge which crosses the central part of the city.

The city is naturally drained by four rivers with many tributaries: the River Ona in the north and west, the River Ogbere towards the east, the River Ogunpa flowing through the city and River Kudet in the central part of the city. Lake Eleyele is located in the north-western part of the city, and the east of the city is bounded by the River Osun and Lake Asejire. These rivers are the main drainage channels that can cause flooding when not properly maintained. There is an extensive network of rivers and streams throughout the city as a result of a combination of the geology of the area and the tropical monsoon climate.

2.4 HISTORICAL CONTEXT

Ibadan, along with Kano and Kumasi (Ghana), is one of the few major pre-colonial sub-Saharan cities to retain its importance as an urban centre today.

The earliest record of the settlement in present day Ibadan is of an Egba village, which from the 1820s grew because of displaced people from the wider region escaping internal conflict within the Yoruba Empire. The indigenous settlers benefited from close proximity of the city to the edge of the savannah and the hills which provided protection, water and good quality agricultural land. The population later swelled with the arrival of immigrants from what is now western Nigeria. Ibadan grew extensively into a popular hub of commerce and also dominated the political and military scene in Yoruba, filling the vacuum created by the fallen Oyo kingdom. People displaced by war saw Ibadan as a refuge because of its location, economy and military power.

In 1893, the city with a population of 120,000 became a British Protectorate. It developed as the centre for the colonial administration of the Western Region, which reinforced its position as a focal point for trade, and commerce. Post-independence Ibadan retained its administrative and political importance in the Western Region and today Ibadan is the capital of Oyo state.

The physical growth and expansion of Ibadan like many other cities was influenced by its transport networks. In 1901, the railway from Lagos was constructed, and in 1912 extended northwards to Kano, ensuring the economic significance of Ibadan and further contributing to it becoming a major trading centre. The Ibadan-Lagos Expressway, commissioned in 1978, further led to rapid urbanisation in the eastern and northern parts of the city, followed by the Eleyele Expressway in the west of the city. Since then, the Ibadan urban area has spread further into all parts of the neighbouring local government areas.

The major spatial growth of the Ibadan urban area occurred mainly in the periods from 1964 to 1984 and 2000 to 2016. Of the total land area of the city covering 314,596 ha, 54,600 ha (17.4 per cent) is urbanised whereas 16,478 ha (5.2 per cent) of built development lies within the villages and the peripheral areas of the city. The undeveloped area comprising agricultural land, forests, and open spaces totals 243,500 ha (77.4 per cent).

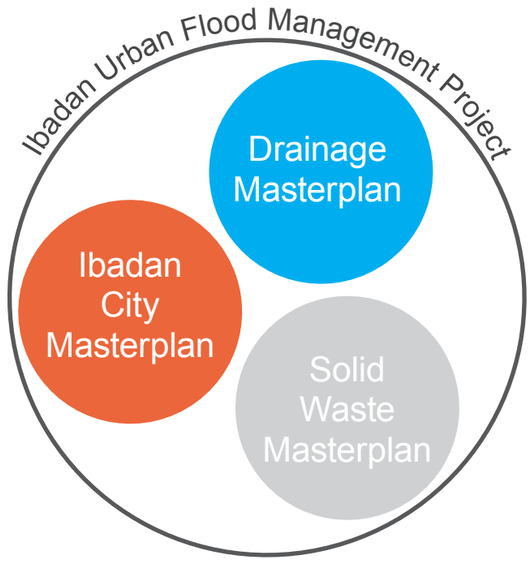

Figure 2.1: Diagram of Three Masterplans Within Ibadan Urban Flood Management Project

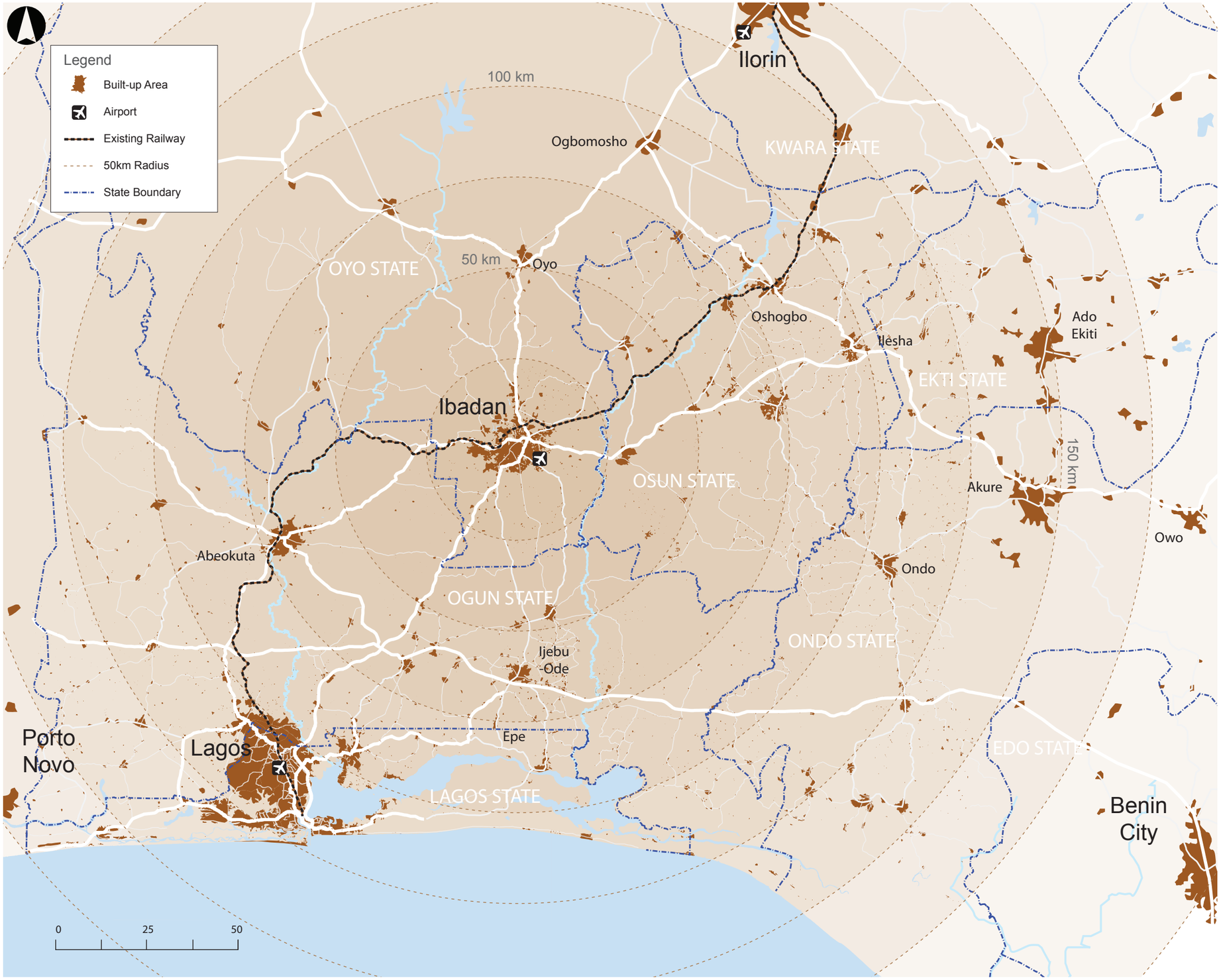

Figure 2.2: Ibadan within the Context of South-Western Nigeria

2.5 SUMMARY OF EXISTING CONDITIONS

In spite of being a vibrant city with a strong sense of identity, Ibadan faces many challenges. This section provides a summary of the existing conditions and the main conclusions drawn from the baseline findings of the Diagnostic Report.

2.5.1 Physical Growth of the Built-Up Area and Land Use Distribution

- The built-up area has expanded rapidly in the past 16 years. Physical urban growth has been along the main highways with infill development taking place as communities become established.
- The limited amount of land occupied by industrial and commercial uses is an indicator that the formal economy is small and not creating sufficient jobs for the size of population.
- The core area of the city suffers from the pressures of an inadequate provision of infrastructure to support the high population density. The houses are generally in poor condition and the provision of community facilities and utilities is low. There are numerous older buildings that have historical importance, but many are in a poor state of repair.
- In the inner built-up areas of Ibadan, the mix of land uses is more varied and includes large institutional and educational facilities. There are a number of industrial facilities which are primarily located along the Lagos Ibadan Expressway. In addition, there are numerous markets which are notably distributed in and around the core area, where there is maximum connectivity and accessibility.
- Many of the residential areas have been developed in an informal manner and the supporting infrastructure to meet their needs is insufficient.
- Outside the built-up area there are large areas of forest and agricultural land, although high grade agricultural soil is limited to the southern parts of Ibadan.
- The surrounding vegetation and the varying topography of the city provide an attractive setting that help improve residents' quality of life. They are assets that should be used to attract investment.
- There is a shortage of formal recreational facilities, both indoor and outdoor within the built-up area.
- Uncontrolled growth to the periphery of Ibadan is affecting the dense vegetation and forestry – this related deforestation is limiting the ability of water to be absorbed into the ground and is one of the causes of flooding.

Figure 2.2 overleaf shows the land use distribution in 2016 for Ibadan. The land use classification is sourced from the 'Space Standards for Physical Development in Oyo State' prepared by the Ministry of Physical Planning and Urban Development in December 2014.

The land use classification is as follows:

- Residential includes bungalows, duplexes, maisonettes, flats, terrace housing/apartments, condominiums/ service flats, tenement houses and cottages.
- Commercial includes markets, shopping centres/malls, office complexes, showrooms/garages/warehouses, banks, petrol/gas filling stations, hotels, motels/guest houses, bars/restaurants and event centre/multi-purpose hall.
- Recreational includes amusement parks, children's park,sports complexes, gymnasia, fitness centres, club houses, concert halls, resorts, cinemas, theatres, discotheques and mobile/temporary homes (caravan).
- Conservation includes zoos/wildlife/nature areas/urban forests, cemeteries, museums, arboretum, heritage sites, games reserves, historic/listed buildings and wet land.
- Health institutions includes teaching hospitals, general hospitals, specialist hospitals, clinics, laboratories, maternity centres and primary health centres.
- Agriculture includes farm houses, ranches, orchards, bee farms, rabbitry, hatcheries, poultry, fish ponds, piggery, horticultural gardens, plantations, cultivated lands (arable farms) and snailry.
- Institutional buildings and services includes the Secretariat complex, libraries, river ports, motor parks, lorry depots, truck depots, water pumping stations, sewage treatment plants, electricity substations, fire stations, telephone exchanges, postal agencies/offices, radio stations, satellite earth stations, TV stations, prisons, remand homes, juvenile centre, archives, police stations and barracks.
- Religious includes churches, mosques, other worship centres, wild grounds and crusade ground.
- Educational includes day care/playgroup/crèches, nursery/primary schools, secondary schools/colleges, tertiary institutions, special schools, research institutes, training centres, vocational centres.
- Industry includes light industries, medium industries and heavy industries.
- Light Industries includes wood work, shoe factory, garment industry, motor repair workshop, dry cleaning, watch repairs/cobblers/electronic, workshops, bakeries, agro-based and allied industries.
- Medium Industries includes printing press/publishing houses, soap manufacturing and mills.
- Heavy industries includes printing press/publishing houses, soap manufacturing, mills, petrochemical and steel industries, surface mineral works, electric power station, gas works, water works and metal fabrication.
- Circulation includes roads, streets, parking spaces, alleys, footpaths, walkways, railway stations, airports, tri/ motorcycle parks, bus terminals and motor parks.

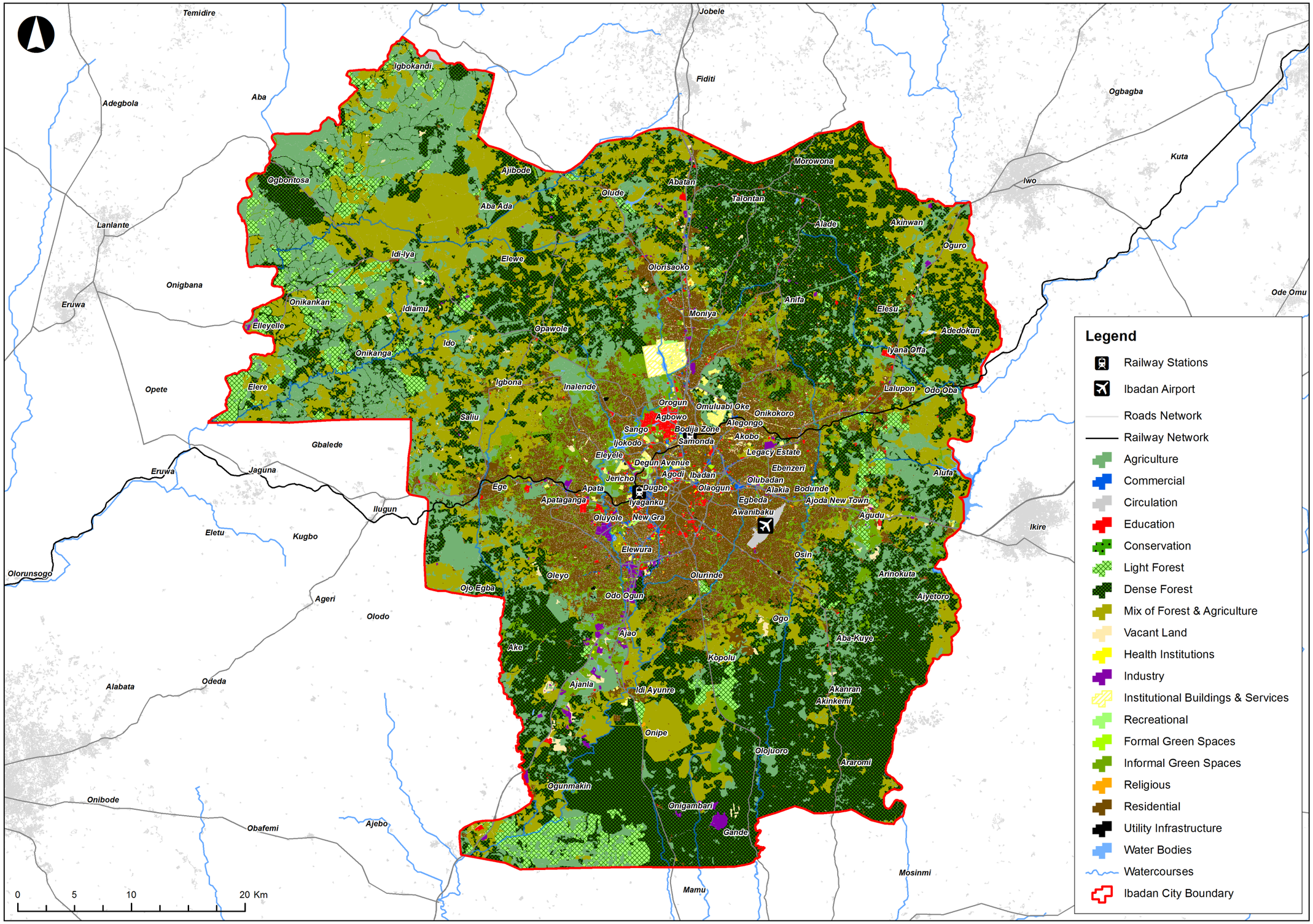

Figure 2.3: Land Use Distribution 2016

2.5.2 Population

1991 and 2006 Census Results and Demographic Trends

Table 2.1 presents information on Ibadan's population from the national 1991 and 2006 Censuses, and which reflect the most recent direct estimates (i.e. based on actual surveys/ censuses rather than projections).

Table 2.1: 1991 and 2006 Census Results and Demographic Trends

LOCATION	POPULATION			AREA (SQ. km.)	PERSON DENSITY (PER SQ. km)	
	1991	2006	AGR		1991	2006
Inner LGAs	1,228,663	1,343,147	0.6%	128	9,599	10,493
Outer LGAs	606,637	1,216,706	4.7%	2,899	209	420
Ibadan	1,835,300	2,559,853	2.2%	3,027	606	846
Rest of Oyo State[1]	1,617,420	3,021,041	4.3%			
Oyo State	3,452,720	5,580,894	3.3%			
Nigeria	88,992,218	140,431,790	3.1%			

1) i.e. excluding the Ibadan LGAs.

Source: National Population Commission, 2006.

From the Census data, the 1991-2006 growth for Ibadan as a whole is 2.2% annually. This growth rate however masks the major variation between the inner and outer areas of the city with the former having an extremely low growth rate of only 0.6% annually compared to the 4.7% for the outer areas. This variation indicates a strong trend of increasing movement of population from the densely occupied inner areas (1991 average: 9,600 persons per sq. km) to the lower density outer LGAs (1991 average: 600 persons per sq. km) where land for new housing is much more plentiful. This trend, which is noticeable in numerous cities worldwide, is likely to continue for the foreseeable future.

However, there is an important inconsistency in the intercensal growth rates. This is that Ibadan's overall growth rate (2.2%) is substantially lower than the growth rate for the rest of Oyo State (4.3%), which in turn implies that there has been a much higher level of population growth in the more rural parts of the state. This is considered implausible.

Table 2.2 presents demographic indicators between 1990 and 2015.[1] At the national level, the data shows that both birth and death rates remained essentially constant between 1990 and 2005, giving a resultant overall rate of natural increase (RNI) of around 2.5%. More recently, death rates have decreased faster than birth rates, leading to the RNI increasing to 2.7% annually.

The NDHS data shows that all fertility indicators (crude birth rate, total fertility rate and gross reproduction rate) for urban areas are consistently 10-15% lower than the national average. The same is true for the under 5 year mortality rate.[2] These rates, which have decreased substantially since 1990, are also consistently lower (13% to 25%) in urban areas. When these differentials are applied to the national level rates for the period from 1990 to 2015, an indication of the urban RNI can be estimated. These estimates produce an average annual RNI for urban Nigeria of around just over 2.1% between 1990 and 2006.

1 More detail and analysis is provided in the Diagnostics Report, Chapter 5.

2 Child mortality has a disproportionate effect on overall death rates as they account for between a quarter and a third of all deaths.

Comparing this to the growth rate of 2.2% for Ibadan from the preceding Table indicates a negligible migration rate of around 0.1% annually. This is considered to be unlikely for one of the largest cities of Nigeria during a period of rapid urbanisation.[3]

Corroboration that migration to Ibadan was on the low side during this period is provided by examining the age distributions from the 2006 Census and, in particular, the variation in the proportion of the population aged 20-39 years (as migrants tend to be concentrated in this age group[4]). Ibadan's proportion for this age group is 32.4%, which is only slightly above the proportions for the country as a whole (30.2%), Oyo State excluding Ibadan (30.8%), and far below the 40% found in Lagos and Abuja where in-migration is known to have been high.[5] At the same time, the fact that Ibadan has a higher proportion within this age group than the rest of Oyo State is at variance with the much lower intercensal growth rate for Ibadan – 2.2% compared with 4.3% for the rest of the state. This reinforces the above-mentioned concern relating to the accuracy of the 2006 Census data.

Table 2.2: Demographic Indicators for Nigeria 1990-2015

INDICATOR	AREA	1990-1995	1995-2000	2000-2005	2005-2010	2010-2015
CBR[1]	Nigeria	43.6	43.1	42.8	41.7	40.3
CDR		18.3	17.9	17.0	14.8	13.3
RNI		25.3	25.2	25.8	26.9	27.0
Fertility Indicator[2]						
CBR[6]	Nigeria	-	-	41.7	40.6	39
	Urban	-	-	36.3	36.8	35
	Ratio	-	-	87%	91%	90%
Mortality Indicator[2]						
Under 5 Mortality Rate[4]	Nigeria	213*	-	185	162	128
	Urban	-	-	153	121	100
	Ratio	-	-	83%	75%	78%
Masterplan Estimates[5]						
CBR	Urban	39.2	38.8	36.3	36.8	35.0
CDR		17.2	16.9	16.0	13.9	12.5

3 Migration rate = overall growth rate – rate of natural increase.

4 National Planning Commission/ IOM/ EU, Nigeria Internal Migration Survey 2010, Table 2.3, p. 10, this age group are the most frequent migrants - which is also consistent with worldwide experience.

5 It should also be noted that stakeholder discussions held during the course of the masterplan's development did not mention a high level of in-migration as a major issue.

Ibadan's Population in 2016

Current Estimates

Table 2.3 presents existing estimates for Ibadan's current (2016) population. The 2016 estimates cover a relatively narrow range – from 3.2 to 3.6 million. This is not surprising as they are all based on the 2006 Census results and do not involve any new surveys or research.

Table 2.3: Current Population Estimates for Ibadan in 2016 (000s)

SOURCE/ DATE	2005	2006	2010	2012	2015	2016	ANNUAL GROWTH RATE		COMMENTS
NPC/ Oyo State Estimates, 20161	-	2,559	-	-	-	3,559	2006-16	3.35%	Average of 2006-11 (3.2%) and 2011-16 (3.5%) growth rates
IUFMP, 20142	-	2,5112	2,893	3,034	-	3,4063	2006-12	2.9%	Obtained by applying 1991-2006 growth rates to each LGA.
UN, WPP 2014	2,509	-	2,814	-	3,160	3,2343	2005-15	2.3%	AGR close to the observed 1991-2006 growth rate

1) Provided to Consultants following presentation of the Draft Ibadan City Masterplan.
2) Integrated Urban Flooding Master Plan which uses slightly lower provisional 2006 Census result.
3) Extrapolated using growth rates shown.
Sources: National Planning Commission/ Oyo State, IUFMP, UN, World Population Prospects, 2015 Revision; Consultants' estimates

Masterplan 2016 Population Estimate

As identified, there are some inconsistencies in the 2006 census results for Ibadan. Given also that over 10 years has passed since the previous census and that population is one of the most critical inputs to the Masterplan, it was decided in discussion with Oyo State Government, that an up to date estimate of Ibadan's current population should be obtained to inform the masterplan. A programme of house counts (to estimate the number of houses) and interview surveys (to obtain the average number of occupants per house) across the Ibadan city area was therefore undertaken. Both house counts and occupancy surveys used the high resolution 1:5,000 scale maps as the sampling basis for these surveys. Table 4 summarises the coverage of these surveys; a detailed description of the methodology used is contained in the Diagnostics Report. The house counts were carried out on 89 maps covering around a third of the total built up area of the city. In total, 936 hectares of residential areas containing over 14,000 houses were counted. For the house occupancy surveys, interviews were held in over 800 houses, covering over 2,400 households and more than 10,000 people. These represent large samples for a city-wide survey.

Table 2.4: Coverage of House Counts and House Occupancy Surveys

RESIDENTIAL TYPOLOGY[1]	HOUSE COUNTS			HOUSE OCCUPANCY SURVEYS			
	SURVEY AREAS[2]	HOUSES COUNTED	NET AREA COVERED (HA^3) (HECTARES)[3]	SURVEY AREAS[4]	HOUSES	HOUSEHOLDS	OCCUPANTS
High Density	19	4,566	146	14	256	1,011	4,388
Medium Density	33	6,051	396	19	357	1,096	4,698
Low Density	17	1,667	167	5	98	163	653
Peripheral	20	1,794	228	9	115	174	898
TOTAL	**89**	**14,078**	**936**	**47**	**826**	**2,444**	**10,637**

1) These are the land use typologies adopted by the study for the land use analysis and were used to stratify the sample.
2) The number of locations where house counts were undertaken; each survey area was located at the centre of a 1:5,000 map with 16 or 25 hectares being counted depending on the typology.
3) I.e. Excluding all other land uses, including the road network.
4) In general, 10 interviews were carried out in each of 2 sub-areas on each map. Not all maps where counts were undertaken were surveyed and surveys were undertaken on some maps where counts were not carried out.
5) Not fully built-up; other areas are.

Table 2.5 presents the headline results from these surveys. The typology categorisation leads to a clear distinction in both densities and occupancy rates which thereby validates the categorisation adopted.

Table 2.5: House Counts and House Occupancy Surveys – Headline Results

RESIDENTIAL TYPOLOGY	NET DENSITY (HOUSES/HA)	VACANCY RATE[3]	OCCUPANTS/HOUSE
High Density	30.8[2]	12%	17.1
Medium Density - ALL	15.4	12%	13.6
Medium Density - INNER[1]	21.3	12%	16.6
Medium Density - OUTER	14.1	10%	12.3

1) Initial examination of the results revealed a marked difference in both densities and occupancy rates between inner and outer medium density areas. This typology is therefore divided into two groups.
2) All results have been weighted to allow for over- and under-sampling.
3) Percentage of buildings identified during surveys as being either: (i) abandoned; (ii) under construction; or (iii) wholly non-residential. For (i) and (ii), criterion was that the roof had to be largely intact or completed.
Source: Consultants' Surveys, 2016.

The derivation of Ibadan's population from the information contained in Table 2.5 is straightforward given that the total area under each typology is available from the Land Use Survey.[6] It requires three simple calculations:

- Total Area * Net density = Total houses
- Occupied houses = Total Houses * Vacancy Rate
- Population = Occupied Houses * Average Occupants per House

These calculations are replicated for each typology and then summed to give the total population. The calculations are shown in Table 2.6.

6 Consultant, 2016.

The estimated population of Ibadan resulting from the surveys and calculations, at 6 million, is far higher than those presented in Table 2.3. Yet this estimate is based on a robust survey methodology that covers a large number of houses, households and population. This is in contrast to the projections which are based on data that is over 10 years old. Nevertheless, because the divergence between a 2016 population of 6 million and previous estimates is so great, a number of crosschecks using comparable information from the 1991 and 2006 Censuses have been undertaken. Accordingly, Table 2.7 compares populations within the LGAs and their growth rates for 1991, 2006 and 2016.

Table 2.6: Ibadan's Population in 2016 – Masterplan Estimate

RESIDENTIAL TYPOLOGY	TOTAL AREA (HA)	% OF TOTAL	NET DENSITY (PEOPLE/ UNIT)	TOTAL HOUSES	VACANCY RATE	OCCUPIED HOUSES	OCCUPANTS/ HOUSE	POPULATION	% OF TOTAL
	LAND USE SURVEY		HOUSE COUNTS	CALCULATED	OCCUPANCY SURVEYS	CALCULATED	OCCUPANCY SURVEYS	CALCULATED	
High Density	3,546	9%	30.8	109,100	12%	97,500	17.1	1,672,000	28%
Medium - INNER	2,142	5%	21.3	45,600	12%	40,700	16.6	674,000	11%
Medium - OUTER	17,986	46%	14.1	253,100	12%	225,600	12.3	2,765,000	46%
Low Density	3,193	8%	10.0	31,900	10%	29,100	6.8	197,000	3%
Peripheral	9,840	25%	7.3	71,700	14%	63,000	7.7	485,000	8%
Villages	2,473	6%	101	24,700	10%1	22,500	101	225,000	4%
TOTAL	**39,180**	**100%**	**13.7**	**536,100**	**11%**	**478,400**	**12.6**	**6,018,000**	**100%**

1) Initial examination of the results revealed a marked difference in both densities and occupancy rates between inner and outer medium density areas. This typology was therefore divided into two groups.
2) All results have been weighted to allow for over- and under-sampling.
3) Percentage of buildings identified during surveys as being either: (i) abandoned; (ii) under construction; or (iii) wholly non-residential. For (i) and (ii), criterion was that the roof had to be largely intact or completed.
Source: Consultants' Surveys, 2016.

Table 2.7: Comparison of LGA Populations: 1991, 2006 and 2016

LGA	POPULATION			ANNUAL GROWTH RATE		
	1991[1]	2006[1]	2006[2]	1991-2006[3]	2006-2016[4]	1991-2016[4]
Ibadan NE	275,627	331,444	347,143	1.2%	0.5%	0.9%
Ibadan N	302,271	308,119	339,410	0.1%	1.0%	0.5%
Ibadan NW	147,918	154,029	155,239	0.3%	0.1%	0.2%
Ibadan SE	225,800	266,457	296,827	1.1%	1.1%	1.1%
Ibadan SW	277,047	283,098	368,141	0.1%	2.7%	1.1%
Inner LGAs	1,228,663	1,343,147	1,506,760	0.6%	1.2%	0.8%
Akinyele	140,118	211,811	625,542	2.8%	11.4%	6.2%
Egbeda	129,461	283,643	755,102	5.4%	10.3%	7.3%
Ido	53,582	104,087	843,540	4.5%	23.3%	11.7%
Lagelu	68,901	148,133	588,533	5.2%	14.8%	9.0%
Ona Ara	123,048	265,571	818,017	5.3%	11.9%	7.9%
Oluyole	91,527	203,461	880,215	5.5%	15.8%	9.5%
Outer LGAs	606,637	1,216,706	4,510,949	4.7%	14.0%	8.4%
Ibadan	1,835,300	2,559,853	6,017,708	2.2%	8.9%	4.9%

1. National Censuses.
2. Consultants' estimate, 2016.
3. Intercensal growth rate.
4. Growth rates using Consultant's 2016 estimate.
Source: 1991 and 2006 Censuses, Consultants' estimates, 2016.

The headline finding from Table 2.7 is that the pattern of population growth in Ibadan since 1991 is essentially the same using either the 2006 or 2016 data, namely that virtually all the increase in population has occurred in the Outer LGAs. This is to be expected given that the inner LGAs were already very densely populated in 1991 and thus had very limited capacity to accommodate new population growth. This consistency is maintained in all inner and all outer LGAs in each of the three series of growth rates. Furthermore, the growth rates for the inner LGAs are of a similar order of magnitude for 1991-2016, 2006-2016 and 1991-2016.

On the other hand, population levels and associated growth rates for the outer LGAs vary considerably and as a corollary, so does the overall growth rate for Ibadan. The divergence in growth rates for the outer areas is particularly extreme in relation to the 2006 results but they are also substantially higher than the 1991-2006 growth rates.

The plausibility of the Table 2.7 growth rates is examined in Table 2.8 along with a comparison of other indicators available from the 1991, 2006 and 2016 data and other sources. In particular, reference is made to the information relating to length of residence in Ibadan obtained during the house occupancy surveys which enables the level of migration to Ibadan since 2006 to be estimated. The key findings from this data are: (i) migrants are concentrated in relatively few areas of the city with few found in the fast-growing peripheral areas;[7] (ii) the level of migration has not been high (around 1.3% annually);[8] and (iii) when combined with the urban rate of natural increase, Ibadan's current growth rate is around 3.5%[9] per annum.

In summary, this analysis shows:

- A consistent pattern of very low growth for the inner areas of Ibadan and very high rates in the outer LGAs - both of which are as one would expect.
- An implausibly low 1991-2006 intercensal growth rate which implies negligible migration, is inconsistent with the equivalent and much higher growth rate for the rest of Oyo state, and contradicts the migration rate estimated from the field surveys for the last 10 years.
- Implausibly high growth rates for 1991-2016 and 2006-2016 which both contradict current information on migration and are much higher than those found in the great majority of developing country cities with comparable populations.
- Similar and plausible trends in house occupancies and average household size.

7 70% of migrants live in around 30% of the 74 survey sub-areas (over half of which are in the high density (core) inner medium density areas); in contrast, under half the survey clusters accommodated only 11% of all migrants.

8 See Diagnostics report (Dar, 2017) for methodology.

9 This is close to the rate used in the NPC/Oyo State projections presented in Table 2.3. The application of this rate to every LGA is however untenable given the trend of much higher growth in the outer LGAs.

Table 2.8: Comparison of Ibadan's Population Growth and Indicators: 1991, 2006 and 2016

ANNUAL GROWTH RATE					COMMENTS
1991-2006 (intercensal): 2.2%					Low and unlikely: this growth rate is much lower than the equivalent rate for the rest of Oyo state which would mean that highly urbanised Ibadan grew at a slower rate than the less urbanised areas of the state; this is counter-intuitive. Secondly, given a rate of natural increase in urban areas of around 2.2%, this implies negligible migration which is both counter-intuitive and inconsistent with the migration rate of 1.3% obtained from the household surveys.
2006 (census) and 2016 (masterplan): 8.4%					Very high and implausible: growth rate is extremely high and implies a doubling of population in 5 years. This is inconsistent with the current overall growth rate of 3.5% (RNI: 2.2%, migration: 1.3%). Analysis of the UN's city database1 also reveals extremely few (under 20 out of over 230) instances of cities in developing countries with populations of c. 2.5 million with 10 year growth rates greater than 5%, let alone 8%.
1991 (census) and 2016 (masterplan): 4.9%					High and unlikely: this growth rate implies a net migration rate of over 2.5% which is not borne out by migration data from the Consultants' surveys. UN growth rates for Ibadan prior to 1991 (3.8%) and 2015-2030 (3.7%)1 are also substantially lower, but are comparable to the current growth rate of 3.5%. A growth rate of almost 5% is also high relative to the increase in Ibadan's total built-up area over the last 30 years - around 2.4% per annum;2 this runs counter to the worldwide trend whereby urban densities tend to decrease over time. Finally, under 10% (out of 190) of developing country cities with populations of c. 1.8 million had 20 year growth rates in excess of 5%, only 3 of these were in Africa.
OTHER INDICATORS		**1991[4]**	**2006**	**2016**	**COMMENTS**
Occupants per house[3]		12.4	-	15.7	Plausible: implies increased densification in the inner LGAs. Increase (c. 27%) is very similar to increase in population (c. 22%). Both imply little increase in the number of new dwellings in these areas which is consistent with a lack of available sites for infill development and observations during field surveys.
Average Household size	Inner	4.7	3.8	4.2	Plausible: consistent with NDHS5 data for urban Nigeria which show a decline from 2003 to 2008 (4.7 to 4.1) and a small increase to 2013 (4.2). 2016 values of 4.4 (masterplan consultants) and 4.2 (NDHS) are also very similar.
	Outer	-	4.3	4.6	
	Ibadan		4.0	4.4	

1) Consultants' analysis of UN data: UN, Department of Economic and Social Affairs, 2014, 2014 revision of the World Urbanization Prospects, New York; https://esa.un.org/unpd/wup/CD-ROM/
2) UN Habitat/New York University/Lincoln Institute, 2016, Atlas of Urban Expansion 2016 edition; http://atlasofurbanexpansion.org/cities/view/Ibadan
3) 1991/ 2006: National Census; 2016: Masterplan Consultants.
4) Relates to 5 inner LGAs only as data for outer LGAs is not available for 1991. 2016 indicators have been adjusted accordingly. No comparable data for 2006.
5) Nigeria Demographic and Health Surveys 2003, 2008 and 2013.
Source: Various, see above.

There are two possible reasons for the inconsistencies in overall growth rates. The first is that the 2016 population estimate of 6 million is a substantial over-estimate. The second is that the population of the outer LGAs was under-counted in either or both the 1991 and 2006 Censuses.

The methodology used to estimate the 2016 population has been extensively reviewed and double-checked along with the results and migration estimates. All are considered to be robust, and as mentioned above, comparable indicators exhibit a high degree of consistency with census and other data (e.g. the NDHS surveys). More importantly, the derived pattern of growth (very low in the Inner LGAs and very high in the outer areas) is exactly as one would expect. Furthermore, stakeholder discussions and anecdotal evidence support rather than contradict a population of 6 million with several commenting that existing projections were significant under estimates. It is also noteworthy that there is a similar divergence in Lagos where the State's population estimate, 17.5 million, is far higher than the 2006 Census result of 9.1 million.

On the other hand, enumerators in 1991 and 2006 would not have benefited from the level of mapping available to the masterplan consultants in 2016, especially in the outer LGAs where huge amounts of new houses had been constructed in areas where little had existed before. Allied to difficulties in making contact with working households and tight work programmes, an already challenging task would have become even more difficult for enumerators – thus increasing the likelihood of an undercounting.

The result is a firm belief therefore that a 2016 population for Ibadan of 6 million should form the basis for the preparation of the Masterplan, and the associated current growth rate of c. 3.5% annually provides a sound basis for the formulation of population projections for the next 20 years.

2.5.3 Population Projections

Three projection scenarios have been formulated for Ibadan's population growth over the next 20 years (low, medium and high). All scenarios are based on: (i) a current population (2016) for Ibadan of 6 million; (ii) the current urban RNI – 2.2% per annum; (iii) incorporation of the UN's projected decline in Nigeria's rate of natural increase, 0.1% in each 5 year period, for the next 20 years; and (iv) adopt as starting point the current growth rate of 3.5%. The scenario specific assumptions are the following:

- Low projection: migration continues at half the current annual rate of 1.3%, i.e. 0.6%.
- Medium projection: migration continues at the current rate of 1.3% annually.[10]
- High projection: migration will be 50% higher than the current rate, i.e. 1.9% annually.

The resultant projections are shown in Table 2.9.

The assumption of reduced migration over the next 20 years is considered incompatible with the likelihood that Ibadan, as one of Nigeria's most important cities, will continue to attract migrants from neighbouring states and the rest of the country. At the same time, a significant increase in the migration rate (the 'high' projection) will require a major and sustained acceleration of Ibadan's economy over the next 20 years, which based on the economic assessment of the Ibadan City Masterplan, is considered unlikely.

Hence, the medium projection scenario is preferred. A population for Ibadan in 2036 of around 11.6 million is therefore used for preparing the Masterplan. On this basis, the population of the city will increase by over 90% over the period from 2016 to 2036 at an average rate of 3.32% annually.[11] It should be noted that this rate is virtually identical to the 3.35% growth rate currently used for the National Population Commission/ Oyo State projections. It is also of the same order of magnitude as the UN's average growth rate of 3.7% for 2015 to 2030. This rate of growth entails an average annual population increase of around 277,000 compared with around 210,000 at present.

Table 2.9: Ibadan: Population Projections, 2016-2036

PROJECTION SCENARIO[1]	POPULATION (000S) AND ANNUAL GROWTH RATES						INCREASE 2016-2036					
	2016	AGR	2021	AGR	2026	AGR	2031	AGR	2036	AGR	%	POP.[2]
Low	6,018	2.8%3	6,899	2.7%	7,871	2.6%	8,936	2.5%	10,095	2.6%	68%	204
Medium	6,018	3.5%	7,137	3.4%	8,424	3.3%	9,894	3.2%	11,565	3.3%	92%	277
High	6,018	4.1%	7,346	4.0%	8,925	3.9%	10,791	3.8%	12,985	3.9%	116%	348

1) For assumptions, see text above.
2) Average annual increase in population in 000s.
3) = Rate of natural increase + migration rate.
Source: Consultants' Estimates, 2017.

10 Note that assuming a constant migration rate still means that the number of migrants arriving will increase every year.
11 UN, 2014, op. cit.

2.5.4 Spatial Distribution of the Population

Based on the above parameters, a population capacity study has been conducted to estimate the population per LGA that can be accommodated along with their respective land area requirements. The following spatial parameters were taken into consideration:

- Developable land available for accommodating the projected population.
- Density assumptions to determine the capacity of developable land for the masterplan.

The following methodology has been used for calculating this population capacity:

- Using the results of the detailed household survey, a plot per hectare density value for each residential typology has been calculated.
- Based on the average number of households per plot and average number of people per household, a population density has been calculated for each residential typology.
- These population densities were factored into the total area for each of the residential types taking into consideration the net developable area which excludes roads, open space and other land uses.

Table 2.10 identifies the estimated population capacity of existing and expansion areas for each of Ibadan's LGAs.

Table 2.10: Ibadan Population 2016 and 2036

LGA	GROSS AREA (HA)	POPULATION 2016	POPULATION 2036
Akinyele	9,408	625,542	1,158,213
Egbeda	11,281	755,102	1,653,746
Ibadan North	1,476	347,143	348,878
Ibadan North East	868	339,410	341,107
Ibadan North West	587	155,239	156,015
Ibadan South East	997	296,827	298,311
Ibadan South West	1,590	368,141	369,982
Ido	17,104	843,540	2,264,583
Lagelu	8,717	588,533	1,140,907
Oluyole	22,549	880,215	2,683,993
Ona Ara	7,420	818,017	1,194,678
TOTAL	**81,996**	**6,017,708**	**11,610,415**

Source: Consultant's Analysis, 2016.

2.5.5 Socio-Economic Context

- The population is growing rapidly (3.32% per annum) and is estimated that over the next 20 years will increase by almost 90% to reach nearly 11.6 million by 2036.
- A major outcome of the rapid population growth is the substantial pressure on social and urban infrastructure which has resulted in large gaps in provision across the city.
- Retail, sales and related activities form the predominant employment sector at 40% of the overall workforce, followed by professional and technical services at 16% of the workforce. This highlights Ibadan's position as a regional hub for trade and markets. The retail and wholesales sector is relatively more concentrated in the Inner Area of Ibadan where it accounts for 40%-46% of employment.
- Agriculture and related activities, mostly concentrated in the outer urban and rural areas account for 39.18% of total employment.
- The city's manufacturing sector has stagnated in recent years as pressures on infrastructure and services have deterred large companies from setting up operations in Ibadan, in some cases even relocating to other commercial centres. This exacerbates the problem of insufficient job opportunities among base industries for the local working population which seeks alternative opportunities in the informal sector.
- Ibadan has a large and vibrant Micro, Small and Medium enterprises (MSMEs) sector (formal and informal businesses). There is a need for greater support to this sector to promote scaling up of enterprises both in terms of access to finance and in providing the necessary infrastructure.
- Similarly, the expansion of the peri-urban area and economy also throws up challenges by increasing the pressure on existing public services, infrastructure and markets. There is a need to ensure that peri-urban activities are usefully integrated into spatial planning and economic development frameworks to maximise the income and employment opportunities it presents for the urban population.
- Given the small size of the business/professional services and manufacturing sector relative to other cities in Nigeria, there is furthermore a case for harnessing Ibadan's strong educational and research institutions to increase their interface with the wider economy and promote diversification towards value-added manufacturing, agri-business and commercial services.

2.5.6 Housing Provision

- There has been limited contribution in the delivery of formal housing with virtually no public sector or formal private sector developments having been initiated in the last 20 years. Aside from their failure to be an important contributor to urban growth, formal processes, although having the potential to provide high standard development and security of tenure, tend to follow cumbersome, drawn out, costly, unrealistic and unaffordable development standards, and are largely unknown to many sections of the population.
- The dominance of urban development by informal processes, nearly all of which have a degree of legitimacy under customary/ traditional practices, are almost a mirror image of the formal processes: they provide most of the land and largely proceed on willing buyer/ willing seller principles, while they have procedures that are generally understood by both.

2.5.7 Housing Characteristics

- Housing conditions in Ibadan vary considerably. Five distinctive housing typologies have been identified based on current residential densities (refer to Figure 2.4). It is based on two primary sources: the comprehensive information provided by the 2006 Census, and the surveys undertaken by the Consultants as part of the data collection exercise. Table 2.11 summarises the housing typologies and presents their housing characteristics, physical infrastructure, tenure and occupancy levels.
- Although limited, a number of projects to improve the building conditions in existing high density areas were carried out in the 1990s with World Bank support and finance. This included upgrading three districts of the core area, namely Agugu, Mokola and Yemetu. The main components were roads and drainage but also included sanitation, health and education facilities. Since 2000, there have been no other similar upgrade projects in the city.

Table 2.11: Housing Characteristics in Ibadan, 2016

TYPOLOGY	LOCATION	GENERAL DESCRIPTION	PHYSICAL INFRASTRUCTURE	TENURE	OCCUPANCY LEVELS
High density	Central/ traditional core; average net residential density: 31 houses per hectare.	Poorly defined road network with many properties inaccessible except on foot; poor condition of buildings many of which are mud brick construction with plaster rendering. Over 80% are of Brazilian type construction.	Roads and alleyways in poor condition – mostly unpaved or deteriorated asphalting. Reliance on groundwater from wells (often not all year)/ boreholes; piped water nonexistent or non-functioning. Poor sanitation with majority of houses having no facilities or non-functional latrines.	Over 80% of households are renters mostly in rooms in Brazilian type buildings. The owner is present in 60% of houses. High turnover: 2/3 households have arrived in last 10 years, most of whom are renters.	Very high averaging 17 persons and 4 households per house. Over 75% of houses are multi-occupied. Average household size (AHS): 4.2.
Medium density	Outer parts of inner LGAs and inner parts of outer LGAs. Average houses per hectare: 15 (21 – inner; 12 – outer).	The dominant typology with over half the total housing stock and population. Buildings mostly built in concrete and in reasonable condition. Around a third are Brazilian type. Fully built-up with little infill potential.	Generally accessible by vehicle but roads almost entirely unpaved and in poor condition. Almost total reliance on wells/ boreholes. Sanitation through pit latrines or WC systems. Little provision of public schools or health facilities.	77% of households are renters. Around half the houses are owner occupied with no tenants and owner is present in 80% of houses. High turnover with around 75% arriving in the last 10 years (owners and renters).	High occupancies averaging 13 persons and over 3 households per house; AHS: 4.3. 60% of houses are in multi-occupation accounting for over 80% of all households.
Low density	Mostly near the edge of core area and within inner LGAs. Houses per hectare: 10	Represent only 6% of total housing stock with 3% of population. Generally high income. Good standard construction.	Easily accessible by vehicle on good/ reasonable standard paved roads. Greater availability of piped water or from boreholes. WC toilets almost universal.	Owners are present in almost every house. Under 40% of households are renters.	Low occupancies: <7 people and <2 households per house; AHS: 4.0. Under 1/3 houses are multi-occupied.
Peripheral	Outer LGAs adjacent to medium density areas along virtually entire perimeter of main built up area. Houses per hectare: 7.	Mostly good standard, 1 floor construction. Many recently built houses and many under construction. Areas only partly built-up so significant potential for new development.	Most accessible by road but condition is very poor – almost all are unpaved and many have not been properly graded. Water supply from wells/ boreholes or neighbours. Sanitation: latrines or WCs (sometimes under construction). Negligible provision of health, education or other community facilities.	90% of houses are owner-occupied; 30% of households are renters.	Low occupancies: <8 people and <2 households per house; AHS: 5.3 persons. Under 20% of houses are multi-occupied.
Rural villages	Outer parts of Ibadan accommodate less than 5% of total population.	Low density/ dispersed settlement pattern. Some new construction by existing families and newcomers. Considerable potential for increased development.	Accessible by road but often unpaved and in poor condition unless located near main roads. Reliant on groundwater. Schools and clinics present in larger settlements.	Mostly owner occupied.	Multi-occupation likely to be limited.

Source: Consultants Survey, 2016.

The key findings from Table 2.11 are:

- Infrastructure is deficient throughout Ibadan with conditions being worst in the traditional core due to the poor state of many buildings and very low levels of vehicle accessibility.
- Multi-occupation and high occupancy rates predominate in all medium and high density areas as do high levels of renting. These are all indicators of a considerable gap between housing supply and demand – although there is little to suggest that Ibadan differs significantly in this regard from other Nigerian cities. These areas are, to all intents and purposes, fully built-up, implying that there is little potential for significant new development in the future.
- The peripheral areas have very different characteristics – substantial new construction, much higher levels of owner occupation and much less multi-occupation / renting. However, these characteristics are likely to change over time as these areas develop and they gradually take on the characteristics of adjacent medium density areas. In the short and medium-terms, they will be Ibadan's main development areas.
- In the longer term, growth will increasingly be located in the outer rural areas of the city as today's peripheral areas become fully developed.

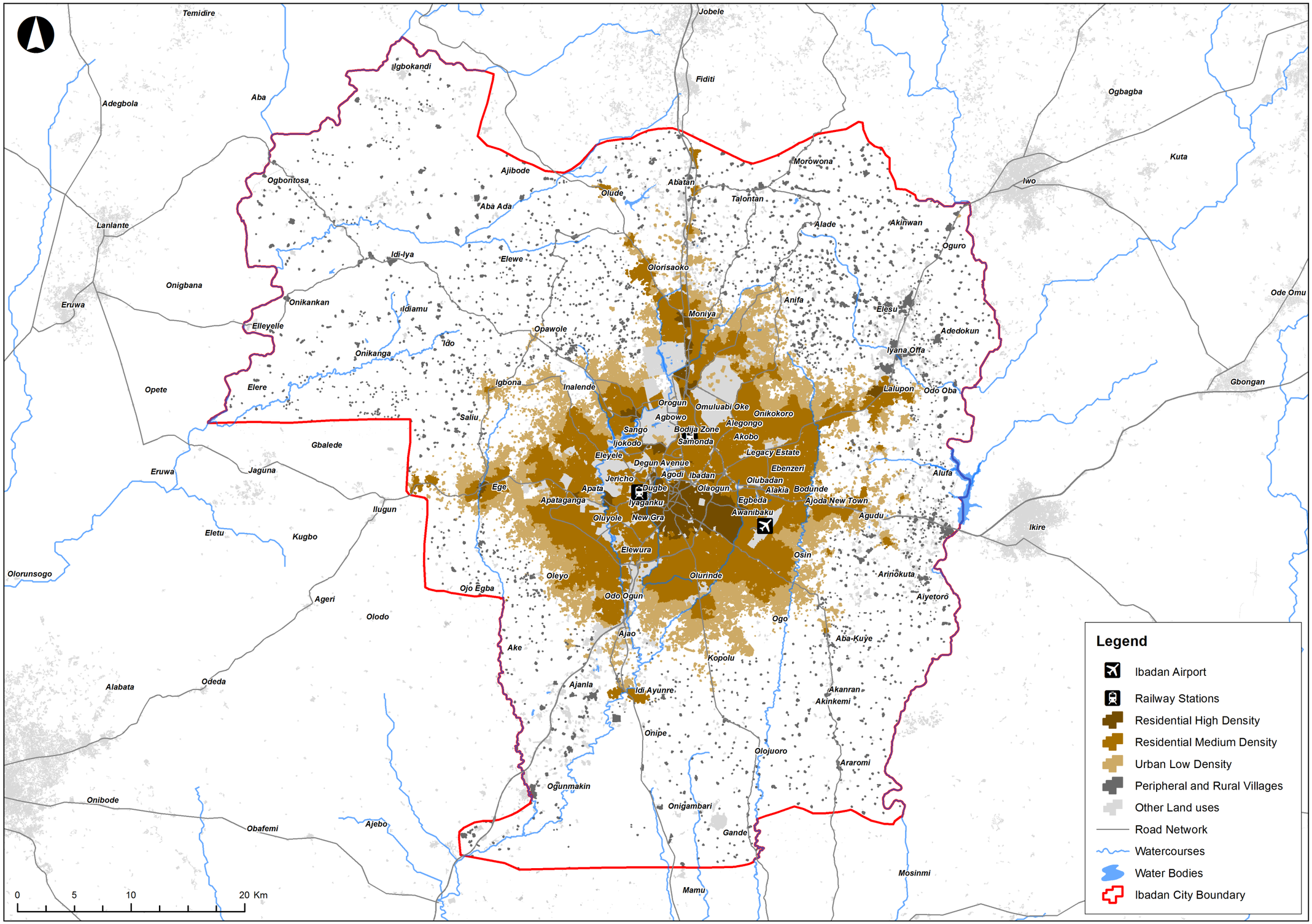

Figure 2.4: Residential Density Distribution

2.5.8 Poverty Indicators

This section considers the issue of poverty within Ibadan. The World Bank uses a widely recognised poverty line of $1.90 per person per day. In Nigeria, the latest figures from 2009 indicate that 53.5% of the population was living on less than $1.90 per person per day. Such data is not available at a suitable geographic scale that would enable this measure to be used to assess poverty within different parts of Ibadan.

The United Nations Development Programme (UNDP) recognises that poverty can be multi-dimensional and influenced by a range of indicators. Within its Multidimensional Poverty Index, the UNDP uses indictors that fall into the following dimensions of poverty:

a) Health,

b) Education, and

c) Standard of living.

The Diagnostics Report[12] has obtained some data relevant to standard of living that has been geographically aggregated so as to be related to specific areas of the city. Set-out below is a description of the findings for each of these. Figure 2.4 also shows the location of identified slum areas in Ibadan, which is a sign of where poverty may be more extreme.

High Density Areas (within Inner Ibadan)

The High Density Areas are predominantly within the defined Core Area of the city. It is within these areas where housing quality is at its lowest, with 49% considered to be in 'poor' condition. Inner Ibadan has the highest access to 'improved sources' of water and 'improved toilet facilities,' although this generally applies to the Medium Density Areas as opposed to High Density Areas. 72% of households within Inner Ibadan have an electricity supply. The High Density Areas have the highest number of households per residential building (4.0). The High Density Areas are also the location for a number of identified slum areas.

Medium Density Areas (part Inner Ibadan, part Outer Ibadan)

Housing quality within the Medium Density Areas is significantly higher than in the High Density Areas, with only 18% considered to be in 'poor' condition. As mentioned above, the Medium Density Areas within Inner Ibadan have the highest access to 'improved sources' of water and 'improved toilet facilities.' The Medium Density Areas within Inner Ibadan have higher access to a household electrical supply than those areas within Outer Ibadan (72% compared to 52%). The number of households per residential building is slightly lower in the Medium Density Areas than the High Density Areas (3.2). The Medium Density Areas are the location for a number of identified slum areas.

Low Density Areas (within Outer Ibadan)

Within the Low Density Areas, housing quality is highest with only 9% considered to be in 'poor' condition. Outer Ibadan has the lowest access to 'improved sources' of water and 'improved toilet facilities'. Access to a household electrical supply is lowest in Outer Ibadan (52%). In the Low Density Areas, the number of households per residential building is significantly lower than elsewhere at 1.7. There are no identified slum areas within the Low Density Areas.

Summary of Findings

The commentary above indicates that all areas are subject to some degree of poverty in respect of the standard of living. The High Density Areas have the lowest quality of housing and and highest number of households per residential building, which is a concerning combination of factors. The Low Density Areas have the highest quality of housing and lowest number of households per residential building. However, access to the basic utilities of improved sources of water, improved toilet facilities and a household electrical supply is low in the Low Density Areas. The Medium Density Areas appear to be subject to a lesser degree of poverty, although there are differences between the Inner and Outer parts of these areas. For example, the parts within Inner Ibadan have better access to basic utilities. The identified slum areas are spread evenly across the High and Medium Density Areas, which is again an indication of poverty being relatively widespread across different parts of the city.

12 Dar, 2017.

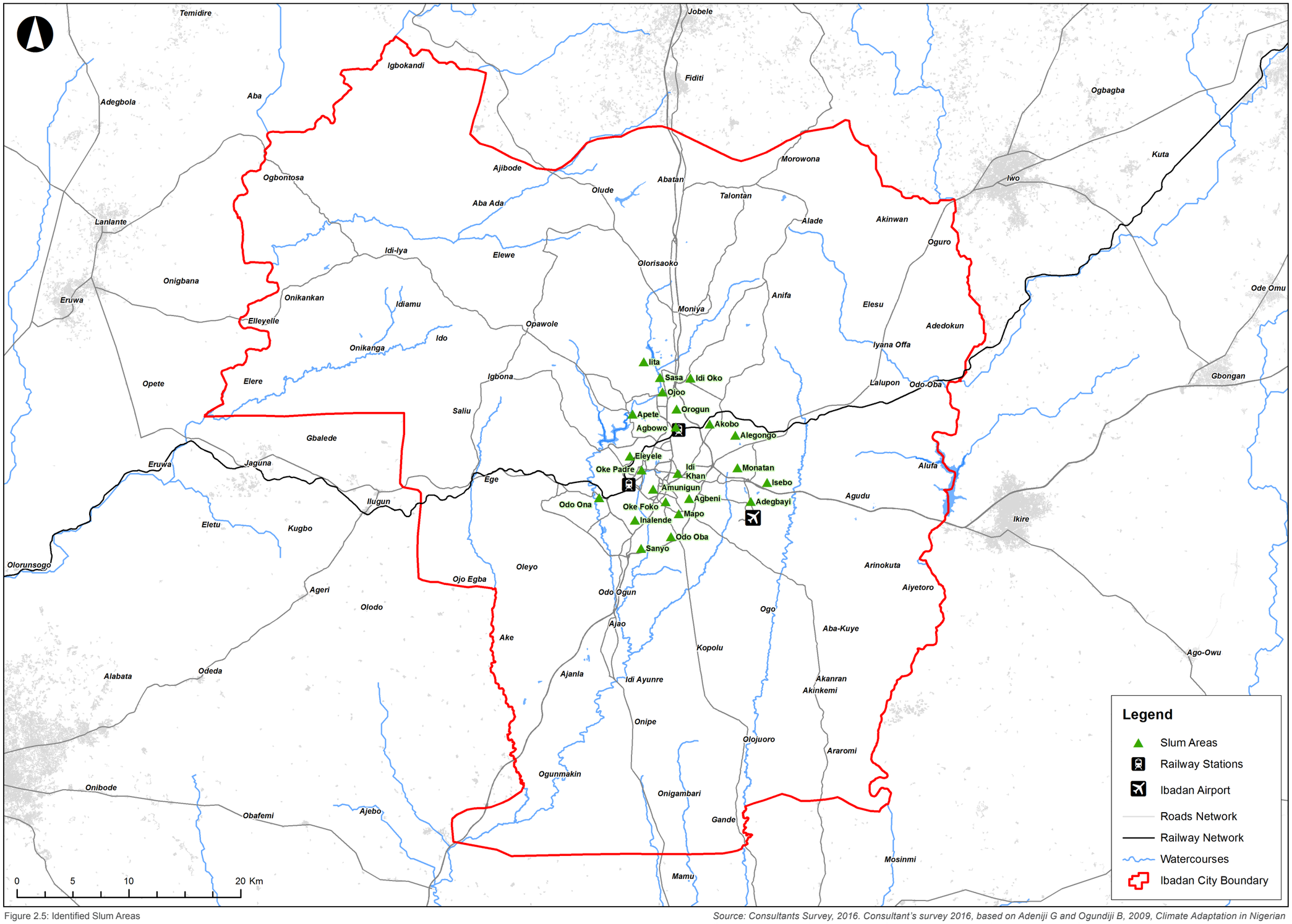

Figure 2.5: Identified Slum Areas

Source: Consultants Survey, 2016. Consultant's survey 2016, based on Adeniji G and Ogundiji B, 2009, Climate Adaptation in Nigerian Cities: Regularising Informal and Illegal Settlements in Ibadan: Fifth Urban Research Symposium.

2.5.9 Housing Market Analysis

This section provides a concise overview of the characteristics of the housing market in Ibadan, reflecting contexts that are specific to both the city, Oyo State and Nigeria more generally. Factors affecting key market variables such as supply of land/housing, demand, access to finance and affordability as well as other relevant market behaviour are considered here.

Housing providers

A large share of homes in Nigeria (and most likely in Ibadan) are being developed informally: by the home-owner itself, but also more marginally by cooperative societies providing building construction services. Formal providers, as described by Makinde (2014), comprise:

- Private developers, which target mainly middle to high incomes, due to the complexity and high cost of purchasing land for housing delivery;
- Housing corporations, active at the state level and operating privately, albeit receiving their main funding from government allocations. The State housing corporations mainly target middle incomes, as they require payment in cash or in instalment during construction; and
- Non-governmental organisations, which target the informal sector and low income groups.

Housing finance

Similarly to the housing provision system, housing finance for home owners in Ibadan is dominated by the informal sector, which is consistent with the World Bank (2011) claim that, South Africa and Botswana excepted, less than 40% of people in Africa have access to formal finance sources (Omola, Ayoride, 2016). Informal financing can take many forms such as thrift, money lenders, village development schemes, etc, and is mostly uncoordinated and scattered (Adedeji, Abiodun, 2012). In Ibadan however, Omola and Ayoride (2016) note that informal housing finance mainly refers to cooperative societies, personal savings, and to a lesser extent inheritance.

There are no less than 190 cooperative societies in Ibadan that are registered with the State Government and list housing provision as their main priority (Adeboyejo, Oderinde, 2013). These cooperatives use the granting of small loans (usually up to ₦900,000 – US $2,500) as their preferred strategy, helping members to finance parts of the housebuilding process such as the roofing or ceiling. These small societies are themselves funded by a mixture of loans interest, members' savings, investment revenues and development levies.

Formal housing finance comprises a number of institutional sources such as commercial banks, insurance companies, State housing corporations, the Federal Mortgage Bank of Nigeria, and mortgage institutions (Adedeji, Abiodun, 2012). In addition, the National Housing Fund (NHF), established in 1992, called for 2.5% of every workers' earnings to be mandatory placed into the Fund, which would in turn be mobilised to provide loans and affordable homes. In Ibadan, as stated by Omola and Ayoride (2016), the home owners using formal housing finance turned in priority towards workplace loan, and more marginally towards financial institutions and mortgage loans.

2.5.10 Challenges of Housing Provision

Policy and Governance Challenges

One of the main challenges associated with housing and affordable housing provision in Ibadan, but more widely in Nigeria, is the lack or inadequacy of clear, implemented and monitored guidelines at the national, state and municipal levels. The 1978 Nigerian Land Use Law, by vesting the land in the Governor of each state and assigning him the duty to grant 'rights of occupancy,' has partly prevented or slowed down opportunities to establish consistent and long-term urban plans (Adelekan, 2016). In fact, the Land Use Law has made titling and land registration processes increasingly bureaucratic, which are often delayed and very costly, and in turn contribute to increase the land price on the formal market (Makinde, 2014). High land prices, the complex registration process and limited areas of available land for housing has resulted in deterring private developers from making efforts to deliver affordable housing, receiving despite many government incentives.

Other Policy Challenges

Similarly, although the 2011 National Housing Policy has, on paper, adopted the idea of mass housing as a solution to tackle the housing crisis and aimed at constructing no less than one million homes per year, implementation has yet to be seen (Akinyode, 2016). The National Housing Fund (NHF) has also produced deceiving results, as in 2004 when the ratio of beneficiaries to contributors barely reached 0.12% (Adedeji, Abiodun, 2012). Sources suggest that the loans offered through the NHF have too restrictive conditions, preventing a large share of potential beneficiaries to obtain them.

Duplicity of the layers involved in the decision-making of housing provision is another issue to highlight. In Ibadan, no less than 16 institutions, three state agencies and two federal agencies are involved at various stages of the housing market processes at various stages. Lack of coordination between those bodies and frequent duplicity of their responsibility result in mismanagement and impact the housing market and the urban development of the whole city (Makinde, 2012). In addition, the creation of the LGAs in Ibadan has complicated the decision-making and slum management processes at the local scale, since some slums are spread across boundaries and thus require the focus of two or more relevant LGAs to agree on their management.

As a result of those challenges, provision of new housing has become more difficult, and planning regulations are often not enforced,13 which in turn reinforce most of the urban problematics that the policies were originally trying to solve. In addition, it also creates for residents a sense of 'disdain' and 'apathy' towards planning institutions, as highlighted by Arimah and Adeagbo (2000).

Lack of Access to Finance

Low income residents of Ibadan struggle to access housing finance. As mentioned previously, the formal finance system is restricted and mainly provides for wealthier populations. Although informal finance is understood to be available in Ibadan for these low income groups, research suggests that bodies such as cooperatives are likely to be used by the most educated of the low income groups, who understand the added value and importance of these mechanisms (Omola, Ayoride, 2016). This means that for some segments of the population, access to finance remains a crucial issue in terms of housing strategy, despite a plurality of informal systems in the local area.

13 For example, barely 10% of houses comply with building regulations in Mapo (core area) (Adelekan, 2016).

Limited Opportunities for Home Ownership

One of the other main challenges of the Ibadan housing market is the difficulty for residents to become home owners. The cost of building materials in particular, when coupled with the low income of the households and the lack of access to finance, is putting a major barrier to home ownership, as well as the necessity to buy the land through 'intermediaries' as costs associated with getting an occupancy certificate signed by the State Governor are too high (Adeyeni, Olayiwola, Oladehinde, 2016). The limited opportunities for home ownership have two main implications:

- The owner occupiers are on average older (mostly over 40 years old), long-term residents of Ibadan, compared with a rental market hosting younger and poorer populations (Jaiyeoba, 2011).
- Limited home ownership is putting greater pressure on the demand for the rental market.

Opportunistic Behaviour from Landlords

Increased pressure on the demand for rental housing contributes to the imbalance between demand and actual supply of rented units. Owing to strong migration inflows from the rest of Oyo state and other parts of the country, the demand for rental housing has increased, in parallel with rising land prices (Akinyode, 2016). As a consequence, low income households are struggling to find decent rental housing, especially given the growing levels of poverty. This is especially true in the city centre, as proximity to the main job opportunity locations attracts a large share of young, low skilled labour.

This in turns allows for opportunistic behaviours to develop on the supply side of the housing market, as noted by Akinyode (2016). In particular, landlords living in Lagos have a tendency to project the rental value of their Ibadan property in accordance to their own situation and need, or sell them to be converted for commercial activities, which restricts housing supply even further in the city. In addition, some indigenous populations, inheritors of the central core land plots, rely on the rent collection as a mean of subsistence, and therefore tend to increase rental values in accordance to their own needs.

2.5.11 Crime

Data has been obtained for 15 of the 23 police stations within Ibadan in relation to the number of offences reported between January and October 2017. This is shown in Table 2.12 and displayed spatially within Figure 2.5.

The data shows a larger number of offences are reported in proximity to Ibadan Rail Station and the commercial uses at Dugbe (which are served by Iyaganku Police Station), and Bodija Rail Station and the commercial uses at Bodija Market (served by Sango and Bodija Police Stations).

This trend is seen elsewhere in the world as the areas around rail stations can be hotspots for crime. Due to the high amount of money circulating and being exchanged within commercial areas, these can also often be targets for criminals and therefore subject to a higher number of offences.

Table 2.12: Crime Data Reported for Ibadan

NO.	NAME OF POLICE STATION	TOTAL OFFENCES REPORTED (JANUARY - OCTOBER 2017)
1	Police Post	No data
2	Orita Challenge Police Station	34
3	Toll Gate Divisional Headquarters	8
4	Oluyole Police Station	0
5	The Nigerian Police (Apata)	0
6	Agugu Divisional Police Station	0
7	Egbeda Police Station	48
8	Divisional Police Headquarters (Agbele/Elekuro)	No data
9	Sango Police Barracks	79
10	Kajorepo Express Police Station	0
11	The Nigerian Police Station (Monatan)	0
12	Iyana Olapa Police Station (Iyana Offa)	12
13	Nigerian Police Station	No data
14	The Nigerian Police Station	No data
15	Iwo-Road Police Barracks	No data
16	Apete Police Station	28
17	Alagbayun Police Post	No data
18	Bodija Police Station	32
19	Ibadan Police Headquarter	Assumed to be administration only
20	Alakia Airport Police	32
21	Iyaganku Police Station	106
22	Testing Ground Police Barrack	No data
23	Eleyele Police College	0

Source: The Nigeria Police, Oyo State Command, 2017.

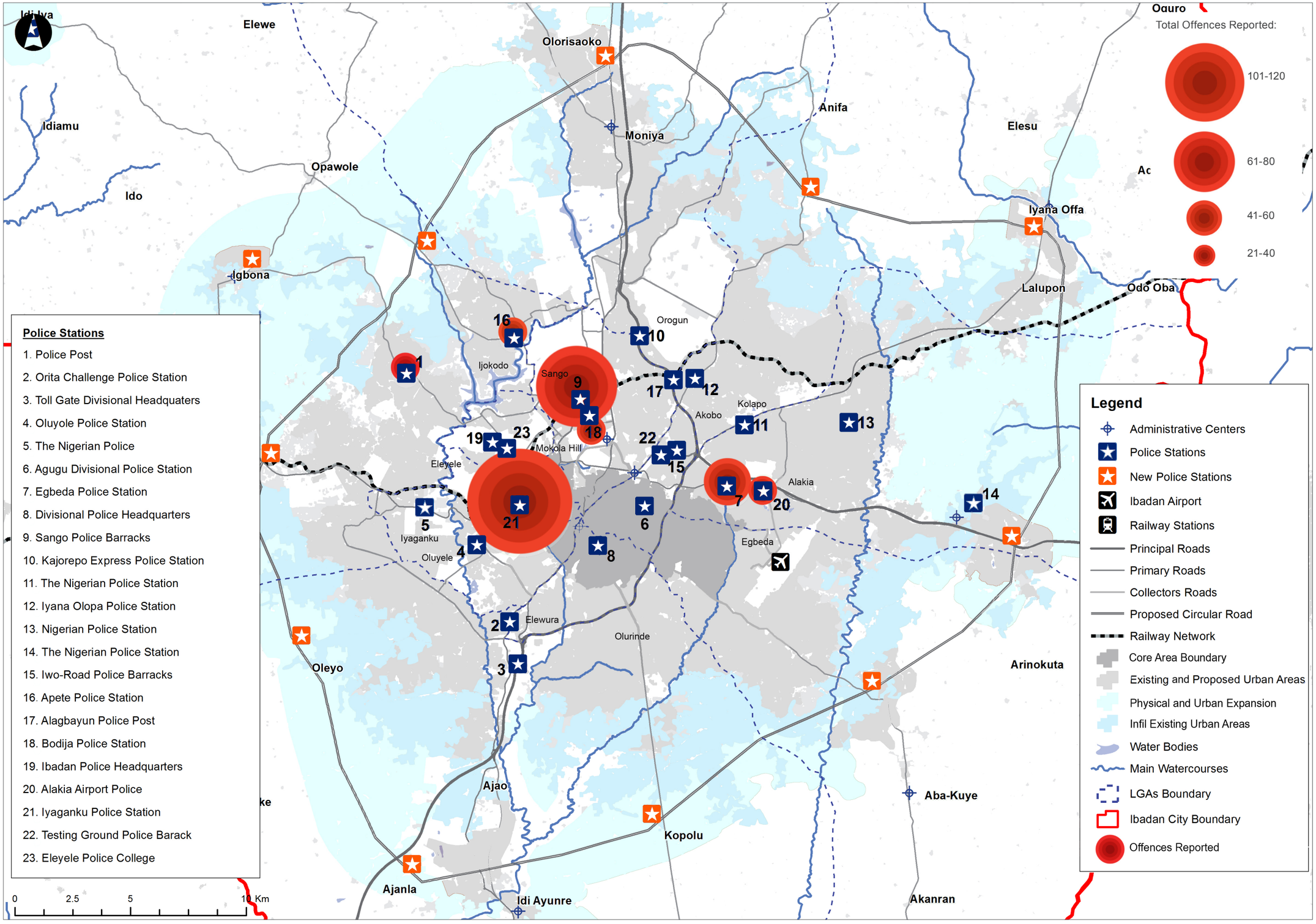

Figure 2.6: Spatial Distribution of Crime Offences in Ibadan

Source: The Nigeria Police, Oyo State Command, 2017.

2.5.12 Social Infrastructure

Education

The latest available data provided by the Oyo State Ministry of Education, Science and Technology set out in Table 2.13 indicates the statistics for public and private primary schools and the number of public secondary schools across the 11 LGAs. It shows that there are 2,350 primary schools which include 1,443 private primary schools and 907 public primary schools, and 337 public secondary schools. There are no pupil numbers provided in relation to this data.

However, another set of statistics sourced from the Oyo State Ministry of Education, Science and Technology in 2016 indicate very high pupil to classroom ratios within the secondary schools. There is no information provided that indicates whether or not some schools operate a two shift system, but even if they do, the pupil to classroom ratio is very high.

Table 2.14 presents the statistics for Federal and private Universities, State and Private Monotechnics/Polytechnics and private Colleges within Ibadan. In summary, there is 1 Federal University in Ibadan North, 2 private Universities, 3 State Monotechnics/Polytechnics which includes 2 in Ibadan North-West and 1 in Ido, 8 private Monotechnics/ Polytechnics and 3 private Colleges.

There is insufficient information available to identify the distribution of and map all existing education facilities across Ibadan.

Table 2.13: Existing Primary and Secondary Schools in Ibadan

LGA	NO. OF PRIVATE PRIMARY SCHOOLS	NO. OF PUBLIC PRIMARY SCHOOLS	NO. OF PUBLIC SECONDARY SCHOOLS
Akinyele	102	123	35
Egbeda	143	76	29
Ibadan North	214	74	42
Ibadan North East	101	72	35
Ibadan North West	90	42	13
Ibadan South East	110	63	40
Ibadan South West	169	86	36
Ido	170	76	21
Lagelu	119	83	26
Oluyole	128	110	27
Ona Ara	97	102	33
TOTAL	**1,443**	**907**	**337**

Source: Ministry of Education, Science and Technology, 2016.

Table 2.14: Existing Universities, Monotechnics/Polytechnics and Colleges in Ibadan

LGA	NO OF FEDERAL UNIVERSITIES	NO. OF PRIVATE UNIVERSITIES	NO. OF STATE MONOTECHNIC AND POLYTECHNIC	NO. OF PRIVATE MONOTECHNIC AND POLYTECHNIC	NO. OF PRIVATE COLLEGES
Akinyele	0	1	0	1	0
Egbeda	0	0	0	3	1
Ibadan North	1	0	0	1	0
Ibadan North East	0	0	0	1	1
Ibadan North West	0	0	2	0	0
Ibadan South East	0	0	0	0	0
Ibadan South West	0	0	0	1	0
Ido	0	0	1	0	0
Lagelu	0	0	0	0	0
Oluyole	0	1	0	1	1
Ona Ara	0	0	0	0	0
TOTAL	**1**	**2**	**3**	**8**	**3**

Source: Ministry of Education, Science and Technology, 2016.

Health

The distribution of healthcare facilities across Ibadan is generally uneven, with pockets of unserved areas in Ibadan North, North-West and South-East and South-West LGAs. In the rural areas, the spread is sparse and there are areas with little or no provision. Access to facilities is also impeded by the poor road network.

In isolated settlements, the provision of new permanent health facilities may not be justified on a cost basis. Similarly, improved infrastructure and road access to major towns or commercial centres will assist in improving access to health facilities to all residents of Ibadan.

Information about healthcare facilities has been sourced from the Oyo State Bureau of Statistics (OSBS) and the Oyo Ministry of Health (MOH). Table 2.15 shows primary, secondary and tertiary level health facilities across the 11 LGAs, based on the MOH and OSBS data, which do not always correlate. Data provided by MOH also includes one military and one police hospital, which are operated by the Federal Government and cannot be accessed by the public - it is unknown whether the OSBS data includes these hospitals.

There is insufficient information available to identify the distribution of and map all existing healthcare facilities.

Table 2.15: Existing Public Healthcare Facilities in Ibadan - by LGA

LGA	PRIMARY FACILITIES (OSBS)	PRIMARY FACILITIES (MOH)	SECONDARY FACILITIES (OSBS)	SECONDARY FACILITIES (MOH)	TERTIARY FACILITIES (OSBS)	TERTIARY FACILITIES (MOH)
Akinyele	36	28	1	2		
Egbeda	22	28	1	1		
Ibadan North	15	16			2	3
Ibadan North East	23	24	1	1		
Ibadan North West	15	14	1	2		
Ibadan South East	16	14				
Ibadan South West	22	22	2	2	4	2
Ido	26	24				
Lagelu	21	22	2	2		
Oluyole	26	30	1	1		
Ona Ara	22	23				
TOTAL	**242**	**245**	**12**	**11**	**6**	**5**

Source: Ministry of Health, 2016.

Open Space and Public Recreation

There is little open space and few recreation facilities within the Ibadan built up area. Other than Agodi Gardens, there are no large public spaces. Although maintained to a high standard, Agodi Gardens are restricted to paid entry only. Within residential areas, there are few parks or open areas where residents can play sports or where they can relax. In the rural areas, there are no formal recreation facilities. There are a number of informal open spaces, but they are unevenly distributed across the city and are of insufficient quantity. The Diagnostics Report provides further detail.

2.5.13 Transport

- In terms of strategic connectivity, Ibadan benefits from its location with respect to the national road and rail networks. The Lagos-Ojo Expressway, part of the Trans-African Highway network, passes through the city as does the Lagos-Nguru railway line. The latter is to be upgraded to standard gauge, with the section from Lagos to Ibadan due to be completed by the late 2010s. This will address the current issues of low service frequencies and slow and unreliable journey times. A number of inter-urban bus routes also serve the city while domestic flights to Abuja and, less frequently, Lagos, operate from Ibadan Airport.
- The primary road network serving Ibadan is formed of radial routes converging at the centre of the city, together with a number of lower-order (collector) orbital links between these radials. The main road network is of a good standard, generally dual-carriageway roads with two or three lanes in each direction. Flyovers have been introduced at major junctions to increase junction capacities. The roads are largely in good condition, albeit with some evidence of localised surface deterioration.
- Over the past 10 years, progress has been made in improving traffic management and control on the city's road network. Examples include increasing the numbers of road traffic signs, improving levels of street lighting, the introduction of one-way schemes, and the installation of public transport infrastructure such as bus shelters. Traffic signals have been installed at key 'bottleneck' locations and these are progressively being converted to be solar-powered to provide reliable power supplies and ensure continuity of operation.
- High levels of localised traffic congestion can occur, most often adjacent to areas of more intensive commercial activity. Congestion is mainly caused by the encroachment of retail activities into the roads, high levels of on-street parking, and stopping/manoeuvering by buses and taxis.
- There are no public off-street car parks in Ibadan - most parking takes place on-street, exacerbating the above congestion problems. The Ministry of Transport and Works has identified a number of locations where on-street parking is a particular problem and where off-street car parks are required.
- The Ministry of Transport and Works has an on-going programme of road construction and rehabilitation which includes some 182 individual projects involving approximately 940 km of carriageway, State-wide. The proposal for an outer Circular Road encircling the whole urban area involves the construction of some 110 km of expressway-standard road.
- Public transport within Ibadan is road-based and mainly privately-operated. Urban bus services are operated by Pacesetter Transport Services with a fleet of around 79 buses. Taxis, danfo (minibus), keke napep (three-wheeled vehicles) and okada (motorcycle) also comprise significant components of the public transport provision.
- The State Government has proposals for a light rail system for Ibadan. The Red Line is the first phase of this and is approximately 12 km long running south to north from the Toll Gate area of the Expressway to the Dandaru area of central Ibadan. Construction will be phased. It has been reported in the press that a Memorandum of Understanding has been signed for the construction of the light rail line and that the project is expected to be completed over a three year period.
- High levels of pedestrian activity are observed across the city. Dedicated pedestrian facilities are provided in the form of footways and road crossings, including footbridges. Pedal cycle usage appears to be low and no dedicated infrastructure for cyclists is provided.
- A high speed rail line connecting Lagos to Abuja is planned to pass through Ibadan. The alignment may necessitate a large amount of clearance and complex land acquisition whilst creating a barrier to movement for journeys crossing the rail line, subject to the routing of the final route chosen.

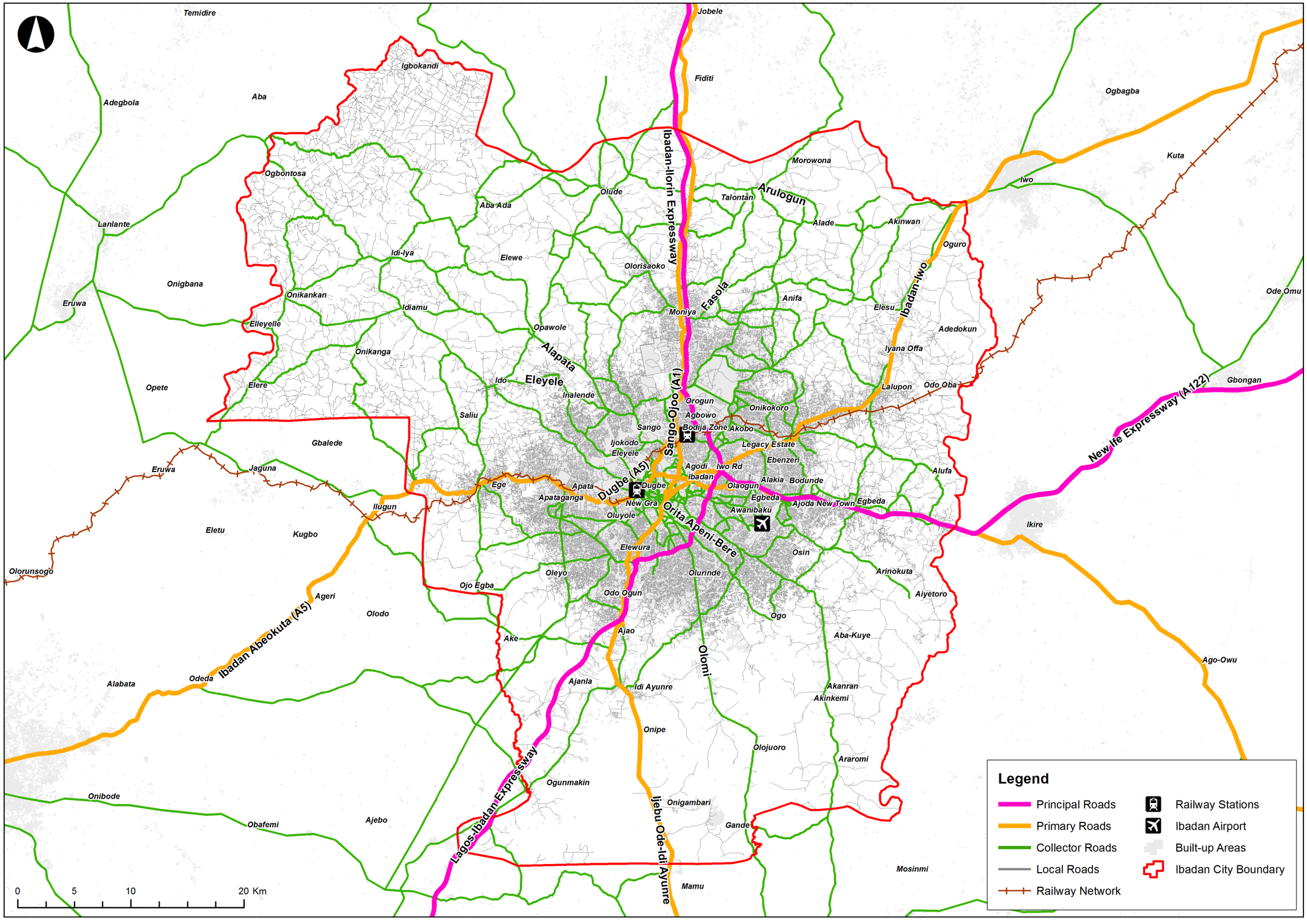

Figure 2.7: Transport Network

2.5.14 Utility Infrastructure

- The predominant means of water supply throughout Ibadan is groundwater from wells and boreholes (tube-wells); in 2006,[14] around two thirds of household received their water directly from these sources. In 2006, only 10% of households were served by a piped water supply; these households are concentrated in the inner areas, and particularly the lower density higher income Government Reservation Area (GRA) areas. The high level of reliance on wells and boreholes reflects the inadequacies of the piped system which is not only insufficiently developed (there are only about 700km of water pipes) but is also old and decrepit (70% of pipes are over 50 years old). Based on information obtained during the 2016 surveys conducted by the Consultant, the reliance on groundwater has increased due to continued inadequate investment in the piped water system, which is virtually nonexistent outside the central areas. It also emerged from the surveys that:
  - households frequently use multiple sources, e.g. well water and sachet water, water from neighbours.
  - many households purchase water either directly, or via water vendors, from privately owned boreholes.
  - during the wet season, rainwater is used to supplement water sources.
- Therefore, the introduction of boreholes, which mirrors national trends, has increased the reliability of domestic water supplies for many consumers while the introduction of sachet water also provides access to good quality water for drinking purposes.
- In 2006, the most common types of toilet facilities were pit latrines (52%), water closets (WCs) (31%) while the remainder (17%) had no facilities at all. Based on survey information, the national trend of increasing use of WCs is also likely to apply to Ibadan with over two thirds of houses in the peripheral areas having WCs. Conversely, sanitary conditions in the high density areas remain especially poor with under a quarter of houses having WCs; in these areas, several latrines are no longer functional and over 10% have no toilet facilities; there is also no evidence of significant use of public toilets. Additionally, given that over 60% of households reside in Brazilian housing, the proportion of households sharing toilet facilities, which is considered to be 'unimproved' by WHO, is likely to be much higher than the national level of around 40%.
- Overall, 63% of households had access to electricity in 2006 (72% in the inner areas). Nationally, the proportion is higher (85%). The 2016 surveys undertaken by the Consultant revealed that while the great majority of houses have access to electricity, which in some rapidly developing areas had been installed by local communities, almost every respondent bemoan the chronic unreliability of the supply.
- In the inner areas, around 42% of households have their refuse collected or use official dump sites while 28% still use unofficial dumps with indiscriminate dumping of waste in the river system. This can exacerbate the incidence of flooding during periods of heavy rainfall. There is therefore a clear need to both extend existing official collection systems and develop consciousness awareness programmes amongst householders, especially in the denser inner areas.
- Over the last 10 years, many of Ibadan's households are likely to have experienced improvements to their water supply, toilet facilities and access to electricity; they are also more likely to use official means of refuse disposal. In many cases, these improvements will have come from householder initiatives rather than from government action.

2.5.15 Institutional Framework

The enforcement of planning laws and regulations in Oyo State is largely ineffective. This is in part due to:

- The sectoral way in which the administration works, with little interaction between ministries and even within departments.
- Insufficient resources needed for the departments to be more effective. This refers not only to plan enforcement but having in place a structure of plans for the State that can guide planning and planning decisions.
- Lack of the institutional arrangements for stakeholder involvement and approval at the local level, which weakens the effectiveness of the role of town planners.

However, many working in the State administration are aware of the need for better cross-sectoral working and the need for more inclusive involvement of stakeholders.

14 National Census, 2006.

2.10.1 Emerging Developments

There are a limited number of formal development projects emerging in Ibadan. Some of these date from several decades ago where development has stalled. The tables below include details of those emerging projects that have been identified through the Oyo State Government acquisitions.

Table 2.16: Emerging Developments - Housing

PROJECTS	DESCRIPTION
Legacy Housing Estate	Legacy Estates is a new housing community developed in partnership with Oyo State Government and Structuracasa. The development occupies about 250,000 sqm of land off the Iwo Road on the north-eastern side of the Ibadan built-up area. Properties are mid/high scale villa units. The project is divided in 2 phases, the first one consisting of 53 units, and the second of 60 units.
Ajoda New Town Development (Egbeda)	Ajoda New town Development Authority was inaugurated in 1976 with more than 5,000 serviced plots for a mixed residential and industrial Estate which covers an area of 289.84ha. Compensation paid partially for the Acquisition of 2.2 hectares under the management of Oyo State Housing Corporation (Notice No. 116 Gazette No 14, Vol. 2 of 7th April 1977).
Government Reservation Area (Ologolo, Oluode, Alfara)	160 hectares with a compensation still outstanding of which a portion is allocated for Mass housing under PPP and HCP (Notice No 28 Gazette No 13 Vol. 23 of 22nd October, 1998).
Nihort Idi-Ishin, Ibadan	Available numbers of plots: 93 Location: Located in a serene environment, beside old Jericho GRA, Ibadan. The site is accessible through Jericho GRA, Aleshinloye and Nihort with close proximity to Jericho nursing home. It is located in an already developed area. Area of site: approximately 40 hectares.
Old Ife Road, Ibadan	Available number of plots: 30 Location: Located at the former/old nitel facilities premises, beside Oluyole FM Radio's property. It is situated in a planned and well developed area, adjacent to water shed centre along the old Ife Road, and is accessible through an interchange of the Lagos-Ibadan Express Road, and a good road networking system close to the airport at Alakia. It is very close to the old Agodi GRA Ibadan. Area of site: approximately 5.9 hectares.
Elenusonso GRA, Ibadan	Available number of plots: 249 Location: Located after Nihort premises on Elenusonso road. It is located in a fast developing area and is accessible by road. Area of site: 44 hectares.
Olunloyo GRA Ring Road	Available number of plots: 544 Ajumose GRA behind the federal, appeal and national industrial courts complexes and Ogun- Oshun river basin development site- 544 plots Olunloyo GRA behind the new Adeoyo specialist state Hospital complex - 249 plots Location: Both schemes are situated within part of the specialist Hospital's ring road GRAs. Acquired land and are serviced by a good road networking system. It is accessible from the new Adeoyo state Hospital road that takes off the MKO Abiola Way (Ring Road) in front of Ososami Street roundabout. Areas of sites: Ajumose GRA-7.19 hectares and Olunloyo GRA-103.72 hectares.

Source: Oyo State Government, Land Acquisition, 2017. Office of the Surveyor General,2016.

Table 2.17: Emerging Developments - Transport infrastructure

PROJECTS	DESCRIPTION
Lagos – Ibadan rail line upgrade	Lagos Ibadan railway modernisation project of the existing line was due to commence in 2012 but has been delayed. The project, which has been awarded to the China Civil Engineering Construction Corporation, is being jointly funded by the Nigerian and Chinese governments, at cost of about $1.5bn. It is part of a new Lagos-Kano standard gauge line. When completed, it will coexist with the old narrow gauge rail line.
Lagos – Abuja via Ibadan high speed rail line	A new line following a more direct route than the existing line from Lagos to Ibadan, it will then connect with Abuja. The project is contracted by the China Civil Engineering Construction Company (CCECC).
Lagos – Ibadan Expressway	The rehabilitation of the Lagos – Ibadan Expressway was awarded in 2013 by the Federal Government at a total cost of N167 billion by the administration of former President Goodluck Jonathan and suspended due to administration problems. The international contracting team was Julius Berger Nigeria Plc and Reynolds Construction Company (RCC). Remobilisation started in June 2016 and work is still ongoing in stages.
Circular Road – Right of way. (Egbeda, Lagelu, Oluyole, Ona-Ara, Ido and Akinyele)	Acquisition of land (1,665 hectares) with an outstanding compensation. Acquisition notices partially served. Valuation of improvement outstanding (Notice No 41 Gazette no 17 Vol. 31 of August 10th, 2006.)
Modern Cargo Airport	Oyo State Government is conceptualising the establishment of a modern cargo airport with hangers and all accomplishments in line with world best practice and two service industries along the Lagos-Ibadan Express Road axis. 200 hectares of land within global industrial acquisition is been earmarked for the project while the state awaits investors.

Source: Oyo State Government, Land Acquisition, 2017, Office of the Surveyor General.

Table 2.18: Emerging Developments - Infrastructure

PROJECTS	DESCRIPTION
Igbaro Village (Ijebu-Ode Road)	A site of over 55ha, for which compensation has been settled, and initiated under Notice 13, Gazette 3 Vol. 27 (14th March 2002).
Lapite Village (Ibadan-Oyo Road)	Acquisition of Land for Landfill site of 20.6 hectares for the Oyo State Environmental Protection Commission (acquisition set aside by High Court).
Aba-Eku (Akanran Road)	Compensation settled for the Acquisition of Land of 9.4 hectares for Sanitation and Environment Board Site (C of O issued to Ministry of Environment and Water Resources).

Source: Oyo State Government, Land Acquisition, 2017. Office of the Surveyor General, 2016.

Table 2.19: Emerging Developments - Social Infrastructure

PROJECTS	DESCRIPTION
Youth Development Centre (Egbeda Tuba)	61 hectares acquired with an outstanding compensation (C of O issued to Oluyole Local Government - Subject of Litigation).
Government Reservation Area (Agede, Salako, Onidundu)	258 hectares with paid compensation with a portion allocated for Private University Under Litigation (Notice No 28 Gazette No 13 Vol. 23 of 22nd October, 1998).
Asylum (Akinkyele, new Ibadan-Oyo road)	Acquisition of 41 hectares for establishment of Asylum. Revocation order signed since April 2009 (compensation outstanding).
Dominion University	Specialised university for management sciences located within the Oyo State Industrial Scheme.
Precious Cornerstone University	Proposed university sponsored by The Sword of the Spirit Ministries. Located within the Oyo State Industrial Scheme.

Source: Oyo State Government, Land Acquisition, 2017, Office of the Surveyor General.

Table 2.20: Emerging Developments - Industrial

PROJECTS	DESCRIPTION
Oyo State Industrial Park (Lagos-Ibadan Express Road)	The proposed Oyo State Industrial Park is located within the state global industrial acquisition of 10,000 hectares of land on both sides of the Lagos-Ibadan Express Road. Approximately 1,401 hectares on the right hand side of the express road coming from Ibadan is earmarked for the development of a purpose built Industrial Park. The actual location is in between Food Oriental and Oyo State Housing Project under Public Private Partnership with Aso Savings and Loans Limited, while on the other side of the park is Aramed Hospital.
Burnt Brick Plant (Oloba and Adeyooye villages)	Acquisition of land (32 hectares) with an outstanding compensation (Notice No 17 Gazette No 6 Vol. 32 of April 5th, 2007).
Inland Container Depot / Dry Port (Erunmu, Ibadan)	Acquisition of Land (121 hectares) with compensation paid. Covered by Ajoda New Town Acquisition (C of O issued to Federal Government).
Trailer Park (Alarobo Area, Monatan)	106 hectares acquired with a compensation paid by Akinyele Local Government (Notice No 57 gazette No 24 Vol. 29 of December 30th, 2004).
Trailer Park (Along Lagos/Ibadan Expressway)	100 hectares. Acquisition of Land with compensation paid. Now within the global industrial acquisition (Notice no 57 gazette No 24 vol. 29).
Chinese Village – Industrial Estate (Along Lagos/Ibadan Expressway)	Acquisition of 3.8 hectares of land for Industrial Estate. Now within the Global Industrial Acquisition.
Industrial Estate / Oluyole Free Trade Zone (Along Lagos/Ibadan Expressway)	Acquisition of 10,000 hectares of land with a compensation partially settled. Portion earmarked for the Oluyole free trade zone. Several litigation (Notice No 2 Gazette No Vol. 31 of January 5th, 2006).
African Regional Centre for Engineering Design and Manufacturing (Wofun, Iwo Road)	Acquisition of 12.8 hectares of land with a compensation paid under Federal Government (Notice No 71 Gazette No 13 Vol. 7 of March 15h, 1982).
Mechanic Village Olukunle village	Acquisition of 38.7 hectares of land for Establishment of Mechanic Village. Release but subject to litigation (Notice No 21 Gazette No 34 vol.10 of August 8th, 1985).
Ibadan Logistics Centre	Oyo State Government has dedicated 12 hectares of land at Erunmu within the land earmarked for the Ajoda New Town in Egbeda Local Government for the development of the Ibadan Logistics Centre under a Public Private Partnership with APM Terminals, a leading player in the world Maritime Industry.
Asphatic Plant	Oyo State Government has acquired land for setting up a quarry and asphalt plant along the Moniya- Ijaiye-Iseyin Road.
Agric Camp	Oyo State Government has acquired land for agro-allied purposes. The Agric Camp also contains the Akufo Dam.

Source: Oyo State Government, Land Acquisition, 2017, Office of the Surveyor General, 2016.

2.6 OPPORTUNITIES AND CONSTRAINTS

Opportunities

Based on the results of the Diagnostics Report[15] and stakeholder engagement, a number of opportunities have been identified in Ibadan as illustrated in Figure 2.9. These include:

- Ibadan is strategically located on major road and rail routes. Improvements to the existing rail line and the proposed high speed line from Lagos are opportunities to open up the city for further investment and increase trade and commercial activity between the two cities. In addition, the proposed Circular Road will help to reduce congestion in the inner areas of the city thereby providing an opportunity to expand outwards. The Lagos-Ibadan expressway is also a key route currently being upgraded and will function as the main entry into the city.
- Other emerging transport developments such as the LRT proposal, offer the potential to improve the connectivity within the city for existing residents and help make it more attractive to investors while creating a greater sense of pride amongst the community.
- Topography and large reserves of forests at the periphery of the city are very important physical features of Ibadan. They could provide opportunities for high value residential or tourism related developments with views into the city and the forest areas. Similarly, the vast agricultural land around Ibadan is a great asset to be potentially exploited for economic growth to provide employment opportunities and sustain livelihoods of many rural communities.
- The rich culture and heritage of Ibadan is an asset that can help to attract domestic and international tourists to the city.
- Ibadan has a vibrant trade and commerce economy with a well established micro-enterprise and SME sector (both formal and informal businesses). With the emerging middle class and a rapidly growing consumer culture, there is huge potential for Ibadan to emerge as a business hub. Education and research can be further strengthened to attract inward investment.
- There is a good supply of land available in Ibadan for development but effective control processes are required to manage it in an orderly and effective way. There is an opportunity to make efficient use of the available land to accommodate the city's growing population and deliver a spatial development strategy with supporting policies to help promote positive investment and growth in Ibadan.
- The six existing administrative centres located within the outer LGAs have the potential to be strengthened and developed into Growth Centres to accommodate a significant share of future population growth.
- The initiative led by the adoption of the Ibadan City Masterplan will enhance the perception of the city as a pacesetter.

15 Dar, 2017.

Constraints

There are a number of constraints and challenges that the masterplan seeks to address (as summarised in Figure 2.8). These include:

- Unchecked urban sprawl with inadequate infrastructure provision has resulted in increasing environmental degradation, particularly with waste disposal into the river corridors.
- Ibadan experiences high levels of localised traffic congestion, most often adjacent to areas of intensive commercial activity. Congestion is mainly caused by the encroachment of retail activities onto the roads, high levels of on-street parking, and stopping/manoeuvring by danfos and taxis. Hence, there is a need to define a road hierarchy that provides adequate rights of way to cater for high traffic volumes and space for commercial street activities.
- There are vast areas of forest or dense vegetation at risk of deforestation and encroachment which must be retained to allow the soil to absorb storm water.
- The role of the Ibadan Airport is currently constrained to a domestic airport only, partly due to the dominance of Lagos Airport. However, it can be transformed into a regional airport if commercial-led initiatives are taken and there is an increase in exchange and trade with other towns.
- The continuous and rapid population growth with inadequate provision of jobs has meant that there is a need to promote and diversify the local economy.
- The informal sector (in particular trading) is a significant employer in Ibadan and there is a big challenge facing the city on how to support and regulate it in order to promote employment, productivity, and income for the poor, while ensuring a safe, healthy and socially acceptable environment for all.
- Housing is the predominant land use within the city and with a rapidly growing population, overcrowding and the poor quality of the existing housing stock has become a major problem. The provision of sufficient land for residential development is therefore one of the key considerations of the Ibadan Masterplan.
- Ibadan has poor east-west connectivity resulting in poor accessibility to the city’s rural periphery. This has led to unplanned development with people living in isolated pockets having no access to basic services and amenities including education and health facilities. The existing informally developed urban areas have grown without adequate social or transport infrastructure. There are significant disparities across the city in terms of distances and therefore access to health and educational facilities.
- Flooding is the most serious threat and encroachment on flood plains, poor maintenance of the drainage system and blockages in the watercourses have increased flood risk. There is a need to mitigate the flooding impact and identify the flood prone areas where no development should be permitted. Providing a proper drainage system is critical.
- A significant number of inhabitants engage in on-street trading and hawking as both formal and informal economic activity. Up to 20% of Nigeria’s workforce are estimated to be working in the informal economy and many such activities are located in urban areas. Street trading causes problems such as encroachment on road rights of way by the traders, traffic congestion as vehicles cannot pass smoothly on time and defacement of the aesthetics of the street. As street traders continue to litter or dump their waste on the roadsides, it pollutes the environment resulting in health problems and reduces the road width or in drainage systems which block the waterways leading to flooding.
- One of the main reasons for the absence of planning controls and the lack of proper land management is due to an ineffective institutional framework, one in which ministries in Oyo State do not share resources, resulting in overlap in their remit. This also results in an inefficient funding stream, whereby resources could be allocated more efficiently. The inefficient institutional framework does not permit communities to be heard effectively, resulting in the inability for these to be able to influence where and how the city should develop.



Figure 2.8: Constraints



Figure 2.9: Opportunities

2.7 VISION

This section sets out the vision, aims and objectives for the spatial development of Ibadan to 2036. The vision statement highlights the overall intent of the Ibadan City Masterplan which will guide the future growth and development of the city.

Vision: "By 2036, Ibadan and its wider region will be a model sustainable and resilient city where development addresses the population's needs, with thriving employment, providing a high quality of life for all."

The spatial vision of the Ibadan City Masterplan is underpinned by a set of key principles which inform all stages of the Masterplan's development and implementation. The principles framing the vision are as follows:

- Sustainable City - Managing environmental impact and promoting socioeconomic development,
- Connected City - Improving connectivity and accessibility of the city,
- Cultural City - Protecting the culture and heritage of the city,
- Resilient City - Developing capacity to absorb future challenges,
- Green City - Protecting the natural environment and providing open spaces,
- Enterprising City - Promoting the local economy, attracting investment and achieving business growth.



Figure 2.10: A Vision for Ibadan

2.8 OBJECTIVES

A series of development objectives help focus the masterplan to address specific issues and challenges facing Ibadan. They also embrace the opportunities presented by future development proposals.

The following objectives inform the Ibadan Masterplan:

Objective 1: To accommodate the anticipated future population.

The masterplan guides the direction of growth and ensures that sufficient land is available to accommodate the projected future population of 11.6 million. New development areas will be planned outside the existing urban areas to release pressure and avoid negatively impacting on established communities.

Objective 2: To prevent flooding and mitigate any flooding impact on urban areas.

Ibadan has experienced varying degrees of flooding in the past fifty years. Flooding has become a serious challenge that plagues the city and is posing a threat to existing and future developments. Flooding can be attributed to natural causes which relate to the low lying topography along with heavy rainfall and man-made causes which include deforestation, encroachment on flood plains, poor maintenance of drainage system and blockage in the watercourses. It is imperative to protect the existing and proposed urban areas from flood risks.

Objective 3: To protect, manage and enhance the natural environment.

Most of the land outside the existing urban areas of Ibadan is covered by forest and derived savannah. Urban growth and development have, however, have led to a significant loss of vegetation. It is of prime importance to protect the natural environment and recognise the wider benefits of the ecology which include improving air quality, protecting biodiversity, reducing flood risks, and providing recreational opportunities.

Objective 4: To improve connectivity and integrate with the emerging transport developments.

The masterplan aims to improve the overall physical connectivity of the city, both internally and with the neighbouring regions, with sustainable modes of transport. It seeks to reduce congestion within the central areas of the city and provide access to jobs, education, health, retail, leisure, recreation and other community facilities. It also promotes the development and use of public transport with an intention to reduce car use and encourage walking and cycling.

Moreover, the State Government of Oyo is taking major initiatives to promote large scale transport and infrastructure proposals for making Ibadan a more accessible and connected place. These emerging transport developments will have a huge impact on the city, both at the regional and local level. The proposals which are in line with the masterplan are fully integrated in the strategy.

Objective 5: To promote the city's economy and attract investment.

Trade and commerce form the backbone of Ibadan's economy with markets being a fundamental part of the city. It has a large and vibrant micro-enterprise and SME sector. However, there is a need for greater support to this sector to promote scaling up of enterprises both in terms of access to finance and necessary infrastructure. The limited amount of land occupied by industrial uses also indicates that the formal economy is very small and does not create sufficient jobs for the size of population. In addition, the city's manufacturing sector has stagnated in recent years as pressure on infrastructure and services has deterred large companies from setting up operations in Ibadan. This exacerbates the problem of insufficient job opportunities among base industries for the local working population who then tend to seek alternative opportunities in the informal sector.

The masterplan promotes the city's economy by developing new industries and providing strategic sites for the development of new business opportunities. The masterplan aims to support and better manage street trading in order to promote employment, productivity, and income for the poor, and at the same time ensure a safe, healthy and socially acceptable environment.

Objective 6: To meet the social needs and requirements of the existing and future population.

An important objective of the masterplan is to ensure that any new development that is planned should improve social cohesion and cause minimal disruption to the existing communities during implementation.

The rapid growth of the existing population of Ibadan (3.32% per annum) has exerted substantial pressure on social services and urban infrastructure which has resulted in large gaps in provision across the city. The masterplan identifies the requirement for the provision of social infrastructure including education, health, leisure, recreation, fire and safety services in order to meet the basic needs of the existing and future population.

Objective 7: To provide adequate utility infrastructure for the existing and future population.

The masterplan proposes an adequate provision of utility infrastructure to meet both current and future development needs. This includes provision of an efficient supply of water and waste water management, drainage network, solid waste management, telecommunication system, and power supply distribution.

Objective 8: To protect and promote the culture and heritage of the city.

Ibadan has a rich culture and heritage. There are many historic buildings and sites across Ibadan, in particular the Core. However, many of them are in a poor state of repair. The masterplan seeks to protect the built heritage through policies that promote restoration and repair.

Objective 9: To enhance quality of life for all.

The masterplan promotes a better quality of life through the establishment of appropriate land use standards, provision of adequate infrastructure facilities, good connectivity and easy access to basic amenities, open space and recreation opportunities.

Objective 10: To provide a sound planning framework for efficient delivery and implementation.

The successful implementation of the masterplan needs a strong and clear planning system. The planning system must be streamlined to help the process move rapidly and turn ideas into reality. An efficient planning framework is more likely to attract developers to invest in Ibadan.



Figure 2.11: Summary of Masterplan Objectives

2.9 TESTING ALTERNATIVES[16]

Initial spatial development framework alternatives were first trialled as a means to test different scenarios and understand their level of impact on the city.

Three alternatives have been tested, and each one following a different spatial development strategy for future expansion of the city while seeking to accommodate the estimated population of 11.6 million by 2036. The three alternatives are described below:

Alternative 1 - Structured Approach

The Structured Approach proposes limited interventions that will improve and regenerate the core area of the city with limited disruption to the established settlements and communities. It allows for future growth around the city in a structured manner. This approach assumes the construction of the proposed Circular Road which will form the main structuring element for future developments. It proposes to enhance the existing LGA Headquarters and protect the natural environment in and around the city.

Alternative 2 - Compact Approach

The Compact Approach proposes a number of physical interventions that will allow for future growth to take place in a polycentric manner by creating six growth centres. The growth centres would be developed as self-sufficient new towns around the six existing LGA Headquarters located in the outer LGAs. Like the structured approach, this approach also assumes the construction of the proposed Circular Road which will act as the main connector between the Growth Centres. It proposes to improve and regenerate the core area of the city while aiming to minimise the disruption to the established settlements and communities. Safeguarding the natural environment is another important criteria.

Alternative 3 - Targeted Approach

This approach takes the existing conditions as given and plans around the issues and challenges that the city is currently facing. It assumes that there will be no construction of the circular road and minimal interventions will be made with respect to any transport and infrastructure proposals. New development areas are targeted along the major transport routes along with infill development within the existing urban areas. The future growth will be developed linearly. This scenario also proposes initiatives to regenerate the core area by making structural adjustments along the road network and upgrading the infrastructure. This scenario recognises may not be able to maximise retention of the forests.

Outcome

After analysis, it was concluded that Alternative 2 was preferred. The compact approach is the most suitable way forward since it most closely translates the vision and objectives set for the masterplan. It proposes the development of a multi-polar city with six high density Growth Centres. It proposes to safeguard the forest reserves while protecting its rich culture and heritage. The transport network is well integrated with the new development making the city better connected and accessible.

16 More detail is provided in the Development Framework Report, Dar, 2017.

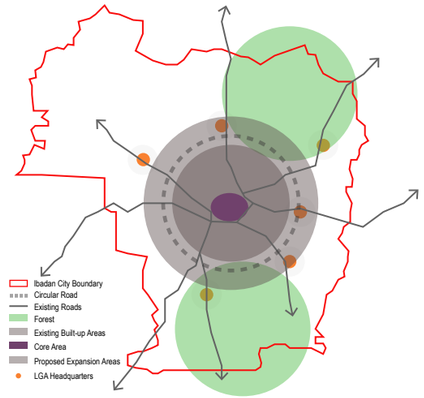

Figure 2.12: Structured Approach

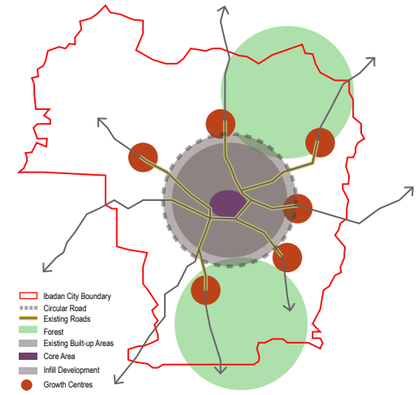

Figure 2.13: Compact Approach

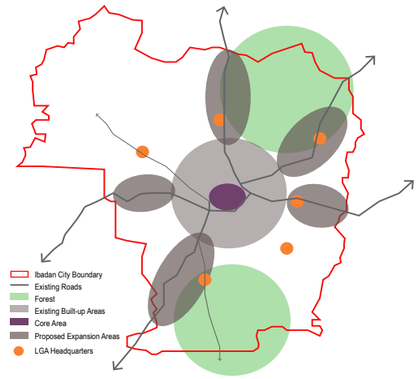

Figure 2.14: Targeted Approach

Table 2.21: Main features of the three alternatives

DEVELOPMENT SCENARIOS	MAIN FEATURES
Structured Approach	• Proposes interventions that will improve and regenerate the core of the city and urban areas. • Proposes large future growth areas to accommodate the anticipated future population. • Integrates future growth with the existing urban environment while limiting disruption to established communities. • Enhances the existing LGA Headquarters. • Safeguards the forest areas. • Protects productive agricultural land. • Historical and cultural sites are protected and promoted.
Compact Approach	• Proposes development of Growth Centres in a polycentric urban model. Each growth centre is self-sufficient and has an individual character. • Improves and regenerates the core area while minimising disruption to existing settlements and communities. • Develops the area around the existing LGA Headquarters as high density mixed use developments. • Protects productive agricultural land and forest areas. • Historical and cultural sites are protected and promoted. • Proposes small future growth areas to accommodate increased population in existing areas.
Targeted Approach	• Ease of implementation. • Proposes limited interventions. • Targets development along major transport routes. • Commercial benefits and improved marketability of the newly developed areas. • Minimal disruption to existing communities.

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2.10 CLIMATE CHANGE FRAMEWORK

Climate change due to human actions is being experienced around the globe. The effects of changing climate are expected to worsen over the coming decades. The Ibadan City Masterplan seeks to mitigate the effects of climate change and be resistant to future shocks. This is informed by an understanding of the baseline climatic conditions and future predictions. Figure 2.15 illustrates the average annual climate as captured at Lagos International Airport,[17] which is the nearest relevant data source for Ibadan. Table 2.22 provides a framework for responding to the main issues presented by climate change to Ibadan. These include thermal discomfort, flooding due to increased rainfall, ecosystem loss and greenhouse gas emissions. Suggested policies, metrics and masterplan impacts are included in the framework to demonstrate relevant sustainability measures.

17 *http://www.meteonorm.com/*

Table 2.22: Climate Change Framework

CLIMATE CHANGE ISSUE	DESCRIPTION	POLICY	METRIC	MECHANISM	BENEFITS	MASTERPLAN DESIGN IMPACT
Extreme Rainfall	Extreme rainfall days are projected to increase by 1-2 days over most of Nigeria for B1 (low) and A2 (high) emissions scenarios by middle (2046-2065) and late (2081-2100) century.	Incorporate Sustainable Urban Drainage Systems and drainage systems that are resilient against the increases in water flow due to climate change.	Prevalence of flood events the masterplan is able to absorb with no damage (100 year design storm).	Hydrologists have developed mapping of areas at risk of flooding based on data gathered on catchment areas and rainfall.	Reduced cost of disaster management and maintenance of hard infrastructure after increasingly likely storm events.	Masterplan is structured around an appropriate drainage system network, with areas allocated for infiltration basins (parks and strategic open space) and flood water transit.
Temperature Extremes	Mean annual temperature over Nigeria as a whole is projected to increase between 1.1°C and 2.5°C by the 2060s and 1.4°C and 4.6°C by the 2090s.	Design courtyards/walking areas to be suitably shaded during the hot season. Reduce Urban Heat Island effect by limiting expanse of hardscaping.	% shaded walkways. % of green space.	% shaded walkways calculated through maps/satellite imagery. Local, vernacular techniques for dealing with high temperatures should be studied in detail and translated to work with modern building functions and lifestyles.	Post Occupancy Surveys can be used to identify other issues along with comfort/ overheating Modelling buildings or building archetypes may also provide future benefits for other forms of analyses.	Open space networks are promoted and interlinked.
Cold/Hot Days	The annual number of ‘hot’ nights is projected to increase in Nigeria. Projections indicate an increase of 32-60% by the 2060s, with ‘hot’ nights increasing most rapidly in June-August. ‘Hot’ days per year are projected to increase by 18-49% by the 2060s. ‘Hot’ days are projected to increase most quickly in June-August.	Buildings and masterplans must be designed in such a way as to adapt to the future changes in temperature.	Percentage of shaded walkways. % hours of overheating in buildings.	% overheating can be calculated through thermal simulations or through Post Occupancy Surveys. Thermal modelling of future climate scenarios.	Post Occupancy Surveys can be used in addressing a range of other issues along with comfort/overheating.	New developments should incorporate appropriate shading strategies and building design to ensure thermal comfort.
Ecosystem Loss	Forests and other ecosystems already under significant pressure from developments, logging and agricultural expansion, would be adversely affected by climate change. Persistent flooding and logging could make forest regeneration more difficult.	Allocate areas of protected forestry.	Area of land protected.	Support the active implementation of the National Biodiversity Strategy and Action Plan (NBSAP), particularly those strategic actions that address climate change impacts.	Maintain ecosystem biodiversity which supports many commercial activities in Ibadan, and mitigates storm events.	Allocate connected parcels of undeveloped land to preserve ecosystem.
Greenhouse Gas Emissions	Conventional fossil fuel energy sources used to generate power in Nigeria release large amounts of greenhouse gases which contribute to climate change and adversely affects Ibadan.	Policies encouraging the construction of renewable energy plants and farms should be encouraged; this includes subsidies, Feed-in Tariffs and tax breaks on such systems. Additionally, policies to discourage the use of conventional fossil fuel energy resources should also be put in place.	% of low and zero carbon sources contributing to the energy and electricity mixes.	Governmental reports released on an annual/biannual basis generally give a good idea of the amount of renewables in a country/region.	The Nigerian government has pledged to lower its greenhouse gas emissions in the coming few years as part of the Paris Climate Change Agreement. Greenhouse gases are a main contributor to climate change and negatively affect the globe as a whole.	Power planning must be carried out as developments are completed to ensure enough capacity and land are given for the development of low and zero carbon energy sources.

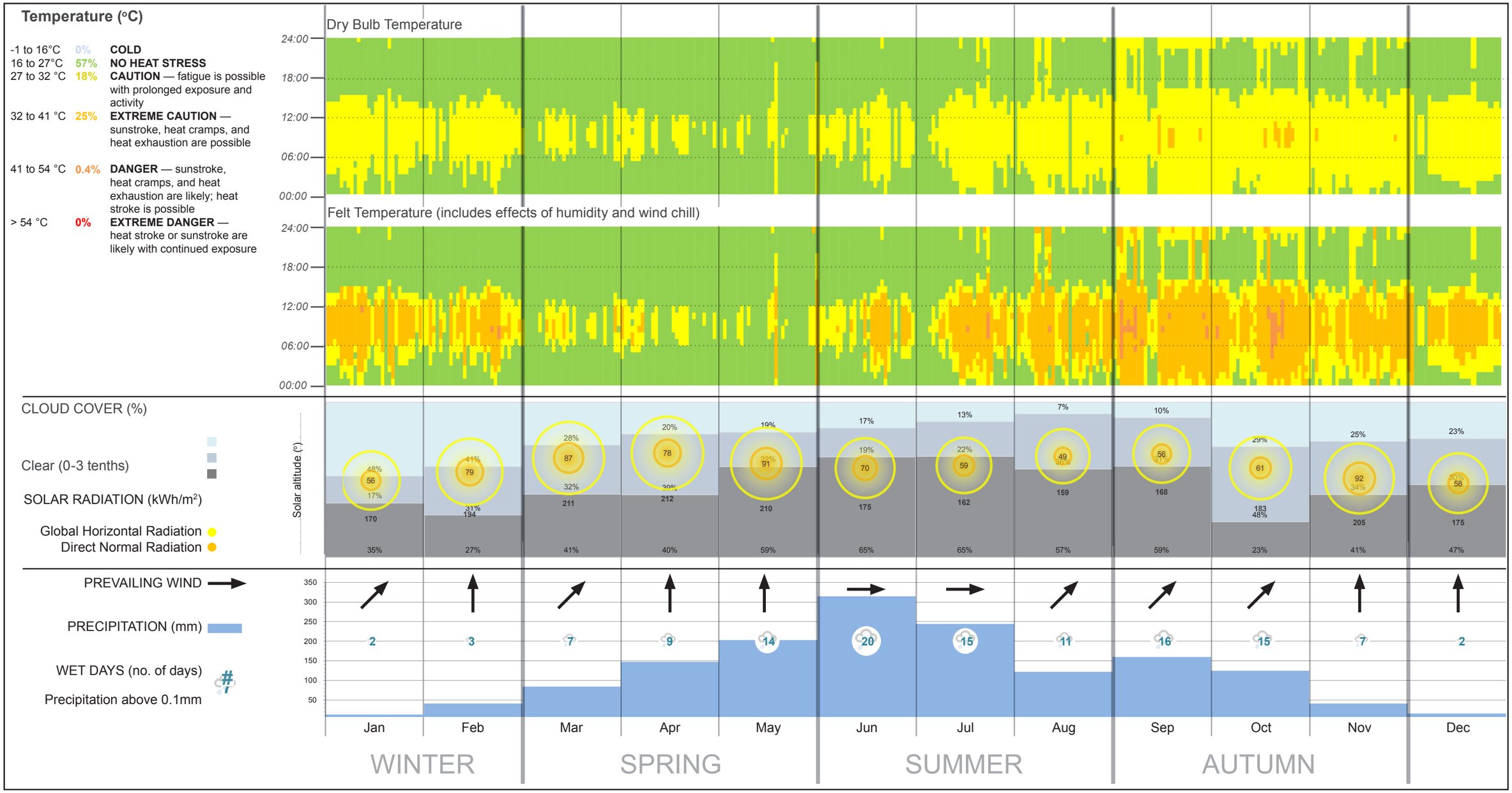


Figure 2.15: Average Annual Climate Summary for Lagos International Airport

Source: http://www.meteonorm.com/

PLANNING STRATEGY

3

3 PLANNING STRATEGY

3.1 INTRODUCTION

The masterplan sets out the planning strategy for Ibadan and provides the direction for future growth and development to 2036. It identifies key interventions and development areas and aims to streamline the planning process through a flexible and proactive approach.

The objectives of the planning strategy are to:

- Guide urban expansion to accommodate future population growth,
- Designate areas for protection and promotion,
- Provide a framework for development,
- Guide developers and investors towards investment opportunities,
- Integrate the proposed expansion areas with the existing built-up areas within the city,
- Integrate the social, economic, institutional and physical aspects of land development,
- Promote economic development and create employment opportunities,
- Provide an adequate provision of housing and promote a diverse mix of land uses,
- Create a safe and healthy environment and better quality of life.

This section is structured into the following categories:

- **Spatial Development Strategy** – The spatial development strategy lays down planning policies to guide future development. It identifies areas for future expansion and infill development and regeneration opportunities for the core area in the city. A residential strategy is also proposed to determine the form and scale of the new developments.
- **Land Use Distribution** – A proposed land use distribution plan defines the location and type of development as it will be in the year 2036. Land uses are classified and distributed within the city and specific sites are allocated for a range of land uses.
- **Social Infrastructure Provision** – Identifies the requirements for the provision of social infrastructure facilities such as education, health, recreation and leisure in areas that are deficient within the existing built-up area and the future expansion areas.
- **Culture, Tourism and Heritage** – Provides guidelines for cultural and heritage assets within Ibadan. It explains key strategies to be adopted for successful restoration and renovation of the buildings of historical and cultural significance. This section also proposes a strategy for promoting tourism, identifying short, medium and long term actions.
- **Implementation and Phasing Strategy** – Provides an implementation strategy and a phasing plan and a delivery mechanism for future developments. It is a stepped process of five year intervals and targets development in specific areas in order to provide an immediate response to the most pressing demands.
- **Addressing Flood Risk** Provides strategic-level guidance as to how the masterplan seeks to address this issue of fundamental importance.

3.2 SPATIAL DEVELOPMENT STRATEGY

The Spatial Development Strategy sets out a vision for sustainable development and regeneration of the city by creating a compact, polycentric, socially mixed, well-designed, connected and environmentally sustainable city.

It presents the physical representation of the Ibadan City Masterplan and delineates specific boundaries within which policies are applicable.

It also sets the basis for future development and ensures that it integrates with the existing urban areas. It is based around a series of guiding principles and provides a comprehensive, physical urban expansion plan. While the spatial planning strategy takes into consideration future demands, it also caters for the needs of the existing community. Refer to Figure 3.1 for the Spatial Development Strategy.

The Spatial Development Strategy is structured into the following categories:

1. New Development Areas – Identifies areas for future growth and development within Ibadan and defines the urban expansion limits to accommodate future population over the period to 2036. This section further describes the constraints and drivers for future development based on socio-economic and environmental factors. It lays out policy that provides a framework to guide future growth and development.

2. Zoning Regulation for Urban Expansion Areas - Provides a set of guidelines to regulate development in the areas and create an attractive environment where people want to live and work.

3. Density – Provides a residential area density strategy for future urban expansion and residential area infill development. It allocates high density development around the Growth Centres and along important transport corridors.

4. Regeneration of the Core Area – Describes the major challenges being faced by the existing built-up areas. The section further identifies the urban renewal opportunities and lays down a series of policies for regeneration in the existing settlement.

The masterplan strategy recognises that the city comprises many established communities. No displacement of existing communities is promoted. Only limited impact will be allowed, and only where this supports the delivery of key strategic infrastructure proposals.

Within the existing slum areas identified within the city (see Figure 2.4), participatory slum upgrading should be undertaken to improve the living conditions for those living in these areas. Measures are likely to include infrastructure and utilities upgrades, and the provision of new social infrastructure and economic enhancements. This would act as a catalyst for a wider improvement to the condition of housing and should be promoted. Detailed surveys of the areas should be undertaken and the scope of work defined in co-operation with existing residents.

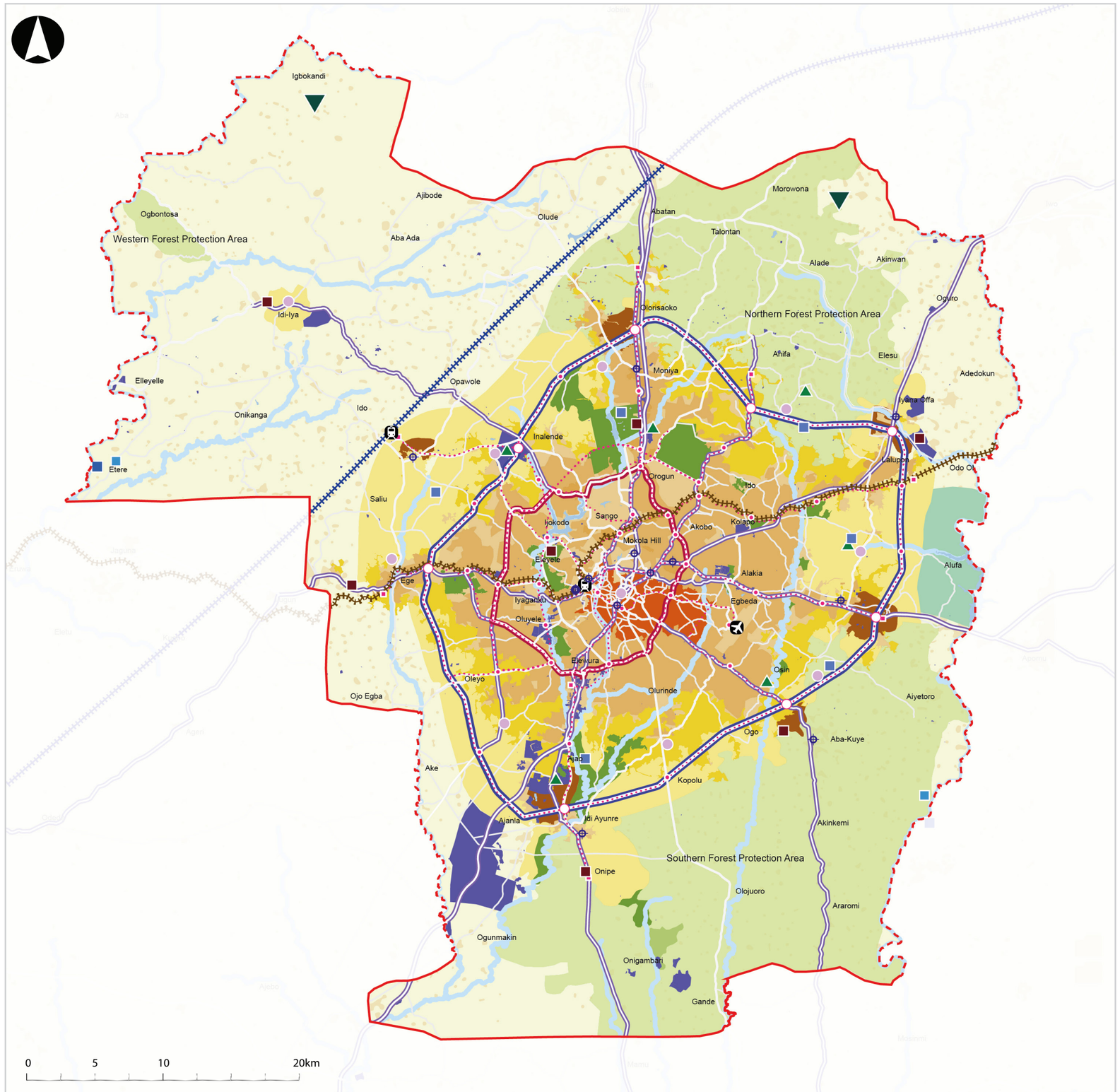


Figure 3.1: Spatial Development Strategy

3.2.1 NEW DEVELOPMENT AREAS

The current population of the existing urban and rural areas of Ibadan is estimated at around 6 million (refer to Section 2.4.2). The inner urban areas have natural growth rates ranging from 0.2% to 1.2% annually while the outer urban areas have higher rates (2.9% to 5.7% annually). This indicates that the current direction of growth tends towards the lower density peripheral areas on the periphery of the city where land is more readily available. It is projected that the population of Ibadan in the next 20 years will reach almost 11.6 million.

Owing to a rapidly growing population with growth variations between peripheral settlements and the densely populated areas, it is important to plan for new development areas with the intention to achieve a compact spatial structure to manage and limit the outward growth of the city. Developer interest will be geared towards these development opportunities and subsequently reduce ad-hoc and unplanned development.

Targeting and planning for development in identified locations will enable such development opportunities to be supported by an adequate provision of integrated and well-connected physical and social infrastructure. Where feasible, digital-ready infrastructure should be provided in order that Ibadan can embrace smart city principles in the future. Another important principle is that new development caters for the needs for all sectors of society. In particular, the built environment should be designed with the needs of people with disabilities given full consideration to ensure the city is accessible for all.

The main objectives for the new development areas are:

- Control urban sprawl and unplanned development.
- Accommodate population growth to 11.6 million by 2036 and identify suitable land for development.
- Create a compact structure with adequate housing choices and essential facilities.
- Provide employment opportunities in well connected and accessible locations in the new development areas.
- Ensure that all residents have good accessibility to essential social infrastructure.

The new development areas comprise of three categories: Growth Centres, Urban Expansion Areas and Infill Areas (see Figure 3.5). Importantly, there are also areas identified within the masterplan where development is not permitted. These include flood corridors, strategic open spaces and protected forest areas, which are discussed later in this chapter.

Growth Centres

The masterplan decentralises the city by creating “Growth Centres” to accommodate population into areas with larger capacities (illustrated in Figure 3.2). This strategy disperses investment more widely across the city. Six Growth Centres are proposed in the outer LGAs of the city, positioned close to LGA administrative centres.

Growth Centres will comprise of high density, integrated mixed use developments which include administrative, institutional and civic functions along with retail, commercial, residential, mixed use and social infrastructure. The Growth Centres will offer employment opportunities and provide a range of housing types. Outdoor open space will be provided for informal traders. The intention is to mix jobs and services with housing and provide good accessibility, reducing the need to travel.

The Growth Centres are each located on or near the Circular Road, making them highly accessible. A mass transit system will link the Growth Centres with the centre of Ibadan. This will provide easy access to the Growth Centres and reduce reliance on private cars, thereby reducing congestion and pollution. Greater accessibility forms a key catalyst to unlocking new development opportunities and developer interest.

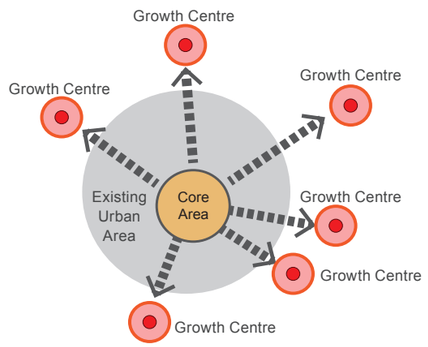


Figure 3.2: Growth Centres Diagram

New Development Areas (NDA):

Policy NDA1: Growth Centres are to be developed outside the existing urban area. These will comprise of high density, mixed use developments and will be fully accessible by public and private transport, including pedestrians and cyclists.

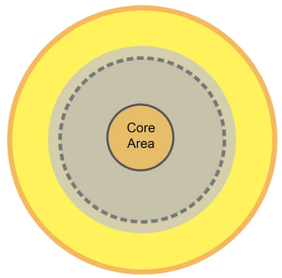


Figure 3.3: Urban Expansion Areas Diagram

Urban Expansion Areas

As Ibadan grows, the surrounding rural land is currently being swallowed by low density development. To facilitate an additional 5.6 million residents, the growth of the urban area is inevitable. The masterplan minimises the loss of agricultural and forest land by promoting and planning for medium density expansion areas. The majority of new development over the next 20 years will take place in these urban expansion areas.

In order to provide liveable and functional new urban areas, a mix of uses is promoted. Physical and social infrastructure will be developed in tandem with residential development. Residential areas will be focused around local commercial centres, where residents will have access to markets, retail and services. Expansion Areas are served by a well defined road network, with access to the Circular Road and public transport.

New Development Areas (NDA):

Policy NDA2: Urban expansion areas are to be developed around the existing urban area and proposed Growth Centres. These will comprise of medium density residential developments with other associated uses.

Infill Areas

The built form on the periphery of Ibadan is generally low density and piecemeal. Having developed organically, it lacks a formal structure and features many vacant and undeveloped sites. The principle of infill development is to provide a structure to these areas, through transport, physical and social infrastructure provision, and make use of vacant land for development. A strategy for infill areas seeks to reinforce the strength and value of existing communities by providing better local infrastructure and integrating key components of new development areas. Infill development will:

- Make more efficient use of land through densification and reduce the need for development on agricultural and forest land;
- Increase access to and integrate with employment opportunities and social infrastructure;
- Make better use of the existing infrastructure and services;
- Provide better physical infrastructure for peripheral areas;
- Replace brownfield sites and abandoned areas with functioning assets.

Figure 3.4 illustrates the approach to infill development. Infill development is a staged process, beginning with the provision of a transport network and infrastructure provision, which will catalyse residential development followed by community facilities and other uses.



Figure 3.4: Infill Areas Process

New Development Areas (NDA):

Policy NDA3: Infill areas are to be developed on the periphery of the existing urban area. New development within infill areas shall reinforce the strength and value of existing communities and respect the existing character.

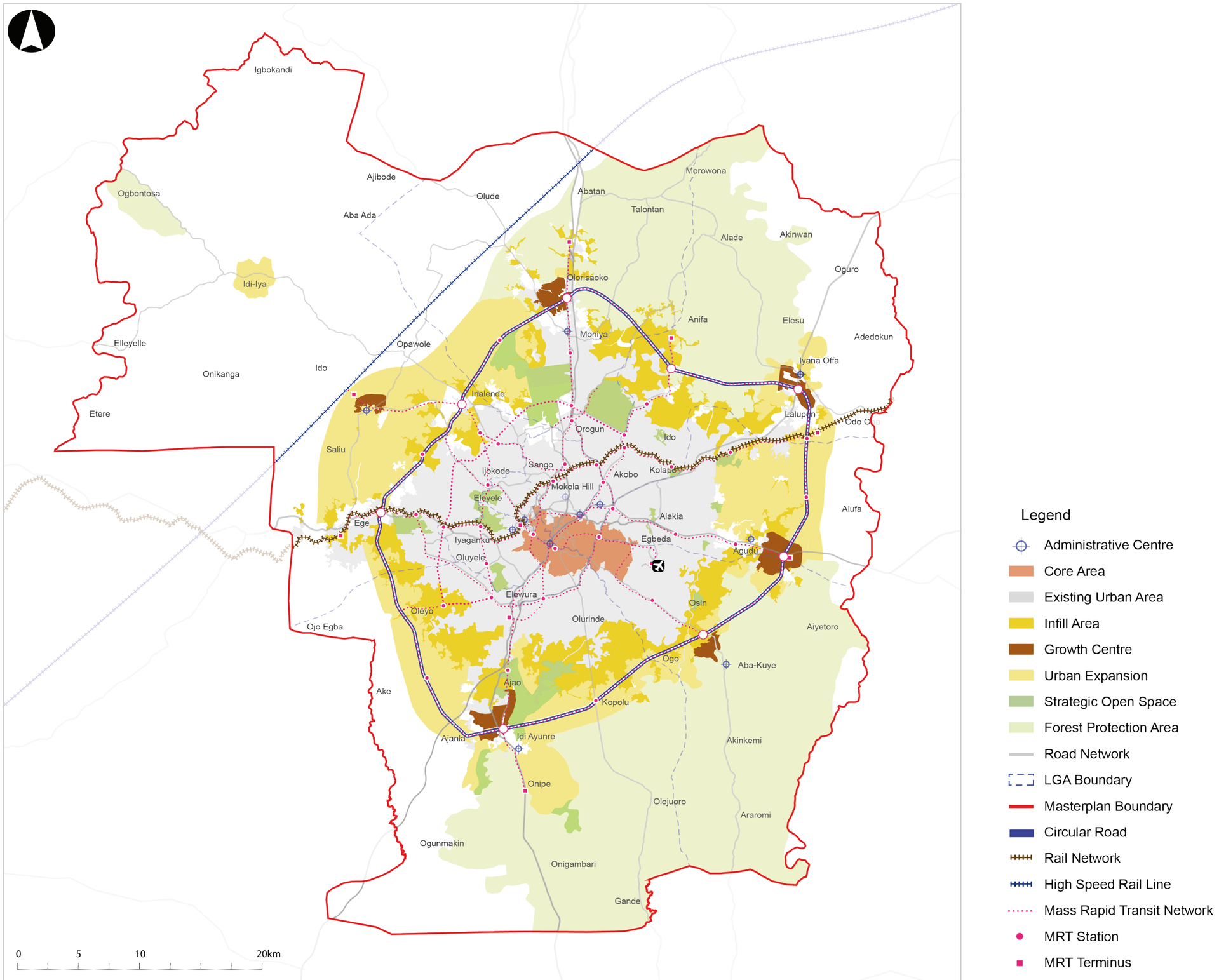


Figure 3.5: New Development Areas

Development Principles

This section describes a number of development design principles to guide development within Growth Centres, Urban Expansion Areas and Infill Areas. Within existing urban areas, the existing Oyo State spatial standards continue to apply.

Plot and Block Sizing

- **Low density standard block sizes** comprise of four standard low density plots (30m x 24m) back-to-back with a local 10m road dividing them. In this way, properties always front onto a road and blocks have a road hierarchy. A typical block is 240m wide (10 plots) and 130m deep (4 plots and a 10m road) (Figure 3.6);
- **Medium density standard block sizes** comprise of four standard medium density plots (30m x 18m) back-to-back with a local 10m road dividing them. In this way, properties always front onto a road and blocks have a road hierarchy. A typical block is 180m wide (10 plots) and 130m deep (4 plots and a 10m road) (Figure 3.8);
- **High density standard block sizes** comprise of two standard high density plots (30m x 15m) back-to-back. Due to expected high volumes of traffic in high density areas, local 10m roads have not been provided. Roads will typically be 18m wide. A typical block is 150m wide (10 plots) and 60m deep (2 plots) (Figure 3.9);
- **Standard plot sizes can be combined** for larger developments;
- **Low density area typical building heights are 1-2 storeys;**
- **Medium density area typical building heights are 2-4 storeys;**
- **High density area typical building heights are 4-6 storeys;**
- **Taller buildings may be permitted** where appropriate (for instance near LRT stations);
- **Limit the removal of existing structures** to reduce impact on existing communities;
- **Infill development is medium or high density;**
- **No development on flood corridors and flood prone areas.** These spaces can be used as public open space when not flooded.

Transport

- **Permeability.** All areas should have a direct and legible road network (Figure 3.7);
- **Upgrade existing roads** and connect to new roads to ensure new communities are integrated with existing ones (Figure 3.7);
- **Road network planned around flood corridors and flood prone areas** (Figure 3.10).
- **Culvert to be provided where it is absolutely necessary for a road to cross a river,** to allow for river flow;

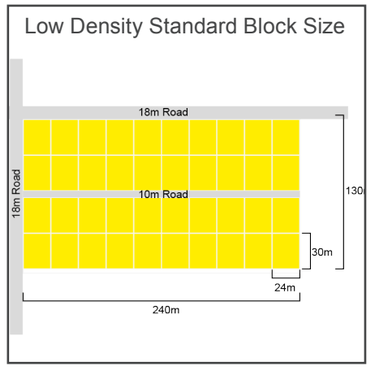


Figure 3.6: Low Density Standard Block Size

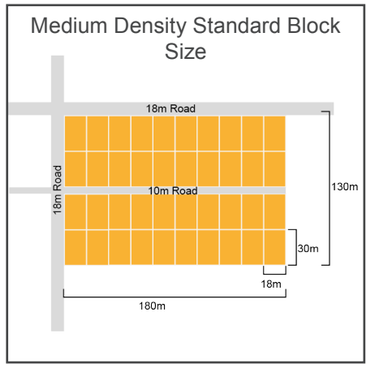


Figure 3.7: Medium Density Standard Block Size



Figure 3.9: Permeable Road Network, Upgraded Roads Connect to New Roads

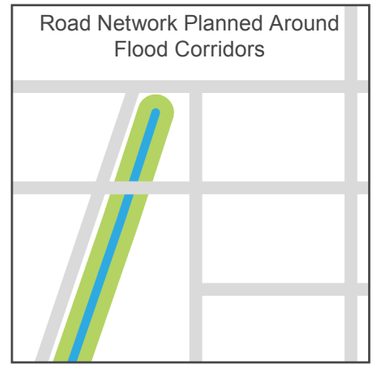


Figure 3.10: Road Network Planned Around Flood Corridors and Flood Prone Areas

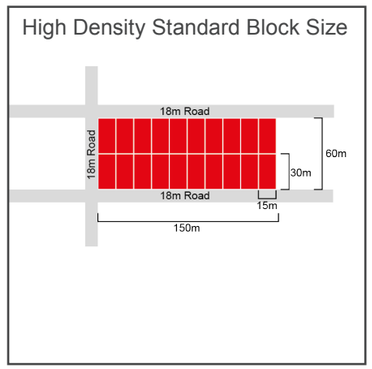


Figure 3.8: High Density Standard Block Size

3.2.2 ZONING REGULATIONS FOR URBAN EXPANSION AREAS

The zoning regulations offer a set of coherent guidelines to regulate the use and development of urban expansion areas in Ibadan. They provide a useful tool to control and guide new development and create an attractive environment where people would want to live.

The main objectives are:

- To provide guidance to plan for new residential communities and meet their housing needs.
- To provide a variety of housing typologies and mix in density alongside meeting housing targets.
- To enable other land uses that provide facilities or services to meet the needs of residents.

For zoning of the urban expansion areas, residential density is used as a basis to provide a range across the city, as follows (an as illustrated in Figure 3.26):

- Residential Area 1 (RA1) - High Density;
- Residential Area 2 (RA2) - Medium Density;
- Residential Area 3 (RA3) - Low Density.

Uses

Uses define the types of additional and complimentary development allowed within a particular residential zone. These are categorised into permitted uses, conditional uses and prohibited uses, as follows:

- Permitted Uses (those that are permitted) - A use that is allowed outright in a particular zone, as it is unlikely to give rise to significant adverse impacts. Any proposed development must meet the development standards of the zone.
- Conditional Uses (those that may be permitted) - A use that is not allowed outright, although it may have beneficial aspects and serve important public interests. Examples of conditional uses in residential zones include agriculture, schools, religious institutions, and fire stations. Conditional use regulations are needed because such uses may have significant adverse effects on the environment, overburden public services, change the desired character of the area, or create a significant nuisance. It may be appropriate to allow the use when there are minimal impacts, allow the use with conditions that reduce impacts, or deny the use if impacts cannot be reduced. Limits on the amount of visitors to the site, the size of the facility, or other aspects of the use are examples of conditions to reduce impacts.
- Prohibited Uses (those that are not permitted) - Some types of uses or development are prohibited in certain zones.

Each residential zone within Ibadan has been assigned permitted, conditional and prohibited uses. The uses for each residential zone are indicated in Table 3.4. Further details on the residential zones and density is set out in Section 3.2.3.

Zoning Standards for Residential Zones

The zoning standards regulate and guide development within the designated new residential zones. Zoning is an important tool for guiding development and use of land, curbing the misuse of land and promoting rational and orderly development of the built environment. The plot coverage restrictions should be strictly enforced as these provide the opportunity for green space to be integrated into the context of residential areas. Each plot should be encouraged to use the undeveloped part for gardens that provide amenity benefits and the opportunity for small-scale urban agriculture, which assists with ensuring local food security. Maximising green space also contributes to reducing surface water runoff, which helps to mitigate flood risk.

The zoning standards seek to control the plot area, sizes, plot coverage and setbacks of a building. The tables below set out the zoning standards for each new residential zone.

Table 3.1: RA1 Zoning Standards

RESIDENTIAL AREA ZONE - RA1	STANDARDS
Plot Density	High Density
Plot Area (Sqm)	450.00
Plot Size Options (m)	15.0 X 30.0
Maximum Plot Coverage	50%
Minimum Front Setback (m)	5.0
Minimum Back Setback (m)	1.8
Minimum Left Setback (m)	1.8
Minimum Right Setback (m)	1.8

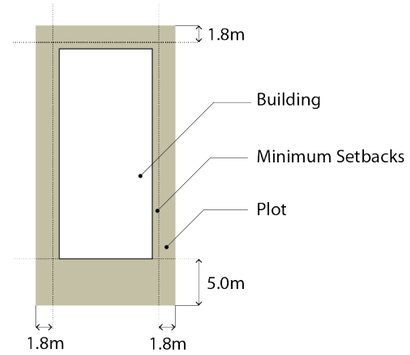


Figure 3.11: RA1 Standard Plot

Table 3.2: RA2 Zoning Standards

RESIDENTIAL AREA ZONE - RA2	STANDARDS
Plot Density	Medium Density
Plot Area (Sqm)	540.00
Plot Size Options (m)	18.0 X 30.0
Maximum Plot Coverage	45%
Minimum Front Setback (m)	4.5
Minimum Back Setback (m)	1.8
Minimum Left Setback (m)	3.0
Minimum Right Setback (m)	1.8

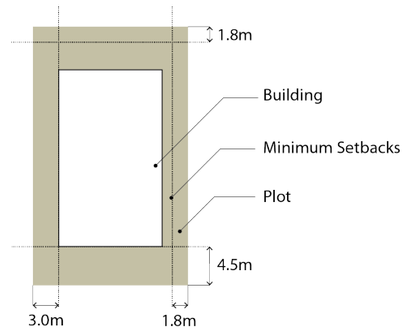


Figure 3.12: RA2 Standard Plot

Table 3.3: RA3 Zoning Standards

RESIDENTIAL AREA ZONE - RA3	STANDARDS
Plot Density	Low Density
Plot Area (Sqm)	720.00
Plot Size Options (m)	24.38 X 30.0
Maximum Plot Coverage	40%
Minimum Front Setback (m)	6.0
Minimum Back Setback (m)	3.0
Minimum Left Setback (m)	3.0
Minimum Right Setback (m)	3.0

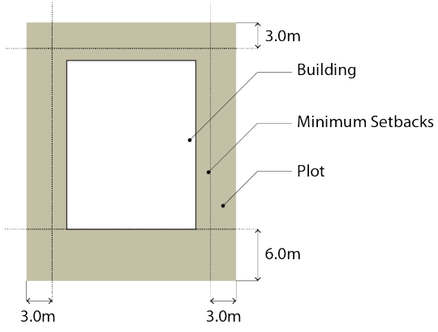


Figure 3.13: RA3 Standard Plot

Table 3.4: Residential Permitted, Conditional and Prohibited Uses

RESIDENTIAL AREA ZONE	PERMITTED USE	CONDITIONAL USE	PROHIBITED USE
RA 1	**Residential** - duplexes, maisonettes, apartments/flats. **Commercial** - retail, shopping centres, commercial centres, convenience shopping, local/weekly markets, offices and business hubs.. **Leisure and Recreation** - hotels, motels, guest houses, restaurants, cafes, sports facilities. **Educational facilities** - high schools, colleges, universities, research institutes, training centres, vocational centres, primary schools, secondary schools. **Health Facilities** - clinics, hospitals, primary health centres, secondary health centres. **Social and Cultural Institutions** - clubs, theatres, concert halls, auditoriums, cinema halls, exhibition halls and art galleries, libraries, community centre, visitor centres. **Transport Infrastructure** - roads, rail, bus stops, rail stations, car parks, taxi ranks. **Open Spaces** - parks, gardens, playgrounds, public squares, urban agriculture. **Public Buildings** - LGA headquarters, other government offices, banks and other financial institutions. **Other Community Facilities** - Police stations, fire stations.	**Other Community Facilities** - Places of worship, cemeteries. **Commercial** - Petrol filling stations. **Leisure and Recreation** - Stadiums, amusement parks. **Infrastructure and Utilities** - Mobile phone base stations.	**Industrial** - Printing press, publishing houses, manufacturing, mills, petrochemical and steel industries, mineral works, gas works, water works, metal fabrication. **Light Industry** - wood works, shoe factory, garment industry, motor repair workshop, dry cleaning, watch repairs, cobblers, electronic repairs, welding workshop, agro-based, allied industries, logistics/warehousing facilities.. **Open Spaces** - zoos, zoological gardens, botanical gardens. **Infrastructure and Utilities** - solid waste and sewage treatment plants, electric power stations, water pumping stations. **Transport Infrastructure** - bus depots, truck depots, lorry depots, motor parks, rail yards, airport. **Leisure and Recreation** - amusement parks, golf courses, resorts. **Residential** - detached houses, villas, cottages.
RA 2	**Residential** - detached houses, duplexes, maisonettes, apartments/flats. **Commercial** - retail, commercial centres, convenience shopping, local/weekly markets, offices. **Leisure and Recreation** - hotels, motels, guest houses, restaurants, cafes, sports facilities, stadium, clubs. **Educational Facilities** - primary, secondary and high schools, colleges, training centres, vocational centres. **Health Facilities** - primary and secondary health centres. **Social and Cultural Institutions** - auditoriums, cinema halls, exhibition halls and art galleries, library, community centre, clubs, concert halls, theatres. **Transport Infrastructure** - roads, bus stops, rail stations, car parks, taxi ranks, bus depots, truck depots, lorry depots, car parks, railways. **Open Spaces** - parks, gardens, playgrounds, public squares, urban agriculture. **Public Buildings** - government offices, banks and other financial institutions. **Other Community Facilities** - Places of worship, police stations, fire stations, cemeteries.	**Light Industrial** - wood works, shoe factories, garment industries, motor repair workshops, dry cleaning, watch repairs, cobblers, electronic repairs, welding workshops, agro-based, allied industries. **Residential** - villas, cottages. **Commercial** - shopping centres, business hubs. **Leisure and Recreation** - stadiums, amusement parks, golf courses, resorts. **Educational Facilities** - universities, research institutions. **Health Facilities** - clinics, hospitals. **Social and Cultural Institutions** - visitor centres. **Open Space** - zoos, zoological gardens, botanical gardens. **Public Buildings** - government offices. **Infrastructure and Utilities** - Solid waste/sewage treatment plants, electric power station, water pumping stations, Mobile phone base stations.	**Industrial** - Printing press, publishing houses, manufacturing, mills, petrochemical and steel industries, mineral works, gas works, water works, metal fabrication), logistics/warehousing facilities. **Transport Infrastructure** - airports. **Public Buildings** - government offices.
RA 3	**Residential** - villas, cottages, detached houses. **Commercial** - retail, convenience shopping, local/weekly markets. **Leisure and Recreation** - restaurants, cafes, sports facilities. **Educational Facilities** - primary and secondary schools. **Health Facilities** - primary and secondary health centres. **Social and Cultural Institutions** - cinema halls, library, community centres. **Transport Infrastructure** - roads, rail, bus and rail stops, car parks, taxi stands. **Open Spaces** - parks, gardens, playgrounds, urban agriculture. **Public Buildings** - government offices, banks and other financial institutions. **Other Community Facilities** - Places of worship, police stations, fire stations, cemeteries. **Light Industrial** - wood works, shoe factories, garment industry, motor repair workshops, dry cleaning, watch repairs, cobblers, electronic repairs, welding workshops, agro-based, allied industries.	**Commercial** - Shopping centres, business hubs. **Educational Facilities** - Universities, research institutions. **Infrastructure and Utilities** - solid waste and sewage treatment plants, electric power stations, water pumping stations. **Commercial** - commercial centres, offices. **Leisure and Recreation** - golf courses, resorts, stadiums, amusements parks. **Social and Cultural Institutions** - auditoriums, cinemas, exhibition halls, art galleries. **Open Space** - zoos, zoological gardens, botanical gardens. **Infrastructure and Utilities** - Mobile phone base stations. **Transport Infrastructure** - Solid waste/sewage treatment plants, electric power station, water pumping stations, bus depots, truck depots, lorry depots, car parks, railways, airports.	**Public Buildings** - government offices. **Industrial** - Printing press, publishing houses, manufacturing, mills, petrochemical and steel industries, mineral works, gas works, water works, metal fabrication, logistics/warehousing facilities. **Residential** - duplexes, maisonettes, apartments/flats. **Health Facilities** - Hospitals. **Social and Cultural Institutions** - visitor centres.

3.2.3 RESIDENTIAL DENSITY

A residential density strategy informs the scale and pattern of development. Used as a measure to determine the scale and quantum of development, it can help identify the city's infrastructure provision needs.

The main objectives of the density strategy are to ensure:

- That sufficient land is allocated in appropriate locations across the city to accommodate the expected growth in population, while making efficient use of land.
- That a range of residential densities are provided in order to ensure a choice in dwelling types.
- That there are areas with higher residential density that can accommodate more active urban centres and other areas of low density for residential communities and neighbourhoods.
- The intensification of development adjacent and close to public transport nodes and corridors in order to increase the use of public transport and to promote sustainable development.

High Density Examples



Figure 3.14: Apartment Block in Dar es Salaam, Tanzania (4 storey)



Figure 3.17: 175 Msasani Apartments in Dar es Salaam, Tanzania (7 storey)



Figure 3.20: Violets Court Apartments in Lekki Phase 1 (6 storey)

Medium Density Examples



Figure 3.15: Duplex Housing at Metro Gardens Estate, Lekki (3 storey)



Figure 3.18: Duplex Housing at Banana Island, Lagos (3 storey)



Figure 3.21: Townhouses in Lekki Phase 1 (2 storey)

Low Density Examples



Figure 3.16: Luxury Housing in Lagos (1 storey)



Figure 3.19: Luxury Villa in Lagos (1 storey)



Figure 3.22: Luxury Villas in Lekki Phase 1 (2 storey)

Density Categories

The masterplan proposes three residential density categories for new development areas: high, medium and low density. These are broken down as follows:

- High density (minimum of 22 residential buildings per hectare) – high density is a characteristic of the Growth Centres. Developed around key transport hubs, the Growth Centres will contain a diverse mix of residential uses, commercial activities, and administrative and institutional functions. The areas will include taller buildings of 4-6 storeys on average with a basic plot area of 450 sqm or 900 sqm if two plots are combined. It is envisaged that residential buildings in the high density areas will contain a number of residential units, generally in the form of apartments.
- Medium density (minimum of 19 residential buildings per hectare) – medium density residential areas cover the majority of the proposed expansion areas. These areas will contain a mix of residential typologies, and will be supported by associated land uses such as small shops, markets or small scale light industry. The plot area recommended for medium density development is 540 sqm with 2-4 storey buildings. Medium density developments will include a mix of blocks (residential buildings containing a number of residential units) and row housing (residential buildings containing a single residential unit).
- Low density (minimum of 14 residential buildings per hectare) – low density residential development is to be located in the peripheral areas of the city, and will comprise low-rise building types with an average height of 1-2 storeys and a plot area of 720 sqm. It is envisaged that residential buildings in the low density areas will generally contain a single residential unit.

Examples of schemes that have been constructed are shown in Figure 3.14 to Figure 3.25 to illustrate what these density types could look like.

High Density Typology



Figure 3.23: Illustration of high density residential typology

Medium Density Typology



Figure 3.24: Illustration of medium density residential typology

Low Density Typology



Figure 3.25: Illustration of low density residential typology

Density Space Standards

Density standards protect the wider character of construction, ensure optimum use of land and regulate residential development. At present, new residential development permitted in Oyo State is guided by the Space Standards prepared by the Ministry of Physical Planning and Urban Development in 2015. The 2015 standards identify the following plot sizes:

- Core Area: 450 sqm.
- High density: 540 sqm.
- Medium density: 720 sqm.
- Low density: 1,080 sqm.

These standards are to continue to apply within the existing urban areas (2017), as identified in the Ibadan City Masterplan.

For new development areas, a range of different standards are to apply as means to make optimum use of the land available, as identified in Table 3.5. This supports the masterplan's over-arching strategy to promote a compact form of development, seeking to limit urban sprawl, and therefore encourage higher residential densities where possible.

For high density developments, the masterplan proposes the scope of joining two 450 sqm plots to create a larger plot of 900 sqm in order to accommodate taller buildings in the Growth Centres, which require larger plot sizes.

Table 3.5: Space Standards

	EXISTING URBAN AREAS		NEW EXPANSION AREAS	
PLOT DENSITIES	PLOT SIZE (M)	PLOT AREA (SQM)	PLOT SIZE (M)	PLOT AREA (SQM)
High Density	18 x 30	540	15 x 30	450
Medium Density	24 x 30	720	18 x 30	540
Low Density	30 x 36	1,080	24 x 30	720

Source: Consultant's Analysis, 2016.

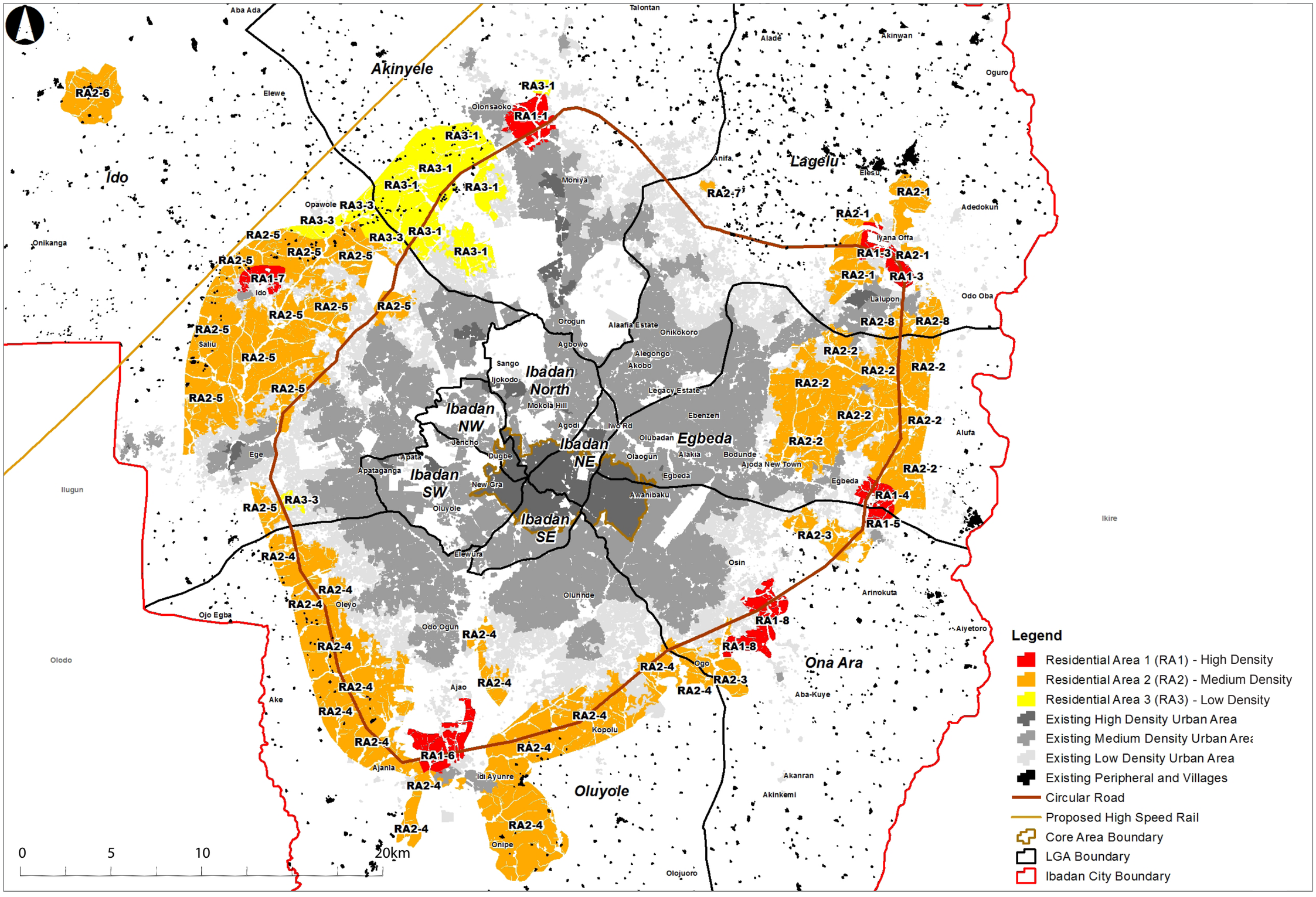


Figure 3.26: Residential Zoning and Density Map

3.2.4 REGENERATION OF THE CORE AREA AND DUGBE

Existing Situation

The existing core area of Ibadan acts as the nucleus of the city. It is rich in built heritage with a high concentration of commercial activity. It was predominantly developed before the introduction of formal planning regulations and controls and before the arrival of modern conveniences such as the car, water supply and electricity. It is a long-established area, being heterogenous in nature. Many of the original owners have moved out elsewhere in the city and rented out their properties, which has contributed to dilapidation due to increased occupancy and activity, combined with insufficient maintenance. However, over the last few years, the average growth rate of population for the inner areas has significantly reduced. This implies that:

- The densification process has slowed considerably, being well below the rate of natural increase,
- There is limited capacity due to overcrowding, so people decide to look elsewhere in the city for accommodation,
- There has been substantial growth of population in the outer areas of the city.

Ibadan's core area is characterised by high density, generally run-down housing and an absence of open spaces and community facilities. There is a general lack of upkeep and infrastructure provision to meet current needs.

The other challenges being faced by the core area, which are common to other parts of the city, include inadequate land use planning, lack of employment opportunities, inadequate infrastructure provision, under-utilised vacant plots, dilapidated housing, lack of a defined road network, lack of pavements for pedestrians, lack of parking facilities, lack of community facilities, poor drainage facilities, lack of an adequate waste disposal system, and poor living conditions.

In the year 1990, Agugu, Mokola and Yemetu districts within the core area were upgraded with World Bank support and finance. It mainly included the upgrade of roads and drainage facilities along with interventions related to sanitation, health and education facilities. However, there have been no other similar upgrade projects in the core area since then.

Masterplan Proposals

The masterplan proposes to make structural adjustments within the Core Area and take initiatives to create a clean and healthy built environment. Redevelopment and upgrade of dilapidated areas within the core is proposed. This will involve the state government working closely with the residents to promote renovation or redevelopment of buildings in need of repair and provide technical and financial assistance to owners in order to initiate proper maintenance of buildings. It also proposes to make efficient use of all available land by bringing under-utilised or vacant plots to appropriate use.

As part of the urban regeneration strategy, heritage-led renewal of the Core Area's rich grouping of buildings of historic and cultural value is proposed as a means to redefine and rejuvenate it. It involves conservation of the heritage buildings along with public realm improvements to preserve and enhance its character. New uses will be permitted in the buildings and sensitive adaptations facilitated where the original use of a historic building is no longer relevant nor viable. Public realm improvements include re-paving the streets, planting trees, installing street furniture and street lighting. An uplift of the city's historic core area will transform it into a cultural destination for its own communities and visitors. Combined with proposed accessibility improvements, this will create a more inviting environment with improved perceptions of safety. The historic core should reinforce a sense of community, make an important contribution to the local economy and act as a catalyst for improvements to the wider area.

New development is targeted around transport hubs with good public transport accessibility or a central transit stop (such as train station, light rail or bus stop). These transport hubs will act as important nodes and will attract a mix of uses including commercial, retail, business, recreation and residential land uses. New development in the Core Area should be proposed as high density mixed use with lower density development spreading out from the centre.



Figure 3.27: Regenerating the Core Area will be undertaken

Figure 3.27: Regenerating the Core Area will be undertaken

The intention is to retain the compact, walkable and pedestrian-oriented nature of the area and promote mixed-use development centred around a high quality rail network. This will reduce dependence on a car for mobility and make the central core of the city more economically viable.

The approach proposes to re-establish corridors and rights of ways to improve connectivity and enable more seamless movement within the core. The strategy seeks to provide vehicular access for solid waste disposal and security services. This might lead to acquisition of a small number of affected plots but the need for this will be minimal. It might involve widening roads by removing obstructions from the existing road space to integrate movement and utility networks. An Inner Ring Road is proposed to bypass internal traffic and provide an easy access and improved link connecting the core area with the rest of the city.

The masterplan also encourages the use of public transport and proposes to develop a mass transit system such as a BRT/LRT network, which will connect the core area with the new development areas. Importance is also laid on providing a pedestrian network within the core area with wide and clutter-free pavements.

Parking is a major issue within the core area and largely takes place on-street. The level of on-street parking owing to commercial activities is so high that vehicles often occupy the entire kerbside thereby reducing the road capacity and causing movement problems. The masterplan proposes to provide car parks and bays or lay-bys for all road users - work-related vehicles, private cars, molues, danfos, three-wheelers (keke napap), motorcycles and cycles in safe and suitable locations.

The regeneration strategy proposes to enhance the pedestrian network within the core areas by improving access to remote areas, providing dedicated paths to avoid conflict with the road users and by upgrading and paving streets where needed.

Upgrade and provision of utility infrastructure facilities is proposed in areas where there is a deficiency to meet the future needs of the local community. This will include provision of an adequate water supply, drainage system, solid waste management, telecom and power supply. Social infrastructure needs should also be met in areas where there is a deficiency.

The core area bustles with traditional markets which provide local employment opportunities. A significant number of people also engage in on-street trading and hawking, which are important sources of revenue for these people. It is imperative to protect the existing markets and maintain the cultural identity and economic viability of the core area.

The masterplan uplifts the market areas by improving connectivity and upgrading public infrastructure around them. It recommended that the markets are equipped with modern facilities while still maintaining their traditional charm. The existing street traders are to be accommodated either in newly developed markets or in commercial centres in the Growth Centres, or expansion areas. This will not only help in curbing the issue of street traders but also evenly distribute economic activity across the city.

All the above mentioned strategies are fundamental to urban renewal of the core area. While it will require the public sector to lead and ensure the coordinated delivery, the private sector will also be a principal stakeholder in implementation. At this stage, the proposal for urban renewal of the core area is at a strategic level and is detailed in the Detailed Urban Plans (DUP) of the Masterplan where a series of short, medium and long term actions are proposed.



Figure 3.28: Dugbe has potential for regeneration

Dugbe

Dugbe is often considered as the commercial heart of Ibadan, one that was extensively developed in the mid-20th Century. It is located on the edge of the Core Area and the two maintain a strong inter-relationship. Similarly to the Core Area, there has been a gradual decay of the public realm, one which does not allow for an attractive experience for pedestrians. Pavements are often cluttered or in a state of disrepair.

The city's future attractiveness and competitiveness is dependent on the quality, safety and functionality of the public realm that provide a wide range of settings for commercial, social and cultural interaction in order to maximise productivity and support the area and city's development. It is therefore proposed that the public realm is upgraded as an essential component of the Core Area strategy. Further details are set-out in the Core Area Detailed Urban Plan.

Regeneration of the Core Area (RCA):

Policy RCA1:

Urban regeneration will enhance Ibadan's Core Area and Dugbe. This will be achieved by undertaking the following improvements:

- Upgrading and widening roads and pavements, where required, to improve the flow and safety of traffic and pedestrians in the local street network to allow for access from utility vehicles.
- Constructing new secondary and tertiary roads in order to improve connectivity within the Core Area.
- When upgrading existing roads and constructing new roads, ensure that:
  - Designated areas for car parking and danfo lay-bys are provided in order to meet parking needs.
  - Restrictions on parking/stopping outside of designated areas are properly enforced in order to prevent unauthorised parking/stopping.
  - Opportunities to lay upgraded or new utilities infrastructure within roads are taken.
  - Sufficient road widths are provided to accommodate the above and to allow access by utilities vehicles.
- Supporting the refurbishment or redevelopment of dilapidated buildings.
- Underaking public realm improvements.
- Upgrading or developing new water, sewerage, waste and electricity infrastructure, where required.
- Upgrading traditional market facilities, where required.

Policy RCA2:

The streetscape and public realm in Dugbe will be enhanced and improved to provide a welcoming and attractive environment for pedestrians and cyclists.

3.2.5 Addressing Flood Risk

As described in Section 1.3, historic flooding events within Ibadan have been a key driver behind the need for a Masterplan to guide the future growth and development of the city. Addressing flood risk also forms one of the 10 objectives underpinning the Masterplan.

A detailed description of the baseline situation in respect of flooding and drainage is contained in Chapter 4 of this Masterplan and in the Detailed Urban Plan (DUP) on Flood Prone Areas. The existing problems facing the city can be summarised as follows:

Natural Causes:

- High rainfall intensity.
- Low land elevations.
- Growth of grass and weeds in channels.

Man-Made Causes

- Encroachment of buildings in flood plains.
- Deforestation, land use change which cause an increase in runoff and deplete flood storage areas.
- Rapid Urbanisation
- Under-sized and deteriorated culverts along some roads that are damaged from past flooding events.
- Dumping of solid waste in streams, some collector drains are silted and full of rubbish and debris.
- Some road culverts for tributary drains are silted and partially blocked with refuse and waste.
- Lack of comprehensive maintenance for natural watercourses.

The Spatial Development Strategy has been formulated to ensure that these problems are addressed as far as possible and to contribute to achieving the Masterplan objective to prevent and mitigate against flooding impacts. No new development is proposed or should be allowed within flood prone areas, which include flood risk corridors along rivers and low-lying areas. These are defined in detail within the DUP.

In order to avoid encroachment of built development into the flood prone areas, it is necessary to provide alternative active uses that are compatible with the risk of flooding. The key proposals in the Spatial Development Strategy are the provision of defined Strategic Open Spaces and areas for Urban Agriculture. Section 3.4.4 describes these further and those areas identified for such uses are set-out in the DUP on Flood Prone Areas.

During normal conditions, these can provide residents with recreational benefits and opportunities for cultivating food. Being open green infrastructure, these areas do not increase runoff and allow rainwater to infiltrate naturally, which therefore do not lead to an increase in flood risk. If flooding does occur, these areas can assist in mitigating the impact as they can act as areas for floodwater storage, thus restricting the rate at which it reaches inhabited areas containing built development.

The provision of Forest Protection Areas is another key proposal of the Spatial Development Strategy in respect of flooding and drainage. Existing forest areas to the north-east, south-east and north-west of the masterplan area are identified for such protection (see Section 3.4.4). The main function of this designation is to prevent the loss of trees, which causes increased surface water runoff upstream of Ibadan and results in greater volumes of water passing through the waterways within the built-up area.

Detailed policies on drainage and flooding are listed in Chapter 4 of this Masterplan and should be read in conjunction with Section 3.4.4 and the DUP on Flood Prone Areas.

3.3 LAND USE DISTRIBUTION

The existing land use pattern of Ibadan shows a clear distinction between the predominantly residential Ibadan built-up area and agricultural use in rural areas. The total land area of the eleven Local Government Areas of Ibadan is 3,145.96 sqkm,[1] out of which about 17% falls within the built-up area, 75% is not developed and 8% is built-up area within rural locations.

The proposed land use distribution plan (Figure 3.29) defines the location and type of development as it will be in the year 2036. A balanced land use distribution will facilitate the long-term economic viability of the city and contribute towards the revitalisation of degenerated areas, the conservation of heritage and natural resources, the provision of an adequate supply of housing to meet growing population demands and needs, the reduction of traffic congestion, and the provision of an open space network.

The proposed land use distribution of Ibadan is based on the following principles:

- Accommodate future population within Ibadan taking account of the demand for housing generated through the emerging industrial, commercial and infrastructure proposals.
- Promote a mix of land uses that provides residential and employment opportunities to encourage variety and vitality.
- Accommodate diverse uses that support the needs of the existing and future residents, businesses and visitors.
- Adopt a flexible approach to accommodate a broad range of land uses in line with the changing demands of the future population.
- Encourage mixed use development especially in the Growth Centres and along the major transport corridors.
- Protect and enhance the natural environment, including forests, agriculture and watercourses.
- Protect the archaeological sites and areas of historical and cultural significance.
- Ensure land uses related to education and health are easily accessible and well served by public transport.
- Provide an equitable distribution of land uses that thereby reduces the need to travel and helps to improve the quality of life.

The proposed land use classification represents Ibadan in 2036 and reflects the Oyo State Government space standards. See Section 2.5.1 for a detailed breakdown of the land use classifications.

1 Ibadan City Masterplan Diagnostics Report, Dar 2017.

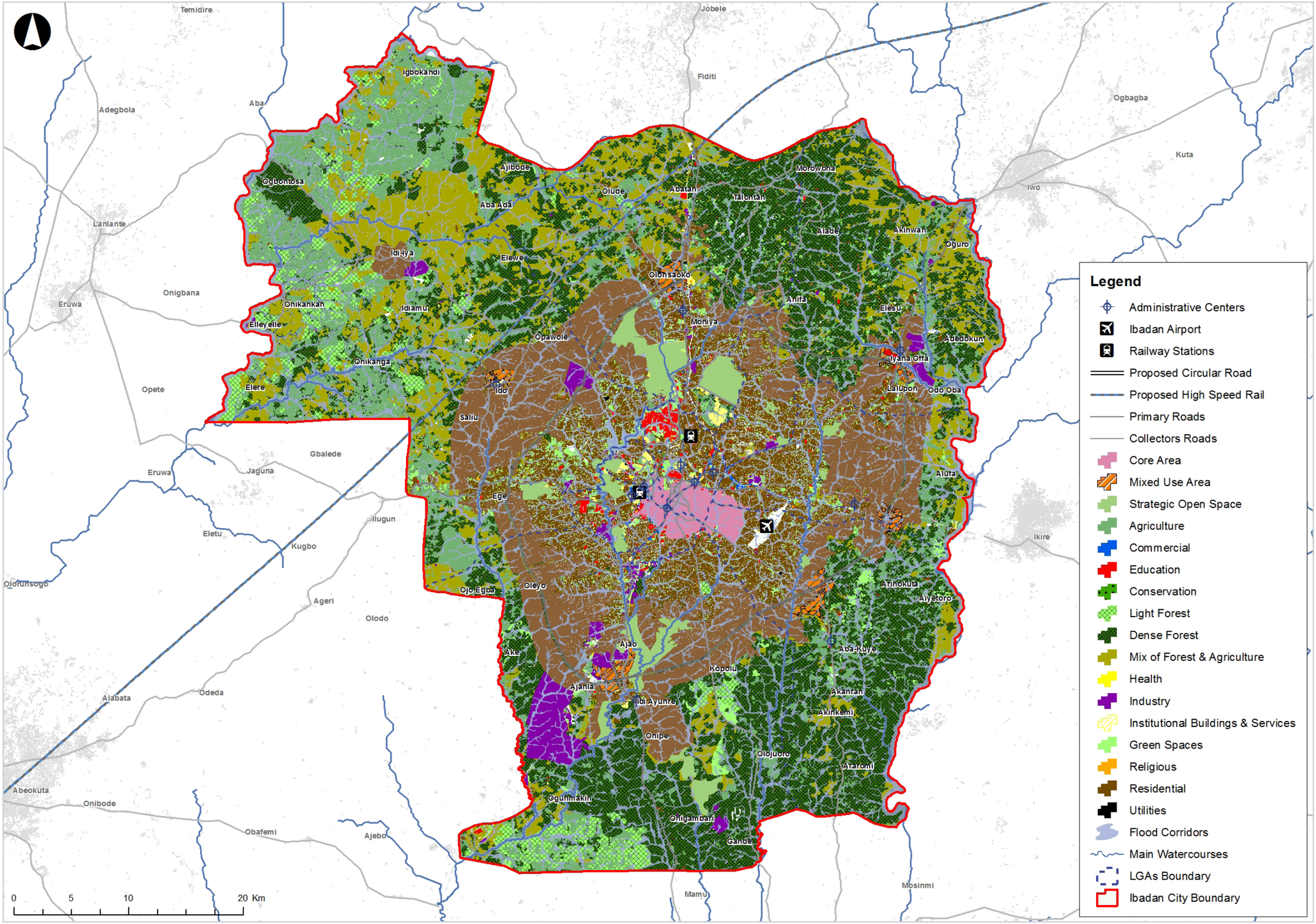


Figure 3.29: Land Use Distribution 2036

3.3.1 RESIDENTIAL AREAS

Residential is the predominant land use category within the city. With the rapidly increasing population, there is a growing demand for the provision of housing.

The new residential areas are categorised into high, medium and low density developments in order to accommodate the projected population and offer a range of housing opportunities.

The masterplan also proposes infill development around the periphery of the existing urban areas. The intention is to make efficient use of all available vacant plots and create a compact model of development that limits the need of land required for development in the new residential areas.

Residential areas will contain a mix of other uses to ensure that local facilities and services are nearby. This will include education, health, government or institutional, commercial, formal and informal open spaces, transport and utilities. The allocated percentage of the other land uses depends upon the density of development in those areas. Within the Growth Centres which have been identified as high density developments, 20% of the land area will be dedicated to residential land use while the remaining 80% will include other complimentary land uses such as commercial, retail, administrative, institutional, offices, open spaces, transport related services, utility infrastructure and other community facilities. Such a mix of land uses will be encouraged as a means to create sustainable and vibrant communities (refer to Figure 3.31).

Within the urban expansion areas identified for medium and low density development, 50% of the land area will be dedicated to residential land use and the remaining will be used for commercial, retail, administrative, institutional, offices, open spaces, transport relate services, utility infrastructure and other community facilities (refer to Figure 3.31 for the spatial distribution of land uses in the new residential areas in the masterplan).

The inter-relationship between residential development and associated land uses such as social infrastructure, economic development and transport provision, plays an important role in creating strong and supportive local communities. The Ibadan City Masterplan focuses on meeting the basic needs of the future population in the provision of social infrastructure, access to efficient public transport, a range of housing types, a wide range of services, such as parks and open spaces, shops, markets, cafes and restaurants, all within an accessible distance.

The percentage allocated to different land uses would contribute towards and facilitate the city's long-term fiscal and economic viability, equitable distribution of community facilities, provision of adequate infrastructure and public services, reduction of traffic congestion, enhancement of recreation and open space opportunities, assurance of a healthy living environment, and achievement of the vision for a more liveable city.

Existing residential areas have developed over many years and house Ibadan's communities. They display a strong character of a mixed-use environment. This residential land use and mix is critical to the wellbeing and balance in Ibadan. The masterplan seeks to retain its current character.

Residential (R) Land Use:

Policy R1: New Residential areas are to be developed according to a range of high, medium and low densities.

Policy R2: New and existing residential areas are to be integrated with the emerging transport and infrastructure proposals.

Policy R3: New residential areas must be accessible and well connected to the local road network.

Policy R4: Existing residential areas should retain a predominant residential character and use.

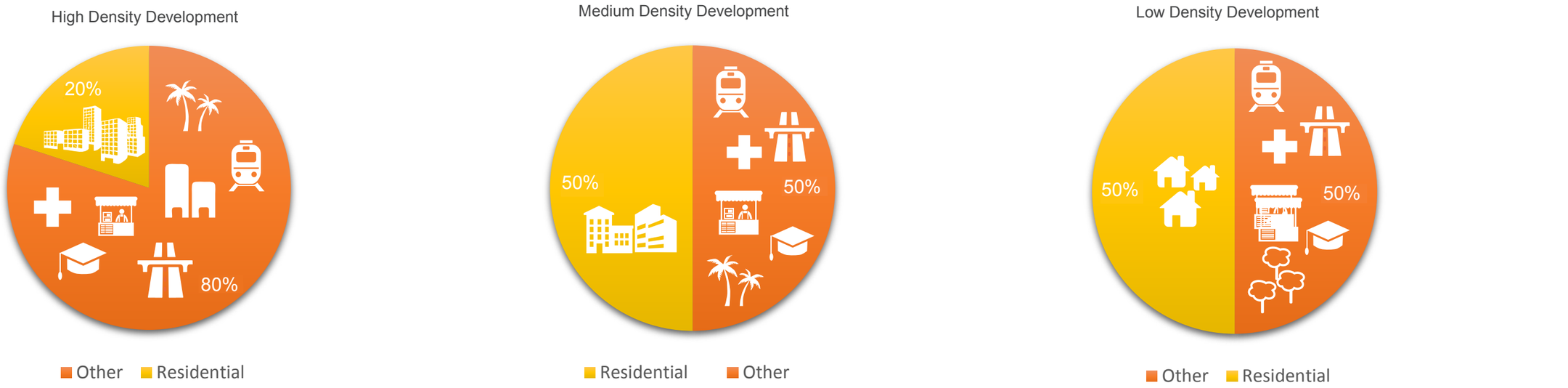


Figure 3.30: Diagrams of Land Use Ratio in Residential Areas

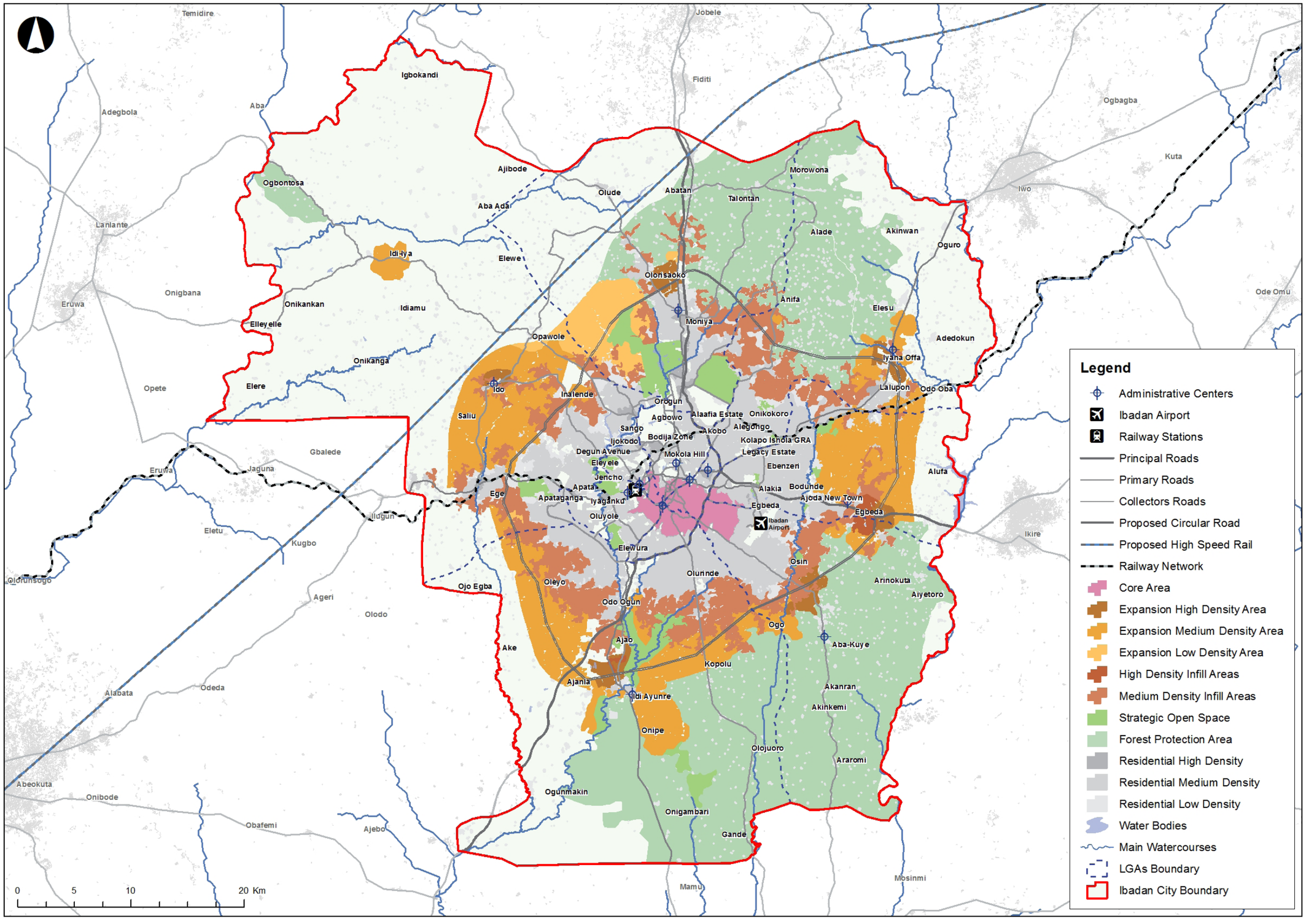


Figure 3.31: Distribution of Residential Density 2036

3.3.2 COMMERCIAL AND MIXED USE

Existing commercial uses within Ibadan comprise of markets and shopping centres. There are at least 82 markets spread across the city, 35 of which can be found in the 5 central LGAs and 47 in the outer LGAs. Traditional markets in Ibadan are primarily located within the core areas. These include Oja'ba, Oje, Orita Merin, Labo, Oranyan, Gege, Old Gbagi, Ayeye, Agbeni and Agbaje. Modern markets are usually found in designated areas such as New Gbagi (between Old and New Ife Road), Aleshinloye, Scout Camp, new Garage, Temidire Garage and Dugbe.

A small number of new markets have also emerged in locations across the city, and are located at the intersection of major routes. Some of the important ones include Gate/Bus Stop, Sango, Iwo Road, Olorunsogo, Academy and Apata.

Modern shopping centres, although a relatively new phenomenon, have gained importance in diversifying local shopping trends. The most prominent example is the Palms Shopping Mall in Ring Road, but there is also the presence of smaller shopping centres such as the Ventura Mall, Agbowo Shopping Complex and the Adelabu Shopping Complex.

The markets and shopping centres in Ibadan provide great potential for the city's commercial development. They are not only economic institutions but also serve as social entities.

Despite this, most of the markets lack adequate solid waste management, proper facilities for the disposal of sewerage, a proper drainage system, access to water, toilet provision and other basic amenities.

The masterplan notes the importance of strengthening the role of the existing traditional markets and enhancing their attractiveness. The upgrade to infrastructure facilities within the existing markets and improvements to their accessibility to public transport is therefore proposed.

In addition, the masterplan proposes an increased commercial offer with an even distribution of commercial land use across the city, with a particular focus on the greater concentration of commercial activities within the 6 new Growth Centres. The masterplan proposes the development of a new commercial centre within each of the Growth Centres, with additional smaller commercial centres spread across the proposed expansion areas. The development of new commercial centres will provide more equitable access to centre functions without reducing the strength of Ibadan's Core Area, while distributing economic activity more evenly across the city.

Located centrally, the commercial centres will form the main business and commercial area within the proposed expansion areas and the Growth Centres in particular. They will contain a range of land uses including retail, commercial, leisure, mixed use and other community facilities. Benefitting from close proximity to infrastructure facilities and improved accessibility to public transport, the new commercial centres will attract a wide range of local, regional and international retail operators and emerge as prime destinations that pull in large volumes of people. They will benefit from active and vibrant commercially viable destinations and contribute significantly towards economic development that provides local employment opportunities. An emphasis will be placed on designing retail destinations that promote an open environment as is traditional in Ibadan's local culture, with trade along streets, with active frontages along buildings.

The masterplan also recognises the importance of local centres in providing services and facilities close to where people live in order to serve their day-to-day needs. The predominant uses should be retail, recreation and community facilities. Such local centres are to be developed within the new residential areas. These should ideally be within a reasonable walking distance (circa 1.2km) or short public transport journey (circa 2.4km) where this is available. Development in these centres will aim to enhance the area's vitality and viability while respecting their character and the amenity of residents.

Mixed commercial areas (see Figure 3.32) and local centres will provide space for local markets. These will accommodate traders to operate and therefore avoid the potential for encroachment on the public right of way. It is common in Yoruba culture for open-air trading to be undertaken. Where appropriate, this should continue to be catered for in new development.

As the city experiences significant population and employment growth over the next 20 years, the 6 new Growth Centres provide an ideal location to support mixed use development. These will be developed as high density centres which will benefit from a high level of accessibility and can therefore support higher intensity land uses and population density. This is the basis for a Transit Oriented Development (TOD) strategy.

Mixed-use development will comprise a wide range of land uses including retail, commercial, administrative, institutional, business and residential. The land uses will be distributed horizontally as well as vertically within a single building. Typically, the ground floor premises will be used for retail or administrative/ institutional functions and the upper storeys will accommodate offices or residential uses. When planning the mix of uses, the potential for noise and disturbance to potential residents should be considered to ensure there are no adverse impacts.

The mixed use developments will provide an increased housing, employment, business and investment choice for the growing city. They will bring together and integrate different land uses and promote the diversification of activities with the efficient use of public infrastructure.

Along the main corridors into the city, commercial development will be permitted to benefit from the passing trade.

Commercial and Mixed Use (CMU) Land Use:

Policy CMU1: Commercial activity is to be promoted within the proposed urban expansion areas, with a particular focus on the high density Growth Centres.

Policy CMU2: Local Centres will be distributed across the urban expansion areas and urban infill in order to provide services and facilities in close proximity to local communities.

Policy CMU3: In order to encourage vitality and diversity in centres, a range of land uses related to commercial activity including retail, markets (formal and informal), shopping centres, hotels, markets, banks and offices will be provided in combination with other uses such as residential and community facilities. A higher degree of mixed uses will be promoted in the Growth Centres in particular.

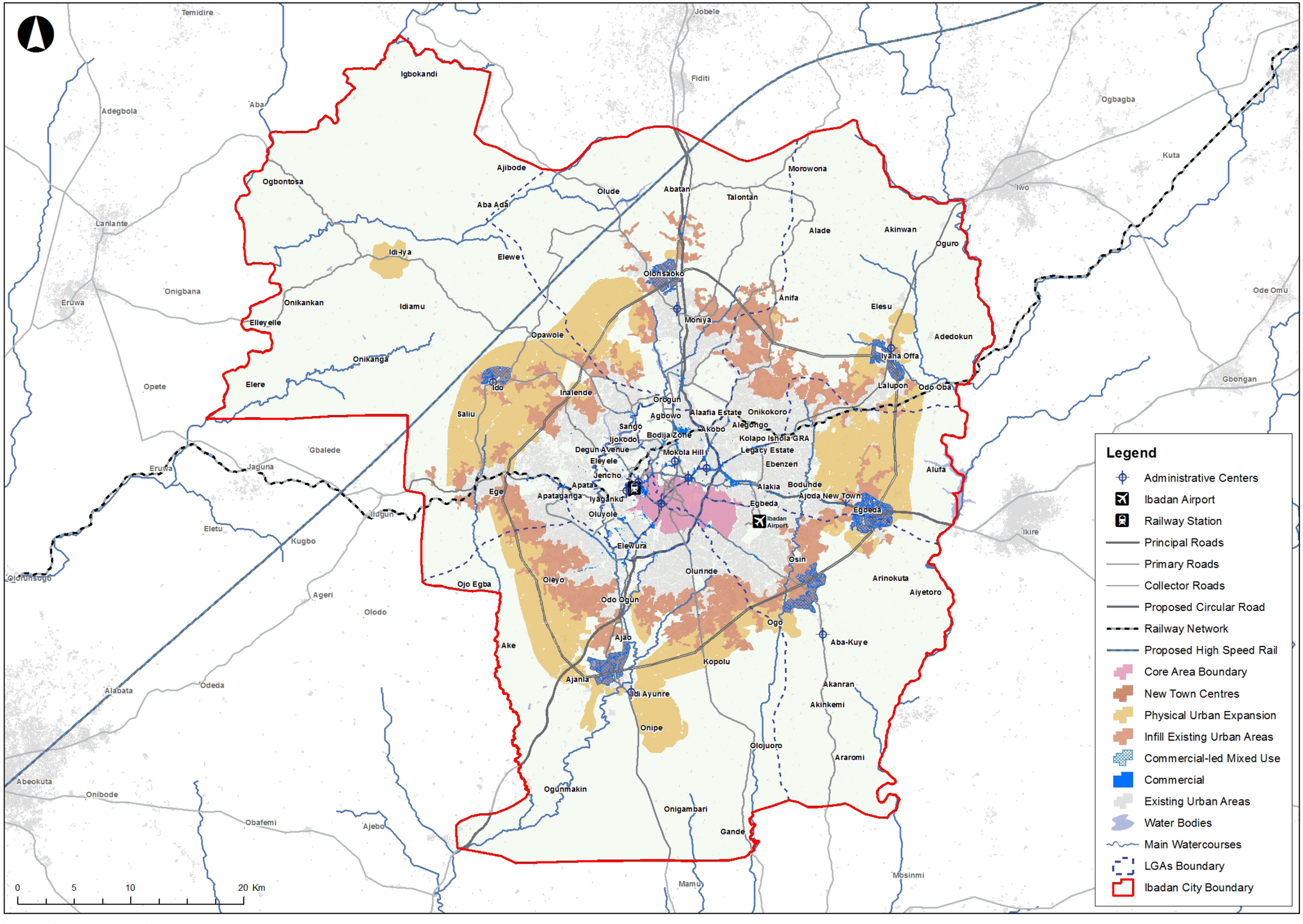


Figure 3.32: Commercial and Mixed Use 2036

3.3.3 INDUSTRY

The industrial establishments within Ibadan comprise of heavy, medium and light industries, with major industries located primarily along the major transport routes. These include industries along Oluyole, Old Lagos Road, Olubadan Industrial Estate near Express Toll Gate, Olubadan Estate along New Ibadan/Ife Express Road and Ajoda New Town, Eleyele Light Industrial Estate, and Nigerian Breweries PLC next to Olubadan Estate with some smaller industries located around it. Traditional industries and other light industrial activities are scattered across the existing urban areas. Many industries have also been developed on the city fringes.

The State Government has designated additional sites for major industrial development in the city. The emerging industrial developments include Oyo State Industrial Park (Lagos-Ibadan Expressway), Burnt Brick Plant (Oloba and Adeyooye villages), Inland Container Depot/Dry Port (Erunmu), Trailer Park (Alarobo Area, Monatan, along Lagos/ Ibadan Expressway), Chinese Village – Industrial Estate (along Lagos/Ibadan Expressway), Oluyole Free Trade Zone (along Lagos/Ibadan Expressway), African Regional Centre for Engineering Design and Manufacturing (Wofun, Iwo Road), Mechanic Village (Olukunle village) and Ibadan Logistics Centre.

The masterplan seeks to build on these assets by encouraging further growth around the existing industrial centres. New industrial premises are proposed across the city with new estates identified in Oluyole, Lagelu and Ido. The sites at Oluyole and Lagelu are located adjacent to the proposed Growth Centres. With designated industrial estates, Growth Centres will be recognised as important employment hubs. The industrial sites are strategically located close to the principal and primary road network ensuring excellent transport connectivity and accessibility.

The masterplan intends to concentrate industrial development and create conditions which are conducive to economic development by ensuring the adequate supply of land in accessible locations. In total, 8 new industrial sites have been identified, which include 4 sites along the Lagos-Ibadan expressway in Oluyole, 2 sites near Ibadan-Iwo road in Lagelu and 2 sites along the Apata road in Ido. The sites in Oluyole will strengthen the existing industrial base in the region and provide significant employment opportunities. These sites will focus on heavy industries such as manufacturing, construction, etc. The industrial sites in Lagelu anchored by the emerging proposal for the Erunmu Dry Port are proposed to be developed for warehousing, new business and logistics space.

Agriculture is an important activity that features prominently in the land use distribution across Ibadan, especially in the north-western part of the city. Based on the socio-economic analysis, agriculture will provide a significant sectoral share of employment in Ibadan by 2031.

The masterplan seeks to promote agro-based industries and has identified 2 sites in Ido to support the rural community in Idi Iya. The investment in agro-based industries is important not only as the economic sector but also to retain the social structure of the city (refer to Figure 3.33).

In recent years, some mineral prospecting has been undertaken within Oyo State and has identified that there is the potential for deposits of a scale that are economically viable to extract. The Masterplan has not classified or zoned any land within the Masterplan boundary for mineral extraction use, but should clear and substantive evidence be provided that confirms the presence of extractable minerals within a specifically defined area, it may be necessary to deviate from the land use classifications/zoning to allow for extraction to take place. In reaching such a decision, the environmental impacts of any extraction should be fully considered (likely through an Environmental Impact Assessment) in order to ensure there are no residual impacts that would have a significant adverse effect. Within areas classified/zoned for new development, there may be scope for minerals to be extracted prior to development taking place. Again, the environmental impacts need to be fully considered and a decision will need to be made as to whether allowing extraction would significantly inhibit delivery of the Masterplan strategy. If it would, a strong justification is needed to demonstrate the benefits of extraction outweigh the disbenefits associated with inhibiting the Masterplan strategy.

Strategic Industrial Areas

In addition to the new industrial sites and industrial estates already referred to, four new industrial areas are proposed across Ibadan. Each of these will be developed according to different strengths, which includes the following:

1. Idi-Iya - based on agri-businesses, including agricultural processing

2. Inalende - based on agri-businesses, including agricultural processing

3. Ajanla - heavy industry, including manufacturing

4. Iyana Offa/ Lalupon - warehousing and storage

1. Idi-Iya:

Area character: The Idi-Iya Industrial area lies approximately 30km to the north-west of Ibadan and to the south-west of a settlement of the same name and extends over approximately 500ha. It will be connected with a new road running through Inalende to the road network of Ibadan. There are no significant water bodies in the vicinity and except for the settlement of Idi-Iya, it is surrounded in all directions by areas of agriculture or open land and is relatively flat. A buffer of no less than 200m between the settlement of Idi-Iya and the industrial area will help to protect the urban area from noise and air pollution. This buffer should be cultivated as a planted urban amenity.

Permitted Uses: Large scale industrial complexes will be developed and will handle the produce cultivated locally in the wider region around Idi-Iya. This new industrial site will handle packaging and other processing for onward transfer to Ibadan and further afield. Due to its isolated location, this area will be suitable to accommodate the heavier and less attractive industries which would cause problems if located within residential areas. In addition, the link with agriculture is clear and so this location will be suitable for processing such products as Palm Oil and Cocoa and other associated agri-businesses. Prevailing winds may help to take air-borne pollution from the industrial premises away from residential areas.

Ancillary uses: Uses to be permitted within the industrial complex will include offices, small scale retail (under 300sqm per unit) linked with the businesses in the industrial area, cafes and small clusters of stalls or markets (no more than in groups of 10 stalls).

Inappropriate Uses: Given the proximity of Idi-Iya and the possible need for trade in the settlement, residential and other community uses should be focused in the settlement and not in the industrial area.

2. Inalende:

Area character: The Inalende industrial area extends over approximately 400ha and is located close to Ibadan's Circular Road, which means it can provide rapid responses to the delivery of local food products in the surrounding urban area. It lies on the route from Idi-Iya to Ibadan, about half way between the two and so could contain related uses and provide a stop off point on the route: it is approximately 15km from the urban centre of Ibadan. Buildings in this location should be suitable for the urban surroundings in terms of building footprint, height, use and intensity of operations.

Permitted Uses: Inalende is similar to Idi-Iya in terms of its prospects to accommodate agri-businesses. However, it is surrounded by other development and as it will be more sensitive to noise and air pollution, it should only contain light industry. This site can handle packaging and other processing for onward transfer to Ibadan and further afield along with other similar food production. Light industries with a direct relationship with urban areas such as home appliances, electronics, automotive components and maintenance should be encouraged to locate here. This area is located directly on the proposed circular road and the network should be designed to allow direct vehicular access into and from the industrial area to avoid heavy vehicles disrupting the surrounding non-industrial areas.

Ancillary uses: Uses to be permitted within the industrial complex will include offices, small scale retail (under 300sqm per unit) which is linked to businesses in the industrial area, cafes and clusters of stalls or markets which may serve to create a good link between the area and the surrounding residential centres.

Inappropriate Uses: Due to its location, industries that create noise or air pollution will not be acceptable. In addition, any industries which involve substances of any potential harm such as chemicals should not take place in this area.

3. Ajanla:

Area character: This by far the largest of the industrial areas proposed around Ibadan and extends over approximately 2,000ha. It is strategically located on the main Lagos expressway and close to Ibadan's Circular Road, providing excellent access to all areas of Ibadan and Lagos. This area encloses an existing lake and has varying topography: areas of undulating land as well as flat land. Given its size and the topography, it should be possible to locate buildings discretely in the landscape to avoid degrading the approach from Lagos and acting as a negative 'gateway' to Ibadan. To additionally protect this transport corridor, a planted buffer no less than 100m wide should be created to screen the industrial area from the expressway.

Permitted Uses: Consolidating the already established industries in the south-west of Ibadan, this area will accommodate further manufacturing plants that create goods for onward sale. Ibadan is already strong in food and beverage production and such types of industry can be located in this area. Its separation and size will also allow heavy industry to be located here without negatively impacting on local areas, some distance away from residential areas. However, uses producing higher levels of air and noise pollution should be located in the south of the industrial area. A buffer of 200m will separate the industrial area from the other development areas to the north.

Ancillary uses: Uses to be permitted within the industrial complex will include offices, small scale retail (under 300sqm per unit) which is linked to businesses in the industrial area, cafes, small clusters of stalls or markets (no more than in groups of 10 stalls). Given the location on the Lagos expressway, it may be appropriate to allow transport related uses such as bus depots and garages to locate here if there is a demonstrable need

Inappropriate Uses: Residential and other associated uses should be focused in the urban areas to the north and not in the industrial area.

4. Iyana Offa / Lalupon:

Area character: The Iyana Offa/Lalupon Industrial area is made up of two small areas totalling 200ha which lie approximately 23km to the north-east of Ibadan on the fringes of the proposed urban expansion. A buffer of no less than 200m between the industrial area and nearvy residential areas will protect the local amenity from noise and air pollution. This buffer should be cultivated as a planted urban asset.

Permitted Uses: Closely associated with the proposed dry port at Erenmu, this industrial complex will comprise warehousing and storage facilities that take advantage of the good accessibility to the wider national transport network for the onward distribution of goods. This location will also benefit from the proximity to the new Ibadan Circular Road and therefore have easy access to the long distance transport network.

Ancillary uses: Uses to be permitted within the industrial complex will include offices, small scale retail (under 300sqm per unit) which is linked to businesses in the industrial area, and cafes to serve the needs of the industrial park.

Inappropriate Uses: Industries that create noise pollution will not be acceptable. In addition, any industry which involves substances of any potential harm such as chemicals will not be permitted. Prevailing winds may prevent air-borne pollution from drifting over the built-up area but these uses should be located here as an exception. This area is located a short distance from the Ibadan Circular Road.

Industry (I) Land Use:

Policy I1: New strategic industrial development is to be planned and developed in the following areas:

- Idi-Iya,
- Inalende,
- Ajanla,
- Iyana Offa/ Lalupon.

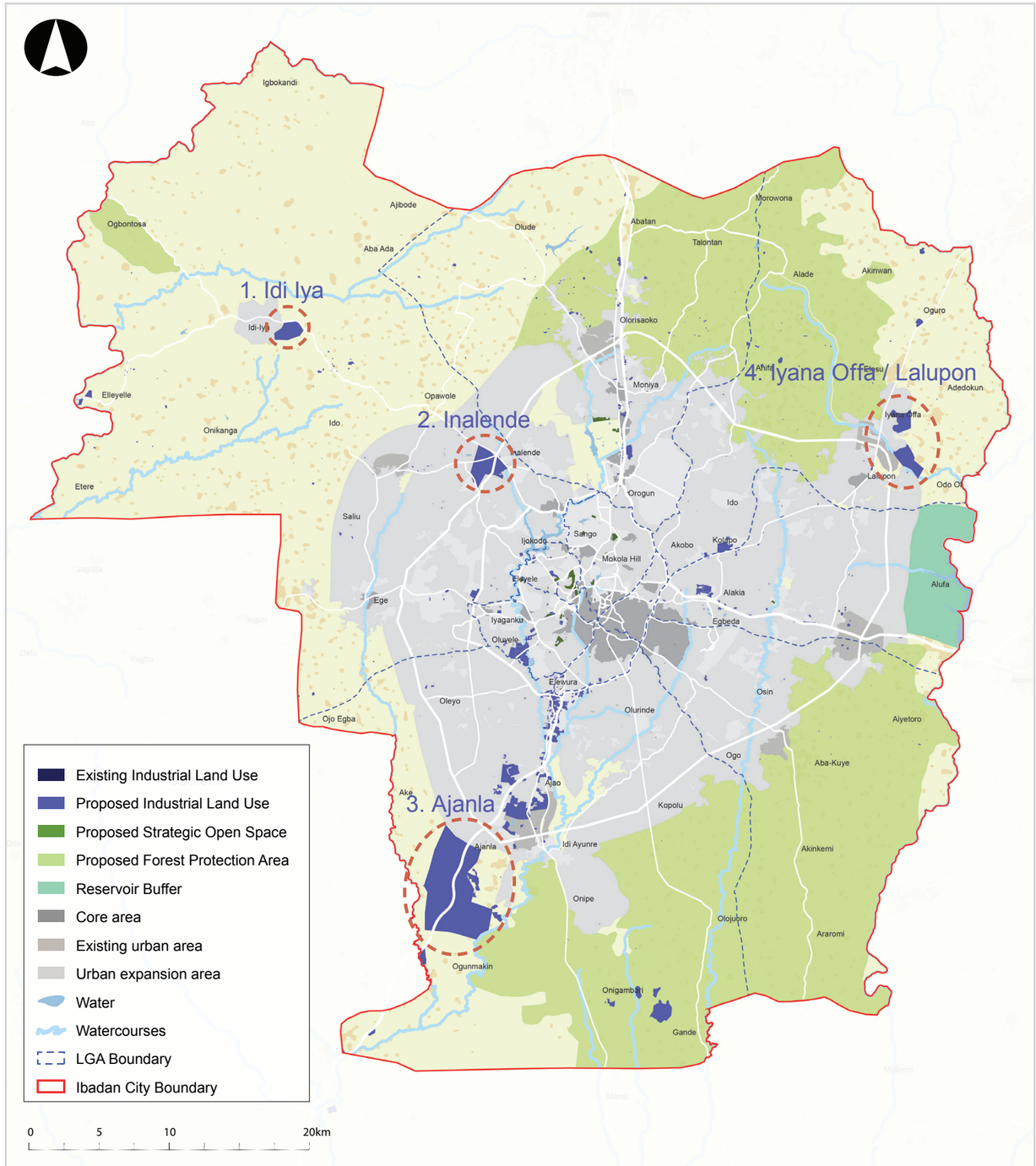


Figure 3.33: Industrial Land use 2036

3.3.4 Agriculture and Rural Communities

Agriculture contributes significantly to the local economy. It is a key source of livelihoods for farmers, rural communities, and those involved along the value chain. Within Ibadan's urban core area, a number of small-scale farmers engage in urban agriculture for household food security and for commercial purposes.

Agriculture is well developed in Ibadan's peri-urban and rural areas, as well as along certain banks of river or alongside drainage channels. The southern floodplains of the city are rich in fluvisol soils that are fertile and highly suitable for farming.

Despite this, the agricultural sector faces a number of challenges and in particular physical constraints:

- Reduced agricultural land availability due to rapid urban development and population growth.
- Disposal of wastewater and solid waste negatively impacting the quality of soil and water for agriculture.
- Inadequate investment and land dedicated for agro-based industries.
- Constant flooding having implications on agricultural practices.

To accommodate the needs of the city's population to 2036, it is important to ensure that agricultural land is available and new investments in food production encouraged.

The masterplan seeks to protect agricultural land, particularly in the north-western parts of the city. All land identified for agriculture (Figure 3.34) is to be preserved predominantly for agricultural use. The upgrade to the local road network will provide better accessibility for farmers and rural communities to markets and services in the central urban areas of Ibadan. Agricultural practices within Ibadan will support the city's local food security provision. Protection of agricultural land will ensure its resilience. Agriculture is also targeted for expansion along the river corridors (including in urban areas) where soil is the most fertile.

In order to support the processing of agricultural produce, the masterplan identifies industrial sites in Ido to be dedicated for agro-based and food processing industries.

Agriculture (AG):

Policy AG1: No development will be permitted on land designated as Agriculture. Exceptions are made to structures that are directly related to agriculture, including storage facilities, farms or other ancillary buildings and structures. Such developments, if required, should:

- Minimise any negative visual impact on the agricultural land.
- Be limited in scope and in the amount of building footprint.

Policy AG2: All land identified for agriculture is to be preserved predominantly for agricultural use.

3.3.5 Open Space and Recreation

While Ibadan does contain open space that can be accessed with a fee (Agodi Gardens or the Trans Amusement Park), there is little in terms of truly public space for all groups in society or to assist with flood risk mitigation. The masterplan proposes the designation and protection of a number of open space facilities to accommodate the needs of the city while supporting mitigation against the impacts of flooding.

Strategic Open Space

The loss of floodplains to development has a significant impact on containing naturally occurring floods. A soft engineering approach allows flooding to happen with minimal consequences on urban settlements. The masterplan identifies Strategic Open Space along river corridors to be retained or restored as floodplains (as shown in Figure 3.34) and form an interconnected river park system. Built development will not be permitted on Strategic Open Space.

Strategic Open Space will have the dual purpose of mitigating the effects of flooding while providing space for public recreation, sport and leisure. These spaces will contain sports pitches, playgrounds, recreation, natural open space, urban agriculture or other facilities. The facilities that lie within designated Strategic Open Space will be designed so as to withstand and accommodate water during flooding episodes. The development of urban agriculture along some river corridors would enhance food security and increase wellbeing for residents.

It is envisioned that these spaces be designed with community input in order to build a local sense of ownership, which would prevent urban encroachment on Strategic Open Space. Local communities must be sensitised as to the impacts of flooding and value of the open space, and their responsibilities, for them to be safeguarded against encroachment.

The largest of these spaces surrounds the IITA on the River Ona in the north of the city, upstream of the Eleyele Dam, the location of the floods in 2011. In the south, at the confluence of the rivers Ona and Ogbere, a large tract of open space will be designed as a means to accommodate flood waters. Development in the surrounding expansion area can be used to fund recreational facilities that incorporate appropriate design solutions for floodwater retention.

There are a number of relatively small Strategic Open Spaces identified along the river corridors. Cumulatively, these spaces will have a significant effect in accommodating and thereby managing the city's resilience in addressing the severity of flooding. They are an opportunity to connect open spaces together via linear routes for pedestrians and cyclists. Setbacks vary in width from 10m to 500m depending on the size of the river.

In addition to the open spaces described above, the green corridor that follows the course of the Nigerian National Petroleum Corporation pipeline must continue to be retained and protected from an encroachment from built development.

Forest Protection Area

Deforestation contributes to flash floods by increasing water runoff while also reducing habitat for flora and fauna. It is critical that existing tree cover is preserved or even enhanced for the benefits they provide to local ecology and in managing rainwater.

In order to preserve the forest assets, the masterplan identifies three Forest Protection Areas (refer to Figure 3.34), within which no development is permitted:

- Southern Forest Protection Area (incorporating the Gambari Forest Reserve),
- Western Forest Protection Area, and
- Northern Forest Protection Area.

The Northern Forest Protection Area has a critical role to play as it lies uphill of the urban areas of Ibadan. Preserving forest in this area will support the management of water and reduce potential downhill polluting impacts.

The forested areas can be profitable and sustainable if managed correctly. Revenue streams may include sustainable logging (supported by replanting), as well as an educational and tourism component, with opportunities for bird watching and forest safari experiences. Protecting the forest areas will also enable protection of flora and fauna. No development will be permitted in identified Forest Protection Areas, other than to support forest-related activities, for tourism, or for forestry-related industry such as tree harvesting. Established activities within the Forest Protection Areas will be retained.

Tree felling is not permitted in Forest Protection Areas, unless exceptional circumstances can be demonstrated and the proposal is supported by a management strategy that leads to a net increase in tree coverage

An administrative body, which may be a quasi-autonomous government organisation or parastatal under the Ministry of Environment, should be established to manage the Forest Protection Area. Its duties will include the management of activities and the enforcement against unauthorised development. This body should work closely with the IITA in identifying and finding solutions to the impacts of pests and disease within Forest Protection Areas.

Protecting the designated Forest Protection Areas may also require the erection of a physical barrier such as a fence in the parts that are most vulnerable to encroachment. The alignment of the Circular Road can support this role.

Recreation

The city contains a number of leisure destinations, the most visited among them being the Trans Amusement Park, Olubadan Stadium, Ibadan Golf Club, Ibadan Recreation Club, the Zoological Gardens and Horticultural Gardens at the University of Ibadan, Ibadan Tennis Club, the Botanical Gardens and the Adamasingba and Obafemi Awolowo (Liberty) Stadia. Access to and the quality of existing public facilities will be enhanced to increase their benefit as local leisure facilities. However, these are predominantly located in the north and west, leaving the rest of the city devoid of such facilities.

Apart from the above, Agodi Gardens is the only major large park that is publicly accessible (with an entrance fee). Within the existing residential areas, there are few parks or open areas where residents can play sports or where they can relax. There are a number of informal open spaces, but they are unevenly distributed across the city. In the rural areas, there are no formal recreation facilities.

The masterplan proposes an equitable distribution of open spaces within the Core Area, new Growth Centres, urban expansion and infill areas. The open spaces will include parks, gardens, recreation and sports facilities. These will enable and promote social interaction for children, youth and adults.

Existing Trees and Vegetation

There are many significant trees and other types of important vegetation within Ibadan, particularly in the Core Area. Large, mature trees are important features of the landscape as they act as landmarks and assist in wayfinding. For those living and working nearby, trees offer valuable shade and contribute to the identity of a local area. Urban trees and vegetation can play an important role in promoting biodiversity, mitigating the urban heat island effect, storing rainwater, cleaning the air and protecting soil from erosion. These significant trees and vegetation should be protected from felling. A comprehensive survey of the trees and vegetation in Ibadan should be undertaken in order to identify those that are significant and enable them to be formally protected.

Open Space and Recreation (OS):

Policy OS1: Strategic Open Space will be used for recreation or open space. No development is permitted in land designated as Strategic Open Space.

Policy OS2: No development is permitted in designated Forest Protection Areas other than to support sustainable forestry-related facilities, for tourism or managed harvesting.

Policy OS3: Tree felling is not permitted in Forest Protection Areas, unless exceptional circumstances can be demonstrated and the proposal is supported by a management strategy that leads to a net increase in tree coverage

Policy OS4: Existing recreation facilities will be enhanced within the existing urban areas.

Policy OS5: Recreation facilities within open spaces that run along the river corridors will be used for water retention during flood events.

Policy OS6: An equitable distribution of open space will be provided across Ibadan.

Policy OS7 : A comprehensive survey of trees and vegetation should be undertaken. Those that are identified as significant should be retained and protected from felling.

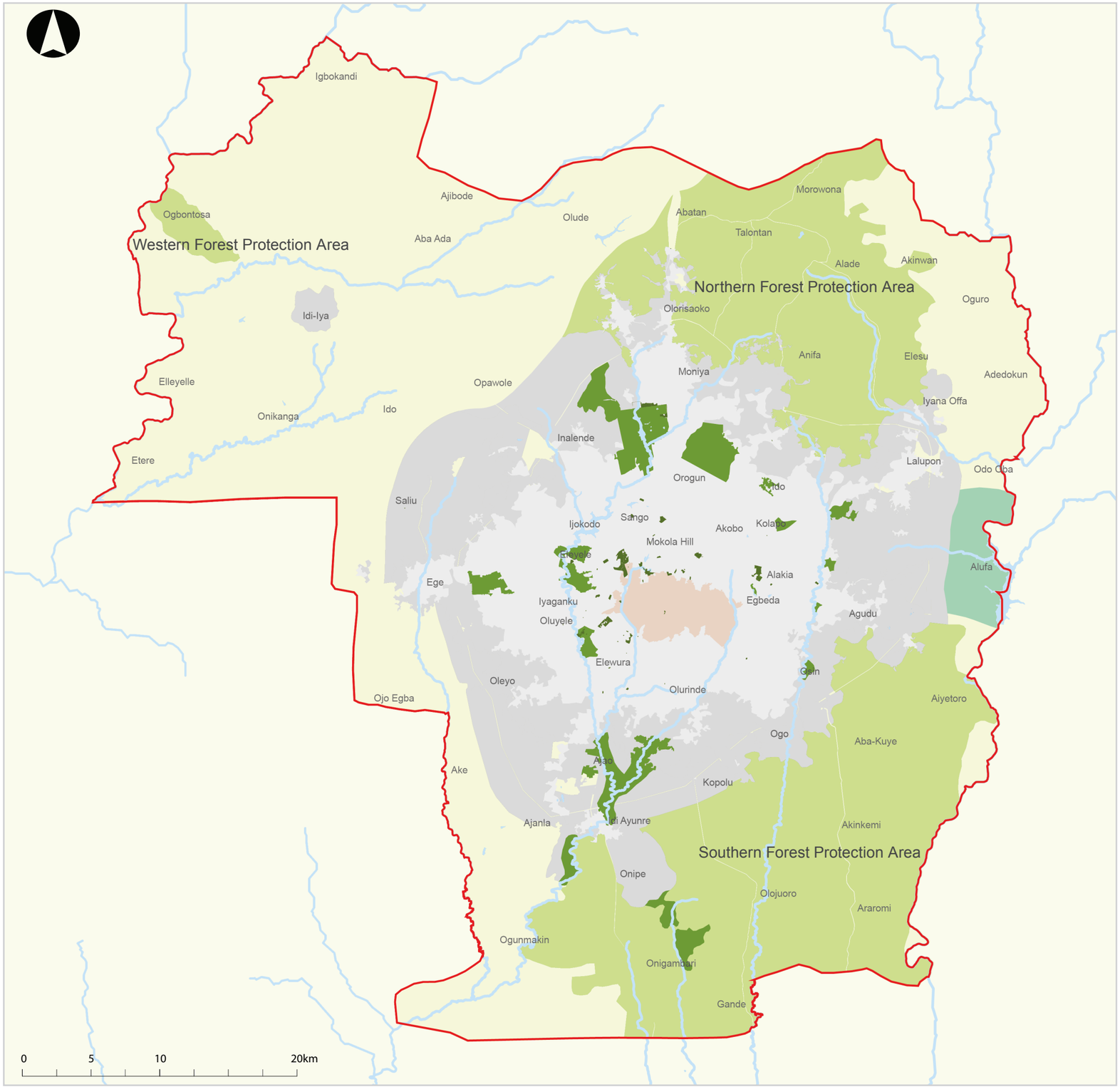


Figure 3.34: Open Space Strategy

3.4 SOCIAL INFRASTRUCTURE PROVISION

This section outlines the strategy for the provision of education, health, security and cemeteries.

Access to facilities and services is largely determined by their location and distribution. Planning for future development areas provides an opportunity to integrate key community facilities within residential areas and along transport routes.

To be well used and serve identified social needs, community facilities should be easily accessible and visible. They should provide equitable access to all potential users, be accessible by public transport and have good pedestrian and cycle connections. They should be on a main street with ground floor street frontage for optimum visibility and accessibility: opening up the awareness of what happens inside promotes usage.

Figure 3.35 illustrates a typical hierarchy of community facilities with their respective distance to residential areas.

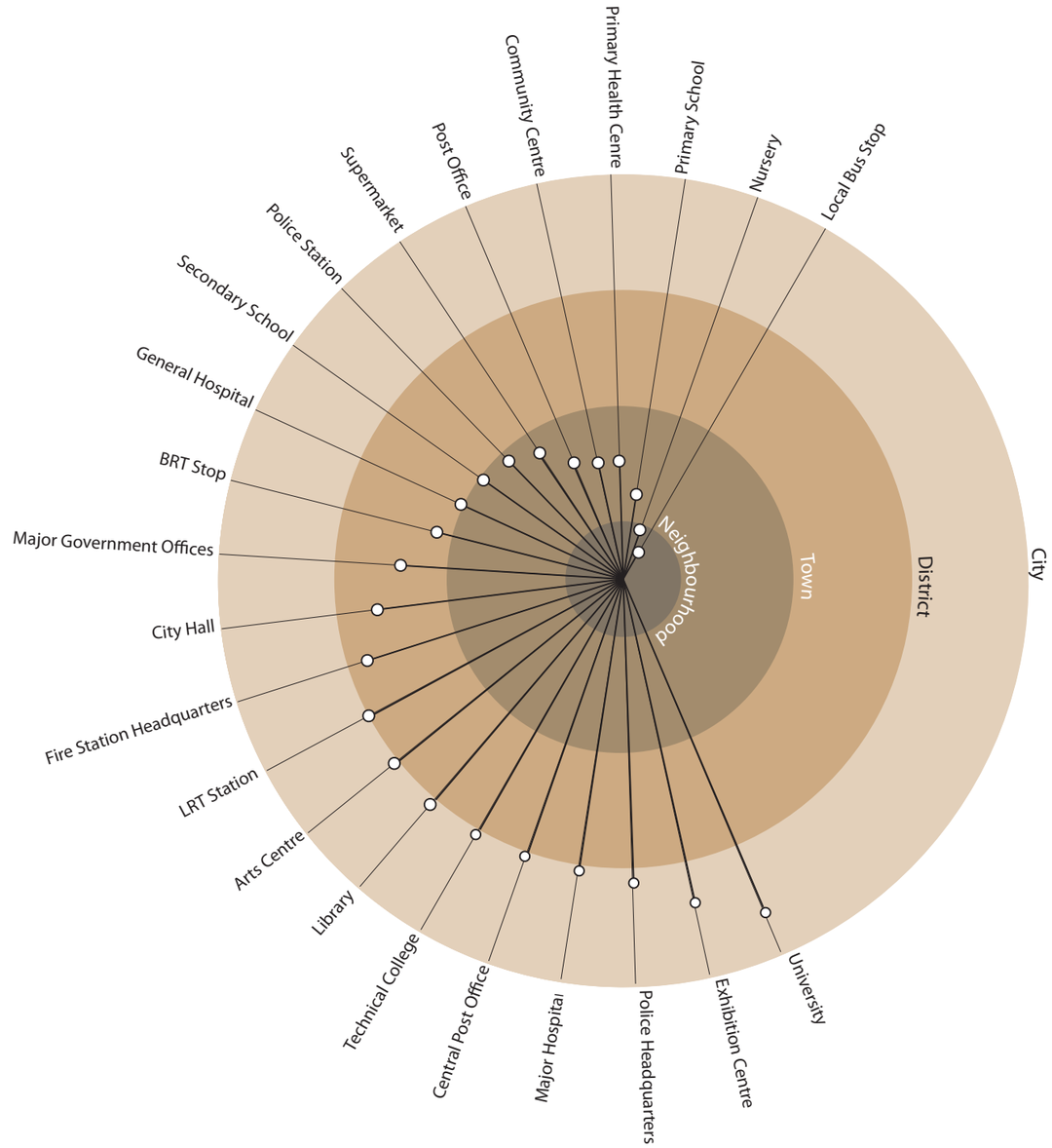


Figure 3.35: Connectivity and access to community facilities

3.4.1 Education

Within Ibadan, there are 2,350 primary schools and 547 secondary schools (2017). The city-wide average primary school-population ratio is about 1:2,560. For secondary schools, this ratio is 1:10,400. These ratios are used (rounded to the nearest thousand) to calculate how many schools will be required across Ibadan by 2036 (see Table 3.6). This exercise is useful to understand the scale of investment needed to provide for the growing population at current levels of provision. However, this metric does not explain the spatial distribution of schools. As is shown in Figure 3.36, there are many areas in Ibadan which are underserved, and some areas which have a high density of schools.

In residential areas the aim is to provide primary schools within 400m of residents, which is approximately 5 minutes walking distance. For secondary schools, a radius of 800m, approximately 10 minutes walk, will be sought. Providing schools within walking distance allows access to education for those without cars and lessens the burden on public transport, while promoting health and reducing polluting vehicle emissions.

Schools and other educational facilities are well distributed in the core area of Ibadan where there is generally good access to education facilities within walking distance (400m). The urban periphery is currently underserved in parts. This need will be exacerbated by the proposed infill strategy, which will densify outer urban areas. More schools will be provided alongside development to meet this demand.

Table 3.6: Additional schools needed by 2036 at current levels of provision

PRIMARY SCHOOLS (1:3,000 PEOPLE)	SECONDARY SCHOOLS (1:10,000 PEOPLE)
1,421	584

Education (E):

Policy E1: The distribution of new educational facilities should seek to meet maximum walking distances from residential areas for primary schools and secondary schools should be 400m and 800m, respectively.

Policy E2: Education facilities are to be provided to meet the identified deficiency in the existing urban areas.

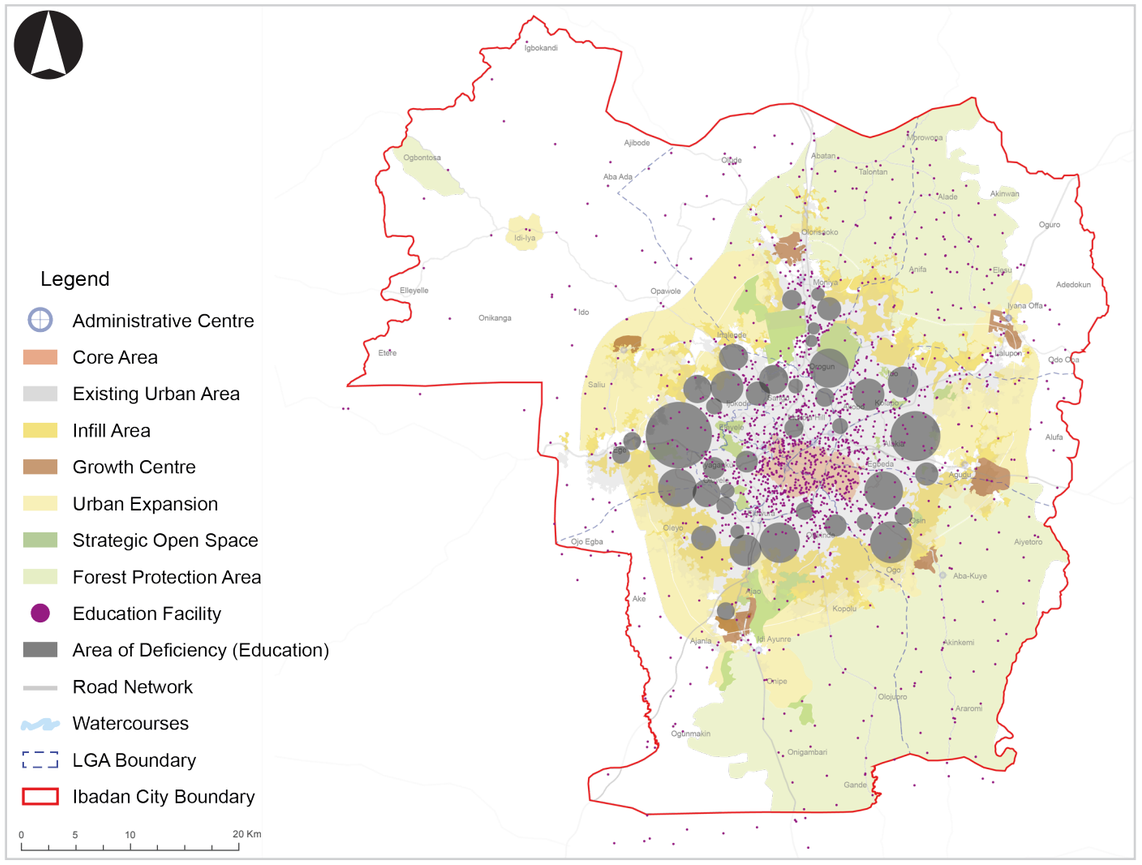


Figure 3.36: Existing urban areas which are deficient in education facilities (primary and secondary)

3.4.2 Health

There are currently 517 primary health facilities within Ibadan, of which about half are privately operated. In terms of secondary health facilities, 15 hospitals exist in Ibadan, including general hospitals, special hospitals, and others. The city-wide average primary healthcare facility to population ratio is about 1:15,000. There is a wide discrepancy between LGAs, with the highest ratio of 1:25,900 in Ibadan North; the best provision is in Ido (1:5,800). Taking the average ratio of 1:15,000 and applying it to the projected population in 2036 shows that an additional 237 primary healthcare facilities are required to maintain this level of provision (Figure 3.7). However, this metric does not pertain to the spatial distribution of healthcare facilities, which is more useful in planning for expansion. Ideally, health facilities are within reasonable walking distance from all residential properties.

Within the central LGAs, there is a discrepancy in spatial access to health services (see Figure 3.37). Residents in Ibadan North-East and Ibadan South-East LGAs generally have equitable access to health services. However, there are some gaps in access in the Ibadan North, Ibadan South-West and Ibadan North-West LGAs. In the urban periphery, very few residents are within walking distance (400m) of healthcare facilities. In rural areas, health facilities are dispersed and accessing them requires longer travel times. Access to facilities is also impeded by the poor quality road network. Primary healthcare facilities should be provided in areas which are identified as being deficient.

In residential areas, it is envisioned that residents will be within 400m (5 minute walk) of a primary healthcare facility. One new secondary healthcare facility will be provided in each of the proposed Growth Centres and in the Idi-Iya expansion area to the north-west (see Figure 3.37). This is to ensure that all residents have reasonable access to a hospital. The Idi-Iya facility will also serve the surrounding countryside.

Table 3.7: Additional healthcare facilities needed by 2036 at current levels of provision

PRIMARY HEALTH FACILITIES (1:15,000 PEOPLE)
237

Table 3.8: Proposed number of new additional secondary healthcare facilities by 2036

SECONDARY HEALTH FACILITIES
7

Health (H):

Policy H1: New primary health facilities will be developed to ensure all residents are within a 400m walking distance.

Policy H2: One secondary healthcare facility is to be provided in each of the new Growth Centres and the Idi-Iya expansion area, totalling 7 additional centres.

Policy H3: Health facilities are to be provided to meet the identified deficiency in the existing urban areas.

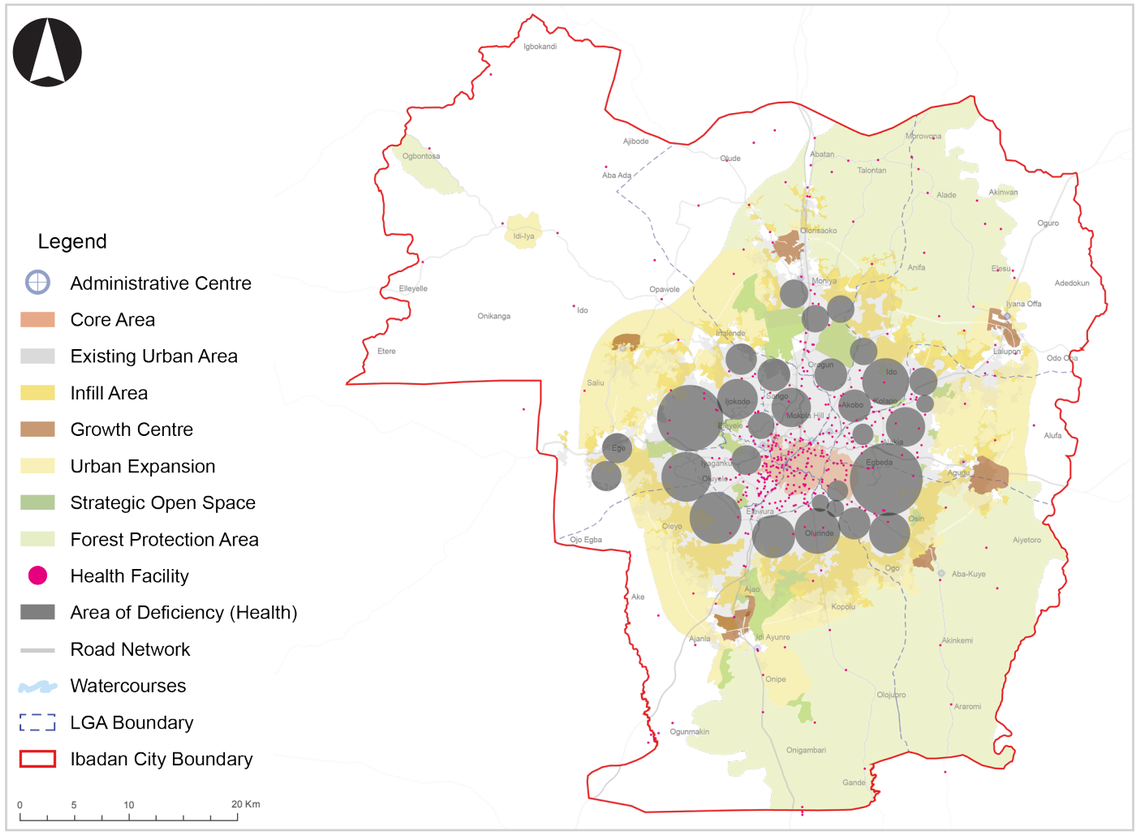


Figure 3.37: Existing urban areas which are deficient in primary healthcare facilities

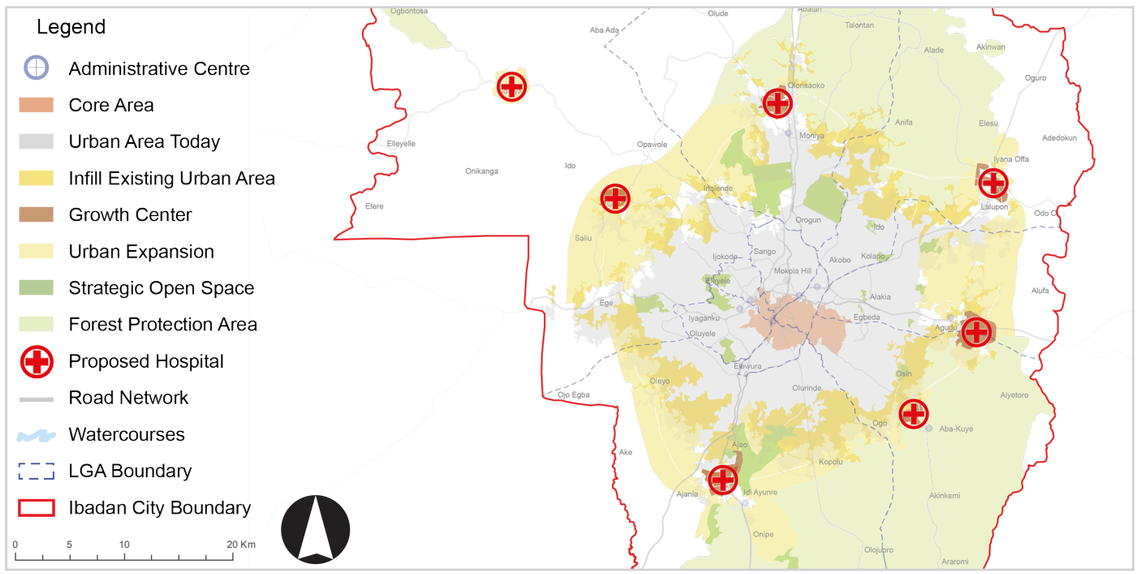


Figure 3.38: Proposed distribution of new additional secondary healthcare facilities

3.4.3 Security

Fire Stations

There are currently 7 fire stations in Ibadan: two within the core area, with the others in outer LGAs. In order to identify deficiencies and future need, a service catchment is used. 2.4km takes approximately 10 minutes to drive in a busy urban environment. This is a good response time for emergency services and is used in Figure 3.39 to map existing and future provision. In order to cover the whole city and expansion areas, it is estimated that Ibadan will require 67 additional stations by 2036 (see Figure 3.39). As this represents an ambitious level of investment, it is proposed that the provision of fire stations is prioritised in Growth Centres, where emergency vehicles can benefit from the circular road and upgraded radial routes. This would extend their service catchment.

Police Stations

In Ibadan, there are currently 23 police stations, mostly located in the inner LGAs with a good provision in Ibadan North. There are large areas of deficiency in the periphery of the city. In order to map deficiencies and plan for future provision, a service catchment of 2.4km is used as this represents approximately 10 minutes driving time in a busy urban area (see Figure 3.40). To provide police stations at this standard, the city will require an additional 55 police stations by 2036. Areas of existing deficiency should be provided for, and stations will be built alongside residential development in planned expansion areas. However, the provision of police stations should be prioritised in Growth Centres where the enhanced road network will improve response time.

Security (SE):

Policy SE1: Fire Stations will be provided on the basis that all residents are within 2.4km of at least one Fire Station.

Policy SE2: The provision of new fire stations will be prioritised in Growth Centres.

Policy SE3: Police Stations will be provided to ensure all residents are within 2.4km of at least one Police Station.

Policy SE4: The provision of new police stations will be prioritised in Growth Centres.

Cemeteries

Cemeteries are an integral part in the life of a community which can serve as more than just the resting place of the dead, providing the living with areas for contemplation, seeking solace, and gaining insights into the past.

Planning for new cemeteries requires determining for the needs, their size and location. It is estimated that over the masterplan period (2018-2036), approximately 800 hectares of land will be required for use as cemeteries.

This area of land has been estimated by applying an annual mortality rate for Nigeria of 12.4 per 1,000 to project the total deaths for Ibadan up to 2036. A land allocation of 3.5sqm per grave (including ancillary spaces for uses such as religious buildings, car parking and driveway) has been applied in addition.

A cemetery should be considered as a necessary part of a community, and its location should be carefully planned. They should be preferably built in residential areas within easy access of public and private transport.

Cemetery (CM):

Policy CM1: New cemeteries will be provided on the basis of the city's annual population growth and death rate.

Policy CM2: Provision of new cemeteries will prioritise residential areas.

Policy CM3: New cemeteries will prioritise accessibility to road access and public transport facilities.

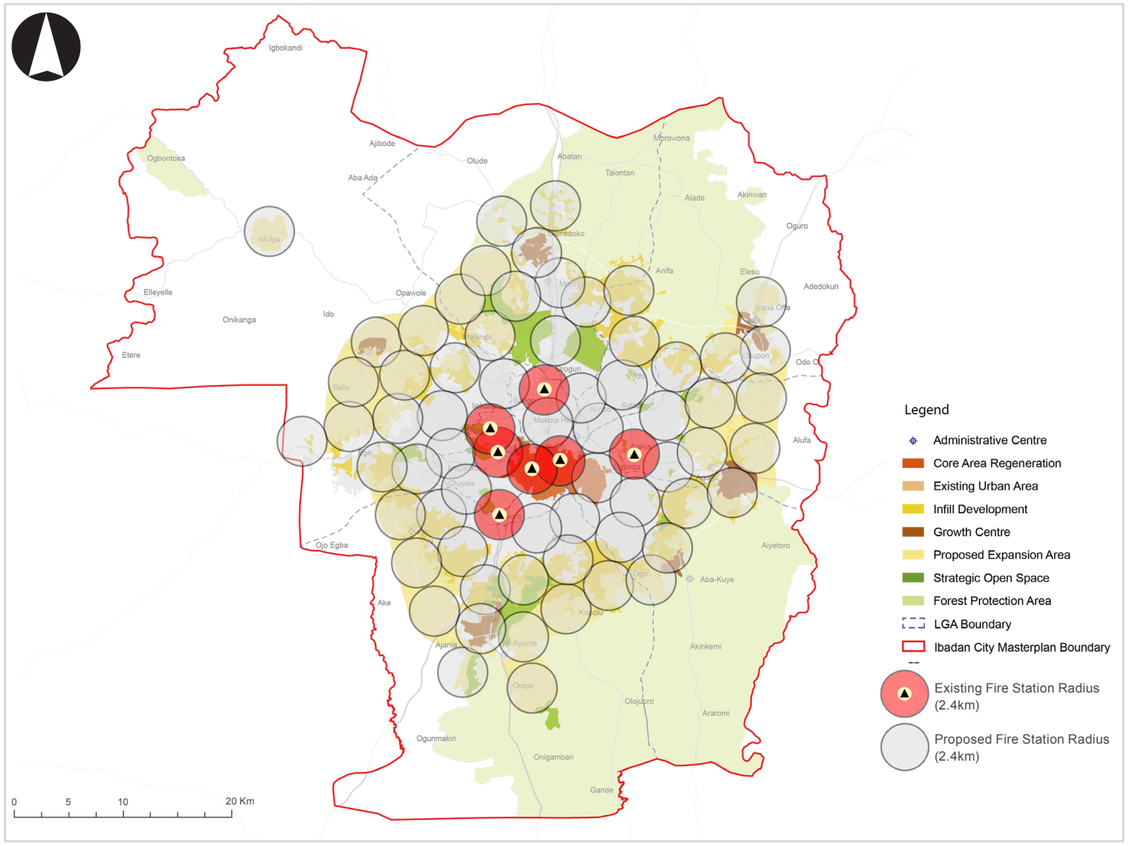


Figure 3.39: Proposed Distribution of Fire Stations

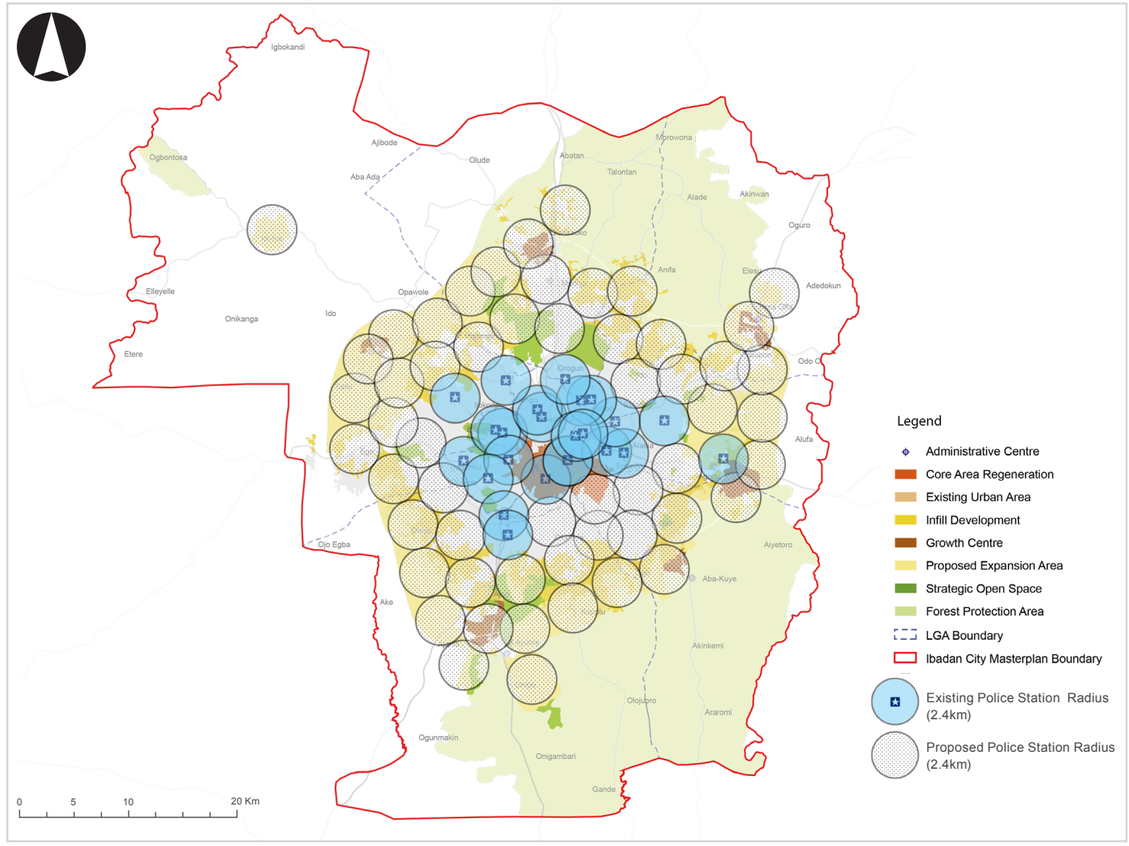


Figure 3.40: Proposed Distribution of Police Stations

3.5 CULTURE, HERITAGE AND TOURISM

This section discusses the principles of heritage conservation and outlines the potential for tourism in Ibadan. Although tourism and heritage are presented separately, the link between them cannot be over-emphasised.

3.5.1 Heritage

Ibadan contains many buildings of historic and cultural value. The history of the city can be interpreted through the built environment which includes traditional Nigerian structures, colonial-era architecture and modernist buildings built in the mid 20th century. The purpose of designating particular buildings and areas as heritage assets is to acknowledge their contribution to the urban environment and culture of the city. The actions and regulations that accompany heritage designation will vary depending on individual buildings and areas.

Heritage Conservation

Heritage is defined as the objects, custom or qualities which are passed down over many years within a family, social group or nation and thought of as belonging to all its members. In this sense, historic sites and buildings are physical embodiments of Ibadan's culture. They are fundamental to a "sense of place" and engender a feeling of connection to the city. The act of protecting and enhancing heritage buildings and sites is known as conservation. The identification of particular buildings or sites for formal protection is fundamental to heritage conservation. The historical age of a building or site is a good indication of its potential as a heritage asset. However, more recent buildings or sites which are examples of a particular architectural style can also be considered heritage buildings. For example, Ibadan contains many good examples of modernist architecture from the 1960s which may be considered worthy of preservation.

Conservation and Restoration Activities

Heritage buildings or sites which retain substantial amounts of their original fabric should be protected from demolition and significant alteration. However, conservation does not mean that a building must be kept exactly as it was when first built. In order for buildings to be maintained, it is paramount that they are kept in use. Therefore, heritage buildings can usually be modernised or be adapted to a new use while still retaining their original significance. Heritage buildings which have suffered damage or insensitive alteration can be restored to their original appearance with the use of traditional building techniques and replica features, if a record of the original features exist. This is known as restoration. Restoration involves investigating, diagnosing and correcting deficiencies and the deterioration of any building. It may also involve the removal of features from other periods in its history and reconstruction of the missing features. Any additions or alterations to the heritage building or any new development within the heritage site should complement the original scale, form, massing and style.

Archaeological findings are physical evidence of past activities and peoples. They are valuable as a direct window into the past. Any archaeological findings should be treated with a proper investigation and and care must be taken not to damage historic artefacts during construction.

Economic Case for Conservation and Restoration

The cost of renovating or modernising a heritage building may seem like a deterrent to heritage conservation. However, there is a strong economic case for protecting the historic environment. Refurbishing heritage buildings which have fallen into disrepair results in local job creation as specialist trades people are required. Historic rehabilitation is generally more labour intensive with less need for materials, compared to new construction, keeping money in the local economy. Heritage conservation is a cost-effective method of regenerating urban areas.[2] By bringing value back to existing buildings, new businesses and residents are attracted without the need for large-scale construction. It has been observed throughout the world that buildings in historic areas have higher property values and appreciate at greater rates than the local market overall.[1] Finally, heritage tourism can result in huge direct and indirect revenue for the local economy.[3]

Built Heritage of Ibadan

The heritage of Ibadan is diverse and includes buildings, monuments, gardens and landscapes. Each of these contain identifiable elements that translate the narrative of the period they represent or inform the architectural or cultural importance of the region. It may be the design of the building, the materials it was built from, the architectural features such as cornices, columns, the interiors features, woodwork, paint colours or even the landscaping that is of heritage value. Ibadan is a historic city with ties to Yoruba culture and colonial influence. It is likely that archaeological remains are present beneath the existing urban fabric which may be unearthed during construction activities.

The majority of the heritage buildings and sites identified in Figure 3.44 are located within the central part of Ibadan, with a cluster in the Core Area. Many of these sites are individual buildings, such as the Central Mosque. There are many historical vernacular buildings within Ibadan which should be identified over time for restoration and conservation.

Three important heritage buildings are discussed below, with a description of their particular historical importance and suggestions for conservation and restoration activities. Mapo Hall and Bowers Tower are examples of landmarks which are well known within Ibadan. Irefin Palace on the other hand is a lesser known building, which is nonetheless a historically important site, worthy of preservation. These short entries provide an example of how heritage buildings can be catalogued into the future, as they are identified.

Mapo Hall: Mapo Hall (see Figure 3.41), designed by Taffy Jones, was constructed in 1925. It is located in the centre of the city, on Mapo Hill, making it a prominent landmark. Architecturally, Mapo Hall has classical European features, indicative that it was built in the era of British rule. The building is used regularly for conferences and weddings. Mapo Hall is a significant heritage structure due to its unique design and connection to a particular period in Ibadan's history. As the hall is generally in good condition, conservation activities may be limited to regular maintenance and protection of surviving historical elements.



Figure 3.41: Mapo Hall

Bowers Tower: Bowers Tower was erected in 1936 as a memorial to Captain Robert Lister Bower, who was the first British resident in the city (see Figure 3.42). Located on the highest hill in the city, the tower is 60 feet high and provides unique views across Ibadan. The structure is a prominent landmark and sits within a large ground which has fallen into disrepair. The setting of the tower should be improved through better landscaping, improved access, and refurbishment of the other buildings on site. Bowers Tower itself, including its spiral staircase and detailing, should be protected from inappropriate alteration.



Figure 3.42: Bowers Tower in its Immediate Setting

Irefin Palace: Irefin Palace (Figure 3.43) is an example of traditional Nigerian architecture, dating from the early 19th century. It is constructed from timber, mud and contains a corrugated iron roof, typical of Ibadan. The palace is one of the oldest structures in the city and provides a strong link to Yoruba culture. Conservation of the palace may include sensitive refurbishment and modernisation and the identification of a viable use to ensure the upkeep of the building.



Figure 3.43: Irefin Palace

2 Donovan Rypkema, Heritage Conservation and the Local Economy, 2008.

3 Oxford Economics, The Economic Impact of the UK Heritage Tourism Economy, 2013.

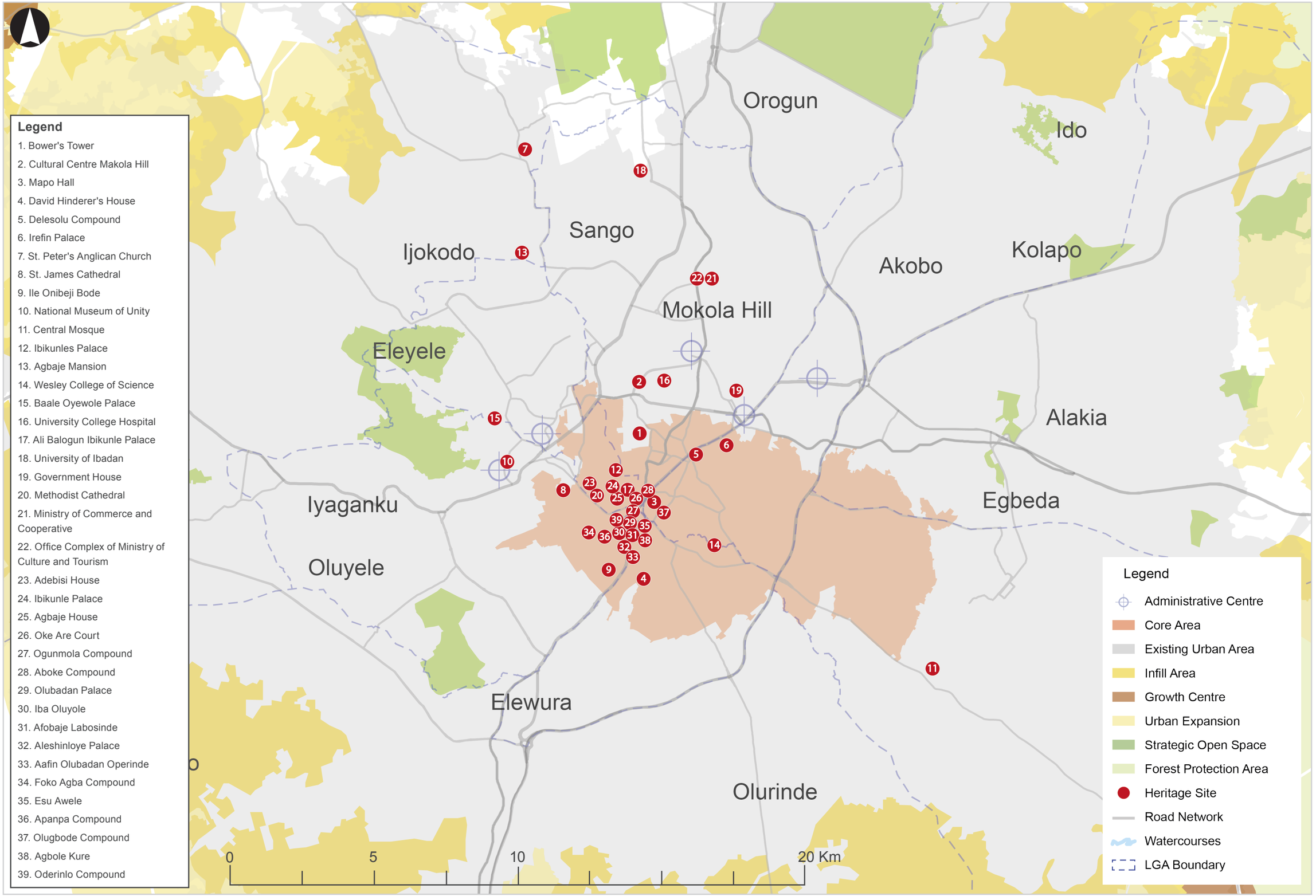


Figure 3.44: Heritage Buildings and Sites

Other Heritage Buildings/Sites: Key heritage buildings and sites within Ibadan are shown in Figure 3.44. Other important heritage buildings and sites include Adebisi Mansion, Ibikunle Palace, Aare Latosa Mausoleum New Bodija, Ali Balogun Palace, Baale Oyewole Palace, Taiwo Akinkunmi House, Kunrunmi Palace, Ogun Kunrunmi Shrine, Esu-Awele Shrine, Oke-Ibadan at Awotan/Eleyele, Kurunmi of Ijaye's Monument, Iba-Oluyole Compound, Foko-Laja Compound, Ijaiye (Kurumi site), Basorun Ogunmola Compound, Olugbode Compound at Uta Baale, Kure Compound at Ojaba, Aboke Compound at Bere, Omi-Adio Railway Station, Erunmu Railway Station, other palaces of Olubadan Kings, Adebisi House in Idi-Kan, Agbaje House in Ayeye and Oke Are Court House, Unity Bank, Radio Station.

3.5.2 HERITAGE ZONING REGULATIONS

Heritage Buffer Zones

Heritage buffer zones are areas around historical buildings or sites which possess additional development restrictions. Within heritage buffer zones, the use and physical form is regulated in order to reinforce and enhance the conservation value of the building or site. Two layers of buffer zones comprising of a 25m and 50m buffer are demarcated from the boundary of the building/site curtilage. The 25m buffer zone consists of the immediate setting of a heritage building with greater associative value and therefore higher levels of restriction. The 50m buffer zone comprises of the wider context of the heritage building, and thus less restriction to development. This creates a transition and a gradient of the level of protection around the heritage site.

In order to protect historical buildings from incompatible uses, a breakdown of recommended permitted, conditional and prohibited uses within heritage buffer zones is provided in Table 3.9. Permitted uses are those which have no negative effect on a heritage building/site and therefore have no extra level of restriction applied. Conditional uses may be allowed within a heritage buffer zone. Prohibited uses will generally not be permitted within a buffer zone. There are separate levels of control for 25m buffers and 50m buffers.

Figure 3.45 illustrates how heritage buffer zones function in relation to a small heritage building in the dense core area. 18 buildings are within the 25m buffer zone and 35 buildings are affected by the 50m buffer zone. However, in the case of a building set within a large curtilage (Figure 3.46), the buffer zones cover a greater area. In this example, 8 existing buildings are within the 25m radius and 41 buildings are within the 50m buffer zone. Any development on vacant sites within buffer zones is also subject to heritage zoning regulations.

The setting of a heritage building or site is an essential part of its significance and character. The economic viability as well as the character of heritage buildings/sites may suffer where inappropriate new development isolates them from their surroundings or degrades their landscape settings.

Any development that adversely affects the setting of a heritage building or site should not be permitted. Development proposals within heritage buffer zones should retain and respect the features that contribute to the building or site's heritage, character and local distinctiveness, demonstrating an appropriate design, in terms of:

- Scale, height, mass, bulk and form of development;
- Plot sizes, plot coverage and street patterns;
- Building lines and setbacks;
- Roof line and roof forms;
- Streetscape rhythm and other streetscape elements;
- Architectural features and design elements applied on facades, and;
- Colour and use of materials.

Formalising Heritage Conservation

The buildings and sites identified in Figure 3.44 provide a starting point for a comprehensive list of Ibadan's built heritage. It should be added to over time as more buildings are identified and local expertise grows. It is suggested that the identification and protection of heritage assets be managed by the Ministry of Information, Culture and Tourism with a close relationship to the Bureau of Physical Planning and Development Control.

The locations and descriptions of protected heritage buildings and sites should be publicly available and used by local authorities for planning and development management. The owners/users of heritage buildings should be made aware of the formal protection and their role in the conservation process. This sensitisation will reduce the need for enforcement, which will be undertaken as part of the planning process.

25m and 50m heritage buffer zones should be demarcated for all identified heritage buildings and sites and made available to local authorities to assist in decision making.

Heritage (H):

Policy H1: Identified buildings and sites of special historic, cultural or architectural significance will be formally protected from demolition and significant alteration, to preserve and enhance their significance.

Policy H2: Development within a 25m or 50m heritage buffer zone of a heritage building/site must respect the historical context in terms of:

- Scale, height, mass, bulk and form of development;
- Plot sizes, plot coverage and street patterns;
- Building lines and setbacks;
- Roof line and roof forms;
- Streetscape rhythm and other streetscape elements;
- Architectural features and design elements applied on facades, and;
- Colour and use of materials.

Policy H3: Development within 50m of an identified heritage building will only be permitted where it is identified as an appropriate, permitted use. Conditional uses will be permitted providing that they do not harm the setting of the heritage building or site. Prohibited uses will not be allowed in heritage buffer zones.

Policy H4: If during construction works, evidence of archaeological findings are apparent, construction should be stopped and investigations undertaken to verify the value of these findings.



Figure 3.45: Heritage Buffer Zones: Example 1

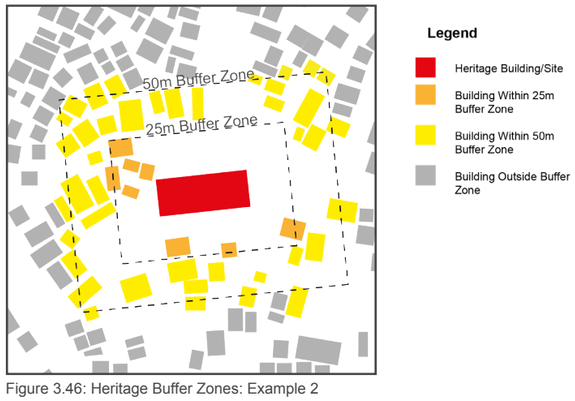


Figure 3.46: Heritage Buffer Zones: Example 2

Table 3.9: Permitted, Conditional and Prohibited Use Recommendations for Buffer Zones

BUFFER ZONE	PERMITTED USE	CONDITIONAL USE	PROHIBITED USE
25m Buffer Zone	• **Residential** - detached houses, duplexes, masionettes, row housing, apartments/flats, etc. • **Commercial** - retail, shopping centres, petrol stations, convenience shopping, local/ weekly markets, offices etc. • **Educational Facilities** - primary schools, secondary schools and universities. • **Leisure and Recreation** - hotels, restaurants, cafes, sports facilities, etc. • **Health Facilities** - primary and secondary health facilities, clinics. • **Government and Institutional** - theatres, concert halls, auditoriums, cinema halls, exhibition halls and art galleries, libraries, community centres, visitor centres, LGA headquarters, other government offices. • **Transport infrastructure** - roads, rail, bus stops, rail stops, taxi ranks, car parks, etc. • **Open Space** - parks, gardens, playgrounds, public squares, sports pitches, urban agriculture, etc. • **Community Facilities** - public toilets, fire stations, police stations, cemeteries. • **Places of Worship** - churches, mosques, other worship centres.	• **Light Industry** - wood works, shoe factories, garment industry, motor repair workshops, dry cleaners, watch repairs, cobblers, electronic repairs, welding workshops, warehousing, etc. • **Sports Facilities** - stadiums. • **Transport Infrastructure** - bus depots, truck depots, rail depots, airports.	• **Heavy Industry** - Petrochemical and steel industries, mineral works, gas works, water works, metal fabrication, etc. • **Infrastructure** - solid waste and sewage treatment plants, electric power stations, etc.
50m Buffer Zone	• **Residential** - detached houses, duplexes, maisonettes, row housing, apartments/flats, etc. • **Commercial** - retail, shopping centres, petrol stations, convenience shopping, local/ weekly markets, offices, etc. • **Leisure and Recreation** - hotels, restaurants, cafes, sports facilities, etc. • **Educational Facilities** - primary schools, secondary schools and universities • **Health Facilities** - primary and secondary health centres, clinics. • **Transport Infrastructure** - roads, rail, bus stops, rail stops, car park, taxi ranks, etc. • **Open Space** - parks, gardens, playgrounds, public squares, sports pitches, urban agriculture, etc. • **Government and Institutional** - theatres, concert halls, auditoriums, cinema halls, exhibition halls and art galleries, libraries, community centres, visitor centres, LGA headquarters, other government offices. • **Community Facilities** - public toilets, fire stations, police stations. • **Places of Worship** - churches, mosques, other worship centres. • **Light Industry** - wood works, shoe factories, garment industries, motor repair workshops, dry cleaners, watch repairs, cobblers, electronic repairs, welding workshops, warehousing, etc. • **Sports Facilities** - stadiums.	• **Transport Infrastructure** - bus depots, truck depots, lorry depots, rail depots, airports. • **Infrastructure** - solid waste and sewage treatment plants, electric power stations, etc.	• **Heavy Industry** - Petrochemical and steel industries, mineral works, gas works, water works, metal fabrication, etc.



Figure 3.47: University of Ibadan



Figure 3.48: Cocoa House

3.5.3 Tourism

Tourism is an under-exploited industry in Nigeria generally, representing just 1.7% of GDP. Increasing domestic tourism will contribute to the local economy, increase employment opportunities and help to preserve and enhance historical and cultural sites. Ibadan has numerous strengths which provide the potential to grow the tourism industry further. The city's unique historical offering has already been discussed. Furthermore, there are many modern attractions such as gardens, recreational destinations and opportunities for shopping and nightlife.

Improvements in basic infrastructure such as road upgrades and public transport provision will make Ibadan more accessible to tourists. The proximity of Lagos to Ibadan means it is possible for residents and tourists to make day trips to the city. The important non-heritage tourist sites in Ibadan are shown in Figure 3.50. However, many heritage buildings and sites also attract tourists, such as Mapo Hall and Bowers Tower.

Local Attractions

Known as a fun and vibrant city, Ibadan already has much to offer tourists. The city is home to the largest amusement park in Nigeria, the Trans Amusement Park, a regional scale attraction. Built on seven hills, there are opportunities to take advantage of the city's vantage points overlooking the city, particularly at Bowers Tower and Mapo Hall. These sites should be capitalised on, by offering a more sophisticated tourism experience, synergising with other nearby sites.

At the University of Ibadan, visitors can access the Zoological Garden, Horticultural Garden and Botanical Gardens. Agodi Gardens has recently been refurbished into a high quality attraction. It contains a waterpark, zoo and well-landscaped areas for walking. Water activities on the lake are also available. Phase 2 of this regeneration is planned, which will include a forest walkway, events hall, chalets, promenade, spa and golf course.

History and Heritage

Ibadan has a rich history. It is vital that historic structures are recognised as tourist sites and as part of a tourism strategy. Promoting heritage in the city will attract tourists interested in the city's culture and history. Improving the prominence of these structures and sites will also help to improve the general appearance of the city and encourage tourists to venture past the main tourist sites. Many historic buildings and sites in Ibadan are in need of investment to bring them back into use and improve their appearance. Attracting tourists can offset the costs of refurbishment and maintenance of heritage buildings. Not all historic sites will be income generating on their own; the majority of revenue will come from incidental spending on food, accommodation and shopping. When this is taken into account, heritage conservation can be highly profitable for the city.

Culture and Events

There are many local festivals throughout the year in Ibadan. Marketing these cultural events domestically will create an influx of tourists at certain times of the year. The allure of a specific event may be the catalyst for visitors who would not normally visit the city. While they are in Ibadan, they will likely visit other attractions and spend money in the local economy.

Surrounding Area

Ibadan is well located as a base for excursions in the surrounding countryside. The Ado-Awaye Suspended Lake is located just 70km from Ibadan and is a geographical feature unique in Africa. The site provides opportunities for hiking and unique views across the region. Within driving distance of Ibadan (160km north) is the Igbo-Oba Royal Forest. This is a protected forest which has historical importance, as it contains the burial ground of four Alaafins.

Recommendations

The following recommendations are made to promote tourism within Ibadan:

Short Term Actions

- Improve signage for tourist destinations, especially at main entry points to the city and public transport termini.
- Produce information boards at historical, cultural and tourist sites (see examples in Figure 3.49).
- Identify and promote local festivals and celebrations as tourist magnets.
- Monitor visitor numbers to inform investment and strategy.

Medium Term Actions

- Improve the urban environment and public realm in the core area and around important sites.
- Create a marketing campaign to attract tourists to Ibadan.
- Establish Tourism Centres at important tourist destinations such as the Bowers Towers, Irefin Palace, Mapo Hall, etc.

Long Term Actions

- Create a comprehensive Ibadan tourism strategy and implementation plan.

Tourism (TO):

Policy TO1: Short, medium and long term actions will be carried out to promote tourism in Ibadan.



Figure 3.49: Map and information board at Agodi Gardens

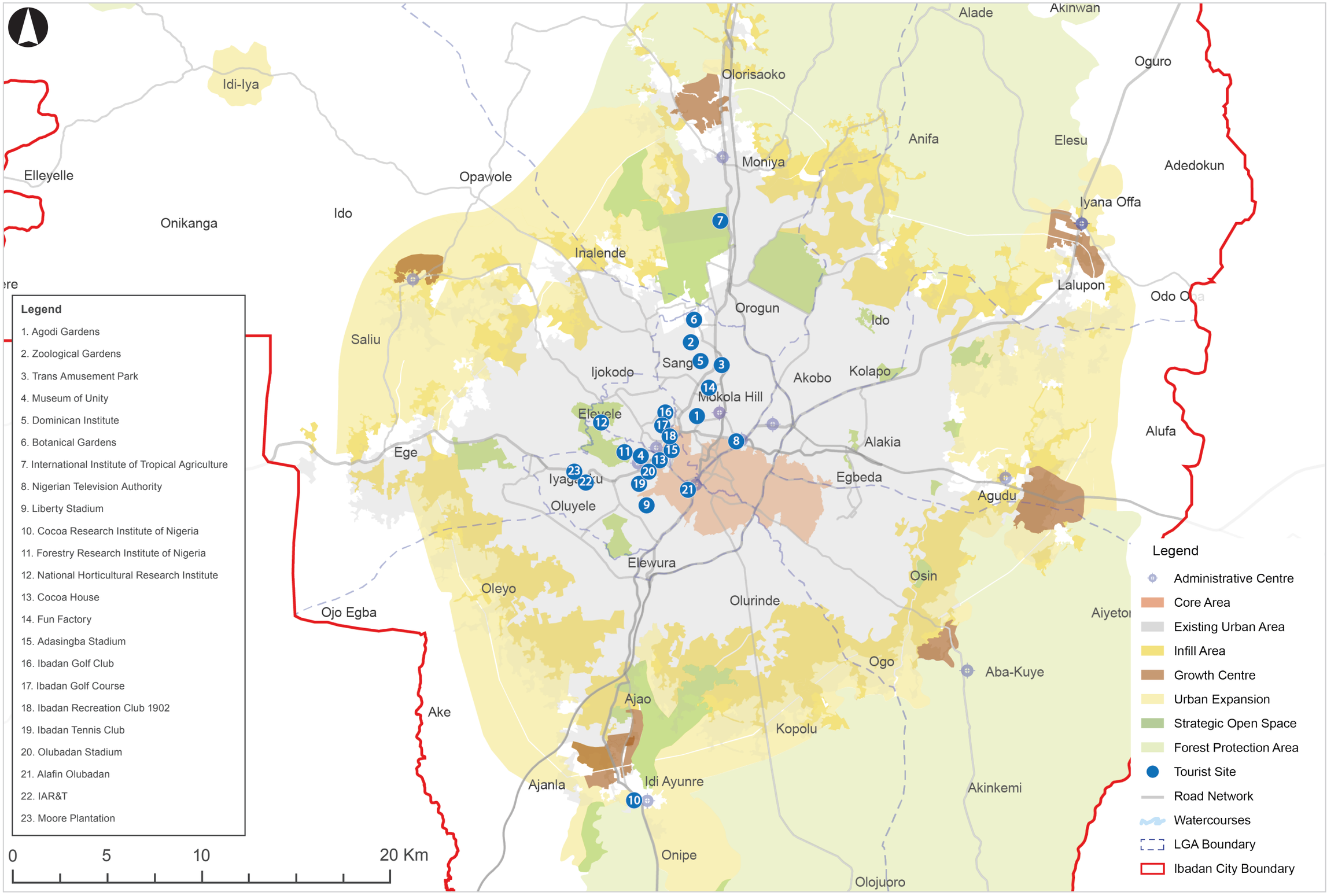


Figure 3.50: Tourist Sites, excluding Heritage Buildings

3.6 IMPLEMENTATION AND PHASING STRATEGY

3.6.1 Implementation Programme

Table 3.10 provides an implementation programme for the Masterplan and shows how the elements of strategic importance can be delivered over the 20-year time period covered by the Masterplan.

Upon adoption of the Masterplan, there will be a need for concurrent detailed development and planning of the strategic elements of the Masterplan. Undertaking this provides the opportunity for comprehensive and joined-up planning of new built development, physical infrastructure and social infrastructure.

It is envisaged that the detailed planning documents would be adopted by early 2019 and that construction could commence shortly afterwards. Construction of the strategic elements of the Masterplan has been split into four sequential phases. The implementation programme shows each of these as being four years in length, which would mean completion of all phases by the end of 2034. This is two years ahead of the Masterplan period and therefore provides some contingency should certain phases be delayed or take longer than the anticipated four years.

It should also be noted that detailed planning for Phases 2 to 4 is forecast to be undertaken later in the timeframe once construction has commenced. This is considered to be a more manageable approach than front-loading all of the detailed planning work and will enable Phase 1 construction to be commenced at the earliest opportunity. It also allows for lessons learnt from earlier phases to be planned for subsequent phases.

Further details on the strategic elements within each phase are provided in the phasing strategy.

Key:

Institutional Arrangement	Construction
Commissions/ Studies	Specific Actions

Table 3.10: Implementation Strategy

TIMELINE	INSTITUTIONAL	REGENERATION OF THE CORE AREA	FUTURE GROWTH AREAS AND URBAN INFILL	FOREST PROTECTION AREAS	STRATEGIC OPEN SPACE AND URBAN AGRICULTURE	SOCIAL INFRASTRUCTURE	CIRCULAR ROAD	PRINCIPAL AND PRIMARY ROADS UPGRADE	PUBLIC TRANSPORT
2016	ICM Development								
2017									
2018	Adopt ICM	Implement DUP model projects	Commission Layout Plans for Phase 1	Commission Forest Management Plan				Commission design of upgraded roads	
2019	Establish IDA or Special Monitoring Unit or Undertake Capacity Building		Adopt Layout Plans for Phase 1	Adopt Forest Management Plan	Construct strategic open spaces and urban agriculture within Phase 1 areas	Construct social infrastructure within Phase 1 areas	Construct Phase 1 of Circular Road	Adopt engineering plans	Construct MRT Phase 1
2020			Commission Layout Plans for Phase 2 areas	Establish parastatal under MoE					
2021		Commission Regeneration Strategy	Adopt Layout Plans for Phase 2 areas	Erect boundary of forest protection areas				Construct Phase 1 upgrade	
2022									
2023			Construct Phase 1 areas		Construct strategic open spaces and urban agriculture within Phase 2 areas	Construct social infrastructure within Phase 2 areas	Construct Phase 2 of Circular Road		Construct MRT Phase 2
2024		Adopt Regeneration Strategy						Construct Phase 2 upgrade	
2025			Commission Layout Plans for Phase 3 areas						
2026			Adopt Layout Plans for Phase 3 areas						
2027	Review Progress of ICM		Construct Phase 2 areas		Construct strategic open spaces and urban agriculture within Phase 3 areas	Construct social infrastructure within Phase 3 areas	Construct Phase 3 of Circular Road	Construct Phase 3 upgrade	Construct MRT Phase 3
2028		Implement Regeneration Strategy							
2029		Review Progress of Regeneration Strategy	Commission Layout Plans for Phase 4 areas						
2030			Adopt Layout Plans for Phase 4 areas						
2031			Construct Phase 3 areas		Construct strategic open spaces and urban agriculture within Phase 4 areas	Construct social infrastructure within Phase 4 areas	Construct Phase 4 of Circular Road	Construct Phase 4 upgrade	Construct MRT Phase 4
2032									
2033									
2034			Construct Phase 4 areas						
2035	Commission NEW ICM								
2036									

3.6.2 Phasing Strategy

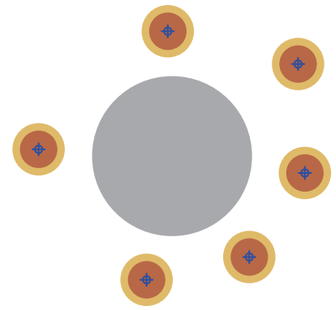
The Ibadan City Masterplan provides a vision covering the period to 2036. In order to develop the masterplan gradually and in a coordinated manner, a phased development is proposed. This will ensure that land is released for urban development in line with the estimated population growth. The intention is to minimise pressure on delivery in any one area, anticipate development (for instance, along new roads) and direct development in strategic ways (such as Growth Centres).

New development proposals in Ibadan should be utilised to assist in funding, financing and delivering infrastructure. For instance, the Circular Road is phased in tandem with urban development along the road's corridor. New developments will benefit from increased accessibility and should therefore contribute to the Circular Road's funding. Funding mechanisms may include placing a levy on new developments, or by forming a public-private partnership whereby developers provide a proportionally adequate provision of infrastructure alongside development.

The phasing strategy focuses on urban development and the road network (new and upgraded roads). The regeneration of the Core Area is dealt with in the Detailed Urban Plans report. The phasing strategy is divided into four phases, which are described on the following pages. The order in which these phases are carried out is more important than the timing of any particular phase. The masterplan will remain relevant even if implementation takes less or more time than anticipated.

Principles of Phasing Strategy

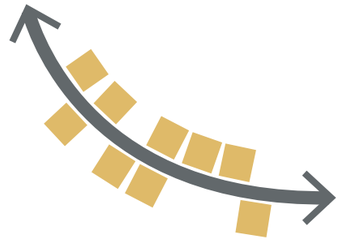
The phasing strategy follows a number of core principles to ensure development is constructed in a timely and rational manner, and ties in with adequate provision of infrastructure. The inclusion of these principles allows for flexibility if for some reason the detailed phasing strategy cannot be implemented as outlined. These principles are illustrated in Figure 3.51.



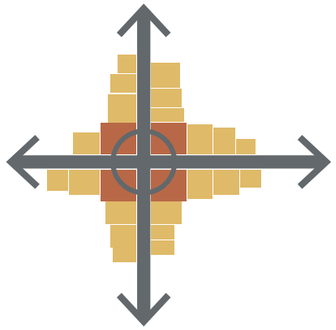
1. High density Growth Centres will be constructed early in the phasing to provide a development anchor.



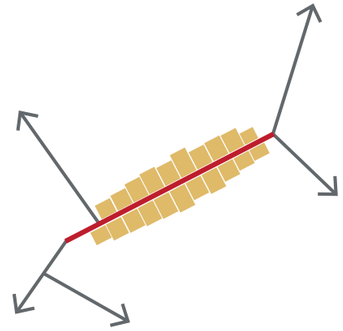
2. Infill development will take place closest to the city centre first and radiate outwards



3. Development will take place alongside the Circular Road as it is constructed.



4. Where a junction is constructed, development will be phased around it.



5. Development will be phased along existing roads as they are upgraded.



6. Social infrastructure, such as schools, healthcare facilities and fire stations will be provided alongside development.

Figure 3.51: Phasing Strategy Principles

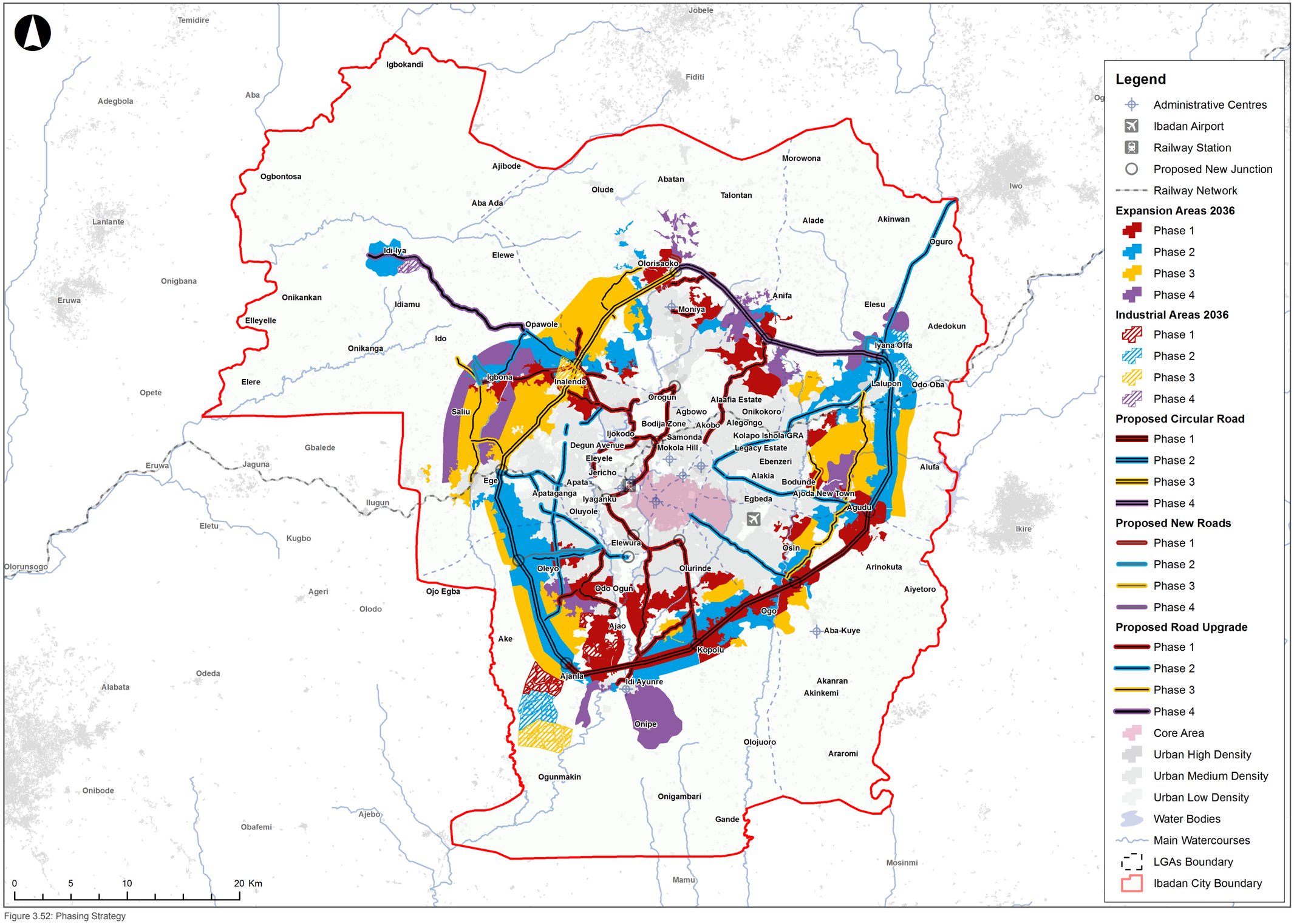


Figure 3.52: Phasing Strategy

Phase One

Phase One will focus on designating protected areas, upgrading infrastructure and initiating high density development at Growth Centres. All identified areas of forest will be designated, and measures to facilitate protection implemented, to the north, south and west of Ibadan. Within the city, strategic open spaces have been identified along river corridors. These spaces will need to be managed and protected to avoid encroachment. Development will begin at Growth Centres to anchor future development and infill development will begin to densify the existing urban periphery.

Population Capacity: Additional 1.1 million people.

Growth Centres: Oluyole, Egbeda and Akinyele.

Urban Expansion: Medium density expansion along southern section of the circular road.

Infill Development: In sparsely developed areas in each outer LGA, especially Oluyole.

Circular Road: Southern stretch, from Ajanla to Egbeda Growth Centre.

New Roads: Between Ibadan-Eruwa Expressway and Awotan-Opawole Road.

Core Area: The core area will undergo a process of regeneration based on the Detailed Urban Plans.

Figure 3.53 splits phase one into development areas, each with a specific Site ID. The breakdown of each development area is provided in Table 3.11, including land area, population capacity and estimated social infrastructure requirements. These figures are for reference and may be used as a guide for development.

Table 3.11: Phase One Development Projects

SITE ID	DESCRIPTION	ESTIMATED SOCIAL INFRASTRUCTURE REQUIREMENTS				LAND AREA (HA)	ESTIMATED POPULATION CAPACITY
		PRIMARY SCHOOLS	SECONDARY SCHOOLS	PRIMARY HEALTH CENTRES	HOSPITALS		
P1A	Akinyele Growth Centre Expansion - Low Density	12	3	12	1	595.80	36,565
P1B	Infill - Medium Density	8	2	8	0	411.31	31,188
P1C	Infill - Medium Density	13	3	13	0	678.06	60,002
P1D	Infill - Medium Density	12	3	12	0	592.36	52,728
P1E	Expansion - Medium Density	7	2	7	0	326.76	41,310
P1F	Expansion - Medium Density	4	1	4	0	209.49	26,509
P1G	Expansion - Medium Density Infill - Medium Density	11	3	11	0	567.21	55,199
P1H	Egbeda Growth Centre Expansion - Medium Density Infill - High Density Infill - Medium Density	28	7	28	1	1,394.65	139,414
P1I	Infill - Medium Density	7	2	7	0	364.98	25,268
P1J	Expansion - Medium Density Infill - Medium Density	27	7	27	0	1,337.30	111,514
P1K	Infill - Medium Density	6	2	6	0	312.67	17,538
P1L	Expansion - Medium Density	25	7	25	0	1,236.40	154,669
P1M	Infill - Medium Density Expansion - Medium Density	28	7	28	0	1,416.33	111,092
P1N	Oluyole Growth Centre	13	4	13	1	651.28	74,144
P1O	Infill - Medium Density	12	3	12	0	582.93	37,160
P1P	Infill - Medium Density	10	3	10	0	508.21	30,571
P1Q	Infill - Medium Density	9	2	9	0	466.65	27,422
P1R	Infill - Medium Density	8	4	8	0	407.62	32,630
P1S	Infill - Medium Density Expansion - Medium Density	11	3	11	0	563.37	49,603
P1T	Expansion - Low Density Infill - Medium Density	13	4	13	0	644.12	51,069
TOTAL	**N/A**	**264**	**66**	**264**	**3**	**13,267.47**	**1,165,596**

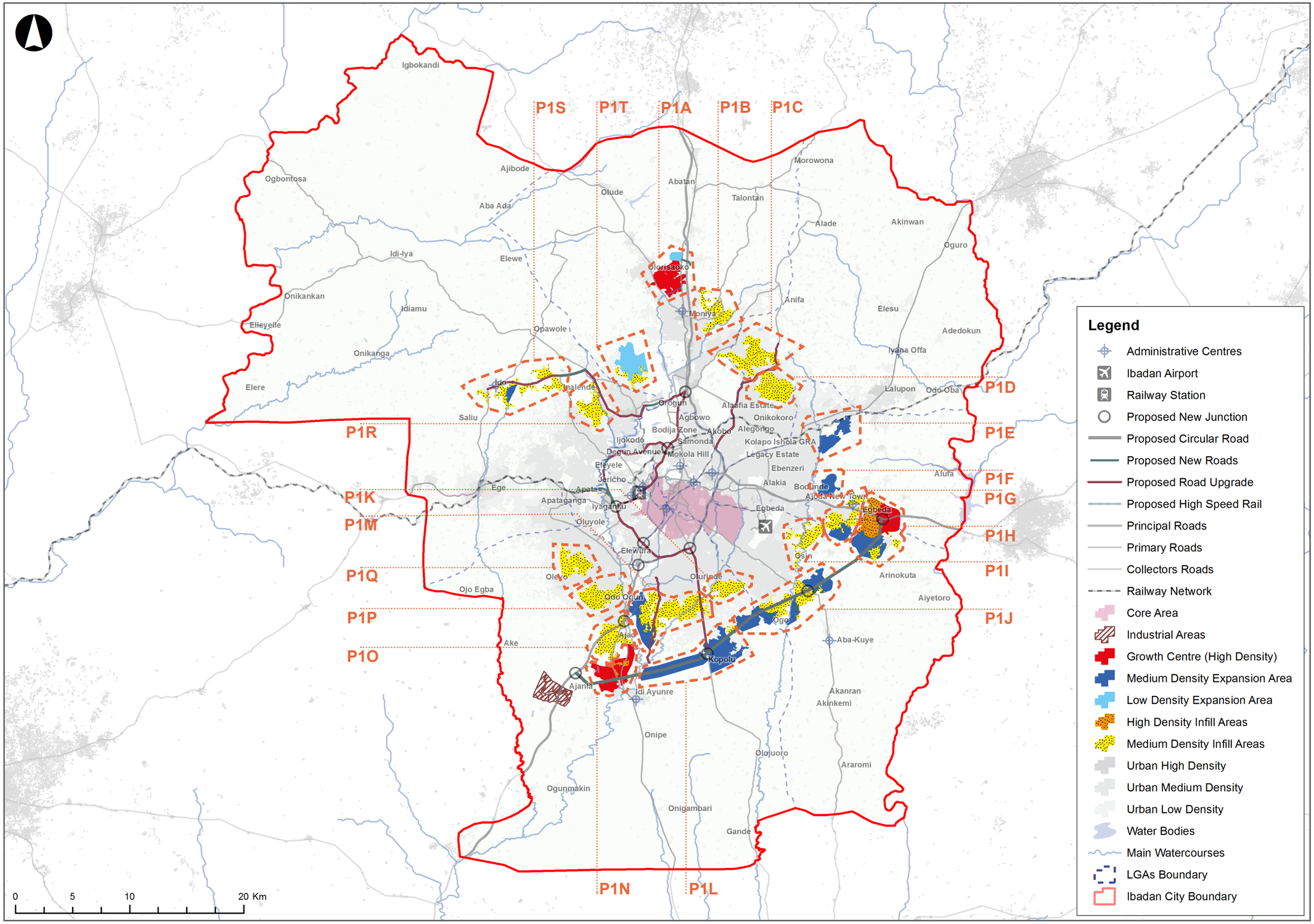


Figure 3.53: Phase One

Phase Two

Phase Two will see the creation of 2 additional Growth Centres, and further extension of the circular road with associated development.

Population Capacity: Additional 1.3 million people.

Growth Centres: Lagelu and Ido.

Urban Expansion: Medium density development along eastern and south-western sections of the circular road.

Infill Development: Medium density infill development between the existing urban edge and the phase 1 and 2 of the circular road, concentrated in Oluyole. Some infill to the north in Akinyele and Ido.

Circular Road: Eastern section from Egbeda Growth Centre to Iyana Offa/Lagelu Growth Centre and the south-western section from Ajanla to Ege.

Core Area: The core area will undergo a process of regeneration based on the Detailed Urban Plans

Figure 3.54 splits phase two into development areas, each with a specific Site ID. The breakdown of each development area is provided in Table 3.12, including land area, population capacity and estimated social infrastructure requirements. These figures are for reference and may be used as a guide for development.

Table 3.12: Phase Two Residential Development Projects

SITE ID	DESCRIPTION	ESTIMATED SOCIAL INFRASTRUCTURE REQUIREMENTS				LAND AREA (HA)	ESTIMATED POPULATION CAPACITY
		PRIMARY SCHOOLS	SECONDARY SCHOOLS	PRIMARY HEALTH FACILITIES	HOSPITALS		
P2A	Infill - Medium Density	5	1	5	0	236.26	17,644
P2B	Lagelu Growth Centre Expansion - Medium Density	14	4	14	1	700.46	56,337
P2C	Expansion - Medium Density Infill - Medium Density	58	14	58	0	2,904.28	351,021
P2D	Expansion - Medium Density Infill - Medium Density	5	1	5	0	251.32	28,788
P2E	Expansion - Medium Density Infill - Medium Density	9	2	9	0	441.99	33,375
P2F	Expansion - Medium Density Infill - Medium Density	17	4	17	0	836.49	79,498
P2G	Infill - Medium Density	17	4	17	0	876.33	52,951
P2H	Expansion - Medium Density	9	2	9	0	447.72	44,895
P2I	Expansion - Medium Density	15	4	15	0	734.47	81,621
P2J	Expansion - Medium Density	36	9	36	0	1,788.43	199,538
P2K	Expansion - Medium Density Expansion - Low Density Infill - Medium Density	48	12	48	0	2,392.93	196,093
P2L	Ido Growth Centre Infill - Medium Density	6	2	6	1	314.41	22,263
P2M	Expansion - Medium Density Expansion - Low Density Infill - Medium Density	32	8	32	0	1,623.02	182,244
P2N	Expansion - Low Density Infill - Medium Density	8	2	8	0	377.36	27,897
TOTAL	**N/A**	**277**	**69**	**277**	**2**	**13,925.45**	**1,374,164**

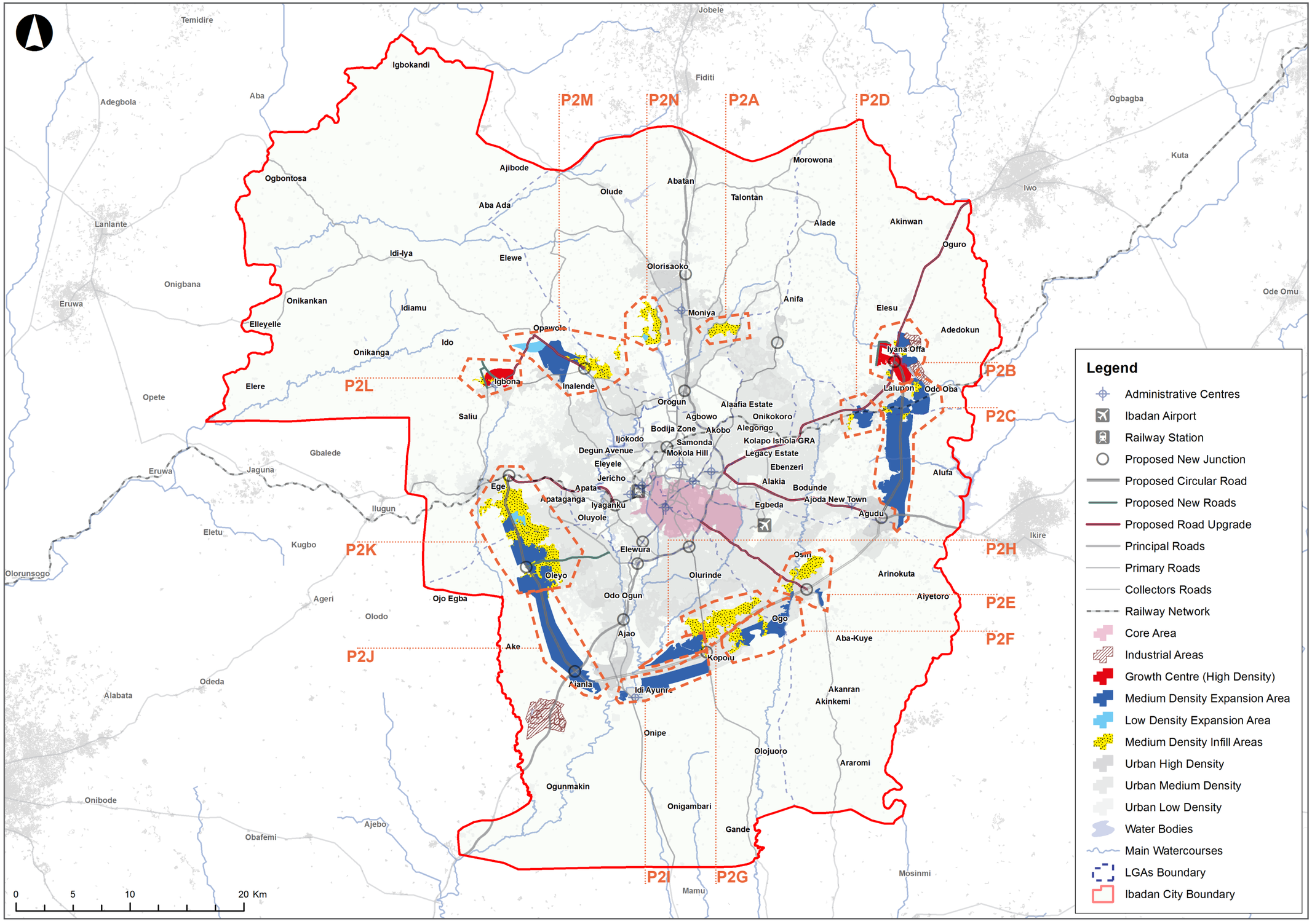


Figure 3.54: Phase Two

Phase Three

Phase Three will see further medium density expansion to support the high density growth centres and the north-western section of the circular road. This phase includes many pockets of development which will knit together urban infill and development along the Circular Road which will have been completed in earlier phases.

Population Capacity: Additional 1.5 million people.

Growth Centres: Ona Ara.

Urban Expansion: A large tract of low density expansion to the north-west of the city, expansion to the south of the Ido growth centre and the outer edge of the south west of Oluyole urban area. Medium density expansion in Egbeda to connect the existing urban area and the already constructed expansion area along the circular road.

Infill Development: Pockets of infill development in Oluyule, Ona Ara, Egbeda, Lagelu and Ido.

Circular Road: North-western section from Ege to the Akinyele Growth Centre.

Core Area: The core area will undergo a process of regeneration based on the Detailed Urban Plans.

Figure 3.55 splits phase three into development areas, each with a specific Site ID. The breakdown of each development area is provided in Table 3.13, including land area, population capacity and estimated social infrastructure requirements. These figures are for reference and may be used as a guide for development.

Table 3.13: Phase Three Residential Development Projects

SITE ID	DESCRIPTION	ESTIMATED SOCIAL INFRASTRUCTURE REQUIREMENTS				LAND AREA (HA)	ESTIMATED POPULATION CAPACITY
		PRIMARY SCHOOLS	SECONDARY SCHOOLS	PRIMARY HEALTH FACILITIES	HOSPITALS		
P3A	Expansion - Medium Density Infill - Medium Density	27	7	27	0	1,374.03	127,993
P3B	Expansion - Medium Density Infill - Medium Density	44	11	44	0	2,190.74	274,719
P3C	Infill - Medium Density	7	2	7	0	367.23	3,0216
P3D	Ona Ara Growth Centre	4	1	4	0	212.27	15,323
P3E	Expansion - Medium Density	5	1	5	0	238.51	32,736
P3F	Infill - Medium Density	9	2	9	0	429.25	29,185
P3G	Infill - Medium Density	2	0	2	0	79.30	5,767
P3H	Infill - Medium Density	5	1	5	0	253.19	18,058
P3I	Expansion - Medium Density	21	5	21	0	1,079.27	141,747
P3J	Expansion - Medium Density	21	5	21	0	1,035.42	131,539
P3K	Expansion - Medium Density Infill - Medium Density	10	2	10	0	493.29	64,318
P3L	Expansion - Medium Density Infill - Medium Density	49	12	49	0	2,445.81	263,660
P3M	Expansion - Medium Density Infill - Medium Density	15	4	15	0	779.06	92,084
P3N	Expansion - Low Density	70	18	70	0	3,524.53	273,995
TOTAL	**N/A**	**289**	**72**	**289**	**0**	**14,501.91**	**1,501,339**

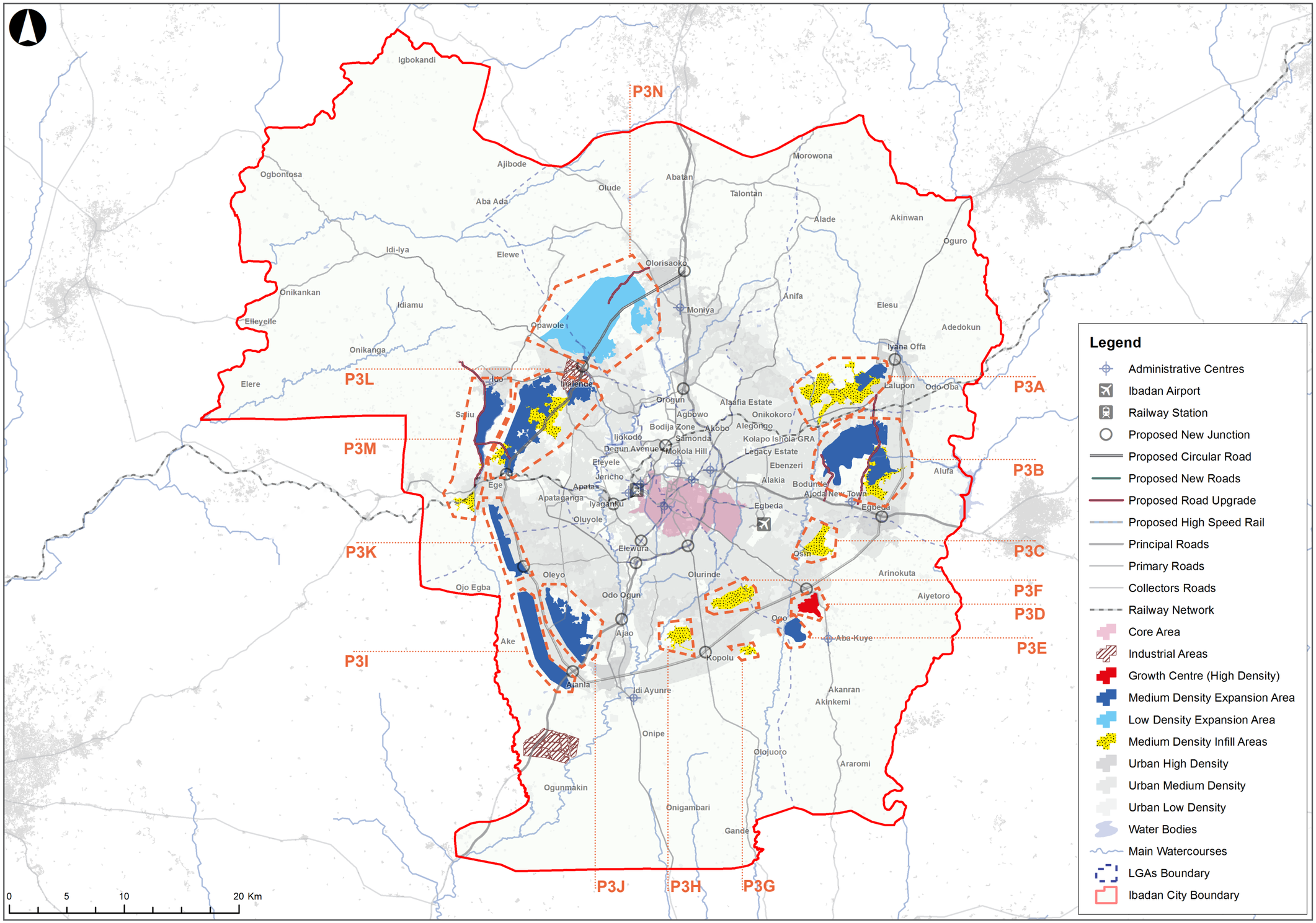


Figure 3.55: Phase Three

Phase Four

Phase Four will see the completion of the Circular Road to the north of the city. This will relieve congestion from the inner city and improve connectivity to all parts of the city.

The remaining planned expansion areas will be completed during this phase, the two largest development areas being on the periphery in the west and south.

Population Capacity: Additional 1.5 million people.

Growth Centres: None.

Urban Expansion: Expansion of Idi-Iya town. Medium density expansion around Ido Growth Centre and the southern-most area of Oluyole. Some expansion areas in Lagelu and Egbeda.

Infill Development: Edge of the northern urban area in Akinyele and Lagelu.

Circular Road: North-eastern section from Akinyele growth centre to Lagelu growth centre.

Core Area: The core area will undergo a process of regeneration based on the Detailed Urban Plans.

Figure 3.56 splits phase four into development areas, each with a specific Site ID. The breakdown of each development area is provided in Table 3.14, including land area, population capacity and estimated social infrastructure requirements. These figures are for reference and may be used as a guide for development.

Table 3.14: Phase Four Residential Development Projects

SITE ID	DESCRIPTION	ESTIMATED SOCIAL INFRASTRUCTURE REQUIREMENTS				LAND AREA (HA)	ESTIMATED POPULATION CAPACITY
		PRIMARY SCHOOLS	SECONDARY SCHOOLS	PRIMARY HEALTH CENTRES	HOSPITALS		
P4A	Infill - Medium Density	13	3	13	0	659.97	53,889
P4B	Akinyele Growth Centre Infill - Medium Density	27	7	27	0	1,340.86	127,527
P4C	Infill - Medium Density	8	2	8	0	426.88	35,959
P4D	Expansion - Medium Density	15	4	15	0	747.76	98,023
P4E	Expansion - Medium Density	18	5	18	0	918.61	118,264
P4F	Expansion - Medium Density	14	3	14	0	699.60	91,643
P4G	Expansion - Medium Density	39	10	39	0	1,961.04	259,334
P4H	Expansion - Medium Density	8	2	8	0	381.45	50,294
P4I	Infill - Medium Density	13	3	13	0	674.95	45,731
P4J	Expansion - Medium Density	18	5	18	0	907.31	102,581
P4K	Expansion - Medium Density Infill - Medium Density	69	17	69	0	3,465.52	422,606
P4L	Expansion - Medium Density	17	4	17	0	839.58	115,674
TOTAL	**N/A**	**259**	**65**	**259**	**0**	**13,023.51**	**1,521,525**

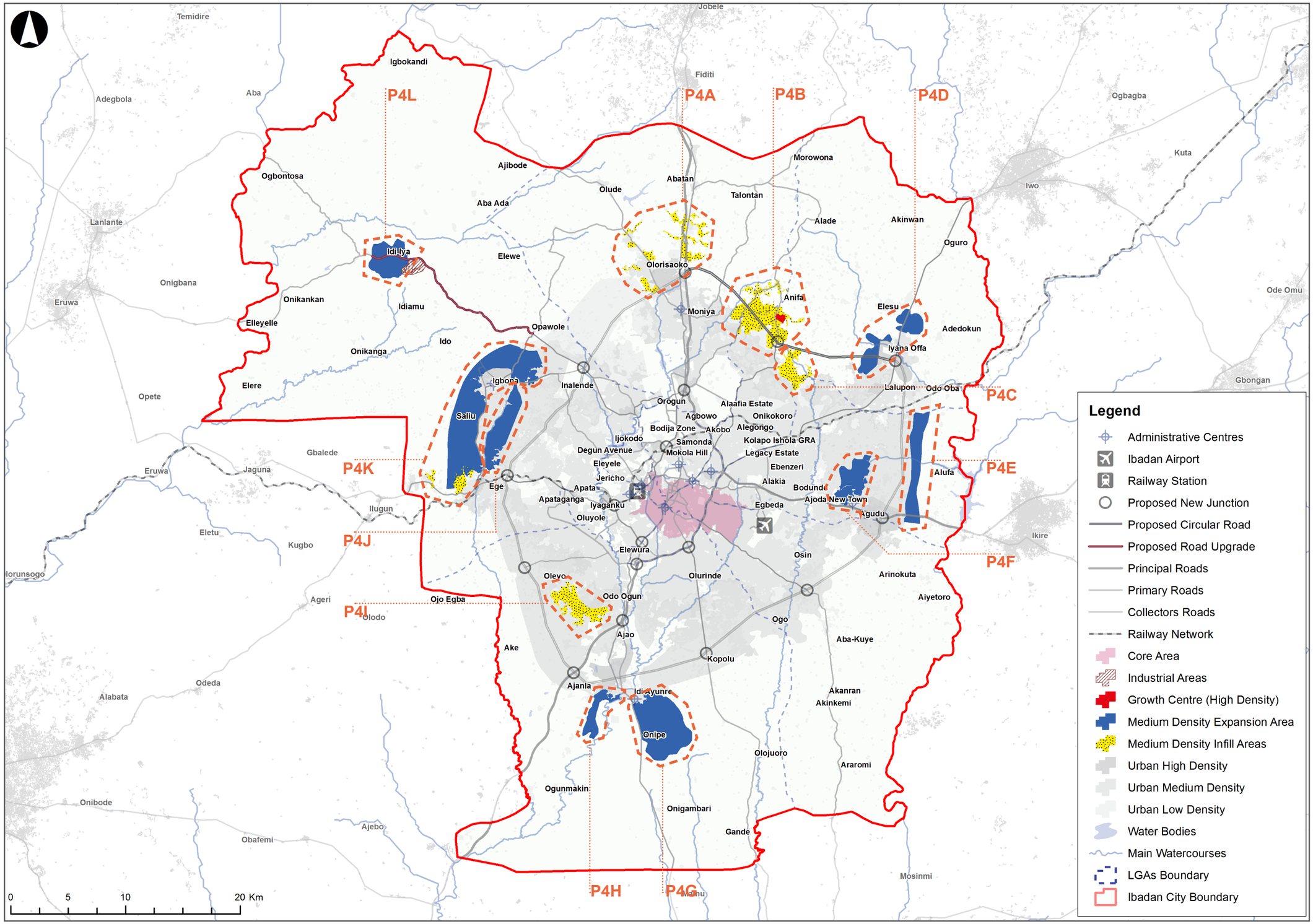


Figure 3.56: Phase Four

Monitoring and Evaluation

The implementation of the Ibadan City Masterplan is proposed to follow a "plan, monitor, manage" approach. The planning proposals and policies are based on evidence and it is important that the implementation of these is monitored. Should evidence demonstrate changing trends and issues that the Masterplan is not suitably addressing, it will be necessary to review existing Masterplan proposals and policies and consider if these should be amended, removed or replaced with new policies.

In order to assist with these monitoring and managing processes, it is recommended that an Annual Monitoring Report is published on a specific date each year to track and provide assurances on the progress made in delivering the Plan's proposals and policies and achieving its objectives. This will require ongoing monitoring of a range of key performance indicators throughout the year and publication of the results alongside agreed performance targets in order to see the extent that the indicators are being met.

It is proposed that the following could form the basis of the key performance indicators:

Table 3.15: Key Performance Indicators

MASTERPLAN OBJECTIVES	RELATED SESA OBJECTIVES	POTENTIAL KEY PERFORMANCE INDICATORS
1. To accommodate the anticipated future population.	19 20	• Net increase in number of new housing units constructed.
2. To prevent flooding and mitigate any flooding impact on urban areas.	1 2 18	• Number of deaths, missing persons and persons affected by disaster. • Direct disaster economic loss, including disaster damage to critical infrastructure and disruption of basic services. • Number of flooding incidents.
3. To protect, manage and enhance the natural environment.	3 8 9	• Net increase in coverage of forest protection areas and strategic open spaces. • Progress with development and implementation of management plans for forest protection areas and strategic open spaces. • Proportion of rivers and bodies of water where water quality is within national and international standards.
4. To improve connectivity and integrate with the emerging transport developments.	50	• Proportion of Ibadan city area that has convenient access to public transport services. • Length of new roads constructed and existing roads upgraded. • Length of MRT network constructed and operational. • Number of MRT stations/stops constructed and operational.
5. To promote the city's economy and attract investment.	31 34 35 36 37 38 40 41 42 43 44 45	• Progress with development and implementation of Ibadan Agricultural Programme and Management Plan. • Net increase in coverage of industrial, commercial and mixed-use land. • Progress with development and implementation of Core Area model projects.
6. To meet the social needs and requirements of the existing and future population.	13 32 33 39	• Net increase in number of primary and secondary schools constructed and operational. • Net increase in number of primary and secondary healthcare facilities constructed and operational. • Net increase in number of police stations and fire stations constructed and operational. • Proportion of Ibadan City area that has convenient access to the above facilities.
7. To provide adequate utility infrastructure for the existing and future population.	4 5 6 45 46 47 48 49	• Proportion of Ibadan city area with access to safely managed sanitation services. • Proportion of Ibadan city area with access to narrowband/broadband services. • Proportion of Ibadan city area with access to electricity services. • Proportion of Ibadan city area with access to safely managed water services. • Proportion of Ibadan city area with access to solid waste collection services. • Proportion of collected solid waste that is recycled.
8. To protect and promote the culture and heritage of the city.	26 27 28 29 30 31	• Net increase in number of heritage buildings identified and protected. • Number of heritage buildings considered at risk due to their poor condition. • Progress with development and implementation of projects to maintain/refurbish heritage buildings.
9. To enhance quality of life for all.	-	• Net increase in coverage of strategic open spaces that are publicly accessible. • Net increase in coverage of leisure and recreation land.
10. To provide sound planning framework for efficient delivery and implementation.	14 15 16 17 23 24 25	• Number of events held to facilitate the direct participation of civil society in urban planning and management. • Progress with implementation of the Masterplan.

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DRAINAGE

4

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4 DRAINAGE

4.1 INTRODUCTION

Flooding in Ibadan is a serious issue, which has caused significant damage to infrastructure, buildings, the city's economy, and has led to loss of life on numerous occasions.

The aim of this section is to provide the macro scale drainage system for Ibadan, addressing the major drainage problems and flooding impact on the city. The determination of existing streams and their approximate discharges, water bodies, and flood prone areas within the city of Ibadan are presented. In addition, this section highlights the design criteria adopted in identifying flood prone areas and their impact on the masterplan. The section concludes with the development of the Macro Scale Drainage System along with a recommendation on the Structural and Non-Structural flood protection measures.

This section is organised into the following sub-sections:

- Data Collected
- Drainage Problems
- Design Criteria
- Development of Ibadan Drainage System

4.2 DATA COLLECTED

Data collection sought to gather all the necessary and relevant information for analysis of the city's drainage system. This includes climate, rainfall data, topographical maps, satellite imagery, land cover maps and Digital Elevation Models. Numerous site visits to different locations within Ibadan were also undertaken to get a full picture of existing drainage streams and waterbodies.

4.2.1 Climate

Ibadan has a tropical wet and dry climate with a lengthy wet season and relatively constant temperatures throughout the course of the year. Ibadan's wet season runs from March through to October, although August sees relatively low precipitation. This low precipitation divides the wet season into two: from March to July and from September to October; flooding usually occurs in these two periods. The period from November to February forms the city's dry season, during which Ibadan experiences the typical West African climate. The mean total rainfall for Ibadan is around 1420 mm, falling over approximately 109 days. There are two peaks for rainfall, June and September. The mean maximum temperature is 26.46 C, minimum 21.42 C and the relative mean humidity is 74.55%.

4.2.2 River Basins

The city of Ibadan is naturally drained by a dense network of rivers and streams, most of which are seasonal such that the volume of water they contain is reduced during the dry season and increased when the rain sets.

Major Basins Surrounding Ibadan

Ibadan is bounded by the River Ogun in the west and the River Osun and Lake Asejire in the east. These rivers have large basins (refer to Figure 4.1).

Local Basins within Ibadan

Three local basins (east, west and middle basins) are to be found within Ibadan's built-up area. These 3 basins present the most important watersheds to be studied as they are located within the urban and most densely populated areas of the city, and are subsequently the areas most prone to be affected by flooding impacts.

The eastern basin is formed by the River Omi, the western by the River Iddo, and the central basin by the River Ona. The largest basin is the one formed by the River Ona, with two main tributaries, namely Ogunpa and Ogbere. Other local basins developed within Ibadan present tributary basins to the rivers Ogun and Osun.

4.2.3 Main Rivers

The city of Ibadan is naturally drained by a dense network of rivers and streams; most are seasonal such that the volume of water is reduced during the dry season and increased when the rain sets in, with a peak flow during the month of August.

Figure 4.2 shows the main rivers running in Ibadan arranged from west to east, these include the Rivers Ogun, Ose, Oso, Iddo, Ona, Ogunpa, Ogbere, Omi, Okoseru, and Osun. The following section describes the main rivers within Ibadan.

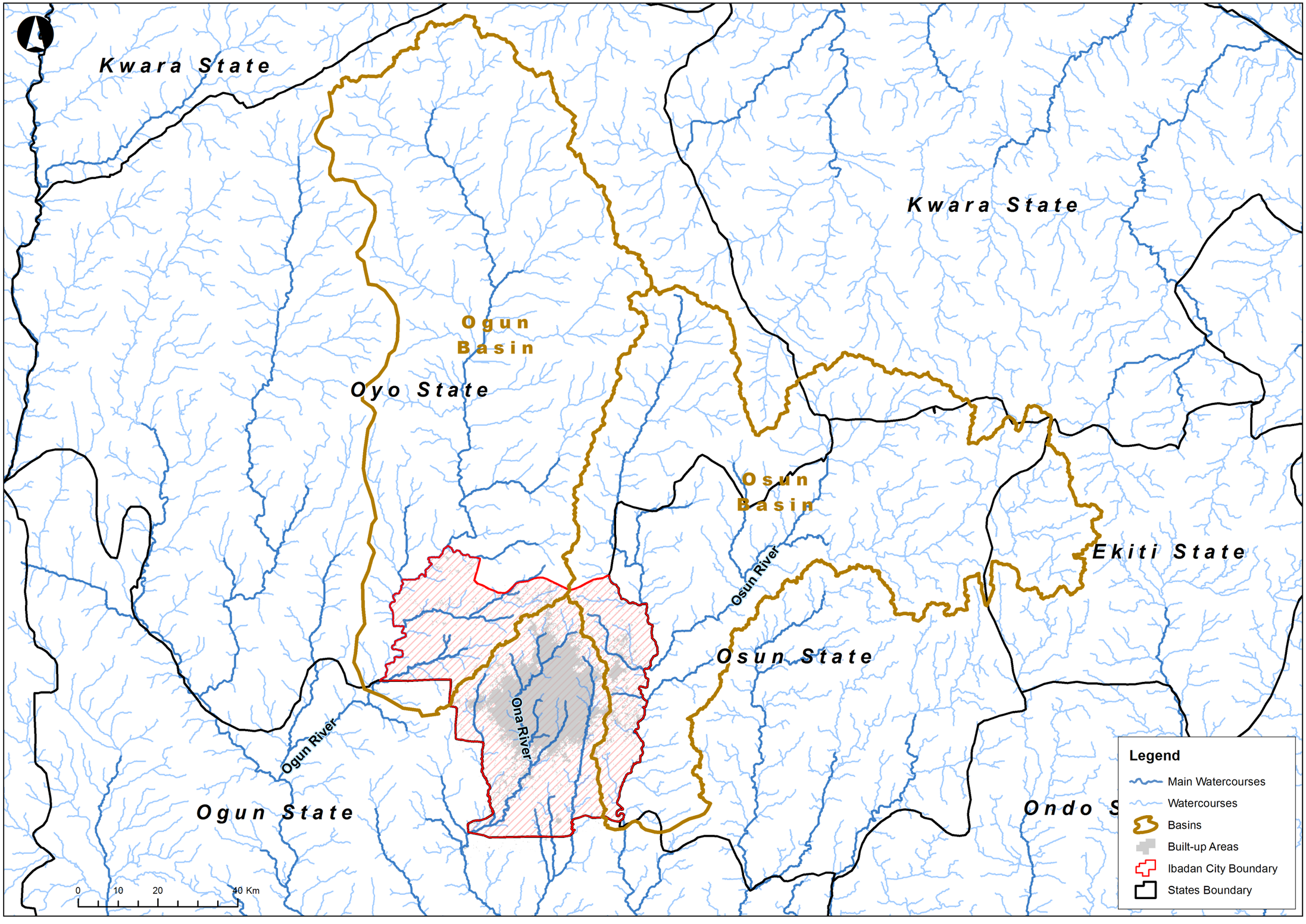

Figure 4.1: Principal Rivers in Ibadan

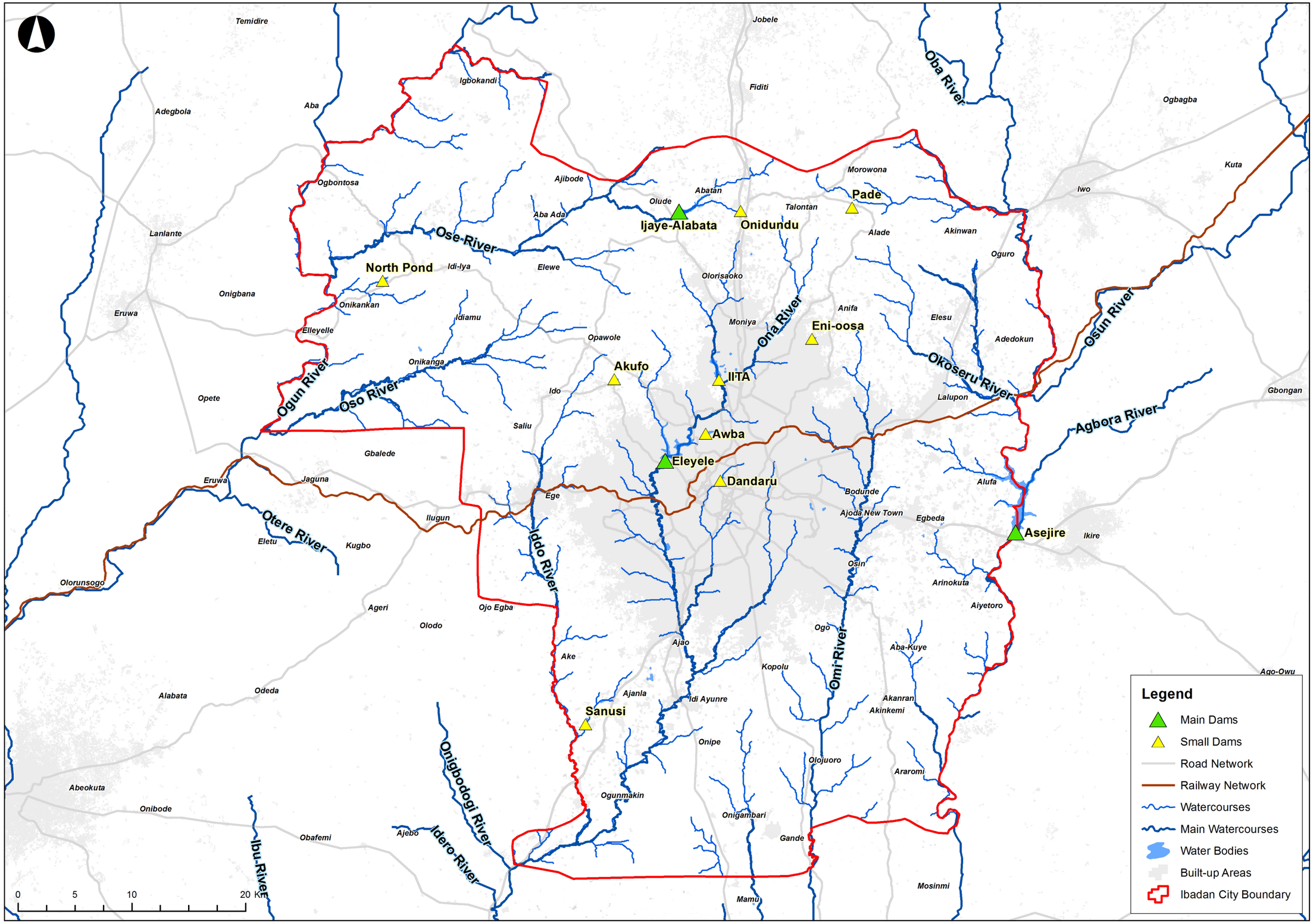

Figure 4.2: Major Rivers and Dams in Ibadan

River Ogun

The River Ogun rises in the Iganran Hills 503m above mean sea level and flows directly southwards over a distance of about 320km before discharging into the Lagos Lagoon. It bounds Ibadan along its western boundary. The total area of the River Ogun's basin extends over 23,000 km^2, occupying parts of Oyo, Ogun and Lagos States.

River Ose

The River Ose is one of the tributaries of the River Ogun. It flows in the north-west of Ibadan from an elevation of about 230m to 125m above sea level. Its catchment area occupies about 450 km^2 over a length of around 40km. Its tributaries are dammed by two earth fill dams: Ijaye-Alabata dam and Onidundu dam.

River Oso

The River Oso is another tributary of the River Ogun and flows across north-west Ibadan. Its catchment area is about 330 km^2, which is contained within Ibadan. Two of its main tributaries are the River Elesin and the River Temdire.

River Iddo

The River Iddo rises in Opawole within the Ido Local Government Area and flows southwards and into the River Ona. The River Iddo is around 51km long and has a catchment area of around 364km^2. It is dammed by an earth fill dam on one of its tributaries near the Sanusi Dam located further downstream (refer to Figure 4.3).



Figure 4.3: River Iddo (Location: 586,531m E, 792,241m N)

River Ona

The River Ona rises in Talontan in Akinyele Local Government Area and is considered as the largest river passing through the Ibadan built up area, having a length of around 81km and a drainage area of around 835 km^2, which includes the River Ogunpa and the River Ogebere basins, but excluding the River Iddo and River Omi basins.

The River Ona flows through the low density western part of the Ibadan built up area. The river flows in a north-south direction where it is dammed at Eleyele, creating a reservoir which continues to be one of the most important sources of water supply in Ibadan. Awba Dam and a further dam at the IITA are located on the River Ona's tributaries. Meanderings are common and the overall channel slope varies from 0.15 to 0.25 percent.



Figure 4.4: River Ona (Location: 595,570m E, 805,844m N)

River Omi

The River Omi is one of the tributaries of the River Ona. It rises in the Lagelu Local Government Area, and flows south where it then joins the River Ona at the Gambari forest reserve. The catchment area of the River Omi within Ibadan is around 448 km^2. The watershed hydrology of the river over the years has changed considerably due to ever increasing anthropogenic activities. The resultant effect is the inundation of farmlands and flooding of residential areas in the Omi-Adio Township, whenever the river regularly overflows after heavy rain.



Figure 4.5: River Omi (Location: 611,417m E, 816,152m N)

River Ogunpa

The River Ogunpa rises from about 220 metres above sea level at the centre of the Ibadan built up area near Agodi and Bodija, and flows southwards past the secretariat to Lake Agodi. This lake was created by building a dam across the Ogunpa (referred to as Dandaru Dam) to store water for water supply but it is now used only for fishery operations. Downstream of the lake, the River Ogunpa flows southwards to the south-east of the Gbagi business district and then to Oke Fodo, Oke Ado and Isale-Ijebu until it is joined by the River Kudeti.

The River Ogunpa's drainage basin has a catchment area of around 73km^2 including the basin to the River Kudeti. The length of the River Ogunpa is around 19km; it discharges into the River Ona.

Although the channelisation of the Ogunpa stream has defined its boundaries, preventing encroachment of houses on either sides of its banks and reducing flood risk, the smooth roughness of the channel has increased the capability of the channel to convey a greater downstream flow rate. The reaches in south Ibadan, where the stretch of channelisation ends, may receive large flows during strong storms and in short periods of time.



Figure 4.6: River Ogunpa (Location: 598,332m E, 813,745m N)

River Ogbere

The River Ogbere rises in Egbeda to the north of Ibadan International Airport and flows southwards into the River Ona. The River Ogbere is around 24km long and has a catchment area of around 105km^2.



Figure 4.7: River Ogbere with Olomi Road (Location: 602,045m E, 807,453m N)

River Okoseru

The River Okoseru is one of the largest tributaries of the River Osun; its basin occupies an area of around 130 km^2 in the north-eastern part of Ibadan.

River Osun

The River Osun forms the border between Oyo and Osun states, and flows southwards to enter Epe Creek near the Lekki lagoon. The basin of the River Osun catchment has an area of more than 8,900 km^2. One of the River Osun's tributaries is dammed in north-west Ibadan by the Pade earth fill dam forming a lake with a capacity of 0.74 Million Cubic Metres (MCM). In addition, the River Osun is dammed by the Asejire Dam located on the eastern boundary of Ibadan with a total capacity of around 32 MCM.



Figure 4.8: River Osun and Asejire Spillway (Location: 624,949m E, 813,471m N)

4.2.4 Dams and Water Bodies

There are 4 four main dams located on the main streams within Ibadan, each one of which impounds a huge reservoir in its upper reaches. These are the Eleyele dam, Asejire dam, IITA dam and Ijaye/Alabata dam (refer to Figure 4.9).

In addition, there are around 7 small dams located on minor streams. These dams are Awba, Dandaru, Akufo, Pade, Sanusi, Eni-Oosa and Onidundu. Fishing ponds are located in many areas along streams.

Table 4.1: Characteristics of the Dams in Ibadan

DAM LOCATION	RIVER	EASTING (m)	NORTHING (m)	DAM TYPE	HEIGHT	CAPACITY (mcm)	DEAD STORAGE (m^3)	CREST ELEVATION (m)	LENGTH (km)	YEAR
Asejire-Ibadan	Osun	625,066	814,025	Earth Fill	26.0	32.20	3,221,800	160	853	1972
Eleyele-Ibadan	Ona	594,270	820,328	Earth Fill	14.5	6.89	890,000	176	243	1942
IITA	Ona	599,002	827,447	Earth Fill					280	
Ijaye-Alabata	Ose	595,484	842,222	Earth Fill	11.0	2.02	202,500	254	565	2010
Awba	Ona	597,840	822,703	Earth Fill	5.5	0.227			110	1964
Danduru	Ogunpa	599,110	818,574	Concrete	5.0	0.10			90	
Akufo	Alapata	589,800	827,490	Earth Fill	8.5	0.11	11,000	240	185	2007
Pade	Osun	610,702	842,571	Earth Fill	9.5	0.74	74,000	278	550	1992
Sanusi	Iddo	587,282	797,179	Earth Fill	9.5	0.62	62,400	132	450	2006
Eni-oosa	Ona	607,181	831,039	Earth Fill	8.0	0.12		269	240	1988
Onidundu	Ose	600,907	842,266	Earth Fill	5.0	0.097		278	145	2013

Easting and Northing values are according to the UTM – WGS 84 – Zone 31 N coordinate system.

Source: Data received from PIU.

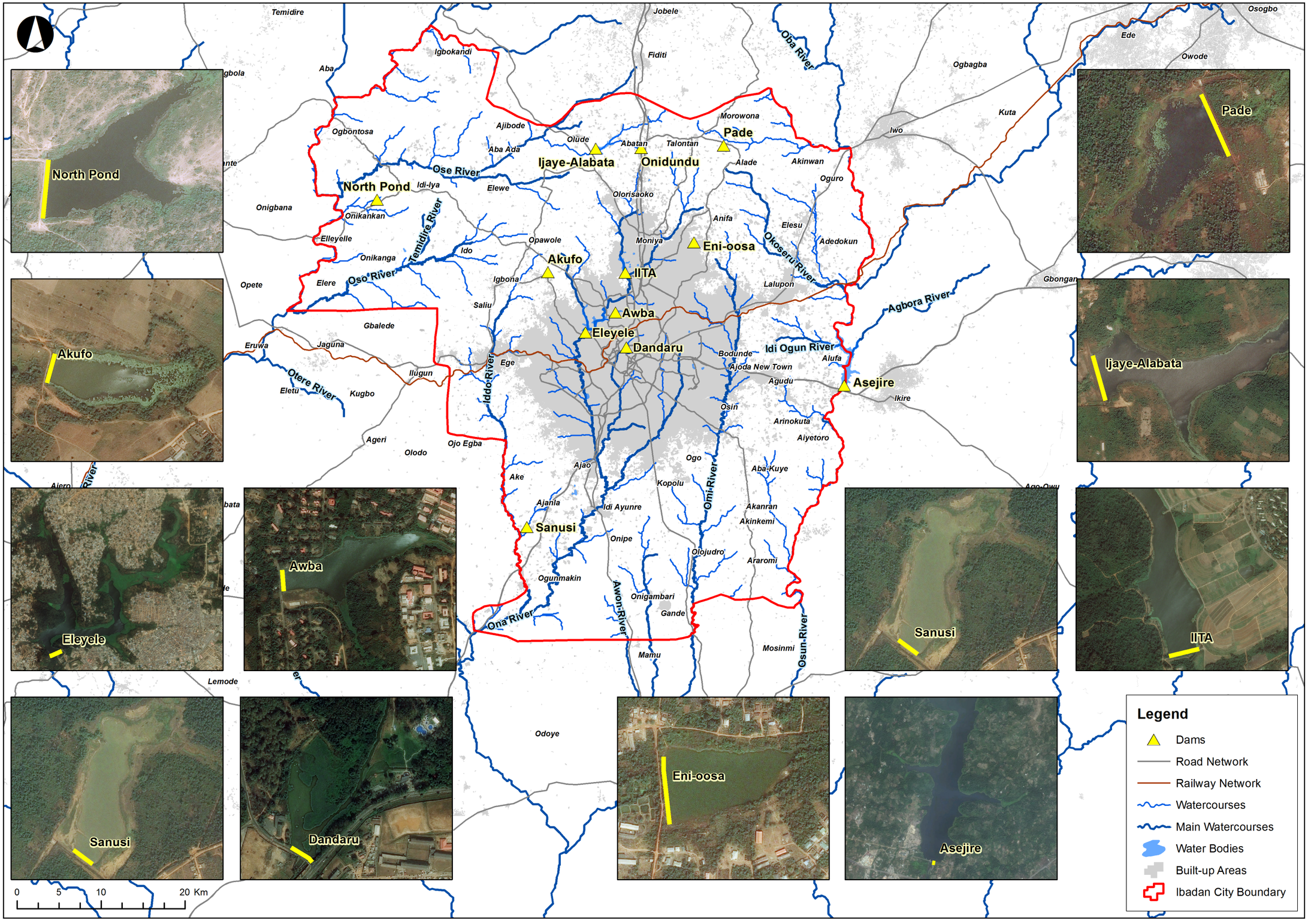

Figure 4.9: Dams and Water Bodies in Ibadan

Asejire Dam

The Asejire Reservoir lies in Oyo State on the River Osun, about 30 kilometres east of Ibadan. The reservoir provides raw water to the Asejire and Osegere water treatment plants in Ibadan. The dam was built in the late 1960s with a crest width of about 8m and is approximately 853m in length. Farming is banned in the catchment area, and trees have been planted on the banks, which has removed the risk. With a plentiful water supply, the reservoir remains full throughout the year with a total capacity of about 32 MCM, which gives a flow of about 4,500 cubic metres per second.



Figure 4.10: Asejire Reservoir Satellite Image (Location: 624,949m E, 813,471m N)



Figure 4.11: Asejire Gated Spillway

Eleyele Dam

The Eleyele Waterworks (dam, reservoir and treatment works) started operations in 1943. The dam is located on the River Ona just downstream from the confluence of the River Ona with the River Alapata.

The reservoir is located to the north-west of Ibadan's city centre. The surface area of the lake is around 160 ha while the reservoir's capacity is around 6.9 MCM.

The area surrounding the reservoir comprises a variable width of light forest and a wetland margin around the perimeter of the lake. The reservoir contains areas of floating vegetation in the vicinity of the spillway a short distance upstream of the embankment. Satellite imagery indicates that the floating vegetation can become extensive and mobile.



Figure 4.12: Lake Eleyele Satellite Image (Location: 594,252m E, 820,317m N)



Figure 4.13: Eleyele Reservoir



Figure 4.14: Eleyele Spillway

Awba Dam

The Awba Dam is an enclosed watershed located at the southwestern part of the University of Ibadan along one of the tributaries of the River Ona. The dam was constructed in 1964 primarily for domestic water supply, fish production and research purposes to the University of Ibadan community. It is a small dam with a surface area of around 6 hectares, a maximum depth of 5.5m and a storage capacity of 0.227 MCM. Awba Dam was dredged in 1971 to increase the water supply to the University community and was further dredged in 2014 to increase fishing activities and for recreational purposes.



Figure 4.15: Awba Dam Satellite Image (Location: 597,839m E, 822,701m N)



Figure 4.16: Awba Dam Reservoir

Ijaye-Alabata

Ijaye-Alabata is an earth filled dam located on one of the tributaries of the River Ose near the Iseyin-Ibadan road. It was constructed in 2010 with a height of around 11 metres and a length of around 565m.



Figure 4.17: Satellite Image for Ijaye Alabata Dam

4.2.5 Site Visit

In order to get a more comprehensive picture of the flood situation, a site investigation was undertaken across the city, for different drainage streams and main rivers, along with their associated structures. A GPS camera was used to take pictures of each site and referenced using a geo-reference application (Geosetter) to set them in their respective coordinates, using the WGS 1984 UTM 31N coordinate system. In addition, comprehensive interviews with the affected communities have been undertaken to assess the flooding problems within each location.

4.2.6 Flooding Background

The case of urban flooding of Ibadan is a typical example of a man-made flood disaster. Ibadan has been afflicted by devastating floods for a long time, when overflow from the River Gege drowned the homes of those living on its banks. The area suffered from varying degrees of floods for a long time. Whenever there is heavy rainfall, most parts of the city get flooded with water overflowing into houses and across roads.

Like many previous floods but far more serious, the August 2011 flood hit the city of Ibadan with an unexpected magnitude of rainfall. After six hours of torrential rain, the Eleyele Dam, which provides drinking water to Ibadan, could no longer hold back the flow. Water poured over the top of the dam, flooding everything in its path and causing the death of more than 120 people, while also inflicting serious damage to infrastructure (many bridges collapsed, roads were washed away, and substantial property was lost), in addition to the livestock and fish in ponds which were carried away by the flood.

On 26 August 2011, the rain gauge at the IITA recorded an all-time rainfall high of 187.5mm. Some of the effects of the damage caused by the flood in 2011 were stationed along the embankments of the bridges on the River Ona at Apete and Ogbere in Olomi which were swept away, causing flood waters to affect all surrounding communities for over four days. Many culverts were completely blocked due to the sweeping of solid waste with the flood.

In the aftermath, studies (including one by the Oyo State Task Force) were undertaken to establish the causes of the flood and identify the short and medium to long-term initiatives required to address this issue. It was recognised that damage from the flood was increased by encroachment on floodplains, neglected maintenance of drains and channels and debris in the waterways.

A key recommendation of the World Bank was the need to enforce planning regulations and provide wider technical assistance linked to infrastructure investments in water infrastructure, waste management and transportation.

Past Flood Analysis and Approved Setbacks

Oyo state has issued regulation in regards to the identification and determination of flood prone areas and river setbacks based on past flood analysis. Oyo state identified the setbacks for several rivers across the city of Ibadan as shown in Table 4.2. The consequence of poorly managed urbanisation is urban development on unstable and risky locations such as along Ogunpa, Kudeti, Ogbere and Orogun floodplains and the hillside of Oke-Are, Oke-Aremo, Sapati and Mokola hills in the centre of the city. This phenomenon is partly responsible for the Ogunpa flood disasters and soil erosion. Within the city's core residential areas, there is currently no comprehensive water and sewage system, an inadequate waste collection and disposal system, and an unstable urban environment that increases vulnerability to natural disasters. Oyo State's currently approved setbacks provided in the table below are considered as insufficient to protect the public from flood hazard.

Table 4.2: Approved Setbacks for Major Rivers in the Ibadan Metropolitan Area

NO.	RIVER NAME	APPROVED SETBACK BY OYO STATE (m)
1	Odo- Ona Elewe	15
2	Adamo	15
3	Alalubosa	15
4	Sango	15
5	Oluyole	15.5
6	Kudeti	30.5
7	Orogun	30.5
8	Onire	30.5
9	Gbaremu	30.5
0	Alaro	30.5
11	Ogbere	30.5
12	Gege	30.5
13	Ogunpa	45
14	Odo-Ona	45
15	Ona-Ara	45.7
16	Others	15

Source: Towards an Environmental Action Plan for Oyo State, Oyo State of Nigeria, 2005.

4.3 DRAINAGE PROBLEMS

The objective of this section is to review the causes of flooding and their impact on different locations in Ibadan, and to give a brief overview on the current situation to mitigate the deficiency in the capacity of existing systems and highlight stormwater drainage problems across different parts of Ibadan. These causes can be discussed as follows:

Natural causes: these include high rainfall intensity, low land elevations, growth of grass and weeds in channels and climate change.

Man-made causes: these include encroachment of buildings in flood plains, deforestation, inadequate planning of the physical environment, the construction of buildings on flood plains in the form of rapid urbanisation, the insensitive dumping of solid waste in streams and rivers which disrupts the free flow of water and the under-design of existing systems.

4.3.1 Natural Causes

High Rainfall Intensity

The amount of annual rainfall is considerably high. The maximum value of daily rainfall over the last 30 years was recorded as 233mm on June 10, 2009. The period from March to October is considered as the rainy season and experiences heavier rainfall intensity than during other months of the year.

Low Land Elevations

The available digital terrain model (DTM) of Ibadan identifies many points with elevations lower than their surroundings. These are considered to be at risk of flooding because water is collected in these points resulting in deep water levels, which cause many problems, including:

- The development of wetlands and swampy areas that are subject to flooding,
- Their great difficulty to be supported with an adequate drainage system.

It has been observed that many settlement and communities lie in depressed areas. After conducting interviews with the communities and the affected residents by frequent flooding events, it is noted that those locations suffer from increased flood hazard caused by the potential of these areas to accumulate water during heavy rainfall events. These areas are identified as flood prone areas.

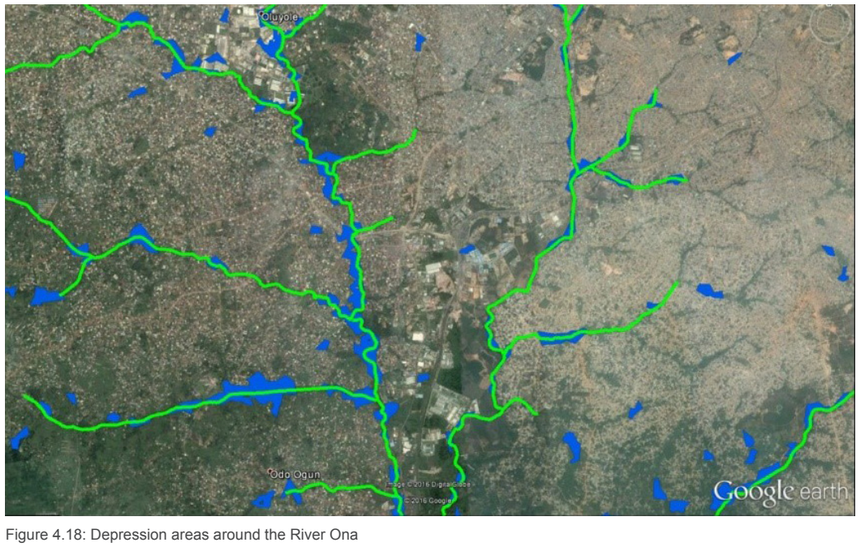

Figure 4.18: Depression areas around the River Ona

Growth of Grass and Weeds in Channels

Due to the fertility of soil in Ibadan, grass and weeds naturally grow on channel beds and embankments, causing an increase in the roughness of the streams – this decreases the hydraulic capacity of the system causing flooding upstream.

Dredging and clearing the channel is necessary.

Rural land degradation have led to development of the massive gullies along with siltation of waterways, riverbank collapse and river course re-routing, and have undermined the existing infrastructure capacity (eg reservoirs, roads, drainage, urban development).



Figure 4.19: Grass and Weeds in Channels - Life Forte Road



Figure 4.20: Grass and Weeds in Channels - Onireke road

4.3.2 Man-made Causes

Encroachment of Buildings in Flood Plains

Flood plains are the areas along streams or rivers that are likely to experience repeated flooding. The risk of flooding is increased due to the human tendency to use the river floodplain to cope with community demands; water is easily available for drinking or commercial uses and floodplain land is often flat and easier to develop than hilly land.

The operational efficiency of Ibadan's rivers and streams is significantly affected by encroachment in flood plains, which forms blockage of the channel alignment by direct construction across the main drainage system.

With an insufficient understanding about the occurrence of large floods and a lack of appreciation on their consequences, people are often tempted by the apparent benefits of developing in such areas. As a result, these people are the first victims of any flood occurrence.

The conservation of existing flood plains from encroachment is necessary. Institutional laws and policies should be issued to prevent citizens from encroaching on these areas. Houses within flood plains specified by river setbacks should ideally be removed, and local flood protection measures implemented. In these circumstances, the inhabitants should be provided with a house of equal size in a reasonably nearby location. Alternatively, compensation should be considered. In areas with a large number of houses and where resettlement or demolition is not a reasonable solution, channelisation provides a better solution to protect existing houses from flood hazards.



Figure 4.21: Encroachment of buildings in flood plains- Dugbe, Ibadan Abeokuta Road



Figure 4.22: Encroachment of buildings in flood plains- Segun Akinsanya Street, Kuola – Apata

Siltation in Ibadan Rivers

All rivers naturally carry silt in their flow due to water velocity, which is referred to as sediment transport. Silt deposits can be observed along river banks in areas of small velocities or stagnant water.

The soils in southern Nigeria are highly susceptible to water erosion. In Ibadan, siltation is most often caused by soil erosion in the river catchments. It comprises of both suspended and dissolved load discharge through the basin outlet. These materials (both suspended and solute load) are generated from both interfluvial areas and channel subsystems within the drainage basin.1

Siltation in Ibadan is mainly caused by gully erosions. Gullies are relatively steep-sided watercourses that experience heavy or extended rainfall. Soil eroded from the gullied area can cause siltation of waterways, road culverts, dams and reservoirs. Gully development may be triggered by increased run-off from land use changes such as tree clearing in a catchment or construction of new residential areas. Once a gully starts, it expands rapidly and is difficult to control. The formation of gullies differs by site, but are largely caused by human factors, including:

- Improper road drainage design and construction, inadequate road drainage maintenance, inadequate gully development monitoring, and inadequate timely gully control;
- Poor solid waste management in urban and peri-urban areas that chokes the already inadequate drainage meant to prevent erosion; and
- Destructive and unsustainable land-use practices that remove protective vegetation through overgrazing, deforestation, cultivation of marginal lands, and uncontrolled mining for building material, linked to poverty.

Rural land degradation have led to the massive gullies along with siltation of waterways, riverbank collapse and river course re-routing, and have undermined the existing infrastructure capacity (e.g. reservoirs, roads, drainage and urban development).

1 Adediji and Fashae 2004 "Sediment Dynamics in a small, 2nd Order Urban River Awba Catchment, Ibadan, Nigeria," Journal of Environmental Geography.



Figure 4.23: Culvert blocked by sediments, IITA - Crossing of Agbe stream with Agbe Road



Figure 4.25: Erosion and formation of Gullies, Olorungunwa, Rock view Estate, Poat stream crossing with Bioku road



Figure 4.24: Sedimentation of silts in channels, Moniya - Crossing of Odo Otun Agbakin channel with Ojo Ibadan Expressway



Figure 4.26: Culvert blocked by sediments, Moniya - Crossing of Odo Otun Agbakin channel with Ojo Ibadan Expressway

Rapid Urbanisation

Urbanisation with its attributes, which includes the development of impervious surfaces such as roads and concrete pavements, causes serious flood problems. Urbanisation increases the percentage of imperviousness; this is an important factor when considering water drainage. It is calculated by measuring the percentage of impervious surfaces to the catchment area. For a natural ground cover, this percentage may vary from 0 to 10%, while for dense commercial areas, it may reach 75 to 100%. Akintola (1995)[2] reported that average impervious surfaces in Ibadan had increased from 9.5% (in 1965) to 28.4% (in 1994). This causes poor water infiltration through the soil and means that older infrastructure will increasingly be inadequate. In this respect, rainwater has the potential to create floods where drainage streams are inadequate to accommodate the storm water.

Re-vegetation and planting of trees should be considered in any scenario for flood prevention. In addition, permeable paving can be integrated in urban areas.

Under-sized and Deteriorated Culverts

Some culverts are either undersized or deteriorated which cause a reduction in the capacities of drainage systems and flooding. The rehabilitation or maintenance of old culverts is essential along with the construction of larger sized culverts when needed in some locations.

2 Report on the 26th of August 2011 flood in Ibadan.

Figure 4.27: Rapid urbanisation is clear between these two figures (2006 and 2014)



Figure 4.28: Under-sized culvert - Jerusalem, Arulogun



Figure 4.29: Deteriorated culvert - Gbegba, Ogbere, River Ogbere



Figure 4.30: Deteriorated culvert - Jerusalem, Arulogun



Figure 4.31: Deteriorated culvert - Ashi Road, Bodija Stream



Figure 4.32: Deteriorated culvert - Akura -Express Road towards Apata Road with Gbadamosi Oloko Street

Dumping of Solid Waste in Streams

It is common in Ibadan for solid waste to be dumped into streams with no attempt made to clear the stream. Solid waste causes a slowdown in the free flow of water further downstream. As it moves with the flow, waste flocks into the drainage structures such as culverts resulting in blockages. The water drainage system is affected and water is not drained. Water subsequently flows out of the system, flooding surrounding areas.

Periodic cleaning and maintenance of these channels is highly necessary. Public awareness and education to understand the impact of dumping refuse is a must. It is recommended to use different media streams to convey the message and inform the public about the seriousness of dumping refuse in the water steams.



Figure 4.33: Dumping of Solid Waste - Ode Aje Kosodo Channel



Figure 4.35: Dumping of Solid Waste - Bembu road – Aba-Alamu

Deforestation

Deforestation is the destruction of forests and standing trees in order to make the forest land available for other uses. Ibadan has suffered from the deforestation of many forests such as the Agala and Igbo Agala forests. The destruction of these forests and use of the land for other purposes has changed the land cover and reduced infiltration rates and retention capacity. This results in a greater volume of water runoff, which in turn increases the probability of flooding.

The existing forested areas in the north and south of Ibadan should be preserved from deforestation in order to limit the impacts of flooding in the city, especially in the north where the land is higher. This could be applied by implementing policies to protect these areas from any further tree removal.

Re-vegetation and planting of trees should be considered in any scenario for flood prevention. In fact, a programme of tree planting should be encouraged.



Figure 4.34: Heavy Vegetation within Flood Plains “Aba Baale Area”

4.3.3 Summary of Drainage Problems

The drainage problems can be summarised as follows:

Natural Causes

1. High Rainfall Intensity.
2. Low Land Elevations.
3. Growth of Grass and Weeds in Channels.

Man-made Causes

1. Encroachment of buildings in flood plains.
2. Deforestation, land use change which cause an increase in runoff and deplete flood storage areas.
3. Rapid Urbanisation.
4. Under-sized and deteriorated culverts along some roads that are damaged from past flooding events.
5. Dumping of solid waste in streams, with collector drains silted and full of rubbish and debris.
6. Some road culverts for tributary drains are silted and partially blocked with refuse and waste.
7. Lack of comprehensive maintenance for natural watercourses.

The above reasons affect the hydraulic efficiency. It causes a reduction in the drainage system capacity and flooding of the areas upstream of the drainage elements.

4.4 HYDROLOGICAL ANALYSIS AND DESIGN CRITERIA

Hydrologic analysis is the most important step prior to the hydraulic analysis of drainage streams. It includes the estimation of the catchment physical parameters, establishment of intensity-duration-frequency curves, and calculation of runoff.

4.4.1 Delineation

Delineation is used to define study area boundaries, and/or to divide it into sub-areas. Delineation is part of the process known as watershed segmentation, which involves dividing the watershed into discrete land and channel segments to analyse watershed behaviour.

Based on the available topographic maps, satellite images and digital elevation models with a 30-metre resolution, the physiographical characteristics of each basin have been determined, in order to obtain all information concerning areas, altitudes, slopes, morphometric parameters, along with information concerning principal streams. Based on the above, the limits of the catchment areas of the watercourses have been delineated using the commercial software package WMS (Watershed Modelling System). Moreover, the area of the Ibadan City Masterplan has been subdivided into sub-drainage areas.

The area is divided into 22 major basins and coded with a unique letter to distinguish them easily (refer to Figure 4.36). Table 4.3 shows the identified basin names for 10 of the 22 major basins.

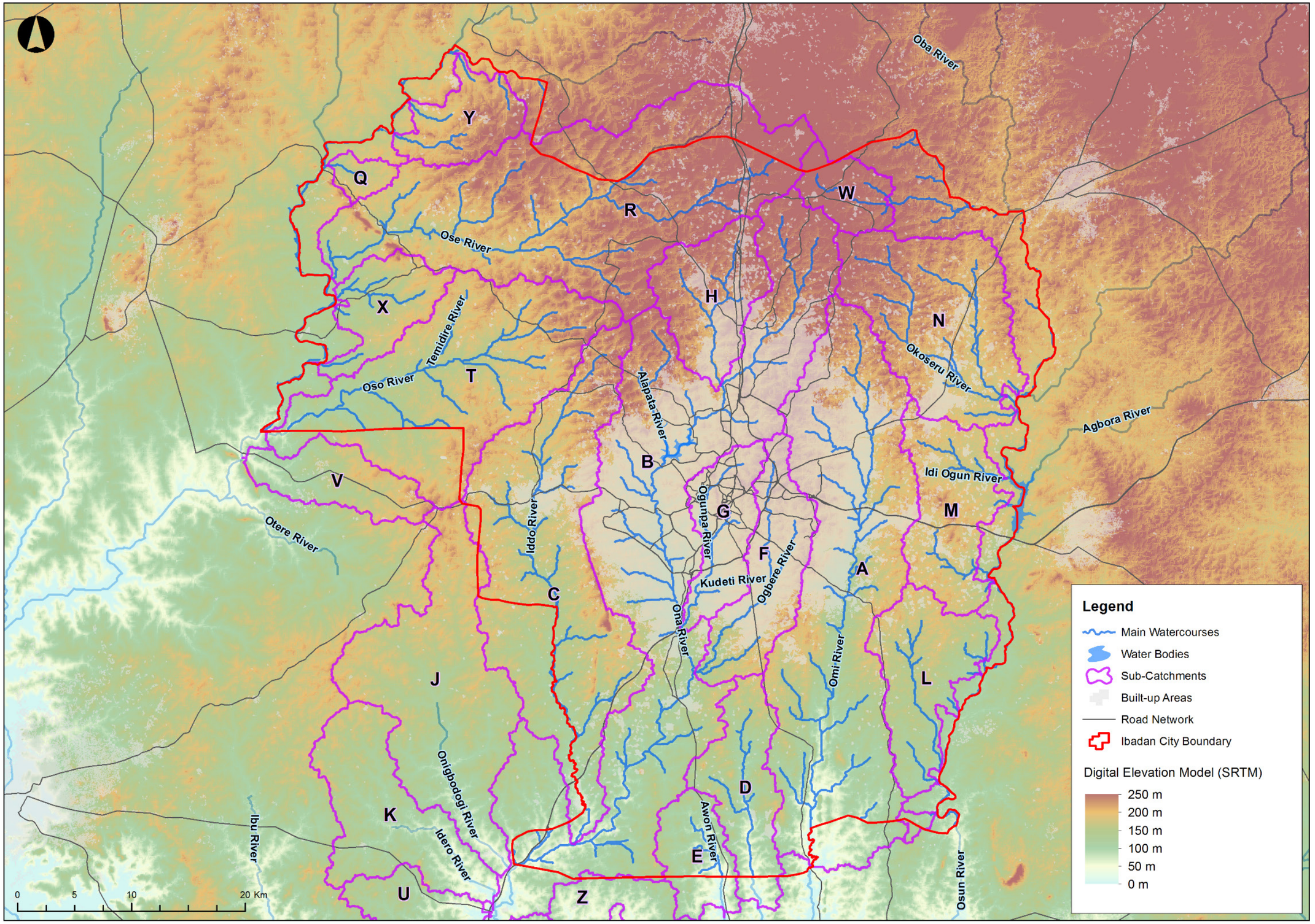

Figure 4.36: Major basins in Ibadan

Table 4.3: Local Basin Names

NO.	SYMBOL	BASIN
1	A	River Omi
2	B	River Ona
3	C	River Iddo
4	D	River Opedi
5	F	River Ogbere
6	G	River Ogunpa
7	M	River Idi Ogun
8	N	River Okoseru
9	R	River Ose
10	T	River Oso

4.5 DIGITISATION USING SATELLITE IMAGERY

Streams determined from the watersheds modelling have been exported on the collected satellite imagery to ensure that these resulting streams are similar to existing streams. It has been deduced that the delineated streams extracted from WMS are not identical to existing streams identified on satellite imagery. The natural streams have subsequently been digitised using the collected satellite imagery.

Green areas adjacent to existing streams have also been digitised to determine locations where encroachments to flooding areas have not occurred in order to reserve these areas for water during flood events.

4.5.1 Rainfall Frequency Analysis

Daily precipitation records for Ibadan meteorological stations is available for different periods. Figure 4.37 shows the maximum daily precipitation records from 1981 to 2016.

Several statistical distributions have been tested to fit the Ibadan data (Gumbel, Pearson type III, Log-normal 3 parameters, and Gamma). It has been found using Bayesian information criterion and Akaike information criterion that the Pearson type III is the best fit for the Ibadan data.

A theoretical ratio of 1.13 to 1.14 is adopted to transform daily rainfall values and 24-hr values (Hershfield, 1961). In the absence of short duration records or any similar information, sub-daily rainfall duration ratios can be assumed between rainfall intensities of 24-hr and those of the 12-, 6-, 3-, 2-, 1-Hr, 30-, 15-, and 5-min ratios (refer to Table 4.5). An example of such ratios were first proposed from durations of 2-hr to 5-min by Bell (1969) based on studies in the USA, and extended to the 24-hr rainfall depth by the Soil Conservation Service of the USA through their SCS type II dimensionless rainfall curve (SCS, 1986).

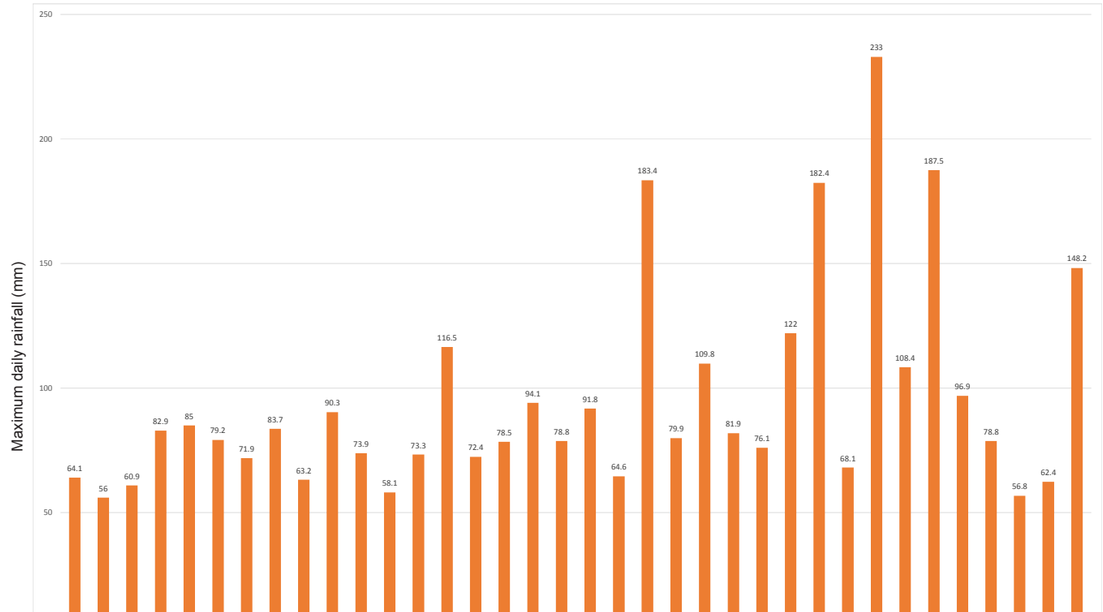

Figure 4.37: Maximum Daily Rainfall in Ibadan

Source: Nigerian Metrological Agency.

The results of the frequency analysis using the Pearson type III after multiplying by 1.13 are shown in Figure 4.38 and Table 4.4.

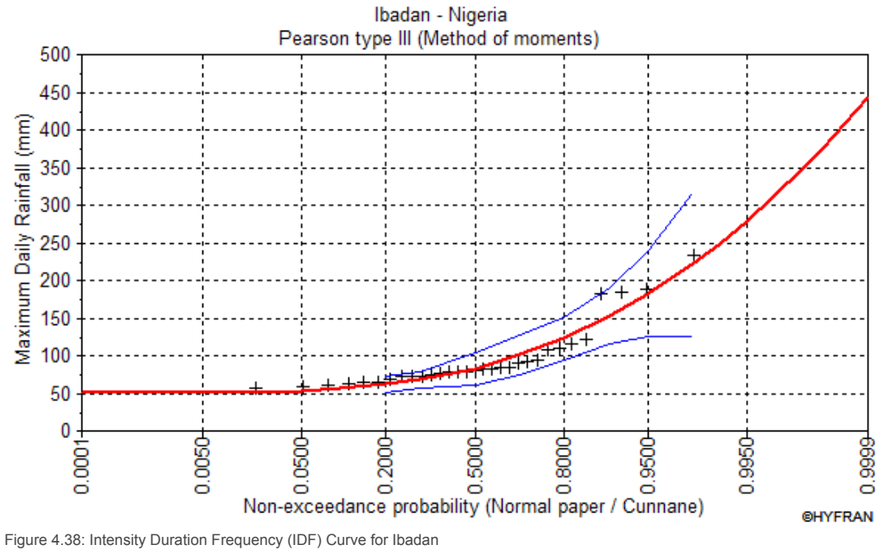

Figure 4.38: Intensity Duration Frequency (IDF) Curve for Ibadan

Table 4.4: Frequency Analysis Results for the 24-hr Rainfall for Ibadan

RETURN PERIOD	24-HR RAINFALL DEPTH (MM)	STANDARD DEVIATION	CONFIDENCE INTERVAL (95%)	
100	282.50	64.8	-	-
50	249.73	48.1	126	315
25	215.83	33.3	126	257
20	205.66	29.1	125	239
10	172.89	19	115	190
5	138.99	14.7	94.1	152
3	115.26	13.4	75.5	128
2	93.90	11	61.6	105

To check the short duration rainfall ratios derived from SCS type II (SCS, 1986) / Bell (1969) standardised storm profiles, an analysis based on the Tropical Rainfall Measurement Mission (TRMM) satellite data available from 1998 to 2015 has been undertaken.

TRMM data give rainfall depths every 3 hours (downloadable from http://disc2.nascom.nasa.gov/Giovanni/tovas/site). The aim of this analysis is to compare the ratios derived from the TRMM data with those of SCS/Bell. The procedure is as follows.

- Based on the 3-hour rainfall depths, 6, 12 and 24 hourly rainfall depths are calculated and maximum rainfall depths (3, 6, 12 and 24 hours) are extracted for each year.
- Rainfall frequency analysis is undertaken using the Pearson type III Distribution. Then, from the 2 to 25-year return period, the ratios of MAX3h/MAX24h are calculated and averaged.
- Using The TRMM data from 3 hours to one day, it has been found that the ratio between a 3-hr storm and a 24-hr storm is 0.74.
- The SCS/Bell ratios have been modified to conform to the TRMM derived ratios as shown in Table 4.5. It is well known that ratios for durations from 2 hours to 5 minutes are fairly constant in different climates because of the similarity of convective storm patterns (Bell, 1969; and Awadallah and Younan, 2012, and references therein).
- Based on multiplying the rainfall depths of Figure 4.37 by the ratios of Table 4.5, the intensity-duration rainfall values are calculated. IDF curves for return periods of 100-, 50-, 25-, 10-, 5- and 2-year are shown in Figure 4.39.

Table 4.5: Frequency Analysis Results for the 24-hr Rainfall for Ibadan

STORM DURATION (MIN)	5	15	30	60	120	180	360	720	1440
SCS/Bell's ratios	0.139	0.239	0.343	0.435	0.565	0.626	0.750	0.877	1.000
Modified Bell's ratios	0.164	0.282	0.406	0.514	0.668	0.740	0.900	0.930	1.000

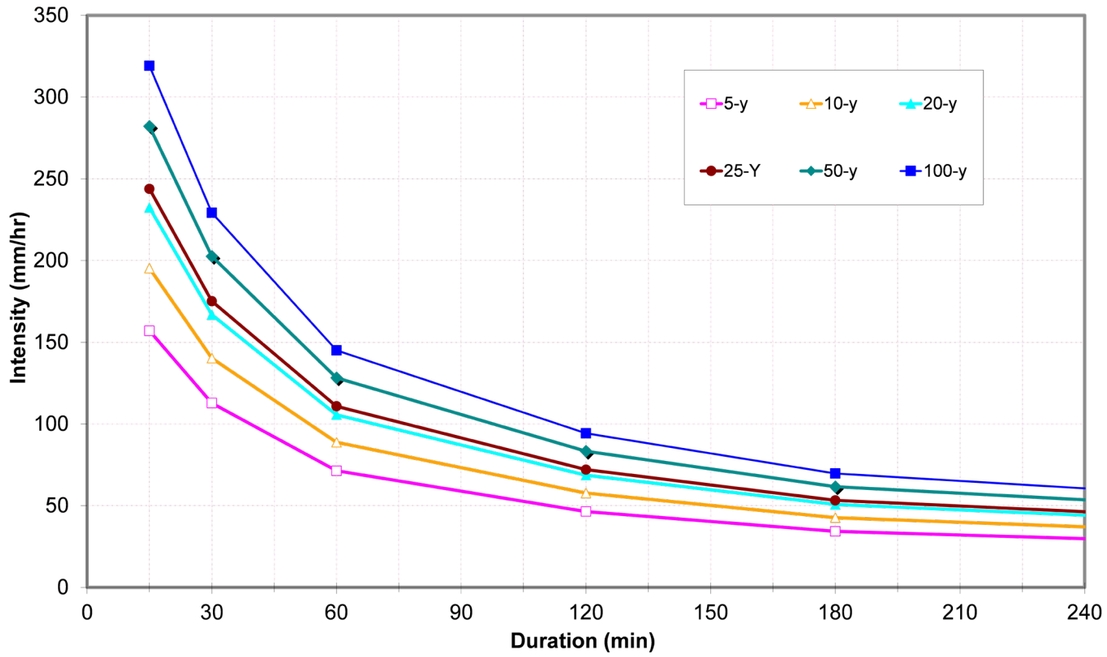

Figure 4.39: Intensity Duration Frequency (IDF) Curve for Ibadan

4.5.2 Time of Concentration

The time of concentration is defined as the time needed for a drop of water to travel from the hydraulically most distant point of the watershed to the design point downstream.

The time of concentration (Tc) is used in numerous equations to calculate discharge. Water moves through a watershed as sheet flow, shallow concentrated flow, swales, open channels, street gutters, storm sewers, or a combination of these. There are many methods utilised to estimate the time of concentration. Examples are the Kinematic Wave Method, Kirpich formula, Bransby-William, Kerby formula, and the NRCS Velocity Method.

In determining the time of concentration, the designer adopts the appropriate catchment conditions in accordance with the required analysis. Ultimate flow conditions should be based on a fully developed catchment in accordance with the allowable land uses identified in the relevant strategic plan, or as directed by the local authority.

For the Masterplan, two methods are adopted to estimate the time of the concentration of the different zones in Ibadan as follows:

Kirpich Equation

For urban areas, the Kirpich equation has been adopted. The Kirpich equation for time of concentration can be expressed as:

$$t_c = 0.0653 \frac{L^{0.77}}{P^{0.385}}$$

Where:

Tc Time of concentration (hr),

L Longest flow path Length (km),

P Catchment area average slope (m/m).

The use of the Kirpich formula is widespread in several countries. The relationship was originally developed from SCS data for well-defined and relatively steep channels draining small to moderate sized watersheds, but it often yields satisfactory results for overland flow on bare soils. Rossmiller 1980 recommends that the estimated Tc should be multiplied by an adjustment factor to make the equation applicable in different land use types. For urbanised areas, the adjustment factor is equal to 0.4.

Minimum Time of Concentration

Although travel time from individual elements of a system may be as short as five minutes (inlet time to tertiary drainage system), the total nominal flow travel time to be adapted from any catchment to its point of entry into the primary drainage system should not be less than 15 minutes (Queensland Urban Drainage Manual, 2007).

4.5.3 Rainfall-runoff Transformation

Several methods may be used to estimate watershed runoff. The application of each method depends on the availability and type of rainfall, flow records, and the catchment size. Methods considered in this analysis are:

- The SCS (Soil Conservation Service, of United States Department of Agriculture),
- The Rational Method.

The rational method is used to calculate the design flood values for catchments not exceeding 500 ha, while the SCS method is used for catchments larger than 500 ha.

Rational Method

The estimate of peak discharges for different return periods using this method is as follows:

$Q = 0.278 \times C \times I \times A$

Where:

Q: Peak discharge (m^3/s).

C: Runoff coefficient.

A: Catchment area (km^2).

I: Rainfall intensity corresponding to the catchment time of concentration (Tc) (mm/hr).

The runoff coefficient (C) reflecting the percentage of water flowing on saturated soil is estimated, as identified in Table 4.6.

Table 4.6: Frequency Analysis Results for the 24-hr Rainfall for Ibadan

TYPE OF DRAINAGE AREA	RUNOFF COEFFICIENT, C
BUSINESS	
Central urban areas	0.70 - 0.95
Neighbourhood areas	0.50 - 0.70
RESIDENTIAL	
Single-family areas	0.30 - 0.50
Multi-units, detached	0.40 - 0.60
Multi-units, attached	0.60 - 0.75
Suburban	0.25 - 0.40
Apartment dwelling areas	0.50 - 0.70
INDUSTRIAL	
Light areas	0.50 - 0.80
Heavy areas	0.60 - 0.90
Parks, cemeteries	0.10 - 0.25
Playgrounds	0.20 - 0.40
Railway areas	0.20 - 0.40
Unimproved areas	0.10 - 0.30
LAWNS	
Sandy soil, flat, 2 per cent	0.05 - 0.10
Sandy soil, average, 2 to 7 per cent	0.10 - 0.15
Sandy soil, steep, 7 per cent	0.15 - 0.20
Heavy soil, flat, 2 per cent	0.13 - 0.17
Heavy soil, average, 2 to 7 per cent	0.18 - 0.22
Heavy soil, steep, 7 per cent	0.25 - 0.35
STREETS	
Asphaltic	0.70 - 0.95
Concrete	0.80 - 0.95
Brick	0.70 - 0.85
Drives and footpaths	0.75 - 0.85
Roofs	0.75 - 0.95

Higher values are usually appropriate for steep areas and longer return periods because infiltration and other losses have a proportionally smaller effect on runoff in these cases.

SCS Method

The SCS Method, universally acknowledged in hydrological practices, enables the estimate of the peak discharge as well as the complete flood hydrograph based on a number of variables and parameters.

The United States Soil Conservation Service (SCS - now the Natural Resource Conservation Service) method estimates runoff using in addition to rainfall, catchment characteristics such as antecedent soil moisture conditions, types of soil, initial abstraction of rainfall, slope, length of the longest channel, surface treatment and land cover. These characteristics are reflected by a Curve Number (CN) value. The Curve Number (CN) is a runoff coefficient used in the estimation of flow values of drainage streams. Its value depends on land use, land cover and available soil cover.

In the SCS - CN method of runoff prediction, a curve number is chosen to represent the land use, land cover, and soil type complexes. This number typically ranges from 25 (for low runoff depressions) to 98 (for paved impervious areas). An initial abstraction factor (Ia) can be specified. The SCS-CN method typically uses an initial abstraction of 0.2S, however the user may specify other values. The value of S is a maximum soil storage depth (in inches) and is calculated from the equation:

$$S = \frac{1000}{CN} - 10$$

Where,

CN = Curve Number

S = Maximum storage depth

Soils are classified into four hydrologic groups: A, B, C, and D based on their runoff potential. Soil A has a low runoff potential, has a high infiltration rate and a high rate of water transmission. This group covers soils such as deep sand, deep loess, and aggregated silt. Soil B has moderate infiltration and water transmission rates. This group includes shallow loess and sandy loam. Soil C has slow infiltration and water transmission rates even if thoroughly wetted. This group includes layered soils with high fine textures such as clay loam, shallow sandy loam, soils low in organic contents, and soils of high clay contents. Finally, soil D has a very high runoff potential due to low infiltration and water transmission rates. This group includes most of clay soils and soils of high swelling potentials. Table 4.7 gives typical CN values for different land use/cover/soil complexes.

Table 4.7: Runoff Curve Numbers for Pervious Areas (CN)*

	HYDROLOGIC SOIL CLASS			
LAND USE/COVER	A	B	C	D
Bare Ground	77	86	91	94
Natural Desert Landscape	63	77	85	88
Range land - Poor Grass Cover (50-75%)	68	79	86	89
Residential Areas (about 500 sqm lots)	77	85	90	92
Streets, Parking Lots and Roads (Paved)	98	98	98	98

* Adapted from USDA-SCS, 1986 and 1975

Judgment on the type of land use has to be made and a conservative estimate (higher CN values) is prudent when doubt exists.

The SCS-CN method calculates the volume of runoff given the input rainfall depth and the CN value. The relation is given by:

$$Q = \frac{(P - 0.2S)^2}{P + 0.8S}$$

Where,

Q = the accumulated depth of runoff (inches);

P = the accumulated depth of storm rainfall (inches); and

S = the value of S is a function of the CN value as given earlier.

Hydrologic soil groups C and D may be chosen to represent the hydrological condition of the soil in general. The Curve Number (CN) associated with normal (average) Antecedent Moisture Conditions (AMC II) for desert soils with poor vegetation cover ranges from 80 to 85. This value is a conservative estimate of the curve number and yields a larger value of peak flow. CN for residential areas may be taken as 91, for mountainous areas 85.

Existing land use, land cover and available soil cover have been reviewed, which has resulted in the generation of a CN map for Ibadan (Figure 2 Appendix 4). The Curve Number typically ranges from 73 (for low runoff depressions) to 98 (for paved impervious areas).

The shape of the SCS flood hydrograph is standard and depends on the watershed area and the lag time of the basin. The lag time is about 0.6 times the time of concentration. The peak flow for one unit of rainfall excess is given by:

$$Q_{peak} \frac{2.08A}{T_R}$$

Where,

Qpeak = the peak discharge in (m^3/s/cm of runoff);

A = the drainage area in (km^2); and

TR = the time of rise of the flood hydrograph which equals the lag time plus one-half of the storm duration in (hours).

The SCS Unit Hydrograph Method is adopted for estimating the storm water run-off.

4.5.4 Design Storm

The frequency of a storm event represents the number of occurrences of that event within a specified period of time. The design frequency depends on the importance of the area to be drained and the location of the drainage system. A longer return period such as the 100-year return period will lead to a conservative design and in this respect a low risk.

It is important to appreciate that there will always remain a risk that the design to accommodate the flood can be exceeded. The risk decreases with the increase in the design return period. The selection of design return periods are based on economic considerations (i.e. cost-benefit analyses of the capital and maintenance costs of improvements compared to the benefits achieved with improved drainage).

The proposed design storm frequency of main drainage streams in Ibadan is considered as a 100-year return period.

4.5.5 Results of the Hydrology Analysis

Surface runoff is calculated based on the Rational and SCS methods as described earlier. SCS modeling is carried out using a free software package HEC-HMS (Hydrologic Engineering Center - Hydrologic Modeling System) developed by the United States Army Corps of Engineers. HEC-HMS software is used to calculate the peak flow from sub-catchments. The results of peak flow estimates for each sub-catchment are presented in Appendix 4.

4.6 HYDRAULIC ANALYSIS AND FLOOD PRONE AREAS

The next step after establishing the design flows from the hydrological analysis is to perform hydraulic analysis to study the capability of a storm water drainage stream to convey the peak flow showing the corresponding water spread on flood plains. The water spread of drainage streams consists of the analysis of their cross-sections to carry the peak flow.

4.6.1 Water Spread Analysis

The determination of the water spread/flood inundation for the stream network in Ibadan is essential to inform the masterplan. Based on the collected information and data available, a rough hydraulic analysis of drainage streams has been undertaken by applying one of the commercial software programmes. A rough estimate of each stream's top width has been identified corresponding to the estimated flow. The stream's top width at a specified section represents the width of the flood corridor at this section.

The above analysis has been implemented on all drainage elements within Ibadan, which has enabled the identification of a flood corridor. Flood corridors can be defined as the area of land adjacent to a stream or river that experiences flooding during periods of high discharge.

The next sections presents the diagnostic drainage study conducted to clarify areas prone to flooding along with the preliminary demarcation of the right of way for flood corridors.

4.6.2 Flood Prone Areas

Flood Prone Areas can be defined as lands susceptible to flooding during a maximum flood event. Any plain low-lying area adjacent to a waterbody such as a river or lake is more likely to have floods any time the water level rises. Built-up areas close to water bodies are most likely to be affected by these floods.

In this section, these areas are divided into two categories; the first category is areas with severe depressions (Low Lying Areas) while the second category is areas adjacent to a waterbody such as a river or lake (Flood Corridors). These two categories are illustrated in the following sub-sections.

Low Lying Areas

Low lying areas or severe depressions are considered to express a risk of flooding because water accumulation can reach high depths which can cause a number of problems. The natural behaviour of water is that it moves from higher ground to lower ground. This means that if there is a higher ground adjacent a lower ground, the lower ground is far more likely to experience floods.

Areas with severe depressions should either be elevated by filling processes for urbanisation or be regarded as green areas. These areas have been estimated approximately by using free Digital Elevation Models such as the Shuttle Radar Topography Mission (SRTM) from NASA. Data of an approximate resolution of 30m have been downloaded for Oyo State and its surrounding regions.

Digital Elevation Models have been used to identify low lying areas within Ibadan. Within the ArcGIS environment, a sink is a cell or set of spatially connected cells whose flow direction cannot be assigned with a valid flow direction value, which means that this area is lower than its surroundings. This can occur when all neighbouring cells are higher than the processing cell. A layout presenting the whole of Ibadan with depressions is shown in Figure 4.40.

It is recommended that this process is re-analysed at a later stage using higher resolution Digital Elevation Models. It is also expected that the Drainage Masterplan Project under the IUFMP will investigate the flood analysis using much more accurate elevation models such as LiDAR.

Flood Corridors

Flood corridors can be defined as the area of land adjacent to a stream or river that experience flooding during periods of high discharge. It includes the floodway, which consists of the stream channel and adjacent areas that actively carry flood flows downstream, and the flood fringe, which are areas inundated by the flood, but which do not experience a strong current. In other words, a flood corridor of a stream is an area near a river or a stream which floods when the water level reaches the flood stage.

The allocation of flood corridors is necessary for the demarcation of a channel stream's right of way. The Right Of Way (ROW) is a reserved no-build area that runs the length of the drainage stream.

For street side drains, open channels and closed conduits that run along the roads within the built up area, the right of way should always include the necessary width for roads and infrastructural elements. Moreover, the flood corridors have contributed to determining preliminary set-backs to rivers and streams for each stream category. To assure the standardisation for setbacks, drainage channels have been divided into categories according to their watershed coverage area. Table 4.8 shows the proposed setbacks for each river/stream category measured from the river's 'centerline,' in addition to providing some examples to these rivers. For the purposes of the Ibadan City Masterplan, the scientific term "Flood Corridors" presents the total width of the river's estimated water spread, while the term "Setback" presents the estimated water spread distance measured from the respective river's identified 'centerline.'

Principal rivers such as the River Ogun and the River Osun are to be provided with a 500m setback (as measured from the respective river's 'centerlines').

The following section illustrates the steps for estimating flood corridors:

4.6.3 Impact of Flood Prone Areas on New Developments

The masterplan excludes all areas prone to flooding and are dedicated to open space or green areas.

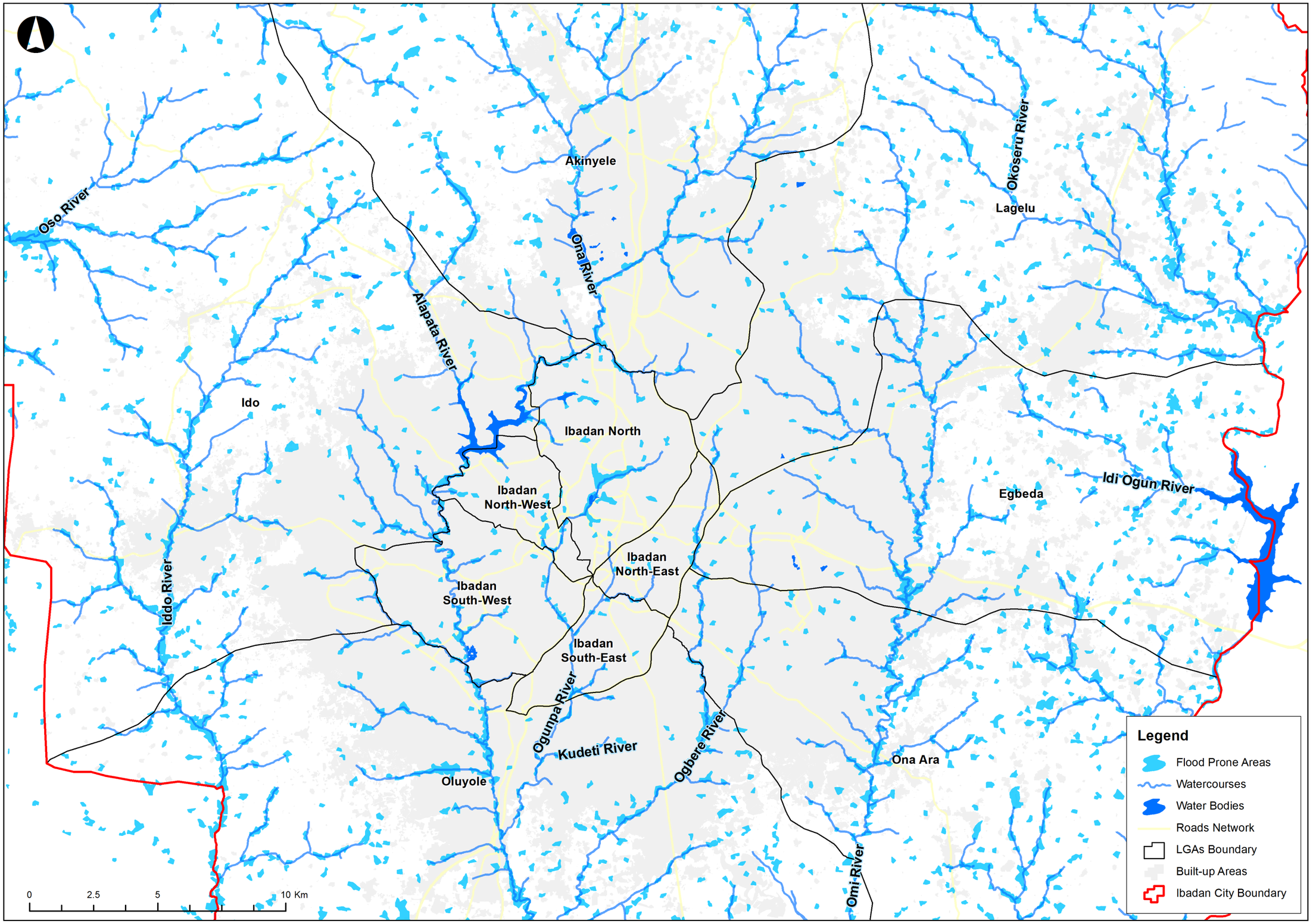

Figure 4.40: General Layout of Flood Prone Areas (Depressions) in Ibadan

4.7 DEVELOPMENT OF IBADAN DRAINAGE SYSTEM

A drainage approach for Ibadan should take into consideration the importance of adopting a long term and sustainable drainage solution for the city based on the proposed future expansion and urban developments, besides solving the existing drainage problems within the urbanised areas of Ibadan.

Table 4.8: Proposed Setbacks for Rivers and Streams according to their Category

	DRAINAGE CATEGORY AND CATCHMENT AREA COVERAGE	PROPOSED RIVER CORRIDOR WIDTH	SETBACK FROM RIVER'S CENTERLINE	EXAMPLES OF RIVERS
1	Major River (50km^2)	120m to 200m according to analysis. Refer to flood corridor map shown in Appendix 3.	60m to 100m	Ona, Omi, Iddo
2	Minor River (25km^2)	100m	50m	Alapata, Alaro, Ogunpa, Kudeti, Ogbere
3	Major Branch (5km^2)	80m	40m	
4	Minor Branch (2km^2)	60m	30m	
5	Major Stream (0.5km^2)	40m	20m	
6	Minor Stream (0.1km^2)	20m	10m	

4.7.1 Objective

The objective of a stormwater drainage plan is to restrict the flow spread of rain on ground surfaces to the limit that will not obstruct or pose any hazard to people, buildings, vehicles, etc, and to convey this runoff water to its final disposal area immediately following a period of rain.

The recommended stormwater development plan consists of gravity channels that convey the collected runoff to the river or creeks. These channels are either trapezoidal earth channels or left natural in non-urbanised areas depending on the site constraints and flow conditions.

The preliminary concepts of the drainage system are formulated on the basis of ponding, infiltration, and gravity flows to receiving water. The main concept is to identify drainage streams and their flood plains for different return periods (Figure 4.41) and to reserve these areas for water, while adopting the "making space for water" concept.

The following actions are necessary:

- Conservation of natural channels wherever possible in places where urbanisation has not yet encroached on the flood plains;
- Conservation of green areas and flood plains on either side of natural streams;
- Ponds are necessary in undeveloped locations where expropriation for land is on the low-side;
- Channelisation is recommended in urban areas to protect existing houses from flood hazards;
- Earth channels are recommended as much as possible;
- Concrete-lined channels are recommended in urbanised areas where it is difficult to allocate wide rights of way;
- Channel sizes are minimised as far as practical.

4.7.2 Hydraulic Design Criteria

The hydraulic design is based on a specified design criteria. The selection of design criteria depends on the physical nature of the area, future development, and economic considerations.

Design Frequency

The design frequency depends on the importance and the location of the drainage stream. The selection of a return period or design frequency is an economic question rather than a meteorological decision. Longer return periods will lead to drainage streams with greater water spreads providing higher flood risks. Consequently, on urbanisation, longer return periods require larger channel sizes to convey these high capacities.

The proposed design storm frequency of main drainage streams will be as mentioned in the above section "Design Storm."

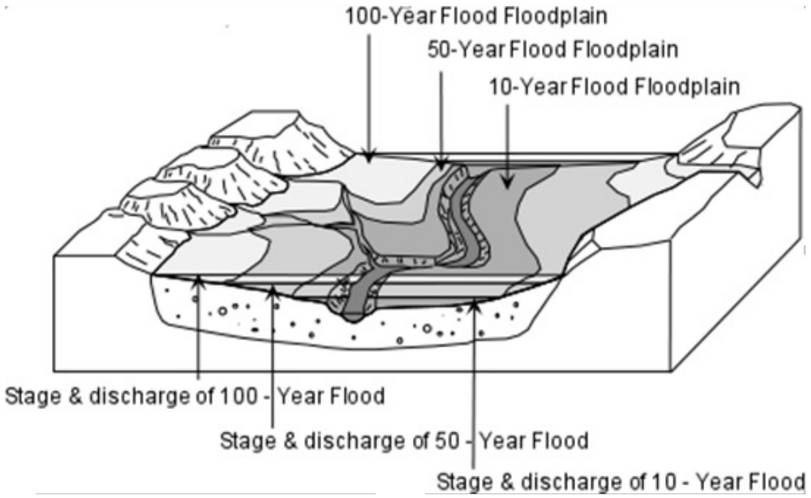

Figure 4.41: Flood inundation for different return periods

Channel Sizing

Design slopes are proposed to match the natural ground slope as much as possible to minimise the earthwork while keeping the design velocities between the allowable limits.

The hydraulic design of the proposed channels and conduits is performed by using commercial software programs (Flow master, and Autodesk Storm and Sanitary Analysis). For uniform flow conditions, the velocity in the channels and conduits is computed applying the Manning Formula as follows:

$$V = \frac{1}{n} R^{2/3} S^{1/2}$$

And Q = A * V

Where:

A = Area of wetted cross section of the channel, m^2

R = Hydraulic radius = A/P m

P = Wetted perimeter, m

S = Longitudinal slope of the channel, m/m

n = Manning roughness coefficient.

Roughness coefficient depends mainly on the soil type, vegetation intensity and whether the channel's course meanders or is straight. Different tables are available in the literature to give a rough estimate of the Manning coefficient. Table 4.9 summarises Manning n values.

Figure 4.44 shows the layout of the proposed drainage system superimposed on the proposed Ibadan City Masterplan. The layout is subdivided into 4 part plans to show the drainage elements in detail (refer to Figure 4.45 to Figure 4.48). The part plans show the top width of the proposed channels along with their Identity codes. In addition, the part plans show the Identity codes of proposed bridges and proposed culverts. The identities of proposed trapezoidal channels are indicated with a suffix C for channels, V for box culverts and B for Bridges.

Table 4.10 and Table 4.11 show the cross-section dimensions of proposed Earth and Lined Channels respectively; the tables include bed width, depth, and top width along with their estimated cost in USD. Table 4.12 shows the cross-section dimensions of proposed culverts (number of cells, width, and height) along with their estimated cost in USD. Table 4.13 shows the span dimensions of proposed bridges along with their estimated cost in USD. Table 4.14 shows a summary of the proposed drainage works and their respective cost estimate.

Table 4.9: Manning Roughness Coefficient

ITEM	MANNING n
Concrete lined channels	0.015-0.016
Earth channels	0.025-0.04
Concrete pipe culverts	0.013
Box culvert	0.015

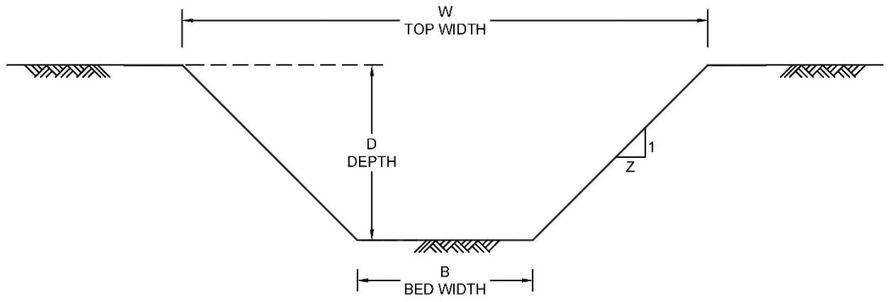

Figure 4.42: Typical Cross-Section for a Cleared Earth Channel

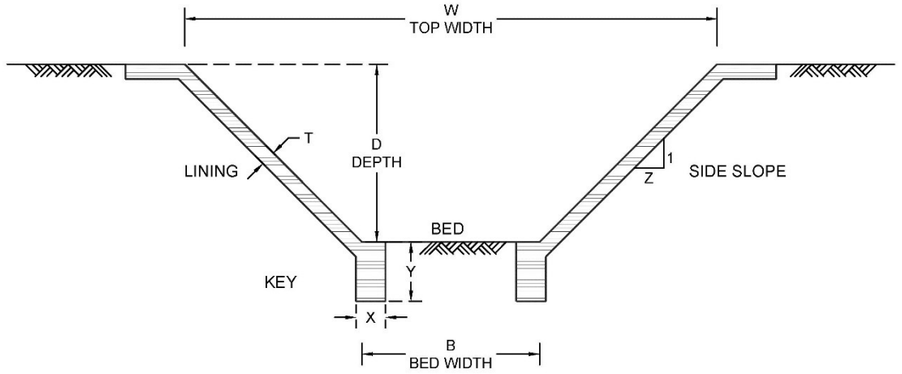

Figure 4.43: Typical Cross-Section for a Lined Channel

4.7.3 Detention Ponds

Detention ponds are proposed to reduce and control storm run-off water as close as possible to its origin, and before it enters a watercourse. These ponds are designed to detain the water for a certain amount of time and keep the runoff to a desired rate. When the rain ends, the water detention pond will empty shortly afterwards. The role of these ponds is to attenuate the flow and decrease the proposed sizes of drainage elements. These ponding areas are selected in undeveloped land locations where expropriation for land is at the low-side.

This alternative is recommended for different locations across Ibadan. The ponds are considered as one of the application of Best Management Practices (BMP), with such systems often being termed Sustainable Drainage Systems (SUDS).

Table 4.10: Proposed Dimensions of Earth Channels and Cost Estimate

Id	FLOW (m^3/s)	BED WIDTH (m)	CHANNEL DEPTH (m)	TOP WIDTH (m)	SECTION AREA (m^2)	CHANNEL LENGTH (m)	EXCAVATION VOLUME (m^3)	COST (US$)
BASIN B								
C1	196.9	45	2.4	65	66.0	2920	192,720	2,197,000
C2	60.8	15	2.1	35	26.3	1100	28,875	329,000
C3	113.9	25	2.3	45	40.3	3070	123,568	1,409,000
C4	233	45	2.6	65	71.5	4140	296,010	3,375,000
C5	163	30	2.6	50	52.0	5240	272,480	3,106,000
C6	349.3	70	2.6	90	104.0	2770	288,080	3,284,000
C7	448	90	2.6	110	130.0	2220	288,600	3,290,000
C8	59.9	15	2.1	35	26.3	2870	75,338	859,000
C9	200.9	45	2.4	65	66.0	3790	250,140	2,852,000
C10	52.5	15	1.9	30	21.4	6130	131,029	1,494,000
C11	71.7	20	2	35	27.5	3500	96,250	1,097,000
C12	80.9	20	2.2	37	31.4	3530	110,666	1,262,000
C13	170.5	40	2.3	60	57.5	3230	185,725	2,117,000
C14	53.4	15	2	30	22.5	1390	31,275	357,000
C15	71.5	20	2	35	27.5	5430	149,325	1,702,000
C16	67	20	1.9	35	26.1	4410	115,212	1,313,000
C17	45.1	15	1.8	30	20.3	2140	43,335	494,000
BASIN G								
C18	71.3	20	2	35	27.5	220	6,050	69,000
C19	54.8	15	2	30	22.5	2010	45,225	516,000
C20	292	60	2.6	80	91.0	5350	486,850	5,550,000
BASIN C								
C21	322.7	70	2.5	90	100.0	1460	146,000	1,664,000
C22	389.9	70	2.8	95	115.5	3320	383,460	4,371,000
BASIN F								
C23	189.5	40	2.5	60	62.5	4280	267,500	3,050,000
C24	242.8	45	2.7	65	74.3	1660	123,255	1,405,000
C25	109.3	25	2.3	45	40.3	3390	136,448	1,556,000
C26	205.7	40	2.6	60	65.0	3090	200,850	2,290,000
C27	273	70	2.3	90	92.0	2280	209,760	2,391,000
BASIN A								
C28	58.3	15	2.1	31	24.2	2140	51,681	589,000
C29	44.3	15	1.8	30	20.3	2510	50,828	579,000
C30	176.7	40	2.4	60	60.0	1170	70,200	800,000
C31	256.9	50	2.6	70	78.0	2190	170,820	1,947,000
C32	290.9	60	2.5	80	87.5	980	85,750	978,000
C33	176.7	40	2.4	60	60.0	1170	70,200	800,000
C65	176.7	40	2.4	60	60.0	2440	146,400	1,669,000
C34	130.5	30	2.3	50	46.0	3520	161,920	1,846,000
C35	130.5	30	2.3	50	46.0	1640	75,440	860,000
C36	459.3	90	2.7	110	135.0	1610	217,350	2,478,000
C37	114.1	25	2.3	45	40.3	1860	74,865	853,000
C38	660.1	100	3.1	125	174.4	1650	287,719	3,280,000
C39	45.7	15	1.8	30	20.3	3590	72,698	829,000
C40	117.5	25	2.4	45	42.0	1790	75,180	857,000
C41	55.1	15	2	30	22.5	2390	53,775	613,000
C42	87.2	20	2.2	37.5	31.6	1190	37,634	429,000
						TOTAL	**6,386,486**	**72,806,000**

Table 4.11: Proposed Dimensions of Lined Channels and Cost Estimate

Id	FLOW (m^3/s)	BED WIDTH (m)	CHANNEL DEPTH (m)	TOP WIDTH (m)	SECTION AREA (m^2)	CHANNEL LENGTH (m)	EXCAVATION VOLUME (m^3)	LINING AREA (m^2)	COST (US$)
BASIN B									
C43	424.1	35	2.3	45	46.0	3800	174,800.00	87,400	8,902,000
C44	44	10	1.3	15	8.1	1320	10,725.00	23,760	2,000,000
C45	176.2	20	1.9	30	23.8	2270	53,913.00	47,670	4,383,000
C46	825.4	55	2.6	65	78.0	5930	462,540.00	177,900	19,336,000
C47	921.6	65	2.6	75	91.0	1680	152,880.00	50,400	5,727,000
C48	55.6	10	1.4	15	8.8	2110	18,463.00	40,090	3,380,000
C49	1053.3	65	2.8	75	98.0	2350	230,300.00	72,850	8,384,000
C50	990.4	65	2.7	75	94.5	5890	556,605.00	182,590	20,779,000
C51	1028	65	2.7	75	94.5	1160	109,620.00	35,960	4,092,000
C52	1078.2	65	2.8	80	101.5	3850	390,775.00	119,350	13,889,000
BASIN F									
C53	89.9	20	1.3	25	14.6	6980	102,083.00	125,640	11,096,000
BASIN G									
C54	96.5	20	1.4	25	15.8	2160	34,020.00	41,040	3,632,000
C55	45.8	10	1.3	15	8.1	1660	13,488.00	29,880	2,516,000
C56	99.7	20	1.4	25	15.8	2940	46,305.00	55,860	4,944,000
BASIN A									
C57	44.3	10	1.3	15	8.1	940	7,638.00	16,920	1,425,000
C58	101.3	20	1.4	25	15.8	2470	38,903.00	46,930	4,153,000
C59	176.7	20	1.9	30	23.8	1200	28,500.00	25,200	2,317,000
C60	309.8	30	2.1	40	36.8	4270	156,923.00	93,940	9,215,000
C61	459.3	35	2.4	45	48.0	750	36,000.00	17,250	1,774,000
C62	643.9	45	2.6	55	65.0	1660	107,900.00	49,800	5,167,000
C63	46.3	10	1.3	15	8.1	1370	11,132.00	24,660	2,076,000
C64	660.1	45	2.6	55	65.0	920	59,800.00	27,600	2,864,000
					TOTAL	**57,680**	**2,803,313**	**1,392,690**	**142,051,000**

Table 4.12: Proposed Dimensions of Culverts and Cost Estimate

Id	EASTING (m)	NORTHING (m)	CATCHMENT AREA (km^2)	ESTIMATED FLOW (m^3/S)	N	WIDTH (m)	HEIGHT (m)	COST (US$)
V1	612,905	809,030	6.2	55.7	4	3	2	231,000
V2	600,101	824,068	15	176.2	12	3	2	664,000
V3	592,962	817,486	12	52.5	4	3	2	231,000
V4	591,940	817,476	12	71.7	5	3	2	285,000
V5	592,781	813,120	24.86	170.5	11	3	2	610,000
V6	594,204	809,637	14.48	71.5	5	3	2	285,000
V7	611,409	829,051	19.43	104.2	7	3	2	393,000
V8	608,386	823,505	8.65	58.3	4	3	2	231,000
V9	608,062	819,069	9.3	70	5	3	2	285,000
V10	611,008	816,082	18	130.5	9	3	2	502,000
V11	612,597	816,047	16.25	108	8	3	2	447,000
V12	603,971	820,323	4.8	35	4	2	2	176,000
V13	603,283	817,176	12.17	80	6	3	2	339,000
V14	603,345	816,982	12.5	80	6	3	2	339,000
V15	605,054	812,117	16.75	109.3	8	3	2	447,000
V16	599,734	819,543	9.5	96.5	7	3	2	393,000
V17	599,429	819,275	9.6	96.5	7	3	2	393,000
V18	598,369	808,829	6.18	54.8	4	3	2	231,000
V19	583,340	828,544	8.5	85	6	3	2	339,000
V20	580,871	824,729	3	30	4	3	2	231,000
V21	579,175	816,894	6.6	60	4	3	2	231,000
V22	576,543	812,639	10	60.4	4	3	2	231,000
V23	575,178	810,436	0.45	38.4	4	2	2	176,000
V24	600,647	835,710	3.2	25	3	2	2	136,000
V25	593,968	830,779	7.6	56.4	4	3	2	231,000
V26	592,050	827,696	6.9	46.9	3	3	2	176,000
V27	586,492	820,244	2.5	50.4	4	3	2	231,000
V28	585,986	819,738	7.3	50.4	4	3	2	231,000
V29	585,268	818,060	7.4	65	5	3	2	285,000
V30	588,771	804,881	8.16	62.4	4	3	2	231,000
V31	590,841	801,265	6.5	46.1	3	3	2	176,000
V32	617,203	812,332	5	50	4	3	2	231,000
V33	618,079	814,734	4.4	40	3	3	2	176,000
V34	619,810	819,626	12.12	72	5	3	2	285,000
V35	619,748	820,861	17.1	83.4	6	3	2	339,000
V36	620,003	826,888	10.2	65	5	3	2	285,000
V37	599,368	842,825	3	30	4	2	2	176,000
V38	600,853	845,034	10	60	4	3	2	231,000
								11,110,000

Table 4.13: Proposed Dimensions of Bridges and Cost Estimate

Id	EASTING (m)	NORTHING (m)	ESTIMATED FLOW (m^3/S)	SPAN (m)	EXPECTED COST (US$)
B1	611,439	816,150	643.9	130	5,850,000
B2	601,112	828,102	424.1	105	4,725,000
B3	600,820	827,933	424.1	105	4,725,000
B4	605,570	833,759	324.2	90	4,050,000
B5	593,204	818,751	851.9	145	6,525,000
B6	593,535	816,160	990.4	160	7,200,000
B7	594,055	813,655	990.4	160	7,200,000
B8	594,759	811,116	1028	160	7,200,000
B9	595,033	810,451	1028	160	7,200,000
B10	595,492	806,214	1078.2	160	7,200,000
B11	610,067	807,544	760	140	6,300,000
B12	603,458	813,329	95	50	2,250,000
B13	603,504	811,335	190	70	3,150,000
B14	603,558	809,713	220	75	3,375,000
B15	596,375	800,753	1126.4	170	7,650,000
B16	612,104	822,981	256.9	80	3,600,000
B17	612,515	821,879	290.9	85	3,825,000
B18	612,329	819,383	309.8	90	4,050,000
B19	604,288	810,492	205.7	75	3,375,000
B20	599,834	835,165	188	70	3,150,000
B21	597,524	833,839	230	75	3,375,000
B22	598,914	834,027	233	75	3,375,000
					109,350,000

Table 4.14: Summary of Proposed Drainage Works and their Respective Cost Estimate

	LENGTH (KM)	NUMBER	COST (MILLION US$)
Earth Channels	116.8	-	72.8
Lined Channels	57.7	-	142.1
Culverts	-	38	11.1
Bridges	-	22	109.4

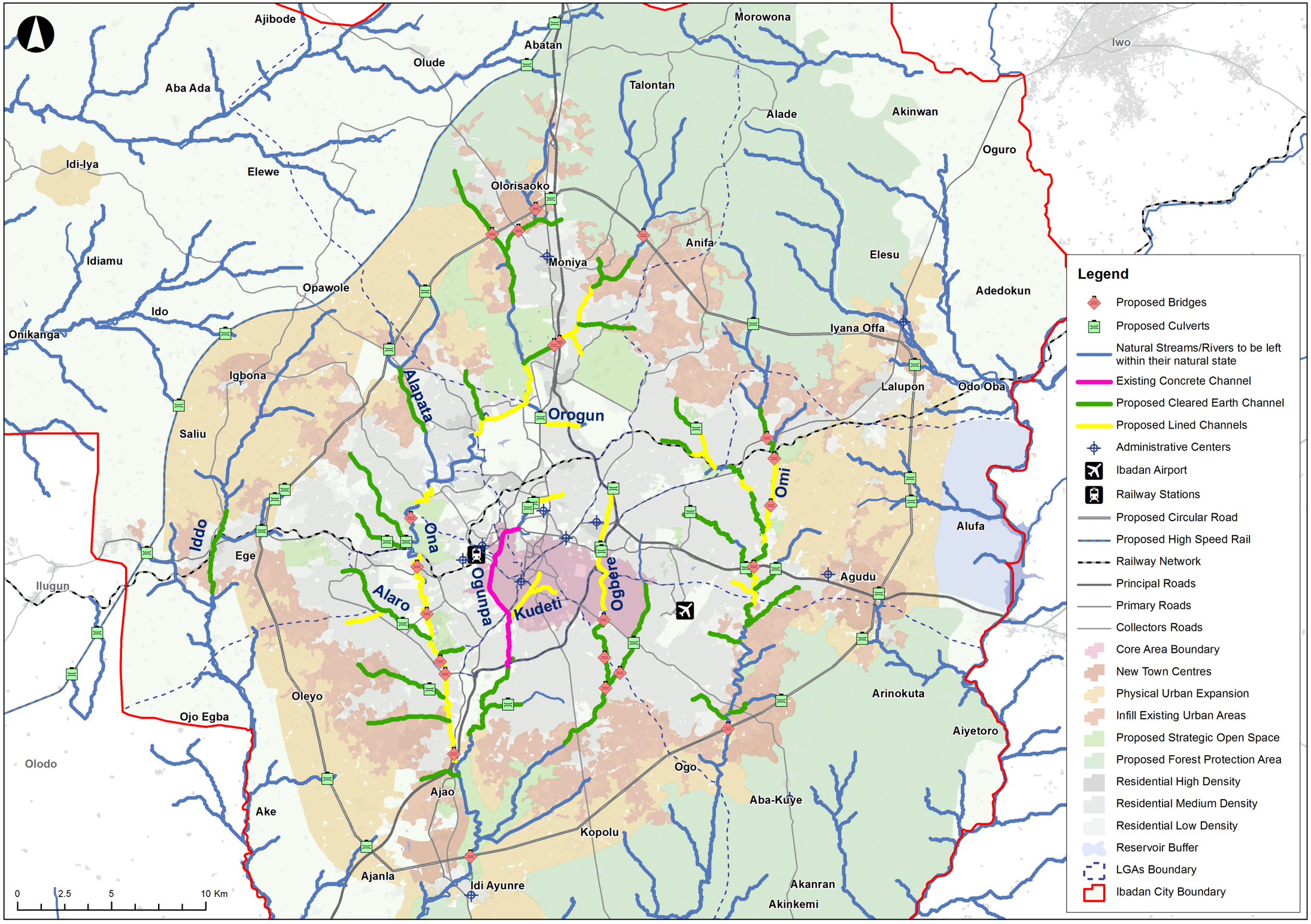

Figure 4.44: General Layout for the Proposed Drainage System

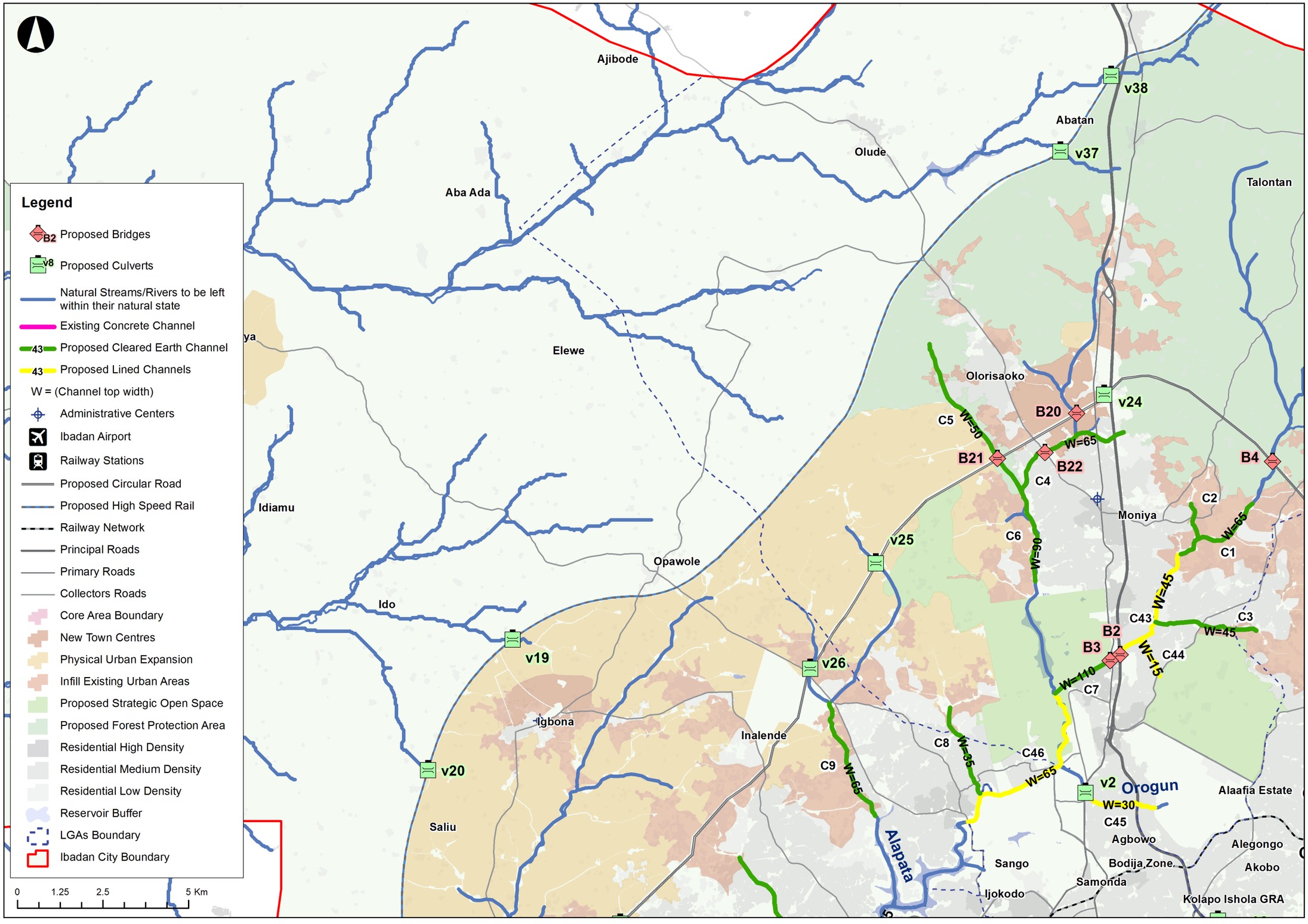

Figure 4.45: Proposed Drainage System (Part 1/4)

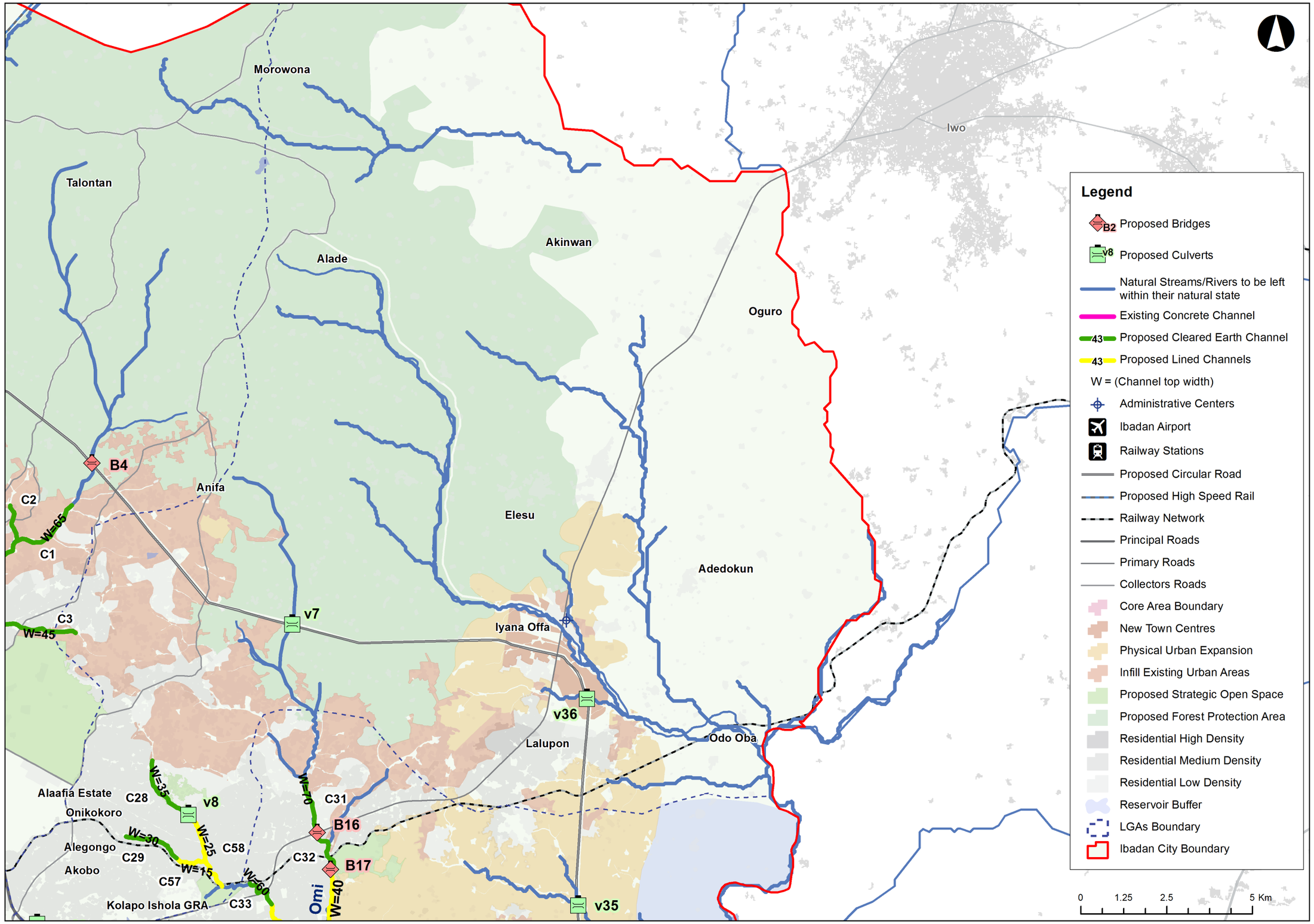

Figure 4.46: Proposed Drainage System (Part 2/4)

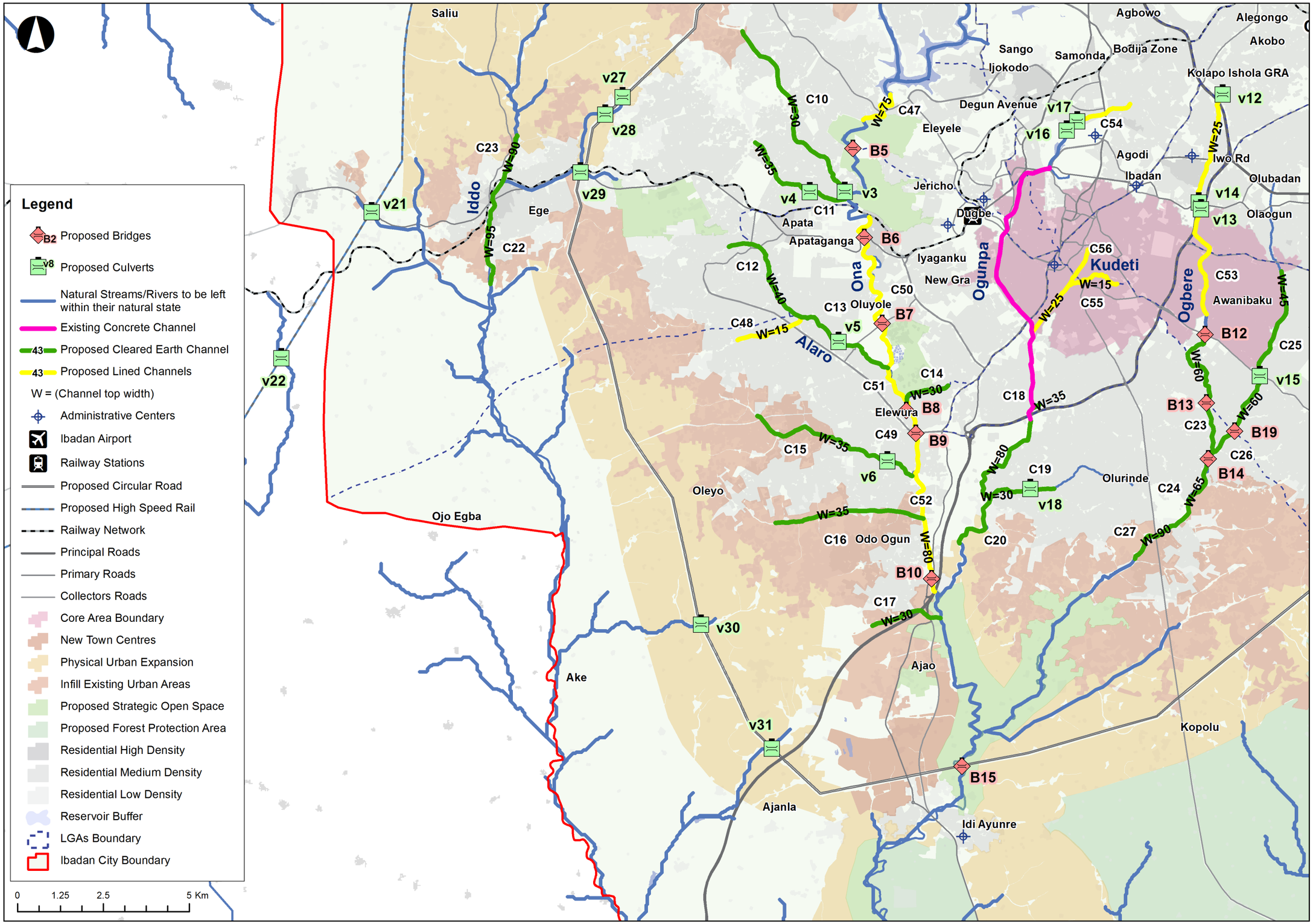

Figure 4.47: Proposed Drainage System (Part 3/4)

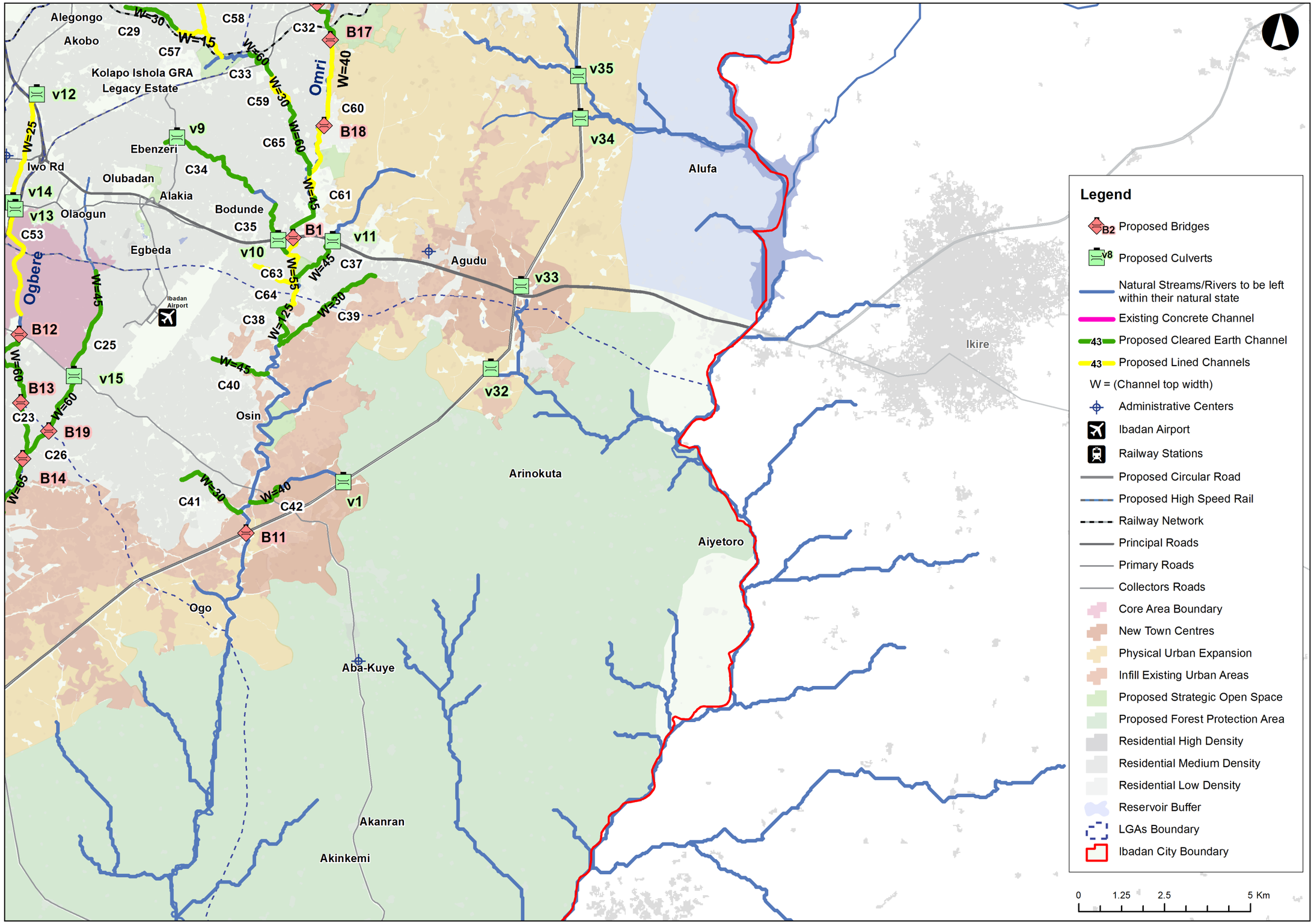

Figure 4.48: Proposed Drainage System (Part 4/4)

Identified Dam sites

The aim of this section is to locate all possible dams on the upper reaches of the River Ona to detain the water for a certain amount of time and to allow limited amount of water to flow to the Eleyele dam. This was accomplished first by defining the possible locations and then screening of these dams to select the most suitable ones.

Table 4.15 shows the identified dam locations along with their corresponding dam height, expected impounding reservoir surface area and capacity. Figure 4.50 shows the distribution of the identified dams.

Screening of Dam Sites

Many criteria may be used to filter the potential dams and select the optimum one. First, reservoirs should not have any impacts on the urban area. Second, dams should not be too high to account for a reasonable cost. Third, higher capacities are favoured over lower capacities with the same dam height.

In this respect, the height of dams should not exceed 10m, and the depth of water in any reservoir should not exceed 8m to account for a 2m free board.

Table 4.16 shows the identified dam locations along with their corresponding dam height, expected impounding reservoir surface area and capacity corresponding to a water depth of 8m. Figure 4.49 shows the reservoirs' capacities at a water depth of 8m and the minimum accepted capacity.

By setting the minimum capacity for the reservoirs equal to 0.4 MCM for a water depth of 8m, only 3 reservoirs are excluded, which include 12, 13, 15.

By checking the impact of reservoirs on urban areas, the following reservoirs are excluded: 2, 5, 9, 10, 11, 16, 17, and 18, 19, 21 and 23.

Finally, and based on the above selection criteria, 9 potential lakes are recommended as follows: 1, 3, 4, 6, 7, 8, 14, 20 and 22. Figure 4.51 shows the distribution of these potential lakes.

Table 4.15: Identified Dams and their respective impounding reservoir surface area and capacity

Id	BED LEVEL	DAM CREST LEVEL	MAXIMUM HEIGHT (m)	AREA (m^2)	MAX VOLUME (m^3)
1	228	256	28	3,414,238	36,079,537
2	200	215	15	1,481,108	7,847,886
3	230	251	21	1,529,312	11,510,405
4	225	236	11	601,139	3,131,325
5	243	256	13	689,041	4,115,973
6	250	265	15	945,187	6,226,812
7	251	265	14	561,441	3,354,231
8	243	265	22	1,568,490	12,617,707
9	204	219	15	1,548,632	9,497,018
10	203	211	8	304,350	981,734
11	204	219	15	1,014,185	6,671,758
12	194	219	25	1,310,974	10,840,347
13	204	219	15	364,842	2,036,090
14	214	236	22	1,739,120	12,802,106
15	196	215	19	528,359	4,138,185
16	182	200	18	690,932	4,620,152
17	186	197	11	433,675	2,234,162
18	183	207	24	9,571,213	77,148,076
19	199	219	20	1,340,069	9,548,030
20	242	256	14	638,072	3,724,170
21	198	211	13	417,773	2,329,255
22	224	242	18	2,101,714	11,230,058
23	214	230	16	1,967,549	10,640,093

Table 4.16: Identified Dams and their respective impounding reservoir surface area and capacity

ID	DAM LENGTH (m)	WATER SURFACE AREA AT 8m WATER DEPTH (km^2)	WATER CAPACITY AT 8m WATER DEPTH (mcm)
1	228	256	28
2	200	215	15
3	230	251	21
4	225	236	11
5	243	256	13
6	250	265	15
7	251	265	14
8	243	265	22
9	204	219	15
10	203	211	8
11	204	219	15
12	194	219	25
13	204	219	15
14	214	236	22
15	196	215	19
16	182	200	18
17	186	197	11
18	183	207	24
19	199	219	20
20	242	256	14
21	198	211	13
22	224	242	18
23	214	230	16

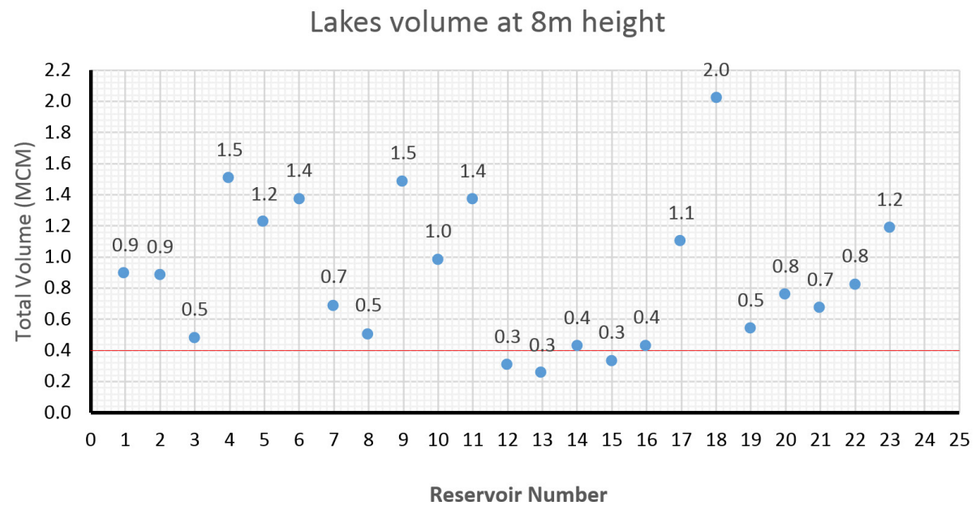

Figure 4.49: Reservoirs' Capacity at water depth 8m

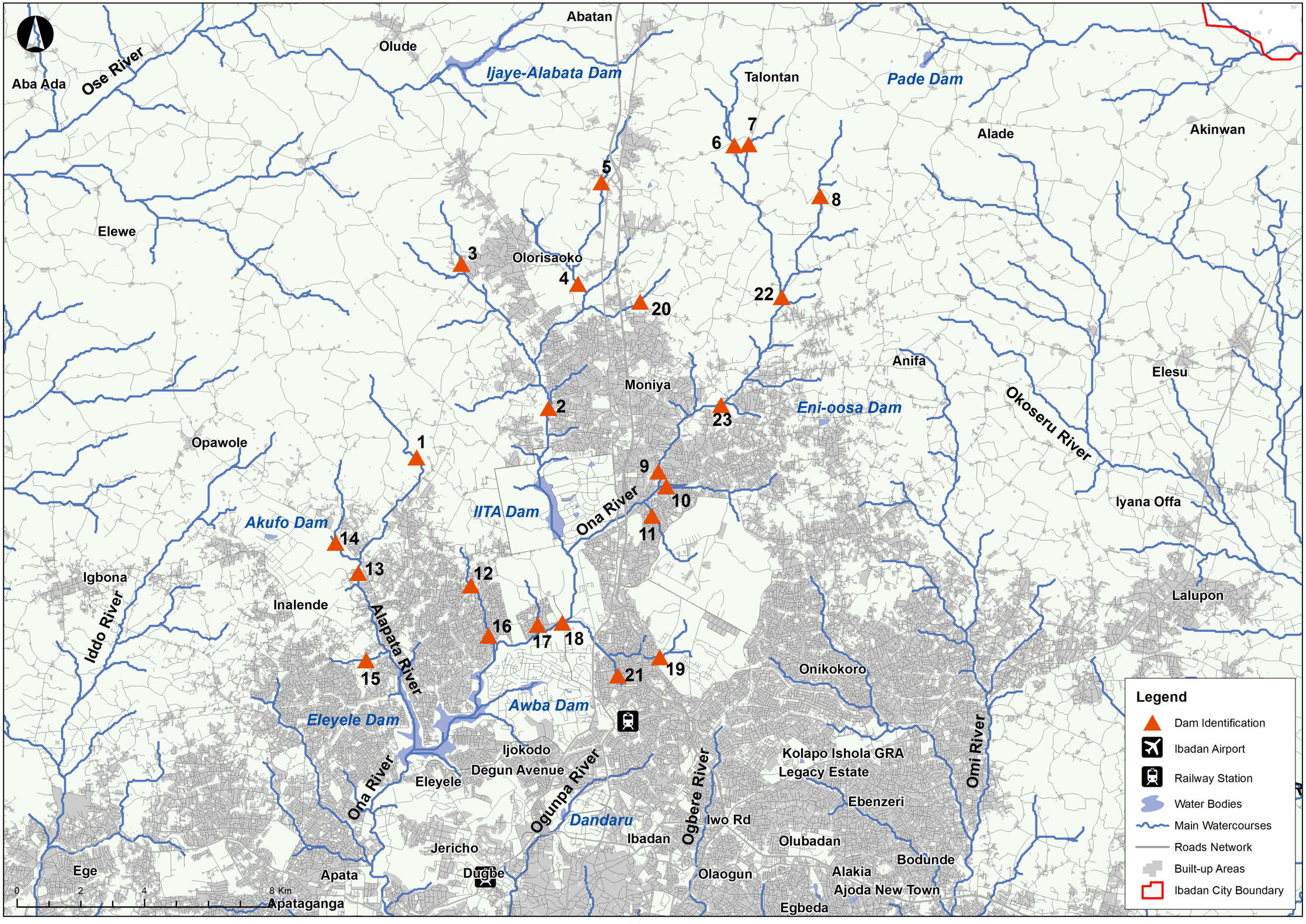

Figure 4.50: Identification of Potential Dams upstream Eleyele Dam

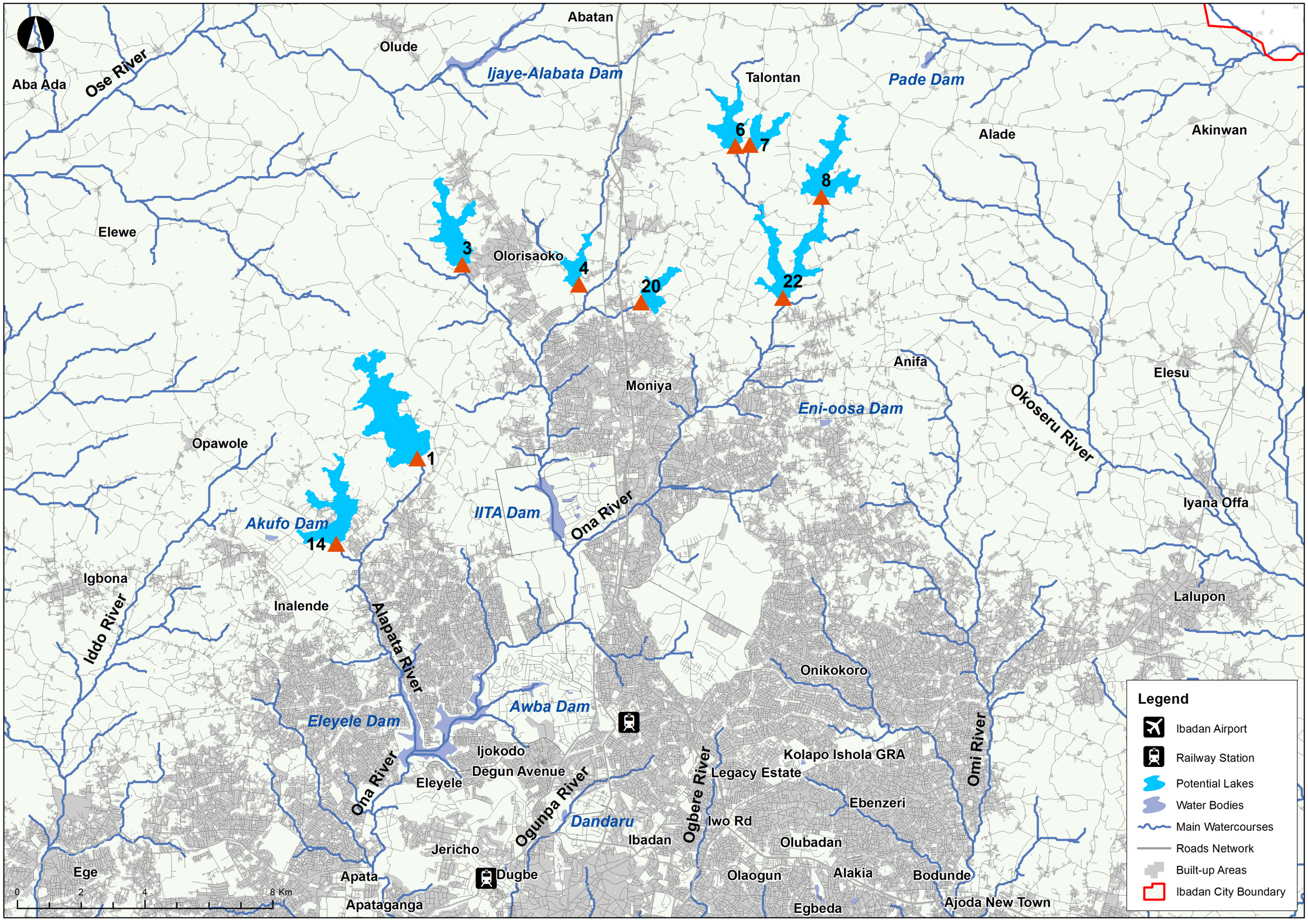

Figure 4.51: General Layout of Potential Lakes

4.7.4 Development of Sustainable Drainage Solutions

The primary response to the problem of urban drainage has typically been to construct drainage channel systems that capture and transfer water to defined receiving areas. More recently, drainage planning has sought to address these issues in an integrated fashion, using designs and technologies that reduce the scale of the problem at source and restrict flows in a fashion that closely mimics the natural environment. Depending on the location, the drainage system may be selected in isolation, or more commonly in conjunction, from a raft of measures or Best Management Practices (BMPs). Such systems are often termed as Sustainable Drainage Systems (SUDS).

The concept of SUDS is to either divert surface water runoff from paved areas to groundwater via permeable paving, soakaways or filter drains or to attenuate on-site the stormwater. Attenuation slows down storm events through storage. It does not eliminate runoff volume. It only reduces the peak runoff rate. Drainage systems are designed to convey a pre-controlled storm runoff. In this case, built-up areas should be limited to certain policies. Such laws can be set by institutional regulations or governmental decrees to ensure non-encroachment on green areas. For further information regarding sustainable drainage planning, refer to Appendix 5.

In the next section, several structural and non-structural flood protection and mitigation measures are proposed, to be integrated within the Ibadan City Masterplan.

- Structural measures are any physical construction to reduce or avoid possible impacts of hazards, or the application of engineering techniques or technology to achieve hazard resistance and resilience in structures or systems.
- Non-structural measures are measures not involving physical construction which use knowledge, practice or agreement to reduce disaster risks and impacts, in particular through policies and laws, public awareness raising, training and education.

Structural Measures

The flood control plan provided in this section covers recommended structural measures to control severe flooding in Ibadan, as well as providing a reduction in the peak discharge throughout the system.

Development of Floodplain Areas

Using floodplains for sporting activities and community parks has been undertaken with success in many countries, and this has resulted in limited encroachment onto floodplains. Sport facilities that can be developed within flood prone areas include soccer fields, golf courses, horse trails, fishing, and hiking trails, as well as picnic facilities. Community parks and rain garden can be created as demonstrated successfully in Cuyahoga Falls, Ohio, USA. However, this requires both demarcation of flood plains according to the proposed setbacks and expropriation of buildings lying in flood plains.



Figure 4.52: Community Park And Rain Garden In Cuyahoga Falls, Ohio

Land Contouring

Land contouring to lower the ground elevation could create additional floodplain storage which helps mitigate the runoff intensity during heavy rainfall events.



Figure 4.53: Land Contouring to Lower Ground Elevation (Colorado State University Campus, Fort Collins, Colorado)

River Restoration

River restoration aims at restoring the natural state and functioning of the river system in support of biodiversity, recreation, flood management and landscape development. By restoring natural conditions, river restoration improves the resilience of the river systems. River restoration is considered as one of the integral parts of sustainable water management

In megacity Seoul, Korea, the restoration of a culturally important river teaches key lessons. A river can be recovered and restored even in a large and dense central business district, with multiple positive effects such as tourist attractions, public access to the river for fishing, in addition to significant ecological improvement.



Figure 4.54: River Restoration in Cheonggyecheon, Seoul, Korea

Wikipedia.com.

Reservoirs / Ponds for Flood Mitigation

Reservoirs contribute to flood mitigation while controlling the drainage as close as possible to its source, and avoiding the on-flow of flooding downstream. The system is to limit the discharges to the exiting channels and to relocate volumes of water from flooding by directing it to reservoirs established in the surrounding floodplains, thus preserving their natural conditions for the mitigation of flooding.

Upgrade Existing Drainage Systems

The upgrade of the existing drainage system within the urbanised area of Ibadan is essential in highly populated areas. The upgrade includes increasing the capacity of channels and construction or upgrading existing culverts and bridges. The upgrade provides both short-term resilience and long-term additional capacity to allow Ibadan to plan for future growth.

Vegetated Swales

These are shallow landscaped areas designed to capture, convey, and potentially infiltrate stormwater runoff as it moves downstream. Vegetated swales are a widely accepted stormwater strategy, are simple to construct and have a relatively low-cost to implement. Vegetated swales can be implemented in places such as residential and commercial streets, within street medians, at the centre of and along the edges of car parks, and within building perimeter landscaping.



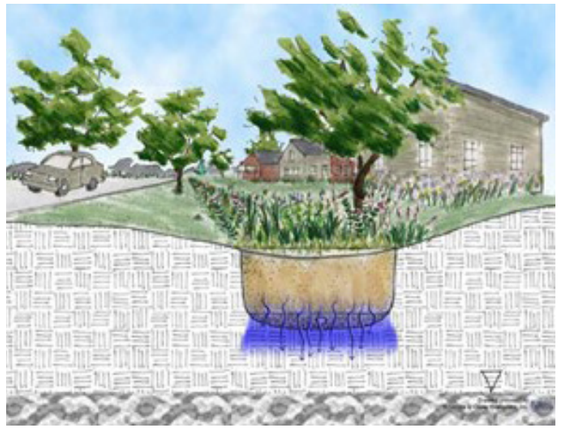

Figure 4.55: Swales Adjacent to Roads

Rain Gardens

Shallow landscape areas that can collect, slow, filter and absorb large volumes of water, delaying discharge into the watershed system. Rain gardens can provide the greatest stormwater flow and volume benefit if large in size. Rain gardens can be placed adjacent to car parks, streets and in large landscaped areas next to buildings.



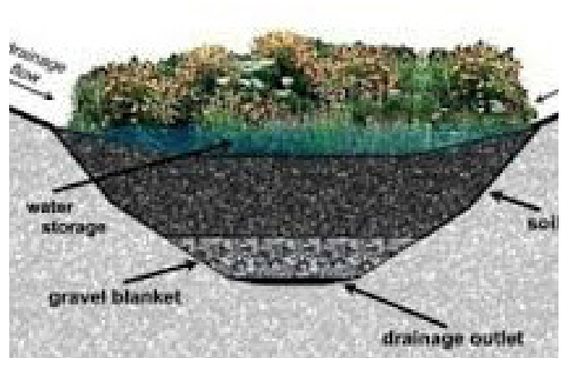

Figure 4.56: Rain Gardens

Green Roofs

Rainfall in green roofs is stored by the substrate and then taken up by the plants from where it is returned to the atmosphere through transpiration and evaporation. In summer, depending on the plants and depth of growing medium, green roofs retain 70-90% of the precipitation that falls on them; in winter they retain between 25-40%. Green roofs not only retain rainwater, but also moderate the temperature of the water and act as natural filters for the water. Green roofs reduce the amount of stormwater runoff and also delay the time at which runoff occurs, resulting in decreased stress on sewer systems at peak flow periods.



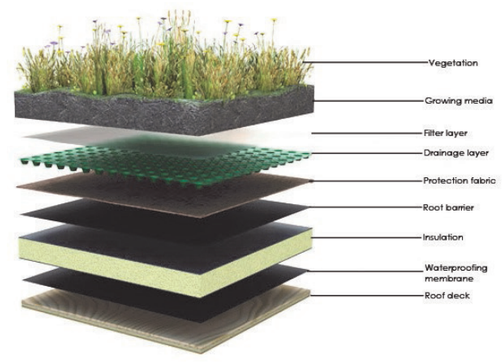

Figure 4.57: Green Roof and Cross-Section

C. Flood Protection

8. Elevate development areas above the inherent flood levels at each site;
9. Provide detention/retention zones for the temporary storage of flood waters to reduce the risk of damage to communities and development infrastructure;
10. Develop sustainable drainage solutions;
11. Channelise highly populated areas (local markets, churches, etc);
12. Re-vegetate and plant trees.

D. Policies

1. Provide policies to stop new illegal settlements and people living within flood prone areas and in dangerous locations;
2. Provide policies and regulations to enforce developers to implement sustainable urban drainage systems and best management practice in order to ensure that stormwater runoff remains with their same values prior to urbanisation;
3. Provide policies for vegetal removal, bush clearing, soil stripping or removal to prevent soil loss;
4. Provide policies and regulations to restrict developers from damaging forests;
5. Provide policies and regulations to ensure that containment of investable soil losses should be within construction premises and not be allowed to erode and be transported beyond the construction site.

E. Awareness

1. Warn people living in flood plains, low land areas and locations with previous recorded causalities;
1. Establish an awareness system and inform people with evacuation plans living in the flood prone areas in the case of events with high rainfall.

F. Long Term Plan

13. Execution of a flood early warning system for the city;
14. Development of flood risk maps for the whole of Ibadan;
15. Design and implementation of a master drainage scheme to accommodate the floods within the city;
16. Implementation of a Solid Waste Management Plan for the urban area within Ibadan.

Permeable Paving

Permeable paving are alternative surfaces that allow stormwater runoff to filter through voids in the paving surface into an underlying stone reservoir, where it is temporarily stored and/or infiltrated. A variety of permeable paving surfaces are available, including pervious concrete, porous asphalt and permeable interlocking concrete pavers. While the specific design may vary, all permeable paving has a similar structure, consisting of a surface pavement layer, an underlying stone aggregate reservoir layer and a filter layer or fabric installed at the bottom (see Figure 4.58).

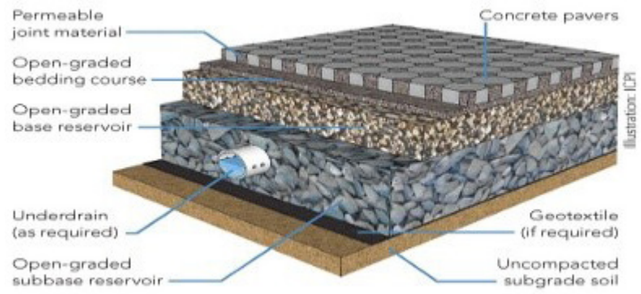

Figure 4.58: Cross Section of Typical Permeable Paving *Hunt and Collins, 2008.*

Permeable paving is typically designed to treat stormwater that falls on the actual paving surface area. However, careful sediment control is needed for any run-on areas to avoid clogging of the down-gradient permeable paving. Permeable paving promotes a high degree of runoff volume reduction and nutrient removal, and can also reduce the effective impervious cover of a development site.

Non-Structural Measures

The flood control plan provided in this section covers the recommended non-structural measures necessary to control severe flooding in Ibadan.

Environmental Teaching Programme (Public Education)



Investing in communities vulnerable to climate change impacts can reduce the damage brought on by extreme weather events and the need for government relief funding.

Increasing the awareness of the population that lives close to water courses is essential for a healthy environment. Awareness can be in the form of printouts in newspapers, electronic media, as well as the use of drama sketches, and plays on flooding-related hazards and risks associated with encroaching on flood plains.

Encouraging and enabling a culture of flood resilience enhances the preparation capacities of citizens and their community as a whole.

4.7.5 Urban Heat Island Effect and Mitigation

"Urban heat islands" occur when cities replace natural land cover with dense concentrations of pavement, buildings, and other surfaces that absorb and retain heat. Surfaces that were once permeable and moist generally become impermeable and dry. This development leads to the formation of urban heat islands - the phenomenon whereby urban areas experience warmer temperatures than their rural surroundings. This effect increases energy costs (eg, for air conditioning), air pollution levels, and heat-related illness and mortality.

In a fast-developing city such as Ibadan, more vegetation is being lost, and more surfaces are becoming paved or covered with buildings. The change in ground cover produces less shade and moisture which increases the heat in the built-up areas. These built-up areas evaporate less water which contributes to elevated air temperatures (refer to Figure 4.59).

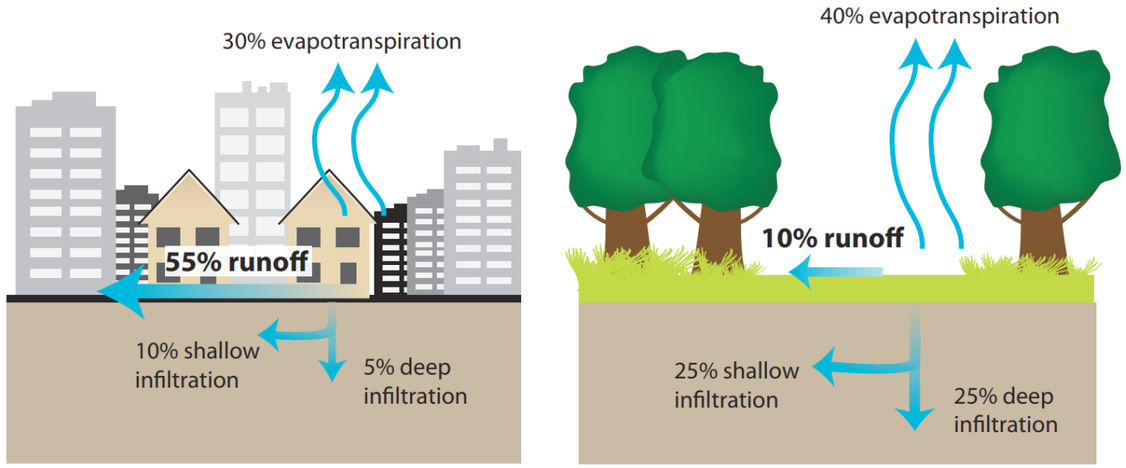

Figure 4.59: Impervious Surfaces and Reduced Evapotranspiration

Trees, green roofs, and vegetation can help reduce urban heat island effects by shading building surfaces, deflecting radiation from the sun, and releasing moisture into the atmosphere. The following section illustrates methods to reduce the Urban Heat Island Effect.

Methods to Reduce the Urban Heat Island Effect

Increase Shade in Urban Areas

Planting trees and other vegetation lowers surface and air temperatures by providing shade and cooling through evapotranspiration, in which plants release water to the surrounding air, dissipating ambient heat (refer to Figure 4.60 and Figure 4.61).



Figure 4.60: Increased Shade in Urban Areas by Canopy Trees

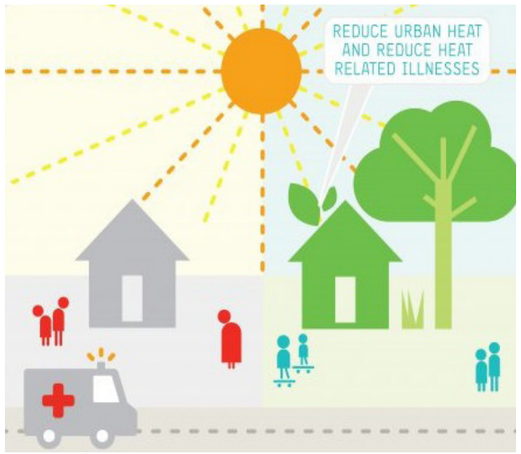

Figure 4.62: Increased Shade and Reduced Heat

Install Green Roofs

A green roof, or rooftop garden, is a vegetative layer grown on a rooftop. Green roofs provide shade and remove heat from the air through evapotranspiration, reducing temperatures of the roof surface and the surrounding air (refer to Figure 4.61).



Figure 4.61: Green Roof

Install Cool Roofs

Cool (or reflective) roofs help to reflect sunlight and heat away from urban buildings and reduce roof temperatures.

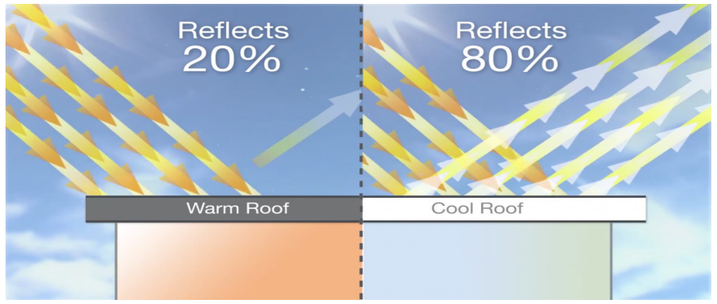

Figure 4.63: Cool Roof Reflection

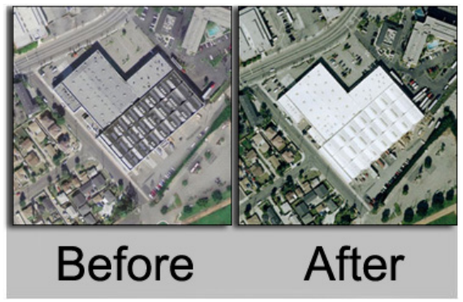

Figure 4.65: Cool Roofs Before and After Installation



Figure 4.64: Installation of Cool Roofs

Strategies to Reduce Heat Island Effect[3]

There is a variety of methods that can be used to reduce heat island effect, which includes voluntary and policy efforts, detailed as follows:

1. Voluntary Efforts

Most community strategies have relied on voluntary efforts to reduce the heat island effect. This can be grouped into the following categories:

Demonstration Projects: Local governments, universities, and other organisations can demonstrate projects, research and the benefits of reducing the heat island effect. Documenting the project and its results can provide the data and publicity needed to develop larger initiatives, promote new technologies and help get them to market, and sometimes even encourage local economic development.

“Lead by example” programmes involve implementing strategies within local and state government facilities, operations, and fleets, where appropriate. These programmes offer energy, environmental, and financial benefits while creating an important opportunity for governments to demonstrate the economic feasibility of the strategies they are promoting. This leadership can raise public awareness of the benefits of urban heat island reduction strategies, which can lead to increased public and private sector support for advancing them.

Incentive Programmes: Incentives have proven to be an effective way to stimulate individual heat island reduction actions. Incentives from governments, utilities, and other organisations can include below-market loans, tax breaks, product rebates, grants, and giveaways. Local governments may provide coupons to homeowners towards the purchase of trees or encouraging residents to strategically plant vegetation around their homes.

Urban Forestry Programmes: Local governments can adopt urban forestry or tree planting programmes. Local governments may grant communities and organisations that promote or maintain urban forests.

Education Programmes: Education programmes may focus specifically on students, who may help plant trees and vegetation.

Awards: Governments and community groups may award individuals that contribute in mitigating heat islands.

2. Policy Efforts

Local governments may include urban heat island mitigation strategies in policies or regulations, which range from purchasing guidelines to building codes. Policy efforts can include:

Procurement: Local governments may start by procuring cool technologies for municipal buildings. In addition, local governments can revise bid specifications to include cool products in future construction developments.

Tree and Landscape Ordinances: Local governments may enact tree and landscape ordinances that can ensure protection of trees and provision of shade. Tree protection ordinances can be set to prohibit the removal or clipping of trees without a permit. Local government may set ordinances for developers to preserve tree stands during site construction. Street tree ordinances may govern how to plant and remove trees along public rights-of-way.

Comprehensive Plans and Design Guidelines: Comprehensive plans and design guidelines are another way that local governments may promote heat island reduction. Specific policies can include the following:

- promote design concepts that use engineered green space to maximise shading over surfaces that tend to heat up,
- promote education and awareness of cool roof materials and construction techniques,
- promote alternative pavement technologies in parking areas, and
- set regulations for car park shading requirements.

3 United States Environmental Protection Agency (2008), “Reducing Urban Heat Islands: Compendium of Strategies, Heat Island Reduction Activities.”

Drainage (D): Establishment of Policies, Laws and Regulations

The laws and regulations governing development in Ibadan, as far as the recognition of flood hazards are concerned, are generally inadequate to protect the populace from floods. In this respect, the establishment of the following policies, laws and regulations is recommended:

Policy D1: Delimitation of Set-Backs: The existing statutory set-backs to the major streams and rivers are inadequate in the face of increased urbanisation in the city. It is necessary to review existing laws and regulations to accommodate the extent of natural flood plains of the streams and rivers for flood control. No development should be permitted in any area identified as prone to flooding.

Policy D2: Restrict Dumping Refuse in Unauthorised Locations: Empower and equip the Environmental Health Department of Local Governments within Ibadan to enforce laws and regulations to prevent the indiscriminate dumping of refuse and waste in unauthorised locations.

Policy D3: Enforce Developers to use Sustainable Urban Drainage Systems: Provide policies and regulations to enforce developers' use of sustainable urban drainage systems and best management practice in order to ensure that storm water runoff remains with their same values prior to urbanisation.

Policy D4: Restrict Deforestation and Enforce Tree Protection: Provide policies and regulations to stop developers from damaging forests or the removal of trees by applying and enforcing strict penalties for such violations.

Policy D5: Climate Change Adaptation and Beautification: One of the most potent preventive measures against flooding is vegetation. The Oyo State Government should adopt a policy of "greening" Ibadan through planting of trees and shrubs. This will reduce runoff and therefore flooding, preserve soil moisture and reduce the rate of atmospheric warming. Vegetation cover, especially trees along flood plains, also reduce the inland penetration of wind and water, as well as provide brief refuge from a rising tide. In addition to these ecological services, "greening" of the city has the potential to create employment opportunities, enhance the aesthetics of Ibadan, as well as create a conducive environment for recreation and the improvement of human health.

4.7.6 Recommendations

Several recommendations have been provided to achieve a sustainable drainage system to mitigate the flood hazard within the existing urbanised area of Ibadan and minimise the risk of flooding in future developments. These recommendations are summarised as follows:

A. Existing Streams

1. Maintain natural streams;
2. Utilise existing drainage systems;
3. Upgrade existing drainage corridors;
4. Ensure the connectivity and capacity of the waterways and other flood ways to relieve flood waters to the collecting rivers.

B. Maintenance

1. Initiate effectively regular maintenance and cleaning of drainage systems;
2. Initiate maintenance of affected/damaged water structures during previous flood events.

4.8 REFERENCES

Oyo State, "Report on the Assessment of the 26th August Flood Disaster in Ibadan Metropolis." Report of the Task Force on Flood Prevention and Mitigation, November 2011.

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TRANSPORT NETWORK

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5 TRANSPORT NETWORK

This chapter discusses transport within the Ibadan Masterplan. It includes:

- The private and public transport networks,
- Road hierarchy,
- Alignment options and sections for the Circular Road and Inner Ring Road,
- Proposed upgrades to existing roads and new roads,
- Proposed changes in the provision of public transport, and
- The provision of space for pedestrian and cyclist use.

Rapid population growth and sporadic and uncontrolled development, together with increasing car ownership, has given rise to serious congestion and parking problems across the built-up areas of Ibadan. These inefficiencies within the transport network have significant impacts upon the city in terms of pollution, health, the economy and general quality of life and will only continue to worsen with the expansion of the urban area if not properly addressed.

Because of this, a number of strategies have been proposed that seek to resolve the congestion issues and improve connectivity. This will be undertaken by establishing a coherent road network, upgrading the provision of public transport and creating better options for pedestrians and cyclists These strategies are set out under the headings below.

5.1 ROAD NETWORK

This section outlines the aspects that contribute to the road network, looking at proposed roads and how they can be implemented to alleviate congestion and improve connectivity.

5.1.2 Road Network Concept

Within the built-up area of Ibadan, the road network is currently structured around a series of radial roads which link the outlying areas with the urban core of the city. While the network allows for vehicular traffic to travel inwards to the urban core, it does not connect the outlying areas to each other. With the proposed expansion of Ibadan imminent and an emphasis on focused investment at the growth centres, the new road network must address the connectivity issues in order to allow easier travel whilst avoiding the core area if desired by road users.

The masterplan proposes the use of beltway roads that loop the city, allowing vehicular traffic to bypass the central core rather than pass through it. A clear hierarchy of roads is established. This will ensure that each route has a distinct role to perform and in doing so, congestion will be reduced and connectivity improved. With this ethos in mind, the masterplan promotes the implementation of the Circular Road and an Inner Ring Road that will act as connecting loops whilst a series of spokes radiate from the city centre linking all parts of Ibadan together.

Figure 5.3 shows the road network concept.

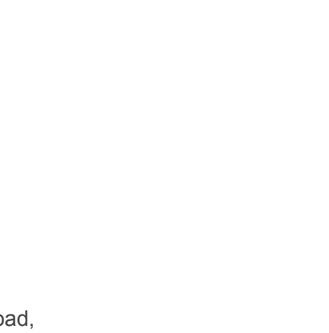

Figure 5.1: Radial Road Network

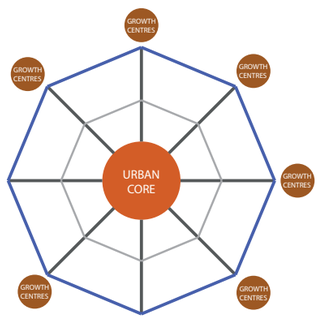

Figure 5.2: Connected Radial Road Network

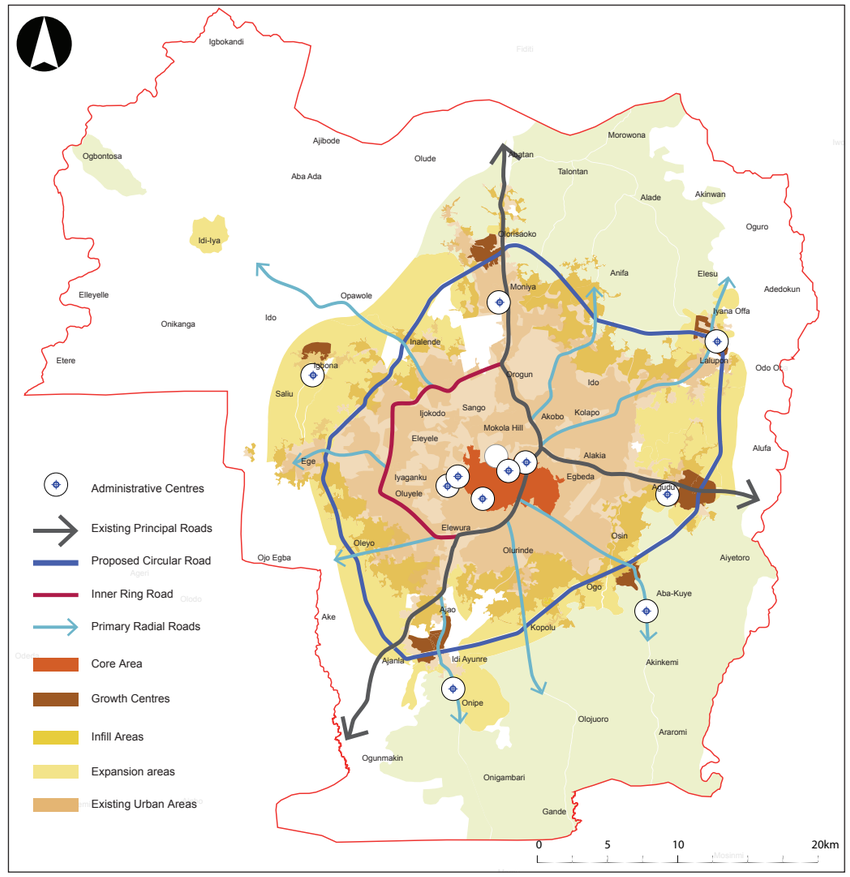

Figure 5.3: Road Network Concept

5.1.1 Road Hierarchy

In Nigeria, responsibility for managing, maintaining and improving roads is divided between Federal, State and Local levels. This, however, does not reflect the function of the road, in that some federal roads may perform local functions while some state roads perform a higher function. In this regard, the categorisation of Federal, State and Local roads is not suitable in planning a road hierarchy for Ibadan.

The National Integrated Infrastructure Masterplan drawn up for the federal government in 2014 established a national road hierarchy through the inception of a strategic road framework. At present, the only road within Ibadan that is included within this strategic road network is the E1 Lagos-Ojoo Expressway The masterplan proposes a hierarchy to be established to allow a suitable categorisation of roads. This is as follows:

- Principal Roads: roads of regional or national significance that connect the major economic centres of the State and those centres to the national strategic road network. They will often be expressways, with restrictions on access and prohibitions on stopping;
- Primary Roads: these connect the main urban areas within the State and main economic centres within the city, and link these areas to the Principal Road network. They may range in standard from two-lane single carriageway roads to multi-lane dual carriageways;
- Collector Roads: these collect traffic within urban and rural areas and feed that traffic onto the Primary or Principal Road networks. They will normally be two-lane roads but may be of a higher standard where traffic demands are high; and
- Local Roads: these provide access to neighbourhoods and to individual sites.

Figure 5.4 classifies the existing hierarchy of roads and Figure 5.5 show the proposed road network concept.

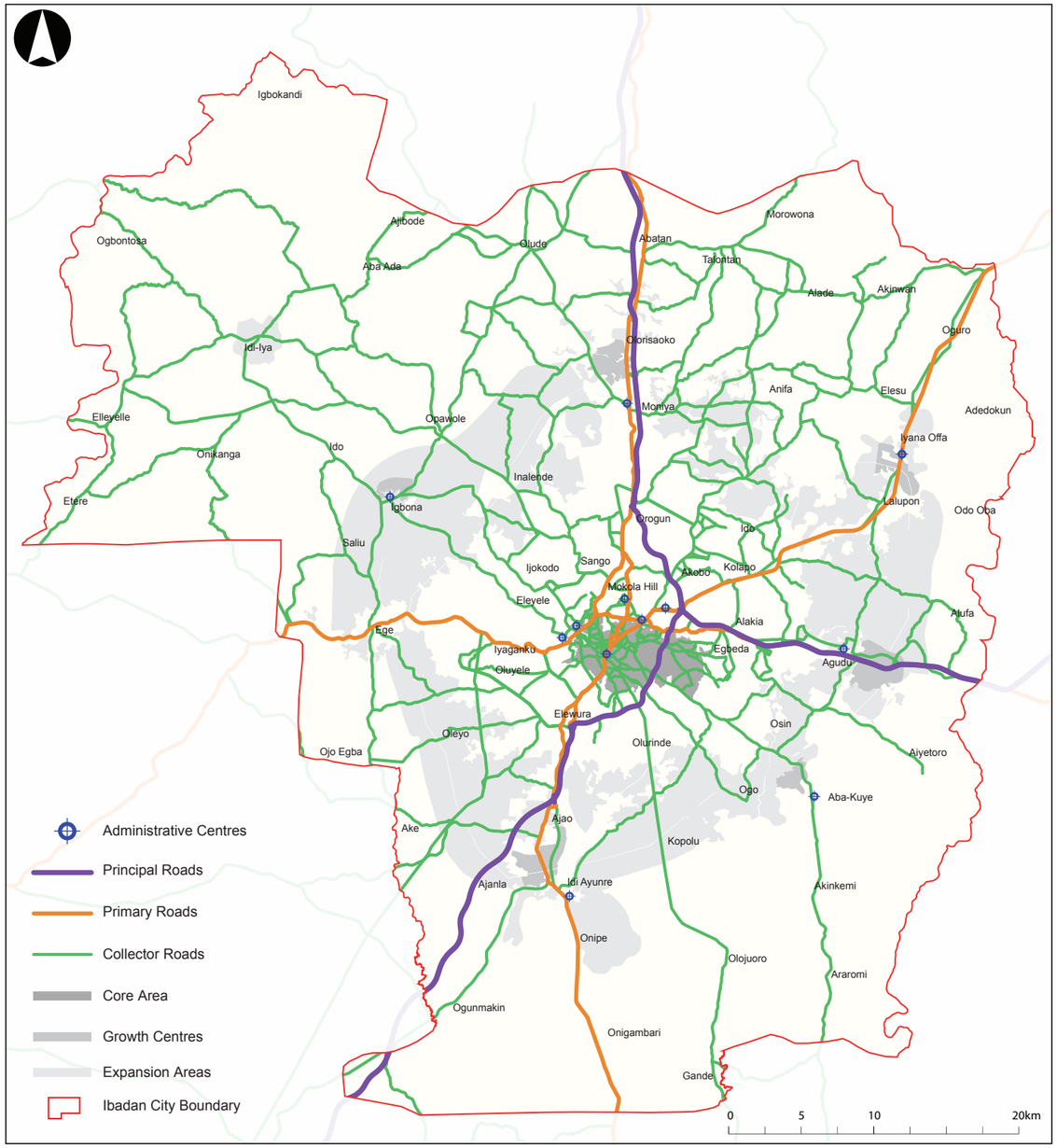

Figure 5.4: Existing Road Hierarchy

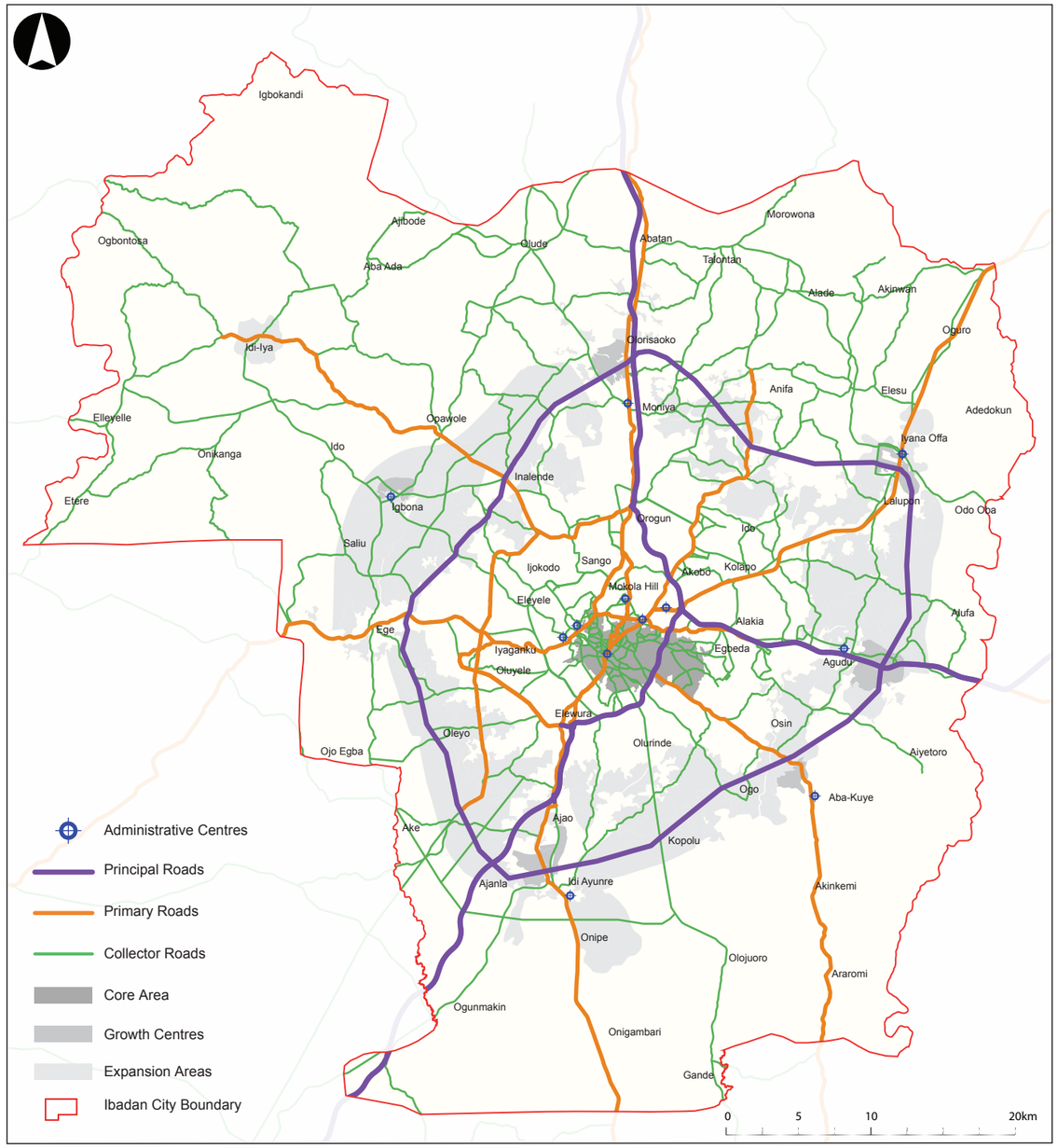

Figure 5.5: Proposed Road Hierarchy

5.1.3 Circular Road

First proposed in 2005, the Circular Road is intended as a 110km expressway that surrounds Ibadan's main urban areas. The alignment proposed by the OSMoWT is shown in Figure 5.5. The Circular Road is an important component of the masterplan to direct through traffic away from the centre. This new road will significantly help ease congestion in Ibadan and improve overall connectivity. It will create a looped expressway that surrounds Ibadan and will serve as an efficient travelling route for users to better navigate the city and its expanded area. This will help free up vehicular traffic in the congested urban area.

A predominant feature of the masterplan is to establish growth centres. The Circular Road plays a key role in ensuring the successful development of these centres by connecting them directly to each other, surrounding residential areas, the principal roads and the main urban core of Ibadan.

A set of typical road sections have been derived for the Circular Road by the OSMoWT. With an average total 60 metre right-of-way, of the road occupies a 35.7 metre width with 2 lanes per direction whilst the remaining area is left as a setback.

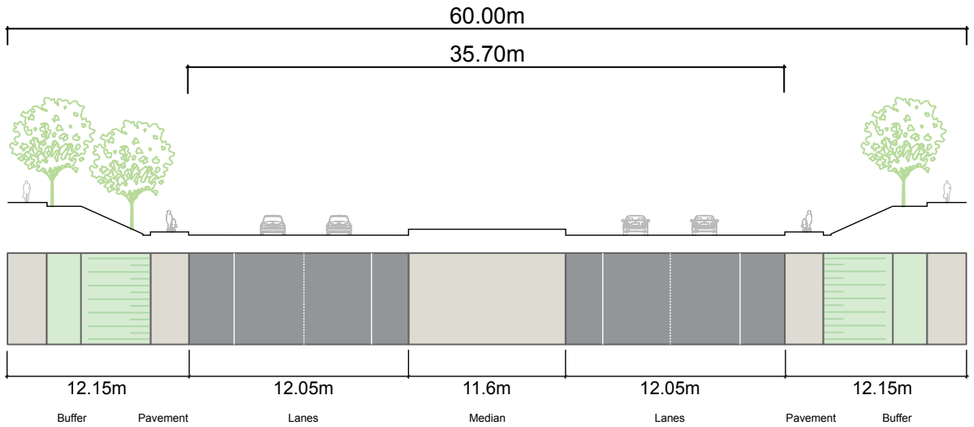

Figure 5.6: OSMoWT Road Cross-Section for Circular Road

Proposed realignment of the Circular Road

The Circular Road's alignment as first proposed by the OSMoWT has been adopted; however, the proposal enters in conflict with a number of masterplan proposals and Forest Protection Areas. The masterplan provides a selection of realignment options in order to avoid these conflicts. They are proposed as alternatives to the adopted alignment, and are to be addressed as separate studies should there be a desire to lessen the road's impact.

The proposals have been broken into segments that each address a specific issue with the current alignment. Because of this, the masterplan proposes 3 options, as discussed further in this section, which can be best identified as 3 levels of intervention: light, medium and heavy.

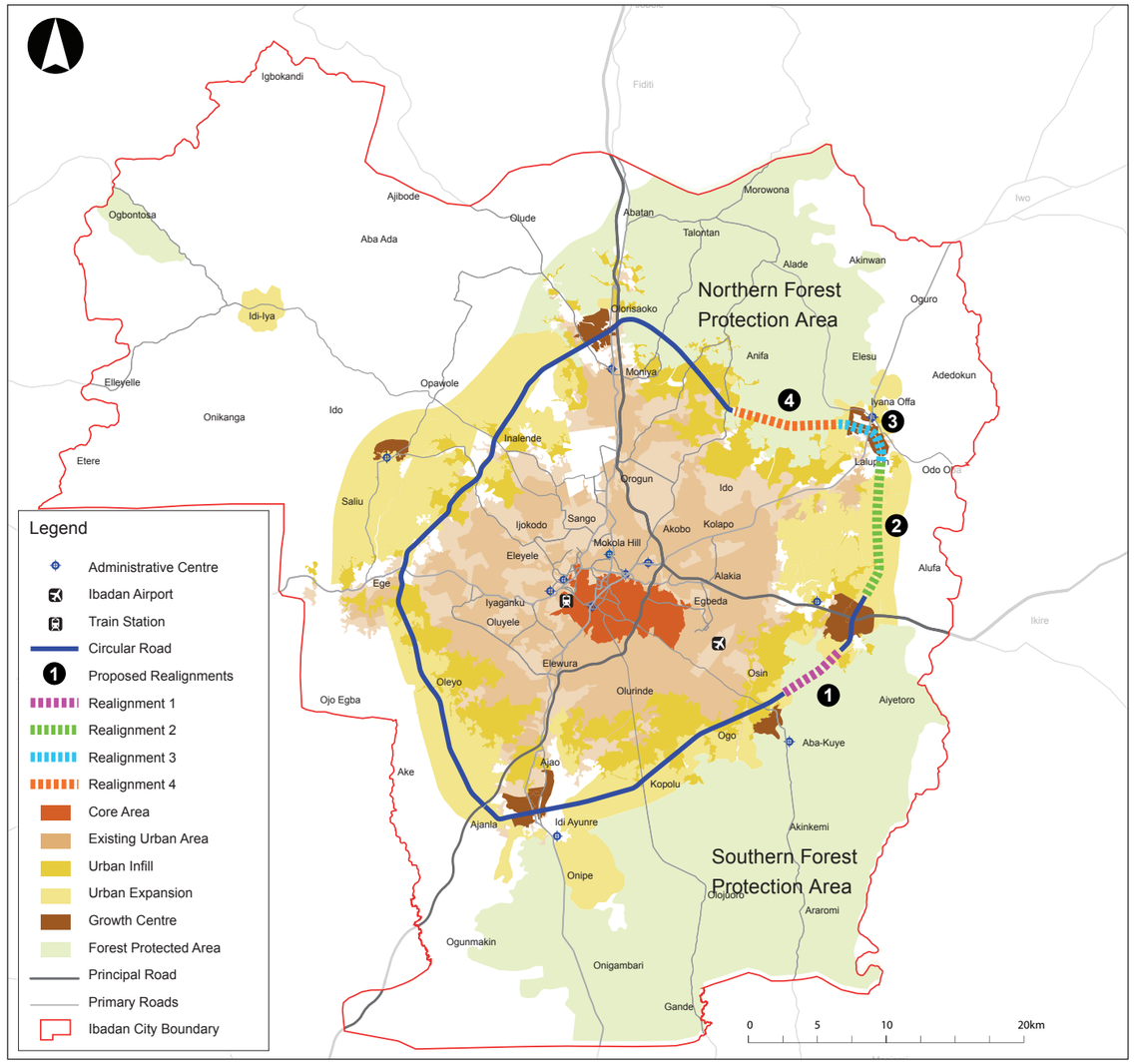

Figure 5.7: Circular Road - Alignment Conflicts

Segment 1

- This segment passes through the Southern Forest Protection Area. It is proposed that this segment of the Circular Road be realigned west so as not to dissect the protected area.
- The new alignment skirts the edge of the proposed urban expansion area and brings the road closer to the existing town of Agudu and the Egbeda Administrative Centre.

Segment 2

- This segment is currently aligned towards the eastern part of the proposed expansion area. In order to create equal accessibility to the Circular Road, it is proposed that this segment is realigned to a more central position in the urban expansion area and therefore better serve the surrounding urban area.
- The new alignment is centred within the proposed urban expansion areas between Ibadan-Iwo Road and the A22.
- By realigning the road, a better reach and distribution of vehicular traffic can be achieved for the future urban expansion areas.

Segment 3

- Under the present alignment, the proposed Circular Road dissects the town of Lalupon. In order to avoid this, the road should be realigned accordingly. Two options are presented for this:
- Option 3A proposes repositioning the road to pass the eastern edge of Lalupon, requiring only minor changes to the existing alignment.
- Option 3B proposes realigning the road to pass the western fringes of Lalupon, connecting with the proposed realignment of Segment 4. Although this option distances the Circular Road from the administrative centre at Iyana Offa/Lagelu, it better serves the new urban expansion areas internally. This option is reliant on the repositioning of segment 4 as discussed below.
- Segment 3 relies on the event that the changes to segments 1 and 2 are not implemented.

Segment 4

- This segment currently passes through the Northern Forest Protection Area.
- The new alignment skirts the edge of the proposed urban expansion area to minimise the impact on the forest protection area.

Table 5.1: Circular Road Realignment Intervention Options

REALIGNMENT OPTION 1 (SEGMENT 3A)	REALIGNMENT OPTION 2 (SEGMENTS 3B AND 4)	REALIGNMENT OPTION 3 (SEGMENTS 1, 2, 3B AND 4)
Option 1 (light realignment) – Requires the least change to the existing Circular Road proposal. The intervention proposes realigning the Circular Road to run along the eastern fringe of Lalupon.	Option 2 (medium realignment) – This intervention similarly addresses the conflict at Lalupon; however, it proposes the Circular Road is realigned along the western fringe of the town. Beyond Lalupon, the Circular Road would then be further realigned in order to safeguard the proposed Forest Protection Area north-east of Ibadan.	Option 3 (heavy realignment) – The largest of the 3 interventions, this realignment proposes the safeguarding of the Southern Forest Protection Area in the south-east of Ibadan. Through this realignment, the existing town of Agudu and the Egbeda Administrative Centre are better served by the Circular Road. Following this amendment, the Circular Road is then shifted inwards on the eastern side to centre the Circular Road within the proposed expansion area in order to improve connectivity in this region. Finally, this option remains consistent in its strategy and realigns the road to avoid the Northern Forest Protection Area as proposed in the medium realignment. This is the realignment that best addresses and limits the impact on forest protected areas, existing settlements and proposed expansion areas.

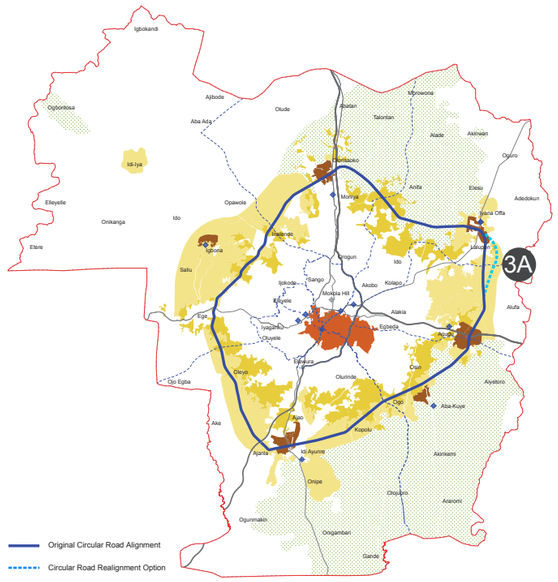

Figure 5.8: Circular Road - Light Realignment

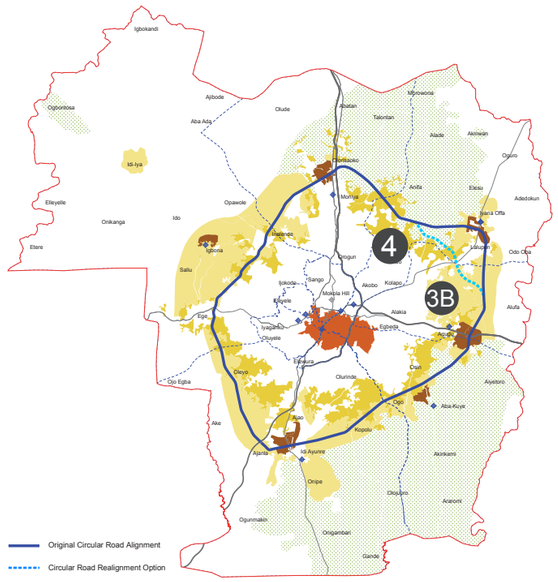

Figure 5.9: Circular Road - Medium Realignment

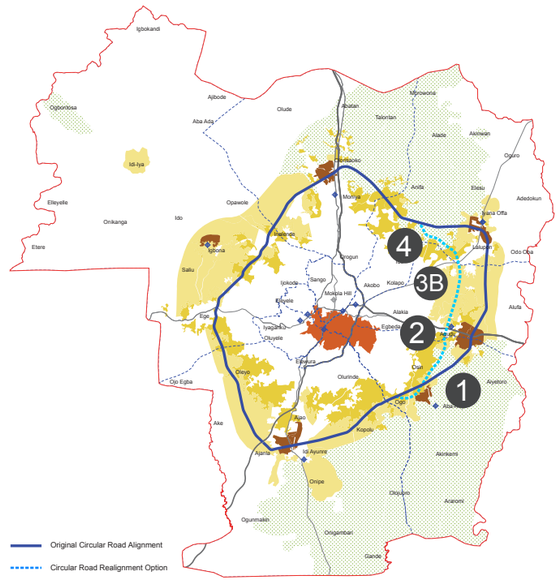

Figure 5.10: Circular Road - Heavy Realignment

The Circular Road Relationship with the Built Environment

As the proposed Circular Road will structure the urban expansion areas, it will become an integrated component of the urban area of Ibadan. The previously proposed cross section provides a safeguard easement area, although it is necessary to explore the potential relationship between the road and the surrounding built environment. This section looks at this relationship, proposing a series of road section options. These have been adapted from the already proposed section but will allow for various forms of interaction between the road and adjacent developments and be better suited to the public transport systems proposed.

These options are dependent on a number of factors, such as expected level of activity, anticipated flow rates of traffic and the extent of management of the road's pavement. They are proposed in order to spark discussion in terms of what is preferred for Ibadan. More detailed design and feasibility studies will be required in later stages for these road cross-sections.

Option 1 - Integrated Access Lanes

Often used in Shanghai and Bangkok, this option incorporates access lanes and express lanes into the road's right-of-way with a large green buffer (median) splitting the direction of traffic. Access lanes are separated from the express lanes with a small reservation and are kept on the exterior for slower moving local traffic. At certain points, this reservation can be removed to allow the joining of traffic where necessary. Running alongside the access lanes will be a wide pavement with sufficient space for pedestrians and cyclists, and can include public transport stops. The frontage of adjacent developments will open up onto the pavement to create an active frontage at street level. In this option, the access lanes can easily join to collector or local roads without interfering with the express lanes of the Circular Road. Additionally, traffic can switch between access and express lanes with ease when needed.

This option can incorporate the use of BRT into the access lanes or provide additional central lanes to create a public transport corridor.

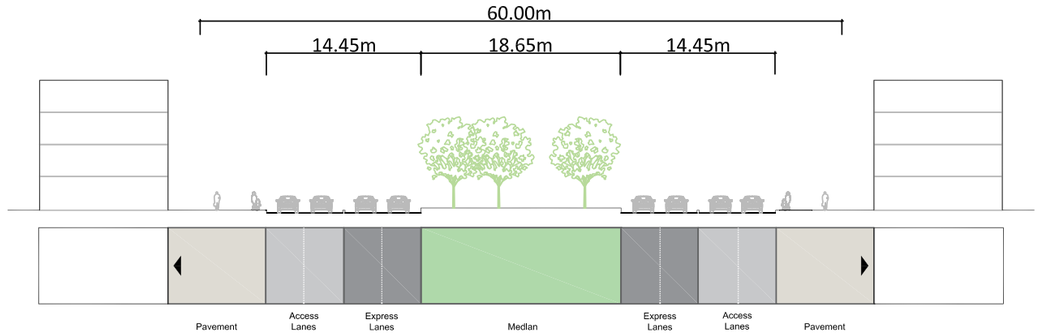

Figure 5.11: Proposed Road Cross-Section For Circular Road: Integrated Access Lanes

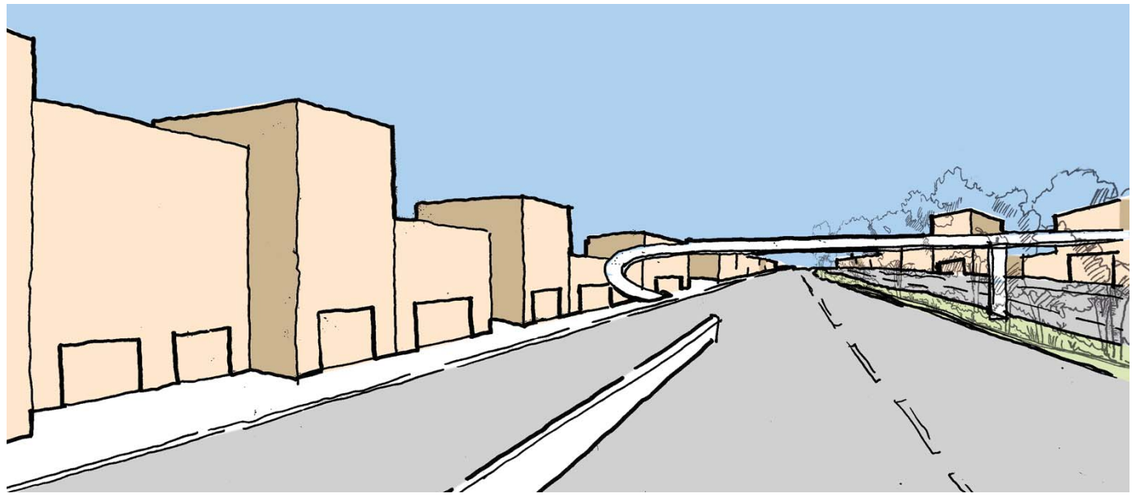

Figure 5.12: Undivided Lanes In Road Section



Figure 5.13: Beijing Typical Road *http://www.tour-beijing.com*



Figure 5.14: Bangkok Typical Road *Google Maps Street View*

Option 2 - Green Barrier Between Access and Express Lanes

In this option, a planted barrier splits the access lanes and express lanes. Similar to option 1, it aims to separate local traffic from express traffic but in this case, is undertaken through the use of a large physical barrier between the two types of lane. This can be seen in Jakarta and Mexico City.

The vegetated barrier separates the express lanes and access lanes and fast moving traffic operates internally whilst local, slower moving traffic travels on the outside of the planted barrier. Alongside the access lanes will be a wide pavement with sufficient space for pedestrians and cyclists and can include public transport stops. The frontage of adjacent developments will open up onto the pavement to create an active frontage at street level. In this option, the access lanes can easily join to collector or local roads without interfering with the express lanes of the Circular Road.

This option can incorporate the use of BRT into the access lanes or provide additional central lanes to create a public transport corridor.

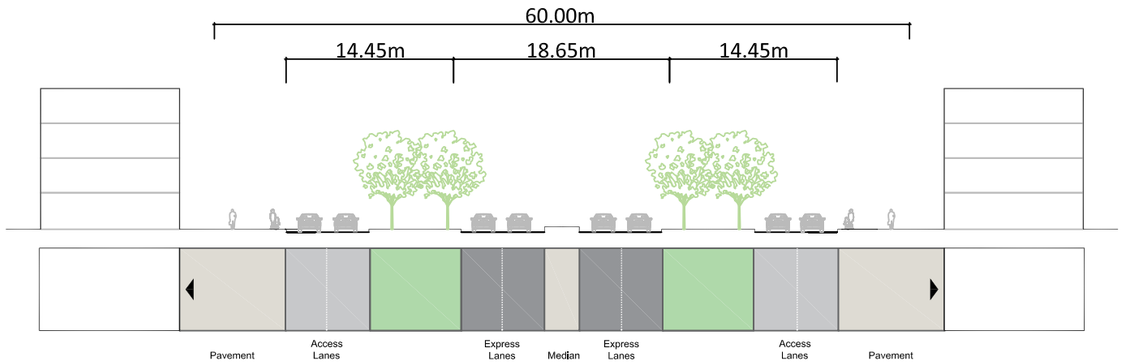

Figure 5.15: Proposed Road Cross-Section for Circular Road: Green Barrier Between Access and Express Lanes



Figure 5.16: Green Barrier Between Access and Express Lanes in Road Section



Figure 5.17: Jakarta Typical Road



Figure 5.18: Mexico City Typical Road *Google Maps Street View*

Option 3 - Access Lanes Separated From Circular Road

Often used in Singapore, this option assumes the Circular Road's role is solely an express route for traffic. In this case, all lanes within the Circular Road's right-of-way are assigned as express lanes. This option does not provide an active frontage to the Circular Road but instead building face away, onto access lanes. Vegetated barriers which separate the adjacent developments from the Circular Road are included and access lanes and pavements are provided one street over . Whilst this is beneficial for safety reasons and allows for fast-moving traffic and grade separated junctions, it loses any street-side culture that may be desired.

This option can incorporate the use of BRT into the access lanes.

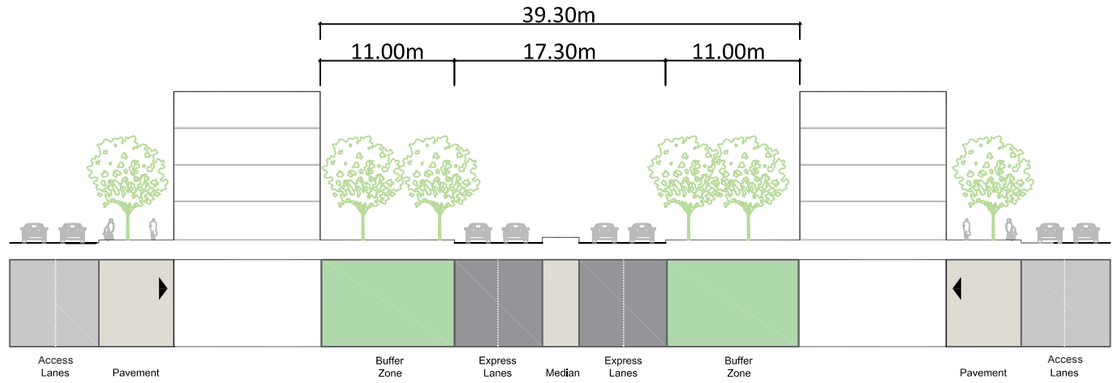

Figure 5.19: Proposed Road Cross-Section for Circular Road: Access Lanes Separated from Circular Road

Circular Road (CR):

Policy CR1: The Circular Road is planned as an expressway to direct through-traffic away from the urban core and built-up areas. Appropriate signage should be provided to assist in directing vehicles (particularly HGVs) away from the urban core and built-up areas.

Policy CR2: The alignment of the Circular Road should be re-evaluated to maximise benefits and reduce negative impacts.

Policy CR3: The design and impact on the relationship of the Circular Road with the adjacent built environment should be considered.

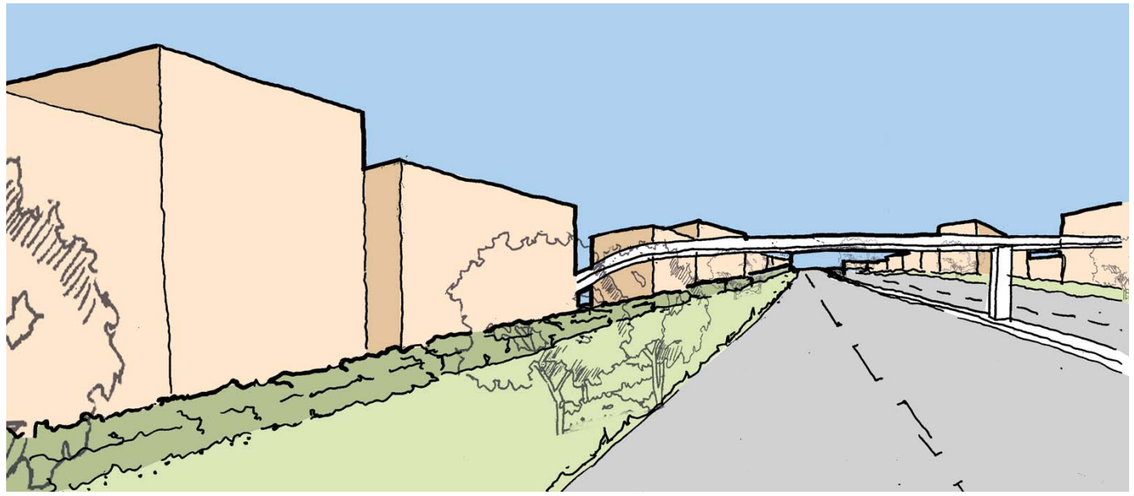

Figure 5.20: Access Lanes Separated from Circular Road in Road Section



Figure 5.21: Johannesburg Typical Road *Google Maps Street View*



Figure 5.22: Singapore Typical Road *Google Maps Street View*

5.1.4 Inner Ring Road

In addition to the Circular Road, an inner ring road is also proposed to provide even greater connectivity within and around the urban core and to improve the efficiency of the city's road network. An inner ring road will provide increased modal choice and enable traffic to bypass the existing urban core. The masterplan acknowledges the benefits of an Inner Ring Road and provides two options for alignment by using existing roads where applicable to form the loop. In both options, the proposal utilises the E1 Lagos-Ojoo Expressway (an existing principal road) to make up the eastern portion of the ring road whilst the western side uses existing roads that may require upgrade to a primary road. Figure 5.23 and Figure 5.24 show the proposed Inner Ring Road alignment options.

Option 1

The main strength of this option is that it does not require the construction of new roads. The upgrading of existing roads would alleviate the traffic pressure on the centre of Ibadan, and mostly in the Core Area. The weakness of this proposal is that it does little to improve the connectivity of the north-west areas of Ibadan, which is poor at present due to the presence of the IITA, the Natural Horticultural Research Institute and Lake Eleyele, all of which take up large areas of land that make connectivity difficult.

In order to improve the general connectivity and accessibility, this option needs to be delivered alongside road upgrades and construction of new road segments to reinforce the radial links in the north-west.

Total Length - 39.6 km

Length of E1 Used - 20.5 km

Road Upgrades - 20.1 km

New Roads - 0 km

Table 5.2: Inner Ring Road - Option 1 Strengths and Weaknesses

STRENGTHS	WEAKNESSES
Requires no new roads, only upgrade of existing roads.	Availability of numerous alternative routes close to the core area may lead to users may trying to take shortcuts which may cause congestion issues internally.
Does not displace established communities.	Does not improve connectivity in the north-west areas of Ibadan.

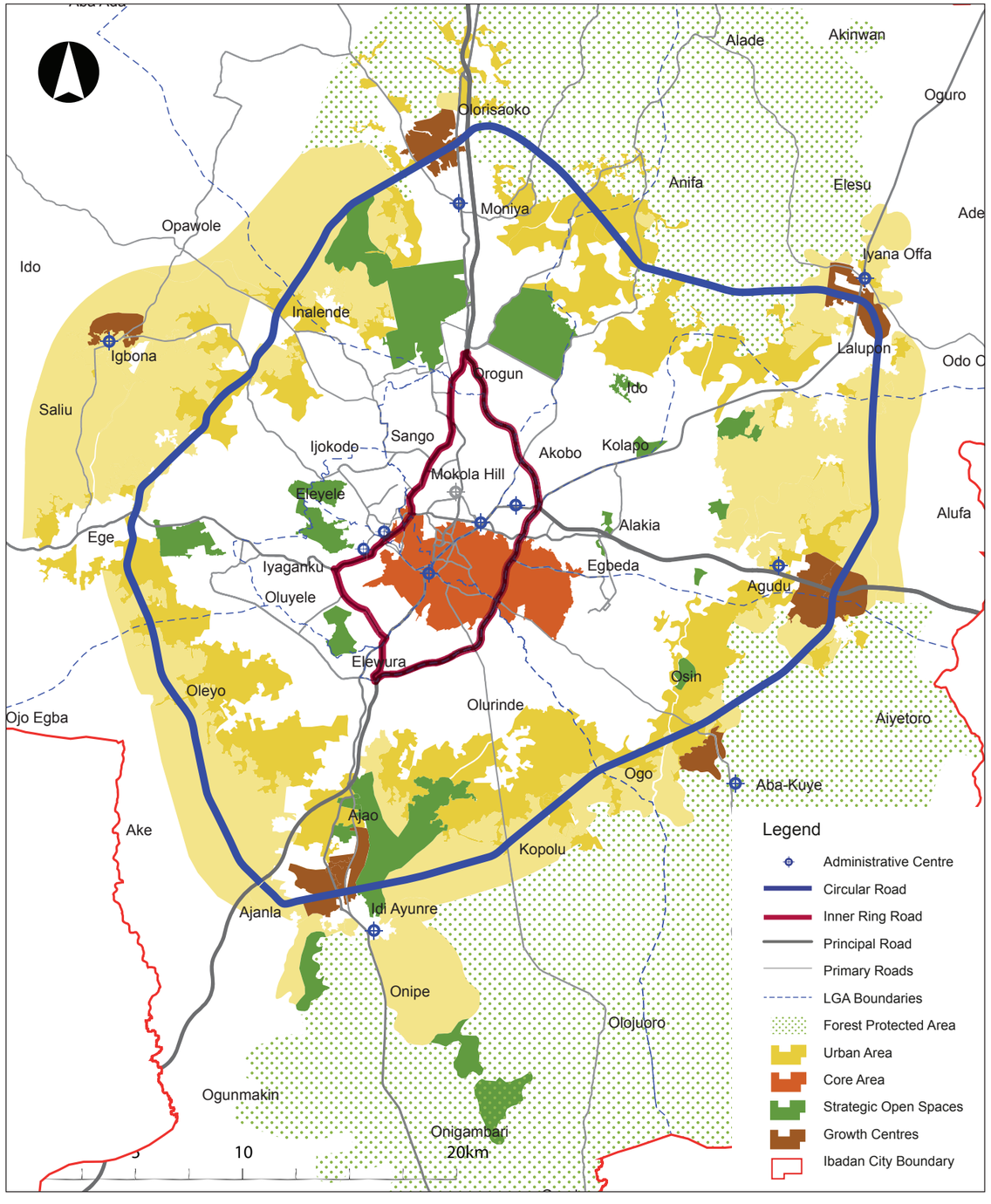

Figure 5.23: Inner Ring Road - Option 1

Option 2

The ring road, as in option 1, is confined to the E1 Expressway on the eastern side but in this case extends west to the recently completed Western Bypass. In order to serve traffic more efficiently, the western part of this ring road proposal runs in between the Circular Road and the green areas of Ibadan (the IITA, the Natural Horticultural Research Institute and Lake Eleyele). The alignment of this section is partly based on that of the proposed Mass Transit Line.

This option requires the building of new segments of roads to complete the inner ring, and more construction works related to upgrade due to the condition of the existing roads used. The strength of this option is that it relieves pressure on the Mokola Road-Federal Trunk Road, as well as improving the north west connectivity.

Total Length - 48.5 km

Length of E1 Used - 20.5 km

Road Upgrades - 23 km

New Roads - 5 km

Table 5.3: Inner Ring Road - Option 2 Strengths and Weaknesses

STRENGTHS	WEAKNESSES
Improves connectivity in the poorly connected north-west areas of Ibadan.	Requires the creation of new segments of road to complete the circuit.
Disperses traffic further from the core area.	New road construction may displace existing communities.

Inner Ring Road (IRR):

Policy IRR1: The Inner Ring Road is planned to provide improved connectivity within and around the urban core and to allow through-traffic to avoid the urban core.

Policy IRR2: The E1 Expressway from Elewura to Orogun will form part of the Inner Ring Road.

Policy IRR3: Existing roads require upgrading to a suitable standard.

Policy IRR4: New road segments may be required to complete the Ring Road.

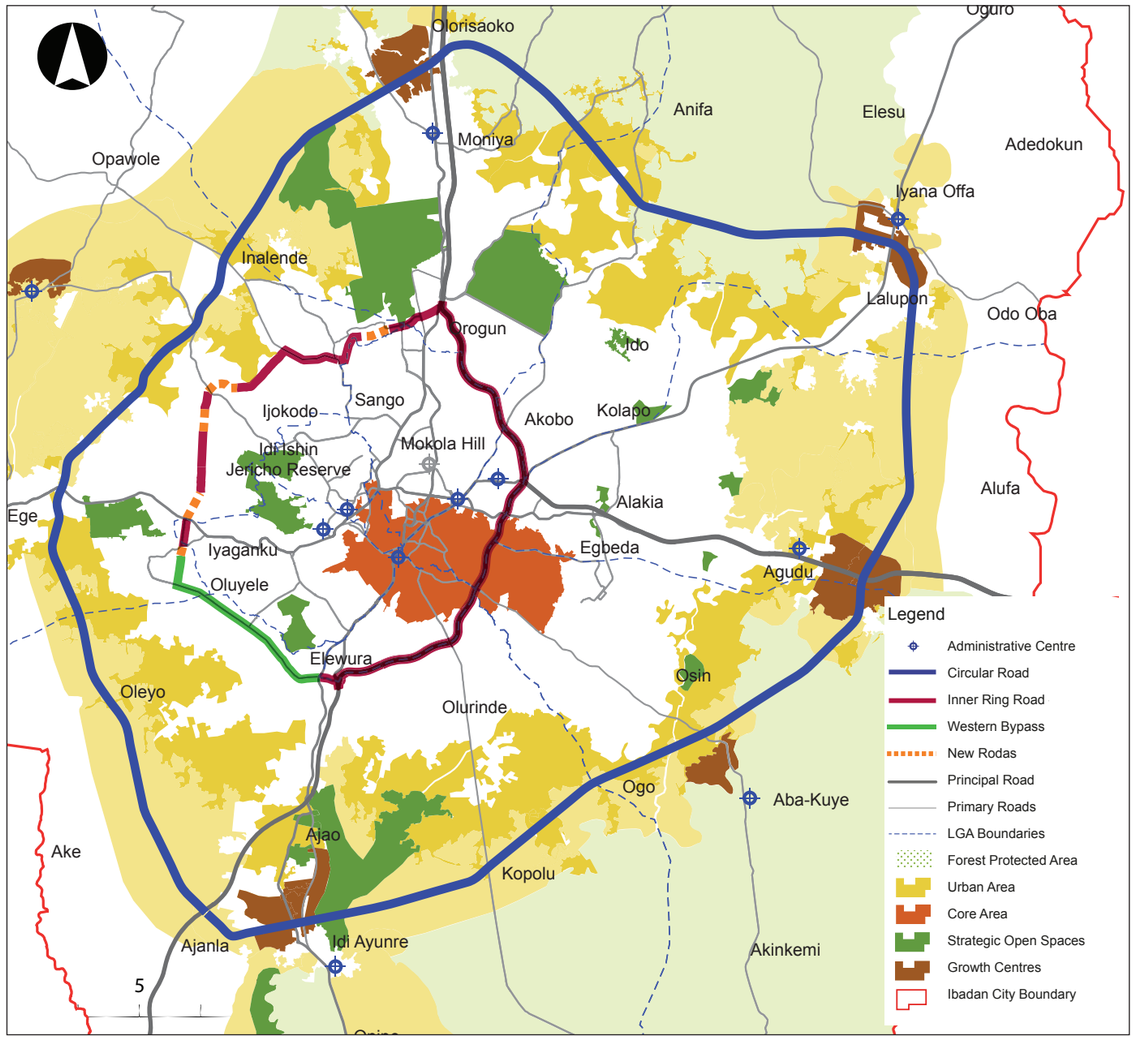

Figure 5.24: Inner Ring Road - Option 2

5.1.5 Additional New Roads and Upgrade of Existing Roads

In order to satisfactorily serve traffic capacities in and out of the city, reduce congestion and improve connectivity, a number of key sections of road have been strategically identified for upgrade along with some additional new roads. The extent of upgrade for each road will need further study according to the respective road's needs. Upgrading will vary in extent according to the road's future use; for example, upgrade to roads that are to be used to form the Inner Ring Road may differ from the upgrade of roads that require the accommodation of the proposed LRT/BRT systems. The proposed upgrade and new roads can be seen in Figure 5.25.

New Roads

A number of new roads have been proposed to provide further enhanced connectivity. These roads have been identified as strategic additions to connect existing roads and alleviate congestion. In addition to the Circular Road and segments of road needed to complete the Inner Ring Road, new supporting Collector Roads connecting radial principal roads in new expansion areas will be required.

Upgraded Roads

In order to create a functional network system, existing roads need to be upgraded to support the traffic flows. These roads can be split into 3 different categories:

- Radial roads. Both primary roads that need to be widened, and collector roads that need to be upgraded to primary roads.
- Segments of road needed to complete the Inner Ring Road.
- Supporting Collector Roads connecting different scales of the road network.

New and Upgraded Junctions

In addition to the upgrade of existing roads and the creation of new roads, new/upgraded junctions will also need to be considered at intersections along the new road network. In total, 18 new junctions have been identified. Of these new junctions, 10 are required to provide connections to the Circular Road. More detailed studies are required at a later stage to establish the need for at-grade or grade-separated junctions.

Upgrading Roads (UR):

Policy UR1: Identified roads require upgrade in order to properly serve the proposed road network.

New Junctions (NJ):

Policy NJ1: 18 new/upgraded junctions are required to aid the proposed road network.

New Roads (NR):

Policy NR1: New roads are required to complete an interconnected radial road system.

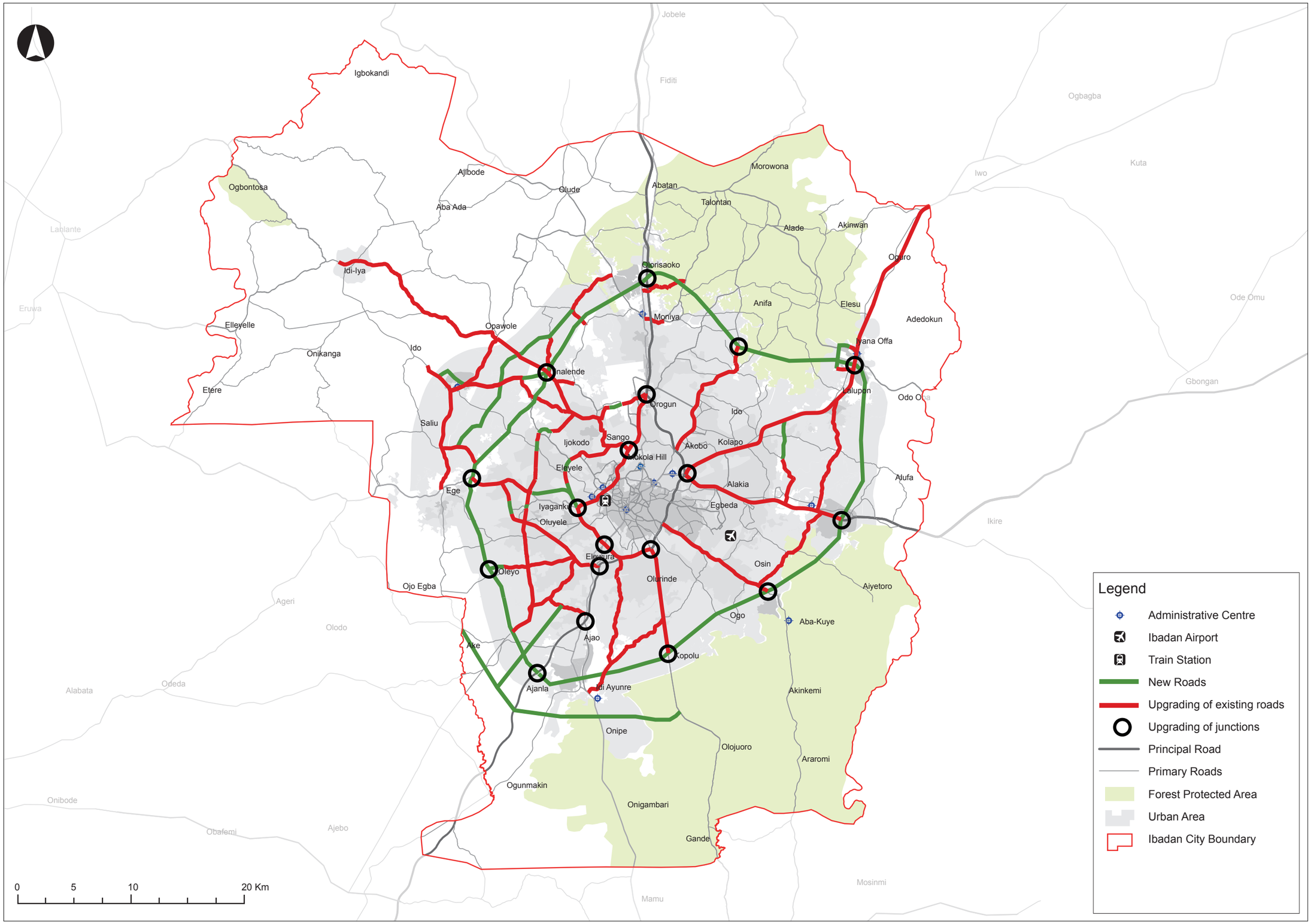

Figure 5.25: New Roads and Roads for Upgrade

5.2 PUBLIC TRANSPORT

This section discusses the proposed changes in the provision of public transport and the creation of a new public transport system in Ibadan. In order to reduce the reliance on the use of private vehicles which cause congestion and air pollution, the masterplan promotes the development of an integrated public transport system.

5.2.1 Existing Situation and Proposed Strategy

At present, Ibadan does not have an intra-city urban rail system, urban bus services are seldom used and the most common form of bus transport within Ibadan is the danfo, privately owned and operated mini-buses. In addition, there are taxis, keke napep and okada (motorcycle taxis). A strategy has been devised to facilitate the establishment of a coherent public transport network that will serve Ibadan.

This will be undertaken by introducing realistic short-term objectives that will pave the way for a long term vision where more advanced systems can be introduced in the future. Figure 5.26 shows the proposed routes for the mass transit network. The network aims to utilise the upgraded road network's alignment where available to connect the urban core, the 11 LGAs and the surrounding urban areas. By incorporating the public transport system with the road network, further expansion of the public transport network will be feasible in the future. In some cases, the proposed routes do not follow the road network but instead run parallel to the existing railway line. The proposed strategy is summarised below:

- Due to the lack of an intra-urban rail network, the masterplan proposes the introduction of a Mass Rapid Transit (MRT) network. The MRT will provide the backbone of the public transport system and will be incorporated into the proposed road network to provide better connectivity within Ibadan whilst making use of the existing infrastructure.
- In addition to this, a high quality bus network operated by high capacity vehicles should serve non-mass transit corridors, primary roads and collectors, and provide feeder services to the mass transit stops/stations. This can be delivered through franchising as is already the case in Lagos (LAGBUS).
- Ibadan lies on the Lagos-Kano-Nguru narrow gauge railway line, one of the two main lines in the Nigerian railway system. This line has suffered from decades of underfunding for maintenance and improvements and therefore requires upgrading to a sufficient standard to cater for Ibadan's growing population. Existing stations should be upgraded and additional stations with high quality interchange facilities should be incorporated near to the high density urban areas. A standard gauge rail line is currently being constructed along the existing route to increase capacity. This is incorporated into the proposed MRT network.
- Danfo is currently a very popular choice of public transport within Ibadan. The primary problem derived from the use of danfo is the congestion created due to informal stopping. The introduction of laybys for danfo is to be promoted so they are able to stop without creating further congestion; these will be placed in close proximity to the new junctions which have interchange services. This has been undertaken successfully in Lagos. The implementation of dedicated laybys will also allow for the creation of sheltered bus stops at waiting points to create a formal network for the danfo.
- There are a number of inter-city bus services for Ibadan. New stops should be placed in close proximity to each administrative centre and new interchanges/stations.
- The above should be supplemented by minibus/ taxi services in areas of lower demand.
- The development of a city-wide integrated public transport system for Ibadan will support the city's change to reducing polluting impacts and thereby improve air quality across the city.

5.2.2 Key Masterplan Proposals

MRT, also referred to as public transit, is a passenger transportation service, designed to carry large numbers of people, usually local in scope, that is available to any person who pays a prescribed fare. It frequently operates on fixed tracks or with separated and exclusive use of potential common track, according to established schedules along designated routes or lines with specific stops.[1] When choosing between the different public transit options, one has to consider cost (including cost of construction, rolling stock, and operation), planning and construction times, flexibility in implementation, passenger capacity, speed and institutional issues. The World Bank defines four generic forms of mass transit that currently exist in major cities as follows:

- Busways – these are generally segregated sections of roadway within major corridors, with horizontal protection from other traffic, and priority given over other traffic at junctions, which are generally signalised.
- Light Rail Transit (LRT) – this is at-grade, with similar horizontal protection to busways.
- Metros – these are fully segregated, usually elevated or underground. It is the segregation that is critical to providing a rapid service, and the technology that allows a high mass ridership to be carried.
- Suburban rail – these services are usually physically part of a larger rail network, usually at-grade and fully segregated.

1 Wright, L and Fjellstrom, K. 2003. Mass Transit Options. Sustainable Transport: A Sourcebook for Policy-makers in Developing Cities. Module 3a

Table 5.4: Public Transport / Transit Technologies *Source: Farr, 2008*, Kottenhoff, 2012.*

	BUS	ARTICULATED BUS	BRT	LRT	COMMUTER RAIL	METRO (HEAVY RAIL)
Cost* ($ million/ km)	0.25-1	0.5-1.25	2.5-35	15-40	1.75-15	30-155
Service Area	Regional / Urban	Regional / Urban	Regional / Urban	Regional / Inter-urban	Suburban	Regional / Urban
Station spacing (m)	300-500	300-500	500-800	500-800	2000+	800-2000
Maximum speed (km/hr)	70	70	70	70-80	80-130	80-100
Operating speed (km/hr)	10-20	10-20	20-35	20-30	40-70	25-60
Service freq (min)	3-10	3-10	3-10	5-15	15-30	5-10
Vehicle: length and width (m)	12, 2.5	18, 2.5	15-25, 2.5	14-32, 2.4-2.65	20-26, 2.5-3	16.23, 2.5-3
Vehicle/train capacity	1	1	1	1-4	1-10	1-10
Passengers / vehicle	80-100	115-150	150-200	200-250	180-200	250
System cap (Pass/Hr/Direc)	1,000-2,000	1,500-3,000	2,500-15,000	2,000-15,000	10,000	10,000-30,000
ROW	Mixed / bus lanes		Busways	Shared / separated	ROW	Separated
Power source	Diesel / hybird /biofuel			Overhead wire	Diesel / hybrid	3rd rail

In the conclusion on their research[2] on mass transit options, Wrigth and Fjellstrom state that there are few reasons for developing cities to favour rail-based systems where passenger capacities would be less than 25,000 passengers per hour per direction. Rail-based systems compared unfavourably with BRT systems on most terms, and especially for key parameters such as cost, flexibility, time frame and institutional demands. However, they add that there is no single 'right' transit solution, and that the best system for a city depends on the local conditions and preferences in technologies.

The MRT system proposal has been designed having in mind Ibadan's existing public transportation system, the forecast in population and the growing demands on the existing infrastructure. Implementing only one form of MRT throughout the city is not recommended. A more diverse offer creates opportunities in financing, as well as flexibility in the future.

Figure 5.26 shows the proposed network which evenly covers the existing and new areas of the city.

Bus Rapid Transit (BRT)

This form of MRT can be implemented in existing roads by retrofitting them, as well as in new ones, making it the most feasible option to operate in most lines. BRT systems always include some form of exclusive right-of-way for buses, and street profiles can be relatively adaptable. A possible scenario is to implement a BRT system that can be upgraded to LRT in the future.

Commuter Rail

Commuter or suburban rail services are mostly provided by general railway companies and they share track with freight and long-distance transport. The existing narrow gauge railway in Ibadan (on the Lagos-Kano-Nguru) can be rehabilitated and improved in order to accommodate the operation of a commuter system. This line would serve the city in the east-west direction connecting the new expansion.

Light Rail Transit (LRT)

LRT systems are comparable to BRT systems in terms of capacity, but can be designed to produce no local polluting emissions. As with BRT, LRT lines are usually segregated from other means of traffic by barriers or slightly elevated tracks, or by full grade separation. A previous study[3] (a rail mass transit) was produced for the Oyo State Government and serves as base for the masterplan proposed MRT network.Public Transport Termini and Interchanges

All MRT systems require interchanges with other elements of the public transport system, and integration with other modes of transport such as cars, walking and cycling. A terminal is proposed in close proximity to each administrative centre and its surrounding expansion area to make these areas easily accessible and to improve connectivity. In addition to these termini, interchanges are placed strategically along the network and key junctions have been identified as areas to place further interchanges. This can be seen in Figure 5.26.

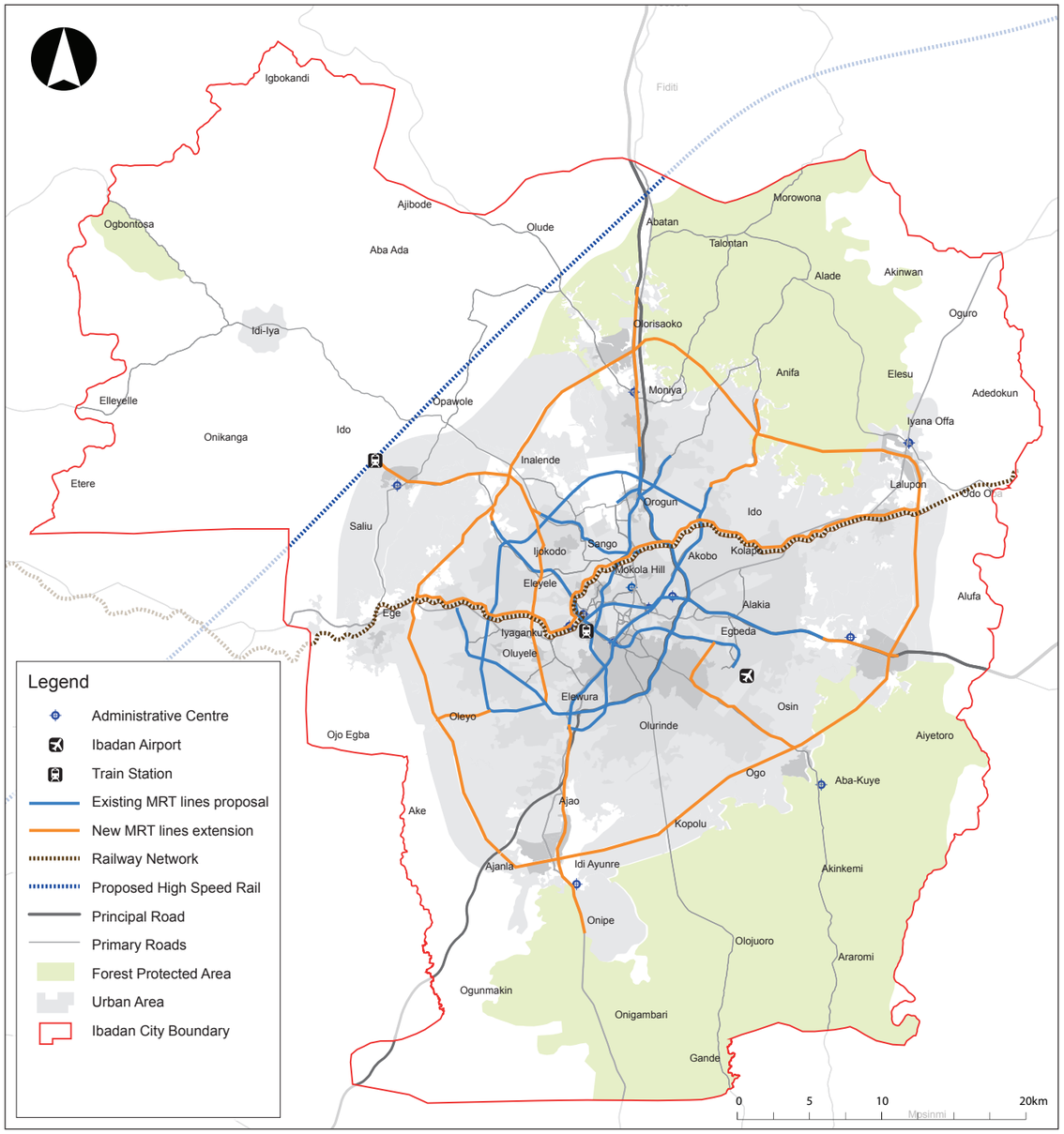

Figure 5.26: Mass Transit Network Concept

2 Ibid.

3 IBADAN Rail Mass Transit, CRCC, China Civil and CCECC Nigeria LTD.

5.2.3 High Speed Rail Link

A proposed high speed rail link from Lagos to Abuja will pass through Ibadan. It is understood that the alignment is intended to cross through the centre of Ibadan. The Ibadan City Masterplan proposes a realignment of this route for the following reasons:

- Crossing through the established urban area would lead to significant disruption to established communities as land is acquired for the rail line resulting in major population displacement along the chosen route;
- An alternative would be tunnelling, which could be considered in order to avoid disrupting established communities, but the length of tunnels would be significant and would require complex construction techniques. This would significantly increase the cost of the project;
- As high speed rail lines require networks that are as straight as possible, there is less flexibility to align the route to avoid all existing features of the built environment. This may have an adverse impact on heritage or other important local landmarks;
- Acquiring land on such a scale will significantly increase the cost of the project;
- A high speed route cannot allow for any direct crossing or the risk of public access onto the track infrastructure. It will require fencing either side to prevent any form of encroachment. This will result in the development of a significant physical barrier right through the centre of Ibadan;
- Crossing the high speed line will only be possible via bridges or tunnels, further adding to the overall project costs.

A new a station on the outer fringes of Ibadan is proposed, which will be in close proximity to the Ido Growth Centre. From here, passengers will be able to use the intra-city public transport network as a terminal and interchange will be located at the high-speed rail station. The creation of this station on the outskirts of Ibadan will help promote high and medium density development close by and presents the opportunity to turn the Ido Growth Centre into a development hub. The proposed alignment of the rail line and the station can be seen in Figure 5.26.

An alternative would be to provide a high speed terminus station rather than a through station, located in the centre of Ibadan, probably using the existing rail alignment. Such a solution, however, would mean that Ibadan would only be served by a smaller number of the high speed train services which terminate at the city, as many would simply bypass the city en route to/from Lagos and Abuja.

Public Transport (PT):

Policy PT1: A BRT/LRT system will be introduced as a mass-transit public transport service.

Policy PT2: New interchanges, stations and termini will ensure seamless transit from one system to another.

Policy PT3: When upgrading existing roads and constructing new roads, designated areas for Danfo Laybys and bus stops will be implemented to ease access to and use of public transport.

Policy PT4: The existing Lagos-Kano-Nguru narrow gauge railway line and stations will be upgraded within the city of Ibadan and will be supported with the creation of new stations close to high density urban areas in order for the network to form part of the inner city transit network.

5.2.4 Integration of Public Transport Within the Road Network

As part of the mass transit public transport network, there is potential to incorporate a BRT or LRT service into the Circular Road. This service could run in both directions, creating an extensive public transport network to aid the intra-city networks proposed previously. At intersections with the radial roads, interchanges would be placed to allow users flexible change between the networks.

There are various options available for the integration of the public transport network into the Circular Road. These are discussed subsequently. Similarly, the Inner Ring Road and upgraded roads could also employ these options if public transport is to be integrated into their road cross-sections.

All of the proposed options fit within the 60 metre road section currently assigned to the Circular Road. Whilst the road cross-sections do not occupy the full 60 metre right-of-way, this width should be kept to allow for upgrade and expansion in the future.

There will be the need to consider the relationship between the MRT and road users, in order to avoid conflicts, particularly if a rail-based system is implemented. There may be a need to elevate the system at certain points to a height where vehicles can pass underneath.

Badagry - Lagos Expressway

The Badagry-Lagos Expressway can be cited as a useful precedent for the creation of the Circular Road. This upgraded road section is a 12-lane road, performing various functions: a public transport corridor with 2 lanes per direction providing both LRT and BRT services, 2 access lanes per direction and 2 tolled lanes per direction. Green buffers break up the various modes of transport to avoid potential conflicts and improve aesthetics. Figure 5.27 provides an illustration of this road's section.

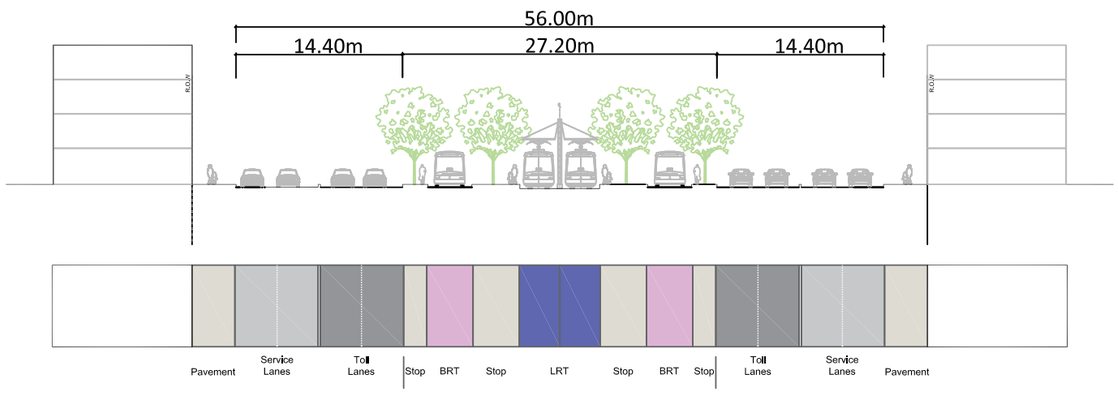

Figure 5.27: Badagry Expressway Upgrade

Circular Road Option 1 - Public Transport Integrated in Access Lanes

An 8-lane road with 2 express lanes and 2 access lanes per direction. A large central median separates the direction of traffic and a division is created between the express and access lanes. The reservation between the express and access lanes can vary in size where necessary and can be removed in sections to allow easy transfer between the 2 types of lane. Planting separates the road from a wide pavement which could integrate the use of cycle lanes if desired.

With no dedicated lane for BRT, this option does not provide a BRT system, although it shows how non-BRT services can operate. This option utilises the local lanes on the Circular Road for bus routes. Buses would be permitted to use the local lanes, although should not use the express lanes in order to allow a constant, fast moving flow of traffic. Stops would be located along the Circular Road with a layby for stopping buses so as to not affect the moving traffic. Laybys and bus stops are a necessary component so that a formal network is established.

Strengths

- Lowest upfront cost.
- Public transport stop adjacent to pavement which allows pedestrian accessibility.

Weaknesses

- Highest future costs if LRT is to be retrofitted.
- No dedicated lane for BRT.

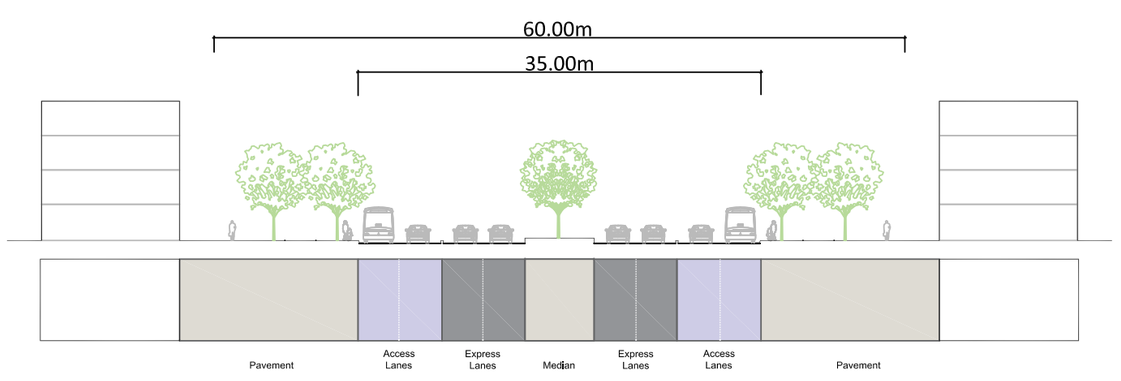

Figure 5.28: Road Cross-Section for Circular Road: Public Transport Integrated into Access Lanes

Circular Road Option 2 - Dedicated Central Lanes for Public Transport

A 10-lane road containing 1 lane per direction for BRT and a central reservation with platforms/stations, 2 express lanes per direction and 2 access lanes per direction. Planting separates the road from the pavement.

In this option, dedicated lanes are assigned alongside the median of the road, permitted only for bus use. The central median would widen at points to create platforms for bus stops where users can easily get on or off and switch directions if desired.

This option allows for easy adaptation to a LRT system in the future.

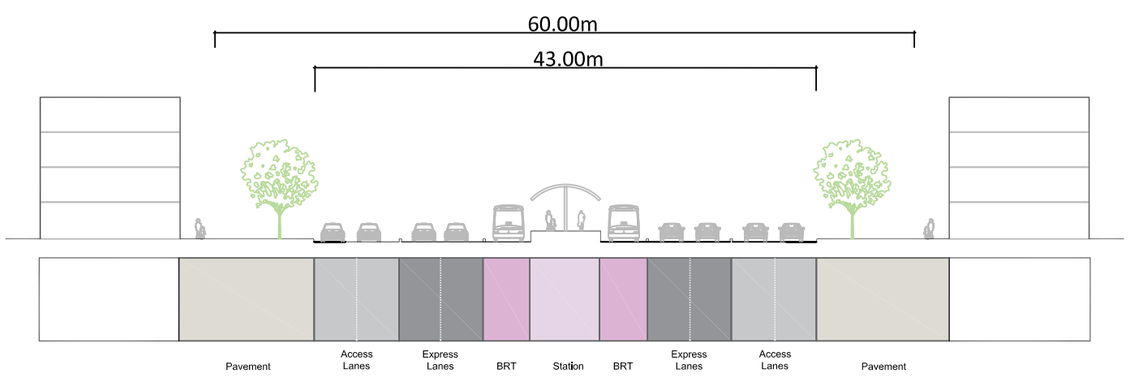

Figure 5.29: Road Cross-Section for Circular Road: BRT in Dedicated Central Lanes



Figure 5.30: Public Transport Corridor with BRT Lane, Peru

Strengths

- Dedicated lanes for BRT - less conflict between transport modes.
- No breaks needed in BRT lane.
- Central platform allows users to easily use BRT services in either direction.
- Lowest cost to upgrade to LRT in the future.

Weaknesses

- Difficult for pedestrian access - potentially higher infrastructure costs to make accessible for users, e.g. bridges.
- Passengers are affected by air pollution at transit stops.
- Largest upfront cost

Circular Road Option 3 - Dedicated Exterior Lanes for Public Transport

A 10-lane road with 2 express lanes per direction, 2 access lanes per direction and 1 lane per direction adjacent to the pavement for BRT. Vegetated barriers separate the road from the pavement and can also be incorporated into the median or the division between public transport lanes and private vehicle lanes.

Similar to option 2, this option provides dedicated lanes for the BRT system. In this case, the bus lanes run alongside the pavement on the exterior of the right-of-way. Bus stops would be located on the pavement allowing easy access from the adjacent developments.

In the future, the median could be adapted to create a public transport corridor centrally to incorporate LRT and lanes would be reclassified accordingly to place public transport centrally.

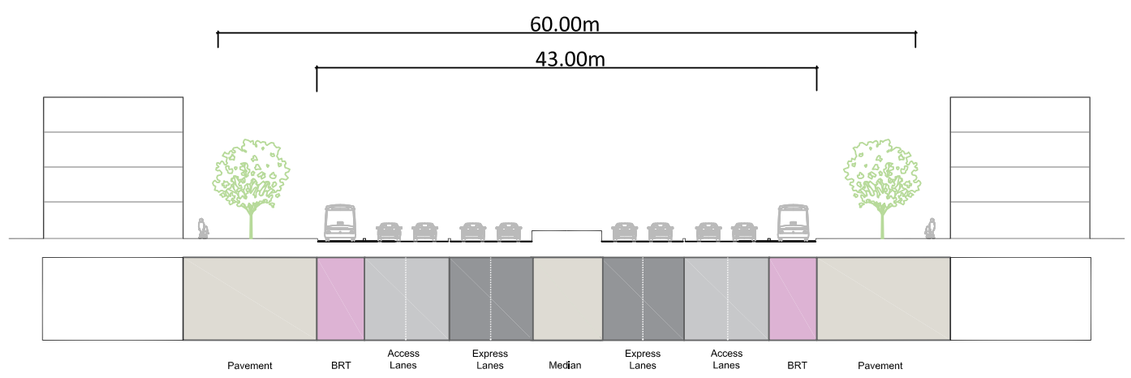

Figure 5.31: Road Cross-Section for Circular Road: BRT in Dedicated Exterior Lanes

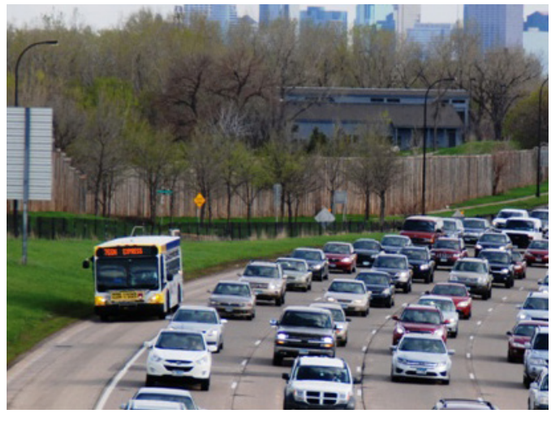

Figure 5.32: BRT in Exterior Lane, Minneapolis

Strengths

- Dedicated lanes for BRT - less conflict between transport modes.
- BRT stops adjacent to pavement which allows good pedestrian accessibility.

Weaknesses

- Breaks needed in BRT lane from side roads/ access points.

5.2.5 Water transportation

The city of Ibadan has a dense network of rivers and streams; most are seasonal such that the volume of water is reduced during the dry season and increased when the rain sets in with a peak flow during the month of August. Seasonal variations in the depth of these waterways and other physical constraints (Figure 5.33 to Figure 5.36) mean it is not feasible to develop them as reliable water transport routes that can operate all year round. This is an important factor to take into account when proposing a water transportation network that is feasible for the city.

While major rivers such as the River Ogunpa or the River Omi cross the city strategically in a north-south direction, their adaptation into a viable water route might be costly, and their capacity and efficiency would be unable at present to make them competitive compared to road transportation. Nevertheless, further studies are necessary to determine the feasibility, costs and potential ridership of such services as they should be considered an alternative for transportation in the near future once Ibadan's road transportation has been reorganised.



Figure 5.33: Shallow Waterway in Ibadan



Figure 5.34: Stepped Waterway in Ibadan



Figure 5.35: Shallow Waterway in Ibadan

Eleyele Lake

Eleyele lake presents an opportunity to improve the connectivity in the north-west of the city (Figure 5.36). The potential of this natural area has yet to be explored. Using water as a mode of transportation and connecting jetties to other modes would result in shorter travel times for the people living in the area.

The key for a successful water transport system in the lake, is the interface with different modes of transportation. Bus stops of main bus routes located on the edge of the lake on strategic locations could be interconnected with the installation of jetties. Passengers and goods could cross the lake with water taxis, boats and ferries. People living and working on one side of the lake would not have to travel long distance by roads to reach the other side.

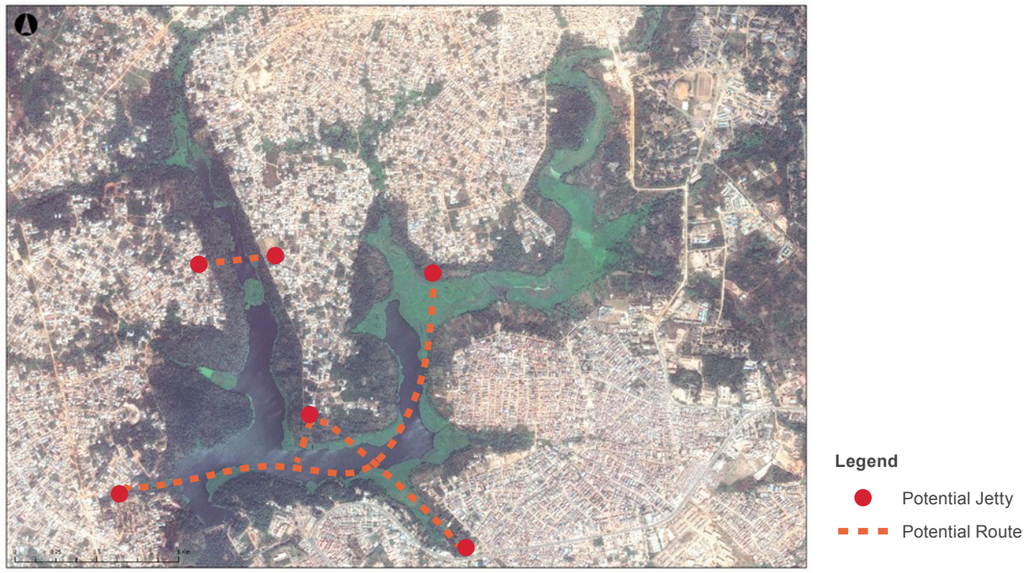

Figure 5.36: Eleyele Lake proposed waterways



Figure 5.37: Parked water taxi in a lake *ShutterStock*

5.3 NON-MOTORISED TRANSPORT

Non-Motorised Transport (NMT) modes (walking and cycling) should be promoted as alternatives to the car for shorter journeys. This section looks at the various aspects of the masterplan that will contribute to the pedestrian and cycle networks in Ibadan.

Pedestrian and Cyclist Strategy

In order to promote a sustainable ethos for the city, it is important to encourage non-motorised forms of transport. The main barrier to the adoption of NMT as a significant mode of transport would be the lack of dedicated facilities. Despite walking being the most common mode of transport, it is rarely recognised and too often the environment for pedestrians is unattractive and unsafe. A large emphasis must be put on making the environment comfortable for walking. Pavements need to be wide where possible, free of clutter, and safe from passing vehicles.

Outside the height of the wet season, climatic conditions are generally favourable for walking and cycling with long daylight hours and warm temperatures. NMT has numerous benefits which include reducing congestion on the road network, reducing air pollutants and emissions, and general improvements to public health.

The strategy aims to utilise these proposed flood corridors as routes of travel for NMT, connecting key nodes on a local level and creating safe areas for pedestrians and cyclists.

In addition, the masterplan proposes that all new and upgraded roads incorporate sufficient space for pedestrians and cyclist, and that street design at the local level also provide space for safe movement on foot and by bicycle.

Main Flood Corridor Routes

As part of the flood protection aspect of the masterplan, main water sources that are prone to flooding have been assigned protection zones in hich restrictions on development are implemented. These areas can double up as green corridors that dissect the city's urban area, creating large green spaces for pedestrians and cyclists.

A number of open spaces have also been identified in the flood prone areas as informal and formal green spaces. It is proposed connect these nodes with pedestrian and cyclist friendly routes to promote NMT. In connecting these spaces, a network for pedestrian and cyclists will be created across the urban area.

Upgraded and New Roads

All future roads in Ibadan will be designed to incorporate sufficient space for pavements to allow safe travel for pedestrians, as well as space for cyclists (either on-street or along dedicated cycle lanes). Drainage facilities that run adjacent to roads can double-up as pavement space.

Pedestrian and Cyclist Friendly Initiatives at a Local Level

Sufficient space for pedestrians and cyclists should be incorporated into the design of all streets. Additionally, each LGA should be responsible for promoting the use of non-motorised travel for short distances in order to reduce car emissions and reduce congestion issues in the denser urban areas.

5.3.1 Cycling Design Principles

Cycling should be a feasible option for people of all ages and abilities. As such, suitable infrastructure should be put in place to help guide and protect cyclists. Measures to manage the volume and speed of motor vehicles, along with specific and well-planned cycle schemes, will help to encourage cycling.

It is proposed that cycle-ways shall be provided on the Primary and main Collector Road networks. Lower order roads will be designed to deliver low vehicle speeds such that cycling may take place safely on the road. Dedicated facilities may be appropriate where numbers of cyclists are likely to be particularly high, such as adjacent to educational facilities, health facilities, and shopping areas.

For the design of cycling infrastructure, the following principles apply:

- Direct – Cycling facilities should provide routes which are direct and convenient for users. Bicycle journeys should be attractive and easy to navigate.
- Attractive – Recognising and valuing the importance of attractive public spaces and cycle routes in encouraging more cycle trips, appropriate behaviour and a sense of place.
- Safe – Cycle routes should be visibly safe to encourage cycle trips. Segregation and facilities for cyclists such as advanced cycle stop lines at junctions give a clear indication that cycle journeys can be made safely.
- Connective – Provide a comprehensive network of cycle routes taking into consideration travelling patterns. Routes can be made up of off-carriageway cycle tracks, cycle lanes, shared use facilities and segregated paths.

5.3.2 Walking Design Principles

Footways will be provided alongside all roads, along with safe crossing facilities. Local areas will be designed to keep vehicle speeds low and encourage movement on foot.

The key principles for pedestrian infrastructure are as follows:

- Context – Creating attractive public spaces by appreciating differences between one place and another, instilling a respect for local heritage and using innovative approaches to create environments that are conducive to on-street civic activities;
- Accessibility – Ensuring that walking routes are convenient and available to all pedestrians, with the minimum of unnecessary deviations and obstacles;
- Comfort – Context-sensitive solutions are required, such as ensuring footways are of a sufficient width to accommodate pedestrian flow and providing shading in open areas;
- Security – Improving pedestrian security through soft measures such as providing walking routes with clear sight lines and adequate, vandal-proof lighting at night;
- Legibility – Providing pedestrians with a clear indication of where they are and how they can get to their destination through the form of the pedestrian space, respecting pedestrian desire lines and by providing on-street information and signage.

Pedestrians and Cyclists (PC):

Policy PC1: The development of non-motorised modes of transport will be promoted.

Policy PC2: Pavements will be widened where possible and new roads designed to integrate wide pavements and cycle paths.

Policy PC3: Pavements are to be maintained and kept free from clutter and safe from passing vehicles.

Policy PC4: The flood plain protection areas will be used as green corridors for pedestrians and cyclists.

Policy PC5: An extensive pedestrian and cyclist network that connects the green spaces in and around Ibadan will be created.

Typologies for Pedestrians and Cyclists

Various options for pedestrian and cyclist routes, whether along green corridors or at a street level, have been considered to improve safety and atmosphere. A number of key actions will need to take place in order to improve the current situation, as follows:.

1. At present, the road's right-of-way is often shared by all modes of transport and a pavement is not established in many areas.
2. The creation of pavements (or the widening of existing ones) should take place to give pedestrians a designated zone.
3. Trees can be used as a physical barrier between pedestrian and vehicular traffic to improve safety.
4. Roads and pavements should be properly maintained with the removal of clutter needed to ensure a comfortable environment for pedestrians.
5. The flood plain protection zones dissect the urban area and can double-up as green corridors for pedestrians and cyclists.

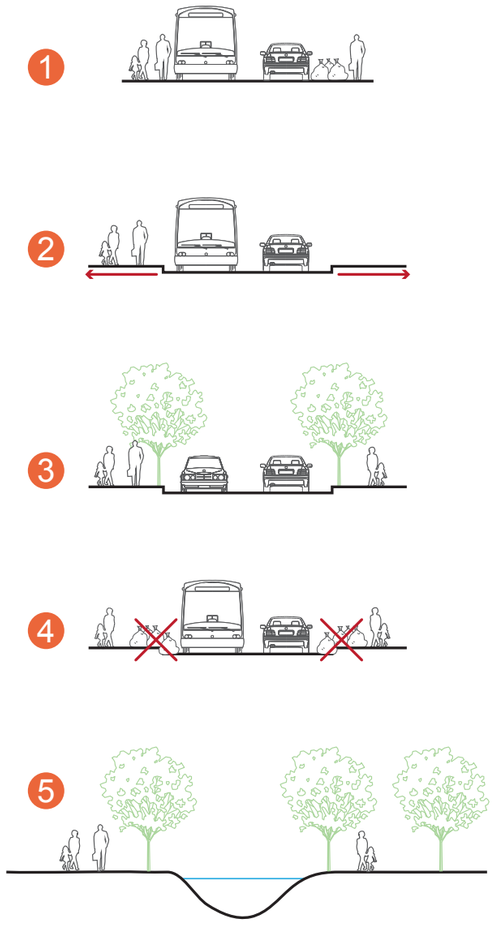

Figure 5.38: Pedestrian and Cyclist Typologies

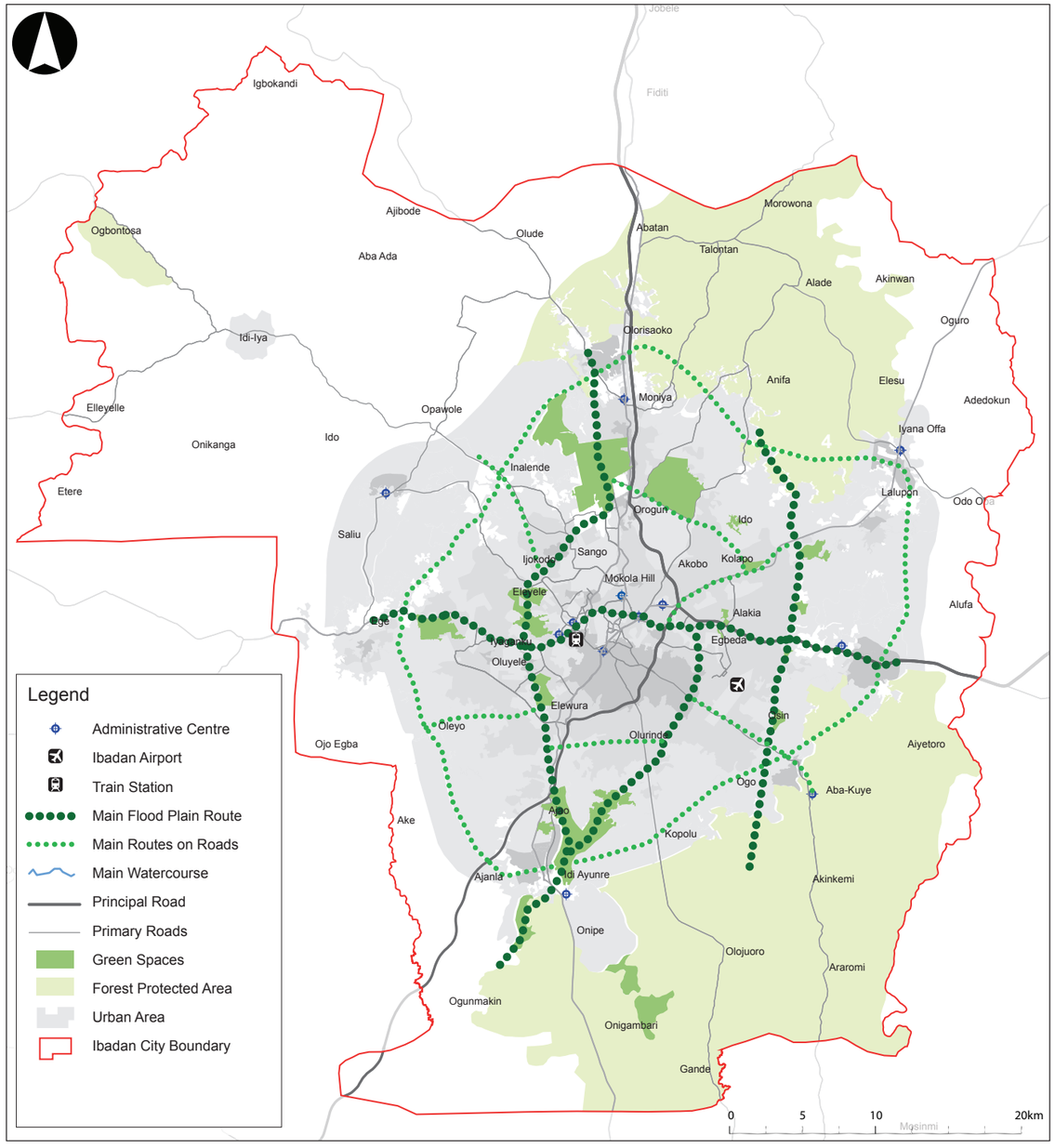

Figure 5.39: Main Pedestrian and Cyclist Network

5.4 TRANSPORT ASSESSMENT

5.4.1 Introduction

Objectives and Scope of the Transport Assessment

This Transport Assessment (TA) has been carried out to confirm the strategic road and public transport networks and infrastructure that will be required to accommodate travel demand in Ibadan up to 2036 based on the development proposals of the Ibadan City Masterplan. Thus, the TA has estimated the demand for movement associated with the land use proposals of the Masterplan and assessed the impact of that demand on the transport networks proposed in the Masterplan. Recommendations have been made regarding the capacity required on those networks, including recommendations for appropriate cross-sections, right-of-ways for strategic roads and appropriate modes for the operation of mass transit routes. The TA has considered all modes of transport, including road, rail, bus and water transport.

The TA study commences with an analysis of the existing transportation demand, based on the traffic and transportation surveys. A strategic traffic model iss then developed to represent traffic movements within Ibadan. That model has been validated against the survey data to ensure that it replicates the existing demand on the road network to an acceptable level. The model has then been used to forecast future traffic movements based on the land use proposals of the Masterplan, and the strategic transport infrastructure and services required to accommodate that demand has been analysed.

Finally, the strategic transport policies required to support the delivery of a sustainable transport system for Ibadan have been considered.

5.4.2 The Existing Situation

Existing Transport Infrastructure and Services

This section summarises the existing transportation infrastructure and services, based on the findings of the Ibadan City Masterplan Diagnostics Report.[4]

The Road Network

The existing road network is shown in Figure 5.40. The current road network has evolved around the urban core with minimal planning. Combined with increasing car ownership, this has given rise to serious congestion and parking problems, especially in the centre of the city. As the city expands with additional population and employment opportunities, traffic levels will inevitably increase which will exacerbate these issues.

In terms of strategic accessibility, Ibadan benefits from its location with respect to the national road network. The Lagos-Ibadan-Ojoo Expressway (A1), part of the Trans-African Highway network, passes through the city and provides a direct route for traffic, in particular heavy goods vehicle traffic.

Within the city, the road network is structured around a series of radial roads linking the outlying areas with the central area of the city. The main road network is of a good standard, generally made up of dual-carriageway roads with two or three lanes in each direction. The roads are largely in good condition, albeit with some evidence of localised surface deterioration.

Progress has been made in improving traffic management for controlling the city's road network. Examples include increasing the numbers of road traffic signs, improved levels of street lighting and the introduction of one-way schemes.

However, localised traffic congestion can occur, most often adjacent to areas of more intensive commercial activity. Congestion is made worse by the encroachment of retail activities on the roads, high levels of on-street parking, and stopping/manoeuvring by buses and taxis.

Junctions

Junctions generally consist of simple at-grade priority junctions, with some roundabouts in the more densely urbanised areas. Flyovers have been introduced at major junctions to increase junction capacities. Traffic signals have been installed at key 'bottleneck' locations and these are progressively being converted to be solar-powered to provide reliable power supplies and ensure continuity of operation.

Planned Improvements to the Road Network

The Ministry of Transport and Works has an on-going state-wide programme of road improvements which includes the refurbishment and upgrading to dual-carriageway standard of several main roads within Ibadan. The roads which are undergoing widening include:

- Idi Ape-Akobo-Odogbo Barracks Road
- Gate-Old Ife Road-Airport-Alakia Road
- Oke-Adu Junction-Gate-Iwo Road Interchange

4 Dar, 2017.

Circular Road

The Ministry of Transport and Works has a proposal for a new outer orbital road for Ibadan, the Circular Road. This will be a 110km long expressway.

Parking

Within the main commercial area of Ibadan there is minimal provision of public off-street parking facilities. Off-street parking that is provided is generally associated with private businesses. Levels of on-street parking are consequently high, often occupying the entire kerbside and giving rise to capacity and movement issues along the roads.

Public Transport

Inter-Urban Public Transport

The Lagos-Kano-Nguru narrow gauge railway line runs through Ibadan. There are two stations within the city. A standard gauge line is being constructed alongside the narrow gauge line, with the section from Lagos to Ibadan due to be completed by 2018. This will address the current issues of low service frequencies and slow and unreliable journey times.

Ibadan lies on the route of the proposed Lagos-Abuja high speed rail line.

A number of inter-urban bus routes also serve the city while domestic flights to Abuja and, less frequently Lagos, operate from Ibadan Airport.

Urban Public Transport

Public transport within Ibadan is road-based and mainly privately-operated. The most widely used form of public transport is the danfo (minibus). These are privately owned and operated and have routes serving local areas throughout Ibadan. They pick up and drop off on an ad-hoc basis and as a result frequently cause congestion when passengers are boarding and alighting in busy areas.

More formal urban bus services are operated by Pacesetter Transport Services with a fleet of around 79 buses. Other popular forms of public transport include taxis, keke napep (three wheeled vehicles) and okada (motorcycle taxis).

Termini and Interchanges

The main public transport termini and interchanges are located along the main radial roads and are clustered towards the centre of the city, and close to the main commercial areas of the city.

The main interchange locations include the airport, railway stations and designated bus stops. At all rail stations there are facilities to interchange to other public transport modes, such as buses, taxis, danfo, keke napep and okada.

There are defined bus and taxi interchanges. However, in most cases these are also used by large numbers of okada.

Improvements to Urban Public Transport

The State Government has proposals for a light rail system for Ibadan (shown in Figure 5.73). This will initially comprise a line running from Ojoo to Mokola, passing through Ibadan and ending at the Lagos-Ojoo Expressway. The Red Line forms the first phase and is approximately 12km long running south to north from the Toll Gate area of the Expressway to the Dandaru area of central Ibadan.

A Memorandum of Understanding has been signed for the construction of the light rail line with the project expected to be completed over a three year period.

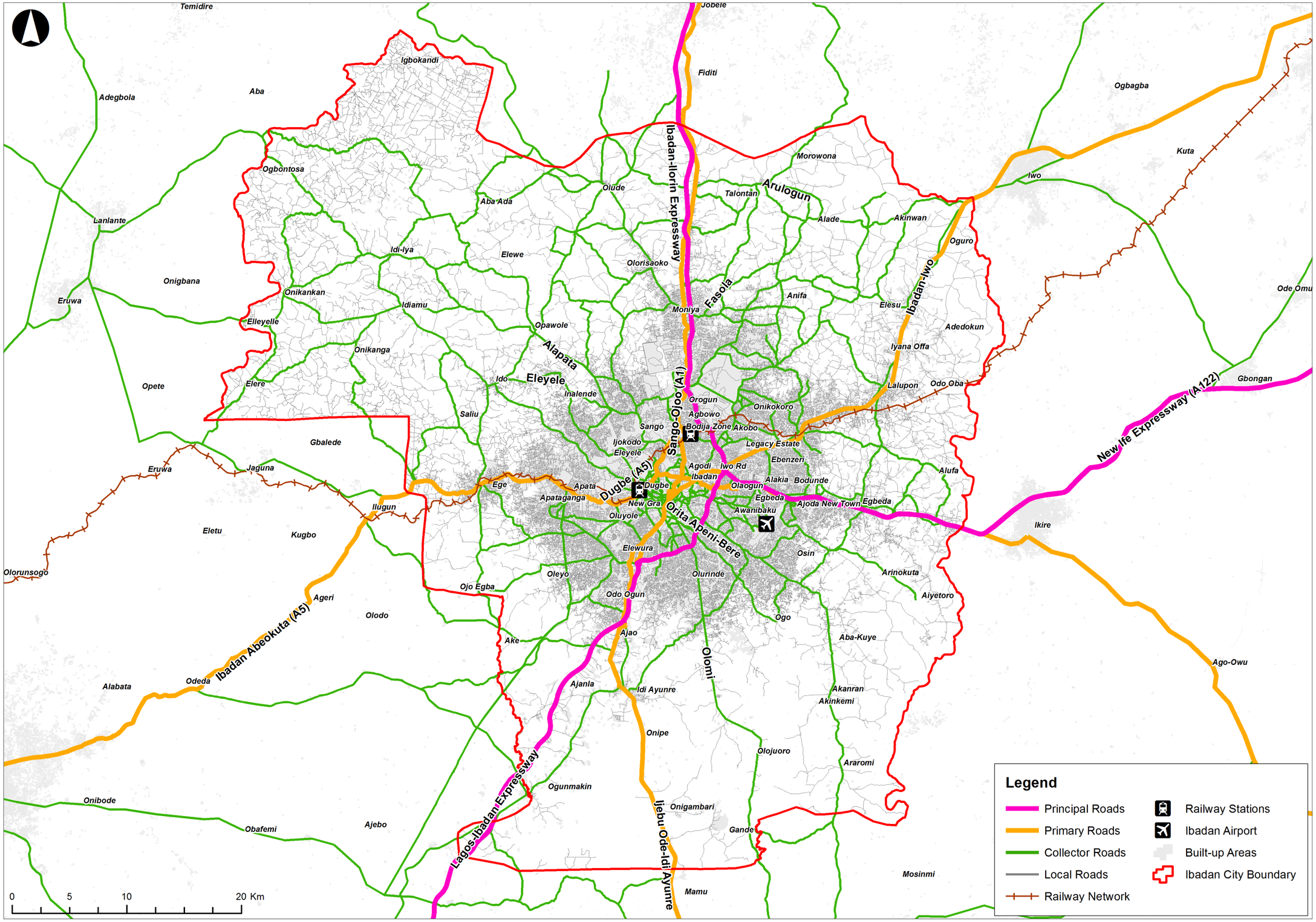

Figure 5.40: Existing Road Network within Ibadan

Provision for Walking

High levels of pedestrian activity are observed in Ibadan, in particular around the commercial areas and market places. The provision of dedicated pedestrian facilities is inconsistent and infrequent. There are a number of footbridges and at-grade crossing facilities, generally around the urban centre.

Provision for Cycling

Low levels of cycling are observed within the Ibadan area; there are no dedicated facilities or infrastructure for cyclists.

Traffic Survey Locations

In order to evaluate the baseline conditions for transportation in Ibadan, the consultants conducted traffic surveys that comprise of Manual Classified Counts (MCC), Public Transport (PT) Occupancy Surveys, Journey Time Surveys (JTS) and Road Side Interviews (RSI) were conducted. The survey data has provided the basis for validating the transport demand mode. The survey locations have been selected based on site reconnaissance and input from key stakeholders.

The surveys were carried out during September and October 2016, outside of any major holiday periods to ensure normal traffic conditions. These surveys are considered adequate to provide a baseline for the traffic model.

Manual Classified Counts and Public Transport Occupancy Surveys

MCC and PT occupancy surveys were carried out on a basis of 15-minute time intervals between 06:00 to 22:00, in standard weekday conditions during October 2016. The surveys were carried out at the 10 locations shown in Figure 5.41 and listed in Table 5.5. The locations were chosen to cover the major routes through Ibadan, where traffic density is highest.

Table 5.5: Manual Classified Count (MCC) Locations and Times

MCC NUMBER	LOCATION	TIMES OF SURVEY	DURATION
1	Expressway between Akande Street and Jakan Street (2 lane dual)	0600 - 2200	16 hours
2	Iwo Road at Fidelity Bank (2 lane dual)	0630 - 0900	2.5 hours
3	E1 at Koloko – Lagos – Ibadan Express Link Road (2 lane dual)	1600 - 1900	3 hours
4	Orita Aperin-Beere Road at Alagbede Street and Owode Street (2 lane)	0630 - 0900	2.5 hours
5	Ibadan – Abeokuta Road at Rinsayo Oil (2 lane dual)	1600 - 1900	3 hours
6	A1 south of Opo Street (2 lane dual)	0630 - 0900	2.5 hours
7	Secretariat – Agodi Road north of Bodija Market Road (2 lane dual)	1600 - 1900	3 hours
8	Queen Elizabeth 2 Road west of Omolewa Avenue (2 lane dual)	0600 - 2200	16 hours
9	A1 – Old Lagos Road / Orita Challenge Road (2 lane)	0630 - 0900	2.5 hours
10	Expressway at Tollgate / Federal Road Safety Commission (2 lane dual)	0600 - 2200	16 hours

Vehicles were classified as either private or public vehicles. Private vehicles were broken down into the following classifications:

- Car;
- Van/Pickup;
- 2 axle truck;
- 3 axle truck;
- 4+ axle truck;
- Bicycles; and
- Other.

Table 5.6 shows the classification of public transport vehicles for the MCC and how occupancy was recorded for each in the occupancy surveys.

Table 5.6: Classification of public transport vehicles and recording of occupancy

PUBLIC TRANSPORT VEHICLES				
MOTORCYCLE	TAXI	KEKE NAPEP (TRICYCLE)	DANFO (MINIBUS-10 SEATS)	STANDARD BUS (40 SEATS)
Empty	Empty	Empty	Empty (0 pax)	Empty (0 pax)
	Low	Low	Low (1-3 pax)	Low (1-10 pax)
			Medium (4-8 pax)	Medium (1-30 pax)
Full	Full	Full	Full (8+ pax)	Full (30+ pax)

Road Side Interviews

Road Side Interviews (RSI) were carried out at the locations shown in Figure 5.41 and Table 5.7.

RSIs were conducted during a 16 hour period between 06:00 to 22:00, in standard weekday conditions during September and October 2016. At each of these RSI locations an MCC was carried out during the same time period.

Table 5.7: Locations of Roadside Interviews

RSI NO.	LOCATION
RSI01	Between University of Ibadan – Ajibode Road and E1 Roundabout (Southbound)
RSI02	Between Army Barracks Primary School Road and Guinness Roundabout (Westbound)
RSI03	Basorun Road between A5 and E1 Roads (South-west bound)
RSI04	A1 between MKO Abiola Way and Liebu Bypass (North-east bound)
RSI05	A5 between MKO Abiola Way and Jibowu Crescent (Eastbound)
RSI06	New Garage Road west of A1 Roundabout (Eastbound)
RSI07	Olomi Road between E1 and Orita Aperin-Beere Road (Northbound)
RSI08	Orita Aperin-Beere Road between E1 and Apenin road (North-west bound)
RSI09	New Eleyele Road west of Sango Eleyele Road (Eastbound)
RSI10	Ijokodo Apete Road between Bookshop Road and Papa Street (Southbound)

Journey Time Surveys

Journey time surveys were carried out on eight routes covering the main road network, as shown in Figure 5.41 and Table 5.8. Surveys were carried out in both directions on a weekday in October during three periods: 06:30 to 09:30, 11:30 to 14:30 and 16:00 to 19:00. A minimum of 2 runs were completed in each direction in each time period. The recorded journey times were used in the model validation process, to ensure that the average vehicle speeds in the model were in line with those observed during the peak periods in Ibadan.

Table 5.8: Journey Time Survey Routes

JOURNEY TIME IDENTIFIER	ROUTE – DIRECTION 1	ROUTE – DIRECTION 2
Black Line	A5 at Ibadan-Eruwa Road to Old Ife Road (A122)	Old Ife Road (A122) to A5 at Ibadan-Eruwa Road
Brown Line	Sango Eleyele Road to Igbona Village	Igbona Village to Sango Eleyele Road
Pink Line	A1 / Quarry Road to Mokola Roundabout	Mokola Roundabout to A1 / Quarry Road
Blue Line	A1 / E1 Intersection to A1 Quarry Road	A1 Quarry Road to A1 / E1 Intersection
Yellow Line	A1 at Kenneth Dike Road to A1 Road at Ijebu Ode-Idi Agunre Road	A1 Road at Ijebu Ode-Idi Agunre Road to A1 at Kenneth Dike Road
Green Line	Ogunmola Street at the A1 to Arulogun Road	A1 to Arulogun Road to Ogunmola Street at the A1
Orange Line	Iwo Road at Basorun Road to Owobowale Road	Owobowale Road to Iwo Road at Basorun Road
Dark Blue Line	Esu Awele-Oja Obu Road at A1 to Odi Odeyale Road	Odi Odeyale Road to Esu Awele-Oja Obu Road

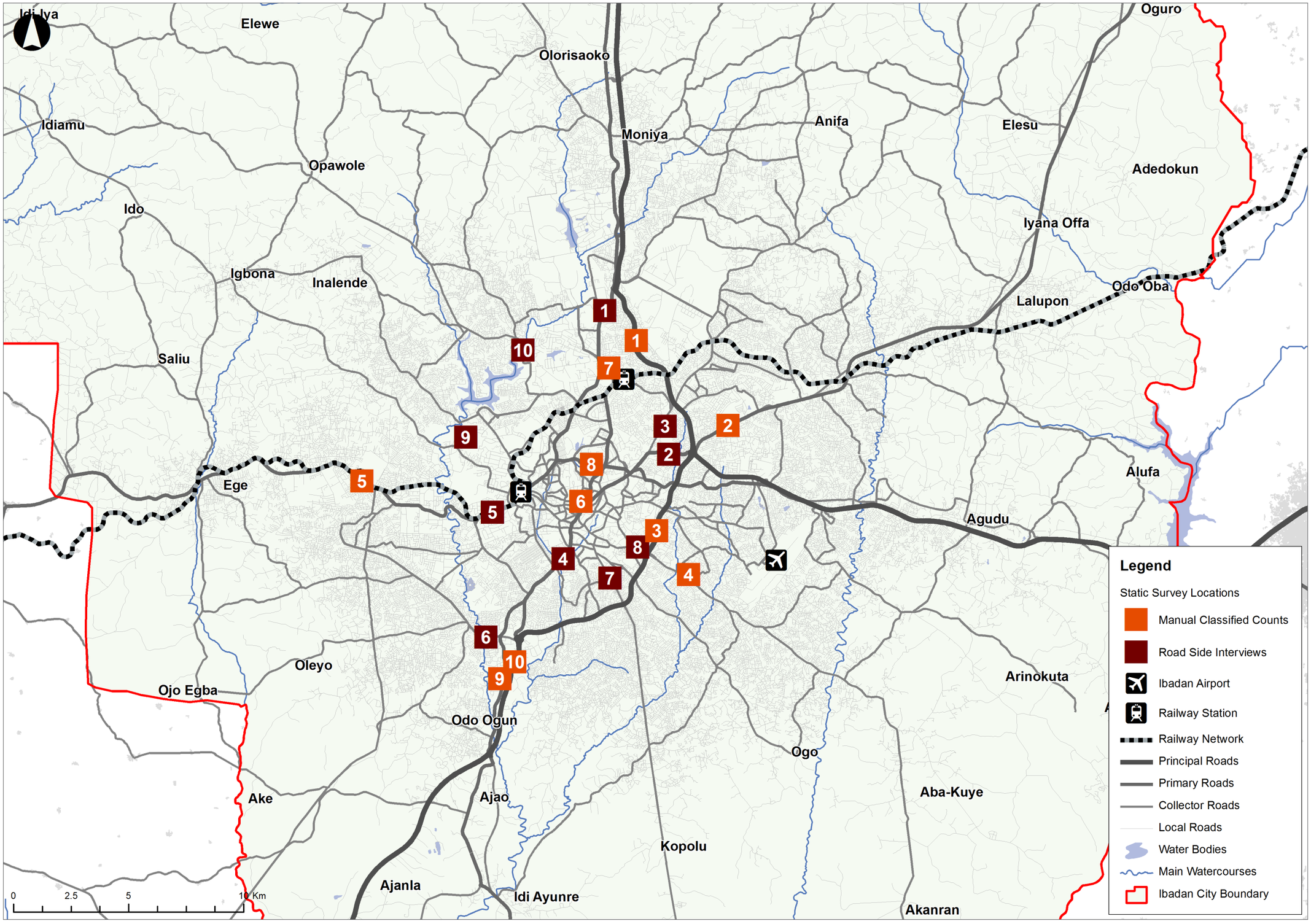

Figure 5.41: Static Survey Locations (MCC, RSI, PT)

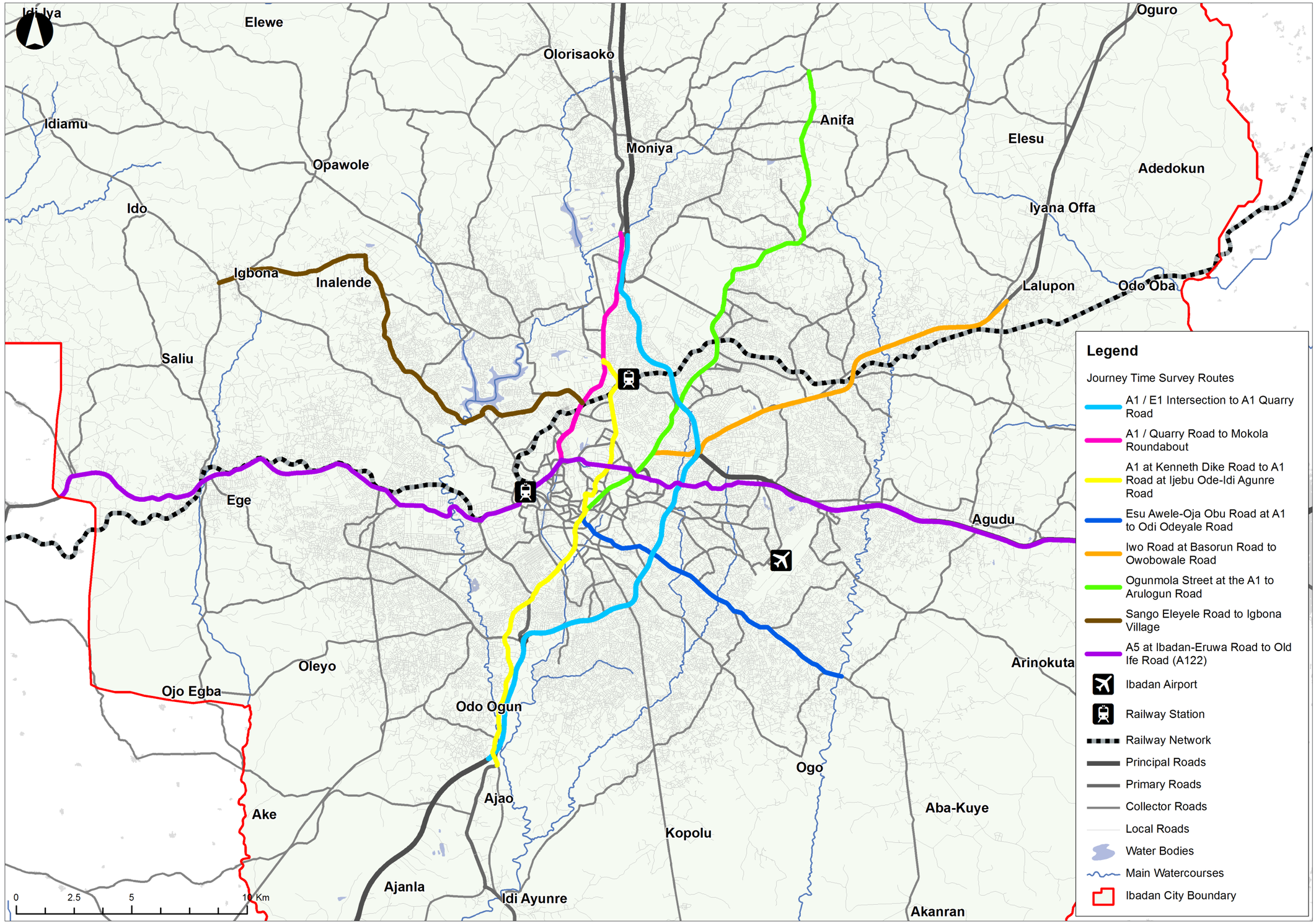

Figure 5.42: Journey Time Survey Routes

Traffic Survey Analysis

Peak hour traffic flows

Traffic flow data was recorded at twenty sites on the Ibadan road network, comprising of 10 sites with MCC only and 10 sites with MCC and RSI. At some MCC-only sites flows were recorded during one peak period only.

Peak hour observed flows are shown in Figure 5.43 and Figure 5.44.

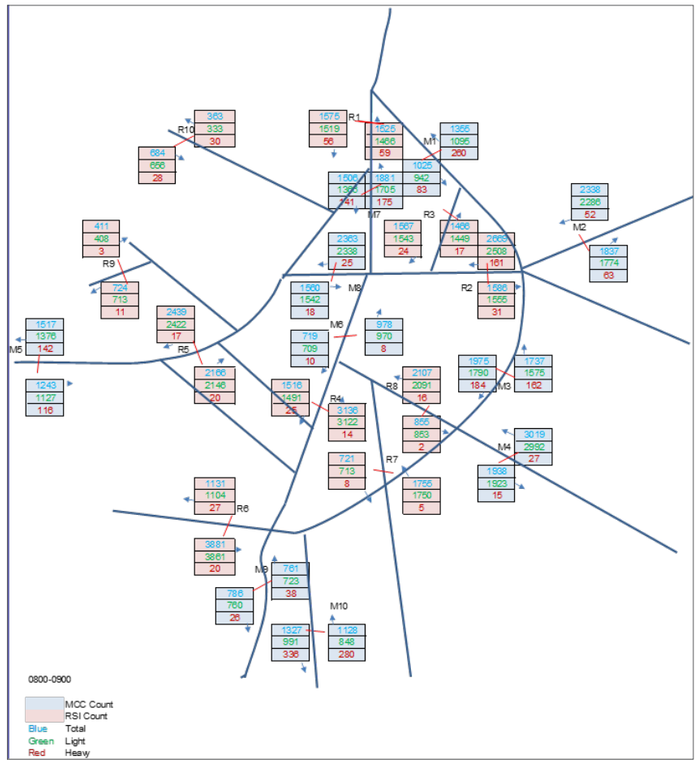

Figure 5.43: 2016 AM Peak Traffic Flows (vehicles/hour)

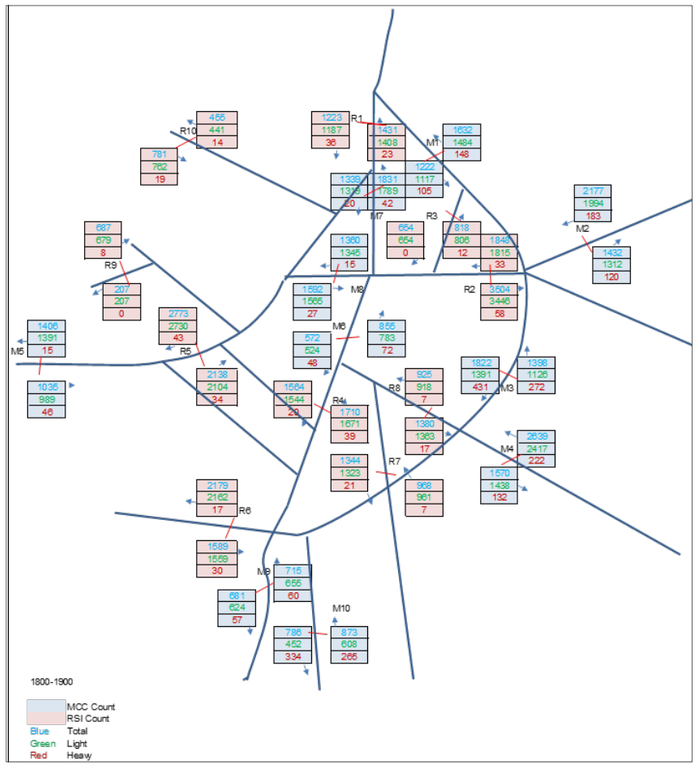

Figure 5.44: 2016 PM Peak Traffic Flows (vehicles/hour)

Traffic composition

The overall traffic composition from the classified traffic counts is shown in Figure 5.45. This shows that the predominant vehicle types on the road are powered 2/3 wheel vehicles, such as motorbikes and keke napap. The second most significant vehicle type is the car. Cars and powered 2/3 wheel vehicles make up 90% of the total traffic observed on Ibadan's roads.

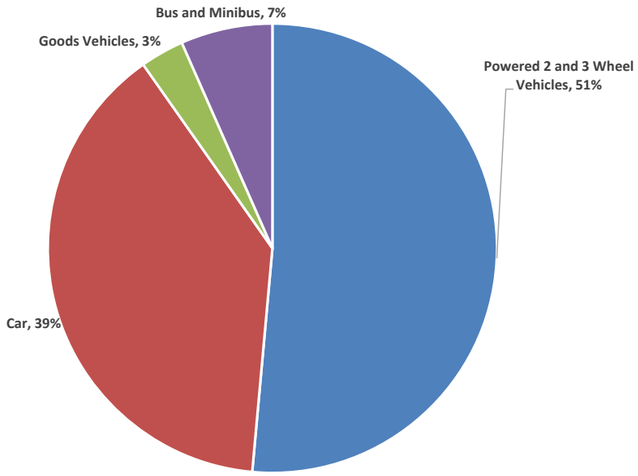

Figure 5.45: Traffic Composition in Ibadan

Journey times

The average speeds in kilometres per hour (km/h) are shown in Table 5.9 for the eight routes.

The journey speeds varied from around 19km/h to 44km/h. The Orange and Blue routes attained the highest overall average speeds. On the Brown, Dark Blue and Green routes, average recorded speeds were below 20 kph in one direction in the a.m. peak period.

Table 5.9: Journey Time Survey – Average Speeds

	AM PEAK AVERAGE SPEEDS (KM/H)		PM PEAK AVERAGE SPEEDS (KM/H)	
ROUTE	DIRECTION 1	DIRECTION 2	DIRECTION 1	DIRECTION 2
Black	25.75	33.73	26.37	25.43
Brown	19.04	22.61	24.45	25.22
Pink	28.55	38.00	29.37	28.32
Blue	37.32	42.75	44.01	39.62
Yellow	29.35	29.09	28.80	20.61
Green	19.97	24.74	22.32	21.61
Orange	29.52	40.00	34.77	29.09
Dark Blue	20.09	14.43	23.78	22.32

Average vehicle occupancies

Average vehicle occupancies from the RSI surveys are shown in Figure 5.46. For buses and minibuses, occupancies taken from the Public Transport Occupancy Surveys are shown in Figure 5.47.

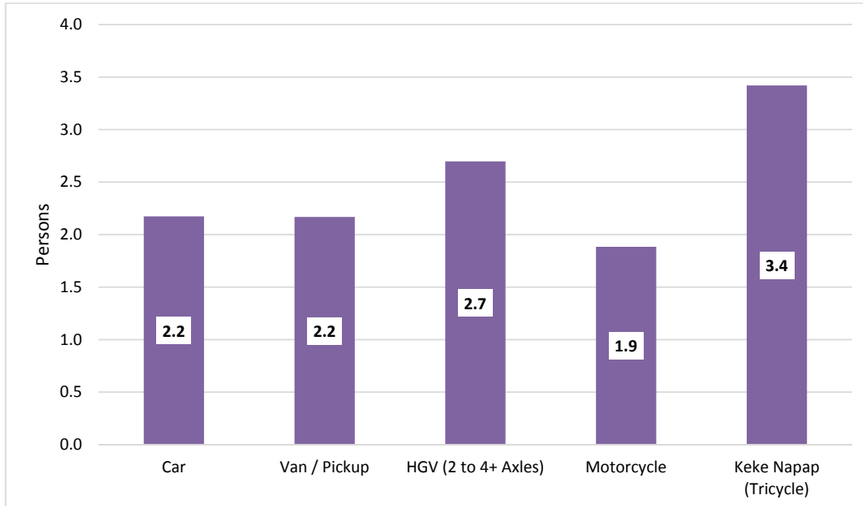

Figure 5.46: Average Occupancy from RSI Surveys

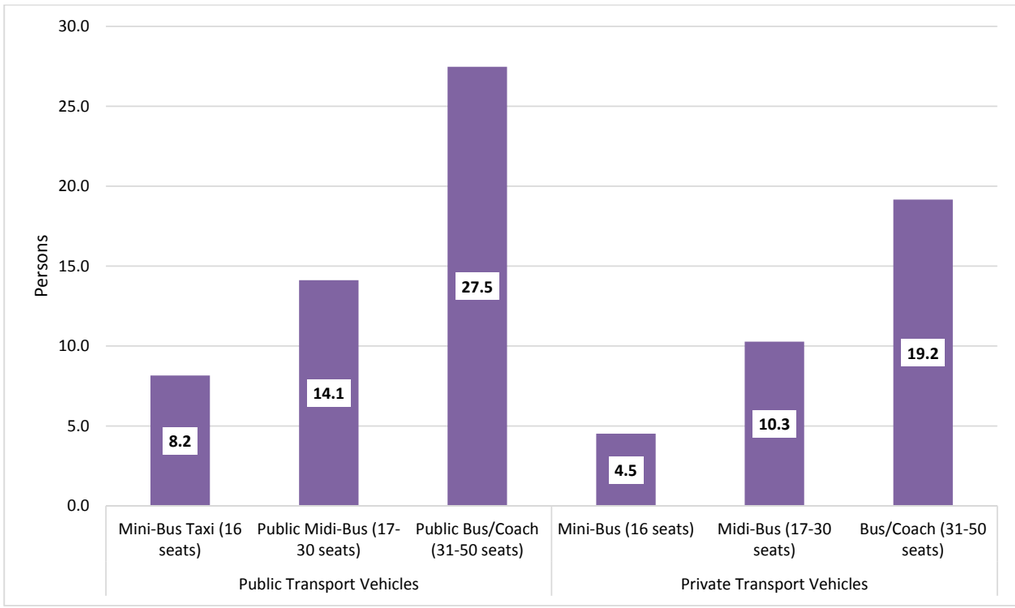

Figure 5.47: Bus Average Occupancy from PT Surveys

Mode shares

The overall mode shares for person trips in Ibadan has been estimated from the total vehicle flows by mode from the counts and average vehicle occupancies from the RSI, MCC and Public Transport Occupancy surveys. For the calculation of mode shares, the taxi occupancy was reduced by 1.0 to exclude drivers, and the average motor cycle occupancy was reduced by 0.5 to exclude okada drivers (assuming 50% of motor cycles counted were okada).

The estimated mode shares are shown in Figure 5.48. It can be seen that around an estimated 40% of journeys are made by powered two/three wheel vehicles, 34% by public transport (including taxis) and nearly 25% by private car.

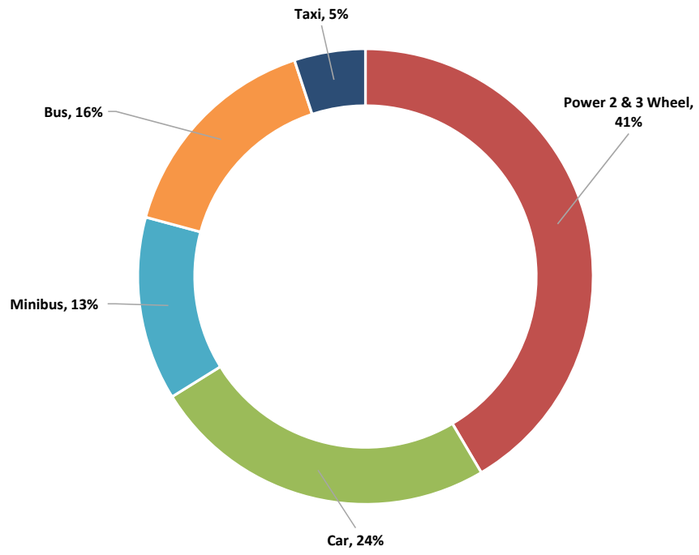

Figure 5.48: Person Trips by Mode – Percentage Share

Journey purpose

The RSI requested information about the purpose of the journey being made. Nine purposes were defined as follows:

- Home
- Work
- Business
- Education
- Shopping
- Social / Leisure
- Tourism
- Religious
- Other

Figure 5.49 shows the overall breakdown of journeys by purpose. It is clear that the overwhelming majority of trips are made for work or business.

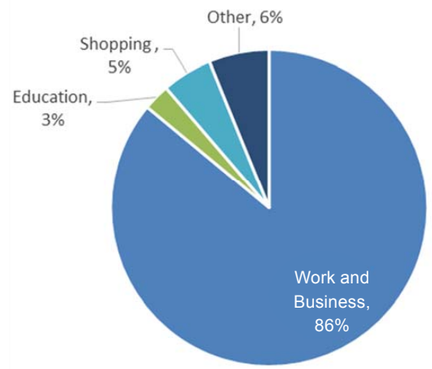

Figure 5.49: Journey Purpose

Parking

The RSI recorded the type of parking used at the origin and destination end of trips – private or public off-street parking, on-street parking or casual (or informal) parking. The results for the destination end of trips are summarised by journey purpose in Table 5.10 and in Figure 5.50 to Figure 5.53.

Table 5.10: Recorded Parking Types at Destination per Reason for Journey

PARKING AT DESTINATION	1 – PRIVATE OFF STREET	2 – PUBLIC OFF STREET	3 – ON STREET	4 – CASUAL PARKING
1 – Home	**88%**	6%	2%	4%
2 – Work	**60%**	20%	6%	14%
3 – Business	**38%**	17%	30%	15%
4 – Education	8%	6%	15%	**71%**
5 – Shopping	**58%**	3%	7%	32%
6 – Social / Leisure	28%	17%	17%	**38%**
7 – Tourism	**80%**	0%	0%	20%
8 – Religious	**68%**	23%	5%	5%
9 – Other	**52%**	17%	17%	14%

At the home end of their journey, nearly 90% of drivers said that they had private off-street parking. At the non-home end for most journey purposes, over 50% drivers were able to use private off-street parking. The most notable exception was for education-related journeys where the majority of parking was casual. This may indicate that there is insufficient parking available at educational establishments, particularly schools.

Use of on-street parking was most significant for business trips while, in addition to education trips, casual parking was used for a significant proportion of shopping and social/leisure trips.

Overall, nearly 60% of drivers used a private off-street car park at their destination, 16% used a pubic off-street car park, 10% parked on-street while 17% used casual /informal parking.

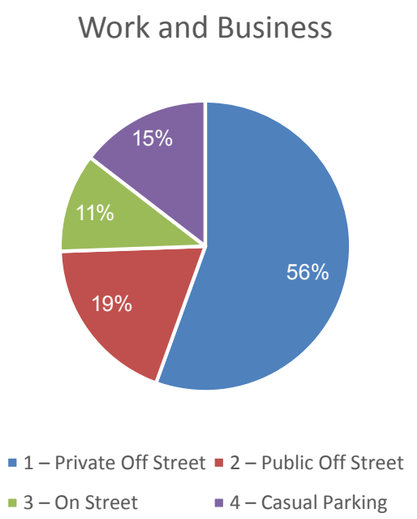

Figure 5.50: Parking for Work / Business Trips

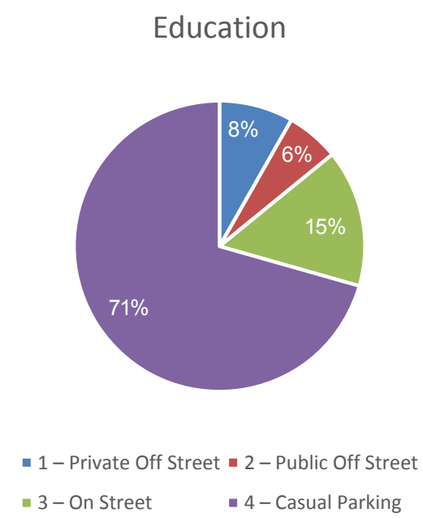

Figure 5.52: Parking for Education Trips

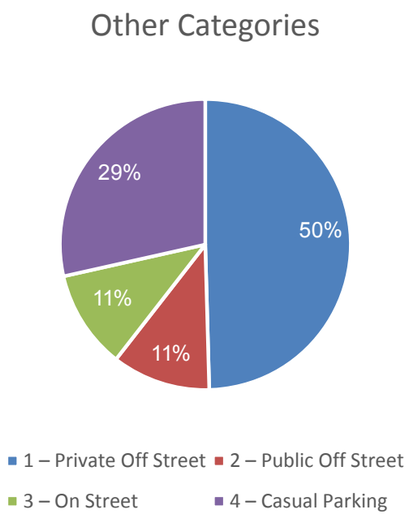

Figure 5.51: Parking for Other Journey Purposes

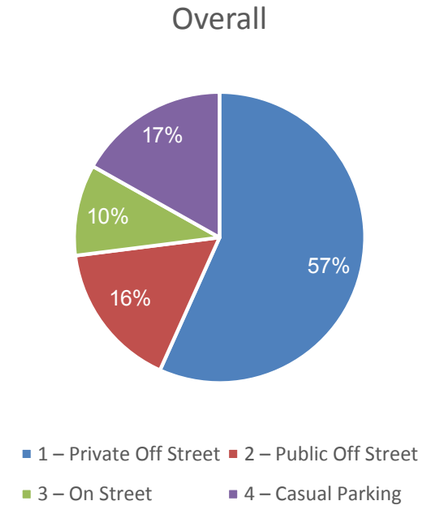

Figure 5.53: Overall Parking Types

Summary of the Existing Situation

This section has presented an assessment of the existing transport system in the Ibadan, with regards to the provision for and demand for movement by all modes of transport. It has described the existing transport networks, their characteristics and operation. Current plans for improvements to the local transport infrastructure have been highlighted.

Some conclusions with regards to the existing situation may be summarised as follows:

- In terms of strategic accessibility, Ibadan benefits from its location with respect to the national road and rail networks. The Lagos-Ojoo Expressway passes through the city as does the Lagos-Nguru railway line. The latter is to be upgraded to standard gauge, with the section from Lagos to Ibadan due to be completed within two years. The Expressway also provides a bypass route taking traffic, in particularly heavy goods vehicle traffic, out of the central urban area.
- The primary road network serving Ibadan is formed of radial routes converging at the centre of the city. The main road network is comprised of a good standard, generally dual-carriageway roads. Flyovers have been introduced at major junctions. Progress has been made in improving traffic management and control on the city's road network and traffic signals have been installed at key 'bottleneck' locations. These are progressively being converted to be solar-powered to provide reliable power supplies.
- However, high levels of localised traffic congestion can occur, most often adjacent to areas of more intensive commercial activity. Congestion is mainly due to the encroachment of retail activities into the roads, high levels of on-street parking, and stopping/manoeuvering by buses and taxis.
- There are no public off-street car parks in Ibadan; most parking take place on-street, exacerbating the above congestion problems.
- The Ministry of Transport and Works has an on-going programme of road construction and rehabilitation which includes some 182 individual projects involving approximately 940 km of carriageway, State-wide. The Ministry also has a proposal for a new orbital road, the Circular Road, involving the construction of some 110 km of expressway.
- Public transport within Ibadan is road-based and mainly privately-operated. Urban bus services are operated by Pacesetter Transport Services with a fleet of around 79 buses. Taxis, keke napep and okada also comprise significant components of the public transport provision.
- The State Government has proposals for a light rail system for Ibadan (see Figure 5.73). This will initially comprise a line from Ojoo to Mokola, passing through Ibadan and ending at the Lagos-Ojoo Expressway. The Red Line is the first phase of this and extends for approximately 12 km from the Toll Gate area of the Expressway to the Dandaru area of central Ibadan. A Memorandum of Understanding has been signed for the construction of the light rail line and the project is expected to be completed over a three year period.
- High levels of pedestrian activity are observed within the city. Dedicated pedestrian facilities are provided in the form of footways and road crossings, including footbridges. Pedal cycle usage appears to be low and no dedicated infrastructure for cyclists is provided.
- Peak period journey speeds on the main road network vary. On parts of the network observed, average speeds fall below 20 kph.
- Traffic composition – powered two- and three- wheelers are observed to account for around 50% of vehicles on the road network with cars accounting for a further 40%.
- Some 40% of trips within Ibadan are made by powered two/three wheeled vehicles, 34% by public transport and 24% by private car.
- The overwhelming majority of trips being made by motorised modes (i.e. excluding walking and cycling) are being made for work or business.

5.4.3 The Traffic Model

A strategic traffic model was developed as a tool for estimating future-year flows on the road network based on the distribution of transport demand generating activities. Models were developed for the Base Year (2106) and Forecast Year (2036), and for two time periods – the a.m. peak hour and p.m. peak hour.

The model development is summarised in this section. The demand forecasts are discussed in the Section entitled ‘Future Transportation Demand.’ The analysis of the future year road network based on those demand forecasts are discussed in the Section entitled ‘The Road Network.’

Structure of the Model

The spatial representation of demand in the model is based on a system of Traffic Analysis Zones (TAZ). The Ibadan City Masterplan area is represented by 137 TAZ as shown in Figure 5.54 and Figure 5.55. TAZ have been defined with reference to land uses and physical boundaries such as roads and rivers

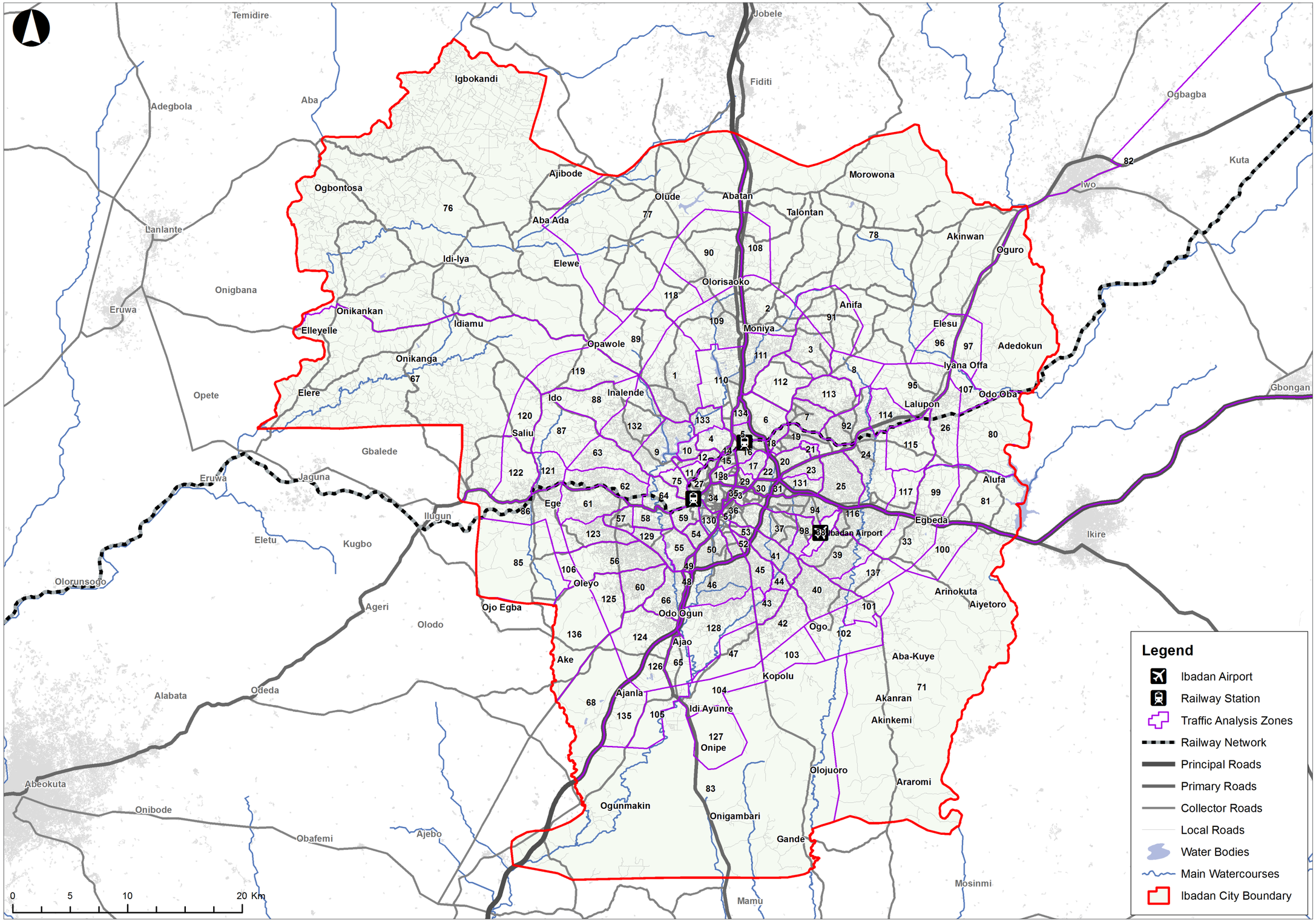

Figure 5.54: Ibadan Traffic Analysis Zones

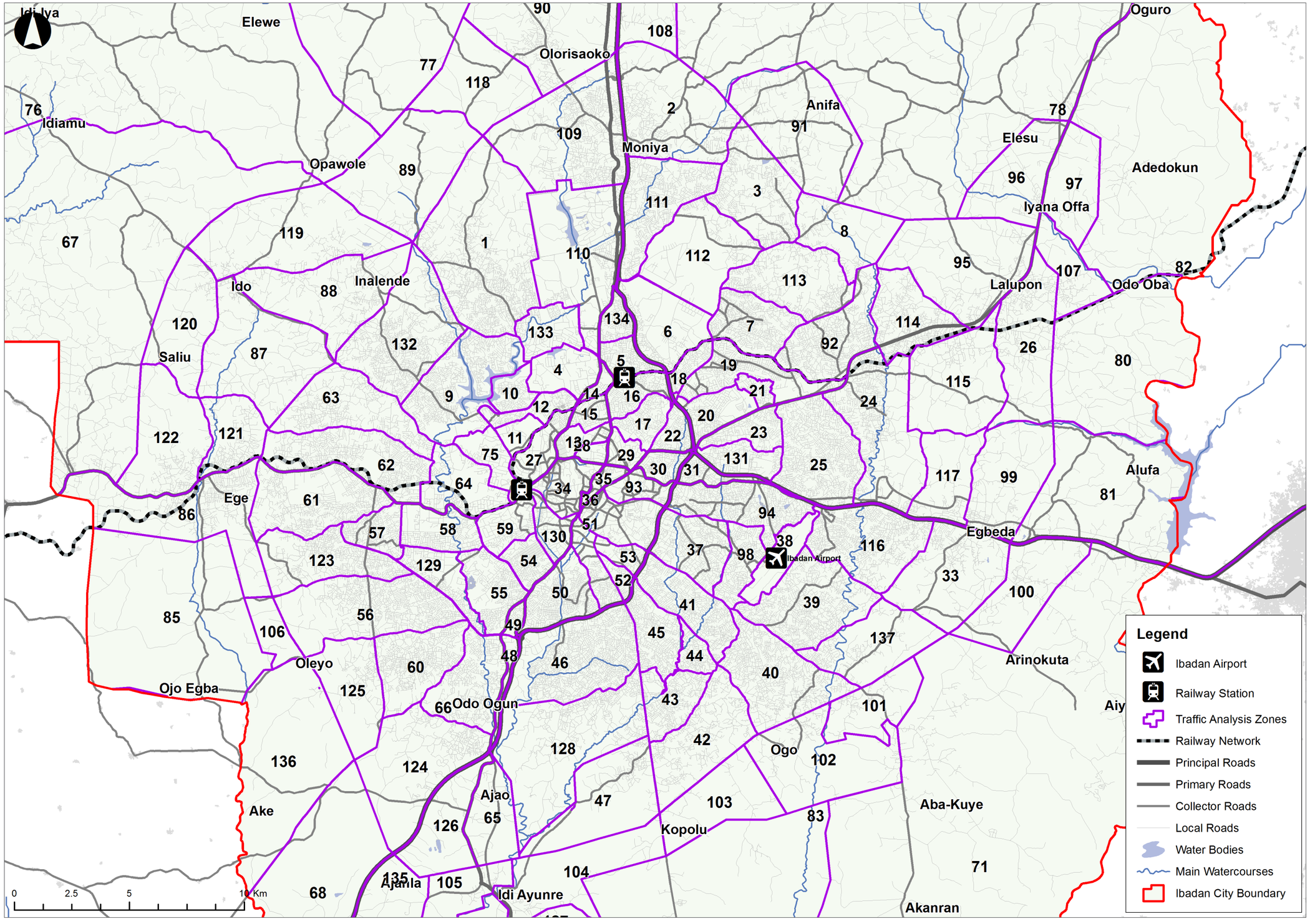

Figure 5.55: Ibadan Traffic Analysis Zones (Central Area)



Figure 5.56: Structure of the Traffic Modelling Process

The model process is shown in Figure 5.56. It comprises four stages or sub-models:

- Trip generation – the estimation of the numbers of trips from and to each TAZ (trip ends) in each time period based on land use and socio-economic characteristics.
- Trip distribution – the linking of trip ends to estimate the movements between each pair of TAZ.
- Mode choice – allocating trips to modes.
- Assignment – conversion of vehicle trips to 'passenger car units' (pcu) and assigning the matrix of pcu trips to available routes on the road network.

The approach adopted for each of these stages is summarised below.

Base Year Model

Trip Distribution

The trip generation sub-model estimates base year trip ends from land use areas recorded by the 2016 land use survey, and trip rates (vehicle trips per unit of area).

The following four main trip-generating land uses are considered in the model:

- Commercial
- Industrial
- Social (health and education)
- Residential

Initial trip rates were obtained from the US Institution of Transport Engineers (ITE) Trip Generation Manual 9th Edition. The a.m. and p.m. peak ITE trip rates used for each of the above land use classifications were calculated as the averages of representative individual trip rates for sub-classification. For example, the industrial trip rate was based on a simple average of light and heavy industrial ITE trip rates.

The initial ITE trip rates was adjusted downwards as part of the validation exercise described below to reflect lower incomes and mobility rates in Nigeria compared to the USA. The final adjustment factors calculated were 0.468 for the a.m. peak and 0.269 for the p.m. peak.

The trip rates used in the model are shown in Table 5.11. Finally, total trip attractions (non-residential trip ends) were constrained to equal total trip productions (residential trip ends).

Table 5.11: Model trip rates

LAND USE	TRIP RATE (VEHICLE TRIPS PER HOUR) – TWO-WAY		UNITS
	AM	PM	
Commercial	0.698	0.762	100 m^2 gross floor area
Industrial	0.359	0.169	100 m^2 gross floor area
Social	1.072	0.311	100 m^2 gross floor area
Residential	2.930	2.368	Hectares

Trip Generation

The trip distribution sub-model estimates the matrix of zone-to-zone trips based on the zonal trip generations and attractions and the relative impedance to travel between each zone pair, measured by travel distance.

A standard gravity model was developed for trip distribution, calibrated to replicate the observed distribution of trip lengths from the RSI.

Mode Split

The matrices of zone-to-zone vehicle trips are disaggregated by mode with reference to the observed overall composition of traffic in the two peak hours from the traffic surveys. Vehicle trips are then converted to 'passenger car units' (PCU) for assignment. The PCU factor for each vehicle type expresses the impact of each vehicle in terms of the equivalent number of cars. Thus, a PCU factor of 2.0 means that the vehicle has an impact on capacity equivalent to the impact of 2.0 cars.

The mode splits and PCU factors are shown in Table 5.12.

Table 5.12: Mode splits and PCU factors

VEHICLE TYPE	AM MODE SPLIT	PM MODE SPLIT	PCU FACTOR
2 / 3 wheelers	54.28%	47.14%	0.50
Car	37.03%	41.30%	1.00
LGV	1.20%	1.75%	1.00
Minibus	4.07%	4.38%	1.00
Bus	2.14%	3.02%	2.00
HGV1	0.43%	1.16%	2.00
HGV2	0.84%	1.25%	2.00

Trip Assignment

The matrix of zone-to-zone PCU movements is then assigned to the optimum route on the highway network based on the travel times on each alternative route, to obtain estimated flows on each link in the network. Assignment is an iterative process whereby link speeds for the calculation of travel times on alternative routes are adjusted from initial free-flow speeds based on assigned volumes and link capacity.

Base Year Network Development

The base year highway network was developed using GIS data. Links were classified into types based on visual inspection of aerial photography. The base year network is shown in Figure 5.57. The characteristics of each of these Base network link types are detailed in Table 5.13.

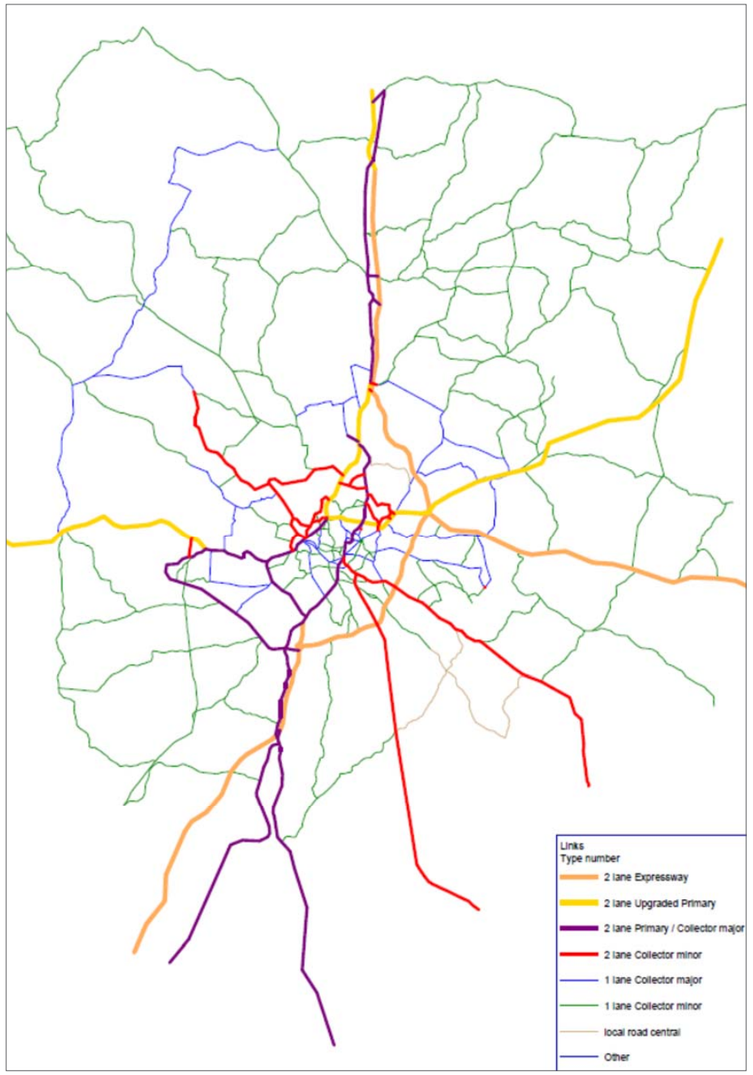

Figure 5.57: Base year model road network

Table 5.13: Base year link types and characteristics

LINK TYPE	CAPACITY (PCU/LANE)	SPEED (KPH)	
		FREE FLOW	AT CAPACITY
Expressway	1,800	56	35
Upgraded Primary	1,300	40	20
Primary/Major Collector	1,100	40	20
Minor Collector	800	32	15
Local Road (urban core)	600	24	10

Base Year Model Validation

The base year model was validated against observed traffic flows and journey times from the surveys, to ensure that it replicated the existing situation with an acceptable level of accuracy.

On nearly 70% of highway, links included in the validation modelled flows were within 25% of observed flows while on nearly 50% of links, they were within 15% of observed flows.

The comparison of modelled and observed journey times saw a similar number of modelled journey times to be quicker and slower than the observed data, suggesting no overall bias in the model. Around two thirds of the modelled journey times were within 15% of the observed times and in excess of 85% were within 30% of the observed times.

This represents an acceptable level of validation to give confidence in the base year model as a basis for forecasting.

Forecast Year Model

Zonal Land Use Estimates

Zonal population and employment estimates for 2016 and 2036 were used to estimate land use areas by category in 2036. Changes in land use areas between 2016 and 2036 for each zone were estimated from changes in population and employment 2016-2036 and the average area per person/job from the 2016 land use survey.

Trip Rates

The base year trip rates described above were adjusted to reflect the impact of socio-economic changes between 2016 and 2036 on trip making – in terms of both numbers of trips made per person and mode shares. The adjustments made were as follows:

- Increased mobility and motorisation due to income (GDP/capita) growth – all trip rates were factored by 1.63 (based on GDP growth of 5% pa and World Bank projection of 63% growth in Nigeria's population 2016-2036).
- Residential trips rates factored by 1.11 for the projected increase in the proportion of the population which is of working age.
- All resultant trip rates were reduced by 20% to reflect the impact on traffic generation of the Masterplan's proposals for public transport improvements, due to mode shift from private cars to public transport and the transfer of public transport demand from low capacity public transport vehicles to MRT or higher capacity buses - around 10% of car trip assumed to transfer to public transport and 50% of public transport trips assumed to transfer to rail/higher capacity buses.

As in the base year model, non-residential trip attractions were factored such that total attractions balanced total residential trip generations.

Road Network

The following road standards were assumed for the Future Year road network:

- Existing/new Expressways – dual-3 (3 lanes per direction)
- Primary Roads – dual-3
- New/upgraded Collector Roads and existing Major Collectors – dual-2
- Other collectors and local roads – single 2 lane carriageways
- Link capacities for each road type were as in the Base Year Model (Table 5.13) other than for Minor Collectors. The capacity of these road was assumed to increase to 1,100 pcu per lane to reflect the impact of improved traffic management.

The traffic model demand forecasts were analysed to validate and modify as necessary these starting assumptions regarding the forecast year network, as discussed in the Road Network section to follow.

5.4.4 Future Transportation Demand

Population and Employment Growth

Forecasts of transport demand in 2036 have been based on the land use, population and employment projections for the new expansion areas coupled with the growth in population and employment for the infill areas and the existing developed areas.

The population of the city was estimated to be around 6.02 million in 2016. This is projected to rise to 11.6 million by 2036. Total employment is projected to rise from 1.9 million to 4.1 million over the same period (note that this excludes the agricultural sector). It is anticipated that there will be an increase in the percentage of the population that is of working age, from 58.6% in 2016 to 65% in 2036. The distribution of population and employment growth within Ibadan is shown in Table 5.14, in terms of the sectors (aggregations of TAZ) shown in Figure 5.58. Figure 5.59 to Figure 5.60 summarise the spatial distribution of population and employment in 2016 and 2036.

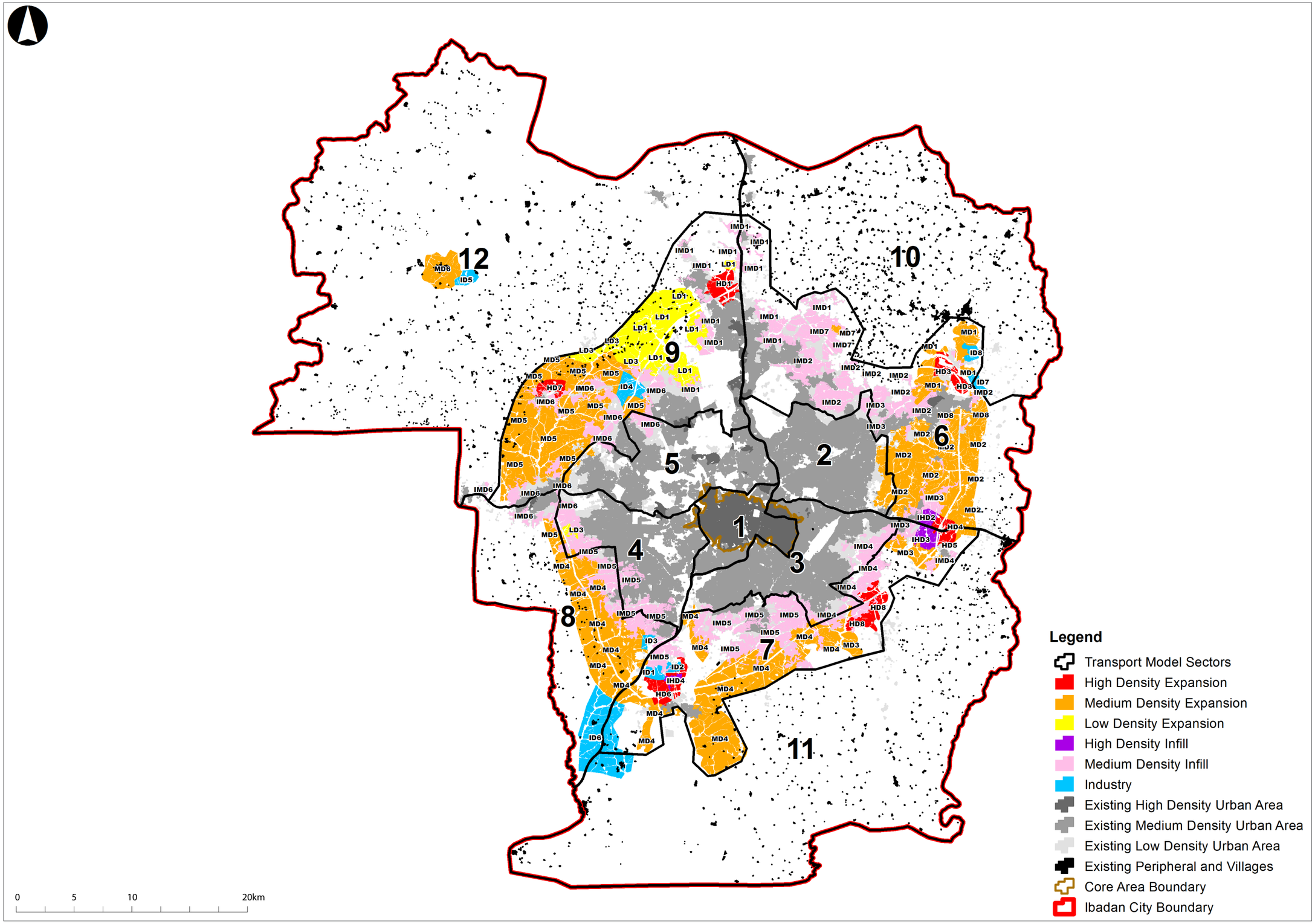

Figure 5.58: Ibadan Sectors overlaid on Development Zones

Table 5.14: Population and Employment for 2016-2036 by Sector*

	SECTOR	POPULATION 2016	POPULATION 2036	EMPLOYMENT 2016	EMPLOYMENT 2036
City Core	1	1,218,172	1,224,262	394,671	341,068
Urban Non-Core	2	708,460	792,249	134,762	208,424
	3	951,416	1,041,878	217,762	283,260
	4	633,787	767,414	135,629	177,184
	5	736,596	787,373	339,070	465,714
Expansion Area	6	589,365	2,019,473	184,697	786,661
	7	238,509	1,645,148	50,710	630,954
	8	160,580	871,926	128,866	341,113
	9	590,659	2,138,838	168,197	588,345
Outer Areas	10	75,640	76,166	20,735	47,963
	11	42,995	51,842	35,630	115,723
	12	66,755	186,670	45,063	97,925
	Total	**6,012,934**	**11,603,240**	**1,855,791**	**4,084,334**

* Note: employment figures do not include the agricultural sector.

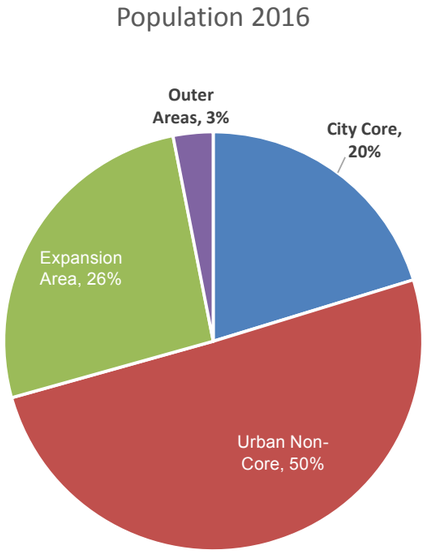

Figure 5.59: Population by Sector for 2016

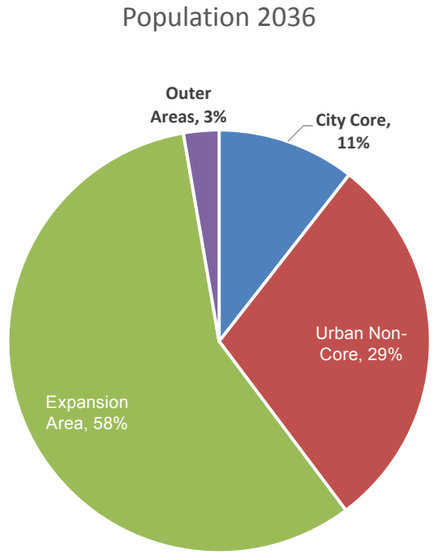

Figure 5.60: Population by Sector for 2036

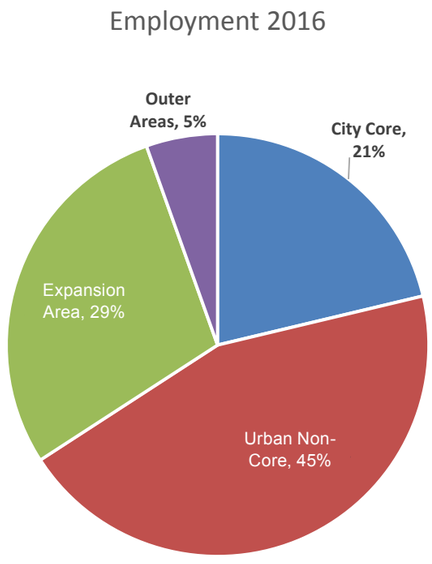

Figure 5.61: Employment by Sector for 2016

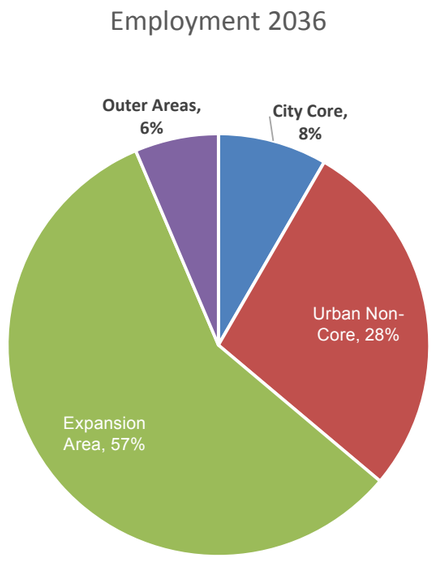

Figure 5.62: Employment by Sector for 2036

It can be seen that population in the core area (Sector 1) is projected to be relatively stable to 2036 while employment is projected to decline by around 15%. In the rest of the existing urban area (Sectors 2 to 5), while population is projected to increase by over 10%, employment increases by nearly 40%. The expansion areas (Sectors 6 to 9) account for over 90% of the total population growth of 5.6m and over 80% of the employment growth of 2.2m. Population growth in the outer areas (Sectors 10 to 12) is projected to be 130,000, while employment is projected to grow by some 160,000.

By 2036, the new expansion and development areas are projected to accommodate around 57% of the city's population and employment.

Forecast Growth in Transportation Demand

Figure 5.63 shows the overall forecast growth in the number of vehicle trips generated in Ibadan up to 2036. Peak hour vehicle trips on the road network are forecast to increase by 177%. These growth forecasts reflect the planned increases in population and employment and increased personal mobility, and car availability associated with rising incomes, offset to an extent by increased use of public transport resulting from the proposed investment in mass transit lines. Vehicle trips on the road network are forecast to be highest in the a.m. peak period which is, therefore, the critical period for assessing the operation of the road network.

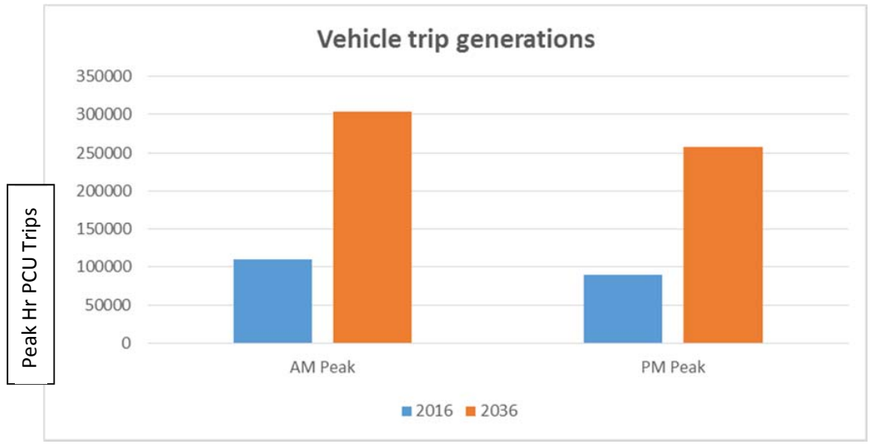

Figure 5.63: Peak Hour Vehicle Trip Generations

Table 5.15 and Table 5.16 show the peak hour trip generations and attractions by sector in 2016 and 2036. These are shown graphically in Figure 5.64 and Figure 5.65.

Table 5.15: AM Peak Hour Vehicle Trip Generations and Attractions by Sector – 2016 and 2036

SECTOR	2016		2036	
	GENERATIONS	ATTRACTIONS	GENERATIONS	ATTRACTIONS
1	10,433	12,727	11,314	9,359
2	12,356	10,476	19,184	15,326
3	14,494	9,936	22,723	15,018
4	13,021	15,710	21,578	24,704
5	19,860	27,553	26,657	31,600
6	12,549	9,190	54,020	48,374
7	7,390	5,293	52,533	55,110
8	4,648	2,736	29,207	30,436
9	10,359	9,657	52,692	51,034
10	1,653	2,203	3,490	4,937
11	1,765	2,496	6,233	11,533
12	1,199	1,750	4,186	6,387
TOTAL	109,726	109,726	303,817	303,817

Table 5.16: PM Peak Hour Vehicle Trip Generations and Attractions by Sector – 2016 and 2036

SECTOR	2016		2036	
	GENERATIONS	ATTRACTIONS	GENERATIONS	ATTRACTIONS
1	10,307	9,220	10,563	10,649
2	10,696	10,844	15,875	16,828
3	9,371	11,066	15,441	18,343
4	12,772	11,483	21,696	19,895
5	20,200	17,259	26,639	24,226
6	7,759	9,255	41,019	43,898
7	4,459	5,396	46,093	45,002
8	2,689	3,439	24,380	24,257
9	7,214	7,753	41,482	42,932
10	1,287	1,244	3,382	2,975
11	1,457	1,322	7,622	5,727
12	1,021	951	4,077	3,536
TOTAL	89,232	89,232	258,268	258,268

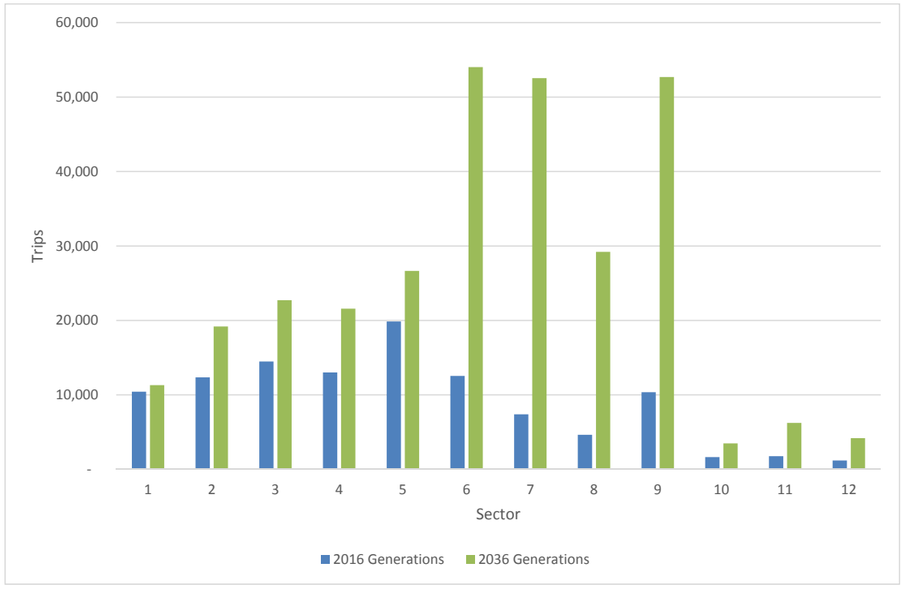

Figure 5.64: Growth in Trip Generations from 2016 to 2036 (AM Peak)

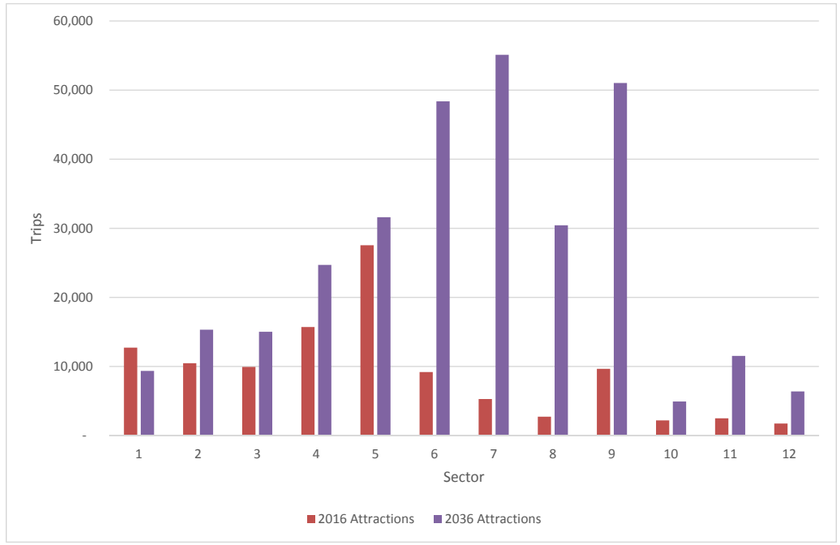

Figure 5.65: Growth in Trip Attractions from 2016 to 2036 (AM Peak)

The distribution of trips in the a.m. peak hour is summarised in Figure 5.66 for 2016 and 2036. It can be seen that the pattern of movement within the city will be expected to change significantly between 2016 and 2036. For example, radial trips to and from the core area are estimated to account for around 20% of total trips on the network in 2016, but fall to under 7% in 2036. On the other hand, orbital trips between expansion areas are estimated to account for 40% of total trips by 2036.

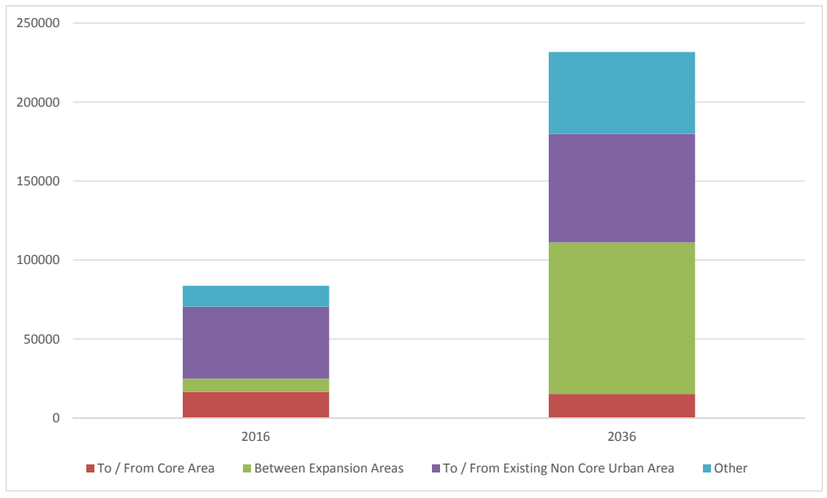

Figure 5.66: Distribution of Trips in 2016 and 2036

5.4.5 The Road Network

The Road Hierarchy

A functional road hierarchy provides the essential framework for evaluating existing road networks, planning and designing future networks, and developing policies and plans for managing those networks. In the Diagnostics Report the following functional road hierarchy was proposed as the framework for planning, designing and managing the Ibadan road network:

- Principal Roads: roads of regional or national significance that connect the major economic centres of the State and connect those centres to the national strategic road network. They will often be expressways, with restrictions on access and prohibitions on stopping.
- Primary Roads: these connect the main urban areas within the State and main economic centres within the city, and connect these areas to the Principal Road network. They may range in standard from two-lane single carriageway roads to multi-lane dual carriageways.
- Collector Roads: these collect traffic within urban and rural areas and feed that traffic onto the Primary or Principal Road networks. They will normally be two-lane roads but may be of a higher standard (Major Collectors) where traffic demands are high.
- Local Roads: these provide access to neighbourhoods and to individual sites.

The existing road hierarchy is shown in Figure 5.67.

The Principal Road network in Ibadan comprises the E1 Lagos-Ojoo Expressway and the New Ife Expressway (A122). The Lagos-Ojoo Expressway is also included in the national strategic road network defined in the Federal Government's National Integrated Infrastructure Master Plan (2014), and is part of the Trans-African Highway connecting Nigeria with Benin to the west and to Niger and Chad to the north/east.

The main radial roads in the city have been classed as Primary Roads, while all other roads in the city are classed as either collector or local roads.

The 2036 Road Network

Substantial expansion of the road network will be required to support the Masterplan and cater for the forecast levels of movements discussed in the section entitled 'Future Transportation Demand.' This will entail the construction of new roads and the further upgrading of existing roads, as well as improvements to traffic management and control.

The proposed 2036 road hierarchy has been defined with reference to the State Government's current road construction plans, the urban development proposals of the Ibadan City Masterplan, and the traffic demand forecasts discussed below. The proposed hierarchy is shown in Figure 5.68. The main changes from 2016 are as follows:

- The Circular Road – a new Primary Road to be constructed to expressway standards.
- Inner Ring Road, incorporating the Western Bypass – a Primary Road comprising upgrades to existing roads and sections of new road construction.
- The upgrade of two collector roads in the south/south-east of the city to Primary Road to reflect the growth in traffic demand in these areas.
- An expanded Collector Road network, including new links and the upgrading of existing roads.

The new roads and road upgrades required to implement this hierarchy are shown in Figure 5.69. It should be noted that this Transport Assessment is essentially a strategic study focusing on the strategic road network. Hence, while it has identified requirements for upgrading existing collector roads and for new Major Collector Roads, the full collector road and local road networks in the expansion areas and infill areas have not been studied or planned in detail.

The traffic model has been used to confirm the appropriateness of the network described above and assess the cross-sectional standards required for each category of road.

Assessment of the Road Network

Figure 5.70 and Figure 5.71 show the forecast a.m. and p.m. peak traffic flows (pcu) on the proposed road network. It can be seen that flows are generally higher in the a.m. peak which is therefore, as noted in the previous section 'Future Transportation and Demand,' the critical period. The assessments described below have, therefore, focused on the a.m. peak hour.

It can also be seen that traffic demand is significantly higher in the southern part of the city. This reflects the substantial concentration of new employment land uses, in particular industrial uses, proposed in this area.

These flows have been analysed to determine the standards for new and upgraded main roads required to ensure that the network delivers the capacity to cater for forecast traffic demand up to 2036.

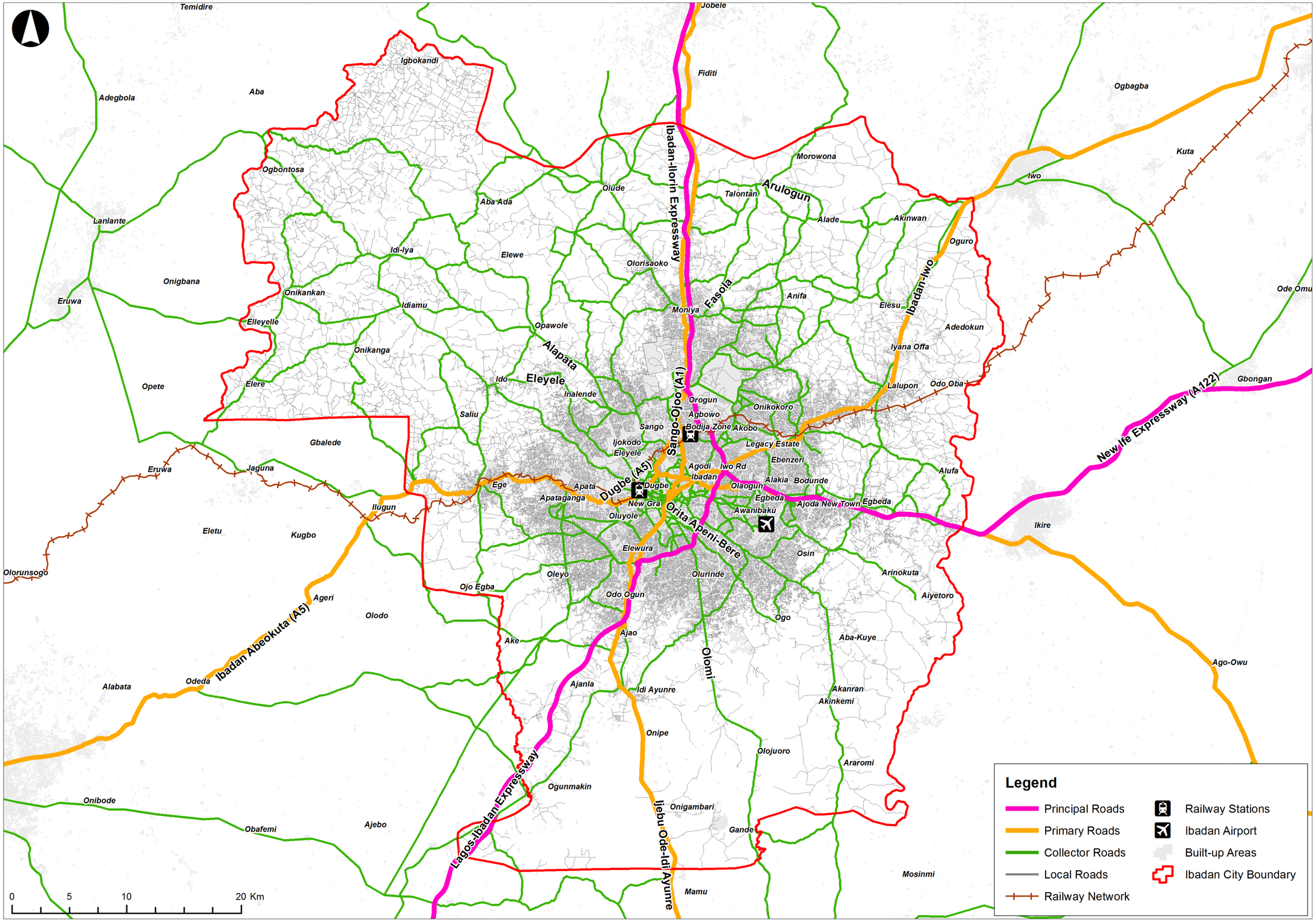

Figure 5.67: Existing Road Hierarchy in Ibadan

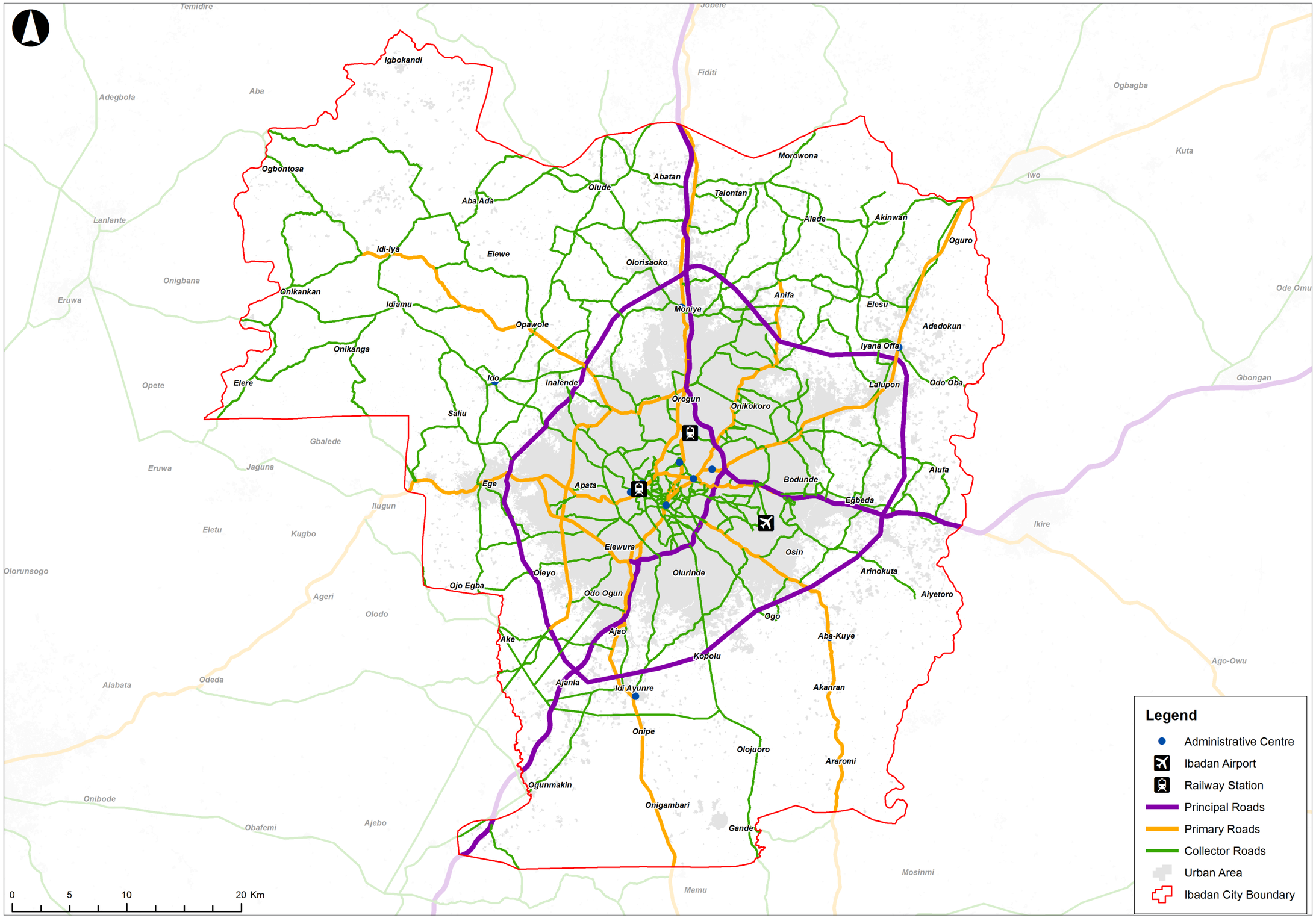

Figure 5.68: Existing Road Hierarchy in Ibadan

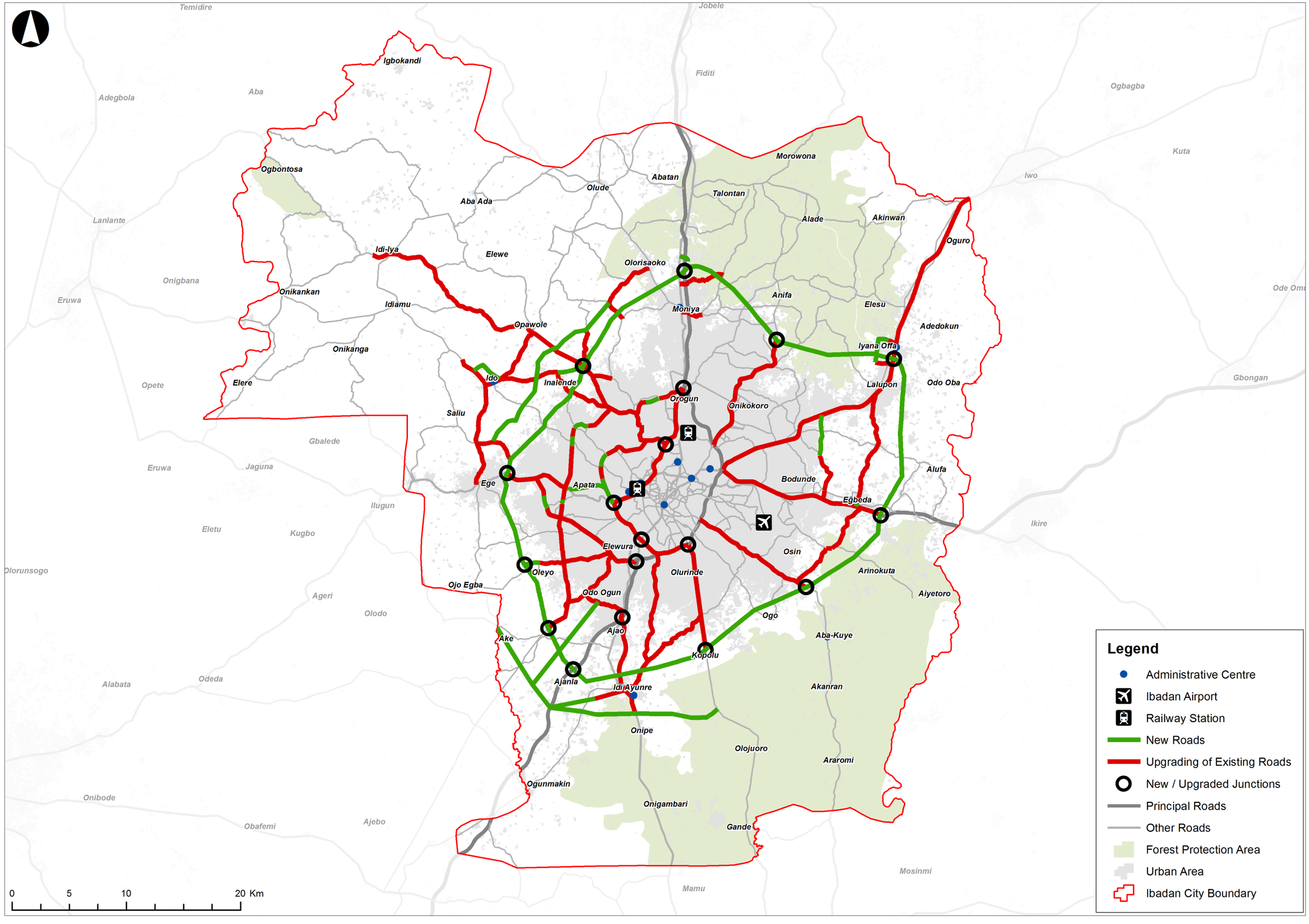

Figure 5.69: Proposed New and Upgraded Roads in Ibadan



Figure 5.70: 2036 AM Peak Assignment Plot



Figure 5.71: 2036 PM Peak Assignment Plot

Principal Roads

Circular Road

Forecast peak direction flows on the Circular Road vary from around 2,000 pcu/hour in the north-east to around 5,400 pcu/hour in the south, with nearly 6,000 over a short section west of the Lagos-Ojoo Expressway. The road is currently planned to be dual-2 standard (two lanes per direction). However, in the south and south-west it will need to be dual-3 to accommodate these forecast flows (Figure 5.72). Over the section west of the Lagos Expressway, four lanes may be required.

Existing Expressways

The Lagos-Ojoo Expressway will need to be upgraded to full expressway standard with 3 lanes per direction south of the A1 Ife Expressway. Between the A1 and the northern intersection with the Inner Ring Road, traffic forecasts are just within capacity for a 2-lane expressway but upgrading to three lanes may be required. North from the Inner Ring Road intersection, the existing two lanes are forecast to be adequate.

Within the Circular Road the Ife Expressway is required to have three lanes per direction to accommodate forecast flows up to 2036.

Primary Roads

Inner Ring Road

The northern section of the planned Inner Ring Road is forecast to carry up to around 2,900 pcu/hour and will need to be dual-3 standard (Figure 5.72). Other than a short section west of the Lagos-Ojoo Expressway dual-2 standard will be adequate for the remainder of this Primary Road.

Radial Primary Road network

The radial Primary Roads should be upgraded/constructed to modern dual-2 lane or dual 3-lane standards. Figure 5.72 shows those parts of the network where it is assessed that dual-2 and dual-3 will be required.

Collector Roads

The new/upgraded collector roads identified on Figure 5.69 are proposed to be dual-2 standard Major Collector Roads.

However, as noted above, the Collector Road/Local Road network has not been analysed in full. In the new development areas a network of lower order roads will be required to complement the higher order roads identified here. In particular it is noted that parts of the skeletal collector road network represented in the strategic model for the new development areas in the south and west of the city are forecast to be overloaded. In planning these new development areas, careful attention will need to be given to the required density of the collector and local road network.

Policies for Managing the Road Network

It was noted in the section entitled ‘Existing Situation’ that progress has been made in improving traffic management and control on the city’s road network. Examples referred to include increasing the numbers of road traffic signs, improved levels of street lighting and the introduction of one-way schemes. As the city develops and traffic increases rapidly, it will be essential that the road network is managed to ensure that it operates efficiently and safely for all users, whilst minimising the impact on the environment. Thus it will be essential that progress towards the realisation of a modern traffic management and control system in Ibadan is maintained. Policies will need to be in place, backed by appropriate regulations and enforcement practices, to address the problems that are currently observed to reduce road capacity and create congestion and safety issues in Ibadan. These problems were highlighted in the Diagnostics Report as including: encroachment by retail activities into the road, high levels of on-street parking, and uncontrolled stopping and parking by public transport vehicles.

The functional road hierarchy will provide the framework for developing appropriate management policies for each part of the network. The following policies are recommended for implementation:

Maintenance Standards and Practices

Systematic and structured inspection and maintenance standards and procedures, related to the road hierarchy, will be implemented. These are necessary to protect the life of assets, minimise the loss of capacity due to poor carriageway conditions, manage and minimise disruption due to maintenance activity, and ensure that maintenance resources are allocated effectively.

Control of Access

Direct access to premises shall only be permitted from Collector Roads and Access Roads.

On higher order roads, movement functions take precedence over access functions. This policy, implemented through the development control process, is required to ensure that roads function is as intended given their status in the road hierarchy by limiting the number of junctions on higher order roads and the interference to through movement due to turning and weaving manoeuvres. It also enhances road safety by reducing turning movements on higher speed roads.

Parking

On-street parking shall not be permitted on Principal or Primary Roads, on the busier Collector Roads, or where it would impact adversely on traffic flows, road safety or the environment.

On-street parking tends to generate circulating traffic searching for an available space and slow manoeuvring into and out of spaces. As with control of access, this policy is required to minimise interference to the movement functions of higher order roads as well as to avoid the road safety issues that arise from such manoeuvres.

Control on Stopping for Loading and Unloading (Including Public Transport Vehicles)

Uncontrolled stopping by goods vehicles and by public transport vehicles for loading and unloading has a serious adverse impact on road capacity and on road safety in many locations in Ibadan. In conjunction with the improved provision of off-road facilities, restrictions on stopping for loading and unloading loading, except in designated bays, shall be implemented to address these issues. Restrictions may be time-limited (e.g. peak hours) or 24 hours subject to adequate off-road loading/unloading facilities being available.

Within the urban area, Primary and Principal Roads should be designated as ‘clearways’ during peak periods, with no stopping on-road being permitted except by public transport vehicles at designated stops.

Enforcement

Enforcement authorities should be given appropriate powers and resources to penalise those who contravene traffic regulations, including those regulations relating to driving behaviour, parking and roadworthiness of vehicle. Enforcement should be carried out in a fair and impartial manner.

Safety

Safety should be considered in all aspects for all road users. Procedures for the systematic recording details of all road traffic accidents involving personal injury shall be implemented. Based on the comprehensive data provided high-frequency accident locations will be identified and prioritised for remedial measures to be developed to reduce the occurrence of accidents. The focus will be on reducing the number of accidents where a person is killed or seriously injured (KSI Accidents) throughout Ibadan.

Intelligent Transport Systems

ITS will be developed for the monitoring and management of the road network. An ITS Strategy shall be formulated, to be implemented with the upgrading and modernisation of the road network. That strategy shall set out how ITS applications will be implemented to enhance the efficient operation of the road network, in particular through enhanced junction control, improve road safety, give priority to sustainable transport modes, and reduce the impact of traffic on the environment.

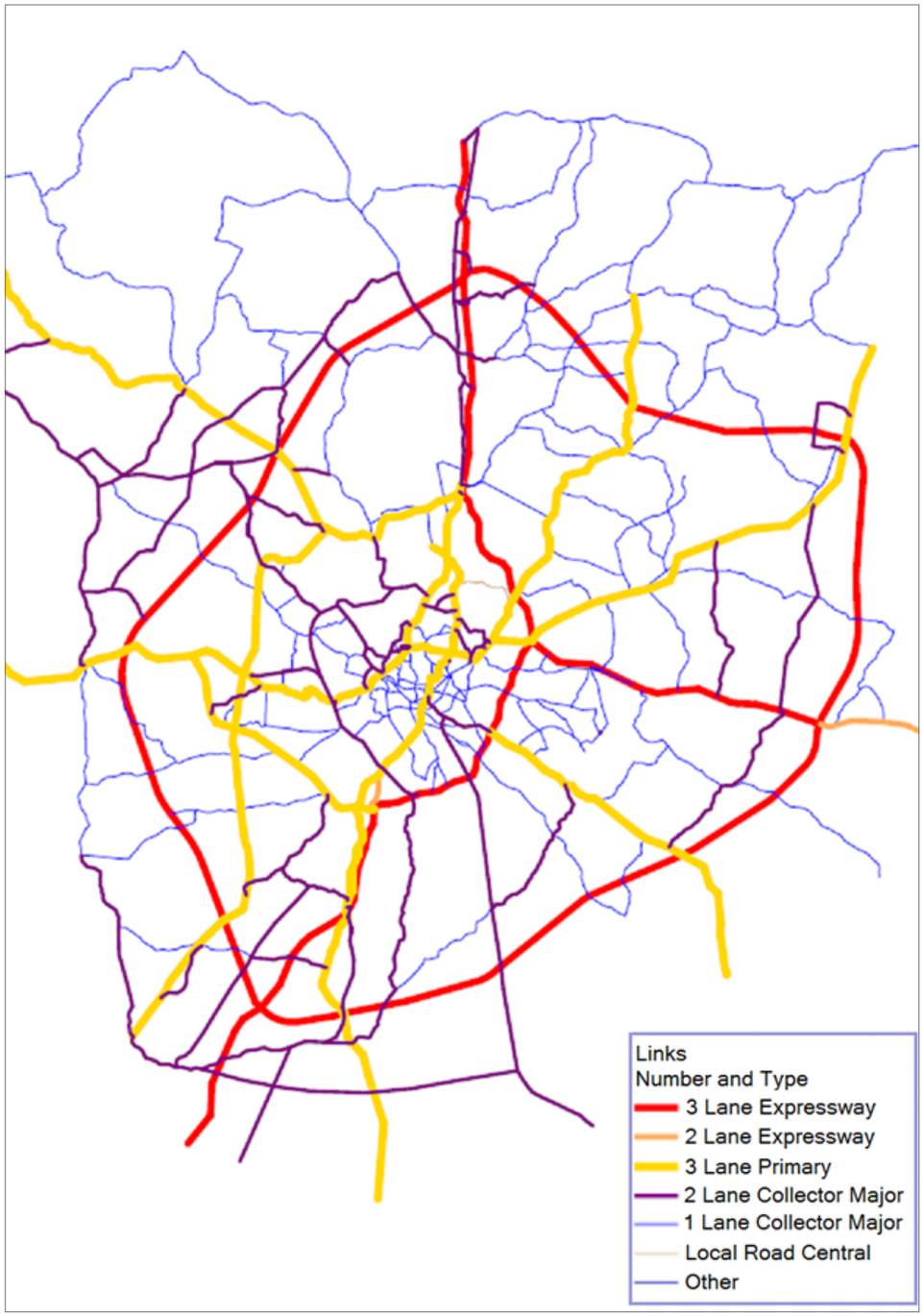

Figure 5.72: Dual-2 and Dual-3 Lane Road Requirement

5.4.6 Public Transport

The sustainable development of Ibadan in line with the Ibadan City Masterplan must be supported by the development of a modern, efficient, affordable and accessible public transport system. The traffic modelling undertaken for this study demonstrated that unless a significant shift from car to public transport and to high-capacity public transport modes is achieved, much of the road network could be severely congested by 2036, unless road construction and upgrading is significantly more extensive than was discussed in the previous section, with consequential detrimental impacts on the urban environment.

Thus a long-term vision for a high quality public transport system for Ibadan has been developed to deliver this mode shift. That system will comprise:

- Mass Rapid Transit (MRT) – MRT will serve the corridors of highest demand and could be either rail-based (LRT or metro) or Bus Rapid Transit (BRT).
- A high quality bus network operated by high capacity vehicles serving non-MRT corridors and providing feeder services to the MRT stops/stations.
- Minibus and taxi services to supplement the above in areas of lower demand, such as the peripheral areas.
- Interchanges and bus termini - modern, attractive and efficient off-road facilities at all significant demand generators and interchange points.

The recommendations on how these modes of transit should be implemented are outlined below.

Mass Rapid Transit (MRT)

The Oyo State Government is already promoting the construction of a light rail system for Ibadan. This will initially comprise a line from Ojoo to Mokola and ending at the Toll Gate area on the Lagos-Ibadan Expressway south of the central area, as shown in Figure 5.73. A Memorandum of Understanding has been signed between the State Government and the China Civil Engineering Construction Company for the construction of the line. The project is expected to be completed over a three year period. A proposed initial phase of the implementation of the Ibadan Light Rail service is the Red Line scheme. The planned alignment is approximately 12km in length and will run from south to north from the Toll Gate area of the Expressway to the Dandaru area of central Ibadan.

The Ojoo-Toll Gate line is envisaged to be the first stage in the development of a comprehensive rail-based MRT network for the city.

The planned rail MRT network has been reviewed and proposed revisions to it are reflected in the Masterplan, in particular with regards to extending lines to serve the new urban centres of high density development and the High Speed Rail station. The proposed network is shown in Figure 5.74. It comprises radial routes linking the new high density urban centres with the existing urban core and orbital lines connecting the new centres.

Very preliminary demand assessments indicate that potential ridership in these MRT corridors will be within the range that would be accommodated by either LRT or BRT. Feasibility studies will be required to provide robust ridership forecasts for these MRT proposals to recommend the appropriate modes to accommodate forecast ridership, to confirm their viability, and establish optimum alignments. In some corridors, demand is unlikely to justify the cost of LRT, and BRT will be the optimum mode. Where LRT may be viable ultimately, BRT may also be considered as a first phase in the implementation of MRT, to be upgraded to LRT in the longer term.

There will be a number of options for integrating MRT within existing/planned road corridors. While rail-based MRT will generally be located in central reserves or on alignments fully segregated from the road, BRT may be implemented as a busway located in the central reserve of the road, as segregated lanes on the nearside of each carriageway (additional lanes or by converting traffic lanes to BRT), or as busway completely segregated from the road alignment. If BRT is proposed as an interim measure pending the introduction of rail MRT in the longer term, then BRT will need to be implemented as a segregated busway either in the central reserve or separate from the roadway.

Where there are constraints on the available ROW width that preclude the provision of dedicated BRT lanes, and these constraints cannot be overcome, within the urban core for example, the BRT vehicles may operate in general traffic lanes. Sections of route where operation in mixed traffic applies should, however, be kept to the minimum.

Bus Network

Public transport in Ibadan is currently provided mainly by low capacity vehicles, which are generally also of low quality. On corridors where passenger demand is high, the large numbers of these vehicles, and their frequent stopping, contribute significantly to traffic congestion and to road safety problems. If such problems are not to be replicated as the city develops, then it will be required to implement a planned and regulated modern urban bus system to complement the MRT network.

A network of routes operated by conventional high-capacity buses will serve the main non-MRT corridors and provide feeder services to the MRT stations/stops. This bus network should be delivered through a franchising system allowing routes, frequencies, fares, operating hours and the quality of vehicles to be specified and monitored. Similar franchising models such as the one used in Lagos (LAGBUS) should be investigated for adoption here.

Minibus operations would be regulated to prevent competition that would undermine the viability of the franchised bus network, restricting them to operating on the lower demand corridors.

Public Transport Termini and Interchanges

Off-road bus loading/unloading and waiting facilities of appropriate scale shall also be provided in all the planned new urban centres and at main interchange locations, including the railway stations and bus-MRT interchanges. Off-road bus loading/unloading facilities shall also be provided at other activity hubs in the existing urban areas and in the expansion areas, such as commercial centres, hospitals, universities/colleges, etc.

The design of new and upgraded roads shall make provision for off-carriageway bus loading/unloading bays at main bus stops. These should have sufficient capacity to accommodate anticipated numbers of vehicles using the stops, thus permitting on-road stopping to load/unload to be prohibited.

The existing stations on the Lagos-Kano-Nguru railway line will need to be modernised and expanded to accommodate the growth in passenger numbers expected due to the growth in population and employment opportunities in Ibadan.

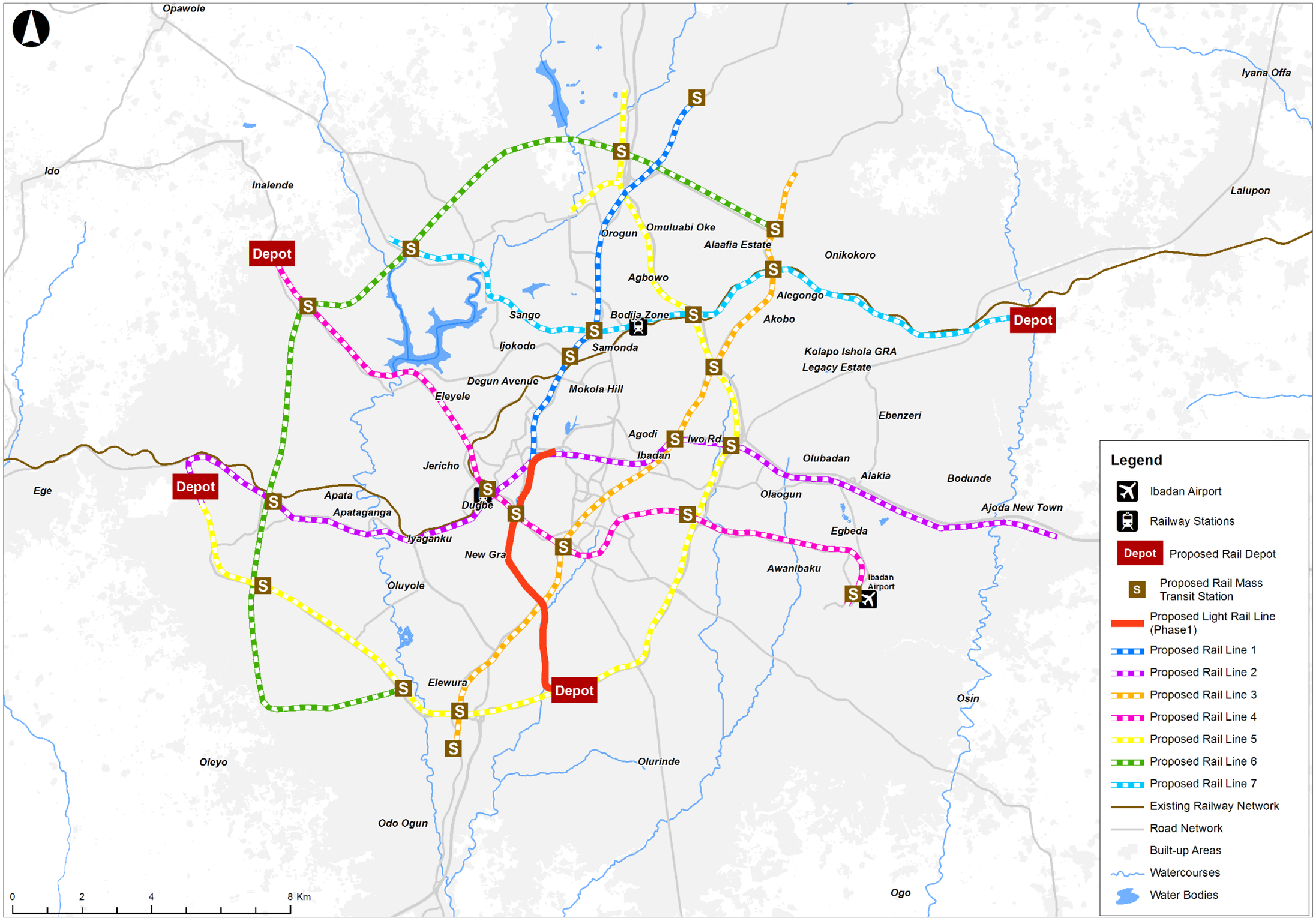

Figure 5.73: Plan of Ibadan Mass Rail Transit Proposal

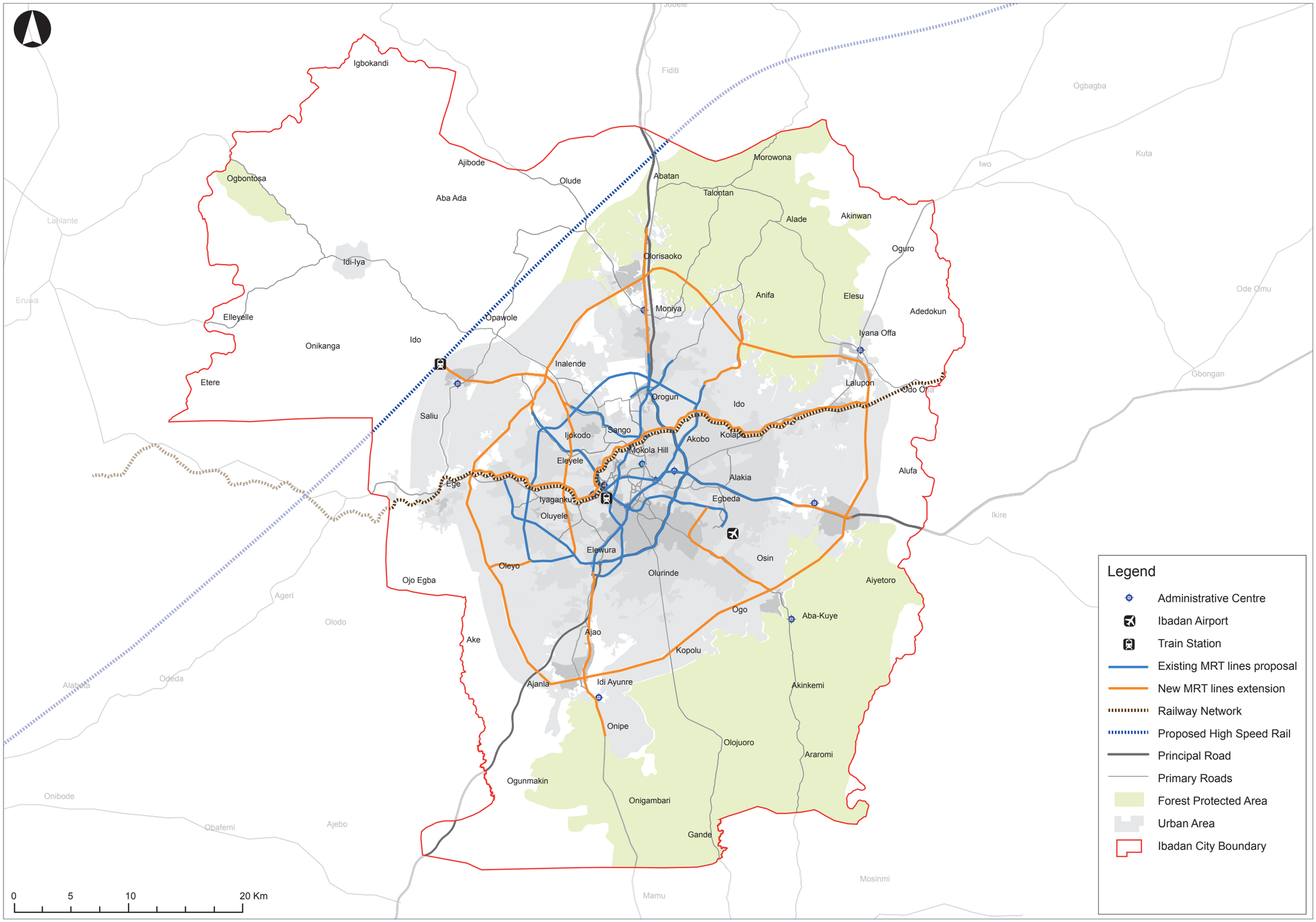

Figure 5.74: Proposed Mass Transit Network

5.4.7 Car Parking

An appropriate level of parking for private vehicles needs to be provided to support the land use proposals of the Masterplan. An under-supply of parking will potentially compromise the viability of developments and will lead to parking spilling over into inappropriate areas where it can have adverse effects on the environment, safety and traffic. An over-supply of parking represents an inefficient use of land and is economically wasteful. It may also erode the benefits from investment in sustainable transport modes by encouraging more use of the private car.

Issues relating to parking do not just concern how much is provided, but also where it is located and how it is managed and regulated. At the level of the Ibadan City Masterplan, land uses are not defined in sufficient detail to calculate parking requirements. Instead, strategic policies can be outlined that provide guidance for the development of parking plans for specific areas/developments as implementation of the Masterplan moves forward.

Parking Strategy for Ibadan

Key elements of parking policy to be incorporated in a Parking Strategy for the city shall include:

Parking Rates/Standards

A detailed set of parking rates or standards should be adopted that specify the number of spaces to be provided per unit of development. Standards should be defined to ensure that all the parking requirements generated by development can be met off-street.

Residential parking standards should be developed based on expected levels of car ownership, such that residents' parking requirements are met off-road, either within curtilages or as common parking areas. Standards should differentiate between different forms of residential development and housing types.

Non-residential parking standards should be framed for all types of development likely to take place in the city. They should be sufficiently detailed in terms of the land use classifications adopted to be able to reflect the different parking characteristics of sub-divisions of the broad land use types, such as for example, different types of retail development.

Bespoke standards should be developed from, or validated against, local or regional research data on current parking demand generation, robust projections of the impact on parking demand generation of increasing incomes and car ownership, and potential mode shift toward public transport.

The potential for parking standards to be implemented to support wider objectives for sustainable development and a sustainable transport system will also need to be addressed. Thus parking standards may be adopted that vary by area, related to such considerations as public transport accessibility, road network capacity, and environmental impacts.

For land uses that generate significant numbers of goods vehicle movements, parking standards should be specified separately for goods vehicles

Private and Public Parking

In the mixed use areas, such as the urban centres, it is recommend that parking is provided as shared parking across the various uses in public car parks. Public shared parking is more efficient than private parking dedicated to single-uses as the timing of peak demand often differs (by time of day or day of week) between uses. By not having to provide for each peak demand individually, the overall quantity of parking required is reduced.

In larger centres, parking capacity intended for short-stay (e.g. shopper) and long-stay (commuter) use should be differentiated by regulation on maximum stays or through charging, which is discussed further below. The parking that is located most conveniently for retail should be allocated to short-stay.

Many of Ibadan's economic and trading activities are done in the streets at a relatively fast pace. Laybys offer an adequate solution for this temporary need for parking spaces. These are designated paved areas at the side of the main roads for vehicles to park for a short period of time to load and unload people or goods.

Even where parking is to be provided as dedicated private parking, to increase the efficiency of land use any opportunities for shared parking should be explored.

Charging for Parking

In principle, public parking should be charged for. Charging not only raises revenues for enforcement and maintenance, it also encourages the efficient turnover of spaces. Furthermore, tariffs can be designed to manage how parking is used – for example to differentiate between a parking intended for short stays and parking intended for long-stay commuter use.

On-Street Parking

On-street parking should only be permitted on collector roads and local access roads and only where it can be provided such that it does not impact adversely on road safety, traffic flow or the environment. In general, on-street parking will be required in locations where demand does not justify the provision of off-street car parks.

All on-street parking in non-residential areas where demand is expected to be high should be controlled and subject to regulations or charging regimes that will ensure it is used efficiently and to the maximum benefit of the local areas it serves. In such areas, on-street parking should be provided for priority users such as the disabled, deliveries, and very short stay parking, where the demand for such parking is likely to occur. Other requirements should, as noted above, be met off-street.

All parking regulations must be enforced effectively.

Park and Ride

Park and Ride (P&R) combines the advantages of private transport in serving dispersed trip origins which are difficult to serve by public transport, and the advantages of public transport in serving 'trunk corridors' to major areas of trip attractions, such as in central areas.

The Ibadan City Masterplan proposes a series of strategic P&R sites located on the MRT network adjacent to the Circular Road. These will primarily serve trips from areas of lower density development in the outer areas of the city and trips from outside of the city. In addition to these strategic sites, it is proposed that car parks of appropriate size be provided at all other MRT stations.

Park and Ride facilities are formed of car parks with public transport connections that allow commuters and other users heading to the city centre or Growth Centres, to leave their vehicles and transfer to a bus or one of the options of MRT. The vehicle is left in the car park during the day and retrieved when the owner returns.

The Ibadan City Masterplan envisons a park and ride on each of the main road intersections with the Circular Road:

1. Ibadan-Ido-Eruwa road
2. Ibadan-Ilorin Moniya road
3. Ibadan-Iwo road
4. Ibadan-Ife road
5. Ibadan-Ijebu-Igbo-Akanran road
6. Ibadan-Olojuoro-Ijebu-Igbo road
7. Ibadan-Idi Ayunre-Lagos road
8. Ibadan-Lagos road
9. Ibadan-Omi Adio-Abeokuta road

People living in existing urban areas and in the future expansion areas would be able to access these parking facilities easily, and change to a public transport system that takes them efficiently either to the different commercial areas, industrial sites, the core area or the Growth Centres.

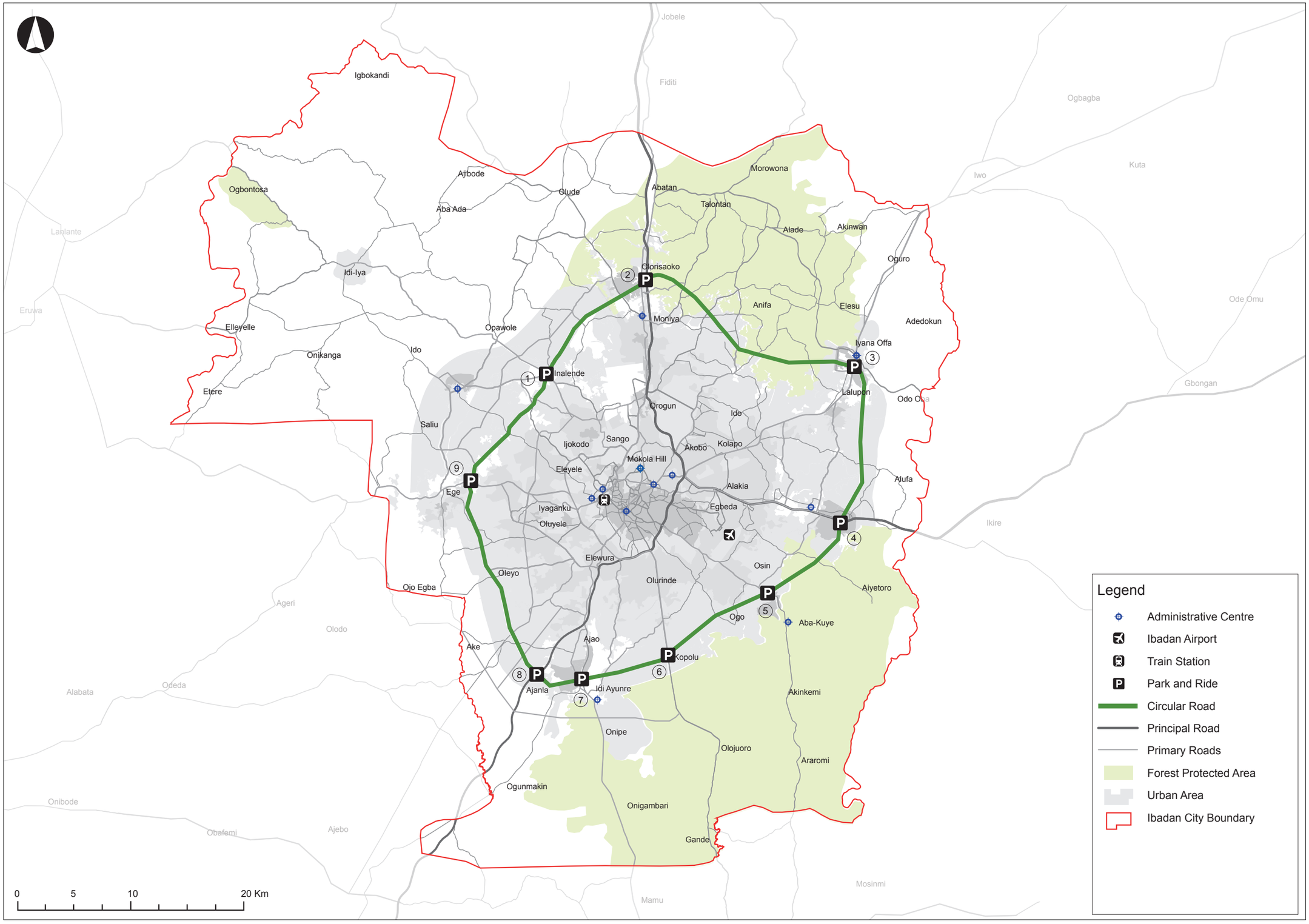

Figure 5.75: Proposed Park and Ride Locations



Figure 5.76: Park and Ride Sign *ShutterStock*



Figure 5.77: Parking facilities in Chatuchak Park, Thailand *ShutterStock*



Figure 5.78: Road marking of a parking spot for loading and unloading, Italy *ShutterStock*

5.4.8 Road Cross-Sections

To support the land use development proposed in this Masterplan, a functional road hierarchy is established for the sub-region as described previously. This entails the construction of new roads and the upgrading of a number of existing roads. Some of the new/upgraded road corridors will incorporate MRT alignments.

The figures on the following pages show some standard cross-sections for new/improved roads. These include:

- Dual 3-lane expressway (48m). Lane widths are 3.65m for all vehicles with a 3.0m shoulder. No footways are provided (Figure 5.79).
- Dual 3-lane urban Principal/Primary Road (37m) including outer shoulder cycleway and footways. Lane width is 3.5m for all vehicles. A 2.5m shoulder is provided (Figure 5.80).
- Dual 3-lane urban Principal/Primary Road (37m) including outer shoulder cycleway and footways with central running BRT segregated from general traffic. The lane width is 3.5m for all vehicles, with 4m for the BRT lane. A 2.5m shoulder is provided (Figure 5.81).
- Dual 2-lane urban Principal/Primary Road (30m) including outer shoulder cycleway and footways, intended for retro-fitting into narrow ROW (Right Of Way) corridors. Lane width is 3.5m for all vehicles with a 2.5m shoulder (Figure 5.82).
- Dual-2 lane main Collector Road (25m) including cycleway on the footpath. Lane width is 3.5m for all vehicles with a 0.5m outer shoulder. The designated cycleway width is 2m (Figure 5.83).
- Single carriageway 2 lane Local/Collector Road (18m, 15m and 10m) with various parking arrangements and sidewalks (pavements). Lane widths are 3.5m with 2.5m provided for parking (Figure 5.84 to Figure 5.86).

It should be noted that where Rapid Transit lanes are incorporated within the ROW, the ROW will need to be increased at Rapid Transit stops.

Enforcement of the BRT lanes will be important to ensure that buses do not get caught in general traffic congestion. It is recommended to provide segregation of the BRT by a solid island, to physically prevent general traffic from entering the BRT lanes.

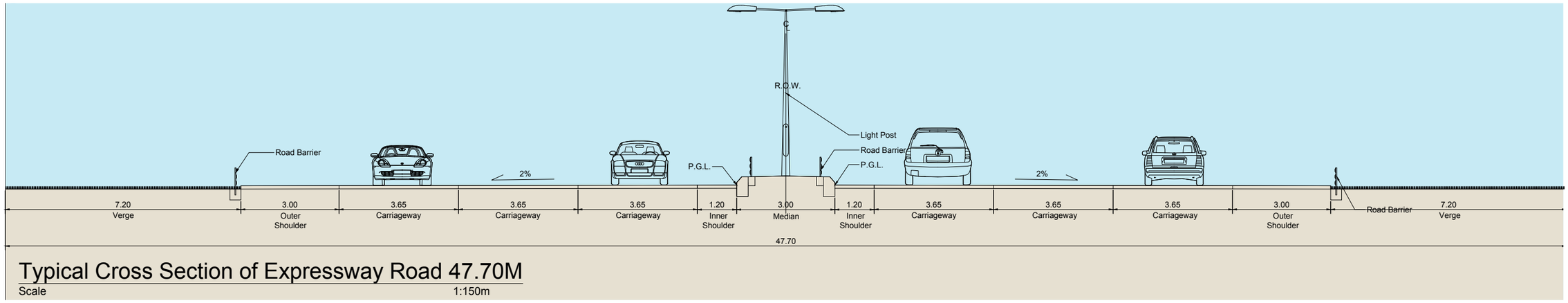

Figure 5.79: Typical Cross Section for Dual 3-lane Expressways

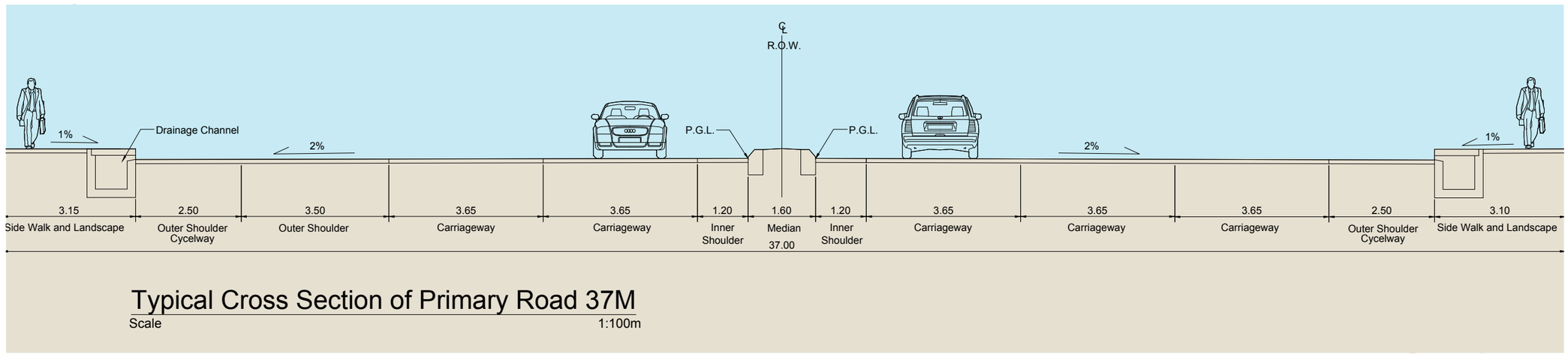

Figure 5.80: Typical Cross Section for Dual 3-lane Primary Roads

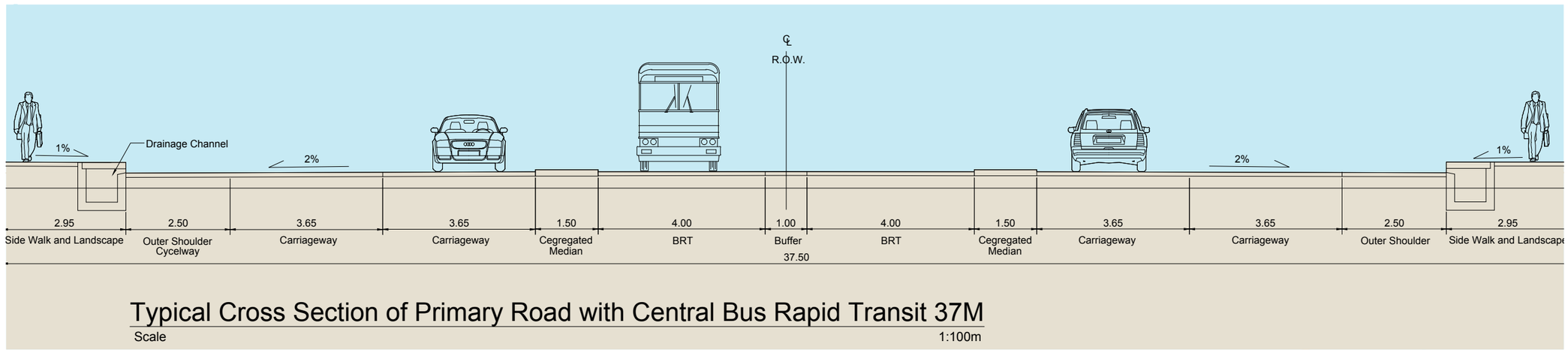

Figure 5.81: Typical Cross Section for Dual 3-lane Primary Roads with BRT

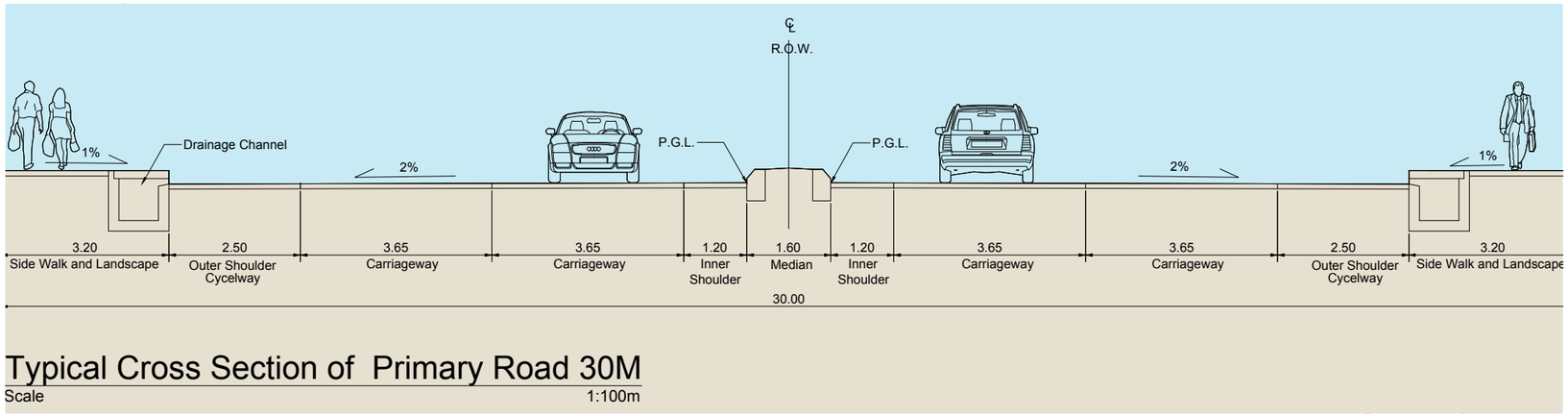

Figure 5.82: Typical Cross Section for Dual 2-lane Primary Roads

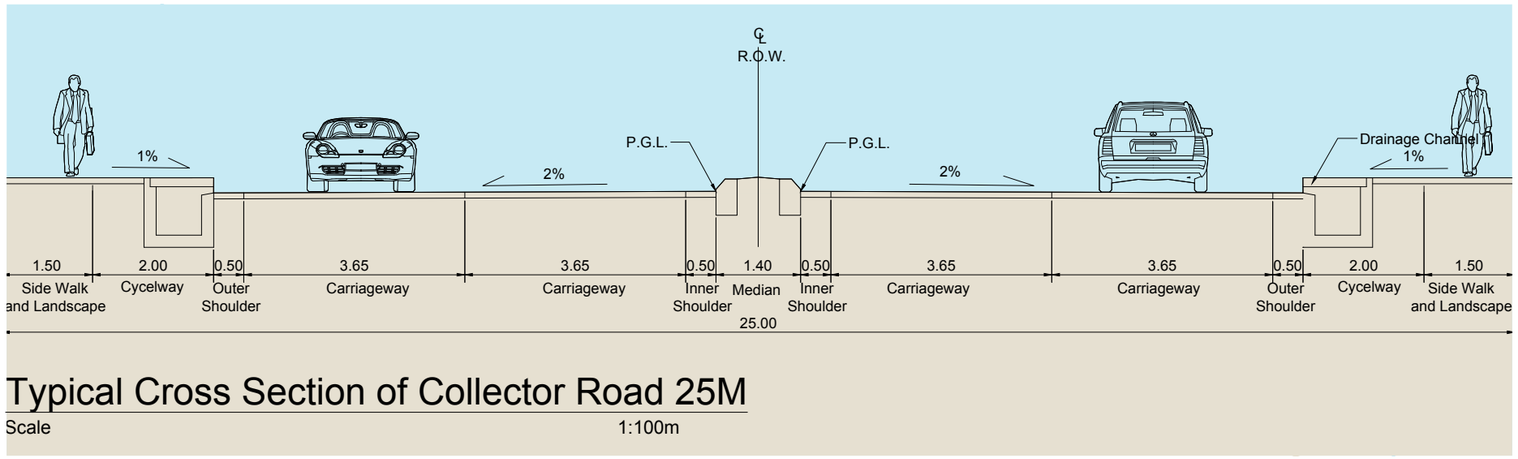

Figure 5.83: Typical Cross Section for Dual 2-lane Collector Roads

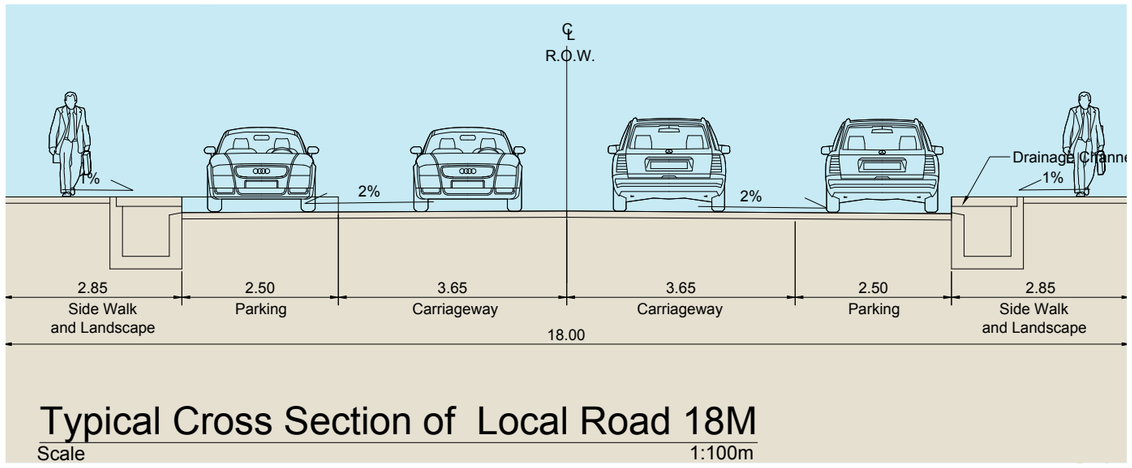

Figure 5.84: Typical Cross Section for 18m Local Roads

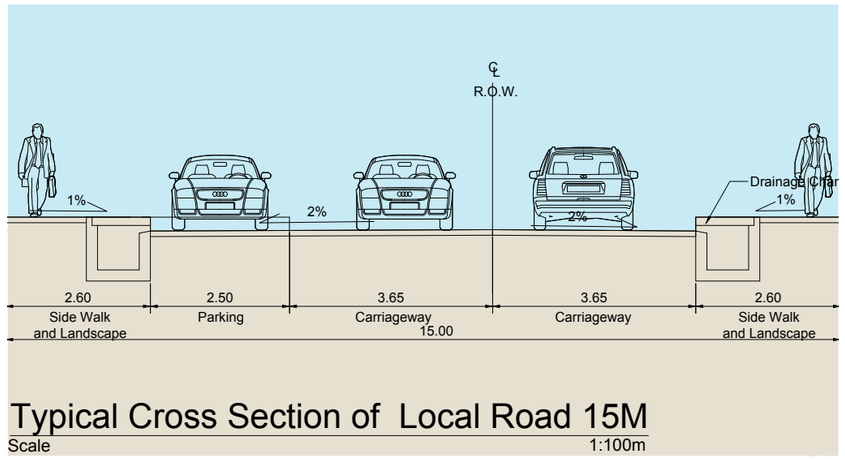

Figure 5.85: Typical Cross Section for 15m Local Roads

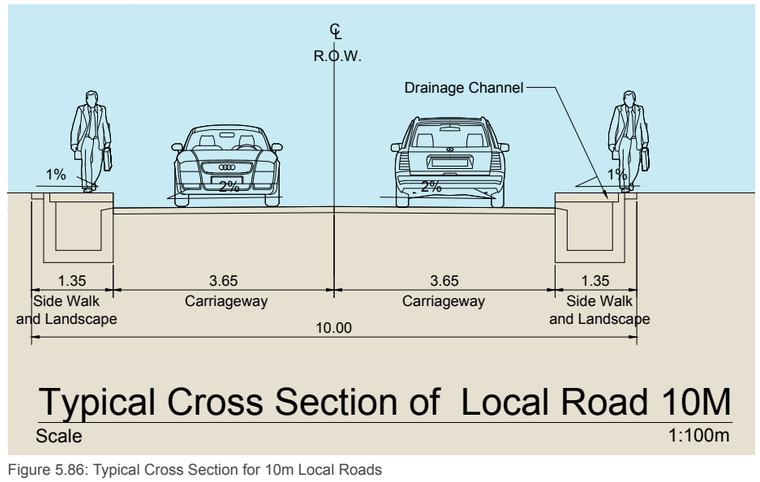

Figure 5.86: Typical Cross Section for 10m Local Roads

5.5 SUMMARY

5.5.1 Growth in Transport Demand

Forecast transport demand in 2036 has been based on the capacity for growth provided by the land use allocations of the City Masterplan. The population of the city is projected to increase from an estimated 6.02 million in 2016 to 11.6 million by 2036. Total employment is projected to rise from 1.9 million to 4.1 million over the same period. Additionally, there will be an increase in the percentage of the population that is of working age, from 58.6% in 2016 to 65% in 2036, which will also contribute to growth in transport demand.

Taking into account the growth in car ownership and personal mobility due to rising incomes, and mode shift due to improved public transport services, vehicle trips on the road network in the peak hours are forecast to increase by 177% by 2036. Thus the total vehicles on the city's road network in the critical a.m. peak hour are forecast to increase from around 110,000 in 2016 to over 300,000 in 2036.

Recommendations for the sustainable development of each transport mode to cater for these forecast demands for movements are summarised below.

5.5.2 The Road Network

The following functional road hierarchy is proposed as the framework for planning, designing and managing the road network:

- Principal Roads: roads of regional or national significance that connect the major economic centres of the State and connect those centres to the national strategic road network.
- Primary Roads: these connect the main urban areas within the State and main economic centres within the city, and connect these areas to the Principal Road network.
- Collector Roads: these collect traffic within urban and rural areas and feed that traffic onto the Primary or Principal Road networks.
- Local Roads: these provide access to neighbourhoods and to individual sites.

Substantial expansion of the road network will be required to support the Masterplan developments and cater for the forecast levels of movements. This will entail the construction of new roads and the further upgrading of existing roads. The proposed 2036 road network therefore comprises:

- The Circular Road – a new Primary Road to be constructed to expressway standards,
- Inner Ring Road, incorporating the Western Bypass which has already been constructed – a Primary Road comprising upgrades to existing roads and sections of new road construction,
- New and upgraded radial Primary Roads,
- An expanded Collector Road network, including new links and the upgrading of existing roads.

Recommendations are made concerning the standard (number of lanes) for each of these roads required to cater for the vehicle flow forecasts from the traffic model. Some example standard cross-sections for new/improved roads are presented.

This strategic assessment has focused on the higher-order roads. In planning the new development areas (expansion areas and infill areas), further study will be required to determine the appropriate density and distribution of lower order collector and local roads.

It will be essential that the road network is managed to ensure that it operates efficiently and safely for all users, and the impact of traffic on the environment is minimised. Policies will need to be in place, backed by appropriate regulations and enforcement practices, to address the problems that are currently observed to reduce road capacity and create congestion and safety issues in Ibadan. This section outlines the scope of these policies covering such matters as maintenance standards and practices, control of access to premises, parking policies and the development of a direction signage strategy.

5.5.3 Public transport

To support the sustainable development of Ibadan, it will be essential to put a public transport network in place that is comprehensive and modern. This will consist of the following elements:

- Mass Rapid Transit (MRT) – either rail-based (LRT) or Bus Rapid Transit (BRT) serving the corridors of highest demand;
- A high quality bus network;
- Minibus/taxi services in areas of lower demand such as the peripheral areas; and
- Modern, attractive and efficient off-road termini and interchanges.

Mass Rapid Transit

The Oyo State Government is promoting the construction of a light rail system for Ibadan. This initially comprises a line from Ojoo to Mokola, ending at the Toll Gate area on the Lagos Ibadan Expressway. The first section to be constructed will be the Red Line covering 12km from Toll Gate to the Dandaru area of Central Ibadan. The Ojoo-Toll Gate line is envisaged to be the first stage in the development of a comprehensive rail-based MRT network for the city.

The planned rail MRT network and proposed revisions to it, in particular extending lines to serve the new urban centres of high density development and the High Speed Rail station has been reviewed to inform the masterplan. Preliminary demand assessments indicate that potential ridership in these MRT corridors will be within the range that would be accommodated by either LRT or BRT. Feasibility Studies will be required to confirm ridership potential and the appropriate modes to operate the MRT services. In some corridors, demand is unlikely to justify the cost of LRT and BRT will be the optimum mode of transport. Where LRT may be viable ultimately, BRT may also be considered as a first phase in the implementation of MRT, to be upgraded to LRT later.

Bus System

A planned and regulated modern bus system will be required to complement the MRT network. A network of routes operated by conventional high-capacity buses should be implemented to serve the main non-MRT corridors and provide feeder services to the MRT stations/stops. Minibus operations would then be regulated to prevent competition that would undermine the viability of the bus network, restricting them to operating on the lower demand corridors.

This bus network should be delivered through a franchising system allowing routes, frequencies, fares, operating hours and the quality of vehicles to be specified and monitored. Developing a suitable franchising model for Ibadan can take into account the Lagos Area Metropolitan Transport Authority's experience with the LAGBUS network in Lagos.

Public Transport Termini and Interchanges

It is proposed that off-road bus loading/unloading and waiting facilities of appropriate scale shall also be provided in all the planned new urban centres. Off-road bus loading/unloading facilities shall also be provided at other hubs of bus boarding and alighting, such as interchanges on the mass transit network and retail centres.

Existing rail stations on the Lagos-Kano-Nguru line will need to be redeveloped to accommodate additional passengers.

The design of new and upgraded roads shall make provision for off-carriageway bus loading/unloading bays at main bus stops with sufficient capacity to accommodate anticipated numbers of vehicles using the stops.

Water Transport

While Ibadan has a dense network of rivers and streams, seasonal variations in the depth and other physical constraints mean it is not feasible to develop them as reliable water transport routes that can operate all year round.

The Masterplan does identify the potential scope to provide water transport services on the major rivers. Further studies will be required to determine the feasibility, costs and potential ridership of such services.

The Masterplan also identifies a significant opportunity to develop water transport services across Lake Eleyele to improve transport connectivity in north-west Ibadan.

5.5.4 Parking

An appropriate level of parking for private vehicles needs to be provided to support the land use proposals of the Masterplan. Parking policies to deliver sustainable levels of parking need to address how much parking is provided, where it is located and how it is managed and regulated.

At the level of this Masterplan, land uses are not defined in sufficient detail to calculate parking requirements. However, the report outlines strategic policies to provide guidance for the development of parking plans as implementation of the Masterplan moves forward. These policies cover:

Parking Rates/Standards

A detailed set of parking rates or standards should be adopted. Standards should preferably be developed from, or validated against, local or regional research data.

Private and Public Parking

In the mixed use areas such as the urban centres, it is recommend that parking is provided as shared parking in public car parks. In larger centres, parking capacity intended for short-stay (e.g. shopper) use and long-stay (commuter) use should be differentiated by regulation on maximum stays or through charging.

In general, public parking should be charged for to raise revenues for enforcement and maintenance, while encouraging the efficient turnover of spaces and tariffs.

On-Street Parking

On-street parking should only be permitted on collector roads and local access roads and only where it can be provided such that it does not impact adversely on road safety, traffic flow or the environment. On-street parking in non-residential areas where demand is expected to be high should be subject to regulations or charging regimes.

Park and Ride

Car parks of appropriate size shall be provided at all MRT stations. Strategic P&R facilities with larger car parks will be located at selected stations most accessible from the main road corridors.

5.5.5 Non-Motorised Transport (NMT)

Non-Motorised Transport (walking and cycling) should be promoted as alternatives to the car for shorter journeys. Conditions in Ibadan are generally favourable to walking and cycling and the main barrier to the adoption of NMT as a significant mode of transport would be a lack of convenient and safe routes and dedicated infrastructure.

The principles for developing NMT in Ibadan are outlined as follows:

Cycling

Dedicated cycle-ways shall be provided on Primary and Main Collector roads. Lower order roads shall be designed to deliver low vehicle speeds such that cycling may take place safely on the road. Dedicated facilities may be appropriate where numbers of cyclists are likely to be particularly high, such as adjacent to educational facilities, health facilities, shopping areas.

Cycle routes shall be designed to be direct, attractive, safe and connective.

Walking

Footways shall be provided alongside all roads, along with safe crossing facilities. Local areas will be designed to keep vehicle speeds low and encourage movement on foot.

The key principles for pedestrian routes are that they should be accessible, attractive, secure and legible.

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SOCIO-ECONOMIC FRAMEWORK

6

6 SOCIO-ECONOMIC FRAMEWORK

6.1 INTRODUCTION

This section builds on the Ibadan City Masterplan Development Framework Scenarios Report[1] which projected future employment in the Ibadan metropolitan area in total and by sector based on the expected structural change in the Nigerian economy. The Development Framework also outlined scenarios for the spatial distribution of the future employment according to three alternative development options. This section provides a revised assessment of this analysis and sets out policies and measures to support the projected employment expansion for key growth sectors.

6.1.1 Data Sources

A number of sources have been relied upon to inform this analysis including, but not limited to:

- International sources such as the IMF and the World Bank;
- National sources including the National Bureau of Statistics, the Central Bank of Nigeria and various ministries statistics; and,
- Previous sectoral studies undertaken by planning and economic specialists.

Furthermore, in order to project Ibadan's population, a demographic consultant spent a number of days on the ground in Ibadan to collect socio-economic indicators and inform population projections.

6.1.2 Section Structure

The remainder of this section is organised as follows:

Methodology and Projections

Presented is the methodology adopted to estimate employment by economic activity by 2036 as well as the results of projections.

Spatial Distribution Of Employment

Building on the above, a spatial distribution of future employment growth is based on the selected masterplan approach.

Masterplan Policies

Sets out policies and measures to support the projected expansion of key sectors.

1 Dar, 2017.

6.2 METHODOLOGY & PROJECTIONS

Employment by economic activity in Ibadan in the period to 2036 has been projected on the basis of a number of indicators and factors related to long term GDP forecasts, population and labour force growth, and also the expected structural change in the Nigerian economy over the next 10-20 years. This will determine a broad picture of how Ibadan's economy is expected to develop to 2036 and enable this to be translated into employment and land use outputs.

6.2.1 Population Projections

Population projections for Ibadan have been projected to 2036 based on three growth scenarios, as shown in the table below.

Table 6.1: Population Growth Scenarios

	SCENARIOS		
	LOW	MEDIUM	HIGH
Growth Rate (CAGR 2016-21)	2.7%	3.4%	4%
Growth Rate (CAGR 2021-36)	2.5%	3.2%	3.8%

Source: External Demographic Consultant Analysis, 2017.

On the basis of these projections, it is forecast that population will increase by around 5,593,000 between 2016 and 2036 (under the median case). The median growth scenario is being used as the preferred growth option during the course of this analysis.

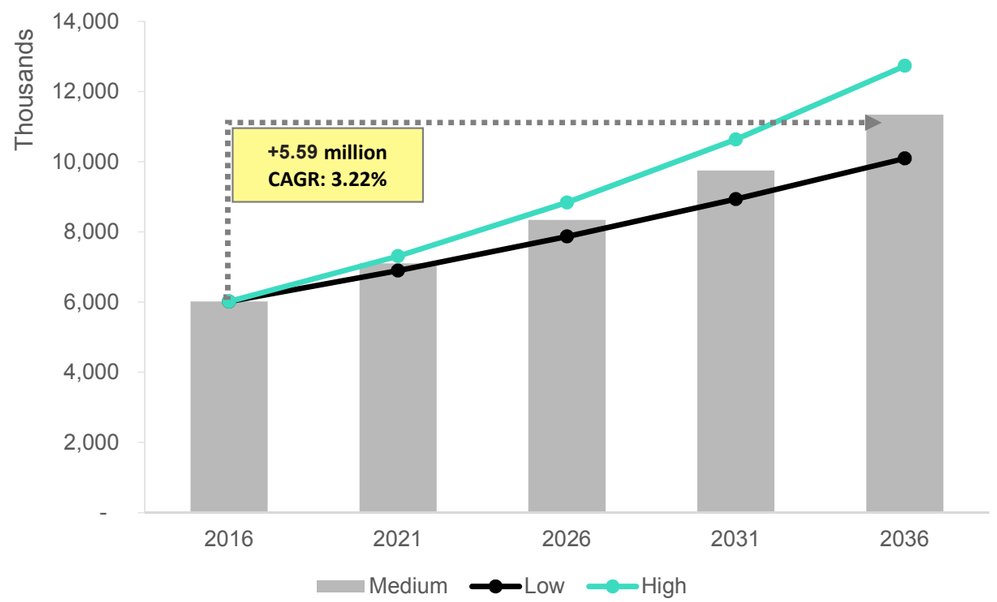

Figure 6.1: Population Projections based on Various Scenarios 2016-2036 (Ibadan)

Source: External Demographic Consultant Analysis, 2017.

6.2.2 Total Employed Labour Force Projections

In order to estimate employed labour force between 2016 and 2036, it was necessary to account for the Ibadan working age population (those aged between 15 and 64 years). Given the limited data availability for sub-national labour force statistics for Ibadan, the latest 2016 national percentages of the working age population breakdown have been used, namely employed, unemployed and inactive population (Figure 6.2) to inform total employment forecasts for Ibadan by 2036.

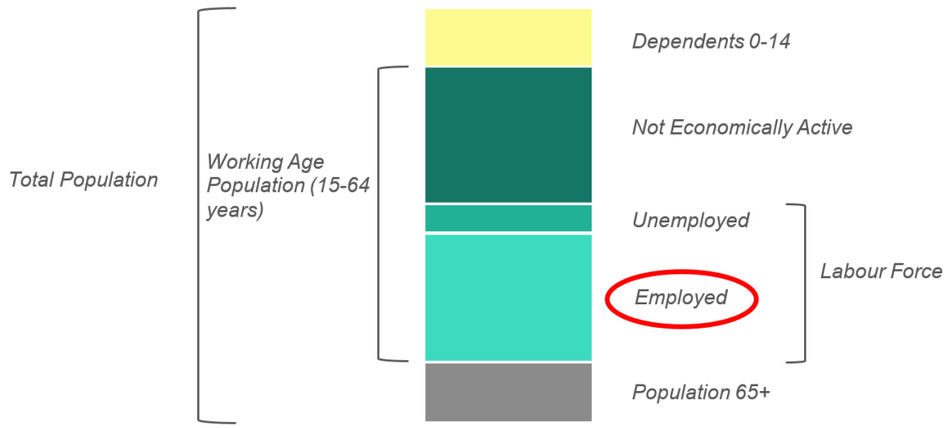

Figure 6.2: Working Age Population Breakdown

Table 6.2 presents the assumptions for the working age population breakdown. For the purpose of this analysis, the working age population share is expected to rise gradually, increasing by 6.4 percentage points, reaching 65% by 2036. This is in line with broad trends at the national level. In addition, the employed, unemployed and inactive shares within the labour force are assumed to remain constant.

Table 6.2: Public Transport / Transit Technologies

VARIABLES	SCENARIOS
Working Age Population out of Total Population (2016)	58.6%
Working Age Population out of Total Population (2036)	65%
Labour force out of Working Age Population (2016-2036)	74.7%
Employed Labour Force (2016-2036)	85%
Unemployed Labour Force (2016-2036)	15%
Inactive Population out of Working Age Population (2016-2036)	25.3%

Source: Consultants' Assumptions, 2016.

Combining the above, it is estimated that the employed labour force will grow by some 2.44 million during the period 2016-2036, as illustrated below.

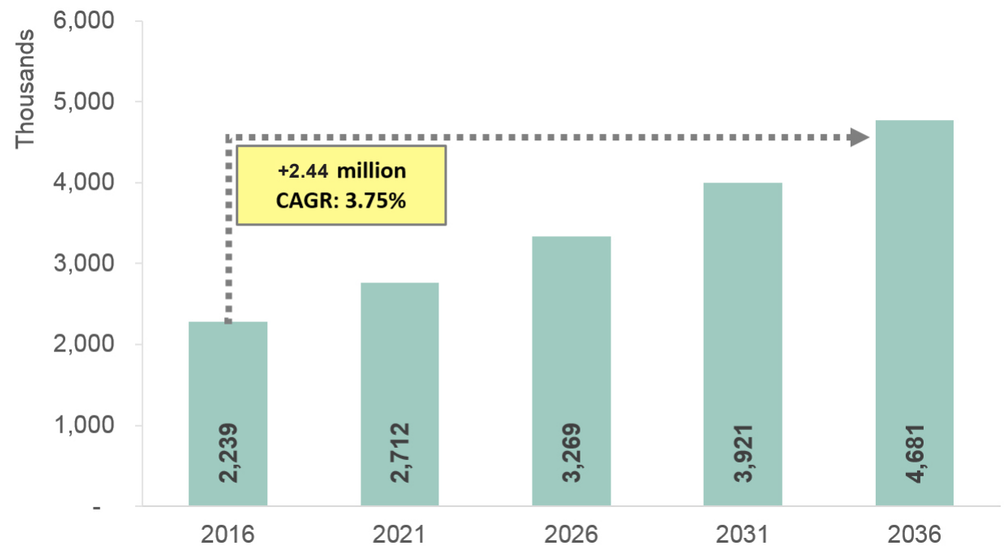

Figure 6.3: Total Employment Projection, 2016-2036

Source: External Demographic Consultant Analysis, 2016.

6.2.3 Sectoral Employment Projections

On the basis of the total employment projections, employment by economic activity in Ibadan for the same period (2016-2036) was considered. In estimating each sector's share of total employment, the following steps were taken:

Total GDP Projections

GDP projections to 2031 have been estimated to inform the sectoral employment projections. In constructing GDP projections, historic trends in output growth between 1985 and 2015 as published by the Central Bank of Nigeria (CAGR of 5.2%) have been analysed. Additionally, output projections for Nigeria prepared by industry experts were made in the period to 2030 (e.g. IMF, McKinsey) and 2050 (e.g. PwC). These external GDP forecasts by the IMF, PwC and McKinsey place GDP projections for the short to medium term at around 5%. This rate has been used to forecast GDP for 2031, and maintaining stable growth rate for the period after to 2036.

Accordingly, it is projected that GDP will increase by around 81,650 N' billion between 2015 and 2030 (Figure 6.4).

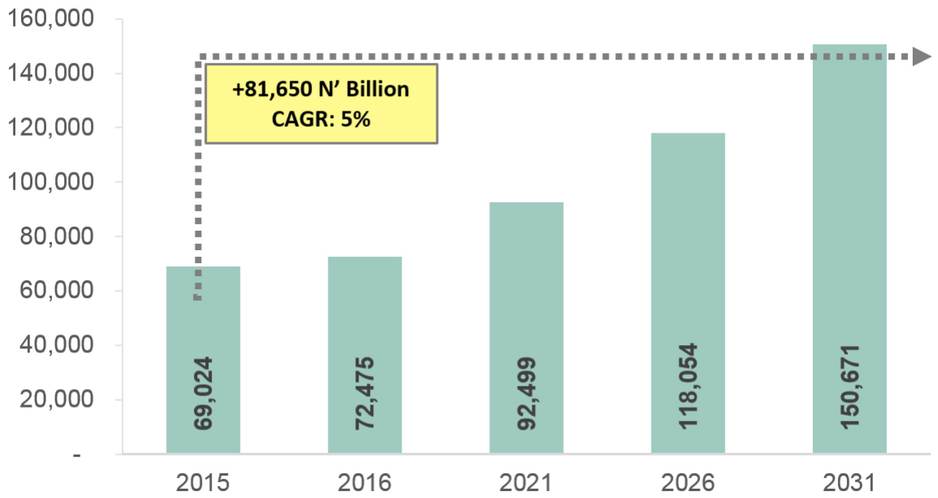

Figure 6.4: GDP at Constant Market Prices Projections (N' Billions), 2015-2031

Source: Central Bank of Nigeria, 2015; Consultants' Analysis, 2016.

* Forecasts starts after 2015.

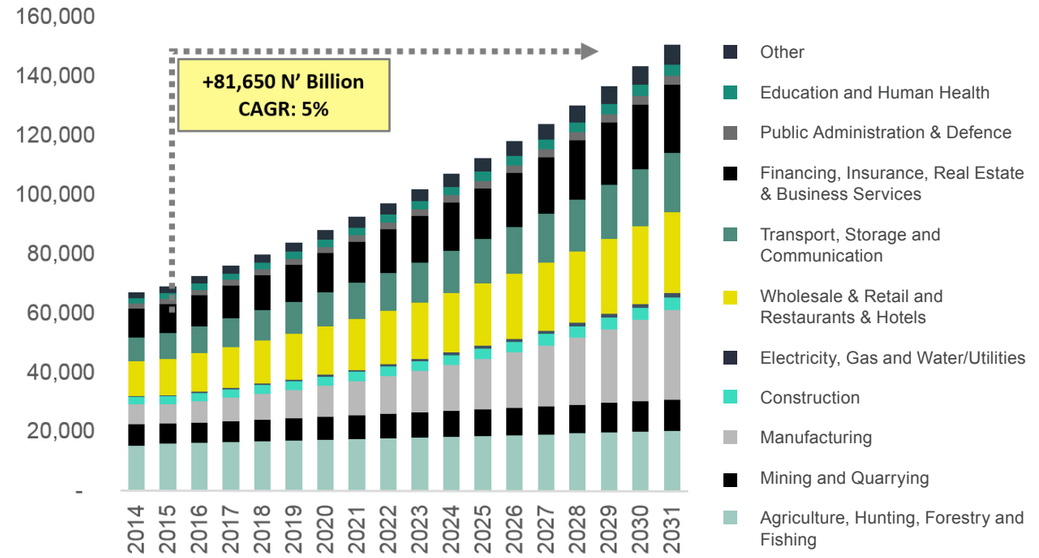

Figure 6.5: GDP Projections by Economic Activity (N' Billions), 2015-2031

Source: Consultants' Analysis, 2016.

GDP Sector Composition Projections

In projecting GDP by economic activity, historic trends have been assessed to understand changes in output as the economy evolves and develops. In addition, given that the long term sectoral evolution of the Nigerian economy is unclear, a number of studies conducted by industry specialists have been referred to in order to identify key growth sectors that are expected to drive value added and increase their share of the economy over time. The identified sectors are most likely to grow at a higher rate than the average output growth of 5%, and their contribution to GDP is expected to increase in the short to medium term.

Research shows that Nigeria has a large young population (around 67% below the age of 30) and a growing middle class that is beginning to use e-commerce have widely. It also has a large domestic market for manufactured consumer goods. As a result, the country has witnessed considerable progress in its non-oil diversification towards service and consumer driven sectors in recent years. Nigeria has an economic potential that lies beyond oil, with several fundamental shifts at work to favour further diversification and growth industries particularly in areas such as:

- Information and telecoms;
- Retail/trade;
- Manufacturing and its integration with other growing domestic sectors;
- Infrastructure (e.g. real estate, transport, electricity, gas and water).

It is considered that the above listed sectors are likely to grow at a higher rate than the total GDP growth rate of 5% in the period to 2031.

All of these considerations are combined together to project GDP by economic activity, as illustrated in Figure 6.5 and Figure 6.6.

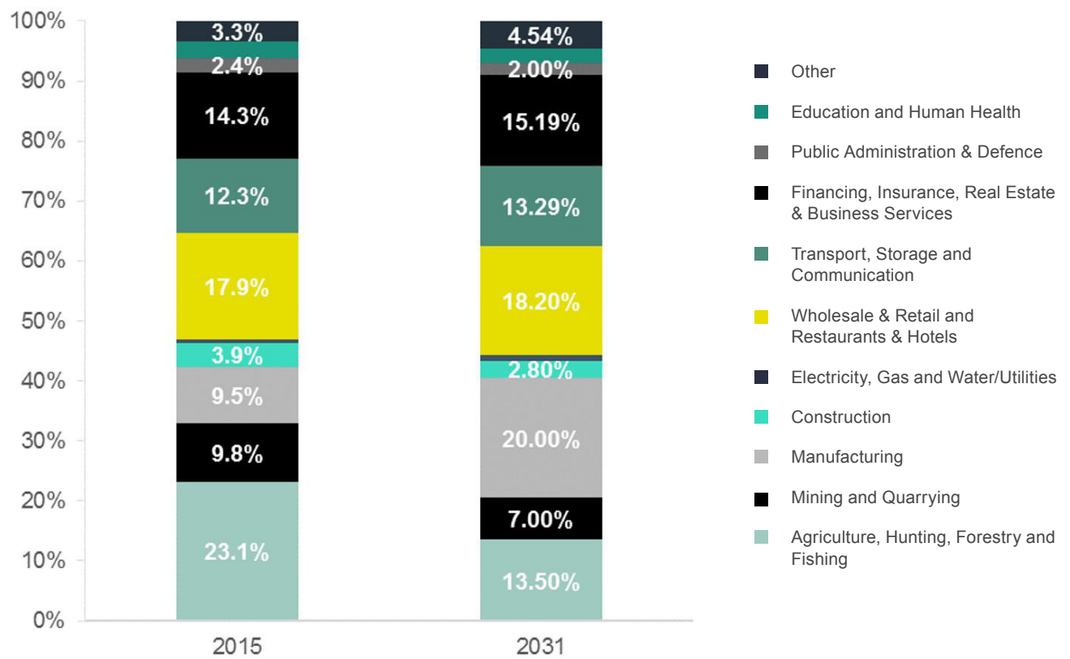

Figure 6.6: GDP Breakdown by Economic Activity, 2015 vs 2031

Source: Consultants' Analysis, 2017.

Employment by Economic Activity in Nigeria

In order to move from GDP to employment at the national level, projections for Nigeria's likely real GDP per capita by 2030/31 based on the overall GDP projections, other research sources, and identified economies with similar levels of GDP per capita in the present day have been assessed.

This is to control for the likely productivity effect that accompanies sectoral change in the economy and determine the likely employment intensity of different economic sectors by 2030. Based on a broad assessment of the average ratios for selected countries and other insight, the following employment to GDP ratios for the various economic activities have been assumed to be a reasonable representation of the employment intensity of GDP sectoral projection for 2030, as illustrated in Table 6.3.

Table 6.3: Average Employment to GDP Ratio by Economic Activity

EMPLOYMENT TO GDP RATIO	AVERAGE
Agriculture, Hunting, Forestry and Fishing	1.85
Mining and Quarrying	0.07
Manufacturing	0.90
Electricity, Gas and Water	0.80
Construction	0.71
Wholesale & Retail and Restaurants & Hotels	1.37
Transport, Storage and Communications	0.56
Financing, Insurance, Real Estate & Business Services	0.40
Public Administration & Defence	0.85
Education and Human Health	1.60
Other Services	2.09

Source: Consultants' Analysis, 2016.

Applying the above ratios the 2031 projected sectoral shares, it is estimated that the largest contributors to Nigeria's employment would be agriculture, forestry and fishing and trade/retail, each accounting for 25% of total employment. Manufacturing is expected to be the third largest sectoral employer, contributing to around 18% of total employment (Figure 6.7).

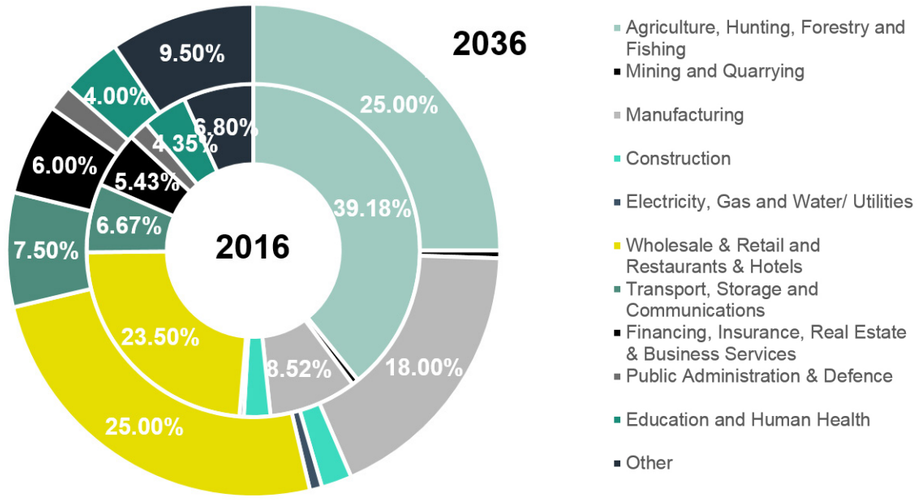

Figure 6.7: Share of Employment by Economic Activity, 2016 vs 2036

Source: Consultants' Analysis, 2016.

Employment by Economic Activity in Ibadan

In order to estimate employment by economic activity in Ibadan using the above national employment shares, the location quotient for each economic activity using the latest 2010 sectoral employment figures published by the National Bureau of Statistics for Nigeria and Oyo State (Table 6.4 and Figure 6.8) have been calculated. The location quotient is an important indicator measuring the relative specialism of a region in an economic sector as compared to the nation. As illustrated in Figure 6.8, mining and quarrying, utilities, trade/retail, transport storage and communications, manufacturing, construction and education and human health are more concentrated in Oyo state than average. Given that Ibadan is the capital of Oyo state (and for the purpose of this analysis), it has been assumed that the employment breakdown in Oyo State and the respective location quotients are the same as in Ibadan.

Table 6.4: Location Quotient Calculations

INDICATORS	CALCULATION
% of employment by sector (regional)	A
% of employment by sector (national)	B
Location Quotient	A/B

Source: Consultants' Assumptions, 2016.

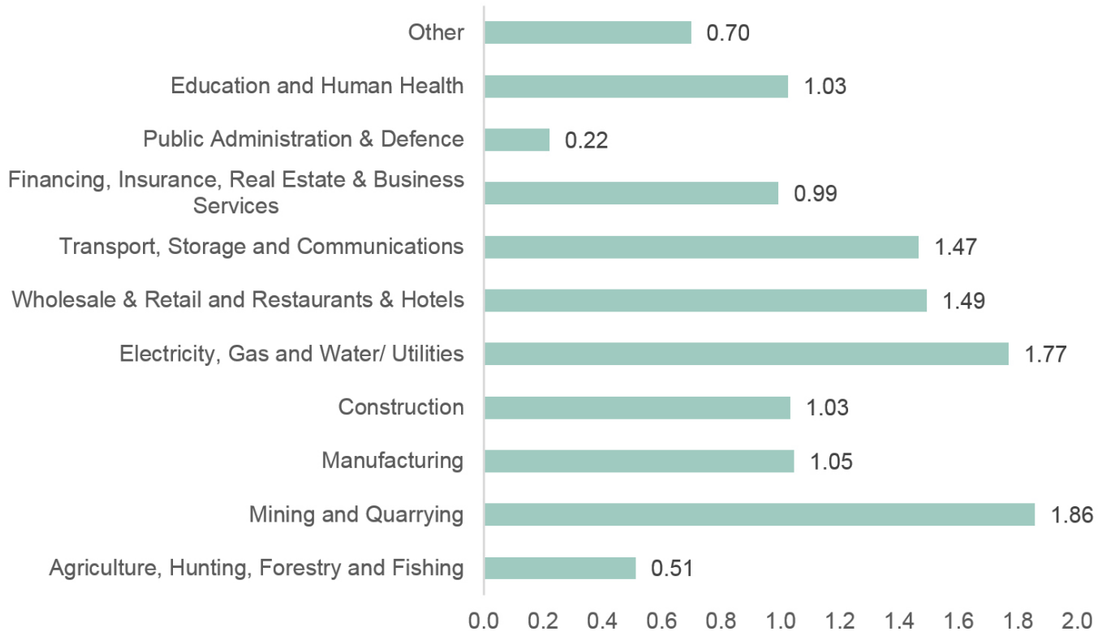

Figure 6.8: Location Quotient for the Various Economic Activities, 2010

Source: Consultants' Analysis, 2016.

Using the above location quotient for each economic activity, the sectoral share of employment in Ibadan in the period to 2031 has been calculated. Commerce and retail is expected to be the largest employer by 2031, followed by manufacturing, agriculture and forestry, transport and storage and communications.

It is considered that the employment composition will remain constant between 2031 to 2036. Figure 6.9 and Table 6.5 illustrate the projected employment by economic activity in Ibadan in the period to 2036.

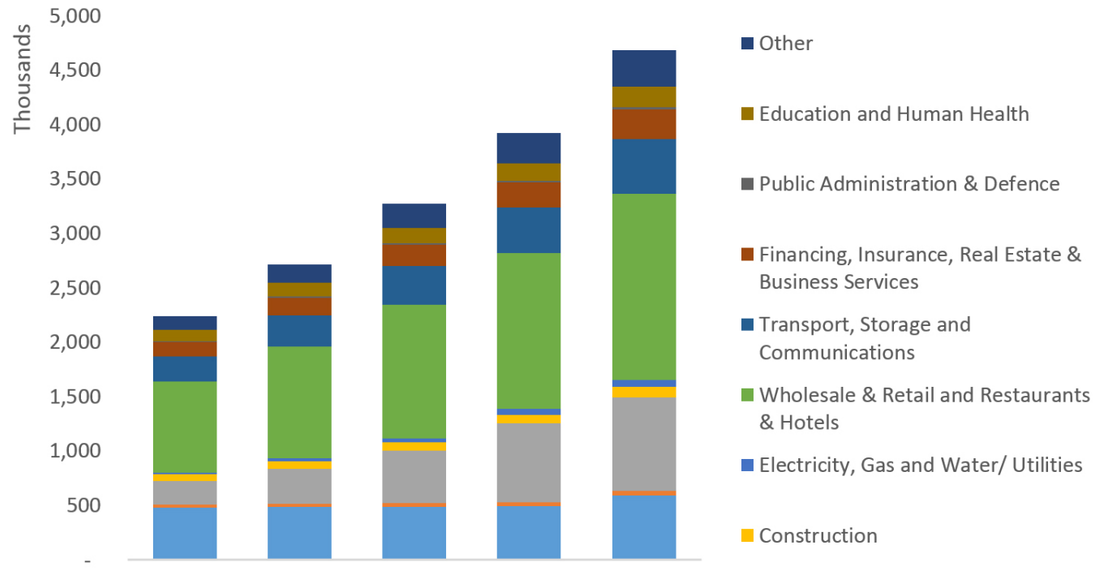

Figure 6.9: Employment Projections by Economic Activity, 2016-2036

Source: Consultants' Analysis, 2016.

Source: Consultants' Analysis

Table 6.5: Employment Projections by Economic Activity, 2016-2036

EMPLOYMENT BY ECONOMIC ACTIVITY	2016	2021	2026	2031	2036	CAGR (2016-2031)
Agriculture, Hunting, Forestry and Fishing	478,756	483,611	488,110	492,230	587,565	1.03%
Mining and Quarrying	28,600	30,810	33,163	35,665	42,573	2.00%
Manufacturing	212,419	319,866	481,262	723,475	863,598	7.27%
Construction	63,339	68,334	73,662	79,338	94,704	2.03%
Electricity, Gas and Water/ Utilities	17,828	26,559	38,516	54,340	64,864	6.66%
Wholesale & Retail and Restaurants & Hotels	835,734	1,027,545	1,230,024	1,432,708	1,710,194	3.64%
Transport, Storage and Communications	233,151	291,991	355,968	422,198	503,969	3.93%
Financing, Insurance, Real Estate & Business Services	128,577	160,134	194,137	228,976	273,324	3.84%
Public Administration & Defence	10,160	11,766	13,264	14,547	17,364	2.69%
Education and Human Health	106,404	124,622	142,079	157,589	188,111	2.89%
Other Services	124,699	167,377	219,336	280,602	334,948	5.06%
TOTAL	**2,239,667**	**2,712,616**	**3,269,520**	**3,921,667**	**4,681,214**	**3.75%**

Source: Consultants' Analysis, 2016.

In general, Nigeria is seeking to diversify its economy away from oil to reduce its dependency on a single commodity. This has been reflected in the present analysis by analysing a number of plans and studies undertaken regarding this matter. All in all, it is expected that the employment breakdown in Ibadan is likely to shift towards service and consumer driven sectors (e.g. trade/ retail, ICT, etc) and manufacturing.

6.3 SPATIAL DISTRIBUTION OF EMPLOYMENT

6.3.1 Overview

The preceding economic and labour market analysis presents the anticipated growth in employment by economic activity for the Ibadan Masterplan Area for the year 2036, based on the preferred 'medium' population scenario of 11.3 million. This incorporates reasonable assumptions regarding the expected structural change in the composition and drivers of Nigeria's economy and how this will subsequently be reflected in the composition of Ibadan's employment structure over the future.

This section details how the growth and sectoral change is expected to be distributed spatially, according to the preferred spatial development strategy. Anticipated future employment is converted into broad land use categories according to the projected sectoral breakdown of employment in 2036. Table 6.6 summarises the anticipated change in employment based on the standard industrial classification between 2016 and 2036.

Table 6.6: Summary of Projected Employment by Economic Activity: 2016-2036 and change in employment

EMPLOYMENT BY ECONOMIC ACTIVITY	2016	% SHARE	2036	% SHARE	INCREASE/ DECREASE (2016-2036)	% SHARE CHANGE (2016-2036)
Agriculture, Hunting, Forestry and Fishing	478,756	21.38%	587,565	12.6%	108,809	-8.8%
Mining and Quarrying	28,600	1.28%	42,573	0.9%	13,973	-0.4%
Manufacturing	212,419	9.48%	863,598	18.4%	651,179	9.0%
Construction	63,339	2.83%	94,704	2.0%	31,366	-0.8%
Electricity, Gas and Water/ Utilities	17,828	0.80%	64,864	1.4%	47,037	0.6%
Wholesale & Retail and Restaurants & Hotels	835,734	37.32%	1,710,194	36.5%	874,460	-0.8%
Transport, Storage and Communications	233,151	10.41%	503,969	10.8%	270,818	0.4%
Financing, Insurance, Real Estate & Business Services	128,577	5.74%	273,324	5.8%	144,747	0.1%
Public Administration & Defence	10,160	0.45%	17,364	0.4%	7,204	-0.1%
Education and Human Health	106,404	4.75%	188,111	4.0%	81,706	-0.7%
Other Services	124,699	5.57%	334,948	7.2%	210,250	1.6%
TOTAL	**2,239,667**	**100%**	**4,681,214**	**100%**	**2,441,547**	**N/A**

The projections show that the retail and hotels/food sector will exhibit the largest absolute increase in employment of just under 875,000, followed by manufacturing which is projected to show an increase in total jobs of just over 650,000. Other significant rises in absolute employment levels are expected in transport and telecoms activities, finance and business services and other (general) service sector activities. All sectors record an increase in overall employment over the projection period.

The manufacturing sector is expected to show the largest increase in its share of employment from 9.5% in 2016 to 18.4% in 2036 - an increase of 9 percentage points, followed by other service activities, which increase by 1.6 percentage points to 7.2% of total employment. The agriculture sector will show the largest decline in its share of employment of approximately 9 percentage points but will remain a significant employer at 12.6% total employment. It will continue to exhibit an increase in total jobs as per all sectors.

The next step is to translate the projected additional employment into broad land use categories to provide an understanding of how projected change in the city's economy might affect long-term employment land use requirements. Further, how planning policy can respond to such requirements and ensure that the needs of growing economic sectors in Ibadan are fully met. It should be noted that this exercise excludes agricultural sector employment which is distinctively different in the nature of its employment land use requirement and is assumed to be located in the surrounding rural areas of the city.

Four broad categories form the standard economic sector classifications. Due to the relatively broad classification, certain sectors are split into more than one land use category (eg. transport, storage and telecommunications, other service activities) and these are divided accordingly.

Table 6.7: Summary of Projected Employment by Economic Activity: 2016-2036 and change in employment

LAND USE SECTOR	EMPLOYMENT CLASSIFICATION	INCREASE/ DECREASE (2016-2036)	% SHARE OF INCREASE/ DECREASE
Commercial	Wholesale, Retail; Restaurants & Hotels, Communications, Financing, Insurance, Real Estate & Business Services, Other Services	1,294,670	55.5%
Social	Education and Human Health	151,628	6.5%
Institutional	Public Administration & Defence	6,998	0.3%
Industrial	Mining & Quarrying, Manufacturing, Construction, Energy & Utilities, Transport and Storage	879,442	37.7%
TOTAL		**2,332,738**	**100%**

The spatial distribution of the additional employment is based on a combined analysis of the following:

- Base employment distributed by Traffic Analysis Zone (TAZ);
- Base population by TAZ
- The composition of employment land use by TAZ;
- The proportionate amount of vacant land estimated by TAZ;
- Additional population projected to 2036 by TAZ and by option development area .

6.3.2 Spatial Development

Table 6.8 summarises the base and projected total employment according to the preferred development scenario, which envisages decentralised polycentric growth located around the alignment of the proposed Circular Road, with an emphasis on high and medium density development nodes and infill development at high and medium density mainly within and around the fringes of the existing urban area. From a strategic planning viewpoint, the Circular Road is expected to be a significant enabler of development for both new expansion areas and infill development within the existing urban area.

In terms of projected growth in designated outer centres, the expansion area map retains just one outer location (MD6), which will represent a standalone urban centre. The area to the south west of Ibadan (MD4) is expected to become an urban extension of other planned development areas in this location, anchored by planned economic growth along the Lagos-Ibadan expressway.

In order to distribute the projected additional employment by broad land use sector for the preferred development scenario, weightings have been applied to the average composition of broad land use category by transport zone covering the Ibadan Masterplan area and the respective share of each land use category within each transport zone grossed up to each expansion area. This ensures that the spatial projection for employment growth controls the influence of existing employment land use patterns and potential clustering of certain economic activities, as well as incorporating the impact of increased development capacity enabled by the proposed expansion areas.

In summary, the results show that the largest share of employment land growth is expected to occur within the existing urban area and infill area, with these accounting for over 60% of the projected increase. The infill areas are spread across a variety of the inner area but in some cases also push into the outer expansion area. Generally, employment land use will become more intensive in the inner area where many existing commercial and industrial activities are currently located. The central core has far less capacity for employment land use growth.

Industrial employment growth will also be concentrated in the south and west of Ibadan in both inner and outer expansion areas. The south of the city is therefore expected to strengthen its industrial role in addition to improve Federal and State road links in and around the Ibadan Masterplan area. The north west of the city will also see relatively important industrial growth due to existing and designated sites enabled by the strategic road network north of the city to Oyo.

Table 6.9 summarises the total employment projection for each LGA. The central and inner urban LGAs are expected to record considerably lower levels of employment due to their relatively smaller land area and the fact that they are already more densely developed. The LGA which is projected to show the largest employment increase is Oluyole, reflecting the increased need for industrial land as a result of the Circular Road and strengthening of the existing corridors which is expected to unlock available sites for industrial units. Ido is projected to show the second largest growth, it contains a significant share of the outer expansion area, the development of an outer urban centre and a significant proposed infill development.

Table 6.8: Spatial Development Approach: Projected Employment 2016 and 2036 by Planning Area

DEVELOPMENT AREA	2016	2036	+/- CHANGE
Urban High Density (Inner)	404,028	431,378	27,350
Medium Density (Inner)	560,196	1,473,244	913,048
Low Density (Inner)	193,872	430,048	236,176
Infill - High Density	48,306	67,869	20,437
Infill - Medium Density	282,081	770,191	488,110
Low Density (Outer)	14,028	41,654	27,626
Expansion - High Density	23,775	27,848	4,073
Expansion - Medium Density	98,349	356,543	258,194
Expansion - Low Density	12,007	27,386	15,379
Industry	76,636	173,660	97,023
Peripheral and Villages (Inner)	50,893	128,064	77,171
Peripheral and Villages (Outer)	72,619	164,555	91,937
TOTAL	**1,836,790**	**4,092,439**	**2,245,649**

Note: Figures exclude agricultural sector employment.

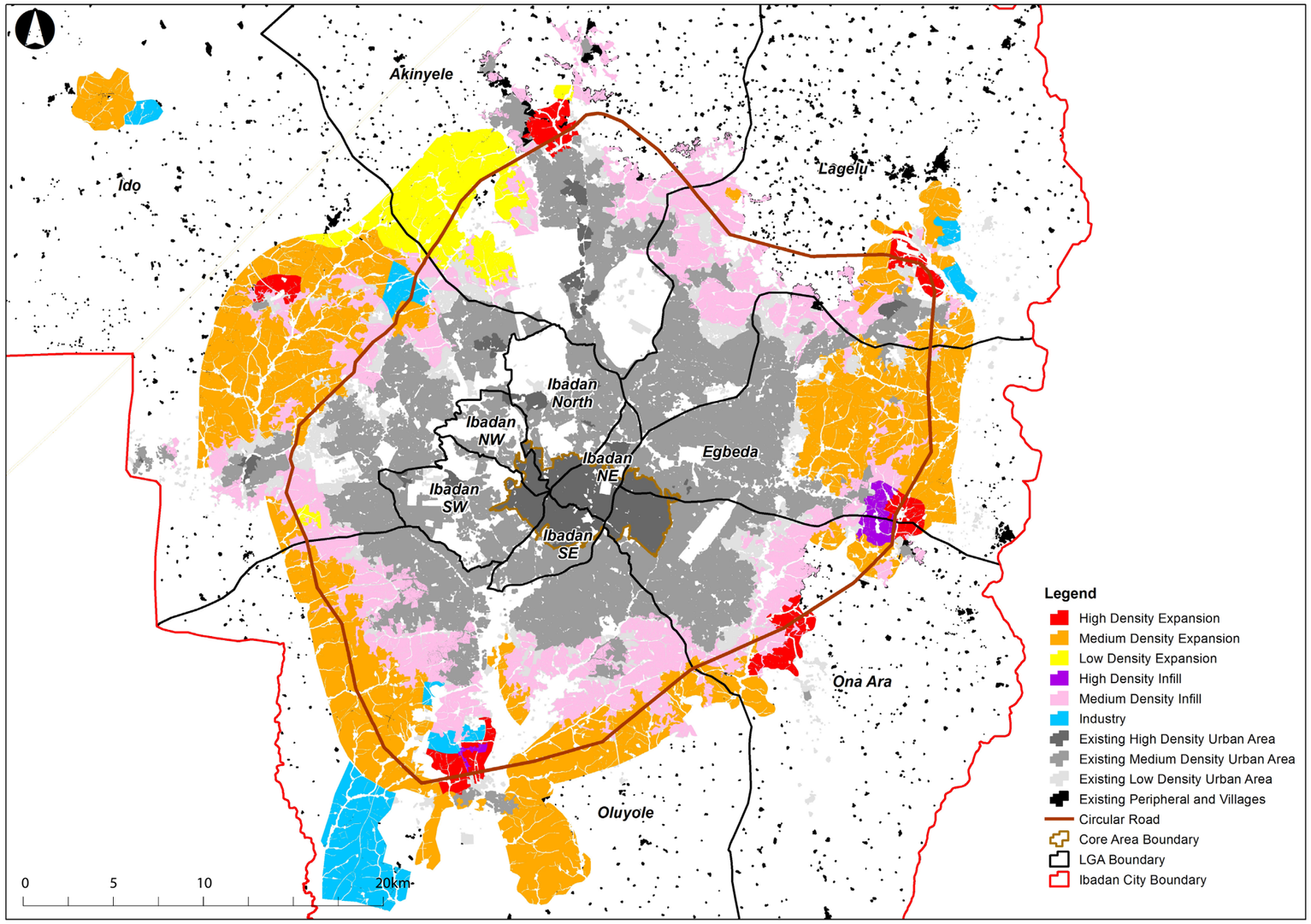

Figure 6.10: Spatial Summary of Spatial Development Strategy

Table 6.9: Projected Total Employment 2016 and 2036 by LGA

DEVELOPMENT AREA	2016	2036	+/- CHANGE
IBADAN NORTH	147,907	300,002	152,096
IBADAN NORTH EAST	124,131	162,013	37,882
IBADAN NORTH WEST	29,962	46,970	17,008
IBADAN SOUTH EAST	60,457	85,526	25,068
IBADAN SOUTH WEST	67,288	116,475	49,188
LAGELU	242,756	546,228	303,473
AKINYELE	198,616	472,368	273,752
IDO	247,698	639,910	392,212
OLUYOLE	275,458	725,940	450,482
ONA ARA	211,621	432,539	220,917
EGBEDA	241,384	565,609	324,225
TOTAL	**1,847,277**	**4,093,580**	**2,246,303**

Note: Figures exclude agricultural sector employment.

6.3.3 Summary

Based on the data available to date, the above calculations are intended to represent a preliminary assessment of the likely distribution of projected employment and employment land use needs in Ibadan over the next 20 years. It is intended to inform and provide a guide as to the probable employment land use requirements at a strategic level over the long term. It also supports economic strategies towards meeting the growth of individual sectors and supporting their development agenda.

The next section sets out potential policies and measures to support employment sector growth for key economic activity drivers, and economic development more generally that will support the masterplan objectives.

6.4 ECONOMIC POLICIES TOWARDS SUPPORTING THE MASTERPLAN

6.4.1 Introduction

This section sets out the context for key economic growth sectors in Ibadan and proposes policies and measures to ensure the city meets the projected employment growth to 2036.

6.4.2 Wholesale, Retail and Related Sectors

The baseline analysis indicates that the largest employment sector in Ibadan is in retail and wholesale trading and related activities, accounting for 40% of total employment. This reflects the presence of large street markets which are numerous in the city and also more formal retail locations which align with the main transport routes. It also reflects a significant proportion of inhabitants engaging in on-street trading and hawking as both a formal and informal economic activity.

More specifically, the retail, sales and related sector is relatively more concentrated in the existing urban Inner Area where it accounts for up to 50% of employment, reflecting the fact that markets and retail area activities are mostly co-located with residential areas. The sector still accounts for between 32% and 40% of employment in the outer area.

In formulating a range of sectoral employment projections in Ibadan over the next 20 years, the analysis indicates that retail and trade would remain the largest employment generator in Ibadan. It is expected that employment in this sector would increase by around 874,500, employing around 1.71 million by 2036 (Figure 6.11).

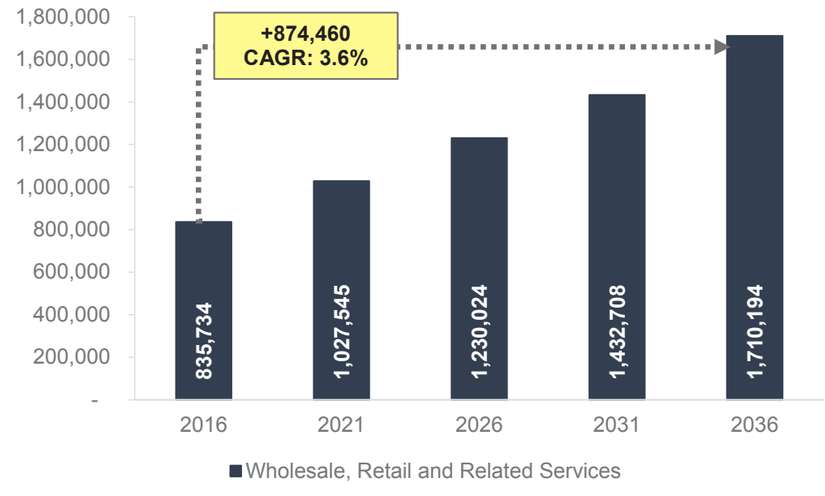

Figure 6.11: Projected Number of Employees in Wholesale, Retail and Related Activities

Source: Consultants' Analysis, 2016.

Based on consultations and analysis, a number of prevailing constraints and weaknesses hamper the operation and development of the retail, wholesale and markets sector. They can be summarised as follows:

- High level of localised traffic congestion as a result of the encroachment of retail activities onto roads, especially main arteries;
- Lack of good quality retail premises for traders and small retailers to upgrade to;
- Underprovision of more formal and modern retail facilities to serve the population;
- Absence of effective processes towards market management; and
- Poor quality of roads and infrastructure impacting the distribution of goods.

In an attempt to overcome the obstacles highlighted above and support the retail and trade sector to meet the projected employment expansion, the masterplan recommends the following policies:

Box 1 - Actions and Policies towards Wholesale, Retail and Related Sectors

- Support State efforts to control on-street trading and modernise trading standards;
- Consider best practice approaches to market management that could be applied city-wide;
- Ensure transport development corridors allocate sufficient land for large scale and modern retail units and projects;
- Improve the physical infrastructure of the markets to support the promotion of safety and wellbeing of market participants; this includes the provision of appropriately placed toilets with hand washing facilities, appropriate drainage system and removal of solid and liquid waste, etc.
- Develop programmes to improve the linkages between local agriculture, manufacturing and retail traders under a 'shop local, buy local' message;
- Consider greater specialisation of markets and explore options for new consumer sectors for specialised markets such as electrical products and IT.

6.4.3 Manufacturing Sector

Manufacturing is a key sector of Ibadan's economy, with around 10% of the employed population engaging in extractive industrial and manufacturing activities. The city and its environs are home to several industries such as in agro-allied, textile, food processing, health care and cosmetic, tobacco processing and cigarette manufacturing, leatherworks and furniture making. Specifically, food production and metalworking form important constituents of the sector (collectively constituting 50% of total manufacturing companies). Given the city's position as a major trading hub, there is considerable scope to boost the role of these two manufacturing sub-sectors by stimulating strong linkages to the regional agriculture industry and transport sectors.

More generally, there is considerable potential to raise the contribution of manufacturing as a key income and employment generator across a variety of production sectors. The masterplan envisages that manufacturing will employ approximately 863,500 workers by 2036 - an additional 650,000+ over the next 20 years, as illustrated in Figure 6.12.

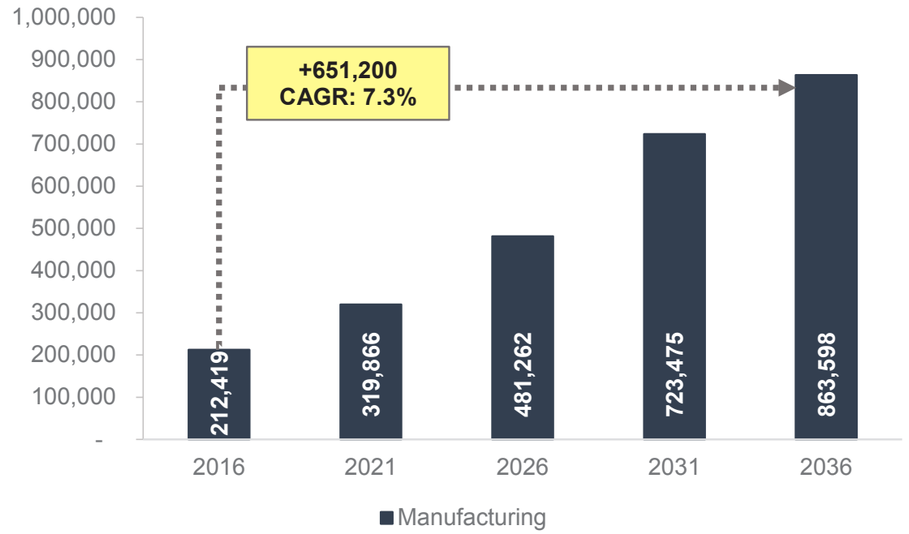

Figure 6.12: Projected Number of Employees in Manufacturing Sector

Source: Consultants' Analysis, 2016.

Nevertheless, a number of key issues still exist that threaten the growth of Ibadan's manufacturing sector. These are summarised as follows:

- Unreliable energy supply - namely constant power outages and voltages fluctuations disrupting production;
- The poor state of road infrastructure which affects the efficient movement of goods and raises operating costs for business;
- High cost of doing business and unaffordable finance, with interest rates charged on commercial lending being relatively high;
- Unfavourable business environment as a result of administrative inertia towards business permits and approvals processes;
- Excessive taxation and charges perceived by business, both State and Federal;
- Lack of access to new technology or production processes due to capital constraints.

Taking such issues into account, the masterplan recommends a set of policies and actions to help address current constraints and support the projected manufacturing sector employment growth in the period to 2036, as follows:

Box 2 - Actions and Policies Towards Manufacturing

- Promoting effective partnership between the public and private sectors to develop and maintain reliable and affordable infrastructure such as power, roads and other facilities;
- Local government to commit to streamline the approvals process towards business by guaranteeing maximum turnaround times and a one-stop shop approach;
- Creating local buyer initiatives for major planned infrastructure projects to ensure building materials and skills are sourced from local producers;
- Investing in common facilities centres (partnership with MAN/UNIDO) in priority sub-sectors such as food production and technology to overcome weak access to finance capital and equipment;
- Promote and strengthen backward and forward linkages between local food manufacturers, commercial farmers/peri-urban growers and food retailers to encourage larger-scale production throughout the supply chain and raise job creation;
- Ensure new expansion areas for development allocate sufficient land for small-scale and start-up manufacturers/workshops;
- Implementing significant financial sector reforms to stimulate the availability of funding to manufacturing companies (e.g. provision of loans at attractive interest rates, minimising the collateral requirements, etc.);
- The safeguarding and allocation of sites in the south/south west Ibadan for manufacturing expansion to leverage accessibility to the Lagos-Ibadan expressway and proximity to existing industrial clusters to be treated as a strategic priority;
- Support initiatives to expand small-scale local power generation projects to help plug gaps in electricity supply, such as those being explored by MAN;
- Create database of SME and large manufacturing enterprises by location in the urban areas, as proposed by the Ministry of Industry, Trade and Cooperatives;
- Follow-up on UNIDO recommendations for industry clusters and common facility centres;
- Matching industrial skills development to meet the requirements of industry through setting up industrial skills councils, serving as a main interface between the stakeholders who develop skills, and those who require skills.

6.4.4 Agriculture

Agriculture remains an important activity that has a significant land use impact in Ibadan. This is in terms of traditional rural farmers, larger commercial farm operators and also urban and peri-urban agriculture (UPA) which are all key sources of local and regional income, in addition to meeting the food and nutritional needs of the urban population.

Given Ibadan's industrial capacity and agricultural potential, there is considerable opportunity to transform the city into an agro-industrial zone for Nigeria if resources are well tapped. It is believed that agriculture, albeit growing relatively slowly compared to other sectors, will continue to play a very important economic role and could be enhanced as an economic generator with improved integration with the wider economy. The masterplan envisages that employment in the agriculture sector will increase at an average annual growth of around 1% p.a., reaching approximately 587,600 by 2036 (Figure 6.13).

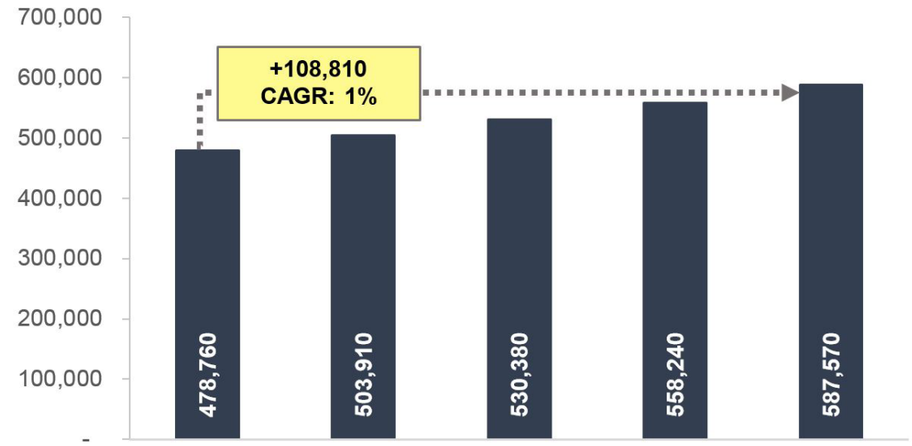

Figure 6.13: Projected Number of Employees in Agriculture Sector

Source: Consultants' Analysis, 2016.

Although agriculture remains a major contributor to Ibadan's economy, the sector still faces a number of challenges, including:

- Rapid urban development and population growth in peri-urban areas, which have adverse implications on the availability of agricultural land;
- Increased risks of flooding as a result of the increased intensity of urban development;
- Underfunded agricultural extension services and limited knowledge, experience and financial strength among agri-business companies;
- Inadequate linkage between farming, agri-processing and the food manufacturing sub-sector;
- Poor pricing of UPA products, lack of agricultural extension advice and limited data availability on agriculture.

To overcome these obstacles and support the projected growth in the sector, the masterplan recommends the following policies:

Box 3 - Actions and Policies Towards Agriculture

- Planning framework to effectively safeguard productive agricultural land on the urban fringe and expansion areas;
- Foster involvement of NGOs for the provision of advisory and extension services to farmers;
- Improve the governmental research units to provide credible and up-to-date statistics;
- Offer training sessions to farmers and agricultural practitioners – this is essential as it will also develop and sustain strong linkages between agriculture and manufacturing sectors;
- Utilise the proposed inter-modal dry port at Lagelu LGA to promote agri-processing plants;
- Need for effective collaboration between academic and research institutions and stakeholders operating in the agribusiness industry;
- Implement a precautionary approach to development in areas of flood risk;
- Develop a macro drainage system to strengthen climate risk management in the face of current climate variability and extreme weather events;
- Implement a long-term strategy to provide wastewater treatment facilities for Ibadan to secure a reliable source of water irrigation;
- Establish micro-credit programmes for UPA farmers.

6.4.5 Energy and Utilities

The utilities sector, namely water and energy, is still underdeveloped in Ibadan and does not fully serve the needs of homes and businesses. Safe and potable water supply in Ibadan is still inadequate and a gap remains in the provision of safe drinking water. Additionally, household electricity consumption is relatively low which is due to a number of factors, including:

- Insufficient generation capacity;
- Unreliable and outdated transmission and distribution network;
- Poor infrastructure;
- Load shedding leading to constant power outages;
- Poor grid management; and
- Lack of investment in maintenance and expansion programmes on existing power plants.

Changes in population distribution, household formation and urban development is likely to increase pressure on available water and power resources as well as drainage systems. However, with effective implementation of policies and actions, the utilities sector will not only be able to serve the needs of the city and grow efficiently, but also become an important economic driver and employment generator in its own right. The development of the sector is imperative as it will have positive spill-over effects on other sectors of the economy including agriculture and manufacturing. This is reflected in the employment projections in the period to 2036: it is estimated that the employed labour force in the utilities sector will grow by some 47,040 during the period 2016-2036, as illustrated below.

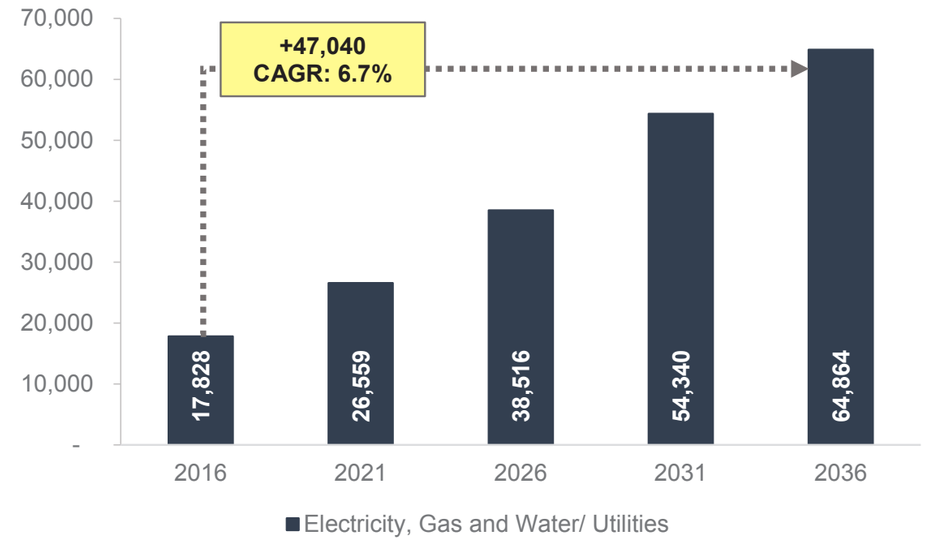

Figure 6.14: Projected Number of Employees in Energy and Utilities *Source: Consultants' Analysis, 2016.*

To overcome the obstacles outlined above and support the energy and utilities sector to meet the projected growth of the urban economy, support new expansion areas and employment, the masterplan recommends the following policies:

Box 4 - Actions and Policies Towards Energy and Utilities

- Establish electric substations required to feed Ibadan with relevant transformer ratings and voltage levels;
- Promote local employment and training programmes tied to the construction of new energy, water and wastewater distribution systems; ensure adequate technical training and capacity among the sector workforce to ensure breakdowns can be remedied effectively;
- Improve the business climate to attract foreign investors in the utilities sector;
- Promote local power generation projects and initiatives for both homes and businesses as a 'quick fix' and encourage services related to their operation and maintenance;
- Evolve a cost-reflective electricity tariff structure to (i) ensure fairness to consumers, (ii) to provide sufficient funding to finance activities of investors and (iii) achieve efficient operations.

6.4.6 Non-Retail Commercial Services

Nigeria's continued rapid population growth is expected to further drive demand for certain non-retail commercial services including in technology, real estate, finance, insurance and other commercial services. This is assisted particularly by the rise of a consumer oriented urban middle class of which Ibadan is no exception.

There are dozens of banks, real estate and insurance firms spread out across Ibadan that service the population. In line with general trends in Nigeria, consumption of business services in legal, financial and technical services is expected to be a relatively high growth area of the economy, and cities need to ensure that there is sufficient development capacity and appropriate sites to facilitate the growth of this sector which is often a key economic generator for major urban centres.

The masterplan projections envisage that employment in the sector will reach some 273,500 by 2036 - an additional 144,750 workers over the next 20 years. Figure 6.15 summarises projected employment growth.

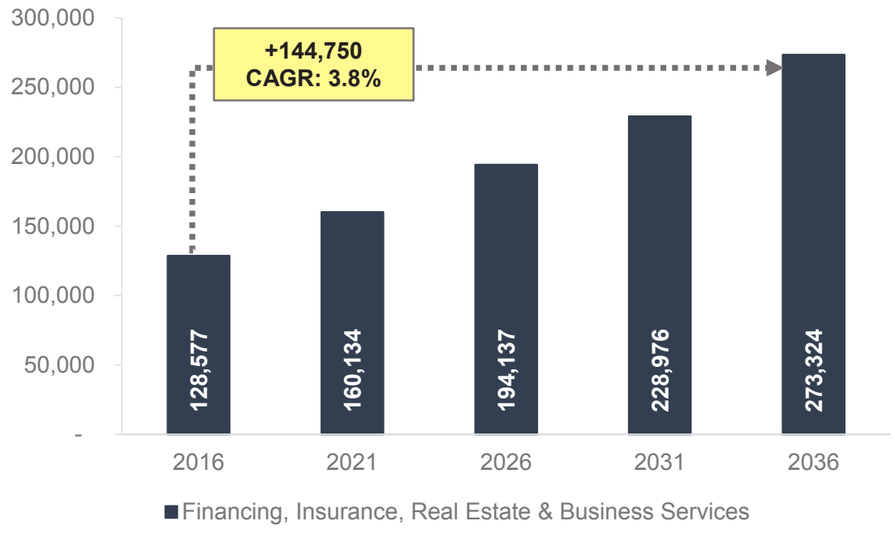

Figure 6.15: Projected Number of Employees in Non-Retail Commercial Services *Source: Consultants' Analysis, 2016.*

Many of the potential issues and constraints affecting the business services sector growth are not necessarily spatial planning related. However, it is necessary to ensure that planning policy is flexible and facilitates sector growth and in the most suitable locations of the city where commercial business clusters can emerge. For example:

- Real estate sector is unable to cater for total demand as it rarely targets low and middle income households;
- Unaffordable finance as a result of relatively high interest rates;
- High costs to document collateral and lengthy/difficult contract enforcement procedures;
- Insufficient durations and tenures for credit facilities.

Overcoming these obstacles is essential as improvements in areas such as finance will spur growth in other sectors of the economy including agriculture, manufacturing and utilities, among others. As such, the masterplan recommends the following policies:

Box 5 - Actions and Policies Towards Non-Retail Commercial Services

- Allow the interchanging of land use between residential, retail and business service uses especially in above ground units to promote mixed uses and variety in existing and proposed commercial centres;
- Ensure adequate supply of affordable commercial premises for start-up enterprises through dedicated sites and an appropriate sub-division policy;
- Promote transport-oriented commercial development around bus and rail stations;
- Encourage larger local firms to purchase commercial services locally;
- Encourage the university research institutes to expand their consultancy activities to strengthen the technical skills base for business services;
- Provide real estate units to accommodate all income groups rather than the highest income bracket only;
- Review policies towards the microfinance sector; extend credit durations/tenures/collateral requirements;
- Streamline State application and approval procedures/regulation towards business.

6.4.7 Education, Healthcare and Community Services

The rapidly growing population is a key factor feeding demand for community services in Ibadan, namely education and healthcare.

Ibadan is well known for being a main educational centre in Nigeria. It has numerous primary and post primary institutions: the University of Ibadan, established in 1948, is widely recognised as Nigeria's first university, with its library maintaining the largest collection of books in the country. Other notable institutions include the Polytechnic and a number of research institutes including the Nigeria Horticulture Research Institute (NIHORT) and the Institute of Agriculture, Research and Training (IART). Statistics show that Ibadan residents are broadly better educated than of those in the rest of Nigeria; this is evident given the status of Ibadan as a key educational hub.

Ibadan is also home to modern health facilities, with the healthcare needs of the population being served by the University College Hospital, two State hospitals, and several private medical facilities, in addition to traditional medical practitioners scattered across the city. Despite this provision, there remain significant gaps in healthcare provision to meet the general needs of the population.

It is expected that community services demand will continue to grow as a result of the burgeoning population base. This has been reflected in the employment projections, illustrated in Figure 6.16.

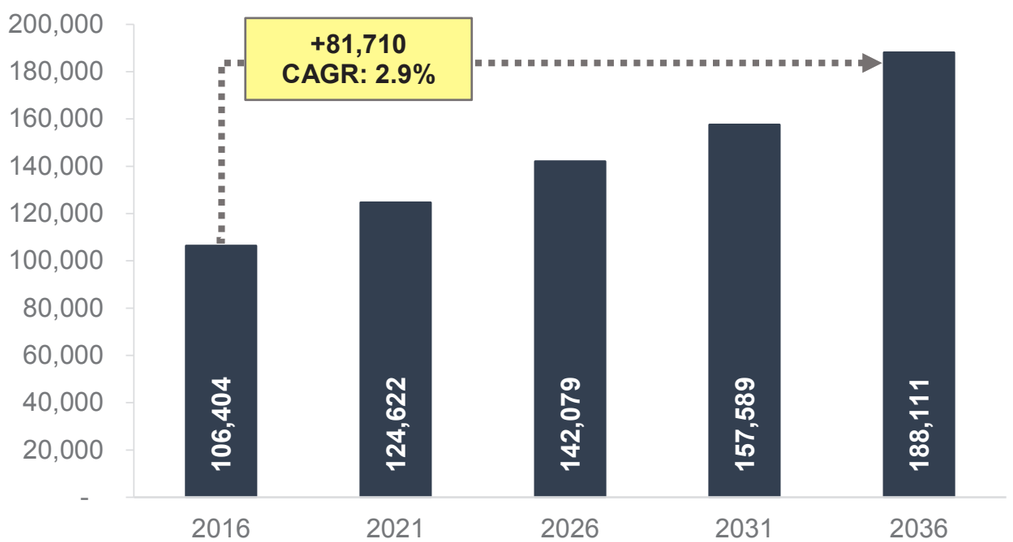

Figure 6.16: Projected Number of Employees in Education and Healthcare Services *Source: Consultants' Analysis, 2016.*

A number of issues facing the education and healthcare sectors have been identified, including:

- The most highly populated parts of the city are under-provisioned with educational and healthcare facilities;
- Poor road networks impede access to facilities;
- Inadequate and poorly maintained facilities;
- Inefficient service delivery;
- Skills do not match the requirements of the labour market as a result of a lack of reliable and timely information.

In order to overcome these issues, the masterplan recommends some far-reaching and fundamental changes to both the education and healthcare sectors, as identified opposite.

Box 6 - Actions and Policies Towards Education Sector

- Solving the problem of uneven distribution of educational facilities in order to improve access to education and educational quality across the whole city;
- Attracting suitably qualified staff through the provision of necessary support systems and incentives (e.g. the provision of free serviced housing);
- Introducing innovative techniques to provide access to education such as the use of ICT to establish a technical platform for remote learning;
- Revising the context of training programmes and upgrading teaching tools for developing technical and professional skills;
- Focusing on technical and vocational skills development;
- Creation of skills councils responsible for matching skills acquisition to market needs.

Box 7 - Actions and Policies towards the Healthcare Sector

- Providing adequate health facilities to fill the gap in the highly dense areas of Ibadan that suffer from a shortage of healthcare services;
- Improving infrastructure and road access to major towns and urban centres in order to improve access to health facilities to all residents of Ibadan;
- Providing well-maintained equipment through partnering with the private sector;
- Assessing training needs to ensure that healthcare service providers have the required know-how and competences;
- Establishing effective partnership between healthcare facilities and Universities to develop adequate and appropriate manpower.

INFRASTRUCTURE

7

7 INFRASTRUCTURE

7.1 TELECOMMUNICATIONS AND ELV NETWORKS

7.1.1 Introduction

This section describes the works needed to meet the forecasted telecommunication and Extra Low Voltage (ELV) requirements for Ibadan.

The design is based on provision of the telecommunication network services from the Nigeria Communication Commission (NCC) or an authorised telecom service provider, operating in Ibadan, offering and delivering fixed telephone, Internet and TV services over the same network, namely a Fiber-To-The-Home (FTTH) network fanning from a nearby exchange.

The design intent is to have, in parallel to the telecom network, a separate ELV converged network within Ibadan carrying and servicing security systems including surveillance Closed-Circuit Television (CCTV) systems.

7.1.2 Scope of work

The scope of work of the Telecom and ELV networks and systems is only limited to Outside Plant (OSP) civil works including ducting systems, hand-holes, manholes, etc. The supply, pulling, installation, termination, and testing of all cabling and equipment for the Telecom and ELV networks will be carried out by an authorised service provider.

7.1.3 Existing Network

There is a shortage of information on the existing telecommunication network installed in Ibadan. Further investigations need to be made to acquire more data about the infrastructure of this network. In support of the masterplan, a number of queries have been sent to the NCC regarding the required information that would be needed to base the new design on. The following provides some general information about the existing network in Nigeria in general and the area under study in particular. As shown in Figure 7.1, the Ibadan City Masterplan area is largely covered by the Global System for Mobile Communications (GSM) network.

Figure 7.2 shows the internet and broadband networks linking Ibadan with other Nigerian sub-regions.

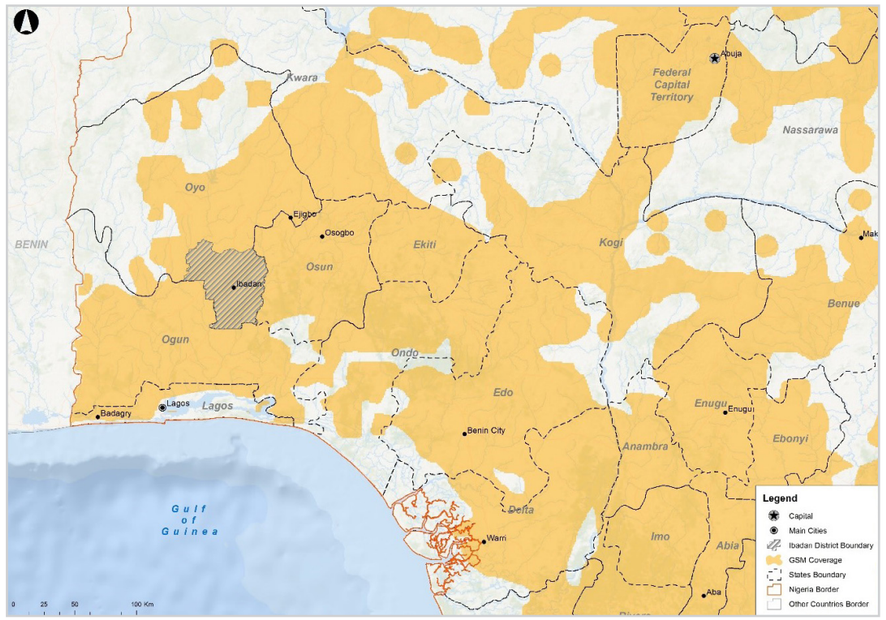

Figure 7.1: Mobile Telephony Coverage

Source: Nigeria's National Integrated Infrastructure Masterplan - 2014.

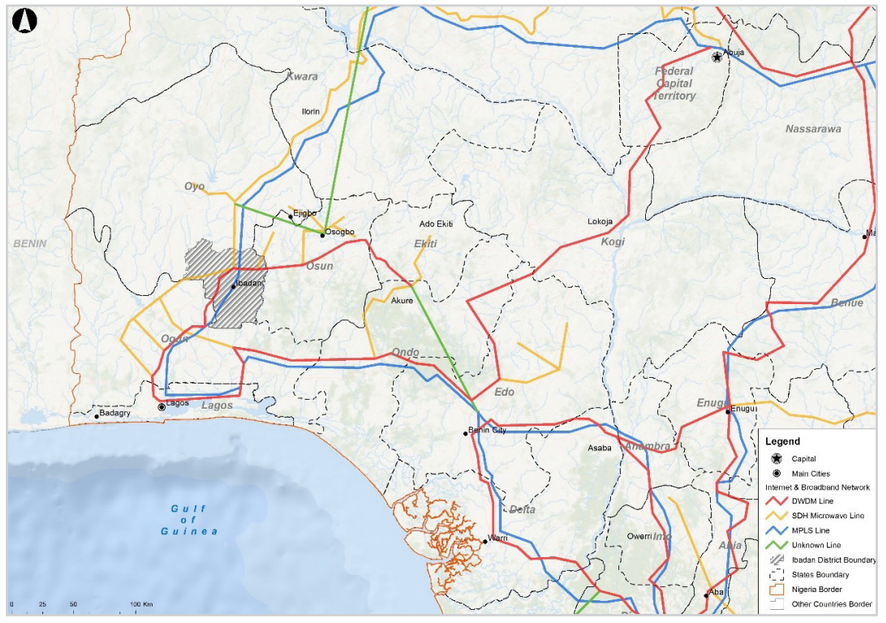

Figure 7.2: Internet And Broadband Networks Linking Ibadan With Other Sub-Regions In Nigeria

Source: Nigeria's National Integrated Infrastructure Masterplan - 2014.

The local operators have implemented a fibre optic backbone linking the different states of Nigeria as shown in Figure 7.3.

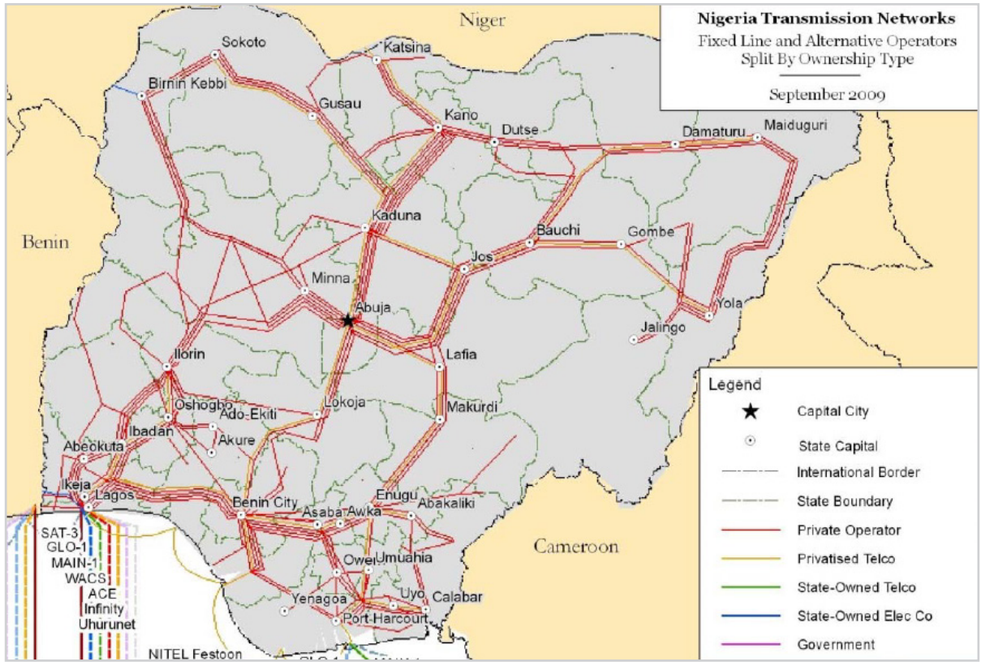

Figure 7.3: Fibre Optic Backbone Linking The Different States Of Nigeria

Source: Nigeria's National Integrated Infrastructure Masterplan - 2014)

The above mentioned information is general and more details about the existing network needs to be obtained for the later stages; the design of the new telecommunication systems will otherwise consider that an entirely new infrastructure and network needs to be developed.

7.1.4 Projected Telecom and ELV Design

Introduction

The infrastructure design of the telecommunication and ELV networks for Ibadan will incorporate basic and enhanced telecommunication and ELV services offered and will be ready to support future advanced services. This section provides, in brief, a framework for telecommunication and ELV systems in Ibadan.

The vision is to have a converged telecommunication network framework to serve building plots and consequently connect and provide every residential property, hotel, office, retail shop, facility, etc, with narrowband and broadband triple play services (voice, TV and internet connection). Ibadan will thus be served by a FTTH network supplied from the NCC or other authorised service provider. This FTTH network will be connected to Nigeria's national network.

Notwithstanding the above, a separate and independent Non-Telecom ELV network infrastructure will be used to build and implement the ELV network carrying the data traffic of the security systems to a centralised monitoring and control centre whose location will be specified at a later stage by authorised parties.

FTTH GPON System for the Triple Play Telecommunication Services

Although the scope of the Telecom Network covers only the civil works for the telecom infrastructure and excludes the corresponding equipment, cabling and any related accessories. Therefore, the present section is given for reference only.

The FTTH design, selected for the triple play telecommunication network for Ibadan, is based on the GPON technology (Gigabit Passive Optical Network). The data stream, depending on PON technology, can range from 20Mb/s up to 10 Gb/s; the most established streams are the Ethernet Passive Optical Network (EPON) (for 1 Gb/s) and GPON (2.5 Gb/s). The 2.5 Gb/s GPON stream is considered to deploy and cater for any necessary demand for subscribers.

PON topology is a shared medium in which a fiber is 'passively' split into many end user connections. The term passive refers only to the optical splitter installed along the FTTH network and does not require external electrical power to function. The OLT (Optical Line Terminal) is the main PON streamer, to be installed within the exchange building which provides the PON data stream and requires electrical power. The splitter splits the signal coming from the OLT equally into each downstream branch; for instance in a 4-way splitter, the stream from the OLT is split into 4 equal streams.

The ONU (Optical Network Unit) is the end-user premises device which reads the fiber signal coming from the OLT and converts the data into an electrical signal suitable for indoor usage thus providing services including voice, data, internet, video/TV, etc.

Between the OLT and the ONU, one or two stages of passive splitters may be used. These splitters will be needed to split the connection to multiple end points. Figure 7.4 below shows the PON Architecture and the related Fibre Optic (F.O.) connectivity between different network components.

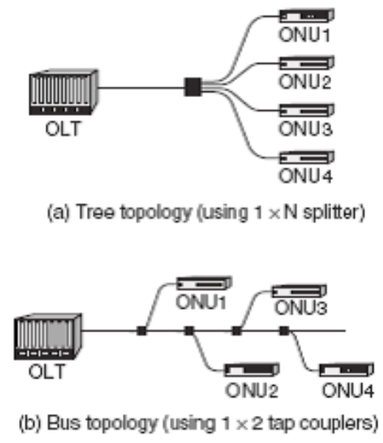

Figure 7.4: Typical PON Architecture

FTTH Active Ethernet System for the ELV Network

Considering that the scope of the ELV Network only covers the civil works for the ELV infrastructure and excludes the corresponding equipment, cabling and any related accessories, the present section is given for reference only.

For the ELV Network, Active Ethernet is assumed to be the cabling methodology to be adopted. This system is a dedicated medium in which each terminal point is allowed independent access. Each terminal point, mainly constituting of a CCTV camera, is connected to Ethernet switches, located in a control centre to be specified at a later stage, by a direct fiber optic cable. This network will be considered as the backbone connection for outdoor ELV Systems.

Figure 7.5 illustrates the connections between a provisional control room/centre and the terminal points (outdoor CCTVs). The diagram is shown for guidance only; all equipment and cabling are outside the scope of work.

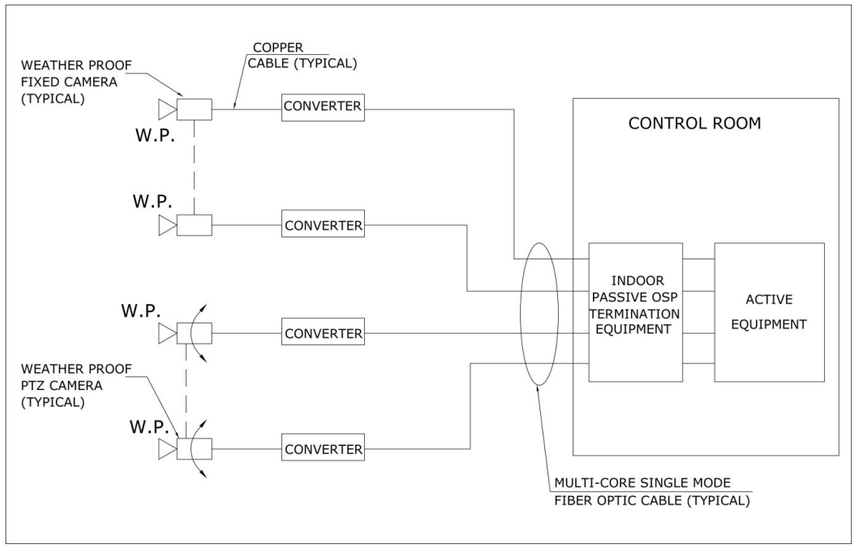

Figure 7.5: CCTVs Connection Diagram

Design Criteria for the Triple Play Telecommunication and ELV Systems

a) Objectives, Constraints and Special Considerations

The concept of the triple play telecommunication and ELV systems as defined and selected:

1. Complies with applicable codes and standards.
2. Meets the specified communications requirements of other systems and equipment.
3. Offers the base for reliability and scalability for the present and future services.

While achieving the conceptual plan objectives, the following important factors are to be considered:

1. Cost effectiveness.
2. Coordination with other design elements.
3. Simplicity of installations, operation and maintenance.

b) Regulations and Standards

The triple play telecommunication and ELV systems' installations will conform to requirements of referenced industry standards, applicable sections, and will be compliant with local requirements, applicable local regulations and code requirements of the relevant authorities jurisdiction.

Unless otherwise stipulated or approved, the triple play telecommunication and ELV systems' infrastructure will also be compliant with the following standards and codes as applicable:

1. Local authority Nigeria Communication Commission (NCC) requirements and practices and the relevant Telecommunication Standardisation Sector (ITU-T) recommendations for OSP distribution and Building Industry Consulting Service International (BICSI) "Customer-owned outside plant."
2. System components, parts and installation to comply with the corresponding recommendations of the Electronic Industries Association, and the International Electro-technical Commission (IEC).
3. The latest issue of several material and test standards, which have been developed and published by the Institute of Electrical and Electronics Engineers (IEEE) for data communications industry.
4. International Telecommunications Union (ITU) recommendations.
5. Building Industry Consulting Service International (BICSI) recommendations.

c) Design Criteria for Estimating the Demand of the FTTH Triple Play Telecom Network

The present section is given for reference and guidance only considering that the scope of the Telecom Network covers only the civil works for the telecom infrastructure.

The GPON network to be adopted delivers 2.5Gb/s per each fiber optic strand. This stream can be subdivided into 1/2, 1/4, 1/8, 1/16, 1/32, 1/64 and can be up to 1/128 or a mixture of any of those. As such, any property can have 2.5Gb, 1.25Gb, 625Mb, 325Mb, 160Mb, 80Mb, 40Mb, 20Mb, etc; other subdivisions can be provided as needed.

At this stage and with the current available data in Ibadan, the capacity of the GPON Fiber Optic cables and distribution network is calculated based on the following planning parameters and assumptions. The bandwidth at this stage is mainly estimated based on the number of units and number of people within each of these units. These figures will need to be reviewed and assessed by the NCC or an authorised service provider.

1. For the units within the high density core and high density expansion areas, the estimated bandwidth is 80 Megabit/s of stream (i.e. 50 Mb/s for five TV sets and 30 Mb/s for internet and voice usage). For such units and in order to attain this stream size, 32-type-splitters are assumed to be used by having 24 active fiber strands and 8 (equivalent to 25%) spare strands. Each of these splitters will be connected to the corresponding OLT exchange with one strand. A single 144-strand primary fiber optic cable originating from the OLT would feed approximately 3,450 such units.
2. For the units within the medium density expansion areas, the estimated bandwidth is 40 Mb/s of stream (i.e. 20 Mb/s for two TV sets and 20 Mb/s for internet and voice usage). For such units and in order to attain this stream size, 64-type-splitters are assumed to be used by having 48 active fiber strands and 16 (equivalent to 25%) spare strands. Each of these splitters will be connected to the corresponding OLT exchange with one strand. A single 144-strand primary fiber optic cable originating from the OLT would feed approximately 6,910 such units.
3. For the units within low density expansion areas, the estimated bandwidth is 20 Mb/s of stream (i.e. 10

Mb/s for one TV set and 10 Mb/s for internet and voice usage). For such units and in order to attain this stream size, 128-type-splitters are assumed to be used by having 96 active fiber strands and 32 (equivalent to 25%) spare strands. Each of these splitters will be connected to the corresponding OLT exchange with one strand. A single 144-strand primary fiber optic cable originating from the OLT would therefore feed approximately 13,820 such units.

4. The industry units are considered as low density areas with 20Mb/s per unit.
5. It is assumed that every 50 employees will constitute one employment entity with a bandwidth equal to the same residential unit depending on its location (in high, medium or low density areas).
6. The size of the primary fiber optic cables radiating from the OLT exchanges and feeding the splitters is assumed to be of 144 strands.
7. Each 3 primary cables (144 strands) will fit in one primary duct by utilising sub-ducts.
8. The maximum assumed number of primary ducts radiating out of each OLT exchange is 24, where 16 will be active and 8 will be left as spare.
9. A PON is typically limited to fiber cable runs of up to 12 km. Consequently, the servicing radius of each OLT exchange should not exceed 7 km accounting for indirect routes from the OLT to the terminal cabinets/ points.

d) Calculations Results for the Triple Play Telecommunication Network

The bandwidth calculations are based on the criteria and planning parameters as applied in the above section. The detailed calculation results are shown in Appendix 1. Figure 7.7 shows the proposed location of exchanges.

e) Design Criteria for ELV Network

Considering that the ELV network will be mainly constituting of a CCTV surveillance system, the strategy is based upon the criteria of monitoring primary/main roads as well as the roundabouts by CCTV cameras.

Telecommunication Exchange Building

New OLT exchange buildings are to be provided as a means to provide the anticipated telecommunications services. The location of the new exchange buildings have been selected as shown in Figure 7.7 based on the above listed criteria where they are located for best service provisioning, optimum coverage and an appropriate distribution scheme. The total bandwidth to be served by all these OLT exchange is estimated at 20 Tbps for 2016 and 41 for 2036 as shown in Appendix 1.

Exchange building plots should measure approximately 35 x 35 sqm, to be confirmed by the NCC or local telecom authorities. This exchange building should be equipped with convenient technical rooms to house the primary cable terminations as well as voice, data and TV/video active PON equipment and transmission equipment in addition to components, power supplies, rectifiers and backup generators for maintained power availability. The building should also contain offices for administration and operation purposes. The exchange building and all related equipment are outside the scope of the general infrastructure works; plot requirements of the related exchanges will be secured at a later stage.

For remote villages in the rural areas, to which no new roads are planned and where the primary fiber optic cable run exceeds 12.5km from the exchange to the terminal user, it is assumed that the units are to be covered by the mobile network rather than fixed line network.

FTTH Triple Play PON Network Distribution and Architecture

Ibadan will be equipped with a new OSP distribution network to supply triple play network services (voice, internet and TV) to all its tenants over the GPON fiber optic cables technology. The OSP distribution network will mainly be composed of primary and secondary networks.

a) Primary Network

The primary network is the cabling network stretching from the OLT exchange's location up to cross connection cabinets, namely GPON Fiber Distribution Terminal (FDT) cabinets. The primary feeder cables, with sizes of 144-fiber-strand that will run from the OLT exchange through ducts, will later be split at some point into multiple 48-strand cables; each will reach a separate FDT cabinet. Each duct can accommodate up to 3 primary feeder cables by utilising sub-ducting.

b) Secondary Network

Multiple GPON FDT cabinets (an FDT space requirement of 2m x 3m is adequate) will be required to serve as distribution points or hubs for subzone areas. The cabinet is considered as the main hub of the secondary network that will be used to feed the plots, over secondary cables, either directly or through subcabinets, namely Fiber Access Terminals (FAT). Furthermore, GPON splitters shall be mainly located in the buildings and FAT cabinets.

The FDT cabinet is mainly used to patch the primary feeder cables and the secondary cables. It is also used for maintenance purposes and to allocate spare fiber optic strands for future plots. Splitters can also be added in the FDT cabinet so that each primary fiber strand can be split into numerous FO secondary cables and each of these strands would feed one plot/building or FAT subcabinet. Splitters to be installed inside FDT cabinets can be cascaded with the ones used at the plots/buildings/FAT if needed.

All cabling, splitters, cabinet shelves and equipment are considered outside the scope of work; however, estimating their sizes and types is crucial to size the civil works accordingly.

ELV Network Distribution and Architecture

Fiber optic cables will be used to feed outdoor CCTV cameras and other security systems, if any. These cables are to be fed from a control centre on the basis of a star topology. It is assumed that the cameras are to be installed on lighting or dedicated poles.

The civil work infrastructure will be sized based on the required cables for the terminal points while leaving spare ducts for future needs. All cables and equipment are outside the scope of work as mentioned earlier.

Civil Works For the FTTH Triple Play GPON Telecom Network

The civil and cable works infrastructure is the basic item in implementing a durable telecom system transport network. As the evolution of technology forces new generation of cabling systems and technologies to carry larger amounts of bandwidth, civil works shall be designed to cope with the ever growing demand. Duct bank capacity infrastructure should allow for flexible network growth and upgrading.

The civil works, which include ducting systems, hand-holes, manholes, etc, shall be designed to comply with international standards and local requirements.

The hand-holes/manholes should be chosen to fit the duct bank capacity and F.O. cable splicing. However, the cable works themselves and all corresponding equipment are considered outside the scope of work.

On the main highway, the provision of duct infrastructure that would accommodate the incoming transmission system is recommended. In addition, reservations should also be allocated for provisional GSM related infrastructure; however, the GSM system is outside the masterplan scope of work. The design shall be based on the assumption that several mobile operators would share the same infrastructure unless otherwise specified by the NCC or local telecom authorities.

The duct bank infrastructure for the telecommunication system shall be mainly placed underneath pavements (on both sides or on one side of roads, as needed).

Civil Works and Cabling for the ELV Network

As in the telecom network, the civil works of the ELV network include ducting system, hand-holes, manholes, etc, that shall be designed to comply with international standards and local authority requirements. However, the cable works and all corresponding equipment are also considered outside the scope of work.

The ELV system duct bank infrastructure shall be mainly placed underneath the pavements. Figure 7.6 shows a typical OSP trenching along the roads.



Figure 7.6: Duct Trenching

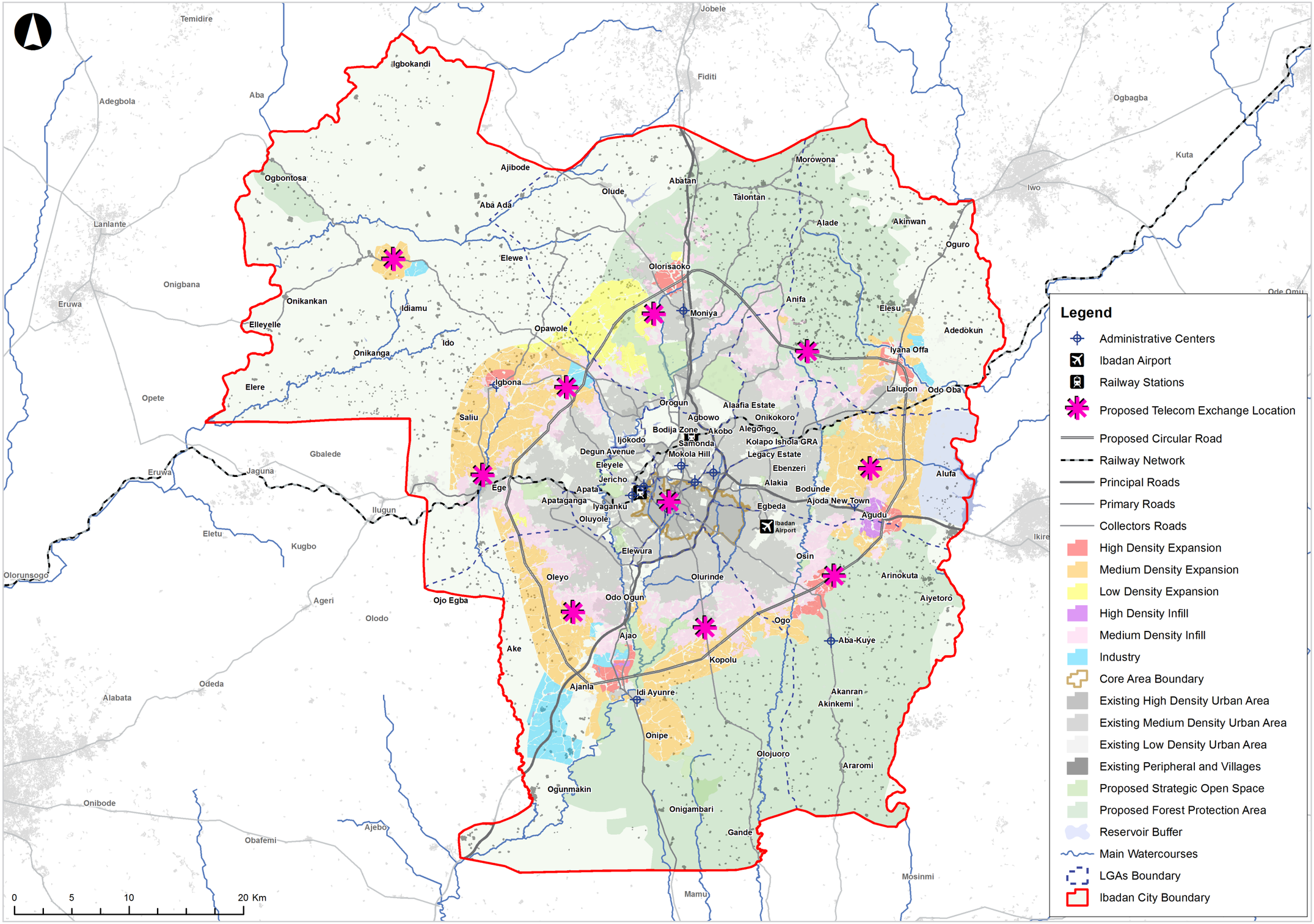

Figure 7.7: Proposed Telecommunication Exchange Locations

7.2 POWER SUPPLY AND DISTRIBUTION

7.2.1 Introduction

This section describes the electrical concept design (at a high level). It includes an overview of the generation and transmission systems in Nigeria as a whole, collected from the Nigeria's Integrated Infrastructure Masterplan document (August 2014). It then considers the infrastructure and network requirements for Ibadan over the period to 2036, based on the proposed Spatial Development Strategy for the city.

7.2.2 Codes and Standards

All electrical systems are to be designed and specified in compliance with the relevant recommendations, codes and standards, as follows:

1. Latest edition of the "British Standard"- Europe Norms (BS –EN).
2. Standard Handbook for Electrical Engineers, published by Mc Graw Hill Handbooks, Donald G. Fink and H. Wayne Beaty.
3. Nominal characteristics of all equipment forming part of the electrical works shall be specified to conform to the relevant BS Standards or "National Electrical Manufacturing Association" (NEMA) and the "International Standards Organisation" (ISO).

7.2.3 Ambient Conditions

All electrical equipment, apparatus, materials, and accessories are designed, specified and derated for a continuous and trouble free operation in the ambient conditions of Ibadan, which are as follows:

1. Altitude: Sea Level (Coastal).
2. Maximum ambient temperature: 40°C (in the shade).
3. Minimum ambient temperature: 21°C.
4. Maximum relative humidity: 89%.

7.2.4 Electricity in Nigeria

Generation and Supply

Nigeria has an installed electricity generation capacity of 7,000 MW, but capacity utilisation currently ranges between 3,500-4,500 MW and in June 2013 was as low as 2,200 MW. 70% of Nigeria's current installed capacity is gas-fired, with the remaining 30% coming from hydropower. The country's total exploitable large-scale hydropower potential is estimated to be over 12,000 MW. Nigeria is estimated to have sufficient gas reserves to generate over 50,000 MW, but currently only has installed capacity of 5,000 MW.

Figure 7.8 shows the existing distribution of power plants in Nigeria and Table 7.1 indicates an overview of the Current Generation Capacity.

The power supply situation in Nigeria is characterised by inadequate generation, and inefficient transmission and distribution. Nigeria's installed power generation capacity is inadequate to cater for the need of a country with (in 2017) over 180 million people.

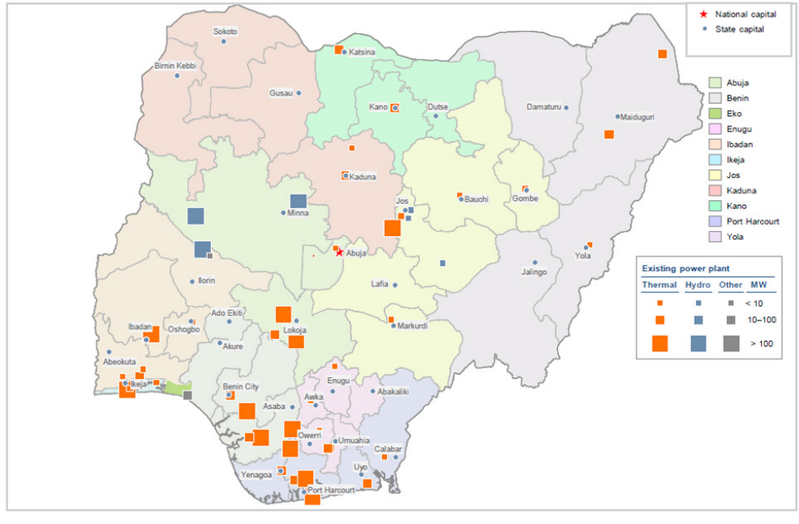

Figure 7.8: Existing Power Plants in Nigeria

Source: Federal Republic of Nigeria- National Integrated Infrastructure Masterplan page 51.

Table 7.1: Overview of Current Generation Capacity

	GENERATION PLANT	LOCATION	INSTALLED CAPACITY (mw)	AVAILABLE CAPACITY (mw)
Hydropower	Kainji	Niger	760	480
	Shiroro	Niger	600	450
	Jebba	Kwara	540	450
	Subtotal		**1,900**	**1,380**
Oil-Fired	Ijora	Lagos	60	
Gas-Fired	Afam	Rivers	726	60
	Ughelli	Delta	900	300
	Egbin	Lagos	1,320	1,100
	Sapele	Delta	1,020	90
	Geregu	Kogi	414	276
	Omotosho	Ondo	304	76
	Olorunsogo	Ogun	304	76
	Subtotal		**4,988**	**1,978**
Coal-Fired	Oji	Enugu	30	
	TOTAL		**6,978**	**3,358**

Source: Federal Republic of Nigeria- National Integrated Infrastructure Masterplan page 52.

Electricity Consumption

Many factors are responsible for the low level of household electricity consumption. These factors include:

- Insufficient generation capacity,
- Insufficient utilisation of the existing generation capacity,
- Insufficient supply of electricity,
- Unreliability of the distribution network,
- Ageing infrastructure,
- Load shedding resulting in frequent interruptions of supply,
- Lack of grid discipline and poor grid management,
- Unbalancing of the electricity demand, supply and consumption, and
- Lack of investment in maintenance and expansion programmes on existing power plants.

7.2.5 Demand Load Estimate of Ibadan

General

In the absence of information related to the existing electrical networks and detailed drawings/documents showing the total connected and demand loads for the different regions, a design criteria based on previous statistics, documents and assumptions to estimate the total electrical demand load for the Ibadan City Masterplan has been used.

a) Basis of Load Estimate (Watts/m^2)

In general, the maximum demand of any development, and at every level in the network, equals the product of three main variables: built-up areas, load density factors, and demand/diversity factors at each level. The former two are constant, whereas the latter is different at each given level. In more technical terms, this is represented as follows:

a) Maximum Demand at Users Level = Σ Built Up Area of each specific occupancy x Load Density @ each specific occupancy x Demand Factor @ each specific occupancy.

b) Maximum Demand at Service Transformer Level = Max Demand at Users Level x Diversity Factor between Users @ each given facility, or building.

c) Maximum Demand at Medium Voltage Loop Level = Max Demand at Service Transformer Level x Diversity Factor between Transformers.

d) Maximum Demand at Primary Substation Level = Max Demand at Medium Voltage Loops Level x Diversity Factor between Medium Voltage Loops.

The final demand load at the power plant level dictates the capacity of the main power plant equipment and associated incoming fuel or gas pipes, and would be quoted as the demand covering the whole of Ibadan.

The demand that is downstream by one level, such as at the primary substation(s) level, dictates the capacity of the primary substation(s), which would be distributed in dedicated plots across the city.

By similar reasoning, the demands at the MV loops level and service transformers dictate the required capacity of the MV cables and service substations, respectively.

b) Load Density Factors (Watts/person)

An electrical load density factor (Watts per person) is calculated/estimated on the total expected population of Ibadan and its spatial distribution by factoring this according to the total population.

The population of Nigeria in 2013 was around 174 million (2.7% increase each year) with a 2200 MW utilised capacity at the power plant level. Therefore, the Watts/person factor is (2200/174 = 12.6Watts/person).

Knowing that only 40% of the total population of Nigeria have access to the electricity grid, around 70 million people have electricity. Therefore, the actual average load factor is 2200/70 = 31.5Watts/person.

Considering the target of providing electricity to 75% of the Nigeria population with a 20GW generation capacity (in 2018- estimated population = 198 million), the load factor is estimated as 20,000/198 = 101 Watts/person. This factor will be assumed as an average load density factor for medium population density areas.

The following population densities have been assumed:

- In high density areas each household contains an average of 17 persons.
- In medium density areas each household contains an average of 12 persons.
- In low density areas each household contains an average of 7 persons.

The load factors will differ slightly between the different expansion categories as shown in the Table 7.2.

A factor of 500 Watts/person is assumed for the employment population (around 5 times the factor estimated for residential population with medium density).

See Appendix 1 for table of load estimates for existing and new expansion areas.

Table 7.2: Load Density Factors (Watts/Person) Vs. Expansion Categories

EXPANSION CATEGORY	LOAD DENSITY (WATTS/PERSON) AT PRIMARY SUBSTATION LEVEL
High Density Expansion	71
Medium Density Expansion	101
Low Density Expansion	245
Employment	500

c) Demand/Diversity Factors

Based on the Standard Handbook for Electrical Engineers, published by Mc Graw Hill Handbooks, the following diversity factors (for the residential areas) may be assumed in the electrical load:

Table 7.3: Diversity Factors for Residential Zones

INDOOR	DIVERSITY FACTOR
At User Level	0.6
At Transformer level, i.e. between users of a given residential building	0.66
At 132/33 kV Primary Substation Level, i.e. between 33 kV loops	0.8
At Power Plant, i.e. between primary substations	0.9
OVERALL	**0.27**

7.2.6 Power Distribution

Figure 7.9 shows the network of existing 330KV transmission lines passing through Ibadan.

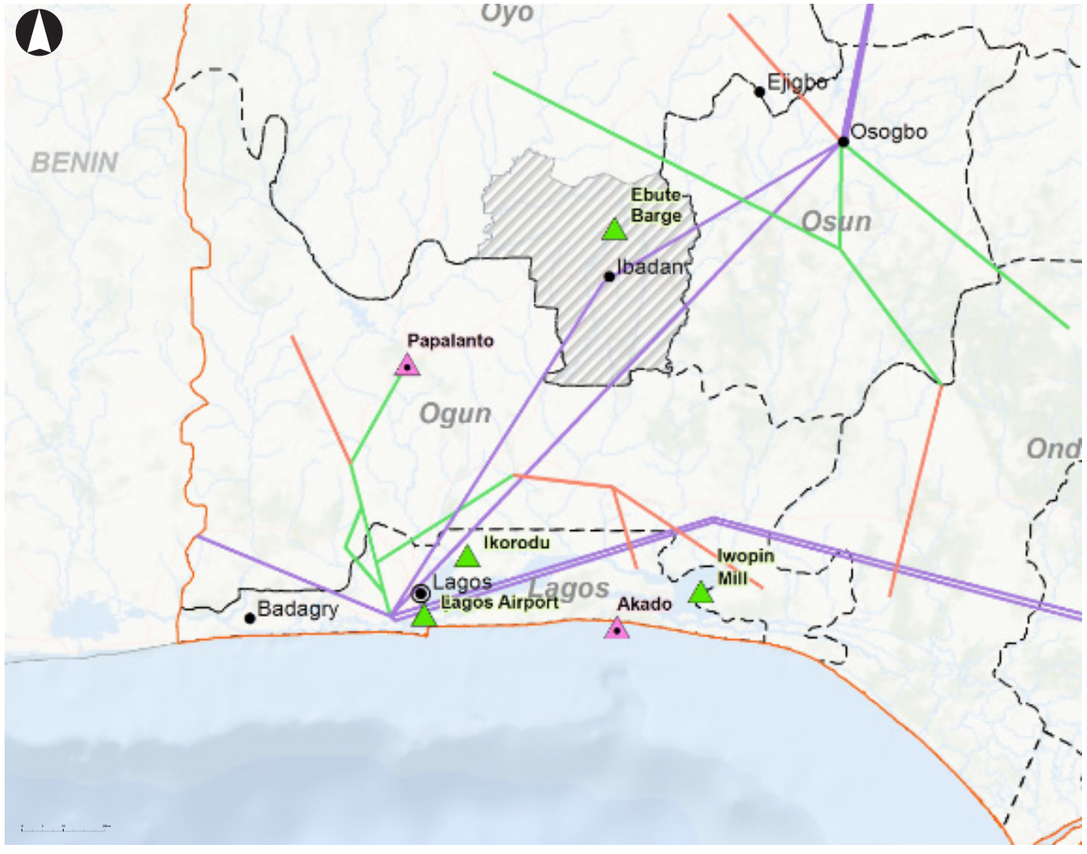

Figure 7.9: Existing Power Plants in Nigeria

The total demand load at the primary substations level for Ibadan will be around 3001 mw in 2036.

Table 7.4 below indicates the six primary substations dedicated for the new expansion areas of the Ibadan City Masterplan and the zones fed by each primary station. Each primary substation might be split at later stages into a number of smaller primary substations based on the distributed loads within each area and based on common practice in Nigeria.

Table 7.4: Required Primary Substations for the New Expansion Areas

PRIMARY SUBSTATIONS REFERENCE NAME (FOR EXPANSION AREAS)	(132/33KV) TRANSFORMERS	AREA	ZONE NAME	TOTAL LOAD AT PRIMARY SUBSTATION LEVEL (mw)	TOTAL LOAD PER ZONE AT PRIMARY SUBSTATION LEVEL (mw)	TOTAL LOAD PER ZONE AT TRANSFORMER LEVEL (mw)
PS1	(6x60MVA 132/33 KV transformers) including one spare transformer	Akinyele	HD1	198.8	56.2	78.1
			LD1		80.1	111.2
			IMD1		62.5	86.7
PS2	(5x60MVA 132/33 KV transformers) including one spare transformer	Lagelu	HD3	150.0	33.4	46.4
			MD1		21.2	29.4
			MD7		6.7	9.3
			MD8		9.9	13.7
			IMD2		35.8	49.7
			IMD7		29.7	41.3
			ID7		7.0	9.7
			ID8		6.4	8.8
PS3	(5x60MVA 132/33 KV transformers) including one spare transformer	Egbeda	HD4	176.9	26.6	37.0
			MD2		104.9	145.7
			IHD2		21.5	29.9
			IMD3		23.9	33.1
PS4	(4x60MVA 132/33 KV transformers) including one spare transformer	Ona Ara	HD5	111.6	23.9	33.1
			HD8		27.8	38.7
			MD3		25.8	35.8
			IHD3		5.3	7.3
			IMD4		28.8	40.0
PS5	(12x60MVA 132/33 KV transformers) including one spare transformer	Oluyole	HD6	450.6	39.0	54.2
			MD4		167.2	232.2
			ID1		37.1	51.6
			ID2		19.2	26.7
			ID3		15.1	21.0
			ID6		94.6	131.3
			IHD4		30.4	42.2
			IMD5		48.0	66.7
PS6	(7x60MVA 132/33 KV transformers) including one spare transformer	Ido	HD7	274.8	23.5	32.6
			MD5		117.0	162.5
			MD6		14.8	20.6
			LD3		12.7	17.7
			ID4		15.4	21.4
			ID5		8.1	11.3
			IMD6		83.1	115.5
TOTAL				**1362.6**	12.7	17.7

The (132/33KV) primary substations will be supplied from the existing power plants and overhead transmission lines from the nearest 132KV network.

The primary substations will feed the 33/0.415KV / 0.415KV secondary distribution substations by 33KV cables held on overhead transmission lines or underground. The schematic diagrams in Figure 7.10 to Figure 7.15 illustrate the above.

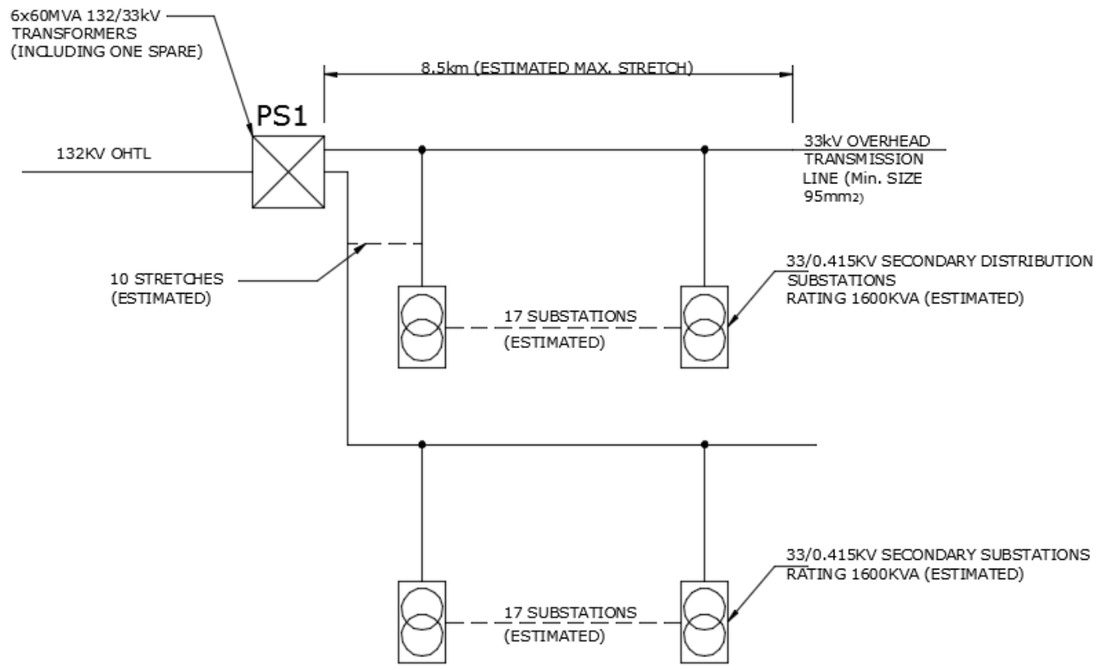

Figure 7.10: Existing Power Plants/Transmission Lines near Ibadan PS1

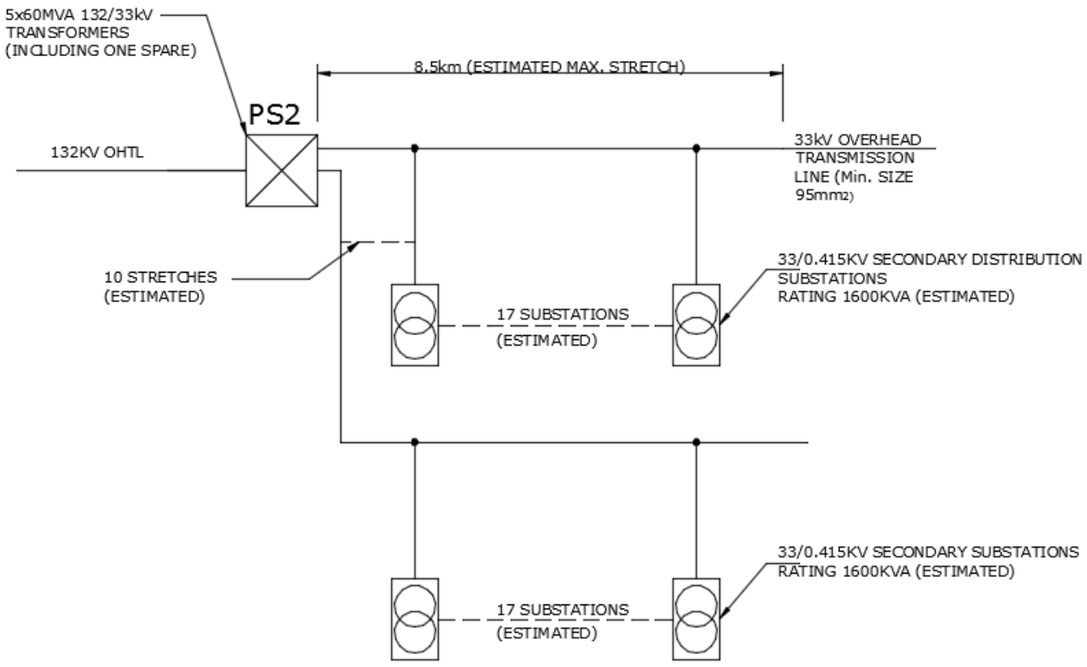

Figure 7.11: Existing Power Plants/Transmission Lines near Ibadan PS2

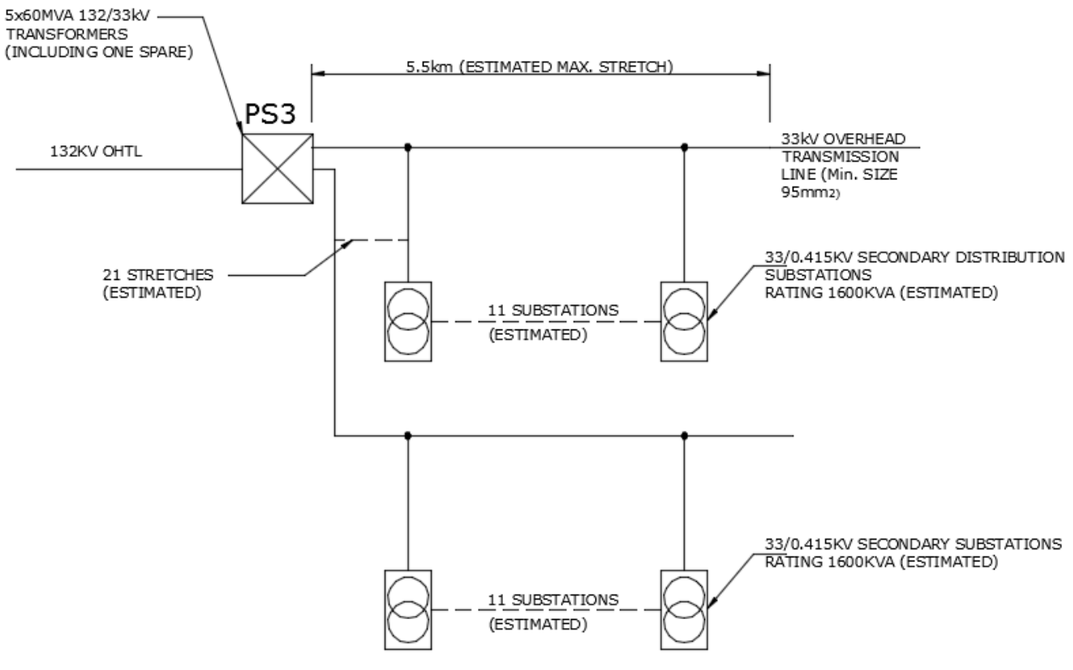

Figure 7.12: Existing Power Plants/Transmission Lines near Ibadan PS3

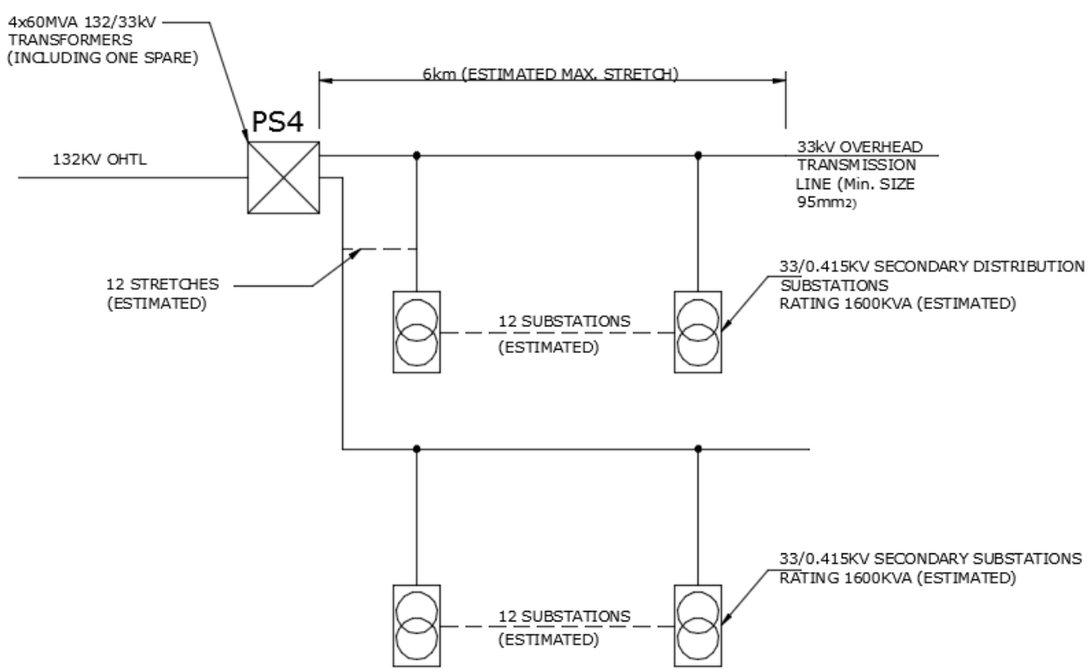

Figure 7.13: Existing Power Plants/Transmission Lines near Ibadan PS4

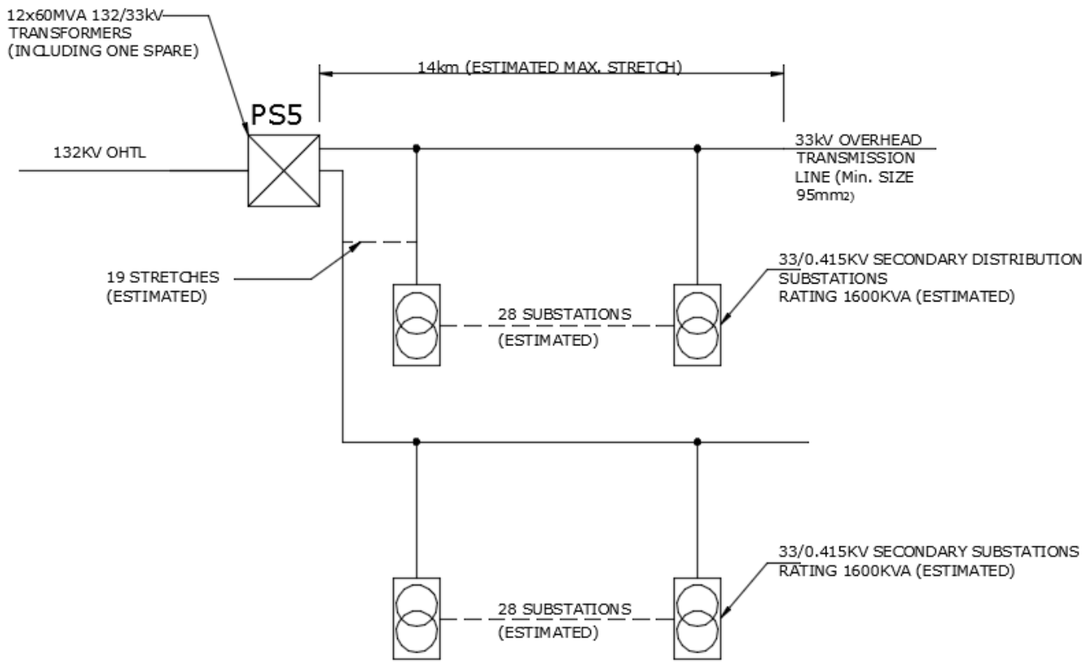

Figure 7.14: Existing Power Plants/Transmission Lines near Ibadan PS5

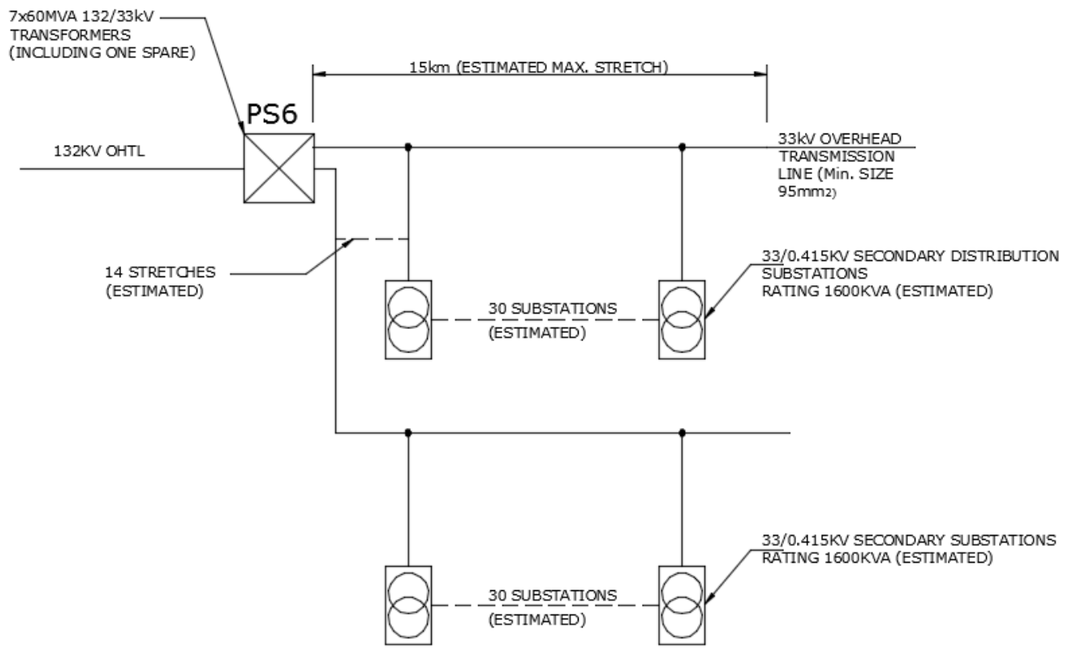

Figure 7.15: Existing Power Plants/Transmission Lines near Ibadan PS6

Figure 7.16 indicates a conceptual layout of the required primary substations for the new expansion areas with the relevant HV network required to feed Ibadan with the relevant transformer ratings and voltage levels.

No network is proposed for the existing areas as insufficient information on the as-built network is available. This can be detailed at a later stage when more information is available regarding the existing HV network (power plants, primary substations and distribution substations with their relevant locations, numbers of transformers, available capacities, etc).

33KV and 11KV Distribution Networks

In Nigeria, 11, 22 and 33 kV are used in the public system. 11 kV is ideal for distribution in moderately loaded areas, where feeders may travel appreciable distances and still fall within acceptable thermal and voltage drop constraints, in addition to resulting in low cost service substation equipment at the consumer end. This voltage would have to be higher than 11 kV to deliver increased amounts of power using the same cable conductor cross section.

As it is able to deliver three times the power using the same cable size, 33 kV is economically attractive on the infrastructure side, as it results in the least number and length of cables, and also the upstream distribution switchgear at the primary substation. However, the cost at the consumer end, which includes the 33 kV secondary switchgear and transformers, is higher.

Secondary Distribution (33/0.415KV)

Secondary outdoor substations (33/0.415KV) will be provided to feed the users low voltage. The coverage area of each substation is around 250m.

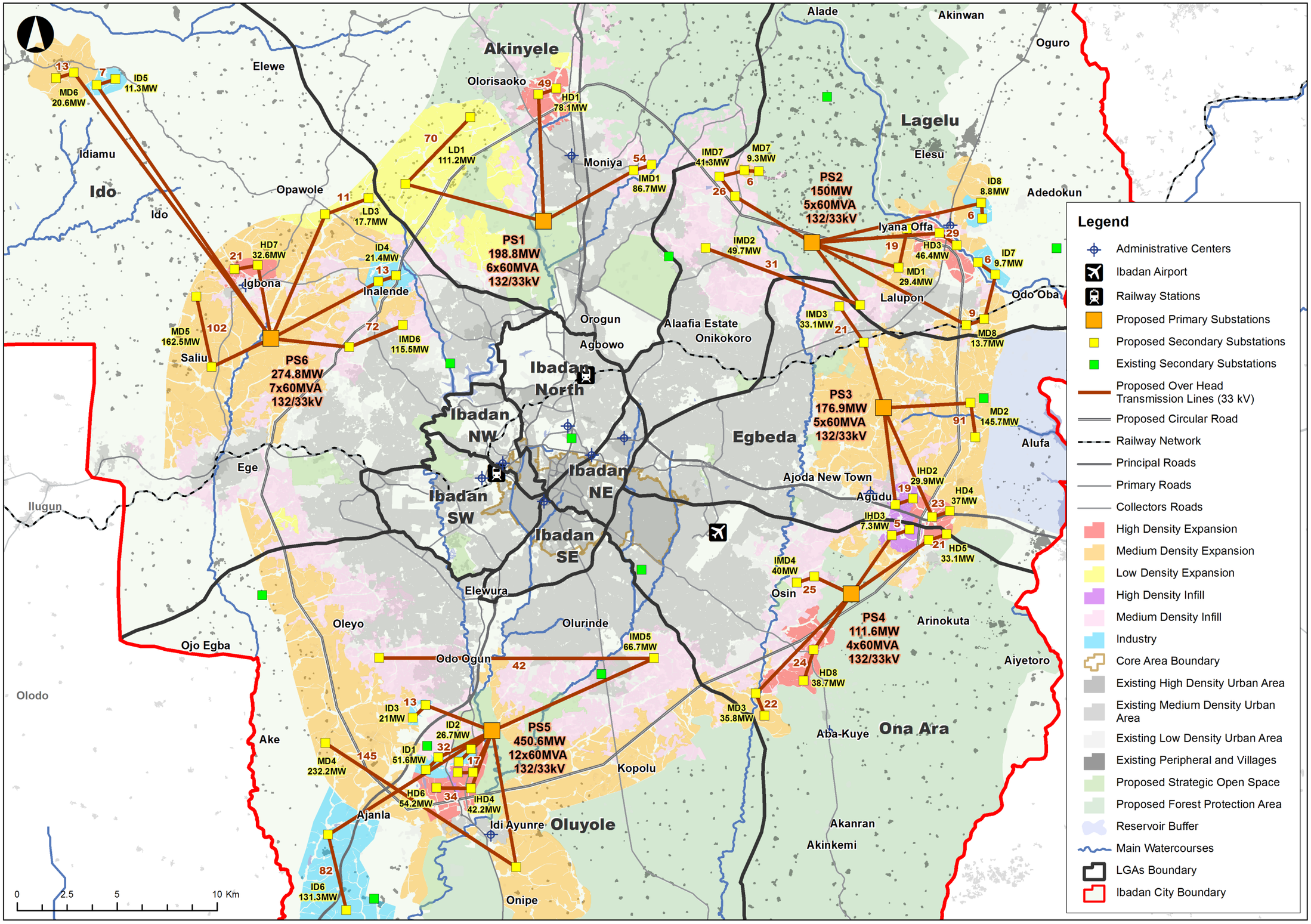

Figure 7.16: Primary and Secondary Substations Distribution across Ibadan

7.3 SOLID WASTE MANAGEMENT

7.3.1 Introduction

This section provides an overview of the existing Solid Waste Management (SWM) situation for Ibadan in accordance with the data made available. It also provides a strategic approach to improve the SWM scheme in Ibadan. The strategy considers the integration of SWM strategy that attains to storage and collection operations with proposed final treatment/disposal facilities.

7.3.2 Review of Collected Data

The information obtained dates back to 2006 and provides a brief on the means of waste disposal in both the inner and outer areas of Ibadan.

The data concerning the inner areas reveals that 42% of households dump their generated waste in official dumpsites. 28% of households use unofficial dumpsites. These tend to be in higher density areas and those in close proximity to watercourses. The remaining households utilise burning or burying methods for their waste.

In the outer areas of the city, it is revealed that under 20% of households use official disposal methods, with a considerable amount of the remaining households burning or burying waste.[1]

Collection services in Ibadan are provided by the Oyo State Waste Management Authority (OYOWMA), Local Governments, and the Private Sector. Local Governments and OYOWMA are responsible for collection from public areas along the main federal expressway. Private contractors are responsible for collection of waste from residential (twice/month), commercial (three times/week) and industrial zones (daily) based on a paid service system and under regulations of OYOWMA. The most common ways of collection are door-to-door, communal depots, and the block system.[2]

Ibadan contains a number of existing SWM facilities, as shown in Figure 7.17. This includes a dumpsite in Sabo (i.e. limited information has been provided on the status of this dumpsite) and a non-operational Transfer Station (Orita Aperin). Moreover, Ibadan includes four main official dumpsites distributed around the city, namely at Lapite in the North, Ajakanga (Oluyole) in the south, Afofurna (Aba-Eku) in the east, and Apete (Awotan) in the west, all of which share the following characteristics:[2]

- No liner system
- No weighing bridge
- Located next to residential areas
- Private waste collectors pay a disposal fee
- Difficult access to and within the dumpsites
- Presence of scavengers

An Integrated Solid Waste Management (ISWM) is considered necessary for the entire city of Ibadan in order to improve the overall SWM structure. Such an ISWM strategy should allow for long term sustainable measures, the rehabilitation of the existing infrastructure, and lay a platform for the proper means of storage, collection, and disposal.

1 2006 Census and NLSS, 2007-2010.

2 World Bank (2016). Private Sector Participation in Solid Waste Management Activities in Ibadan – World Bank and the Public-Private Infrastructure Advisory Facility (PPIAF) For the Oyo State Government.

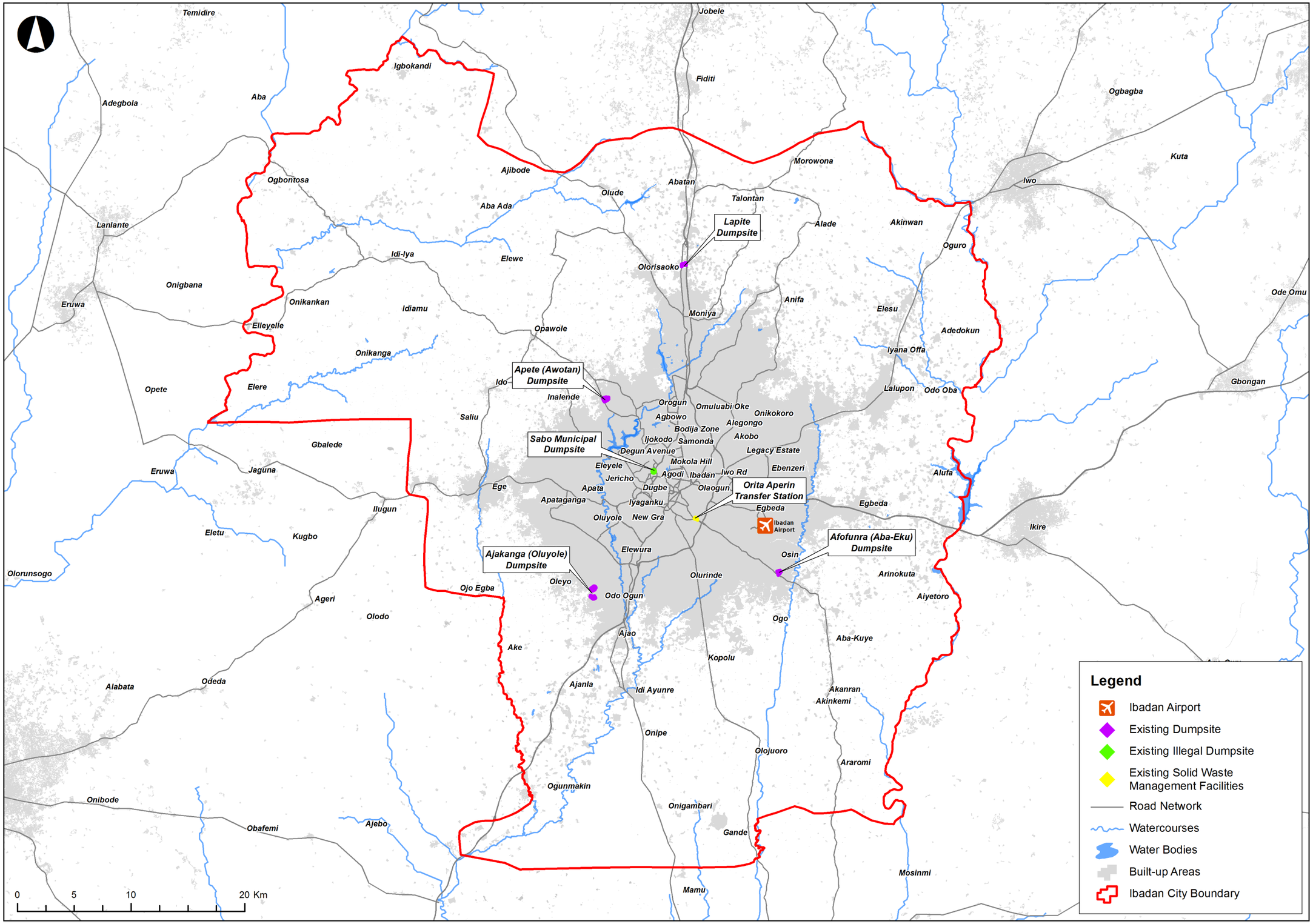

Figure 7.17: Location of Existing Waste Dumpsites and Management Facilities in Ibadan

7.3.3 Sustainable Aspirations

The process of implementing a SWM plan for Ibadan should take into consideration the importance of adopting a long term waste minimisation policy. This should be based on practicing the 3 Rs (i.e. Reduction, Re-use, and Recycling).

Recycling is characterised by turning materials that would otherwise become waste into valuable resources. Waste materials, such as dry recyclables, are separated from the Municipal Solid Waste (MSW) and sent to facilities that can re-process them into new materials or products. Although recycling generates environmental, financial, and social benefits, it is only realised as 'economical' by conducting comprehensive market studies which prove its feasibility and proper market value.

An improved strategy would require the incorporation of the SWM system at a city-wide level. The sustainable measures to be considered on a long-term basis should account for Municipal Solid Waste (MSW) source-separation practices, as recommended in Environmental (Sanitation and Wastes Control) Regulations.[3] Such an approach would result in the establishment of an infrastructure that will aid sustainable future plans set by the relevant authorities. MSW could be source-separated into three main streams:

- Organic waste.
- Dry recyclables (including paper/cardboard, metals, glass, plastic).
- General non-recyclable waste.

7.3.4 Solid Waste Types and Sources

The major types of waste likely to be generated in Ibadan include:

- MSW: most land uses (residential, commercial areas, etc) generate solid waste that is typical of the MSW stream. This comprises general discarded material from households or office-based locations such as food scrap, paper waste, cardboard, plastics, etc.
- Non-Municipal Solid Waste (Non-MSW): could include both non-hazardous (MSW materials) and potential hazardous waste material. In normal cases, Non-MSW is generated from medical centres, hospitals and industry. The above mentioned special types of solid waste should be stored in generation points and collected by an approved specialised operator.

7.3.5 Solid Waste Generation and Composition

Solid waste generation differs in Ibadan depending on population densities (i.e. high, medium and low), rural areas and the associated activities. Table 7.5 presents the adopted MSW generation rates for various residential density types. Based on the rates in Table 7.5 and the information made available, an overall figure for MSW generated daily across the whole of Ibadan is estimated at around 7,600 T.[4]

Typical compositions of MSW generated by the difference land uses are presented in Figure 7.18.

3 Oyo State of Nigeria Gazette – Environmental (Sanitation and Wastes Control) Regulations, 2013.

4 Generated waste quantities were increased by 20% to account for any unforeseen events.

Table 7.5: Adopted MSW Generation Rates

LAND USE		RATE	UNIT
Residential	Low Density	0.688	kg/capita/day
	Medium Density	0.303	kg/capita/day
	High Density	0.452	kg/capita/day
	Rural Areas	0.636	kg/capita/day
Non- Residential		0.56	kg/employee/day

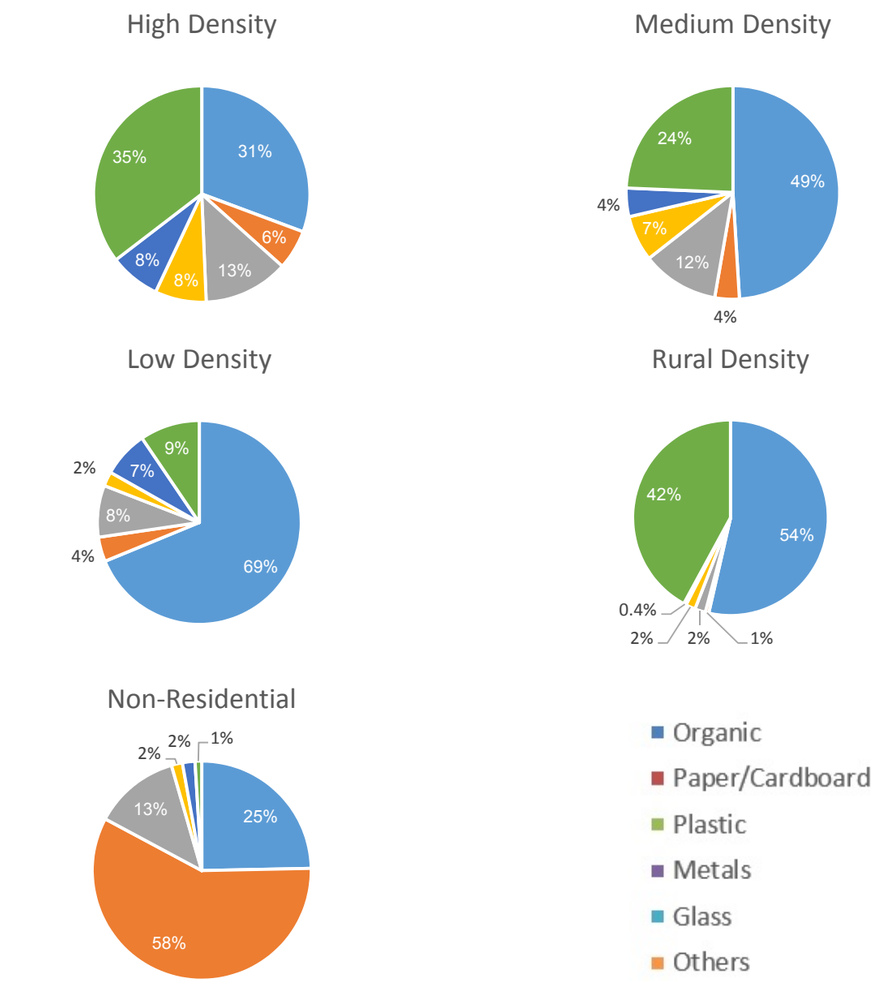

Figure 7.18: Adopted MSW Composition

Based on the adopted waste composition addressed above, the quantity of solid waste expected to be generated from each Local Government Area (LGA) has been estimated as shown in Table 7.6.

Table 7.6: Estimated Daily Generated Quantities of MSW per LGA (T/d)

	ORGANIC		DRY RECYCLABLES		GENERAL WASTE		TOTAL	
	EST. QTY. (t/d)	EST. VOL (m^3/d)	EST. QTY. (t/d)	EST. VOL (m^3/d)	EST. QTY. (t/d)	EST. VOL (m^3/d)	EST. QTY. (t/d)	EST. VOL (m^3/d)
Ibadan North	79	258	104	881	50	334	233	1,473
Ibadan North East	72	235	104	857	62	415	238	1,507
Ibadan North West	34	113	47	393	24	159	105	665
Ibadan South East	65	212	90	751	49	325	203	1,289
Ibadan South West	84	275	110	935	53	352	247	1,562
Lagelu	334	1,096	391	3,443	126	843	852	5,382
Akinyele	529	1,734	507	4,404	137	913	1,173	7,051
Ido	566	1,857	536	4,613	216	1,437	1,318	7,906
Oluyole	604	1,982	545	4,671	234	1,557	1,383	8,210
Ona Ara	292	959	360	3,100	145	966	797	5,025
Egbeda	402	1,318	482	4,222	155	1,035	1,040	6,575
TOTAL	**3,062**	**10,038**	**3,276**	**28,272**	**1,250**	**8,335**	**7,588**	**46,645**

Industrial Waste

The types and quantities of Industrial Waste (IW) vary widely and depend on the individual industrial facility's characteristics such as type, size, processes, technology, materials involved, waste minimisation practices, and quality environmental standards adopted, and can only be best verified during operational stages using IW inventories.

Published sources[5] reveal that solid waste generation rates in typical light/medium industries range from as low as 5 to about 70kg/employee/day. Similarly, solid waste generation rates in heavy industry range from 27 and can extend to an excess of 440 kg/employee/day.

However, in order to provide a base for waste generation projections, typical benchmarking waste generation rates have been identified for selected existing/committed industries[6] in accordance with the data available. The classification of industry among light, medium and heavy is set out in Table 7.7.

5 Estimated rates compiled from Ministry of Environment website; http://www.ciwmb.ca.gov/; Standard Handbook of Environmental Engineering by Robert Corbitt 1990; Integrated Solid Waste Management by George Tchobanoglous 1993; Mercer County Solid Waste Management District- August 2004 and the previous experience of the Consultant.

6 Robert A. Corbitt - "Standard Handbook of Environmental Engineering," 1990, The State of California, California Integrated Waste Management Board: "Estimated Solid Waste Generation Rates."

Table 7.7: Solid Waste Generation Rates from Industries

INDUSTRY CLASS	INDUSTRY TYPE	TYPICAL PUBLISHED WASTE GENERATION RATE (KG/ EMP/D) *	RANGE
Light Industries	Food & beverage products	36	10-36
	Apparel & textile products	10	
Medium Industries	Lumber & wood products	70	5-70
	Furniture & fixtures	30	
	Printing & publishing	14	
	Leather and leather products	15	
	Industrial machinery & equipment	11	
	Electronic & electric equipment	9	
	Miscellaneous manufacturing industries	10	
	Paper & allied products	6	
Heavy Industries	Petroleum	41	27-440
	Chemical	27	
	Sawmills & planning mills	440	
	Primary metal industries	49	
	Fabricated metal industries	70	

** Okey, E., Umana, E., Markson, A. & Okey, P. Municipal Solid Waste characterisation and Management in Uyo, Akwa Ibom State, Nigeria.*

7.3.6 SWM Planning Approach

A general assessment of the current SWM situation has been conducted. This has led to an approach towards formulating an Integrated SWM scheme that revolves around options for solid waste storage, collection/transfer, and ultimate treatment/disposal components. Two options as illustrated by the general waste material flow diagrams in Figure 7.19 and Figure 7.20, are proposed.

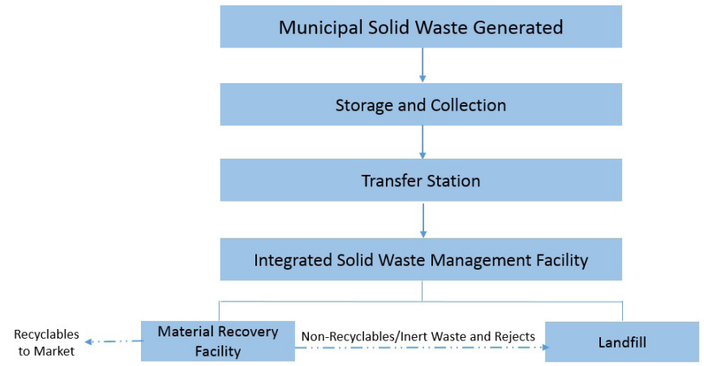

Figure 7.19: Flow Diagram of Proposed Scheme – Option 1

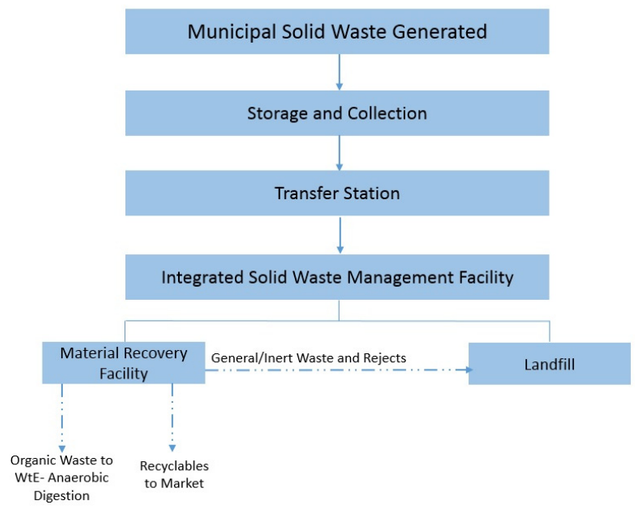

Figure 7.20: Flow Diagram of Proposed Scheme – Option 2

7.3.7 Planning Implications

There are various primary considerations with respect to Solid Waste utility planning for Ibadan. These mainly include the following:

- The quantities of solid waste likely to be generated in the city, in light of anticipated new developments and associated lifestyle improvements.
- The requirement of land for solid waste management facility(ies) and the availability of suitable sites, with respect to the planning and environmental criteria.
- The relative distances to be travelled between collection points and potential disposal sites, hence the likely economic benefits from allocating potential Transfer Stations (TS).
- TSs required in terms of numbers, capacities, and locations; given catchment areas for solid waste inflows from neighbouring areas, daily tonnages, and accessibility to the main road network.
- Environmental considerations related to the siting, design, and management of solid waste management facility(ies).
- The reclamation and conversion of existing dumpsites into useful land uses.

7.3.8 Solid Waste Storage and Collection

Proper SWM practices would entail an adequate temporary storage of discarded solid waste material within the development prior to the collection of such quantities for transportation to further destination(s).

An acceptable waste collection system significantly improves public health and living conditions and decreases open solid waste dumping and burning, which have commonly been practiced in parts of Ibadan.

There are various types for the temporary solid waste storage and collection systems, mainly depending on the preferred level and type of service, the land use distribution, available budgets, the density of the population, compatibility of the storage containers with collection systems, and collection frequency. Other main factors that reflect an implication towards temporary storage requirements include local regulations, climate conditions, aesthetic concerns, building height limitation, etc. The various types of storage include:

- Street bin storage.
- Dedicated waste rooms inside building.
- Enclosures within premises.
- Central storage locations.

Solid waste collection systems should be compatible with proposed storage systems, in terms of containers provided, accessibility to storage locations and adopting an acceptable frequency of collection in line with common practice.

7.3.9 Solid Waste Transfer

It should be highlighted that the main purpose of a TS is to generally optimise collection efficiency and reduce travel costs and traffic congestion. Reduction in costs is done by minimising the number of trips collection trucks may have to make prior to arriving at a final disposal destination.

The cost effectiveness of a given TS mainly depends on project-specific conditions, the estimated quantities likely to be handled, and on the distance between the generation/collection area and the final disposal site.

According to the United States Environmental Protection Agency (US-EPA), the disposal site must be at least 15km from the collection area before a transfer station can be justified economically.[7]

Based on the various criteria above, the establishment of 6 TSs in Ibadan is provided. Figure 7.23 illustrates the tentative locations of the 6 TSs. The rough estimated area allocated for the each of the proposed TS sites ranges from between 0.9 ha to 1.1 ha.

The tentative locations of the TSs are based on the following main considerations:

- Locations of the western TSs (TS1, TS2 and TS6) and the eastern TSs (TS3, TS4 and TS5) are proposed to serve the western and eastern parts of the city, respectively. These are geographically distributed to allow solid waste inflows from adjacent LGAs as shown in Table 7.8.
- Locations are proposed to serve limited surrounding planning zones to avoid excessive loads and inflows to a single station.
- Locations are proposed accessible to main roads towards the proposed landfill site to avoid increase in solid waste transportation costs and excessive traffic impacts.

In this regard, it is significant to note that verification of any selected site should be subject to comprehensive further studies by relevant parties in close coordination with the concerned Authorities. These may include, but not necessarily be limited to: Environmental and Social Assessments, Feasibility Studies, and Preparatory Works (such as geotechnical and soil investigations, topographical surveys, etc).

Similar to the allocation of TSs, these locations have generally been assessed by accounting for the following main criteria:

- Facilities should be sited some distance away from residential and proposed expansion areas, and potential groundwater tables.
- Facilities should be sited in accessible locations that are close to main roads, within reasonable distance to avoid an increase in transportation costs.

7 Office of Solid Waste, Municipal and Industrial Solid Waste Division - U.S. Environmental Protection Agency, “Decision Maker’s Guide to Solid Waste Management, Volume II,” 1995.

Table 7.8: Estimated Transfer Stations Capacities and Service Zones

	WESTERN TRANSFER STATIONS			EASTERN TRANSFER STATIONS		
	TS1	TS2	TS6	TS3	TS4	TS5
LGA	Ibadan North West	Ibadan South West	Akinyele	Ibadan South East	Ibadan North East	Ibadan North
	Ido	Oluyole		Ona Ara	Egbeda	Lagelu
TS Capacity (T/d)	1,423	1,630	1,001	1,278	1,084	1,173

At this stage, an indicative rough cost estimate for each MSW TS in Ibadan is presented in Table 7.9.

Table 7.9: Indicative Cost Estimate for MSW TS(s)

INDICATIVE RANGE OF COST FOR ENCLOSED MSW TS(s)	
Estimated Capital Cost for TS-1 (M$)	27-30
Estimated Capital Cost for TS-2 (M$)	30-34
Estimated Capital Cost for TS-3 (M$)	21-24
Estimated Capital Cost for TS-4 (M$)	25-29
Estimated Capital Cost for TS-5 (M$)	22-25
Estimated Capital Cost for TS-6 (M$)	22-25
Main Assumptions	*Collection of generated waste is considered to be three times per day. *Cost of solid waste storage bins are assumed based on 20 year project duration, with allowance for bins’ wear out (i.e. changed four times due to their lifespan). *Excludes land cost.

Figure 7.21 presents a typical example of a municipal solid waste transfer station. From the TSs, waste is transferred to one of two integrated SWM facilities. These are proposed in the north-west and north-east of the city, as shown in Figure 7.23.



Figure 7.21: Typical Example of a Municipal Solid Waste Transfer Station

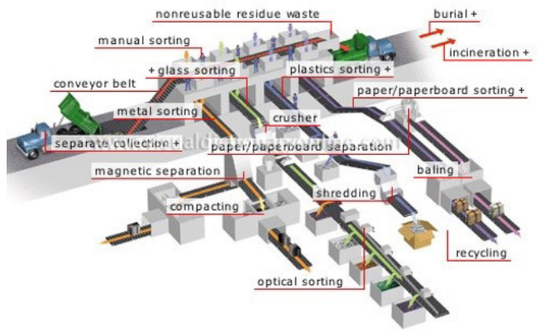



Figure 7.22: Typical Example of a Material Recovery Facility

Source: merriam-webster.com

7.3.10 Solid Waste Pre-Treatment

The pre-treatment of the generated solid waste is proposed through the use of Material Recovery Facilities (MRF). MRF accepts generated solid waste, whether source separated or mixed, and processes and ultimately separates the incoming waste into multi-streams. The components of this facility will generally comprise a receiving area, waste processing/segregation area (waste sorting line) combining hand-sorting and mechanical processing, and a baling/storage section. Upon separation of waste, recyclable material can be marketed based on the standalone feasibility of available markets, while the rest of waste streams (organic waste, non-recyclables and of remaining recyclable material) will be taken for further handling (treatment and disposal). As such, the establishment of two MRFs are proposed in Ibadan, distributed between the north-west and north-east integrated SWM Facilities. The rough estimated area allocated for the proposed MRF, at each facility, ranges between 1.5 ha to 2 ha, with an indicative range of cost between 30-32 M$ per facility (i.e. excludes land cost). Figure 7.22 presents a typical example of a Material Recovery Facility.

7.3.11 Solid Waste Treatment and Disposal

Option 1: Sanitary Landfills

The proper clean-up and closure of existing dumpsites is proposed, with their reinstatement as useful urban attractions such as open public parks.

The establishment of two new engineered sanitary landfills in Ibadan is subsequently proposed, in addition to the aforementioned MRF.

For the purpose of this SWM strategy, rough estimates for required capacities and waste infilling areas to be allocated at the proposed sanitary landfill sites (Table 7.10) have been calculated. An indicative cost for each engineered landfill site is in the range between 50M$ to 70M$ (excluding land cost).

Such engineered landfills, being fully equipped with necessary and adequate gas extraction methods, can serve as potential sources of energy and power.

Option 2: Treatment then Disposal in Sanitary Landfill

In line with the available data on MSW composition in Ibadan (comprising almost 30 to 70% of the entire MSW stream being of organic matter within the different density areas[8]), the waste content provides a platform for adopting Waste to Energy (WtE) potentials in the form of Anaerobic Digestion (AD) Plant(s) at each integrated SWM facility. This would reduce the amount of residual waste required to be disposed of in landfill.

For the purpose of this SWM strategy, rough estimates for required areas to be allocated for been calculated. The rough estimated area for each WtE Anaerobic plant is in a range of 16 ha to 24 ha.[9]

The estimated areas may differ in size depending on whether such plants can be sited independently or combined into an integrated SWM facility, with the latter likely to exhibit the need for less land-take area taking into consideration common ancillary buildings.

An indicative capital cost for a WtE – Anaerobic Digestion plant is in the range of around 810 $/ton of organic waste (i.e. excludes land cost).

An indicative cost for each engineered landfill sites under this option in the range lies 20M$ to 30M$ (i.e. excludes land cost).

Table 7.10: Estimated Landfill Volumes and Areas – Option 1

	NORTH WEST FACILITY	NORTH EAST FACILITY
Volume (x1000 m^3/d)	988	783
Estimated Area (ha)*	11	9
MRF Estimated Area (ha)	1.5 - 2	1.5 - 2
Total Area Required	12.5 - 13	10.5 - 11

* Estimated landfilling area:
- does not include other areas such as service facilities, ancillary buildings, buffer zone, etc.
- based on loose compacted landfill density: 0.95 T/m^3
- additional allowance of 10% for daily cover.
- tentative rough calculations of (i) minimal 4m excavation with internal sloped face of 1V:2H and (ii) 6m cap elevation with 1V:4H slope face.

8 Sustainable Ibadan Project, et'al (2010). "Characterization of Solid Waste in Ibadan: A Rapid Appraisal Survey in Four Residential Communities Conducted Between August 4 and October 24, 2009". Oyo State Ministry of Environment and Water Recourses/InWEnt Capacity Building International Waste Management Program, Ibadan.

9 Excludes additional area for auxiliary buildings, storage and manoeuverability.

Table 7.11: Estimated Landfill Volumes and Areas and WTE Plant Areas – Option 2

	NORTH WEST FACILITY	NORTH EAST FACILITY
Volume (x1000 m^3/d)	387	340
Estimated Area (ha)*	7	4
MRF Estimated Area (ha)	1.5 - 2	1.5 - 2
WTE Anaerobic Plant Estimated Area (ha)	16 - 24	16 - 24
Total Area Required	24.5 - 33	21.5 - 30

* Estimated landfilling area:
- does not include other areas such as service facilities, ancillary buildings, buffer zone, etc.
- based on loose compacted landfill density: 0.95 T/m3
- additional allowance of 10% for daily cover
- tentative rough calculations of (i) minimal 4m excavation with internal sloped face of 1V:2H and (ii) 6m cap elevation with 1V:4H slope face

7.3.12 Conclusion and Recommendations

The proposed SWM strategy for Ibadan is based on site visits to document the SWM system deficiencies and from relevant information obtained from previous reports and desktop research.

It is believed that the new proposed schemes, addressed in both options 1 and 2, provide adequate tools that drastically improve the SWM situation in Ibadan. This covers waste minimisation efforts and landfill diversion schemes, adequate means of storage and collection, and ultimate treatment and disposal at dedicated downstream Municipal facilities.

Nevertheless, the overall strategy could attain to a progressive approach whereby option 1 can be introduced, followed by option 2 (WtE – Aerobic Digestion) by revisiting this Masterplan, and after a few years of its operation.

However, the proposed SWM Plan shall be considered for further discussion among the various relevant stakeholders to ensure acceptable participation for the successful downstream implementation and sustainable outputs. Stakeholders could include the private sector and relevant SWM public authorities involved in SWM at a city-wide level.

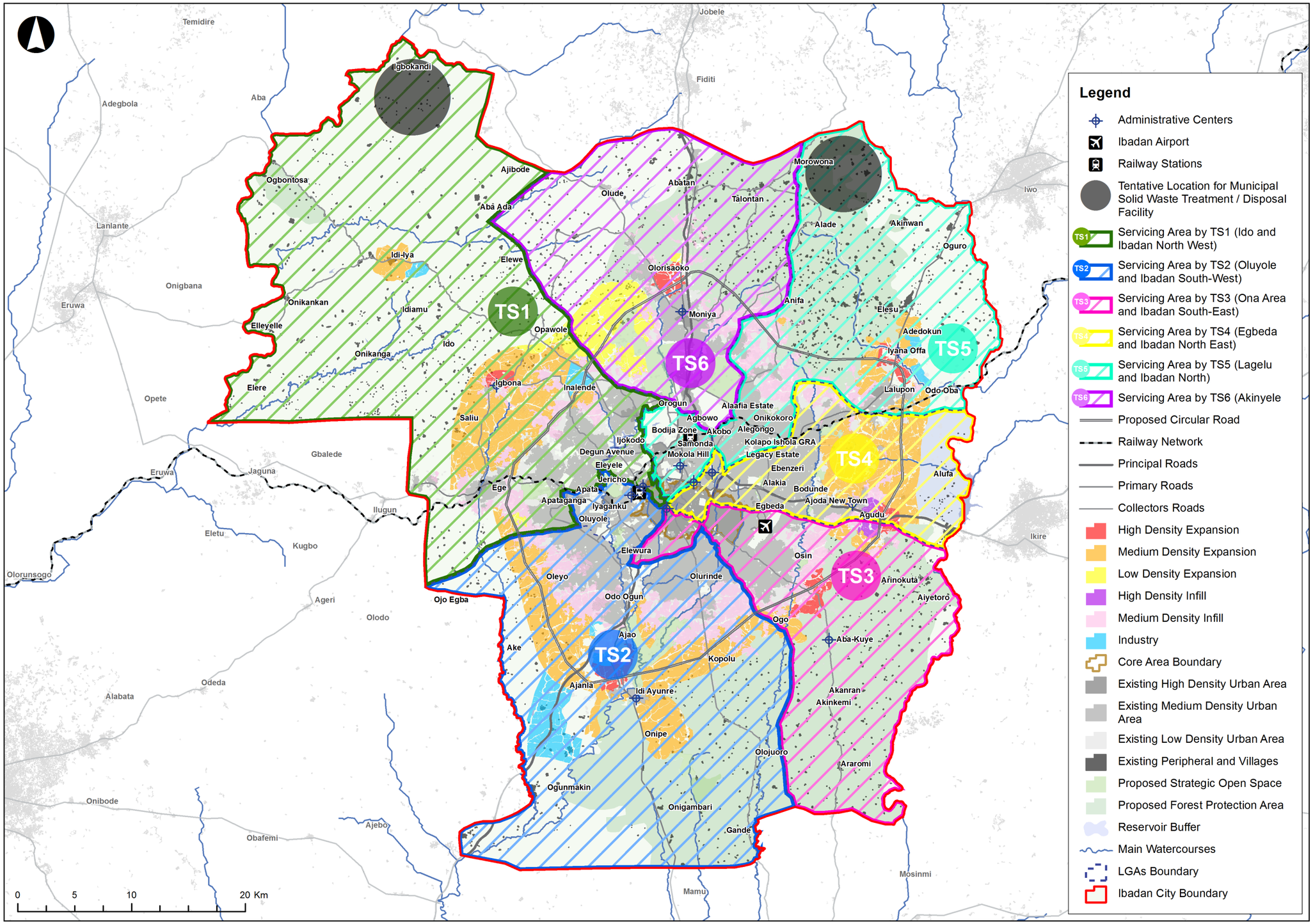

Figure 7.23: Proposed Tentative Locations of Municipal Solid Waste Management Facilities in Ibadan

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7.4 WATER SUPPLY

7.4.1 Introduction

This section presents the conceptual masterplan for the water supply system based on the spatial development strategy for Ibadan. It summarises the findings of the review of existing data and highlights the design criteria that were adopted in the formulation of the conceptual masterplan, including the basis for estimating the water demand for the design horizon year 2036. It is worth noting that the firefighting system will be combined with the water supply system and firefighting system requirements will be accounted for in the design of the water supply system. The remainder of this section is organised into sub-sections as follows:

- Review and Analysis of Collected Data, including recommendations related to the existing systems.
- Design Criteria.
- Water Demand.
- Planning Alternatives for the Water Supply Systems.
- Cost Estimate of the Recommended System.

7.4.2 Review and Analysis of Collected Data

Data collection was conducted in July 2016 with the objective of gaining an understanding of the existing systems within the city of Ibadan as well as the current water consumption rates for the various land uses. Data collection involved the following main activities:

- Site visits to water and wastewater works.
- Meetings with concerned authorities, namely the Ministry of Environment and the Water Corporation of Oyo State (WCOS), to collect information on the existing systems and all available previous studies.
- Reports and studies provided by all stakeholders.
- Desktop research to collect all previous reports and studies published on the internet.

The following sub-sections summarise the findings from reviewing the collected data, in particular data on the existing condition of the water supply systems, data and information related to the on-going (under design/ construction) and the planned/proposed water works projects.

Existing Water Supply System

Ibadan is currently supplied from two main water sources, the Asejire Dam and Eleyele Dam as well as groundwater wells (boreholes) scattered accross the city. The storage capacity of the surface water sources (Dams) is summarised in Table 7.12. Groundwater wells are either public or private wells and boreholes and are used as either a prime/main source of water or as an alternative source to supplement the supply from the main sources during supply interruptions. In addition to the main surface water sources and groundwater wells, residents within Ibadan use other local sources, such as natural springs, adjacent rivers/streams, and rain water.

Water supplied through the public water supply system is fed from five (5) public water treatment works (WTW). These are:

- Asejire WTW
- Osegere WTW
- Eleyele WTW
- Owode WTW
- Lalupon WTW

The Lalupon WTW and Owode WTW have capacities that are much smaller than the capacity of the other three and are considered only for the supply of developments in their vicinity. In addition, the Lalupon WTW was not mentioned by WCOS representatives during the meetings and is not listed in the documents/reports received from the stakeholders. Consequently, this WTW was not visited to assess its condition. However, the Lalupon WTW is listed as a WTW (located at Osegere) only in the "*Major Water Development Schemes in Oyo State*" sent by PIU and in the report "*The project for review and update of Nigeria national water resources masterplan*" prepared by the Japan International Cooperation Agency (JICA) team on January 2014. Table 7.13 summarises data collected on the existing WTW along with their current condition. In addition to the public WTW, several private water supply schemes exist in Ibadan; these are listed in Table 7.14.

Table 7.12: Existing Dams Supplying Ibadan

DAM NAME	SURFACE WATER SOURCE	DESIGN STORAGE CAPACITY (mcm)	DEAD STORAGE (mcm)
Asejire Dam	Osun River	33	7.95
Eleyele Dam	Ona River	7.05	0.91

Source: GKW CONSULT (February 2003) "Engineering Consulting Services for the Masterplan and Final Design for Ibadan Water Supply Final Report Executive Summary Water Corporation of Oyo State."

Table 7.13: Existing Water Treatment Works within Ibadan

WTW NAME	SURFACE WATER SOURCE	PRODUCTION DESIGN CAPACITY (m^3/d)	PRODUCTION CAPACITY BY YEAR 1998 (m^3/d)	PRODUCTION CAPACITY BY YEAR 2014 (m^3/d)	PEI BY YEAR 1998 (%)	PEI BY YEAR 2014 (%)	CURRENT STATUS
Asejire	Asejire Dam	186,000	36,142	28,249	19.4	15.2	New high lift pumps are being installed
Osegere	Asejire Dam	13,500	--	0	--	0	Proposed for rehabilitation + 2,000 m^3 GWR is under construction
Eleyele	Eleyele Dam	27,240	10,748	3,668	39.5	13.5	--
Owode	Spring and Intake wells	130/900	72	0	0	0	Proposed for reha-bilitation
Lalupon	Osun River	436	0	0	0	0	--

Source: Water Corporation of Oyo State (WCOS). Japan International Cooperation Agency (January 2014) "The project for Review and Update of Nigeria National Water Resources Masterplan" Volume 8 Draft Catchment Management Plan Ogun-Oshun Basin in HA-6: Western Littoral Federal Ministry of Water Resources (FMWR).

Table 7.14: Existing Private Water Supply Schemes

PRIVATE WATER SCHEMES	RAW WATER SOURCE
University of Ibadan	Awba Dam
Coca-Cola	Eleyele Dam
Nigerian Breweries	Asejire Dam
Sona Breweries	Ona River
7 UP	Eleyele Dam
UCH	Dandaroo on Ogunpa Stream at Agodi Gardens

The water supply system across Ibadan comprises the following elements:

- Water Treatment Works
- Transmission Mains
- Water Booster Stations (BSs)
- Ground Water Reservoirs (GWRs) and Pumping Stations
- Elevated Water Reservoirs (EWRs)
- Distribution Network

Some systems include all of the above components, while others rely on direct pumping from a booster station to the distribution networks. Three main schemes are adopted in the city of Ibadan as illustrated in Figure 7.24.

Table 7.15: Existing Booster Stations

NAME	SUPPLIED BY	GWR EXIST?	VOLUME (m^3)	STATUS
Agodi	Asejire WTP	Yes	2 x 2,250	Operating
Bere	Agodi BS	No	Unknown	Under Rehabilitation
Bodija	Agodi BS	Yes	Unknown	Under Rehabilitation
Ososami	Agodi BS	Yes	Unknown	Under Rehabilitation
Erunmu	Osegere WTP	Unknown	Unknown	Under Rehabilitation
Mokola	Eleyele WTP	Unknown	Unknown	Under Rehabilitation
Sango	Unknown	Unknown	Unknown	Under Rehabilitation
Ojoo	Agodi BS	Yes	2,250	Operating

Source: Water Corporation of Oyo State (WCOS) 2016.

Table 7.16: Existing GWRs and EWRs

NAME	SUPPLIED BY	VOLUME (m^3)	VOLUME (m^3)	HEIGHT TO BOTTOM TANK (m)
Basorun GWR	Agodi BS	2,250	Unknown	--
Letmauck Barrack GWR	Mokola BS	2,250	Operating	--
Oke-Are GWR	Unknown	200	Under Rehabilitation	--
Lalupon EWR	Erunmu BS	1,700	Under Construction	Unknown
Ososami EWR	Ososami BS	400	Under Construction	Unknown
Oke-Itunu EWR	Mokola BS	400	Under Rehabilitation	Unknown
Odogbo Military Barracks EWR	Agodi BS	100	Not Operational	Unknown

Source: Water Corporation of Oyo State (WCOS) 2016.

As illustrated in Figure 7.24, there are currently three schemes of water supply within Ibadan, which include:

1. Water after treatment is supplied directly to the villages / urban areas / communities through water mains connected to the transmission mains.
2. Water after treatment is supplied to booster stations (BSs) and ground water reservoirs (GWRs) from which it is pumped directly to distribution networks within adjacent villages / urban areas / communities.
3. Water after treatment is supplied to booster stations (BSs) and ground water reservoirs (GWRs) from which it is pumped to elevated water reservoirs (EWRs) and then to distribution networks within the villages / urban areas / communities.

Table 7.15 and Table 7.16 provide a list of the existing BSs and water reservoirs.

In brief, the following can be concluded from the review of available information on the existing water supply systems:

- Less than 15% of the raw water stored in the reservoirs/dams is being treated and used for supply.
- Not all households are connected to the existing water supply networks.
- Treated water is not supplied at all times due to an insufficient power supply and consequently the non-operational booster stations.
- Some existing water reservoirs are non-operational due to the lack of supply from transmission lines.
- The distribution networks are not operational at all times since no water reaches them from booster stations.
- Households connected to the water supply system receive water on an intermittent basis.
- The majority of the water works, including water treatment works, booster stations and reservoirs need rehabilitation.
- Distribution pipes also need rehabilitation, replacement or realignment due to their old age and due to their location with respect to existing and planned roads and developments.

Moreover, it is worth noting that Ojoo BS and Odogbo Military Barracks EWR are not under WCOS authority and only serve the Odogbo Military Barracks.

Figure 7.25 to Figure 7.28 illustrate the identified existing water works mentioned above and their coverage areas. Serviced areas have been delineated for illustration purposes only, highlighting the different water supply sources. Area limits need to be further reviewed through detailed studies which are beyond the scope of this project.

The inadequacy of the existing water works and the water supply systems have led to an increase in the construction of localised wells and boreholes that are used to supply water to adjacent developments. A significant portion within all LGAs, whether they are initially supplied by water supply networks or not, rely on deep wells, boreholes, and other sources such as rivers, streams, natural springs, rain water, and tanker trucks, as their current source of water supply.

The existing boreholes are equipped either by hand or motorised pumps. It is worth noting that the number and operating ratio of the existing boreholes are unknown and available lists are considered inaccurate as the data received lacks detail, does not identify their location and the borehole data available is outdated as it only includes those drilled between 1993 and 2008. Figure 7.29 shows the LGAs that rely primarily on wells, boreholes, rivers, streams, etc, for their water supply.

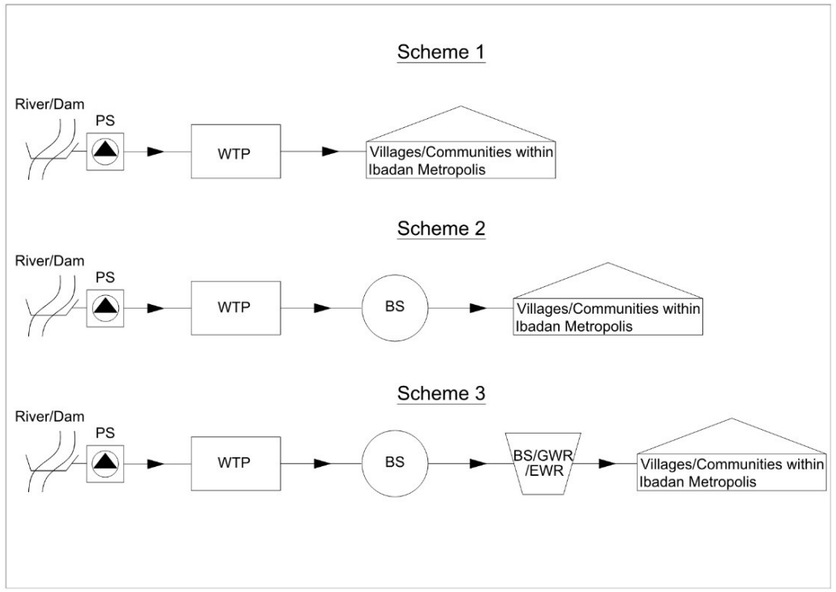

Figure 7.24: Water Supply System Schemes

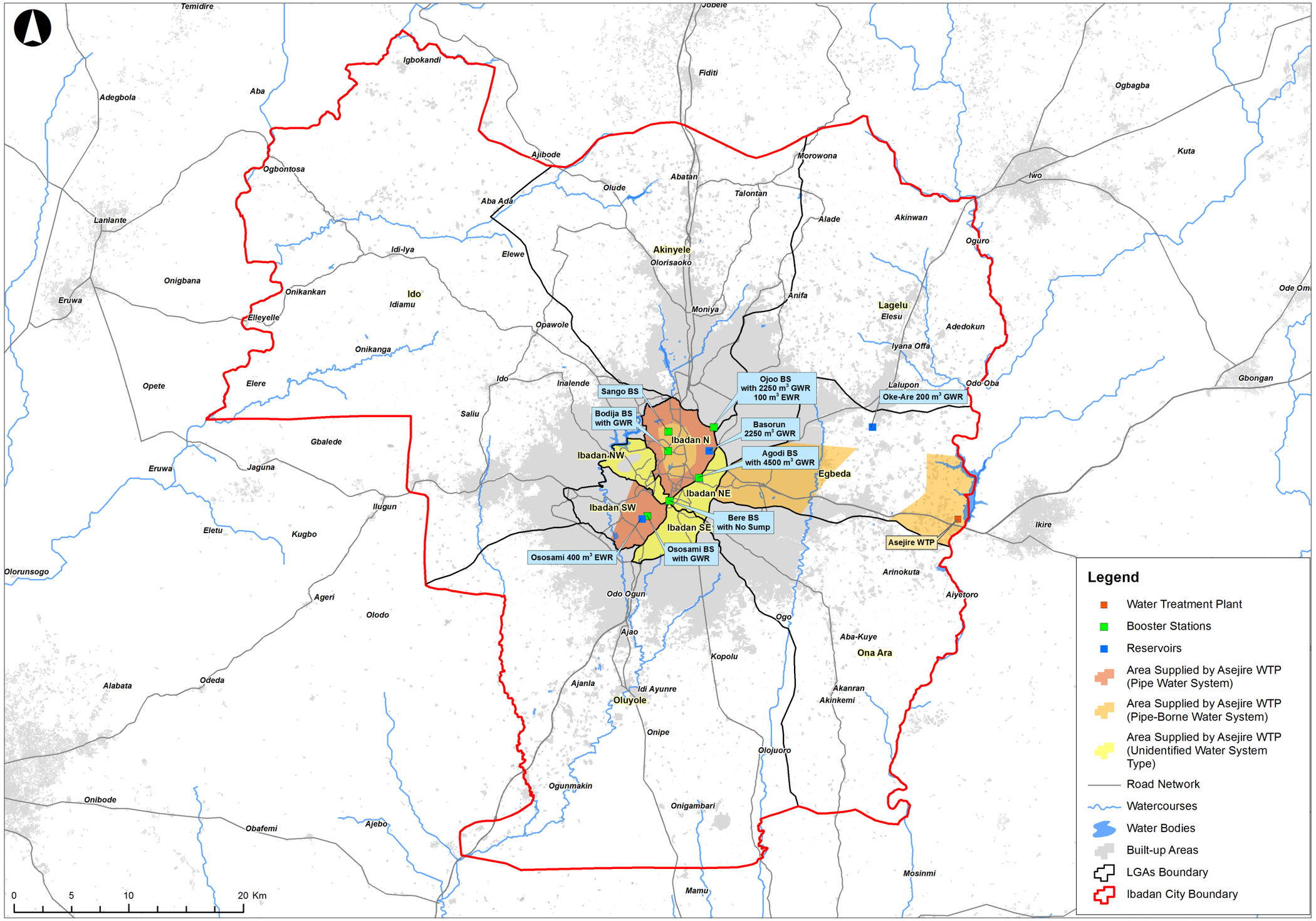

Figure 7.25: Existing Water Works and Areas Covered by Asejire WTP

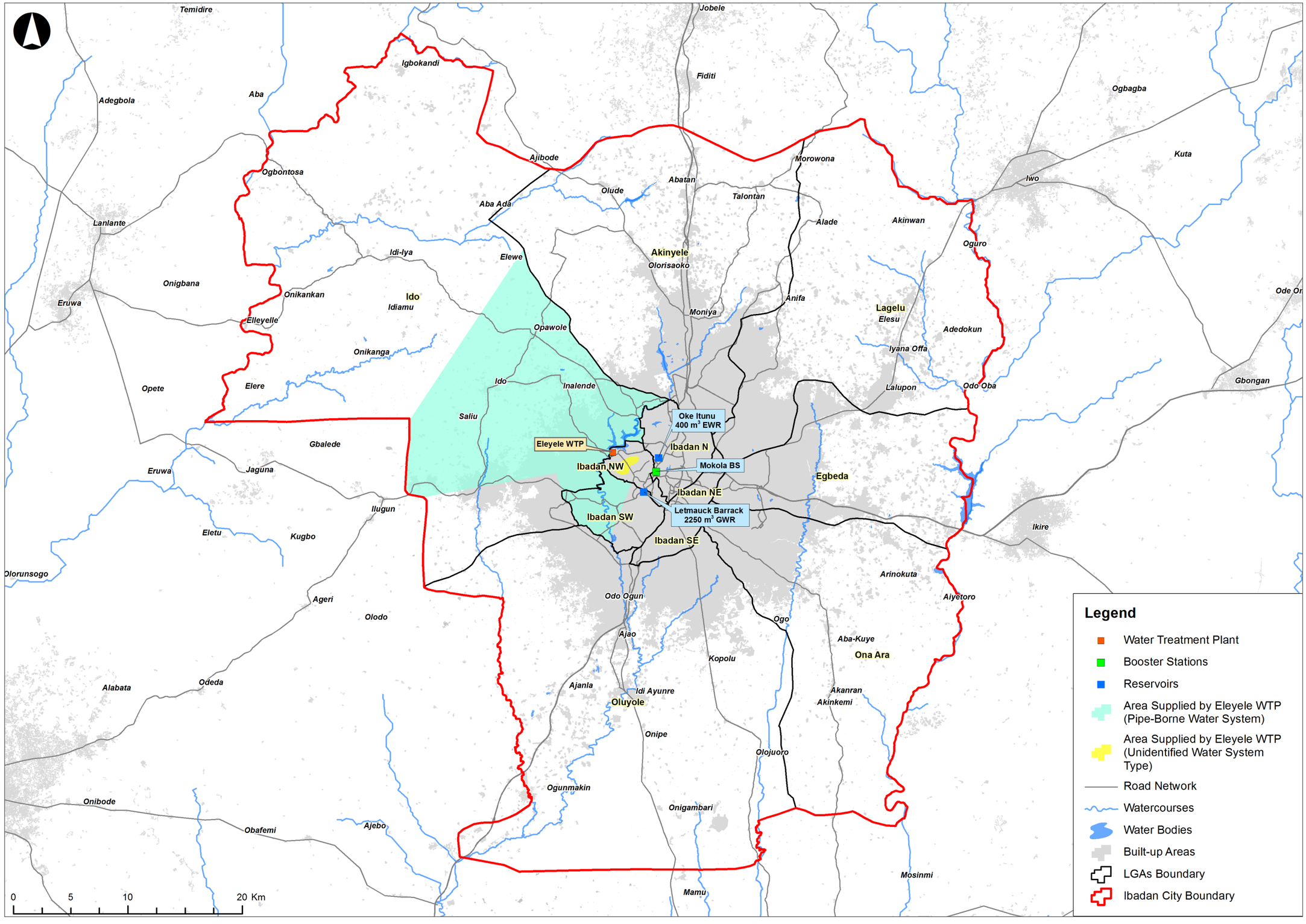

Figure 7.26: Existing Water Works and Areas Covered by Eleyele WTP

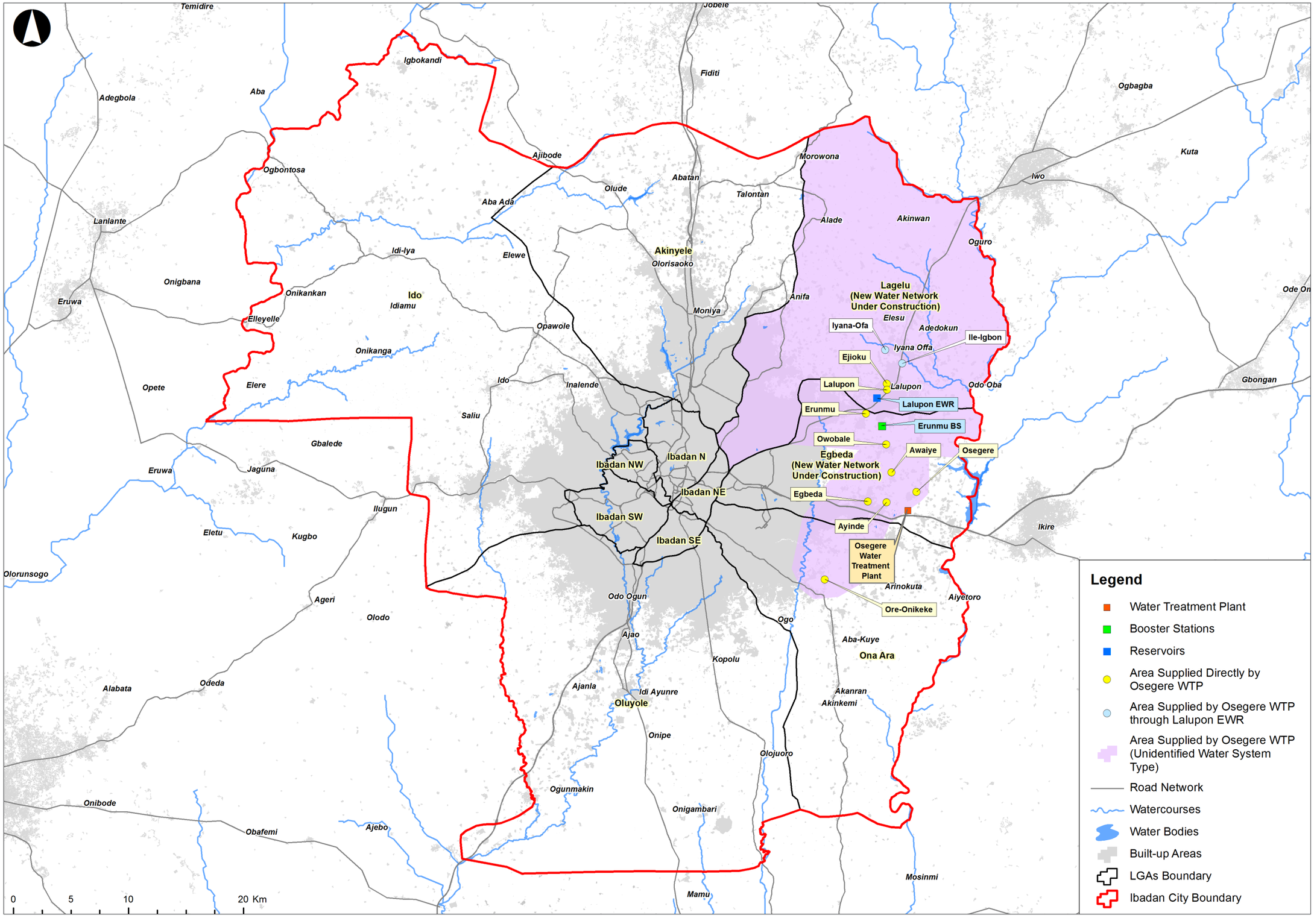

Figure 7.27: Existing Water Works and Areas Covered by Osegere WTP

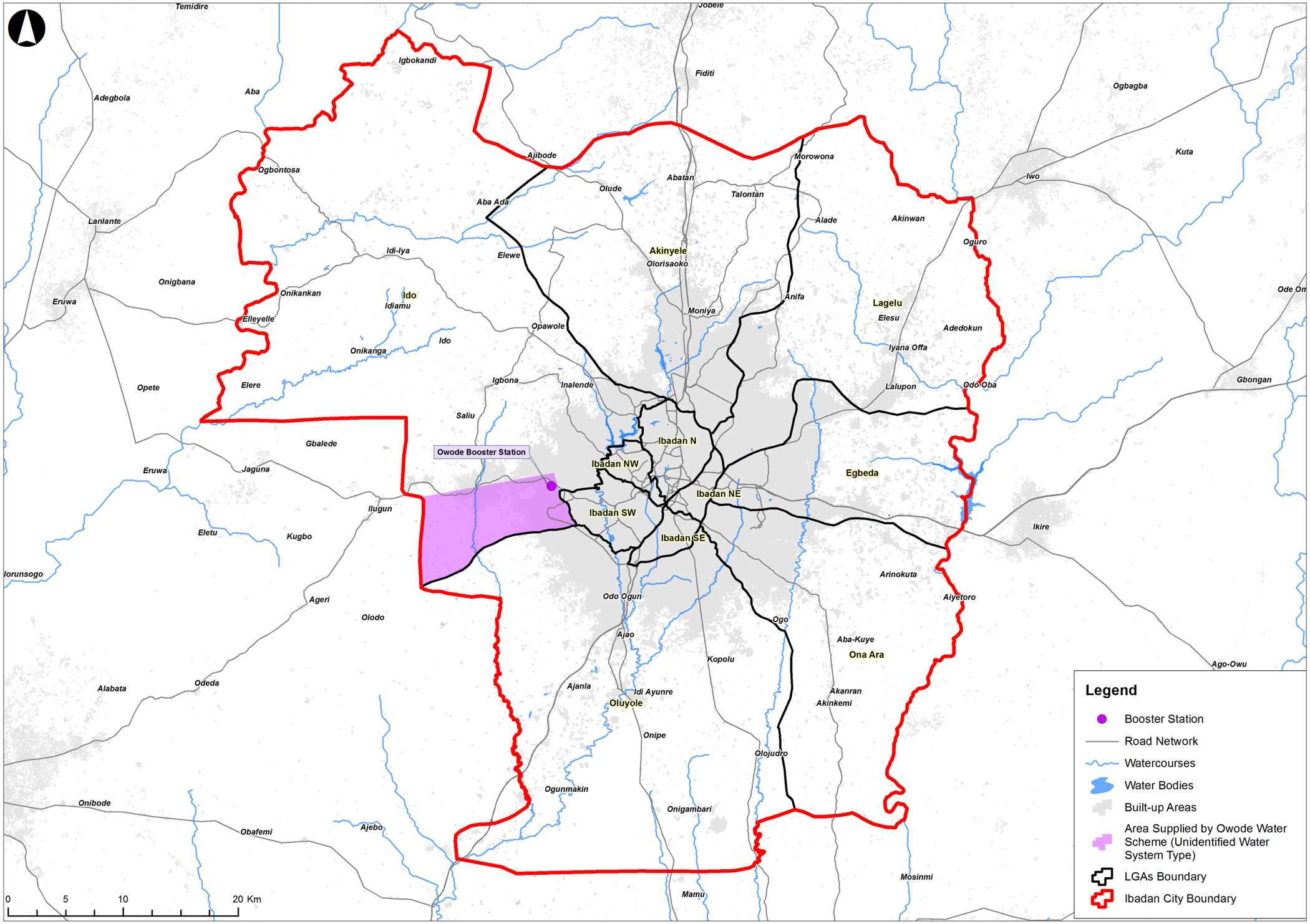

Figure 7.28: Existing Owode Water Scheme and the Serviced Area

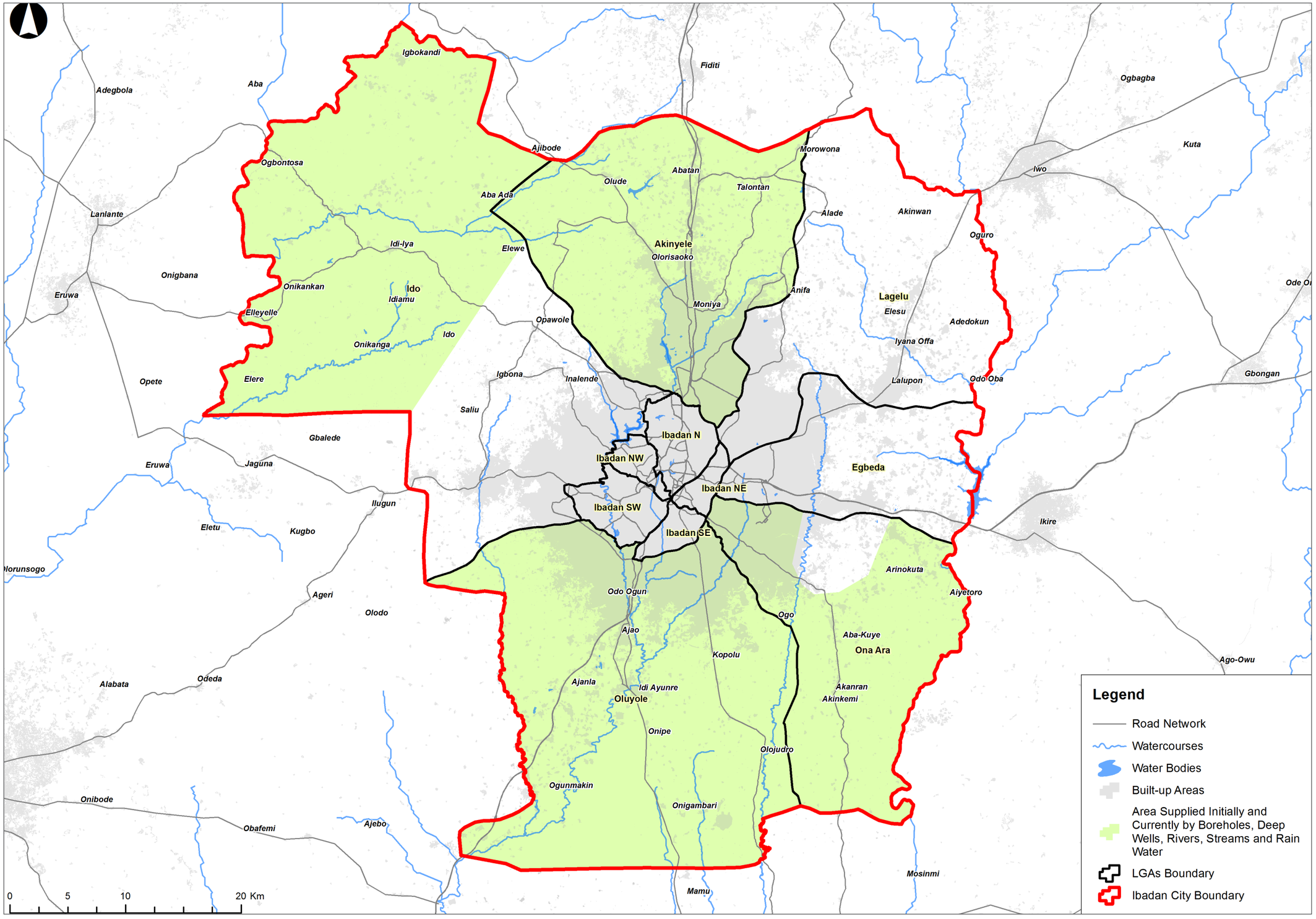

Figure 7.29: Areas Primarily Supplied by Public or Private Boreholes, Deep Wells, Rivers, Streams, and Rain Water

As for the water quality, based on preliminary findings from samples taken from rivers within different states in Nigeria, the surface water quality is good in general as the concentration of Biochemical Oxygen Demand (BOD) and Dissolved Oxygen (DO) are within the standards of aquatic living environment in all seasons. The above applies for the two surface water sources used to supply the water in Ibadan as summarised in Table 7.17.

Table 7.17: Preliminary Evaluation of Water Quality Status of Osun and Ona

RIVER NAME	INTAKE POINT	WET SEASON		DRY SEASON	
		BOD (MG/L)	DO (MG/L)	BOD (MG/L)	DO (MG/L)
Osun	To Asejire WTP	1.4	9.7	1.3	9.6
Ona	To Eleyele WTP	1.2	6.2	6.2	6.1

Source: Water Corporation of Oyo State (WCOS). Japan International Cooperation Agency (January 2014) "The project for Review and Update of Nigeria National Water Resources Masterplan" Volume 8 Draft Catchment Management Plan Ogun-Oshun Basin in HA-6: Western Littoral Federal Ministry of Water Resources (FMWR).

Moreover, the physical, chemical, and bacteriological analysis sheets of Asejire and Eleyele raw water samples received from WCOS (data does not have the date of sampling and analysis) show that there is no presence of E.coli; however, the opposite is true for samples taken from the River Osun. Moreover, natural springs water is not safe for direct human consumption based on the water samples taken from four natural water springs due to the presence of coliform and hard chemicals.

With regard to the groundwater quality, dissolved chlorides and nitrate appear to be in some wells and boreholes and this is due to wastewater contamination of the water bearing aquifer caused by the leaking of raw domestic wastewater from soakaways. Also, water is contaminated in the high density areas due to the construction of most of the wells and boreholes adjacent to soakaway pits of buildings and due to the fact that most of the wells are not covered properly or covered with dirty materials. Generally, the water of the rivers and streams in the high density areas are also polluted since the sewage, wastes, and industrial effluents which contain inorganic and chemical materials are discharged directly without any treatment.

Water Supply Calculations

Assuming the existing water works and networks are fully operational, around 205,000 m^3/d can be supplied. With an existing population of 6,017,708[10] and existing number of employees of 1,859,886, the estimated total average water demand and the peak day demand (PDD), in addition to 10% losses, are 684,275 m3/d and 940,878 m^3/d respectively. All of this leads to an existing deficit in the water supply of around 736,000 m^3/d.

Water demand estimates have been calculated based on the average residential water consumption rates that are summarised in Table 7.18 and a peak day demand (PDD) factor of 1.25.[11]

Table 7.18: Average Water Consumption Rates (Assumed for Existing Population)

LANDUSE TYPE	FLOW (L/C/D)
Residential (medium density)	110
Residential (high density)	90
Industrial/Commercial/Government Acquisition/Public and Semi-Public	30

Source: Consultant's estimate, 2016.

10 Dar, 2017

11 This PDD factor is considered based on previous studies and masterplan projects undertaken by the Consultant in Nigeria, such as the Lekki Masterplan, and the Lagos Mainland Central Masterplan.

Ongoing and Planned Projects

Due to the huge deficit in the supply of water and the will of WCOS and several stakeholders to enhance the water supply within Oyo State, some rehabilitation and construction water works projects are ongoing in addition to proposed water facilities projects. The ongoing and proposed projects that are planned by WCOS are listed below.

Ongoing Projects

- Rehabilitation of Oke-Are 200m^3 GWR is almost completed.
- Rehabilitation of Oke-Itunu 400m^3 EWR is almost completed.
- Rehabilitation of Ososami BS, Bere BS, Sango BS, and Mokola BS.
- Rehabilitation of the high lift pump station at Asejire and installation of new high lift pumps.
- Rehabilitation and extension of water supply distribution networks within the areas that are generally supplied from the booster stations mentioned previously.
- Rehabilitation and extension of about 120km water supply distribution networks that cover Oluyole, Agugu, and Ibadan North zones.
- Construction of two compartment reservoir of capacity 2000m^3 at osegere WTP.
- Construction of Lalupon 1700m^3 EWR.
- Construction of Erunmu BS that supplies Lalupon EWR.
- Construction by AFDB of new water supply distribution networks covering Lagelu and Egbeda LGAs.

Proposed Projects

- Rehabilitation of Osegere WTP.
- Rehabilitation of Owode Water Supply Scheme.
- Alamuyo and Orogobo springs have been presented for construction in 2013.
- Alabata Water Supply Scheme.
- Sanusi Water Supply Scheme.

7.4.3 Design Criteria

The following paragraphs present the design criteria and parameters adopted in the formulation of the conceptual masterplan of the water supply systems.

Water Consumption

Based on other studies and masterplan projects[12], the recommended water consumption rates are summarised in Table 7.19. These rates are considered higher than the current consumption rates; however, they fall within the international standards that are being adopted for strategic long term planning and implementation of the water policy considered as discussed in section 7.4.7. Moreover, these water consumption rates would provide an enhanced standard of living and would improve hygiene, hence reducing health risks for the inhabitants of Ibadan.

12 Lekki Masterplan, and Lagos Mainland Central Masterplan, Dar.

Table 7.19: Average Water Consumption Rates (Assumed for Existing Population)

TYPE OF USE	FLOW (l/c/d)
Residential (low density)	150
Residential (medium density)	110
Residential (high density)	90
Employees	30
Industrial area per employee	30

Source: Consultant's estimate, 2017.

Storage Requirements

A 24 hour storage capacity is normally considered as a desirable minimum to safeguard against the possibility of breakage in the transmission lines or interruption in supply from the water source, and to cater for the variation between the maximum water consumption rate during a day and the average daily flow from the source as well as to provide storage for firefighting purposes. However for Ibadan, a 12 hour storage capacity is considered as an acceptable minimum for various practical reasons. In particular, all households are expected to have one or more private water storage tanks with an average capacity of $1m^3$.

Design Peak Factors

Climatic conditions tend to cause wide variations in water use. The highest daily water demand normally occurs during the dry season. Peak hourly demands also occur during the day. The hours of occurrence depend upon the characteristics of the city and the habits of the inhabitants. Thus, the total amount of water used by a household may be distributed over only a few hours of the day, during which the actual demand is much greater than the average. To mitigate these peak demands, the average daily water demand is multiplied by peak factors. The peak factors applied in the design of water supply systems are Peak Day Demand (PDD) and Peak Hourly Demand (PHD). The PDD is normally used in sizing the facilities upstream of the balancing storage, while the PHD is usually used for sizing the distribution network.

The use of PHD for sizing the network is not applied in areas where private reservoirs are installed in every building because these reservoirs can accommodate for the hourly variation in demand. Consequently the use of water tanks at buildings/dwellings eliminates the need to size the distribution network using the PHD. Accordingly, it is recommended to use PDD for sizing the network because standard practice in Nigeria is to have private storage in all buildings and this trend is expected to continue in the future.

Literature review of demand patterns have shown that the average daily demand in the month of peak demand may be 10 to 30 percent higher than the annual daily average and that the peak day demand can be up to 80 percent higher in some cities. In Ibadan, variations in temperature between rain and harmattan seasons is relatively mild. For the same reasons, the variation in daily use is expected to be lower than in other countries. Accordingly, a PDD factor of 1.25 is recommended.

Network Hydraulics and Material

Distribution Networks

The hydraulic analysis and conceptual design of the network will be carried out using the water network simulation software WaterGEMS based on Hazen Williams's formula. The Hazen Williams coefficient is considered as 150 for uPVC and PE pipes, and 130 for new Ductile Iron (D.I) pipes.

As noted above, the distribution mains will be sized to deliver the required maximum day water consumption instead of Peak Hourly Demand. This will reduce the investment cost and subsequently the cost recovery factor.

The distribution mains shall be sized to deliver water with a minimum residual pressure of 15.0 m. This minimum residual pressure will allow the delivery of piped water to the roof reservoir of two to three storey buildings. This criteria is used to determine the required height of the elevated water tanks.

The distribution mains design shall be checked to ensure that the average water supply demand plus the firefighting demand can be delivered at a residual pressure of 15.0m (20 psi), which is sufficient to fill firefighting tankers. The maximum allowable velocity in the distribution networks should not exceed 2.0m/s to minimise head loss.

Transmission Lines

Transmission lines will be constructed to convey water to strategic/staging reservoirs directly from the water treatment or between such reservoirs. The pipes will be sized to deliver the peak day water requirements in the areas to be served by the reservoirs.

The maximum allowable velocity in the transmission lines should not exceed 2.5 m/s to limit friction loss, and optimise pumping and/or elevated water tank height requirements.

Pipeline Materials

Several pipeline materials were examined for their suitability to the prevailing physical and hydraulic conditions in Ibadan. The parameters considered for selecting suitable pipe material are as follows: material and construction cost, corrosion resistance, structural strength, expected service life, environmental conditions, maintenance and available pipe sizes.

The following materials are considered satisfactory:

- For pipe diameters larger than 300 mm: Ductile Iron (DI), GRP, uPVC or Prestressed Concrete Cylinder Pipes (PCCP).
- For pipe diameters ranging from 80 mm to 300 mm: DI, and uPVC.
- For pipe diameters less than 80 mm: Polyethylene (PE), uPVC and Galvanized Mild Steel (GMS).

The availability of these pipe materials in the local market and consequently their cost effectiveness should be further studied in the preliminary designs of the water supply system to determine the most feasible pipe material. For the purpose of the Ibadan City Masterplan, the following pipe materials were selected, as recommended by WCOS, for two ranges of pipeline diameters:

- Ductile Iron (DI) for pipe diameters greater than 300 mm.
- uPVC for pipe diameters less than or equal to 300 mm.

Fire Fighting System

The water distribution system will be designed as a combined network to cater for the requirements of Civil Defence and international codes of practice for firefighting (e.g. NFPA). The firefighting tankers (Pumpers) of the Civil Defence will obtain the water from fire hydrants acting as filling points.

The distribution mains design will be checked to ensure that the average water supply demand plus the firefighting demand can be delivered at a residual pressure of 15.0 m (20 psi), which is sufficient to fill and/or feed the firefighting tankers.

The fire hydrants will be installed on pipe diameters that are not less than 150 mm in order not to cause excessive pressure losses in the water supply system during a fire event. Fire hydrants will be located at strategic points and key locations in the vicinity of main buildings, commercial centres, etc, to facilitate fire services.

7.4.4 Water Demand

Based on the above mentioned design criteria and on the population estimate as per the proposed masterplan for Ibadan, it is estimated that the average total water demand is 1,334,739 m^3/day. The peak day demand is estimated to be 1,668,424 m^3/day. For water supply purposes, the masterplan area is divided into 14 zones taking into consideration the existing and proposed masterplans. Based on the population and employees breakdown proposed for the 2036 planning strategy, the estimated water demand for the proposed and existing urban zones are summarised in Table A.4 in Appendix 6. The breakdown of the population and average water demand for each type of land use and for the different water zones proposed for Ibadan are summarised in Appendix 6 - Table A.5 and Table A.6. It is to be noted that the total population excludes the individual plots listed in Appendix 6 - Table A.7 which were not considered, since they are located at a distance exceeding around 3km from the nearest proposed transmission water main or scattered over a huge area. Excluding these plots, the overall strategy is based on optimising the cost of network and reducing operational cost in the long run. It is therefore recommended that these individual plots have their own water boreholes and package treatment unit.

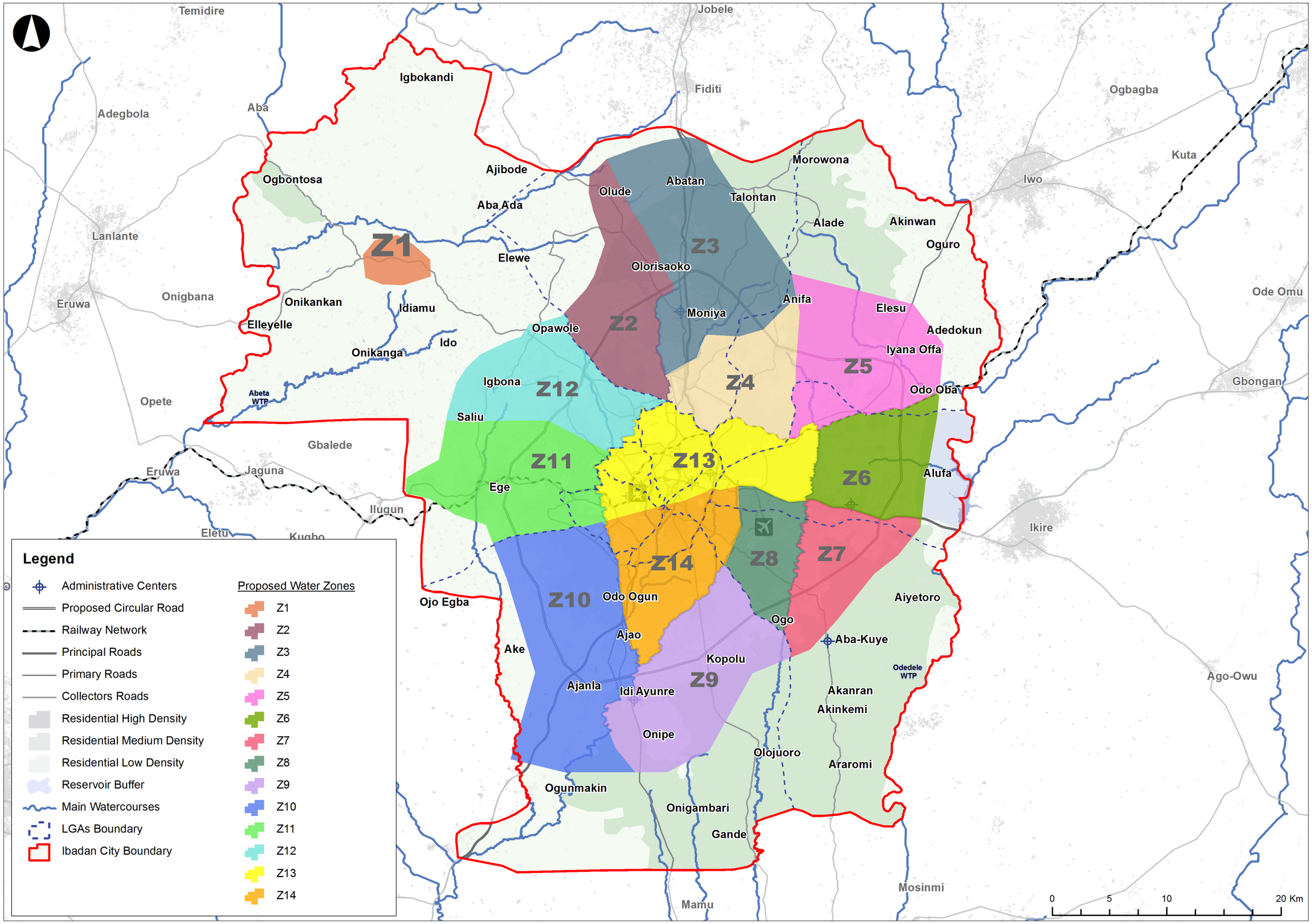

Figure 7.30: Water Supply Zones

7.4.5 Planning Alternatives for the Water Supply Systems

The proposed water supply system comprises the following components:

1. Water Treatment Plants (WTP)
2. Distribution Centres
3. Zonal Storage Reservoirs and Elevated Tanks
4. Transmission Mains
5. Distribution Network

Below is a detailed description of each of the system components:

- WTPs are to treat water from the rivers, mainly the River Osun and the River Ogun, or from groundwater sources through wells and boreholes. A feasibility study based on a hydrological assessment of the water sources should be carried out to assess the reliability of these sources to supply the city of Ibadan with the forecast water demand taking into consideration the implementation, phasing and development plans. The proposed total capacity of the surface and groundwater treatment plants shall be equivalent to the estimated PDD (plus 10% to cater for the losses) for Ibadan, which is about 1,800,059 m^3/d (equivalent to 20.83 m^3/s) for the ultimate phase of the Masterplan.
- Central distribution centres are intended to supply the different sectors with water. Based on the existing and proposed built form as well as the geographical location of Ibadan, the area was divided into two sectors each covered by one central (regional) distribution centre (applicable only for Alternative 1, discussed further in the transmission system part). Each central distribution centre acts as a staging reservoir with pumping stations to convey the water demand to the different storage reservoirs located in each zonal distribution centre (DC) within each water zone. The main advantage of using regional/central distribution centres is to provide a reliable water supply system that provides flexibility for phasing the construction of water works based on the development of the city. The DC is to be constructed first and then additional pumps can be added to meet the demand resulting from new developments. Each central DC will comprise the following:
  - Ground reservoir directly fed from the WTP. These reservoirs are area staging reservoirs with storage capacity equivalent to PDD of all the water zones covering the city area. Generally, six hours are considered as the optimal storage capacity which will allow for the maintenance of the pumps in case of breakdown. Since storage is allowed for within the various zones and in order to minimise the construction cost of these tanks, the minimum allowable storage capacity has been considered.
  - Pumping stations to convey water to the DCs of each water zone.

The number of central distribution centres has been determined so as to optimise the sizing of the transmission pipes, the pump's heads as well as the length of transmission pipes supplying the different zones from the central distribution centres. The use of regional/central distribution centres requires pumping stations with a high capacity (high heads and high flows) at the central distribution centres level. It will also result in pumping the water demand to the distribution centre and then to pump it back to the different zones for longer distances which will increase the cost of transmission pipes and of pumping stations.

The division of the Ibadan City Masterplan area into 14 sectors by using two central distribution centres can optimise the length of transmission pipes serving the different zones. It is worth noting that the pump heads at the central distribution centres will vary from 15m to 30m. This is based on the total flow conveyed by these pumping stations and the required head to convey the water to the DCs covering the 14 water zones, taking into account the flows of these pumps.

- In the centralised transmission system (Alternative 1) storage reservoirs within each water zone will have a storage volume equal to the half-day peak demand of the zone supplied from this reservoir, since the balance of the one day storage will be provided in the central distribution centres. On the other hand, a storage volume of one-day peak demand of the served zone is considered in the decentralised alternative (Alternative 2). An elevated tank is to be constructed next to each storage reservoir to supply the zone with water at an acceptable residual pressure as mentioned earlier. The capacity of each elevated tank shall be equivalent to the volume of water that can be supplied to the elevated tank for a minimum duration of 15 minutes for the centralised alternatives and a minimum duration of 30 minutes for the decentralised alternative. The 15 minutes and 30 minutes criteria for sizing the elevated tank are also considered as the minimum allowable so as to optimise the cost of construction of these tanks. This condition necessitates the installation of emergency power supply at the distribution centres within the zone whereby 15 minutes will be sufficient for starting the generators and resuming pumping to the elevated tanks under conditions of power outage.
- Water transmission mains will connect the water supply system all together.
- An independent/decentralised water distribution network will be constructed in each water zone. The primary network will be composed of pipes with diameters ranging between 400mm and 2400mm and the secondary network will be composed of pipes ranging between 150mm and 300mm. The exact pipe sizes within the distribution network is to be determined at the detailed design stage based on the above mentioned design criteria.

Source of Water

Based on previous studies, two proposed dams, namely Odedele and Abeta, have been identified and studied in order to estimate the storage volumes and safe yields of their reservoirs. Figure 7.34 and Figure 7.35 show the location of the proposed surface water sources. As shown, Odedele Dam will be constructed on the River Osun and the Abeta Dam will be constructed on the River Ogun. An active storage capacity of 140 MCM for the Odedele dam has been calculated in order to be able to extract a continuous demand of up to 297 MCM/year (813,699 m^3/d) with a 90% probability. The same applies for the Abeta dam having an active storage capacity of 160 MCM which satisfies a continuous demand of up to 565 MCM/year (1,547,945 m^3/d) with a 95% probability.

Since the deficit cannot be covered solely by either one of the proposed dams even with all three existing WTW (Asejire, Eleyele, Osegere) producing at design capacities, both of the proposed surface water sources should be used to fulfill the city's water demand up to 2036. It is to be noted that the design capacities of the WTPs will be determined once a decision is made on whether rehabilitating the existing WTPs is more cost effective than constructing the new plants with additional capacities, in the short and long term. This analysis requires further investigations of the condition of the existing facilities and the rehabilitation requirements which is beyond the scope of the Masterplan.

Taking into consideration the locations of the two dams, the provision of separate treatment plants for each source and not centralising the treatment at one location is recommended. This option of having two treatment plants, one near each dam, provides more flexibility in the source and a higher redundancy in the supply mains.

For planning purposes, it is assumed that the existing plants will be abandoned and the supply of water will be taken from the two proposed WTPs. Based on this assumption, the design capacities and required site areas for the new WTPs have been calculated as summarised in Table 7.20.

As shown in Table 7.20, an additional WTP (WTP 1) is considered in Alternative 1 to serve water zone 1 (shown in Figure 7.34), since no connection is allowed to the transmission line supplying the central DC#1 directly from Abeta WTP. Therefore, it is recommended thata separate surface water source to supply the said water zone is used. A separate WTP (WTP 1) is required to treat the raw water supplied from the said surface water source. The water demand required to be extracted is the PDD (plus 10%) of water zone 1, which is 18,492 m^3/d. Figure 7.34 shows the location of all the proposed surface water sources supplying the city of Ibadan according to Alternative 1. Further studies should be undertaken in order to determine the exact location of the additional surface water source and its treatment plant (WTP 1).

Table 7.20: Proposed WTPs Design Capacities and Site Areas Required

WTP	ALTERNATIVE 1		ALTERNATIVE 2	
	Design Capacities (m^3/d)	Area Required (ha)	Design Capacities (m^3/d)	Area Required (ha)
Abeta WTP	1,200,000	65.3	1,200,000	65.3
Odedele WTP	600,000	23.0	600,000	23.0
WTP 1	18,500	1.1	-	-
Total	1,818,300		1,800,000	

Transmission System

Two alternatives, centralised and decentralised transmission water supply systems have been considered within the city of Ibadan.

Alternative 1

This alternative consists of supplying the water demand for Ibadan via a pumping station and a transmission line connected to the water treatment plants. The PDD will be centralised equally in two central distribution centres. The water will be pumped from the Abeta WTP to the central DC#1, from the Odedele WTP to the central DC#2, and from WTP 1 directly to the DC of the water zone 1. The central distribution centres will be provided with pumping stations to convey the water demand to the different water zones. Each water zone will have its own DC comprised of ground water reservoirs (GWRs), elevated tanks (ETs), and pump stations (PSs).

The main pipelines are designed to be constructed in two phases and to provide more flexibility in the system, where two parallel transmission pipelines are running instead of only one. Figure 7.31 and Figure 7.32 present single line diagrams for the proposed transmission systems supplied from the proposed surface water sources.

Table 7.21 to Table 7.23 summarise the pipe diameters needed with their estimated lengths, the number and capacities of the ground reservoirs (GRs) and elevated tanks (ETs) within each water zone, and the number and capacities of the GRs within each central DC.

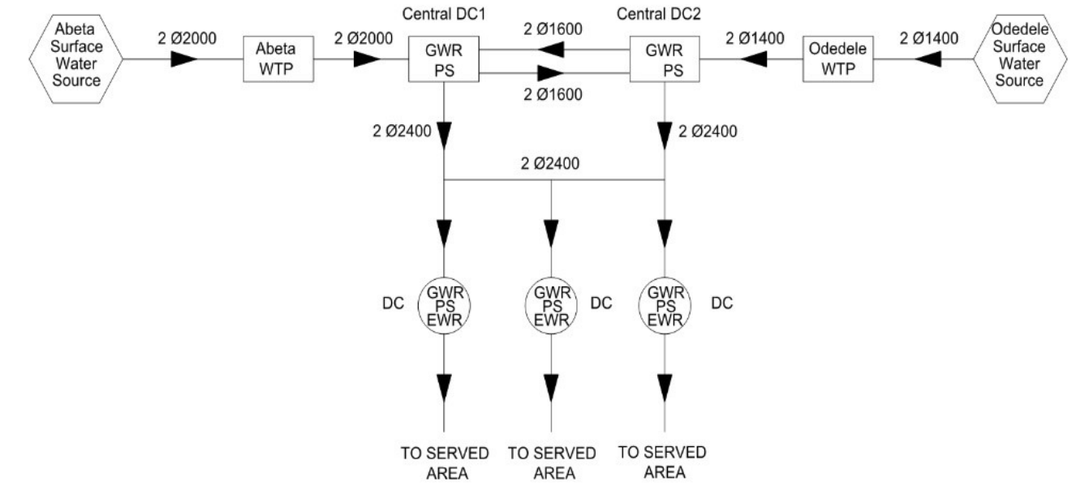

Figure 7.31: Single Line Diagram for Water Transmission System – Surface Water Sources - Alternative 1



Figure 7.32: Single Line Diagram for Water Transmission System Serving Zone 1– Alternative 1

Table 7.21: Pipe Diameters and Lengths – Alternative 1

DIAMETER (mm)	LENGTH (m)
400	1,050
700	550
800	1,850
900	4,300
1,000	2,450
1,100	7,300
1,400	127,500
1,600	82,000
2,000	116,000
2,400	240,000

Table 7.22: Number and Capacities of the Ground Reservoirs and Elevated Tanks within each Water Zone – Alternative 1

WATER ZONE	STORAGE VOLUME (m^3)	NO. OF GROUND RESERVOIRS AND PUMP STATIONS	GROUND RESERVOIR CAPACITY (m^3)	GROUND RESERVOIR AREA (m^2)	NO. OF ELEVATED TANKS	ET1 CAPACITY (m^3)	ET2 CAPACITY (m^3)	SITE AREA (m^2)
Z1	10,000	1	10,000	1,700	1	200	-	4,600
Z2	50,000	1	50,000	8,500	1	1,000	-	14,250
Z3	50,000	1	50,000	8,500	1	900	-	14,250
Z4	50,000	1	50,000	8,500	1	1,050	-	14,250
Z5	50,000	1	50,000	8,500	1	1,000	-	14,250
Z6	70,000	1	70,000	11,700	1	1,500	-	18,250
Z7	40,000	1	40,000	6,700	1	750	-	12,000
Z8	50,000	1	50,000	8,500	1	1,000	-	14,250
Z9	70,000	1	70,000	11,700	1	1,500	-	18,250
Z10	110,000	2	55,000	9,200	2	1,150	1,150	35,700
Z11	85,000	1	85,000	14,200	2	1,000	1,000	25,200
Z12	85,000	1	85,000	14,200	2	900	900	25,200
Z13	110,000	2	55,000	9,200	2	1,050	1,050	35,700
Z14	110,000	2	55,000	9,200	2	1,200	1,200	35,700

Table 7.23: Number and Capacities of the Ground Reservoir within each Central Distribution Centre – Alternative 1

CENTRAL DC	STORAGE VOLUME (m^3)	NO. OF GROUND RESERVOIRS	GROUND RESERVOIR CAPACITY (m^3)	GROUND RESERVOIR AREA (m^2)	SITE AREA (m^2)
Central DC#1	900,000	9	100,000	16,700	210,300
Central DC#2	900,000	9	100,000	16,700	210,300

Alternative 2

This alternative also consists of supplying the water demand for the city of Ibadan via a pumping station and a transmission line connected to the water treatment plants. However, the water demand will be decentralised and directly supplied from the transmission lines. Therefore, the storage capacities of the GR and ET within each water zone are one-day demand and 30 minutes of the PDD respectively. The storage capacities of the GR and ET are twice the ones in the centralised alternative (Alternative 1). Figure 7.33 presents single line diagrams for the proposed transmission systems of Ibadan. Finally, and similarly to alternative 1, the main pipelines are designed to be constructed in two phases and to provide more flexibility in the system, where two parallel transmission pipelines are running instead of only one. Figure 7.24 and Table 7.24 and Table 7.25 summarise the pipe diameters needed with their estimated lengths, and the number and capacities of the GRs and ETs within each water zone.

Figure 7.34 and Figure 7.35 overleaf illustrate the transmission systems of the previously elaborated alternatives.

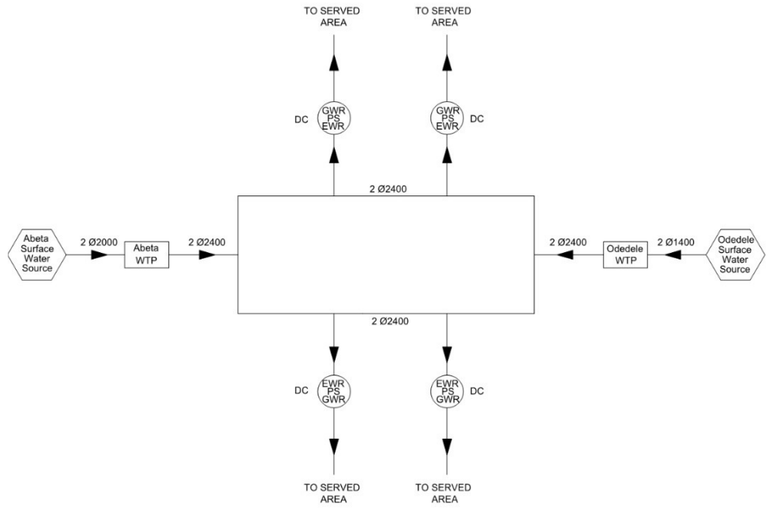

Figure 7.33: Single Line Diagram for Water Transmission System – Alternative 2

Table 7.24: Number and Capacities of the Ground Reservoirs and Elevated Tanks within each Water Zone – Alternative 2

WATER ZONE	STORAGE VOLUME (m^3)	NO. OF GRs AND PSs	GROUND RESERVOIR CAPACITY (m^3)	GROUND RESERVOIR AREA (m^2)	NO. OF ETs	ET1 CAPACITY (m^3)	ET2 CAPACITY (m^3)	ET3 CAPACITY (m^3)	ET4 CAPACITY (m^3)	SITE AREA (m^2)
Z1	18,500	1	18,500	3,100	1	400	-	-	-	6,800
Z2	90,000	2	45,000	7,500	2	1,000	1,000	-	-	30,500
Z3	90,000	1	90,000	15,000	2	950	950	-	-	26,600
Z4	105,000	2	52,500	8,750	2	1,000	1,000	-	-	34,100
Z5	90,000	1	90,000	15,000	2	1,000	1,000	-	-	26,600
Z6	140,000	2	70,000	11,700	2	1,500	1,500	-	-	42,100
Z7	75,000	1	75,000	12,500	1	1,500	-	-	-	19,400
Z8	90,000	1	90,000	15,000	2	950	950	-	-	26,600
Z9	140,000	2	70,000	11,700	2	1,500	1,500	-	-	42,100
Z10	225,000	3	75,000	12,500	3	1,500	1,500	1,500	-	76,600
Z11	180,000	2	90,000	15,000	3	1,200	1,200	1,200	-	59,400
Z12	167,000	2	83,500	14,000	3	1,200	1,200	1,200	-	55,400
Z13	210,000	3	70,000	11,700	3	1,500	1,500	1,500	-	72,500
Z14	225,000	3	75,000	12,500	4	1,200	1,200	1,200	1,200	86,900

Table 7.25: Pipe Diameters and Lengths – Alternative 2

DIAMETER (mm)	LENGTH (m)
450	4,850
700	600
800	4,700
900	1,050
1000	11,950
1100	350
1200	7,300
1400	26,900
2000	2,700
2400	326,000

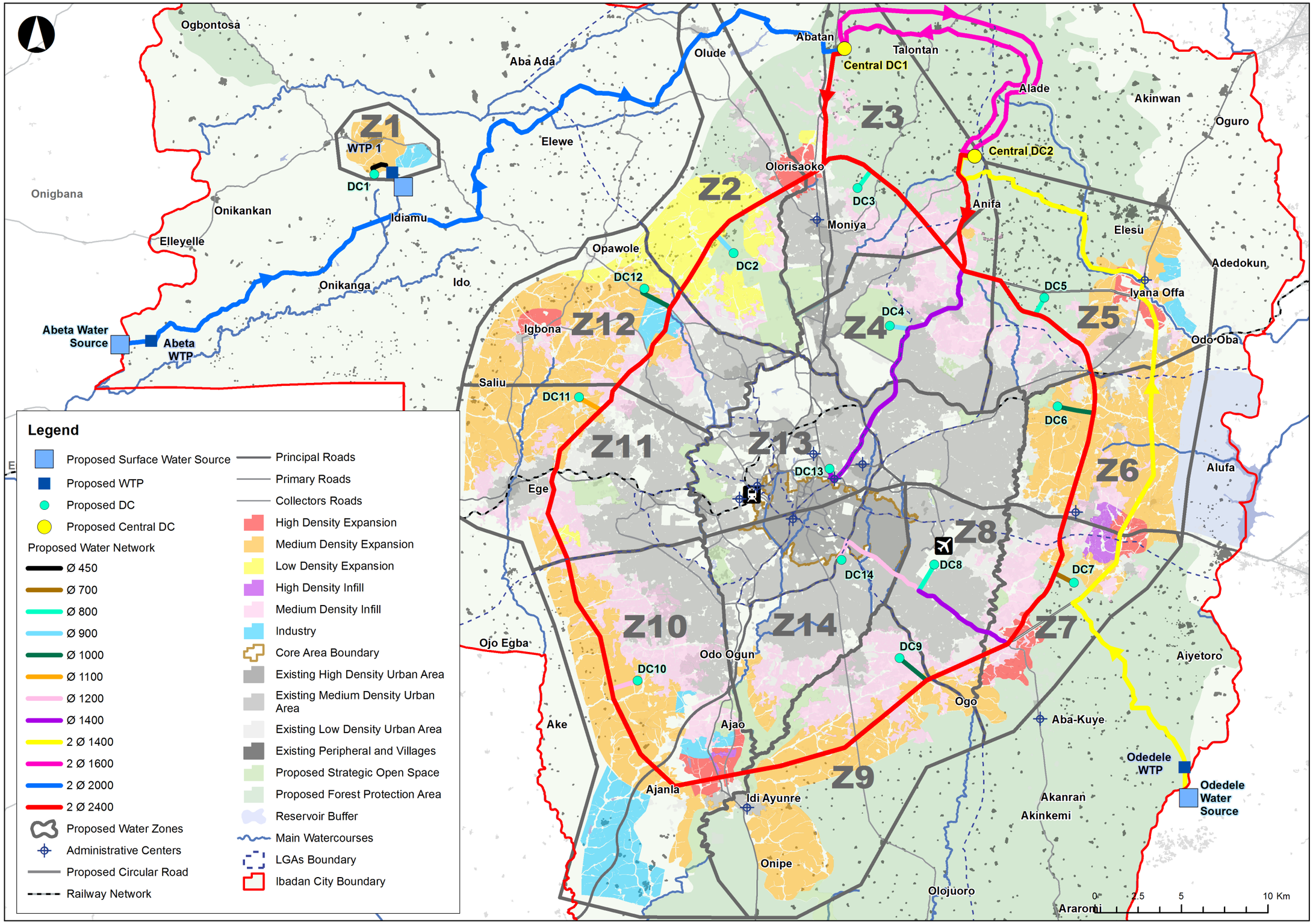

Figure 7.34: Transmission Water System - Alternative 1

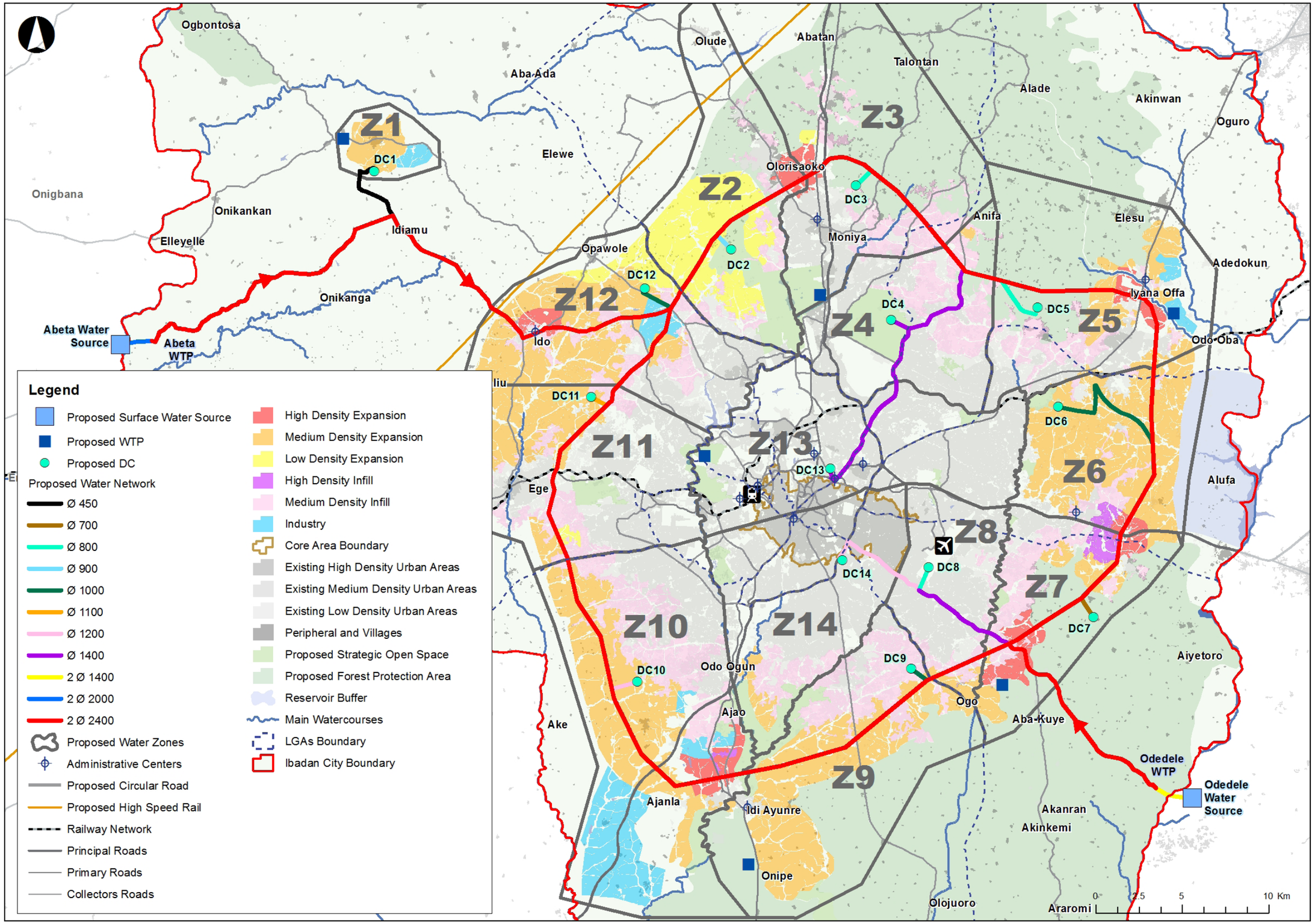

Figure 7.35: Transmission Water System – Alternative 2

Evaluation of Alternatives

The advantages and disadvantages of the two alternatives are summarised Table 7.26.

Table 7.26: Advantages and Disadvantages of the Two Alternatives

ALTERNATIVE #	ADVANTAGES	DISADVANTAGES
Alternative 1: Supply via central reservoirs fed from the WTPs	1. During periods of maintenance for failure of transmission pipelines, supply can be shut-off providing better control of water loss or allocation. 2. O&M of the system is centralised, hence reduced O&M efforts and costs. 3. Both central distribution centres are interconnected which provides more reliability for the water supply system in case of failure. 4. Maximum storage backup in case of failure in the WTP.	1. If failure occurs in the transmission pipelines, more than one zone will be affected. 2. Additional groundwater source to supply a negligible demand.
Alternative 2: Supply directly from the WTPs through the transmission pipeline	1. No central DCs required, less pipe-lines, less pump stations, less costly.	1. Distribution of water is controlled from the water treatment works only. 2. If failure occurs in the WTP, all zones will be affected immediately. 3. If failure occurs in the transmission pipelines, more than one zone will be affected.

In conclusion, even though Alternative 2 is less costly, it is discarded due to the above mentioned disadvantages. Therefore, the option of using central reservoirs supplied from the WTPs (Alternative 1) is recommended.

Distribution Networks

Each cluster of storage reservoirs will be supplied with water from one distribution centre. The storage reservoir will be provided with an elevated tank connected to an independent distribution network to supply the zone covered by this storage reservoir. This will provide more reliability into the system since the risk of any failure in one of these storage reservoirs will impact only the area covered by this reservoir.

Figure 7.36 shows a typical schematic layout for the operation of the water supply distribution system.

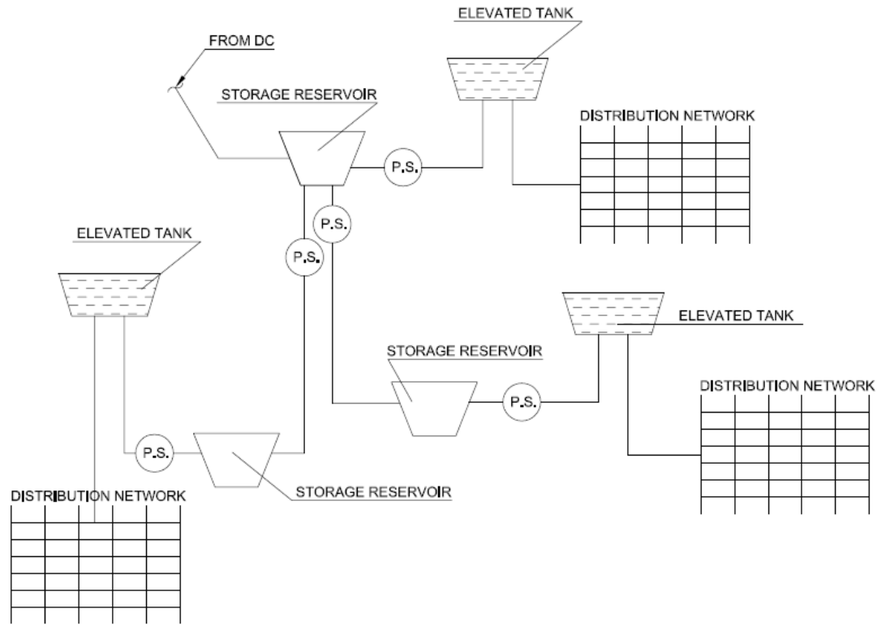

Figure 7.36: Water Distribution System Schematic Layout

7.4.7 Water Policy

Based on the proposed system, a water policy in Ibadan whereby the following general water management guidelines are implemented is recommended:

- Ensure easily accessible and clearly labelled water meters are provided and capable of monitoring the water consumption of, at a minimum, the following major uses:
  - Office buildings
  - Retail and malls
  - Residential buildings
  - Hotels
  - Schools, etc.
- Water meters are to be installed on all water transmission and at distribution centres in order to monitor the water network and be capable of detecting major system-wide leaks.
- All meters are to have data logging capability and be connected to a central community-wide monitoring system so that information on the water network performance can be recorded.
- The monitoring system shall have, as a minimum, the following capability:
  - Provide hourly, daily, weekly, monthly and annual water consumption by each major use;
  - Compare consumption to previous days, weeks, months and years for trend analysis;
  - Detect leaks by determining 'out-of-range' values and alert facility operators to unusually high consumption; and
  - Record peak water consumption for each major use.
- The developer/system operator shall provide a written commitment to supply water monitoring data to the Water Authority.
- The leak detection system must be capable of:
  - Sounding an alarm when a leak is detected;
  - Identify varying leakage rates; and
  - Be programmed to meet water consumption requirements.
- Use of water efficient fixture units and / or recycled water in all main facilities such as schools, hotels, malls, etc, in order to achieve at least 20% reduction on the overall water usage.
- Develop a regional water policy for water resources management which focuses on:
  - Conserving water resources and maintaining the quality at standards that are appropriate for the intended use.
  - Institute standards and mechanisms for enforcement to assure efficiency and minimise degradation in systems for water.

7.4.6 Cost Estimate of the Recommended System

The cost comparison of Alternative 1 and Alternative 2 depicted in Table 7.27.

Table 7.27: Cost Comparison of all Alternatives

COMPONENTS	BUDGET COST (MILLION US$)	
	Alternative 1	Alternative 2
Transmission Lines	1,538.8	1,229.8
Central Distribution Centres	382.7	-
Ground Reservoirs & Pump Stations	169.2	464
Elevated Tanks	11.7	23.2
Total Cost (Million USD)	2,102.4	1,717.0

WTPs and Distribution network costs are not added for comparison as it is almost common for both proposed alternatives. Taking into consideration the existing and proposed urban areas, the estimated cost of the WTPs and the distribution network are US$ 850 million and US$ 1,400 million respectively. In summary, the proposed scheme for the supply of water to the city of Ibadan comprises the following:

1. Construction of new WTPs.
2. Construction of new central DCs.
3. Construction of new GRs and ETs and/or rehabilitation of existing GRs and ETs wherever these exist at the locations of the proposed scheme.
4. Construction of a distribution system.

It is worth noting that all works related to central DCs, GRs, and ETs in terms of their location and pumping capacity as well as height of ETs and the rehabilitation of any existing GRs and ETs shall be addressed in a detailed study at a later stage in the Masterplan's implementation.

7.5 WASTE WATER MANAGEMENT

7.5.1 Introduction

This section describes the proposed alternatives for wastewater collection, treatment and disposal systems. It includes the results of the review and analysis of collected data and information on existing and planned systems. In addition, the design criteria that were adopted in estimating the generated wastewater flows for the design horizon year 2036 as well as the criteria adopted in formulating the conceptual masterplan of the wastewater collection system and treatment plant are identified. The section concludes with an evaluation of the proposed schemes and the recommendation of the preferred scheme. A budgetary cost estimate of the recommended wastewater collection and treatment scheme based on the conceptual design is also included. The section is organised into sub-sections as follows:

- Review and analysis of collected data, including recommendations related to the existing systems
- Design Criteria
- Planning Alternatives for the Sewerage Collection System
- Evaluation of the Proposed Systems
- Recommended System
- Cost Estimate of the Proposed System

7.5.2 Review and Analysis of Collected Data

Data collection was conducted in July 2016 with the objective of gaining an understanding of the existing systems and treatment plants within Ibadan. Data collection involved the following main activities:

- Site visits.
- Meetings with concerned authorities, namely the Ministry of Environment of Oyo State, to collect information on the existing and planned systems as well as all available reports and studies.
- Reports and studies provided by all stakeholders.
- Desktop research to collect all reports and studies that have been published on the internet.

The following sub-sections summarise the findings from reviewing the collected data, in particular data on the existing condition of the sewerage system, data and information related to the planned/proposed sewerage and sanitation projects.

Existing Wastewater System and Sanitation Facilities

As advised by the Ministry of Environment and the Water Corporation of Oyo State, there is an existing wastewater collection/sewerage system within certain areas, although the system was never connected to any households or buildings and has never been operational. In addition, the routing and location of the existing wastewater system has not been modified and consequently most of the existing wastewater collection pipes are no longer accessible due to the construction of buildings or other structures on top of them. The location of the existing sewage networks and that of the existing public toilets are shown in Figure 7.37. These plans were prepared by mapping the old maps that are available within the report “Masterplans for Wastes Disposal and Drainage, Ibadan” prepared by the World Health Organisation (WHO) in 1970. Taking into consideration that the system exists under built structures and was never operational, it is safe to say there is no existing public wastewater collection system in Ibadan.

As informed during the above mentioned meetings, and based on the documents that were collected, septic tanks and soakaways are the only sewage disposal methods used in the low-density areas, while pit latrines are used in the densely populated area. Septage from septic tanks is pumped and directly discharged into streams. In addition, aqua privies and pail latrines are also used as public sanitation facilities. Based on the document prepared by the Oyo State Rural Water Supply and Sanitation Agency (RUWASSA) in November 2015, regarding the elimination of open defecation in Oyo State, 44.4% and 1.6% of Oyo State’s population have access to improved and unimproved sanitation respectively, while 54% practice open defecation. In general, grey water and industrial wastewater are discharged into surface drainage systems except in residential reservations and estate areas where they are discharged into soakaway pits. However, a limited number of large institutional, commercial, and industrial entities have private wastewater treatment plants (WWTP) to treat their sanitary waste.

Ongoing and Proposed Projects

Based on the research and meetings conducted with concerned authorities and stakeholders, there are no on-going or any proposed wastewater projects within Ibadan; however, a roadmap to make Oyo State open-defecation-free by 2025 was developed with a time plan of 9 years for implementation, starting from the year 2016. About 4,302,000 of Oyo State’s population is expected to be serviced by a sanitation system and around 863,000 of domestic and non-domestic toilets are to be built by the year 2025.

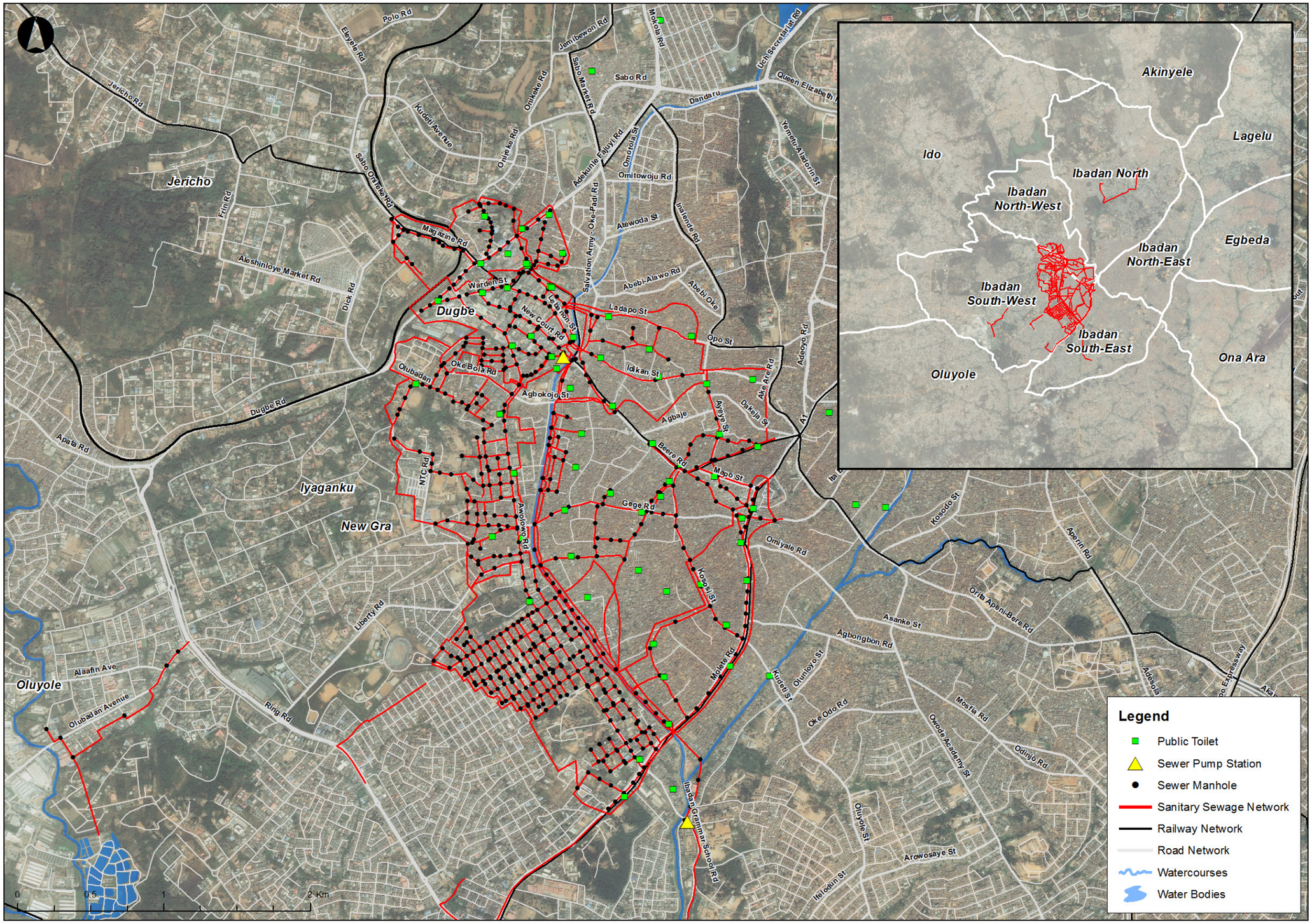

Figure 7.37: Existing Sewage Network and Distribution of Public Toilets

7.5.3 Design Criteria

The following sub-sections present the design criteria adopted in estimating the projected wastewater generation from Ibadan taking into consideration the proposed planning strategy, along with the proposed criteria that were adopted in the design of the wastewater collection system and treatment plant.

Wastewater Generation

Based on international design practice, wastewater generation is considered to be a percentage of water consumed by the population within any study area. Based on previous studies in Nigeria and taking into consideration the general water use and losses in the system, the generated wastewater flow is considered to be about 70% to 80% of the water consumed. Water consumption rates as proposed in the water supply section have been used to estimate the wastewater generation rates. The generated wastewater is estimated based on wastewater generation rates and the projected population with an additional 5% to 10% of the estimated flow to account for infiltration/inflow into the manholes and pipes. Table 7.28 presents the recommended wastewater generation rates based on the various land use classifications.

The total average wastewater flow is estimated to be about 1,067,772 m^3/d. Based on the population and employees breakdown proposed for 2036, the estimated generated sewage flows for the proposed and existing urban areas are summarised in Table 7.29.

Table 7.28: Average Wastewater Generation Rates

LAND USE TYPE	FLOW (L/C/D)
Residential (low density)	120
Residential (medium density)	88
Residential (high density)	72
Employees	24
Industrial area per employee	24

Table 7.29: Generated Sewage Breakdown of the Proposed and Existing Urban Areas Based on the Proposed Planning Strategy

LGA	LAND USE TYPE	ZONE NAME	POPULATION 2036	EMPLOYEES 2036	RESIDENTIAL AVERAGE SEWAGE GENERATION (m^3/d)	EMPLOYEES AVERAGE SEWAGE GENERATION (m^3/d)	TOTAL AVERAGE SEWAGE GENERATION (m^3/d)
IBADAN NORTH	Urban High Density (Inner)	-	180,860	44,713	13,022	1,073	14,095
	Medium Density Inner	-	166,078	63,985	14,615	1,536	16,150
	Low Density Inner	-	1,941	191,304	171	4,591	4,762
IBADAN NORTH EAST	Urban High Density (Inner)	-	306,326	75,731	22,055	1,818	23,873
	Medium Density Inner	-	34,780	86,282	3,061	2,071	5,131
IBADAN NORTH WEST	Urban High Density (Inner)	-	95,173	23,529	6,852	565	7,417
	Medium Density (Inner)	-	60,842	23,441	5,354	563	5,917
IBADAN SOUTH EAST	Urban High Density (Inner)	-	213,009	52,661	15,337	1,264	16,600
	Medium Density (Inner)	-	84,888	32,705	7,470	785	8,255
	Low Density (Inner)	-	414	160	36	4	40
IBADAN SOUTH WEST	Urban High Density (Inner)	-	188,834	46,685	13,596	1,120	14,717
	Medium Density (Inner)	-	178,181	68,648	15,680	1,648	17,327
	Low Density (Inner)	-	2,967	1,143	261	27	289
LAGELU	Urban High Density (Inner)	-	40,939	25,000	2,948	600	3,548
	Medium Density (Inner)	-	430,276	75,000	37,864	1,800	39,664
	90% of Low Density (Inner)	-	47,847	29,145	4,211	699	4,910
	50% of Low Density (Outer)	-	1,190	9,779	105	235	339
	Expansion - High Density	HD3	20,784	66,804	1,496	1,603	3,100

Table continued overleaf

Note: this table excludes populations located away from the main built-up areas.

LGA	LAND USE TYPE	ZONE NAME	POPULATION 2036	EMPLOYEES 2036	RESIDENTIAL AVERAGE SEWAGE GENERATION (m^3/d)	EMPLOYEES AVERAGE SEWAGE GENERATION (m^3/d)	TOTAL AVERAGE SEWAGE GENERATION (m^3/d)
AKINYELE	Expansion - Medium Density	MD1	169,646	10,121	14,929	243	15,172
	Expansion - Medium Density	MD7	6,634	13,449	584	323	907
	Expansion - Medium Density	MD8	69,236	7,178	6,093	172	6,265
	Infill - Medium Density	IMD2	221,102	33,646	19,457	807	20,264
	Infill - Medium Density	IMD7	62,031	58,814	5,459	1,412	6,870
	Industry	ID7	-	13,909	-	334	334
	Industry	ID8	-	12,721	-	305	305
	Industry	ID8	-	12,721	-	305	305
	Urban High Density (Inner)	-	144,228	39,894	10,384	957	11,342
	Medium Density (Inner)	-	301,208	120,511	26,506	2,892	29,399
	75% of Medium Density (Outer)	-	56,754	14,225	4,994	341	5,336
	85% of Low Density (Inner)	-	49,430	19,044	4,350	457	4,807
	60% of Low Density (Outer)	-	11,726	4,518	1,032	108	1,140
	Expansion - High Density	HD1	30,403	112,480	2,189	2,700	4,889
	Expansion - Low Density	LD1	305,096	20,908	36,612	502	37,113
	Infill - Medium Density	IMD1	194,045	107,422	17,076	2,578	19,654
IDO	Urban High Density (Inner)	-	79,114	21,330	5,696	512	6,208
	Medium Density (Inner)	-	618,896	133,892	54,463	3,213	57,676
	90% of Low Density (Inner)	-	95,005	44,270	8,360	1,062	9,423
	Low Density (Outer)	-	2,124	13,972	187	335	522
OLUYOLE	Expansion - High Density	HD7	17,957	46,987	1,293	1,128	2,421
	Expansion - Medium Density	MD5	973,067	46,987	85,630	1,128	86,758
	Expansion - Medium Density	MD6	115,674	7,879	10,179	189	10,368
	Expansion - Low Density	LD3	45,270	6,478	5,432	155	5,588
	Industry	ID4	-	30,798	-	739	739
	Industry	ID5	-	16,262	-	390	390
	Infill - Medium Density	IMD6	264,857	141,342	23,307	3,392	26,700
	Urban High Density (Inner)	-	113	49,171	8	1,180	1,188
	Medium Density (Inner)	-	709,252	92,025	62,414	2,209	64,623
	Medium Density (Outer)	-	24.49	120,753	2	2,898	2,900
	90% of Low Density (Inner)	-	127,251	19,369	11,198	465	11,663
	70% of Low Density (Outer)	-	910	351	80	8	89
	Expansion - High Density	HD6	39,010	78,000	2,809	1,872	4,681
	Expansion - Medium Density	MD4	1,354,875	76,124	119,229	1,827	121,056
	Industry	ID1	-	74,267	-	1,782	1,782
	Industry	ID2	-	38,427	-	922	922
	Industry	ID3	-	30,168	-	724	724
	Industry	ID6	-	189,121	-	4,539	4,539
	Infill - High Density	IHD4	6,939	60,838	500	1,460	1,960
	Infill - Medium Density	IMD5	398,554	19,450	35,073	467	35,540

Note: this table excludes populations located away from the main built-up areas.

Table continued overleaf

LGA	LAND USE TYPE	ZONE NAME	POPULATION 2036	EMPLOYEES 2036	RESIDENTIAL AVERAGE SEWAGE GENERATION (m^3/d)	EMPLOYEES AVERAGE SEWAGE GENERATION (m^3/d)	TOTAL AVERAGE SEWAGE GENERATION (m^3/d)
ONA ARA	Urban High Density (Inner)	-	342,498	84,380	24,660	2,025	26,685
	Medium Density (Inner)	-	395,755	66,990	34,826	1,608	36,434
	Medium Density (Outer)	-	5132	30,819	452	740	1,191
	95% of Low Density (Inner)	-	51,241	19,742	4,509	474	4,983
	85% of Low Density (Outer)	-	2600	1,002	229	24	253
	Expansion - High Density	HD5	5,979	47,733	431	1,146	1,576
	Expansion - High Density	HD8	39,467	55,689	2,842	1,337	4,178
	Expansion - Medium Density	MD3	133,165	30,951	11,718	743	12,461
	Infill - High Density	IHD3	34,597	6,564	2,491	158	2,648
	Infill - Medium Density	IMD4	159,364	31,822	14,024	764	14,788
EGBEDA	Urban High Den-sity (Inner)	-	90,761	47,225	6,535	1,133	7,668
	Medium Density (Inner)	-	606,886	200,000	53,406	4,800	58,206
	80% of Low Density (Inner)	-	38,622	27,947	3,399	671	4,069
	85% of Low Density (Outer)	-	1,699	49,681	150	1,192	1,342
	Expansion - High Density	HD4	15,547	53,284	1,119	1,279	2,398
	Expansion - Medium Density	MD2	744,357	74,436	65,503	1,786	67,290
	Infill - High Density	IHD2	29,700	43,014	2,138	1,032	3,171
	Infill - Medium Density	IMD3	105,265	33,129	9,263	795	10,058
TOTAL			**11,328,391**	**3,768,216**	**977,334**	**90,437**	**1,067,772**

Note: this table excludes populations located away from the main built-up areas.

Wastewater Collection System Design Criteria

Introduction

The proposed criteria for the design of the wastewater collection system have been selected based on experience in similar projects, and international design standards. These criteria are described hereunder as follows:

Peaking Factor

The Babbitt Formula has been adopted to calculate the peaking factor of the sewage flow. This formula, as shown below, inversely relates the population to the peaking factor. The greater the contributing population, the lower the peaking factor. The minimum peaking factor adopted is 2.0 and the maximum is 5.0.

$$K = \frac{5}{P^{0.167}}$$

Where,

K = Peaking Factor

P = Population in thousand

Pipe Diameter, Velocity, Gradients and Cover

The minimum diameter selected to reduce the probability of clogging shall be 200 mm for main sewers and 150 mm for service connections. The minimum and maximum design velocities used for the analysis and design of sewage gravity lines are summarised in Table 7.30.

Table 7.30: Velocity Criteria for Sewer Lines

PIPE DESCRIPTION	MINIMUM VELOCITY (m/s)	MAXIMUM VELOCITY (m/s)
Gravity Lines	0.6	3.0
Pressure Lines	1.0	3.0

The minimum pipe cover shall be 1.2m. This cover will provide flexibility for house connections, protect the pipe from traffic loads, and avoid the crossing interference/conflicts with other services such as water, electricity and telecoms. Pipes are to be encased in concrete where bed cover is shallower than 1m or deeper than 5m.

Pipe Flow Depth and Ventilation

All sewer lines will be analysed and designed by considering a maximum ratio of flow depth to pipe diameter of 75% to provide a good margin of safety and to ensure proper ventilation. Nevertheless, it is expected that at the beginning of a development or the operation of a sewerage system, the number of service connections would be limited and the sewage flow generated would not be able to ensure the minimum cleansing flow velocity. Hence, solids would deposit along the sewers and induce septicity.

Frequent flushing is recommended at the beginning of the operation of a sewerage system until a minimum cleansing velocity is reached. It is also recommended the existing sewerage systems are flushed to clean the sludge deposited over the long period of operation.

Pipe Material

The selection of pipe material should accord with on the following criteria:

- High resistance against chemical attack, internally from the sewage and externally from the soil conditions.
- Smooth inner wall surface.
- Strong mechanical strength to resist backfilling and traffic load with least additional protection.
- Locally manufactured or availability in the market or in neighbouring countries.
- Cost effectiveness.

For the purpose of the masterplan, the following pipe materials have been selected based on the above criteria. Further data collection and discussions with the concerned authorities are recommended to confirm the suitability of the following pipe material.

Unplasticised Polyvinyl Chloride (uPVC) Pipes: uPVC pipes will be used for diameters of up to 500mm in gravity networks and up to 250mm in pressure pipelines. uPVC pipes are resistant against hydrogen sulphide emitted by sewage, are easy to handle due to their light weight and can withstand a high operating pressure reaching 16 bars which allow their use in pumping and lifting stations.

Glass Reinforced Plastic (GRP) pipes: GRP pipes will be used in gravity networks for diameters of over 500mm and pressure pumping main for diameters over 250mm. GRP pipes are resistant against hydrogen sulphide attack, are relatively light weight, can be easy to handle and lay in long lengths and can also be used as pumping mains for pumping and lifting stations that absorb very high pressures.

Flow in Pipes

The following equations are recommended:

- Manning equation for sizing Gravity Sewage Network:

$$Q = (1/n) \times A \times (R^{2/3}) \times (S^{1/2})$$

Where,

n = Roughness coefficient (0.01 for uPVC and GRP pipes)

A = Cross Sectional Area

R = Hydraulic radius

S = Longitudinal slope %

Q = Rate of discharge m3/sec

- Hazen-William Formula for sizing pressure pipelines:

Where, $V = kCR^{0.63}S^{0.54}$

C = Hazen-Williams coefficient dependent on relative roughness (C=150 for plastic pipes)

R = Hydraulic radius

S = Slope of the energy grade line (HL/L)

K = Factor dependent on units = 0.849 for m/sec

Manholes

Manholes will be provided for inspection and maintenance at junctions, drops, changes in pipe diameters, directions and gradient, and at regular intervals to accommodate cleaning equipment. Maximum manhole spacing should not exceed 75m.

Manholes shall be either precast circular rings or cast in situ. Inner walls and benching of manholes shall be protected with tar epoxy lining.

At sewer diameter changes, outlet pipes will have a soffit level equal or lower than the soffit levels of the inlet pipes. Drop manholes shall be provided for sewer diameters where the difference in inverts of the inlet and outlet pipes or of the inlet and manhole exceeds 0.6m.

Wastewater Treatment Plant Design Criteria

Characteristics of Treated Sewage

The following criteria for treated sewage are adopted to allow for treated sewage re-use. This criteria takes into account the fact that wastewater re-use for irrigation is one of the most useful and viable means for disposal of treated sewage.

- BOD: 10mg/l
- Suspended Solids (S.S): 10mg/l
- Faecal coliform: <200mg/l
- Nitrogen removal: not required

This level of treatment is equivalent to a tertiary level of treatment with effluent quality suitable for reuse in irrigation and for disposal to the environment.

Planning Parameters for Sewage Treatment Plants

The criteria adopted in the planning and development of the conceptual designs of wastewater treatment plants are:

- Alternatives to be developed in co-ordination with the design of the collection network.
- Peak flow at each plant will depend on the peak flow at the area served.
- Plants to be designed in modules for flexibility of construction in phases as needed.
- Wastewater treatment plants to be conventional in nature, whose performance and reliability are consistent and already proven.
- To have low consumption of chemicals or energy.
- To be flexible for modification if effluent quality is sought to be updated or revised.
- To be capable of producing well-stabilised sludge that can be safely utilised for agricultural purposes.
- Layout of treatment facilities to achieve economy, efficiency, and effectiveness in operation and performance.
- To have easily accessible equipment and facilities to facilitate maintenance and replacement.
- To have on-site laboratory, workshops, and disinfection facilities.
- Capable of controlling all sources of on-site objectionable odour generation, or disagreeable insect breeding.
- To have the least impact, if any, on the preservation of quality and integrity of the surrounding environment.
- To have aesthetic appearance suitable to its surrounding.

7.5.4 Planning Alternatives for the Sewerage Collection System

Wastewater Treatment Plant Locations

The wastewater treatment plants (WWTPs) are to be provided in low level open spaces and green areas. This is needed in order to:

1. Reduce the number of pump stations needed for pumping the collected raw sewage into the WWTP.
2. Keep the WWTP as far away as possible from residential areas.
3. Facilitate the use of treated sewage effluent (TSE) for irrigation.

A WWTP location is to be selected at the lowest and most centralised point of the served area and where possible in planned open spaces or green spaces to facilitate the use of TSE for irrigation while minimising interference with proposed developments. It is worth noting that in cases where a WWTP site is located within green areas some distance from rivers, excess TSE during the rainy season should be channelised to reach the nearest river.

Site Topography

Ibadan is characterised by hilly topogaphy, whereby the terrain elevation varies between 100m and 300m, and the terrain is intercepted by valleys at various locations. A digital elevation model has been generated from a medium resolution surface model (SRTM – 30m resolution) to generate preliminary contours. The contours may not be accurate but can be used to guide the general scheme for wastewater collection by gravity to the extent possible. Therefore, the contours were taken into consideration in developing the proposed wastewater collection system alternatives.

Pump Stations

Ibadan's topographic context means that several pumping stations will be needed to convey the collected raw sewage to the WWTP, in order to cross the valleys. Pump stations are recommended wherever pipe depth exceeds 10 metres so as to avoid deep excavations and related complications during construction due to the potential high water table and to convey the wastewater from low points to adjacent zones. Deep sewers can be constructed by one of the following methods, whenever proposed:

- Micro-tunneling that requires specialised contractors and hence necessitates the construction of all deep lines, incurring large investments at an early stage. This is expected as all such lines may be constructed within the same period so as to reduce costs associated with the mobilisation and demobilisation of the specialised contractors. The maintenance of such deep sewers may also be cumbersome and require special equipment.
- Open trench excavation is expected to be costly in Ibadan as it will require dewatering and protection measure (sheet pile) to retain the trench width during excavation. This disadvantage renders this method unfeasible because the water table is high (1-2m below ground level).

For the purpose of formulating a conceptual masterplan for wastewater collection, the use of deep sewers has not been considered, the depth of sewers is limited to 8-10 metres where open excavation can be implemented and the conceptual design relies on pumping stations to convey wastewater to the wastewater treatment plants. It is recommended that in future stages of developing the design, the feasibility of using pumping stations versus deep sewers be further investigated.

Wastewater Collection and Discharge Alternatives

Two alternatives for wastewater collection and treatment are considered, based on centralised and decentralised systems. Centralised versus decentralised options are based on the number of wastewater treatment plants envisaged. The main factor in selecting the preferred alternative is the required number and capacity of the wastewater treatment plants (WWTPs) in addition to the topographical constraints. The following subsections describe the proposed alternatives. The evaluation of the alternatives is presented in Section 7.5.5.

Alternative 1

In this alternative, two (2) main wastewater treatment plants (WWTPs) of different capacities in addition to a micro WWTP located within Ido LGA (serve sewage zone 1, as shown in Figure 7.38) are considered. However, due to the topography of Ibadan and taking into consideration the recommended maximum pipe depth, several lift/pumping stations are required to convey the collected wastewater to the WWTP serving the respective catchment area.

The population (residential and non-residential) and the average sewage discharge per land use type and sewage zones are listed in Table 7.31 and Table 7.32. It is to be noted that the total population excludes the individual plots listed in Table 7.33, since they are located at a distance exceeding around 3 km from the nearest proposed wastewater collection main trunk or scattered over a huge area. Excluding these plots, it is based on optimising the cost of network and reducing operational cost in the long run.

It is recommended that these individual plots have their own package treatment unit. The proposed primary sewage collection system layout and the LSs/PSs as well as the WWTPs are illustrated in Figure 7.38, with smaller scale versions in Figure 7.39 to Figure 7.42 that provide further detail. The main components per sewage zone and the number of manholes of the primary gravity network are listed in Table 7.34. The gravity pipes diameter of the wastewater collection primary network along with their lengths for each zone are listed in Table 7.35. It is worth noting that the only difference between Alternative 1 and 2 is that four (4) of the PSs in Alternative 1 are converted to WWTP in Alternative 2. Therefore, additional pressure pipes (force mains) are required in order to transfer the wastewater of the said PSs to their allocated final discharge points. The diameters and length of these additional force mains are listed in Table 7.36. Finally, the secondary sewer gravity pipes and number of manholes estimated are listed in Table 7.37.

Table 7.31: Population Distribution Estimates per Sewage Zones – Alternative 1

LAND USE TYPE	POPULATION			
	Z1	Z2	Z3	Total
Low Density (Inner)	-	182,613	231,686	414,299
Low Density (Outer)	-	13,894	6,194	20,088
Medium Density (Inner)	-	1,639,929	1,946,474	3,586,403
Medium Density (Outer)	-	56,753	5,132	61,885
Urban High Density (Inner)	-	1,619,197	62,658	1,681,855
Expansion - Low Density	-	350,366	-	350,366
Expansion - Medium Density	115,674	1,061,963	2,389,017	3,566,654
Expansion - High Density	-	48,360	122,026	170,386
Infill- Medium Density	-	667,907	737,311	1,405,218
Infill - High Density	-	-	71,236	71,236
Total Residential Population	115,674	5,640,982	5,571,735	11,328,391
Projected Existing Urban Areas Employees	-	1,345,698	655,315	2,001,013
New Urban Areas Employees	7,879	595,362	758,289	1,361,529
Industrial	16,262	30,798	358,613	405,673
Total Employees	24,141	1,971,857	1,772,217	3,768,215
OVERALL TOTAL POPULATION	**139,815**	**7,612,839**	**7,343,952**	**15,096,606**

Table 7.32: Average Sewage Generation Estimates per Sewage Zones – Alternative 1

LAND USE TYPE	AVERAGE SEWAGE GENERATION (m^3/d)			
	Z1	Z2	Z3	Total
Low Density (Inner)	-	16,070	20,388	36,458
Low Density (Outer)	-	1,223	545	1,768
Medium Density (Inner)	-	144,314	171,290	315,603
Medium Density (Outer)	-	4,994	452	5,446
Urban High Density (Inner)	-	116,582	4,511	121,094
Expansion - Low Density	-	42,044	-	42,044
Expansion - Medium Density	10,179	93,453	210,234	313,866
Expansion - High Density	-	3,482	8,786	12,268
Infill - Medium Density	-	58,776	64,883	123,659
Infill - High Density	-	-	5,129	5,129
Total Residential Average Discharge	10,179	480,937	486,218	977,334
Projected Existing Urban Areas Employees	-	32,297	15,728	48,024
New Urban Areas Employees	189	14,289	18,199	32,677
Industrial	390	739	8,607	9,736
Total Employees Average Discharge	579	47,325	42,533	90,437
TOTAL AVERAGE DISCHARGE	**10,759**	**528,262**	**528,751**	**1,067,772**

Table 7.33: Areas to be Served Privately

LGA	LAND USE TYPE	POPULATION 2036	EMPLOYEES 2036	RESIDENTIAL AVERAGE SEWAGE GENERATION (m^3/d)	EMPLOYEES AVERAGE SEWAGE GENERATION (m^3/d)	AVERAGE SEWAGE GENERATION TO BE TREATED PRIVATELY ON SITE (m^3/d)
LAGELU	10% of Low Density (Inner)	5,316	3,238	468	78	546
	50% of Low Density (Outer)	1,190	9,779	105	235	339
	Peripheral and Villages (Inner)	16,890	90,254	1,486	2,166	3,652
	Peripheral and Villages (Outer)	47,828	-	4,209	-	4,209
AKINYELE	25% of Medium Density (Outer)	18,918	4,742	1,665	114	1,779
	15% of Low Density (Inner)	8,723	3,361	768	81	848
	40% of Low Density (Outer)	7,817	3,012	688	72	760
	Peripheral and Villages (Inner)	1,578	608	139	15	153
	Peripheral and Villages (Outer)	28,288	20,159	2,489	484	2,973
IDO	10% of Low Density (Inner)	10,556	4,919	929	118	1,047
	Peripheral and Villages (Inner)	2,300	4,305	202	103	306
	Peripheral and Villages (Outer)	39,763	56,673	3,499	1,360	4,859
OLUYOLE	10% of Low Density (Inner)	14,139	2,152	1,244	52	1,296
	30% of Low Density (Outer)	390	150	34	4	38
	Peripheral and Villages (Inner)	9,300	13,256	818	318	1,137
	Peripheral and Villages (Outer)	23,235	33,116	2,045	795	2,839
ONA ARA	5% of Low Density (Inner)	2,697	1,039	237	25	262
	15% of Low Density (Outer)	459	177	40	4	45
	Peripheral and Villages (Inner)	5,102	11,582	449	278	727
	Peripheral and Villages (Outer)	16,625	23,694	1,463	569	2,032
EGBEDA	20% of Low Density (Inner)	9,655	6,987	850	168	1,017
	15% of Low Density (Outer)	300	8,767	26	210	237
	Peripheral and Villages (Inner)	6,154	15,759	542	378	920
	Peripheral and Villages (Outer)	4,799	6,840	422	164	587
TOTAL		**282,024**	**324,569**	**24,818**	**7,790**	**32,608**

Table 7.34: Primary Sewage Collection System Main Components – Alternative 1

ZONE NO.	WWTP CAPACITY (m^3/d)	WWTP SITE AREA DIMENSIONS (mxm)	NO. OF PS	NO. OF LS	PRIMARY GRAVITY PIPES LENGTH (m)	NO. OF PRIMARY MANHOLES	PRESSURE PIPES LENGTH (m)
1	10,750	130 x 85	-	1	3,472	50	-
2	528,750	3700 x 2000	12	63	228,416	3,263	10,000
3	528,750	3700 x 2000	17	41	177,255	2,532	16,000
TOTAL	**1,068,250**		**29**	**105**	**409,143**	**5,845**	**26,000**

Table 7.35: Pipe Diameters and Length per Zone – Alternative 1

PIPE DIAMETER	PIPE LENGTH (m)			
	Z1	Z2	Z3	Total
200	-	2,686	-	2,686
300	1,077	31,527	13,464	46,068
400	1,664	33,949	42,092	77,706
500	587	49,087	24,162	73,836
600	143	37,351	20,924	58,418
700	-	24,492	15,858	40,350
800	-	13,702	9,129	22,831
900	-	5,062	8,952	14,014
1000	-	12,600	10,260	22,860
1200	-	12,061	22,899	34,959
1400	-	5,381	2,878	8,258
1600	-	224	6,054	6,278
2200	-	294	583	877

Table 7.36: Force Mains Diameters and Length of the Additional Ones Compared to Alternative 2 – Alternative 1

ZONE NO.	FORCE MAINS (mm)	LENGTH (m)
2	Ø 1400	15,600
3	Ø 1600	26,150
3	Ø 1800	24,000
2	Ø 2000	18,300
TOTAL		**84,050**

Table 7.37: Estimated Secondary Sewer Gravity Pipes and Manholes

	SECONDARY SEWER GRAVITY PIPE LENGTH (m)	SECONDARY SEWER MANHOLES NO.
Existing Urban Area	2,570,000	51,400
Proposed Urban Area	3,020,000	60,400
TOTAL	**5,590,000**	**111,800**

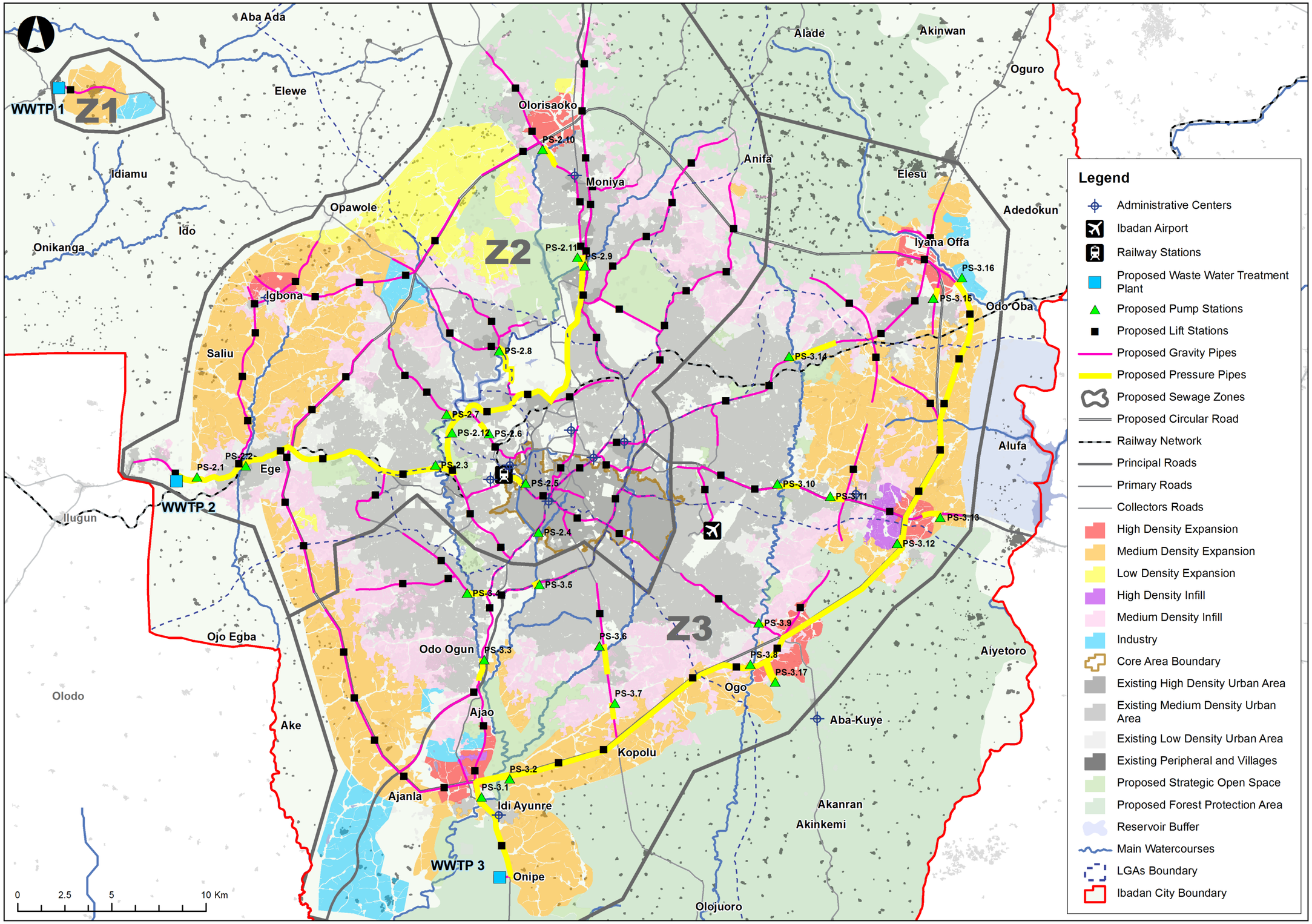

Figure 7.38: Ibadan – Sewage Primary System – Alternative 1

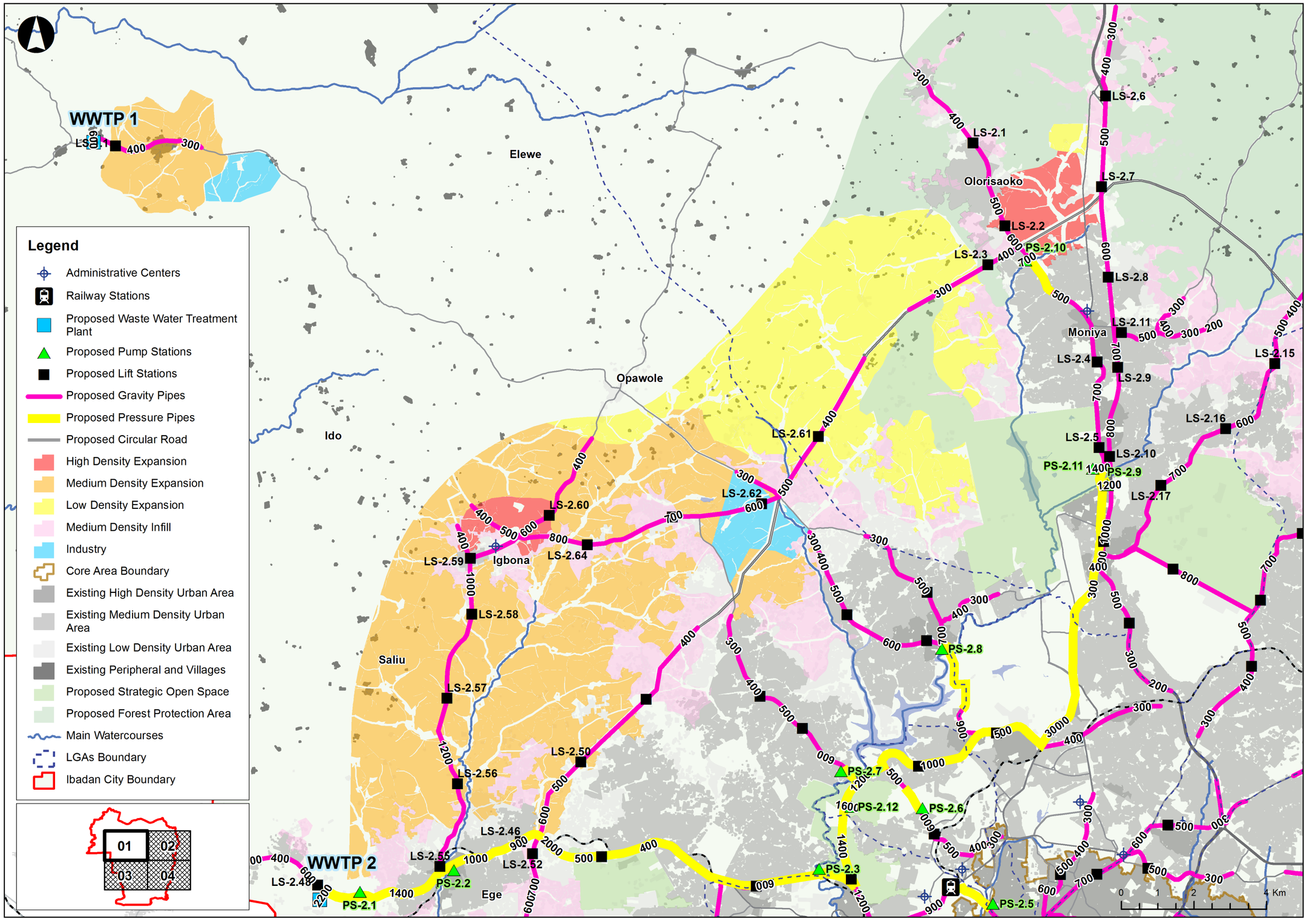

Figure 7.39: Ibadan 1 – Sewage Primary System – Alternative 1

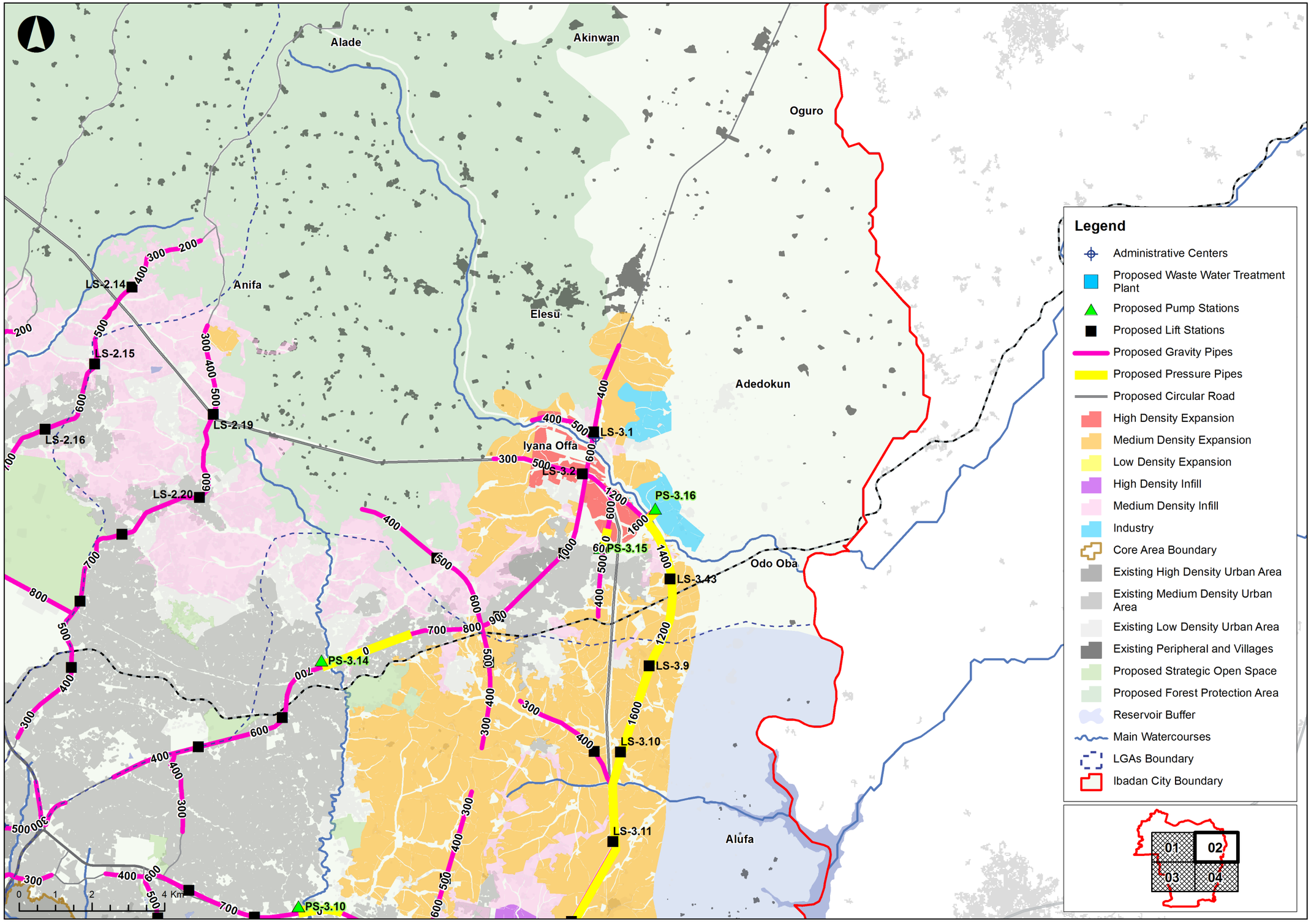

Figure 7.40: Ibadan 2 – Sewage Primary System – Alternative 1

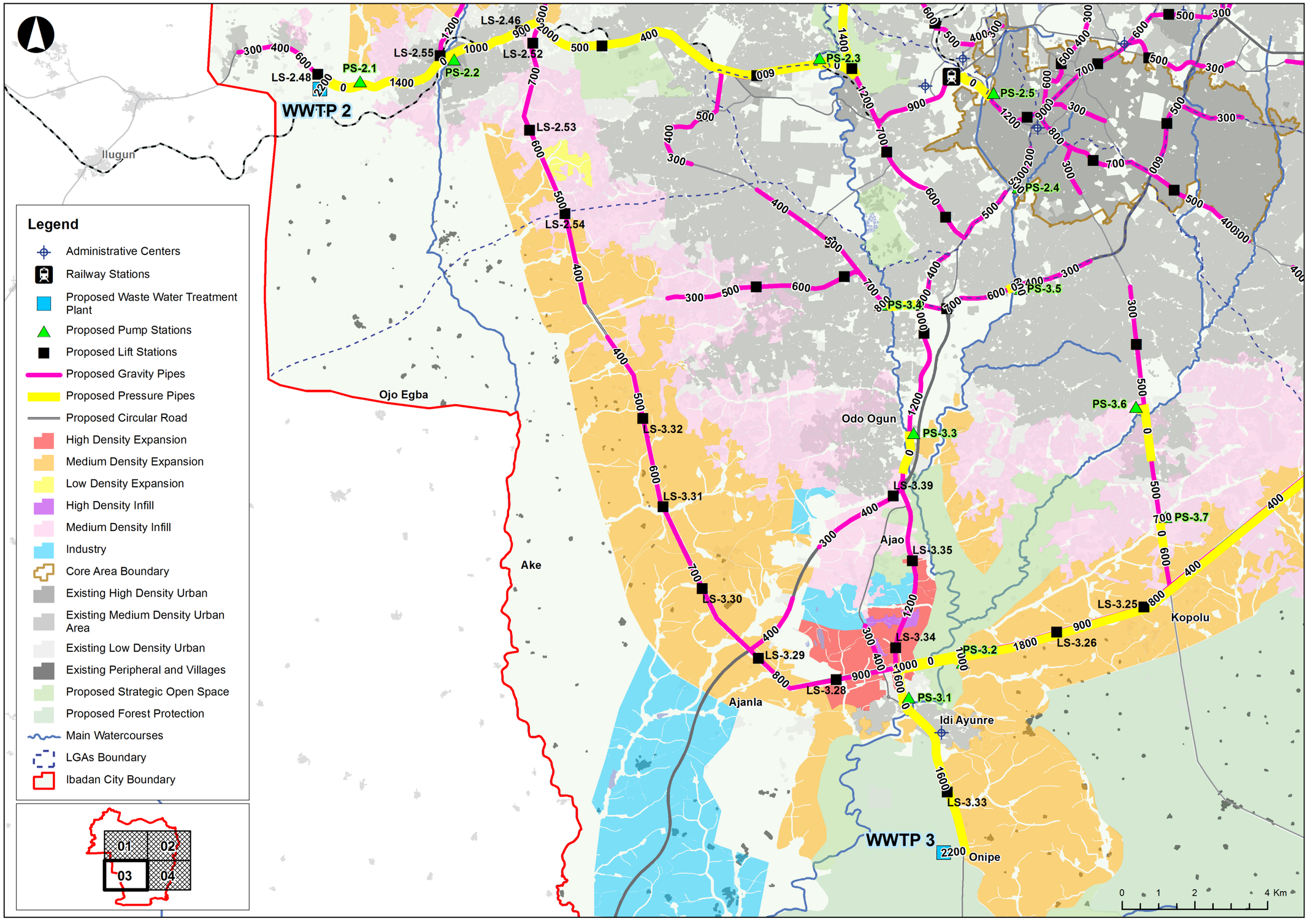

Figure 7.41: Ibadan 3 – Sewage Primary System – Alternative 1

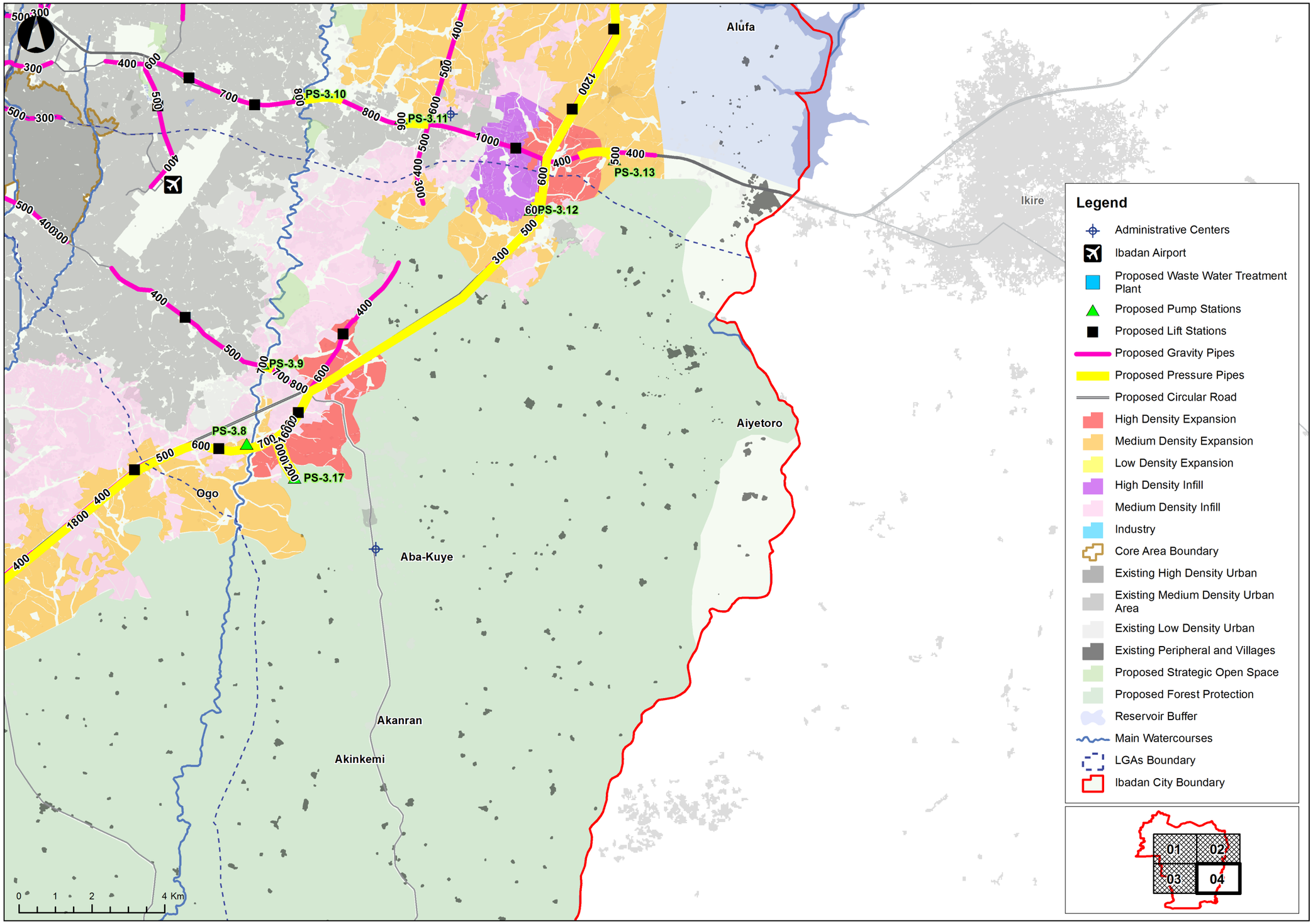

Figure 7.42: Ibadan 4 – Sewage Primary System – Alternative 1

Alternative 2

In this alternative, all the wastewater generated from across Ibadan is collected and discharged into six (6) sub-main wastewater treatment plants (WWTPs) of different capacities in addition to the micro WWTP described previously in Alternative 1. The area of Ibadan has been divided into seven (7) zones taking into consideration the topography in order to provide decentralised systems and allow for flexibility in its phasing and development. It is worth noting that in this alternative, several lift/pumping stations are required to convey the collected wastewater to their assigned WWTP in order not to exceed the recommended maximum pipe depth. The population (residential and non-residential) and the average sewage discharge per land use type and sewage zones are listed in Table 7.38 and Table 7.39. The proposed primary sewage collection system layout and the LSs/PSs as well as the WWTPs are illustrated in Figure 7.43 with smaller scale versions in Figure 7.44 to Figure 7.47 for further detail. The main components per sewage zone in addition to the number of manholes of the primary gravity network are listed in Table 7.40. The gravity pipe diameters of the sewage primary network with their length for each zone are listed in Table 7.41. The secondary sewer gravity pipes and number of manholes are the same as the ones estimated for Alternative 1.

Table 7.38: Population Distribution Estimates per Sewage Zones – Alternative 2

LAND USE TYPE	POPULATION							
	Z1	Z2	Z3	Z4	Z5	Z6	Z7	Total
Low Density (Inner)	-	80,843	103,544	58,074	70,069	68,389	33,380	414,299
Low Density (Outer)	-	2,128	846	1,685	3,663	11,766	-	20,088
Medium Density (Inner)	-	194,462	800,024	293,888	852,562	498,795	946,672	3,586,403
Medium Density (Outer)	-	-	-	1,091	4,041	56,753	-	61,885
Urban High Density (Inner)	-	33,390	4,036	-	58,623	144,228	1,441,578	1,681,855
Expansion - Low Density	-	193,426	-	-	-	121,504	35,436	350,366
Expansion - Medium Density	115,674	1,022,767	1,195,461	146,733	1,046,824	6,634	32,562	3,566,654
Expansion - High Density	-	17,957	40,249	39,467	42,310	30,403	-	170,386
Infill - Medium Density	-	242,122	320,575	183,086	233,651	365,248	60,537	1,405,218
Infill - High Density	-	-	6,939	-	64,297	-	-	71,236
Total Residential Population	115,674	1,787,095	2,471,673	724,023	2,376,039	1,303,720	2,550,166	11,328,391
Projected Existing Urban Areas Employees	-	106,929	159,331	73,817	422,168	249,840	988,929	2,001,013
New Urban Areas Employees	7,879	241,353	266,660	108,154	383,475	307,688	46,320	1,361,529
Industrial	16,262	23,553	331,983	-	26,630	-	7,245	405,673
Total Employees	24,141	371,836	757,974	181,970	832,273	557,528	1,042,494	3,768,215
OVERALL TOTAL POPULATION	**139,815**	**2,158,931**	**3,229,647**	**905,993**	**3,208,311**	**1,861,248**	**3,592,660**	**15,096,606**

Table 7.39: Average Sewage Generation Estimates per Sewage Zones – Alternative 2

LAND USE TYPE	AVERAGE SEWAGE GENERATION (m^3/d)							
	Z1	Z2	Z3	Z4	Z5	Z6	Z7	Total
Low Density (Inner)	-	7,114	9,112	5,110	6,166	6,018	2,937	36,458
Low Density (Outer)	-	187	74	148	322	1,035	-	1,768
Medium Density (Inner)	-	17,113	70,402	25,862	75,025	43,894	83,307	315,603
Medium Density (Outer)	-	-	-	96	356	4,994	-	5,446
Urban High Density (Inner)	-	2,404	291	-	4,221	10,384	103,794	121,094
Expansion - Low Density	-	23,211	-	-	-	14,580	4,252	42,044
Expansion - Medium Density	10,179	90,003	105,201	12,912	92,120	584	2,865	313,866
Expansion - High Density	-	1,293	2,898	2,842	3,046	2,189	-	12,268
Infill - Medium Density	-	21,307	28,211	16,112	20,561	32,142	5,327	123,659
Infill - High Density	-	-	500	-	4,629	-	-	5,129
Total Residential Average Discharge	10,179	162,632	216,688	63,083	206,448	115,821	202,483	977,334
Projected Existing Urban Areas Employees	0	2,566	3,824	1,772	10,132	5,996	23,734	48,024
New Urban Areas Employees	189	5,792	6,400	2,596	9,203	7,385	1,112	32,677
Industrial	390	565	7,968	-	639	-	174	9,736
Total Employees Average Discharge	579	8,924	18,191	4,367	19,975	13,381	25,020	90,437
TOTAL AVERAGE DISCHARGE	**10,759**	**171,557**	**234,879**	**67,450**	**226,422**	**129,202**	**227,503**	**1,067,772**

Table 7.40: Primary Sewage Collection System Main Components – Alternative 2

ZONE NO.	WWTP CAPACITY (m^3/d)	WWTP SITE AREA DIMENSIONS (mxm)	NO. OF PS	NO. OF LS	PRIMARY GRAVITY PIPES LENGTH (m)	NO. OF PRIMARY MANHOLES	PRESSURE PIPES LENGTH (m)
1	10,750	130 x 85	-	1	3,472	50	-
2	171,500	1280 x 670	2	18	61,337	876	1,550
3	235,000	1700 x 940	7	17	69,824	997	7,850
4	67,500	420 x 245	2	5	20,889	298	750
5	226,500	1650 x 900	6	19	86,541	1,236	7,150
6	129,500	960 x 515	2	23	75,733	1,082	2,000
7	227,500	1680 x 910	6	22	91,346	1,305	6,700
TOTAL	**1,068,250**		**25**	**105**	**409,143**	**5,845**	**26,000**

Table 7.41: Pipe Diameters and Length per Zone – Alternative 2

PIPE DIAMETER (mm)	PIPE LENGTH (m)							
	Z1	Z2	Z3	Z4	Z5	Z6	Z7	Total
200	-	-	-	-	-	2,149	538	2,686
300	1,077	2,382	5,614	-	7,850	10,626	18,519	46,068
400	1,664	14,806	11,701	9,456	20,935	11,121	8,023	77,706
500	587	11,478	8,896	3,512	11,754	15,154	22,456	73,836
600	143	7,208	7,617	3,075	10,232	12,548	17,596	58,418
700	-	5,203	7,273	1,279	7,306	12,299	6,991	40,350
800	-	3,154	5,944	616	2,569	8,662	1,886	22,831
900	-	1,124	6,074	1,644	1,234	-	3,938	14,014
1000	-	6,282	1,475	782	8,003	2,765	3,552	22,860
1200	-	6,693	9,041	526	13,332	104	5,264	34,959
1400	-	2,714	-	-	2,878	307	2,360	8,258
1500	-	294	-	-	-	-	-	294
1600	-	-	6,190	-	447	-	224	6,862

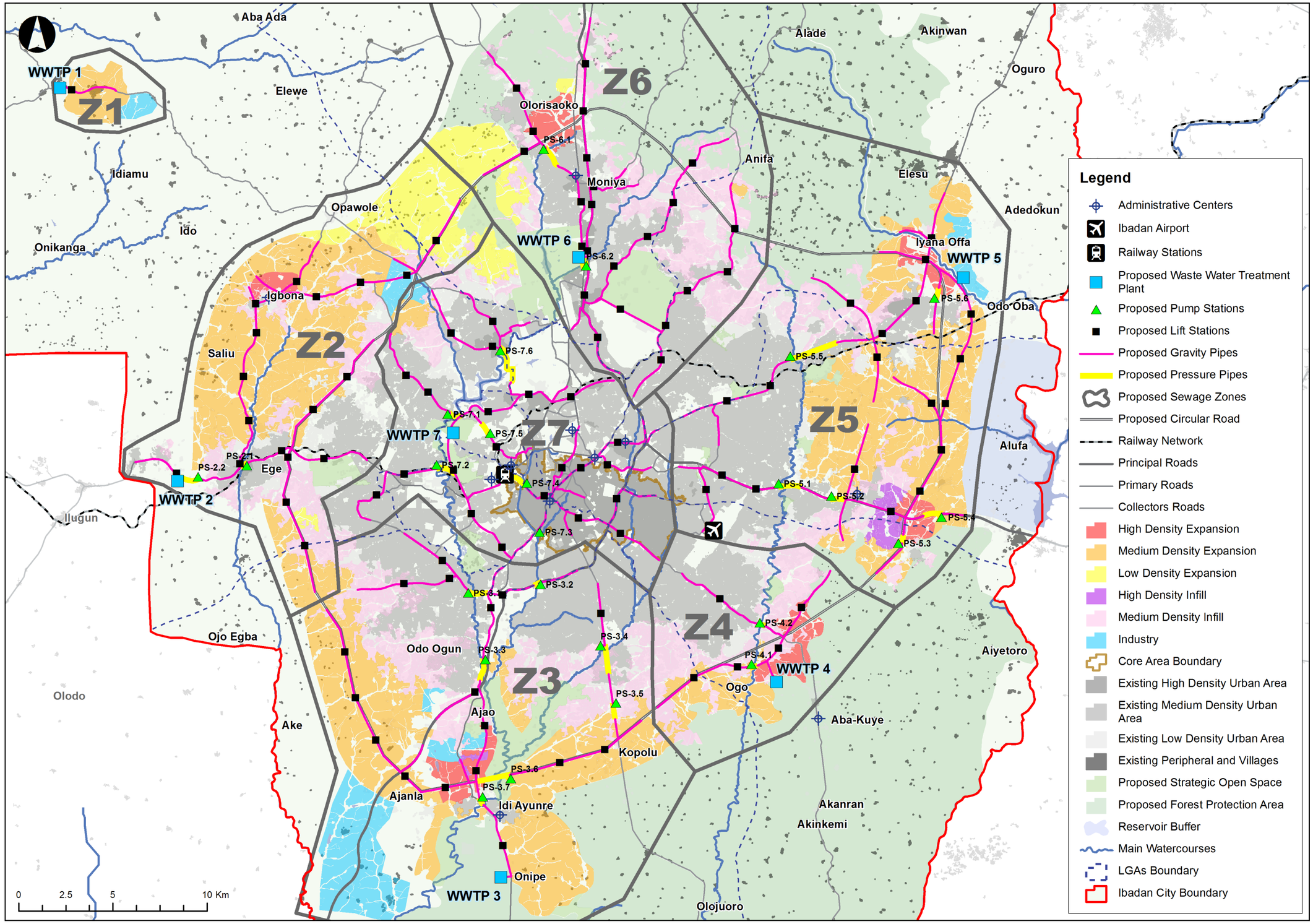

Figure 7.43: Ibadan – Sewage Primary System – Alternative 2

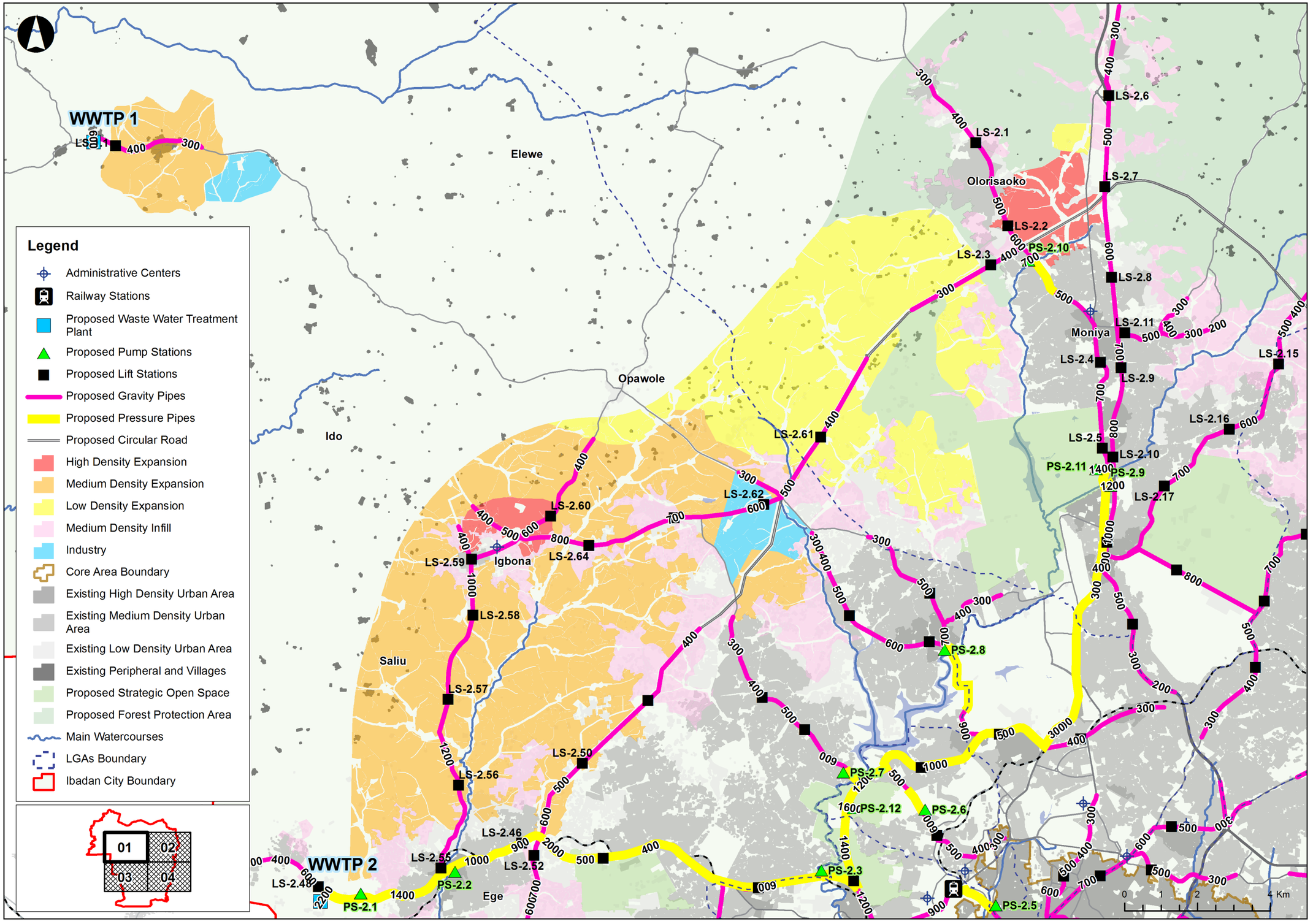

Figure 7.44: Ibadan 1 – Sewage Primary System – Alternative 2

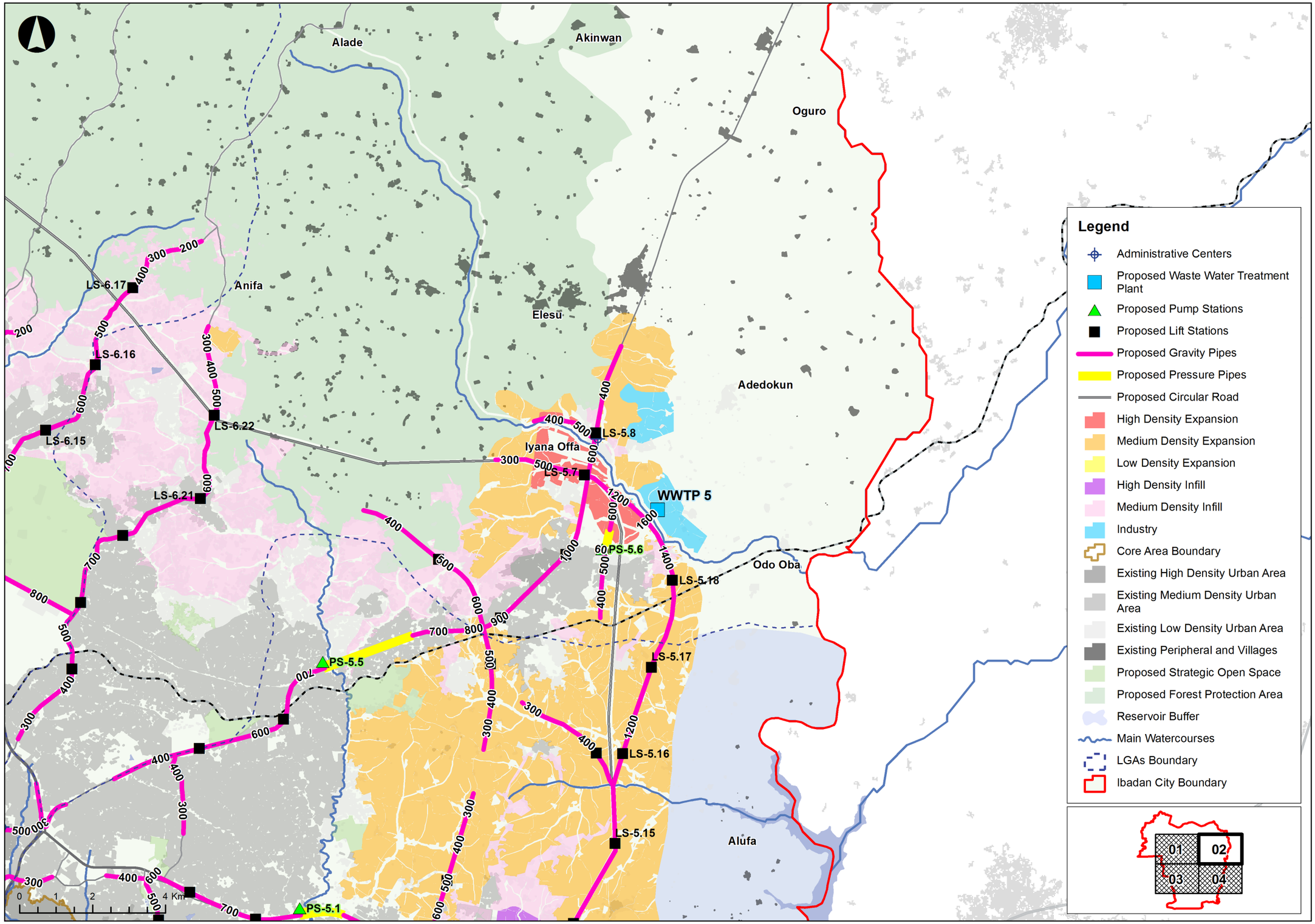

Figure 7.45: Ibadan 2 – Sewage Primary System – Alternative 2

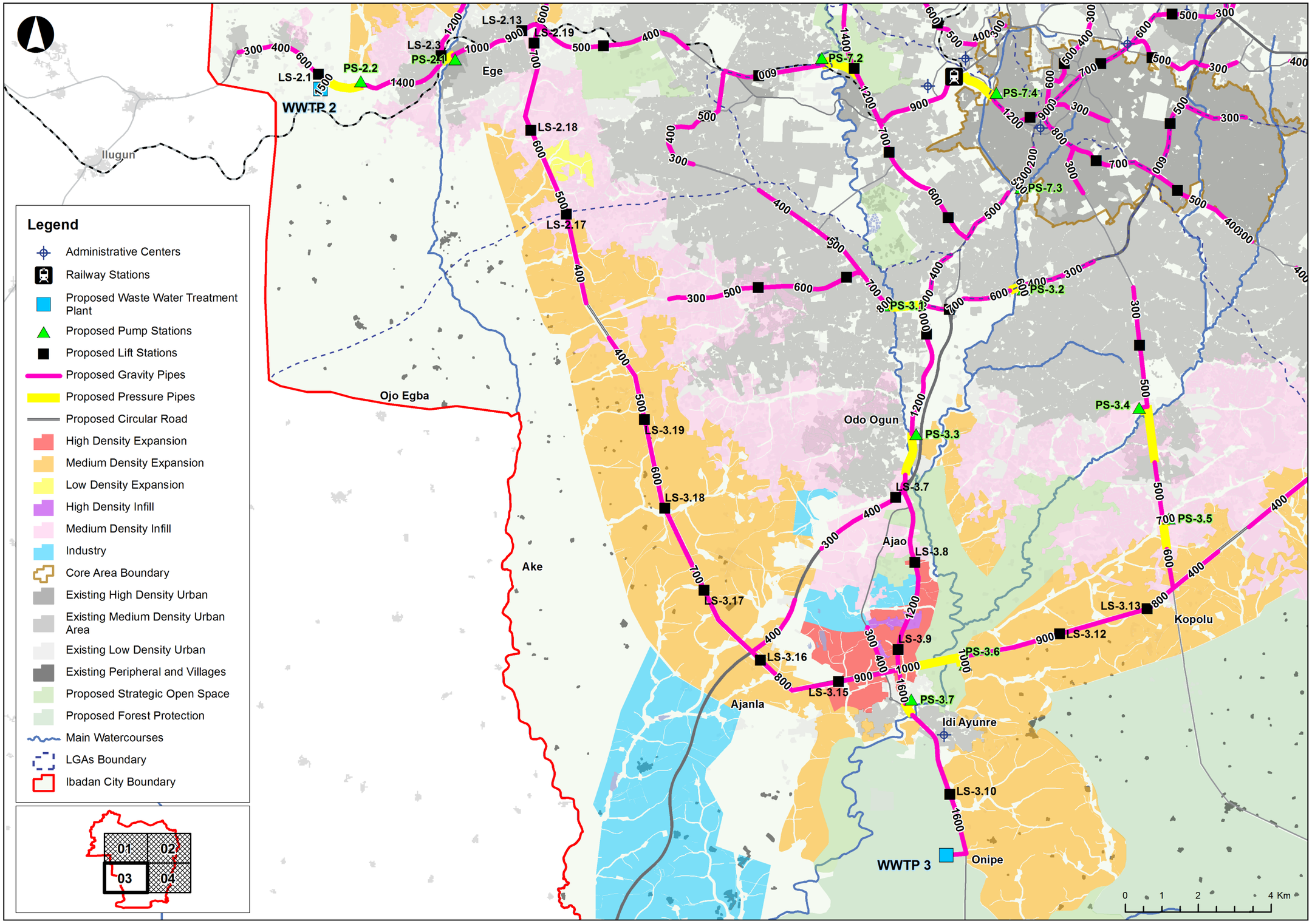

Figure 7.46: Ibadan 3 – Sewage Primary System – Alternative 2

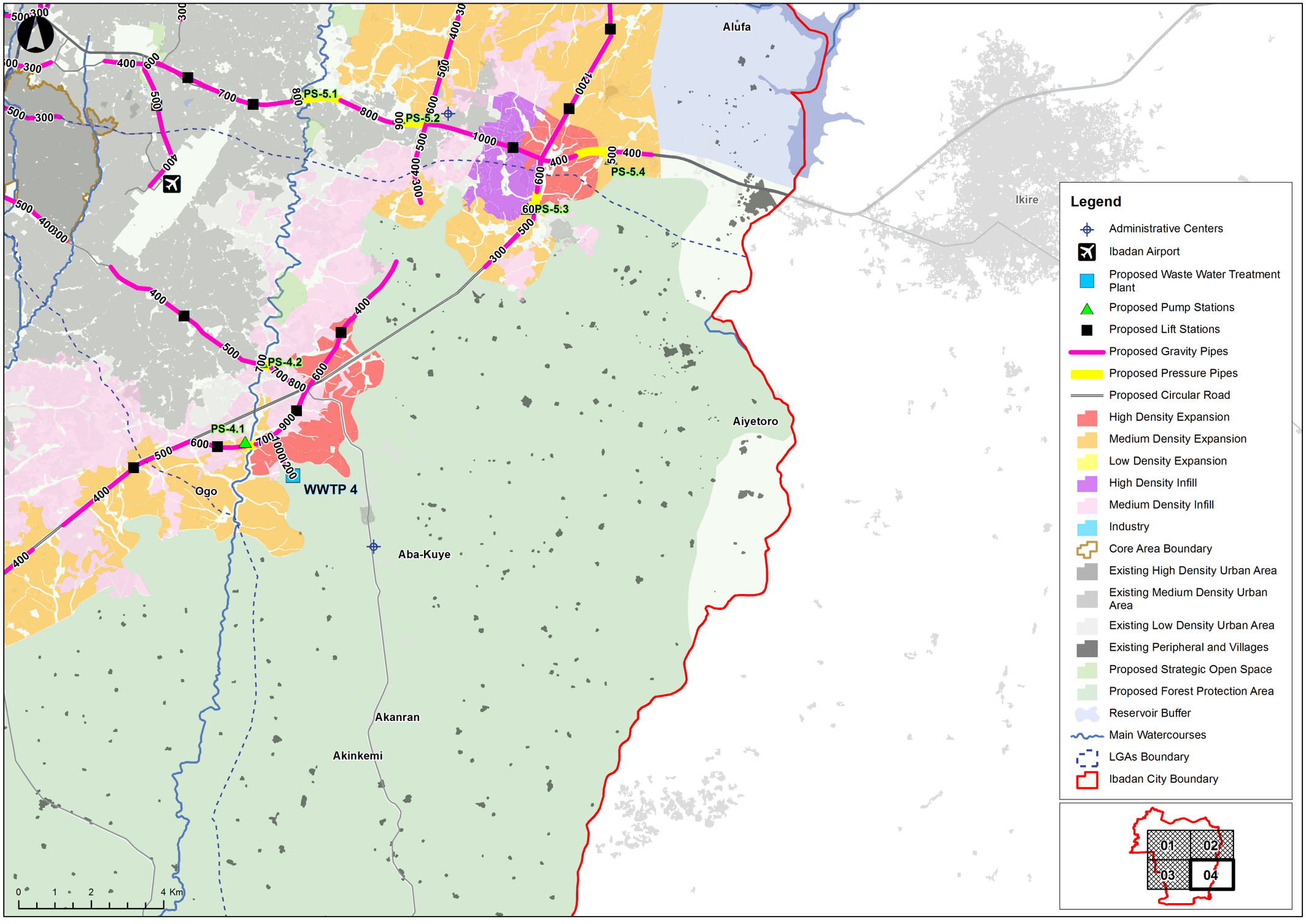

Figure 7.47: Ibadan 4 – Sewage Primary System – Alternative 2

7.5.5 Evaluation of the Proposed Systems

Alternatives 1 and 2 as described in the previous section have been evaluated. In order to compare the costs of the two alternatives, the similar items were excluded (secondary sewer pipes and manholes). The cost of the following items have been compared:

- Wastewater Treatment plants
- Lift/Pump stations
- Pressure Pipes (Force mains)
- Primary Sewer Gravity Pipes
- Primary Sewer Manholes

Alternative 1 vs. Alternative 2

In Alternative 1, three (3) wastewater treatment plants (WWTPs) are proposed, which minimises the risk of nuisances and environmental hazards. However, the addition of four (4) PSs are required compared to Alternative 2. In addition, around an additional 84km of different diameter pressure lines (force mains), as listed in Table 7.36 are required in Alternative 1 as compared to Alternative 2. These are additional costs above

Although the total capacity of the proposed WWTPs in both alternatives is the same, the cost of the proposed WWTPs in Alternative 2 (7 WWTPs) is higher due to the construction and workforce cost. As for the primary network, the length of the gravity pipes and the number of manholes are almost the same between the two alternatives.

The advantages and disadvantages of each alternative are summarised in Table 7.42.

Table 7.42: Alternatives 1 and 2 Advantages and Disadvantages

ALTERNATIVE	ADVANTAGES	DISADVANTAGES
1	• Minimises the number of wastewater treatment plants (WWTPs) and the risk of nuisances and environmental hazards.	• Less flexibility of construction phasing and spatial development strategy. • Requires four more PSs. • Requires more pressure lines with a total length of around 84 km. • Higher Upfront Cost
2	• Lower operational cost. • Provides more flexibility in the construction phasing and spatial development of the strategy. • Lower upfront cost.	• Higher operational cost. • More WWTPs required.

7.5.6 Recommended System

The advantages and disadvantages of each alternative have been evaluated as discussed in the previous section, where Alternative 2 is less costly upfront, provides more flexibility in the phasing of construction and ties in more closely with the spatial development strategy. Alternative 2 is therefore the recommended system.

As previously discussed, the proposed scheme seeks to divide the masterplan area into seven (7) areas, each served by an independent WWTP. Table 7.43 summarise the characteristics of the recommended scheme.

Table 7.43: Recommended System Main Characteristics

	Z1	Z2	Z3	Z4	Z5	Z6	Z7	TOTAL
Population (Residents and Employees)	139,815	2,158,931	3,229,647	905,993	3,208,311	1,861,248	3,592,660	15,096,606
Average Sewage Discharge (m^3/d)	10,759	171,557	234,879	67,450	226,422	129,202	227,503	1,067,772
Treatment Plant Site Area (m^2)	11,050	857,600	1,598,000	102,900	1,485,000	494,400	1,528,800	6,077,750
No. of Lift/Pump Stations	1	20	24	7	25	25	28	130

7.5.7 Cost Estimate of the Proposed System

A summary of the scheme cost estimate is given in Table 7.44 taking into consideration the secondary system in terms of gravity pipes and manholes only. It is worth noting that the exact location and capacity of all proposed WWTPs and PSs/LSs in addition to all other main components data are to be determined in a more detailed study.

Table 7.44: Proposed System Cost Estimate

ITEM DESCRIPTION	QUANTITY	UNIT	COST (MILLION US$)
Wastewater Treatment Plants	1,067,772	m3/d	1,198.2
Lift/Pump Stations	130	No.	170.4
Pressure Pipes	26,000	m	23.4
Primary Gravity Pipes	409,150	m	294.2
Secondary Gravity Pipes	5,765,000	m	2,997.8
Manholes	121,150	No.	605.8
TOTAL			**5,289.8**

INSTITUTIONAL AND LEGAL ARRANGEMENTS

8

8 INSTITUTIONAL AND LEGAL ARRANGEMENTS

8.1 CONCERNS AND ISSUES

The development of a new Masterplan is not simply an issue of developing a good plan, with different land uses, road and rail, water, drainage, and networks proposed, but also needs to provide a way of managing the dynamic process whereby such a plan can be realised. This raises a number of issues:

1. What factors need to be in place for the plan to be realised?

2. Is a special agency needed, and if so is it practical, to oversee implementation of the plan?

3. Roles of existing agencies and departments; the need for new legislation and capacity building.

4. Involving stakeholders – role of Community Development Associations.

5. Involving stakeholders – role of Non-Government Organisations such as local chambers of commerce and other business based organisations, trade unions, local pressure groups covering the environment, transport, or other interest groups.

6. How to encourage the private sector to cooperate: use of incentives and sanctions.

7. How to safeguard the weak and vulnerable, especially the physically and mentally challenged, the aged and women, in particular women-headed households.

8. The respective roles of the State and local governments.

The challenge facing the decision makers, at this time, is how to manage the expansion of an existing city, which so dominates its wider region. This is not the same as the development of a new town, where the overwhelming proportion of the population growth in the selected area will be in-migrants, settling on virgin land, which was possibly agricultural, forest or other-use land, including non-productive land. However, Ibadan is expected to increase in population by 90% over the period to 2036 through infilling, densification, upgrading and rationalisation of older informal settlements, as well as the development of land not yet classified as urban, while at the same time protecting very valuable agricultural land and the existing forest areas, which are vital in the plan to protect the city from similar devastating floods as experienced in 2011.

The city currently faces the following structural and legal institutional issues:

- The coordination of spatial development, land use and infrastructure, with social and economic strategies, is weak.
- The lack of an adequate legal basis for strategic physical planning and integrated development.
- The Oyo State Planning Commission has an inadequate status to require compliance of other MDAs, and focuses on economic development.
- The IUFMP World Bank Flood Management and Prevention PIU does not have the remit nor legal status to oversee implementation of the Masterplan.
- The Nigerian constitution limits the role of Local Government. There is a need for improved institutional arrangements for involvement of CDAs and NGOs.
- The Bureau of Physical Planning and Development Control is best placed to control spatial development but does not have the capacity to manage the economic development and the application of fiscal and other incentives and disincentives for encouraging or discouraging specific types of economic and spatial development.
- There is no State policy for lean and effective government which would prescribe the institutional solution chosen.
- The separation of urban planning and environmental ministries has weakened the enforcement capacity of the planning agency.
- The Oyo State Emergency Management Agency is not regularly consulted on planning decisions.
- There is a lack of an established system for monitoring development against the Masterplan.
- There is an inadequate enabling environment for the positive involvement of private sector investors.
- There are different processes for land allocation for investment in rural as opposed to urban areas. There is a need for a single system across the whole of the masterplan area.
- Bureaucratic processes limit productivity and restrict innovative approaches to problem solving. They also impact on the ‘ease of doing business’ which is so important if the private sector is to be involved in the realisation of the Masterplan.
- The system of records on land is primitive, there is a lack of a computerised land use management information system, digital mapping is not yet used in both planning and land records, and there is no platform for recording such data, all of which are linked to the issue of the ease of doing business
- There are inadequate numbers of staff in planning departments and underqualified or inexperienced. Staff are overstretched and development control capability is weak.

The State has limited resources for additional institutions and must rely on existing staff as much as possible, but also needs to develop innovative ways of increasing productivity at marginal additional cost.

8.2 THE CURRENT INSTITUTIONAL ARRANGEMENTS FOR URBAN DEVELOPMENT

The development of urban areas involves many Ministries, Departments and Agencies (MDAs). The present arrangement for managing development divides the tasks along sectoral lines, with each MDA having its own area of responsibility. There is no single agency responsible for coordinating the efforts, although there are opportunities in the budgeting process. Responsibility for the various functions and activities required in the implementation of the masterplan are given below.

8.2.1 Planning Functions

The functions covered by the previous State Ministry of Lands, Housing and Physical Planning/Urban Development are central to the urban development process and for the planning and development of urban expansion in the State. The Ministry consisted of five directorates: for strategic physical planning, for development control, for land management, for research and for housing. Housing is represented by the Oyo State Housing Corporation responsible for sites and services, slum upgrade, and the construction of housing, commercial and industrial sites. In effect, its primary activity is the sale of plots for self-built units for the middle income rather than the poor.

Responsibility for the preparation and review of plans lay with the Strategic Physical Planning Directorate, which had two Assistant Directors, one responsible for the initiation of planning policy, the preparation and review of plans, and public enlightenment. The second was responsible for the upgrade of urban areas, community improvement, environmental management, the development of planning standards and mediation. Under the Director of Strategic Physical Planning there were also 33 District Planning Directors. However, these were not all adequately experienced as planners. The Directorate of Physical Development Control had two sub-directorates, one responsible for approving requests for development permits, and the other for monitoring and enforcement. A third Directorate, the Research and Statistics Directorate was shared with the Lands Directorate. The Lands Directorate is responsible for the sale of land to private developers in the urban areas, the valuation of land and the establishment of property tax. However, the proposed Lands Allocation Committee has never been established and approval of land sales is made by the Commissioner of the Ministry.

All of the above functions should now reside with the recently established Bureau of Physical Planning and Development Control which sits in the Office of the Governor.

All departments are understaffed or lack adequate experience. Furthermore, there were problems of funding with inadequate resources available for transport and security.

Land titling is the responsibility of the Deeds Registry and the Surveyor General who safeguards against duplication or overlapping claims. However, the system is manual and records are in the form of hard copies, subject to distortion with age. There is currently no use of digitised plans and land records. The same problem is found in the Strategic Physical Planning Directorate, where GIS experience is limited.

8.2.2 Investments

Within Oyo State, responsibility lies with the Bureau of Investment Promotion, which is responsible for policy issues and records. Its mission is the promotion of sustainable investments. The state Ministry of Trade, Industry and Cooperatives (OSMTIC) has mission "to promote economic activities through a structured approach for wealth creation, full employment of the people, prosperity in business and effective business management in a friendly business environment, improved standard of living of the people, effective utilisation of agriculture products and improve revenue profile of the State."[1] The objectives include:

- To stimulate growth of existing Micro, Small and Medium Enterprises (MSMEs) and emergency of new ones in the State.
- To promote establishment of Agro-Allied cottage industries focusing on utilisation of local agricultural products, working with the relevant sectoral organisations.
- To put in place a legal and institutional framework that would facilitate the realisation of set strategic objectives.

In 2012, the Governor launched the RTR (Restoration, Transformation and Repositioning) Agenda to boost the economy of the State. This included tax breaks for investors and reduction in the cost of land purchase by up to 80% for non PPP investors. The spending plan prioritised infrastructure and social services, allocating 33.9% of spending to economic development, 29.3% to social services and 13.1% to regional development. Investments included, amongst others, infrastructure, streamlining the land purchasing and registration system, and investment in developing technological skills.[2]

Along with the OSMTIC, the State Planning Commission is responsible for the overall economic development strategy and "to prepare Development Plans designed to accelerate the development of the economy and guarantee a higher standard of living and happiness for the people."[3] Agri-based industries are one of the most important sources of industrial growth, using produce from the high yield agricultural land. But the RTR also identified tourism and trade as important sectors and the need to clean up the environment, especially drain-clearing to prevent flooding. Clearly, coordinating these different agencies in the development policies and programmes to strengthen the economic base of Ibadan is complex.

8.2.3 Land Allocation

The power to distribute land lies with a number of MDAs. Under the 1978 Federal Land Use Act, all land is held on a lease that the Government has the power to revoke. For urban land, authority lies with the State government and for rural areas with the Local Government. The primary responsibility for land distribution in urban areas is with the Directorate of Lands, but for an external investor, approval should also be given by the Directorate of Strategic Physical Planning (now within the BPPDC under the Governor), and the Ministry of Works and Transport (OSMoWT) and the final approval given by the Commissioner of the Ministry responsible for land.

Under the 1978 Act, land required for the benefit of the society may revert to the State without compensation being paid except for the pre-existing developments and crops. In practice, where possible, the person losing the right to a piece of land is compensated by receiving an equivalent piece of land elsewhere. However, it does not take account of loss of business which results from compulsory acquisition.

To obtain the right of use to a piece of land, the applicant having satisfied the Lands Directorate and the other agencies involved, receives a Certificate of Occupancy (CofO), which is registered in the Deeds Registry. Privately owned land, in the same ownership pre-dating the 1978 Federal Law can be registered, in which case the plot is surveyed by the Surveyor General's department and a 99-year lease is provided to the owner. Without this, the ownership of the land cannot be transferred officially.

The procedure for purchasing land in urban areas is under the remit of the Estates Department in the Ministry of Local Government and the BPPDC (previously the Department of Strategic Planning and Development). However, in rural areas, the procedure does not involve any planning approval, often involving the local chief and the current landowner's agreement to the sale. Land is then registered through the Surveyor General's department. If an external investor is the potential purchaser, the Bureau of Investment Promotion needs to be involved in the decision.

The system of approval of the sale of land needs to be made consistent in the rural as well as the urban parts of the whole of the Masterplan area, in all 11 local government areas. Thus, there may be a need for the whole of the masterplan area to be considered urban even if large parts are 'planned' as forestry reserves or agricultural land, to ensure that inappropriate development does not take place in areas which were formerly rural.

8.2.4 Roads and Drainage

Roads are divided into four categories: Principal, Primary, Collector and Local. Principal roads that are of strategic importance are the responsibility of the Federal Ministry of Works, while primary roads are the responsibility of OSMoWT. However, the distinction between the different classifications is not clearly stated nor used. Local Governments are primarily concerned with Local and some Collector roads, though some of the roads may be part of the Federal or State system. This confusion makes the planning and development of the main road networks within the urban area of the city difficult to delegate to any agency and raises the question of who should be involved. Drainage is mainly connected to road networks and so the authority responsible for building the roads also builds the drainage system. However, these systems are connected by primary drainage, which is under the remit of the Oyo State Ministry of Environment and Water Resources (OSMEWR), working through the Local Governments.

Clearance of drains around property is the responsibility of the property owner, while the Office of Drainage Services has overall responsibility for clearing the drainage system that falls under the State.

8.2.5 Solid Waste

Solid waste is one of the major challenges to all local governments and Ibadan is no exception. Solid waste is also a major contributor to blocked drains and flooding. Solid Waste is the responsibility of the OSMEWR, working through the Oyo State Solid Waste Management Authority (OYOWMA), Local Governments and the private sector. Proposals for improving solid waste management includes the provision of safe and accessible waste collection facilities, the development of solid waste transfer stations and the development of material recovery facilities for recyclable materials and the provision of properly prepared final disposal sites. It also requires large scale educational programmes to help develop improved SWM, such as the 3 Rs (Reduce, Recycle, Reuse). Solid waste production increases with the expansion of population and so the planning of the provision of these facilities needs to be properly integrated into the development process.

The New Environmental Law imposes strict penalties on improper waste disposal and was brought into effect in February 2017. The problems will be enforcement, with lack of manpower and because of opportunities for corruption.[4] The new laws will need to be accompanied by public education campaigns and simple ways of reporting

1 Web Page of Government of Oyo State, Ministry of Trade, Investments and Cooperatives. http://www.oyostate.gov.ng/ministries-departments-and-agencies/ministry-of-trade-investment-and-cooperatives/

2 Oxford Business Group 2013. https://www.oxfordbusinessgroup.com/overview/opening-doors-investment-state-set-serve-new-investors-it-streamlines-procedures-and-improves

3 Oyo State Government website.

4 Ajimobi reads riot act to environmental officers by Dele Ogunyemi. Daily Trust 12 January 2017 http://www.dailytrust.com.ng/news/environment/ajimobi-reads-riot-act-to-environmental-officers/128585.html#iHRIUbyPIRYrJLej.99

violations. Overall, the performance of the responsible agencies needs to be monitored with power given to the monitoring body to remove or replace the officials that fail to perform as proposed. Under these laws, the first arrests had been made within a week of the laws implementation.[5]

8.2.6 Water Supply and Sanitation

Water provision throughout the rural areas is the responsibility of the Oyo State Rural Water Supply and Sanitation Agency (RUWSSA). This has responsibility for:

- Water supply: Provision of safe water for the communities through borehole construction.
- Sanitation: construction of communal ventilated improved pit/sanitary platform latrines and establishment / manufacturing of slab production centres.
- Planning monitoring and evaluation units (PM&E), community mobilisation and hygiene education: This is the software component and involves the mobilisation and enlightenment of all communities on water and sanitation activities.

In the urban areas, the supply is the responsibility of the Water Corporation of Oyo State (WCOS). In effect there is no public sanitation system, so the form of sanitation used is mainly pit latrines and latrines connected to septic tanks, although some larger institutions and industries have their own sewage treatment plant. The State has a programme, launched in 2016 to make Oyo State defecation-free by 2025. This involves the development of domestic and public toilets.

8.2.7 Power and Telecommunications

Following the breakup of the PHCN (Power Holding Company of Nigeria) and the privatisation of power generation and distribution, the Nigerian Electricity Regulation Commission was established in 2013. Power generation is handled by six companies while transmission of power lies with one company (TCN) for the whole of Nigeria. The distribution of power is the responsibility of the Ibadan Electricity Distribution Company. Development of the power system will therefore need to involve agreement with the respective companies. However, the main issue would appear to be the limited power generation capacity and the poor state of the transmission lines.

Telecommunications are provided by the private sector providers under the control of the Nigerian Communications Commission (NCC). Development of networks will be a decision of the individual providers with the agreement of the NCC.

8.2.8 Tourism and Places of Historic and Cultural Interest

Responsibility for tourism development in Oyo State lies with the Oyo State Ministry of Information, Culture and Tourism, with its two wings, the Tourism Board and the Council for Arts and Culture. Their responsibilities include:

- to rejuvenate the Historical Monuments and Cultural Landmarks of Oyo State in order to attract tourists and gain strong socio-political and economic standing;
- to discover and promote new tourism sites;
- to regulate places of tourism and hospitality; and
- to develop the skills and capacity within the sector.

It also aims at harnessing members of the Yoruba race to promote and develop tourism.[6] A Daily Independent survey of tourists, carried out in January 2015, suggested that little had been done to realise these objectives.[7] However, this criticism may be deemed unfair with the opening of Agodi Gardens with its swimming pool and play area and with the promise of the development of a zoo. The question is whether other places of historic and cultural interest are being developed in the peripheral expansion areas and how much such places are being developed by private investors and aided by the State Government training programmes. The State Commissioner believes that the economic recession can be tackled by attracting more investments to the state's culture and tourism sector.[8]

8.2.9 Housing

Housing provision is predominantly developed by the private sector, individuals and companies. State housing tends to be provided by the respective Government Ministries and organisations who provide accommodation for staff. There are currently 100 identified slum areas requiring attention, but little capacity to deal with these areas[9] and where there is little if any public investment in infrastructure. It is important that the number of such areas do not increase and provision will need to be made for suitable serviced areas to meet the needs of the increasing population.

8.2.10 Education

Public Education is the responsibility of the Oyo State Ministry of Education (OSMOEd), who are responsible for planning, design and supervision of schools. A number of bodies play various roles, including:

State Universal Basic Education Board (SUBEB) with its major function of the management of basic education, that is, primary schools in the State;

- Oyo State Post-Primary Teaching Service Commission (TESCOM) responsible, among others, for the appointment, promotion, postings, transfer, discipline, and termination of staff in the State Teaching Service;
- Board for Technical Education (BOTAVED) responsible for running of technical and vocational schools and hiring staff;
- Oyo State Agency for Non-Formal Education (ANFE); and
- Oyo State Scholarship Board.

Meeting the needs of the expansion of the city will require the cooperation and preparedness of all these bodies to play their role and requires consideration of their capacity to meet their responsibilities. The responsibility for design and construction of new educational facilities lies with the Ministry of Works and Transport.

8.2.11 Health

The provision of health facilities is the responsibility of the Oyo State Ministry of Health (OSMOH). The Hospital Management Boards are responsible for staffing their respective hospitals. The Boards also undertake minor repairs. Major works require the involvement of the OSMOH. The Ministry is also responsible for the training of workers in the sector, and for disease control and laboratories for testing water and food.

The Oyo State Ambulance Service provides free ambulance services in the State and is being expanded.

The main teaching hospital, University College Hospital is under the Ministry of Health of the Federal Government. Doubling the population will require increases in the capacity of the health sector, with more infrastructure and staff. This will need coordinating with plans for urban expansion.

5 Inside Ibadan – Latest News https://ibadankiniso.com/another-10-arrested-in-ibadan-for-flouting-environmental-laws/

6 Ministry of Culture and Tourism web page.

7 Source: allafrica.com/stories/201501160053.html

8 Oyo identifies culture, tourism as key to tackling recession by Yinka Adeniran, – The Point, October 29, 2016. http://www.thepointng.com/oyo-identifies-culture-tourism-as-key-to-tackling-recession/

9 Consultant's interview with O.G.Olutade and S.B. Taiwo (Head and Deputy Heads of Strategic Spatial planning Department of Ministry of Lands, Housing and Physical Planning, 1st August 2016.

8.2.12 Parks and Recreational Areas

There is no information available on the operation and maintenance of parks and open spaces.

8.2.13 Agriculture

Agriculture policy is the responsibility of Oyo State Ministry of Agriculture, Natural Resources and Rural Development (OSMOA). Agriculture is seen as the most important part of the State's economy and the Ministry's mission is to maximise the efficiency and effectiveness of this sector. The Diagnostic Report[10] for the Masterplan identified highly productive agricultural and woodland areas, which need to be protected. The near doubling of population will put considerable pressure on these lands. Planning and development control will be essential to this effort.

8.2.14 Security Services

Security services are provided by the police and fire services. Ibadan is served by the Oyo State Fire Service, which has 13 fire stations across the State including up to six that serve the peripheral city area.[11] The Federal Fire Service, which is part of the Federal Ministry of Interior, provides training for fire officers. The Ministry also includes the Nigerian Police Force, which is represented in Oyo State by the Oyo State Command. There are eight police stations in the core urban area.[12] Problems in the past have been the lack of funding for equipment and with the level of education of police officers. Training of fire officers is undertaken by the National Fire Academy.

These two agencies must work closely with the State Government in times of natural or man-made disasters. Their inputs are coordinated by the Oyo State Emergency Management Agency (OSEMA), which is an office directly under the Governor. Disaster Risk Management requires the planning and preparation of not only the first responders (which includes the ambulance services and hospitals) but pre-disaster planning. This includes the planning of how the state and voluntary organisations will respond to a disaster, the provision of suitable collection points or areas for temporary shelter for those affected, but also how to minimise the risk of disaster and finally how to ensure the efficient deployment of the rescue services and the evacuation of those affected by the disaster or at additional risk because of the first disaster. This requires the involvement of the physical planners, land management agencies, schools, health services, roads and public transport, the agencies responsible for power and water with those agencies that concerned with drainage and flood management.

8.3 THE OPTIONS

The task of coordinating, implementing the masterplan, facilitating and encouraging growth of the city in the desired areas and limiting it in others, requires a cross sectoral approach. At present, the only institutional bodies with cross sectoral responsibilities are the existing PIU for the World Bank supported Ibadan Flood Prevention and Management Project and the Oyo State Planning Commission. However, as mentioned, neither is able to fulfil the requirements for the institutional arrangements to implement the Masterplan. The Oyo State Planning Commission does not have the status required to coordinate other MDAs and is more focused on policy than implementation. The PIU, on the other hand, has limited capacity, especially where it is necessary to be pro-active in the realisation of the proposals. It is, therefore, recognised that for a limited period at least, a strengthened institution will be required, supported in legislation.

It has been suggested that Ibadan should become a separate State. This is not the option preferred, at this time, as this is a Federal responsibility and will require a number of adjustments in administrative boundaries, a task that may take years to be approved. Another suggestion is that a local government should be established for the metropolitan area and this should be headed by an elected Mayor with extensive powers. Given the State's policy for lean government and the limited resources available, such proposals would inevitably lead to greatly increased staffing requirements. Such management models will put a strain on the capacity of the State.

The criteria for the selection of the best option are as follows:

- The institution must have the power to control the use of land and coordinate the delivery of the utilities and public facilities in a timely manner,
- The institutional arrangements must not increase the cost burden on the State significantly,
- The institutional arrangements must receive the support of the political establishment and of the administrative establishment (the MDAs).

Three options have been considered in detail:

- No institutional changes, but focus on capacity building and improving the way the existing organisations operate.
- The creation of an Ibadan Development Authority to coordinate all the work required to realise the Masterplan.
- The establishment of a Special Coordinating and Monitoring Unit to ensure that the cooperating MDAs have included in their rolling development plans and annual budgets those development projects required for the realisation of each phase of the Masterplan.

10 Dar, 2017.

11 These include HQ, Agbowo Fire Station, Mapo Fire Station, Molete Fire Station, Aleshinloye Fire Station, New Gbagi Fire Station and Agugu Fire Station.

12 These are the Police HQ, Apete, Songo, Mokolo, Gbagi, Iyangkaku, Orita and Kuola.

8.4 THE OPTIONS REVIEWED

8.4.1 Option A: No Change but Focus on Capacity Building

This option requires the least structural realignment. The MDAs retain their responsibilities. The major cost element will be in the equipping and training of staff. However, it will also require the passing of a new law that sets out the structure and responsibilities of the physical planning agency (in this case the Bureau of Physical Planning and Development Control – BPPDC). This option, however, is not exclusive and will be required for the future development of Oyo State, especially given the importance of attracting private sector investment to realise the plan. Hence, improving the systems and capacity of the existing urban development agencies, the building of key infrastructure and the development of community and public facilities, will all contribute to making Oyo State a more attractive location for investment.

The proposed planning law should include:

- The types of plans, identifying who is responsible for preparing the plans, the requirement for stakeholder consultation, system for plan approval, review and revision, the rights of appeal, etc.
- The functions of the Bureau – Policy making, the preparation of a State-Wide Spatial Development Framework, special area plans (e.g. areas of strategic importance, urban regeneration, etc), quality control and supervision of District Planning Offices, preparation of planning regulations, etc.
- Clarification of the rights of citizens and other stakeholders to be consulted.
- Creation of an independent tribunal for appeals.
- Identification of a system of sanctions in law and the powers to review and revise these sanctions.
- The responsibility and requirement of implementing regulations, including Planning Guidelines, Planning Standards and Building Regulations.

Other key areas where institutional strengthening is required include:

- Development of a Land Use Management and Information System, with the training required to operate the system.
- Development of the abilities of all MDAs to prepare multi-year rolling programmes and budgets and to monitor progress.
- Development of the skills of the urban planners, including the preparation of development plans.

Land Use Management and Information System plus GIS Training

The ‘architecture’ of the land use monitoring and information system needs to be developed, which would clarify the geo-referencing system, the information to be collected, the rights to access the information, the rights to change or add to the data and the system for backup. The protocol for all of this needs to be agreed by the main users and supporters of the system. The system will need to be based on mapping produced from ortho-rectified imagery, flown or based on satellite imagery with control points. This imagery will need to be provided at agreed levels of accuracy dependent on the use for which it is being used. The images will need to be ground-truthed to verify the accuracy of the image. The preferred software will need to be chosen. While ArcGIS and ArcInfo provide simple ways of establishing the system, the wider use of such software is expensive and much of the freeware available is compatible and can be programmed to provide the same sort of data at the cost of the system designer. If such a software is preferred, there are no or limited costs for renewing the license. The choice is between the speed of implementation against long-term costs.

Once the system has been designed, staff need to be trained in the use of the system including transferring what was previously in hard copy, through scanning to digitised images and into accurate maps using the base maps provided by the preferred system of remote sensing. The task facing the State is the transfer of all hard copy titles and cadastre into soft copies. This task should be applied initially to new plots and plans and later should include historic documentation, as the latter task is likely to take a number of years. The state will also need to make an order that after a specified date, all land plot data and physical development plans must be produced in digital format based using the agreed system for coordinates. In the meantime, training can begin for members of the major land agencies to use the software. As the ICM provides some ArcGIS licenses, the first people have been given training in the use of this software and so are in a position to become the trainers of further groups. About 50 persons are identified as needing such training. Longer-term training will need to be taken forward and will take up to two years; the long-term programme for the digitisation and accurate recording of all the existing data will take up to ten years. In the meantime, all new data would be added in the format.

For this system to be implementable, a considerable amount of equipment is required to produce the digital maps and to store the data. Hard copies of maps and plans need to be stored in such a way that they do not deteriorate. Local surveyors will need to be trained in preparing their data in the accepted digital format and where they are unable to do this, an agreed system of fees should be imposed which would enable the private surveyor to have the Survey Department or Planning or Lands departments prepare the drawings in the new format.

Multi-Year Rolling Programmes and Annual Budget Preparation

All MDAs need to be able to produce multi-year rolling programmes and budgets. The programmes need to be linked to the phasing of development identified in the Masterplan and other State development plans and priorities. This will be done in close association with the Ministry of Finance, Planning and Budget.

Urban Planning Skills Development

The staff of the Bureau include district planning officers. Most have qualifications but need greater experience. Few of the staff have experience in the development of strategic development plans, going beyond land use planning. This will be important for the application of the proposed revised integrated physical planning law. As part of the process, a review of the available training institutions, including skills and staff availability must be undertaken. The NITP have continuous professional development courses but each year offer a different area of study, which may not meet the needs of the planners in the Bureau. A review should be carried out with the help of the University of Ibadan, which currently offer post graduate courses, to provide courses which meet the needs of the Bureau and District office staff.

8.4.2 Option B: The Creation of the Ibadan Development Authority

Defining the Problem

This option recognises the need for a single agency that can coordinate the work of all the MDAs identified in Section 8.2 and proposes a dedicated institution that has the status and power to oversee the development of the city from its current population of 6.1 million to 11.6 million by 2036, such that it is able to provide an adequate quality of life for those living in it by that date, which puts emphasis on agriculture as a key source of economic development, while developing a multi-nodal approach to the development of the expansion areas, with new employment and commercial centres developed around and outside the old core urban area. This Institution, which the consultant refers to as the Ibadan Development Authority (IDA), would be the executive agency for overseeing and coordinating the implementation of the Masterplan. Its remit would be the total Ibadan masterplan area, covering 11 local authorities. The Authority would be answerable to the Governor directly, but would be overseen by a Board.

A number of key activities need to be addressed by the agency or authority that will coordinate the realisation of the Masterplan. First, critical to the management process is the way in which both the overall and local plans are developed, such that the process facilitates the 'buy-in' of key stakeholders. This will help ensure compliance with the plan for not only will the land zoning and allocation reflect the desires of potential investors but will be better understood by residents who may help identify non-conforming land uses and so help the Ministry supervise and monitor its implementation. The Masterplan has gone through a number of draft stages during which the proposals were the subject of stakeholder meetings, including Local Governments and Community Development Associations, State MDAs, academia and research institutes. This must continue and be extended when detailed plans are prepared to facilitate future 'buy-in' by all sectors and interest groups. 'Buy in' to the plans produced is one way greater compliance can be assured as both developers and affected residents can play a more active role in ensuring the plans are followed as approved. Currently, there is no legal requirement for full stakeholder consultation at the planning stage and no legally established procedure for objections and any review of the proposals by an independent body (tribunal). These issues will need to be included in any revised urban planning law, as proposed in Option A.

The second consideration is how to attract investment. Without investment by both the State and the private sector, business will not thrive and jobs will not be created, meaning people will not wish to settle in the proposed expansion areas. The proposed agency or authority needs a department to lead the campaign to attract investors. It will require the support of the MDAs responsible for acquiring land, providing the infrastructure and facilities that make a place attractive to investors and meets the needs of a fast-growing community. The system of management of the proposed agency will have an impact on the success of the key agency or agencies to attract investors and residents. Studies in the UK have shown the towns that grew most successfully and according to plan had horizontal as opposed to vertical management structures, where all levels of administration had easy access to top management and administration was open to suggestions from the community and other stakeholders. While vertical management structures tend to be more efficient in the development of the physical infrastructure, they were often unattractive to investors or those with initiatives for the development of a cohesive and dynamic community.[13]

Care must be taken that the plans do not result in land speculation. Most of the expansion areas are in rural districts. In such areas, the decision to sell land lies with the Local Government and the Board of Investments, whose main concern is the viability of the investment. However, such a system is open to abuse and land may be purchased by a speculator based on a totally false scheme with the intention of reselling the land to genuine settlers at a later date when prices of land have risen substantially. The preferred body responsible for the oversight of the Master Plan's realization needs to be able to over-rule or control decisions made by the Board of Investments, revoking leases where the proposed developer has not acted within a reasonable period of time or without just cause beyond their control. For this reason, this function needs to be included in the responsibilities of the supervising authority.

It is recognised that the establishment of an authority will require a structure that does not replicate the role of the Ministries but will bring together teams made up of persons with the skills and the motivation required to meet specific cross-sectoral tasks and achieve clear objectives. There are two alternative ways of staffing the proposed authority structure. These are, either to second staff from existing MDAs, or to use open recruitment for all positions. There are advantages and disadvantages to both proposals. The advantage of the first is that those hired should be better able to work with their 'mother' departments or agencies, but, as a disadvantage, will possibly be more process, rather than results, oriented in their working styles. The advantage of the second is that the staff are likely to be less bureaucratic in their way of working and be more results oriented. However, they would possibly be less familiar with the workings of the existing MDAs with whom they may have to cooperate. If all the staff are seconded from the existing agencies, it will undoubtedly result in some strain on the capacity of those same agencies. Although, with Ibadan currently using 70% of the State's investment budget, the roles of most of the existing MDAs will be substantially reduced, even if spread geographically more widely. This could result in some resistance to the IDA concept.

A compromise is proposed whereby all positions in the IDA would be advertised on the open market, but members of MDAs would be entitled to apply. All positions would be on fixed term contracts, renewable if the performance of the person in the position is considered satisfactory and their work is still required. Those from the MDAs would be able to return to their old positions and rank after completing or ending their contract. Salaries in the IDA would be higher but there would be no pension contributions from the Authority during their employment. This will reduce the cost of employing the staff while giving the choice to the employee.

The establishment of the authority needs to be based on law. A new law will need to be approved that will identify the IDA's area of authority, its roles and structures and the relationship between it and the existing MDAs and the system of funding. This should be accompanied by a review of the ability of the existing MDAs to act effectively in fulfilling their revised role, including an evaluation of their legally defined powers, their manpower and skills capacity to take on the tasks and on their funding. Clear lines of responsibility will need to be established between the Authority and the present MDAs of the State and Federal governments. In particular, the functions of the BPPDC under the Governor need to be clarified and established in law as proposed in Option A, so that the roles and responsibilities included in the Oyo State Regional and Urban Planning Law of 2001 are operationalised and revised in such a way that it takes into account the need to strengthen the role of the residents and stakeholders in the planning process, and the present status of sub-state level local governments. While the IDA will be the planning authority within the whole Masterplan area, the Bureau will still have a policy making and standard setting role for the whole State including Ibadan and as such will be responsible for overseeing the processes required by law are followed. Further, the appeal mechanism established for the State can be applied in cases where there are appeals from stakeholders within the IDA planning area. However, the preparation of plans and their approval will be the responsibility of the Authority

Not all functions of existing MDAs will need to be absorbed by the IDA. The staffing and running of most social facilities, such as schools, hospitals and health clinics should remain with the relevant MDA. However, the IDA must always work closely with the institution or agency responsible for staffing, operations and maintenance to ensure that they have incorporated the increased requirements in their longer term budget pans. If the MDA responsible is unable to do what is expected of them in terms of staffing and other running costs for budgetary reasons, the Authority should have the power to provide temporary assistance, especially in areas where the operationalisation of the facility is essential to the strategy for encouraging specific areas of growth as part of the Masterplan.

Ibadan Development Authority Board

The IDA would have a Governing Board, headed by the State Governor and with the commissioners of the key Ministries, including:

- the Bureau of Physical Planning and Development Control in the Governor's office,
- the Ministry responsible for Lands and Housing,
- the Ministry of Economic Planning,
- the Ministry of Justice,
- the Ministry of the Environment,
- the Ministry of Local Government,
- the Ministry of Public Works and Transport,
- the Ministry of Agriculture,
- the Ministry of Trade, Investment and Cooperatives,
- the Bureau of Investment Promotion,
- the Disaster Management Agency,
- representatives of the private sector, such as the local Chamber of Commerce,
- respected members of the Academe, and
- the heads of the Local Governments or CDAs and possibly influential representatives from Non-Government Organisations.

The Board will be free to include in its deliberations other persons who will not have a vote in any resolution of the Board. The Board will also have a Secretary, who will be a lawyer. Any member of the Board should declare any personal interests they have in the issues discussed by the Board, and should face automatic dismissal if they fail to do so.

13 See work of Dr Maurice Broady 1926-2010.

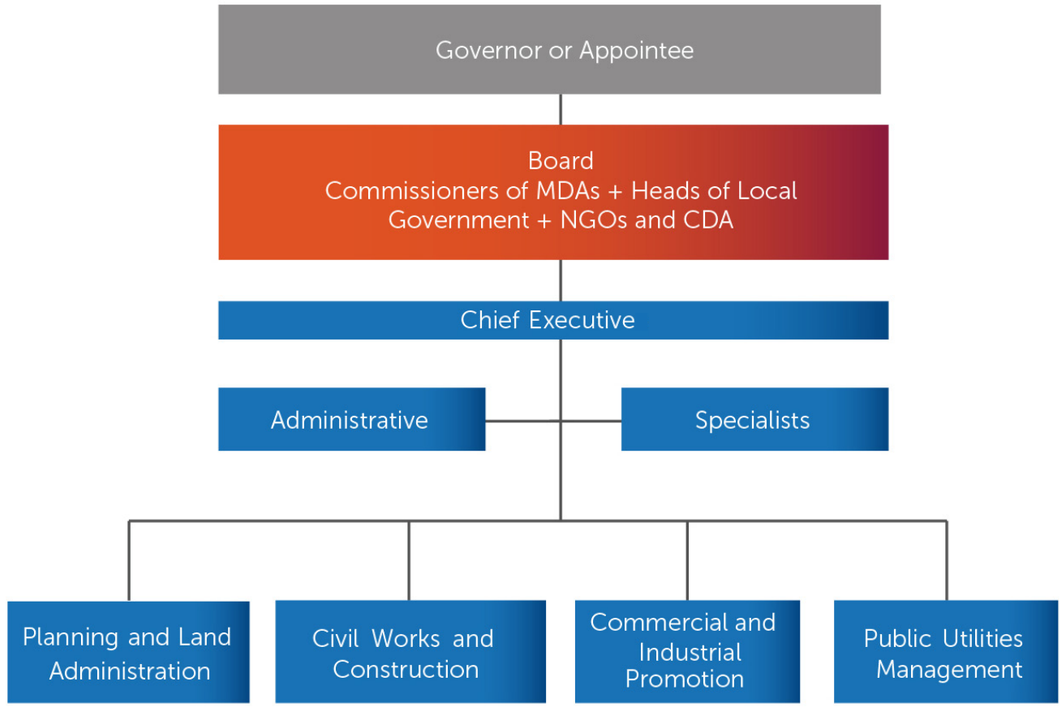

Figure 8.1: Organogram of Ibadan Development Authority

The functions of the Board are:

- to approve the annual work programme and budget;
- to approve variations in the plan; and,
- to accept contracts entered into by the Authority above a certain pre-determined value.

The Chief Executive would be expected to report to the Board on a regular basis, and to prepare an annual report on progress along with the annual budget. The Board would also use its influence to lobby for help and cooperation from the Federal Government. The Chief Executive would attend meetings of the Board but not be a member, as he or she would be required to report to the Board on progress and the Board would be the ultimate judge of his/her performance and have the authority to replace the Chief Executive.

The Functions of the Authority

The IDA would be an executive body, with the status of a Ministry within the Oyo State Administration. The Authority would be established by law and have a dedicated budget line in the State budget. The Chief Executive would be selected by the Board but appointed by the Governor. The Chief Executive should be someone with a strong background in commercial development or investment banking, but with an understanding of environmental issues and a record of integrity.

The Authority will be responsible, amongst others, for:

- Realising the implementation plan, including preparing, where needed, detailed plans; undertaking consultation with stakeholders and affected families;
- Requiring and reviewing EIA on the detailed plans for development and sending them for approval by the State Ministry of Environment;
- Preparing a phased transportation plan with the Ministry of Works and Transportation to complement the area development proposals;
- The development of a tourism programme in cooperation with the Tourism Board and the Council for Arts and Culture;
- The promotion of programmes aimed at assisting women, minorities and the disadvantaged, with the assistance of the Ministry of Women's Affairs and Social Welfare;
- Preparation of detailed plans, identifying suitable areas for specific needs, social infrastructure and the security services, as well as other major land users, such as housing, industry and commercial development with plans for all infrastructure;
- Working with the Federal authorities on the linkages between the road and rail network which forms part of the plan, including upgrading, and the National Principal roads and proposals for a new fast rail track linking Lagos with Abuja via Ibadan;
- The design of all other roads that are the responsibility of the State or local government which traverse the area of the city;
- The development of social facilities such as schools and hospitals or primary health care centres would be negotiated with the State Ministries of Health and Education as staffing and providing operational budget would involve the responsible agencies;
- Drainage and flood management within the boundaries of the city with the cooperation of, and in conjunction with, the State Ministries of Works and Environment;
- Drainage cleaning undertaken in conjunction with the Office of Drainage Services;
- The development of programmes for improved solid waste management in conjunction with Oyo State Slid Waste Management Authority, and would encourage private companies to participate and exploit opportunities for recycling waste;
- The protection of agricultural land, which is an important part of the development option chosen;
- Improving the quality of agriculture and the means of processing and marketing the products. The Authority will need to work closely with the Ministry of Agriculture, Natural Resources and Rural development, as well as with the local farmers themselves, based on the strategy included in the Masterplan;
- Encouraging investors to help improve the productivity of the sector and to develop markets for the produce, including the food processing sector; and
- The Masterplan proposes an Environmental Management Plan covering concerns for soils, water supply, ecology including forest areas and the fauna and flora they support, air quality, noise pollution and cultural heritage sites. The Plan would be the main management tool for the Authority of the environmental impact of the development process and to evaluate the various areas of activity. Such a plan would be developed in close conjunction with the Ministry of Environment and the State Environmental Protection Agency.

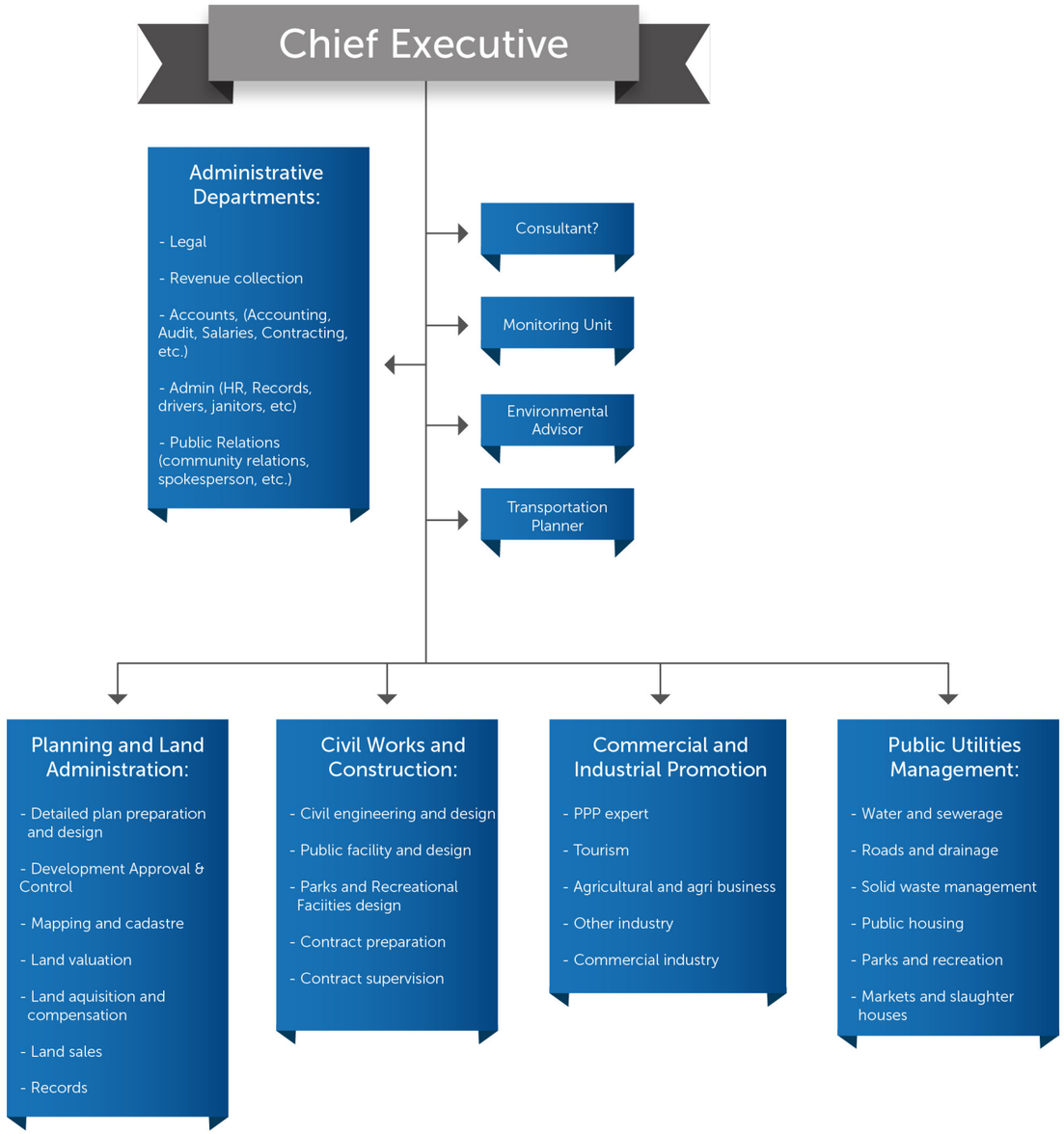

Figure 8.2: Structure of Ibadan Development Authority

Operation of the Authority's Departments

The size of each department will vary according to the task. It is expected that a fully staffed Administrative Department will have about 20 staff members, excluding any cleaners, drivers, etc. Planning and Land Administration will require around 20 professional and sub-professional staff, while the Civil Works and Construction Department will require a similar number depending on the stage of the work and may vary based on the work load and stage of development. The Commercial and Industrial Promotion Department is expected to require about ten staff, while the Public Utilities Management Department would have an office staff of around 15, but would require additional field workers and daily labour. The total staff is, therefore, expected to be around 100, with the majority of these being drawn from existing MDAs of Oyo State.

The Administrative Department is an office directly under the Chief Executive as will be the transportation planner, the environmental specialist and the monitoring specialist, as all these tasks cut across a number of sectors. The transportation specialist will work in conjunction with the State Government,addressing transportation policy covering both land and water transport. The Environmental Advisor will have responsibility for the realisation of the Environmental Management Plan (EMP) and will have oversight responsibilities for all other departments to ensure the standards established in the EMP are achieved. The Monitoring specialist will be responsible for developing the monitoring system and making regular reports on progress. In the Administrative Department, the Public Relations section of the office is extremely important in ensuring the dialogue between stakeholders and the Authority is maintained throughout the development process.

The Planning and Land Administration Department combines land use and land administration, and will be the department responsible for preparing detailed plans and the zoning regulations. It will be the department that must give the development permit, including the conformity with land uses but also check the structural integrity of the building planned. The department will also facilitate the leasing of land parcels to investors and the identification of suitable land parcels for all sorts of development. The department will also ensure the land is available and properly surveyed and recorded. This department, with the approval of the Board, should be able to offer incentives to developers proposing investment in the desired development. A precedent for this, with 80% price reduction for non PPP investors has been established[14] and should be used judiciously by the authority, with its availability conditional on the developer starting and completing their planned investment within an agreed time limit, during which the land cannot be sold or transferred to a third party.

The Civil Works and Construction Department will prepare the structural designs of infrastructure and public facilities. It will prepare the necessary specifications for the designs and with the Administrative Department, Contracts section, assist in evaluating tenders. Later, they will supervise the work of the contractor.

The Public Utilities Management Department will manage the public utilities and services, and at a time approved by the Board, hand over these to the State bodies responsible, or to the private sector. Where a PPP arrangement is considered advantageous, the Department will help design the terms and conditions and monitor the effectiveness of the service provided.

The Commercial and Industrial Promotion Department is responsible for developing policies and programmes for approval by the Board, for the encouragement of investment in tourism, commercial and industrial development. Part of its task will be the monitoring of a tourism development plan. In addition, the department has a PPP specialist who will identify opportunities for private investment in the construction and management of the public utilities, including water, sanitation, solid waste, markets and transport systems.

It should be noted that while the physical infrastructure and public facilities will be developed by the Authority, most of the community facilities will be handed over to the responsible Ministry on completion and the staffing, operations costs and maintenance will be the responsibility of these same Ministries. Likewise, police and fire stations will be staffed and operated by these respective services. Over time, some roads and the drainage system will be handed over to the State Ministries or the local government.

14 The Report: Nigeria 2013 by the Oxford Business Group.

Financial Considerations

The budget required to realise the Masterplan will be part of the State Budgetary system. This will require the Ibadan Development Authority Board to submit its budget to the Ministry of Economics, Planning and Budget. The funds are dispersed through the Ministry of Finance. The problem faced by many agencies is that the funds available do not match the budget due to changes in revenue available.[15]

There is a need to focus capital expenditure in sites that can most quickly provide a return, which in its turn can result in the administration receiving greater revenue from this source. Were the sites to be serviced before their allocation and sale, the price they could command would be greater. Further, it is important that any land tax component should be regularly updated and take into account the development plans for the area. The proposed programme to update the land tax maps and to digitise and geo-reference the cadastres, needs to be implemented. Were this task to be speeded up and focus given to the land within the expansion areas, the revenue would be considerable as rural or fallow land is converted to urban uses.

For this to benefit the Ibadan directly, legislation may be needed to enable the Authority to 'ring-fence' some of the revenue from land sales and land taxes for the exclusive use of Authority in the development of the city. The power to do this could be linked to the life of the Authority, which should not exceed the proposed phasing programme of 20 years. Further, the proposal to give the Authority the power to waive certain taxes and charges will also need to be included in the legislation proposed for the establishment of the IDA.

The budget for all State initiated development within the masterplan area will be centralised in the Authority. This will include the current budget allocations to the LCDAs and the Local Governments, even though the latter receive their funds from the Federal Government. As current practice is for these funds to be managed by the State Government, the delegation of managing the distribution to the Authority should not pose a problem, although it should be identified in the proposed law establishing the IDA.

Role of Stakeholders

Stakeholders include not only residents and land owners, but MDAs of the State Government, Pressure Groups and NGOs, CDAs, Local Governments, representatives of Industry and Commerce, the security agencies, organisations of the farming community and academics in a wide range of disciplines that either have a direct interest in the city or parts of it, or in the impacts of potential development to the expansion areas and their populations. In the preparation of detailed plans for each sector, the Authority will work with State and at times, Federal Agencies, to reach a mutually agreeable plans, programmes or projects. In the planning process, stakeholder participation is formally part of the planning process in Oyo State. Time must be given for the existing residents, land owners/claimants and other stakeholders with an interest in the area concerned, to make representation to the planning division of the Authority. Where possible, exhibitions should be arranged to demonstrate the spatial and visual impact of the proposals, including the environmental impact. These exhibitions should precede the holding of 'town hall' meetings in the locality. The media should be encouraged to come to the meetings. However, to formalise the involvement of the community in the Development Authority, the establishment of a State-wide Community Development Advisory Council[16] representing all the Local Government and Local Council Development Areas is proposed. This Advisory Council would elect from their members, representatives on the Board of the Authority. This will also ease any eventual handover of the management of the different areas to the local government at the end of the 20 years identified for the plan's implementation.

One problem facing the Authority is how to ensure that the desired types of development take place where and when wanted. While public participation in the planning process should increase the likelihood that there will be fewer abuses of the plan, the provision of land with services does not guarantee participation. This can only be facilitated or encouraged by the identification of sites and the servicing of those sites. A further incentive may be provided through a system of financial benefits. If certain charges can be waived, for a specific period of time, this makes the development in the growth areas more attractive.[17] The Authority would take on the role of the Land Allocation Committee, presently exercised by the Commissioner. The Authority would need to make this clear to all possible investors exactly what sorts of development the Authority wishes to encourage. However, if they do so, it must be done in a transparent manner.

The Next Steps

The creation of the IDA requires legislation. Further, it will need to be agreed. Initially, the Authority will be heavily dependent on the State budget and, if the system of recruitment requires the release of MDA staff, on the willingness of these MDAs to release them. The structure of the Authority will not echo the State Administration. It is often suggested that the different departments and agencies do not communicate well with each other. The IDA will need to have a different management structure and system. The formulation of this structure is a priority task, in addition to the following:

- Agreement by the ExCo on the structure of the Board and Authority.
- Agreement on the way of staffing the proposed IDA. The second alternative is preferred: the recruitment of all staff on performance based, time limited contracts, open to both existing MDA staff and the general public, with the rights of MDA staff so recruited to return to their MDA at the end of their contract.
- Establishment of the Working Group by Executive Order, staffed from the current Ministry of Justice, the BPPDC, the office of the Head of Services, the Ministry of Finance and Budget with the specific function of developing and drafting the law and preparing material for the sensitization of law makers (Note: this task must be given a strict timetable, such that the draft law is ready for consideration by the Governor and ExCo within 6 months of its establishment). The draft law would be accompanied by a timetable for the approval of the Law.
- Programme for the sensitisation/enlightenment of the law makers, so they will see reasons to pass the law to set up the IDA. Comments on the law should be taken into account to improve its acceptability.
- Based on the draft law, the Governor will give an initial Executive Order to set up the IDA, and recruit the Chief Executive, who will in turn recruit the staff he/she requires to begin working on the programme for the implementation of the Masterplan. The Chief Executive has the Status of Commissioner and would be ex-officio a member of the ExCo.
- Approval of the law establishing the IDA and the recruitment of staff.
- Approval of the development programme prepared by the Chief Executive and staff by the ExCo.
- Performance Monitoring system established.
- Operationalisation of the IDA.

It is important that the process is undertaken as quickly as possible. Within six months of the establishment of the Working Group, the IDA would be established by Executive Order and the Chief Executive Recruited. The State Government should aim to have the law passed within six months of the Ibadan City Masterplan's adoption and the IDA operational within a further six months.

15 This can be seen in the sharp down turn in revenues experienced in the period 2014 to 2016, when world oil prices fell substantially resulting in a 30-40% drop in the revenues available to the State Budget. See press release http://www.oyostate.gov.ng/2015-budget-speech-of-his-excellency-the-executive-governor-of-oyo-state-senator-abiola-ajimobi-delivered-at-the-oyo-state-house-of-assembly-on-tuesday-23rd-december-2014/

16 Ajimobi schedules monthly meetings with Oyo community leaders. http://www.oyostate.gov.ng/ajimobi-schedules-monthly-meetings-with-oyo-community-leaders/ April 2013

17 Oyo State the Land Use Charges Law of 2012, established a new means of combining the various taxes and charges, such as land rent and tenement charge, betterment tax, all of which were small, into one Land Use Charge. This used a formula that combines land values and property values, as follows: M[(LA x LV)+(BA x BV x PCR)], where m= mill rate, LA = Land Area, LV = Land Value, BA = Built floor area (units), BV= Built Value (units), PCR = Property code rate (depreciation form 1, no depreciation to 0, total ruin). The m value is as follows: Commercial = 0.375%, High Class ? = 0.375%, Rented housing = 0.125%, Educational, health, Industry = 0.125%, pure owner occupier = 0.0375%. Land Values are revised every five years.

8.4.3 Option C: Creation of Special Monitoring and Coordinating Unit

Issues

The analysis, based on workshops involving the MDAs suggest a number of problems with the implementation of the Masterplan and with the establishment of a special Development Authority (such as that proposed under Option B). These are:

- Major problem with the budget allocation to ensure adequate budget available to meet work plan and phasing plan.
- Budgets proposed and budgets realised often result in a shortfall in the amounts available and requiring an adjustment to the budgets and programmes of the MDAs.
- Second option assumes separate budget line for Ibadan Development Authority and complete control over programme and work of staff dedicated to implementation of approved programme. The exclusive nature of such an allocation may result in opposition from other MDAs who see their budgets, and hence power, substantially reduced.

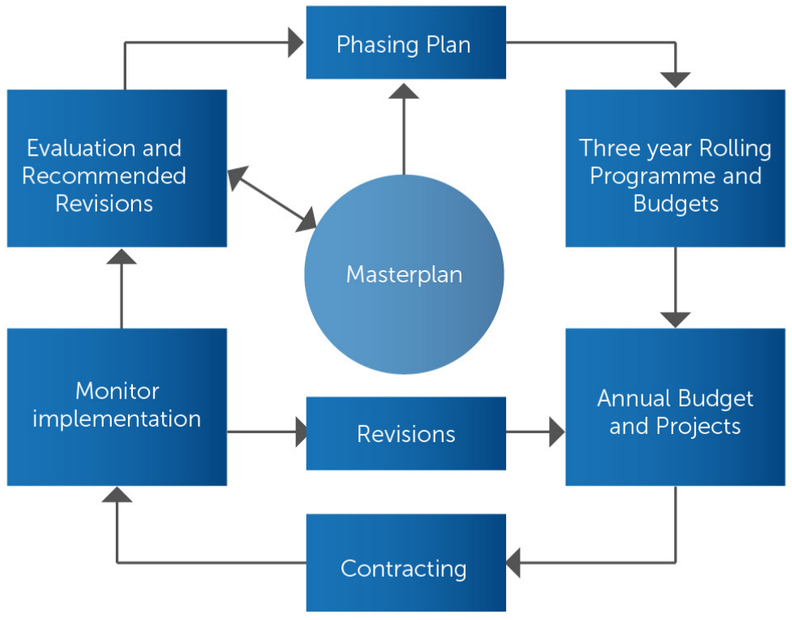

Figure 8.3: The Project Cycle

While budget allocation and availability are not exclusive to the proposed IDA, the issue is critical to the effective implementation of the programme as proposed in the Masterplan. Figure 8.3 shows the project cycle, and identifies the need for continuous updating and revision of the task related budgets and the Masterplan itself.

The third option therefore considers the establishment of a specialist unit to ensure programmes for new development are focused on ensuring an adequate budget allocation is made by each of line agencies to complete annual programme. There is a need monitor the realisation of the plans. This would be through the establishment of a Specialist Monitoring Unit (SMU).

Proposal

This unit will need the authority to require the cooperation of the MDAs and authority to review budgets and the performance of the MDAs concerned. It is therefore proposed that it be housed in the office of the Governor. It will have a dedicated staff, with specialists in finance, monitoring and evaluation of the various sectors (infrastructure, industrial and commercial development, housing, agriculture, transportation, etc.). It should be headed by a person with good financial skills, good technical understanding of developmental issues, and with a respected high degree of integrity.

It is also proposed, as with the second system of recruiting staff for the proposed IDA, that all positions be available to persons from the private sector as well as from existing MDAs. The team members will be hired on performance based limited time-period contracts but with greater salary inducements than available in the present public service, but with less security (no pension scheme). Members of existing MDAs recruited would be able to return to their original MDA at the end of their contract.

The Structure

The Unit would be within the Office of the Governor and be headed by the Chief Executive who would have the rank of a Director General. Effectively, the Unit would be subject to the decision of the ExCo, as the Unit would prepare the annual and triennial implementation plans which would be approved by the Executive Council, chaired by the Governor. Further changes in the phasing of the plan and in the budget allocated to any particular MDA would need to be accepted by the ExCo. As such, the annual programme of work would be implicitly approved by each of the Ministries and Agencies.

The SMU would consist of three departments:

- An Administrative department, responsible for human relations (including the hiring of staff and the evaluation of the work done), finance/accounts (including the preparation of the SMU's own budget and accounting for the expenditures), and a public relations section responsible for preparing reports on the work of the SMU and helping prepare the Annual Report for the ExCo.
- Budget Overview department, responsible for reviewing the budgets of each of the MDAs concerned with the delivery of the programme and checking it seems in line with the approved current phasing plan. The department would also prepare proposals for adjustments in the annual budget where the plan has slipped for whatever reason, and discuss the proposals with the relevant MDA. This department would work closely with the Programme Monitoring department, especially with professional experts in different sectors.
- The Programme Monitoring department. This would review the activities and outputs of each of the sectors (MDAs) towards the realisation of the Masterplan. This unit would work closely with the Project Management Office in the office of the Secretary to the State Government. It would be responsible for helping the MDA concerned identify the causes of any delays or hold-ups in the realisation of their approved programmes and provide advice on how these might be resolved. It would also undertake project evaluations. This department would contain or could contract specialists in infrastructure engineering, land management, housing, agriculture, industrial and commercial development, recreation and tourism, transportation, etc, to help identify the causes of problems within any sector.

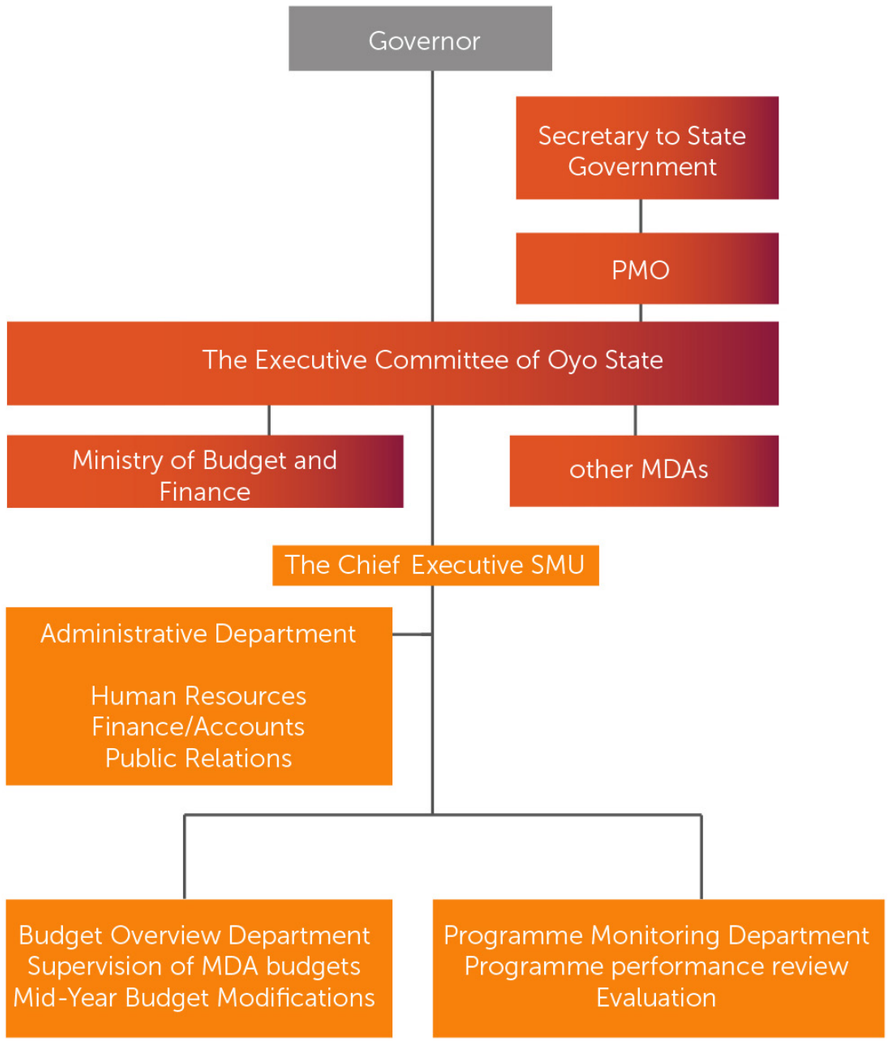

Figure 8.4: Special Monitoring Unit Organogram

Functions

The functions and powers of the proposed Unit would include:

- To require all MDAs to base investment program and projects on the Masterplan and to prepare a three year rolling programme with budgets.
- To review the work programme and phasing plan of the Ibadan City Masterplan and estimate 'level of effort' and hence staffing and budgetary requirements.
- To check budget requests to ensure they meet the required phasing programme of each development area.
- To identify budgetary and resource constraints and advise on revised programmes.
- To monitor fulfillment of the proposed programmes and identify problems and bottlenecks, and advise on follow up action required.
- To identify budgetary and resource constraints and advise on revised programmes.
- To propose revisions to phasing of masterplan implementation.
- To undertake evaluation studies of the 'success' or 'failure' of the plan achieving its objective, identify causes and recommend actions.

Advantages

- Requires minimal restructuring of the Government structure,
- Limited additional staff required.
- System of employment will minimise additional costs being incurred by State and ensure the staff are achievement/output oriented.
- Will improve realism of development programme, with adequate resources (budget and staffing) dedicated to agreed programme.
- Can be applied to all current and future Growth Centres or development areas, to ensure they achieve their purpose.
- Will minimise opposition from implementing MDAs protecting their area of responsibility.

Disadvantages

The weaknesses of this option are similar to Option 2, although while Option 2 requires the establishment of a super agency that takes over the functions of the existing MDAs, this option works with existing MDAs and so will be less controversial. However, these objections are not considered crucial to the realisation of the proposal if the proposal is acceptable to the ExCo and there is true political will. The concerns are:

- To strengthen the authority of the Unit and allow it to require the cooperation of the MDAs, the unit will need to be supported by legislation and political commitment to establish and provide it with the authority to act and if necessary impose sanctions.
- There is a danger of some overlapping responsibilities of the Ministry of Budget and Finance. To avoid this, the Unit will be seen as a filtering service, reviewing budgets before submission to the Ministry of Finance. Further, the Unit will be in a position to argue for the request by an MDA but will also be aware of the need to change the schedule of implementation where budget allocations fall short of what is expected to be required.
- While the remit of the MDAs is often State wide, the focus of the SMU would be (at least initially) the implementation of Ibadan City Masterplan. While Ibadan dominates the economy and investment made by both the State and private sector in Oyo State, there are many other areas where state investment is required, so there is a danger of conflicting priorities in some MDAs.

- Some MDAs may object to being required to provide transparency to their budget preparation and priority-making processes. However, if this is enshrined in law, it will be easier to implement.
- Has no authority to deal directly with the Federal agencies.

Next Steps

The next steps for this option are:

- Acceptance by the ExCo of the proposal to establish a SMU.
- Establish working group with representatives of the Office of the Secretary to the Government, the PMO, the BPPDC, Ministry of Budget and Finance and the Ministry of Justice to draft law on the Special Monitoring Unit's powers and responsibilities. This to report within 6 months.
- Executive order establishing the SMU and the selection of the Chief Executive who would act as an advisor to the working group.
- Programme for the sensitisation/enlightenment of the law makers, so they will see reasons to pass the law to set up the SMU. Comments on the law should be taken into account to improve its acceptability.
- Chief Executive recruits the staff he/she requires to begin working as a special monitoring unit overseeing for the implementation of the Masterplan. The Chief Executive has the Status of as Director General and would be ex-officio member of the ExCo.
- Approval of the law establishing the SMU and the recruitment of staff.
- Budget Overview Department reviews budget of implementing MDAs with regards to the implementation of the first phases of the Masterplan.

8.5 CONCLUSIONS

Three options are offered. However, they are not totally separate. Option 1 is required whatever the decision taken by Oyo State Government is to the options. Option 2, with the establishment of the IDA also requires a Monitoring Unit. However, the Monitoring Unit of the IDA would focus on the performance of the IDA, which is an all-inclusive agency, covering all aspects of Ibadan's future development. The proposed SMU oversees the work of the existing MDAs with regards to the realisation of the proposed programme identified in the Masterplan. There are advantages and disadvantages of both of these options. The SMU (Option 1) will not have direct authority to instruct the particular MDA to prioritise a specific project or programme. This can only come through the ExCo. However, the SMU will have a less dramatic impact on the government system and thus be more acceptable to Oyo State Government and the MDAs within the State and as such have a greater chance of being implanted.

In discussions with various parties within the State Government, both options received some support and faced some opposition. It is considered that both could work given sufficient political support.

The decision, therefore, lies with the Government of Oyo State, so that it can be formally adopted as the way forward by the Governor and the ExCo before submission to the Assembly.

CONCLUSION

9

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9 CONCLUSION

The Ibadan City Masterplan provides a strategy and vision for the future of the city, which spans across 11 LGAs, to the year 2036. Its overall approach is to address the future of Ibadan by:

- Developing a multi-polar city comprising of six Growth Centres distributed across the periphery of the existing urban area, each of which is structured in close proximity or alongside the existing administrative centres for the outer LGAs,
- Connecting these Growth Centres together via a Circular Road which will encircle the existing urban area,
- Providing new linkages into the centre of the city via existing or upgraded radial routes, each of which will carry new public transport systems,
- Accommodating the projected increase in population by identifying new urban expansion areas and infilling existing developed areas,
- Protecting and enhancing existing heritage assets, and utilising these as part of strategy to increase tourism,
- Regenerating the Core Area and Dugbe,
- Planning new areas for economic growth and enhancing existing economic sectors such as agriculture,
- Protecting existing areas of dense vegetation or forest cover as a means to manage and prevent future episodes of flooding,
- Identifying corridors prone to flooding and providing a solution on how to manage these,
- Providing for an adequate provision of utilities and social infrastructure to meet the needs of the existing and future population,
- Reviewing existing institutional arrangements in order to provide a comprehensive framework to implement the masterplan.

The masterplan has been developed in several stages, each of which was presented to stakeholders in a number of forums over several months in 2016 and 2017. The comments received from all stakeholders were fully considered and taken on board, and have informed the final outcome of the strategy.

The stakeholders, which include staff from Oyo State ministries, the World Bank, academic institutions which include the University of Ibadan, the Ibadan Polytechnic, among others, as well as other MDAs and the private sector, have all provided huge and valuable contributions of their time to informing the masterplan. Engagement with community groups has also been invaluable in getting a detailed understanding of local concerns and aspirations for Ibadan.

The reports that form the baseline to this Masterplan include the Diagnostics Report (October 2016, revised June 2017), the Development Framework Scenarios Report (December 2016, revised June 2017), the Stakeholder Engagement Report (December 2017), the Capacity Building Report (December 2017) and the Comments Report (March 2018). These should be consulted alongside this document to obtain a comprehensive picture of the spatial framework for Ibadan.

This Masterplan document is accompanied by Detailed Urban Plans for flood prone areas, the Circular Road and the Core Area, which should be read in conjunction with this report.

A full Strategic Environmental and Social Assessment has been undertaken to support the masterplanning process.

APPENDICES

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APPENDIX 1: POWER SUPPLY

Table A.1: Load Estimate for Existing and New Expansion Areas

LGA	-	-	-	GROSS AREA (HA)	2036 (POPULATION PER ZONE)	EMPLOYMENT 2036	WATTS/ PERSON FOR RESIDENTIAL POPULATION	WATTS/ PERSON FOR EMPLOYMENT POPULATION	DEMAND LOAD FOR RESIDENTIAL POPULATION AT PRIMARY SUBSTATION LEVEL (mw)	DEMAND LOAD FOR EMPLOYMENT POPULATION AT PRIMARY SUBSTATION LEVEL (mw)	TOTAL LOAD AT PRIMARY SUBSTATION LEVEL (mw)	TOTAL LOAD PER ZONE (EXISTING AND NEW) AT PRIMARY SUBSTATION LEVEL (mw)	TOTAL LOAD PER ZONE AT PRIMARY SUBSTATION LEVEL (mw)
IBADAN NORTH	Core	Urban High Density (Inner)	EXISTING	381	180,860	44713	71	500	9.7	22.4	32.0	439.0	439.0
	Other	Medium Density Inner		1,056	166,078	63985	101	500	10.3	32.0	42.3		
	Other	Low Density Inner		38	1,941	191304	245	500		95.7	95.7		
IBADAN NORTH EAST	Core	Urban High Density (Inner)		646	306,326	75,731	71	500	16.4	37.9	54.2		
	Other	Medium Density Inner		222	34,780	86,282	101	500		43.1	43.1		
IBADAN NORTH WEST	Core	Urban High Density (Inner)		201	95,173	23,529	71	500	5.1	11.8	16.9		
	Other	Medium Density (Inner)		387	60,842	23,441	101	500	3.8	11.7	15.5		
IBADAN SOUTH EAST	Core	Urban High Density (Inner)		449	213,009	52,661	71	500	11.4	26.3	37.7		
	Other	Medium Density (Inner)		540	84,888	32,705	101	500	5.3	16.4	21.6		
	Other	Low Density (Inner)		8	414	160	245	500	0.1	0.1	0.1		
IBADAN SOUTH WEST	Core	Urban High Density (Inner)		398	188,834	46685	71	500	10.1	23.3	33.4		
	Other	Medium Density (Inner)		1,133	178,181	68648	101	500	11.1	34.3	45.4		
	Other	Low Density (Inner)		59	2,967	1143	245	500	0.4	0.6	1.0		

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LGA	-	-	-	GROSS AREA (HA)	2036 (POPULATION PER ZONE)	EMPLOYMENT 2036	WATTS/ PERSON FOR RESIDENTIAL POPULATION	WATTS/ PERSON FOR EMPLOYMENT POPULATION	DEMAND LOAD FOR RESIDENTIAL POPULATION AT PRIMARY SUBSTATION LEVEL (mw)	DEMAND LOAD FOR EMPLOYMENT POPULATION AT PRIMARY SUBSTATION LEVEL (mw)	TOTAL LOAD AT PRIMARY SUBSTATION LEVEL (mw)	TOTAL LOAD PER ZONE (EXISTING AND NEW) AT PRIMARY SUBSTATION LEVEL (mw)	TOTAL LOAD PER ZONE AT PRIMARY SUBSTATION LEVEL (mw)
LAGELU	Core	Urban High Density (Inner)	EXISTING	86	40,939	25,000	71	500	1.1	12.5	13.6	168.0	318
	Other	Medium Density (Inner)		2,736	430,276	75,000	101	500	35.9	37.5	73.4		
	Other	Low Density (Inner)		1,054	53,163	32,383	245	500	5.1	16.2	21.3		
	Other	Low Density (Outer)		47	2,380	19,558	245	500	-	9.8	9.8		
	Village	Peripheral and Villages (Inner)		183	16,890	90,254	-	500	-	45.1	45.1		
	Village	Peripheral and Villages (Outer)		517	47,828	0	101	-	4.8	-	4.8		
	High	Expansion - High Density	HD3	275	20,784	66,804	71	500	-	33.4	33.4	150	
	Medium	Expansion - Medium Density	MD1	1,117	169,646	10,121	101	500	16.1	5.1	21.2		
	Medium	Expansion - Medium Density	MD7	44	6,634	13,449	101	500	-	6.7	6.7		
	Medium	Expansion - Medium Density	MD8	456	69,236	7,178	101	500	6.3	3.6	9.9		
	Medium	Infill - Medium Density	IMD2	1,486	221,102	33,646	101	500	18.9	16.8	35.8		
	Medium	Infill - Medium Density	IMD7	417	62,031	58,814	101	500	0.3	29.4	29.7		
	-	Industry	ID7	156	-	13,909	-	500	0.0	7.0	7.0		
	-	Industry	ID8	143	-	12,721	-	500	0.0	6.4	6.4		

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LGA	-	-	-	GROSS AREA (HA)	2036 (POPULATION PER ZONE)	EMPLOYMENT 2036	WATTS/ PERSON FOR RESIDENTIAL POPULATION	WATTS/ PERSON FOR EMPLOYMENT POPULATION	DEMAND LOAD FOR RESIDENTIAL POPULATION AT PRIMARY SUBSTATION LEVEL (mw)	DEMAND LOAD FOR EMPLOYMENT POPULATION AT PRIMARY SUBSTATION LEVEL (mw)	TOTAL LOAD AT PRIMARY SUBSTATION LEVEL (mw)	TOTAL LOAD PER ZONE (EXISTING AND NEW) AT PRIMARY SUBSTATION LEVEL (mw)	TOTAL LOAD PER ZONE AT PRIMARY SUBSTATION LEVEL (mw)
AKINYELE	Core	Urban High Density (Inner)	EXISTING	304	144,228	39,894	71	500	7.4	19.9	27.4	159	357.8
	Other	Medium Density (Inner)		1,915	301,208	120,511	101	500	18.3	60.3	78.5		
	Other	Medium Density (Outer)		481	75,671	18,967	101	500	5.7	9.5	15.2		
	Other	Low Density (Inner)		1,153	58,153	22,405	245	500	8.8	11.2	20.0		
	Other	Low Density (Outer)		387	19,543	7,529	245	500	2.9	3.8	6.7		
	Village	Peripheral and Villages (Inner)		17	1,578	608	101	500	0.1	0.3	0.4		
	Village	Peripheral and Villages (Outer)		306	28,288	20,159	101	500	0.8	10.1	10.9		
	High	Expansion - High Density	HD1	402	30,403	112,480	71	500		56.2	56.2		
	Low	Expansion - Low Density	LD1	3,138	305,096	20,908	245	500	69.6	10.5	80.1	198.8	
	Medium	Infill- Medium Density	IMD1	1,304	194,045	107,422	101	500	8.7	53.7	62.5		

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LGA	-	-	-	GROSS AREA (HA)	2036 (POPULATION PER ZONE)	EMPLOYMENT 2036	WATTS/ PERSON FOR RESIDENTIAL POPULATION	WATTS/ PERSON FOR EMPLOYMENT POPULATION	DEMAND LOAD FOR RESIDENTIAL POPULATION AT PRIMARY SUBSTATION LEVEL (mw)	DEMAND LOAD FOR EMPLOYMENT POPULATION AT PRIMARY SUBSTATION LEVEL (mw)	TOTAL LOAD AT PRIMARY SUBSTATION LEVEL (mw)	TOTAL LOAD PER ZONE (EXISTING AND NEW) AT PRIMARY SUBSTATION LEVEL (mw)	TOTAL LOAD PER ZONE AT PRIMARY SUBSTATION LEVEL (mw)
IDO	Core	Urban High Density (Inner)	EXISTING	167	79,114	21,330	71	500	4.1	10.7	14.8	206.6	481.3
	Other	Medium Density (Inner)		3,935	618,896	133,892	101	500	49.0	66.9	115.9		
	Other	Low Density (Inner)		2,092	105,561	49,188	245	500	13.8	24.6	38.4		
	Other	Low Density (Outer)		42	2,124	13,972	245	500	-	7.0	7.0		
	Village	Peripheral and Villages (Inner)		25	2,300	4,305	-	500	-	2.2	2.2		
	Village	Peripheral and Villages (Outer)		430	39,763	56,673	-	500	-	28.3	28.3		
	High	Expansion - High Density	HD7	238	17,957	46,987	71	500	-	23.5	23.5	274.8	
	Medium	Expansion - Medium Density	MD5	6,408	973,067	46,987	101	500	93.5	23.5	117.0		
	Medium	Expansion - Medium Density	MD6	762	115,674	7,879	101	500	10.9	3.9	14.8		
	Low	Expansion - Low Density	LD3	652	45,270	6,478	245	500	9.5	3.2	12.7		
		Industry	ID4	347	-	30,798	-	500	0.0	15.4	15.4		
		Industry	ID5	183	-	16,262	-	500	0.0	8.1	8.1		
	Medium	Infill- Medium Density	IMD6	1,824	264,857	141,342	101	500	12.5	70.7	83.1		

Table continued overleaf

LGA	-	-	-	GROSS AREA (HA)	2036 (POPULATION PER ZONE)	EMPLOYMENT 2036	WATTS/ PERSON FOR RESIDENTIAL POPULATION	WATTS/ PERSON FOR EMPLOYMENT POPULATION	DEMAND LOAD FOR RESIDENTIAL POPULATION AT PRIMARY SUBSTATION LEVEL (mw)	DEMAND LOAD FOR EMPLOYMENT POPULATION AT PRIMARY SUBSTATION LEVEL (mw)	TOTAL LOAD AT PRIMARY SUBSTATION LEVEL (mw)	TOTAL LOAD PER ZONE (EXISTING AND NEW) AT PRIMARY SUBSTATION LEVEL (mw)	TOTAL LOAD PER ZONE AT PRIMARY SUBSTATION LEVEL (mw)
OLUYOLE	Core	Urban High Density (Inner)	EXISTING	0.24	113	49,171	71	500	-	24.6	24.6	257.1	707.7
	Other	Medium Density (Inner)		4509	709,252	92,025	101	500	62.3	46.0	108.4		
	Other	Medium Density (Outer)		0.16	24.49	120,753	101	500	-	60.4	60.4		
	Other	Low Density (Inner)		2803	141,390	21,521	245	500	29.4	10.8	40.1		
	Other	Low Density (Outer)		26	1,301	501	245	500	0.2	0.3	0.4		
	Village	Peripheral and Villages (Inner)		101	9,300	13,256	-	500	-	6.6	6.6		
	Village	Peripheral and Villages (Outer)		251	23,235	33,116	-	500	-	16.6	16.6		
	High	Expansion - High Density	HD6	516	39,010	78,000	71	500	-	39.0	39.0		
	Medium	Expansion - Medium Density	MD4	9,145	1,354,875	76,124	101	500	129.2	38.1	167.2		
	-	Industry	ID1	151	-	74,267	-	500	0.0	37.1	37.1	450.6	
	-	Industry	ID2	78	-	38,427	-	500	0.0	19.2	19.2		
	-	Industry	ID3	61	-	30,168	-	500	0.0	15.1	15.1		
	-	Industry	ID6	2,125	-	189,121	-	500	0.0	94.6	94.6		
	High	Infill - High Density	IHD4	37	6,939	60,838	71	500	-	30.4	30.4		
	Medium	Infill- Medium Density	IMD5	2,745	398,554	19,450	101	500	38.3	9.7	48.0		

Table continued overleaf

LGA	-	-	-	GROSS AREA (HA)	2036 (POPULATION PER ZONE)	EMPLOYMENT 2036	WATTS/ PERSON FOR RESIDENTIAL POPULATION	WATTS/ PERSON FOR EMPLOYMENT POPULATION	DEMAND LOAD FOR RESIDENTIAL POPULATION AT PRIMARY SUBSTATION LEVEL (mw)	DEMAND LOAD FOR EMPLOYMENT POPULATION AT PRIMARY SUBSTATION LEVEL (mw)	TOTAL LOAD AT PRIMARY SUBSTATION LEVEL (mw)	TOTAL LOAD PER ZONE (EXISTING AND NEW) AT PRIMARY SUBSTATION LEVEL (mw)	TOTAL LOAD PER ZONE AT PRIMARY SUBSTATION LEVEL (mw)
ONA ARA	Core	Urban High Density (Inner)	EXISTING	722	342,498	84,380	71	500	18.3	42.2	60.5	179.8	291.4
	Other	Medium Density (Inner)		2,516	395,755	66,990	101	500	33.2	33.5	66.7		
	Other	Medium Density (Outer)		33	5132	30,819	101	500	-	15.4	15.4		
	Other	Low Density (Inner)		1,069	53,938	20,781	245	500	8.1	10.4	18.5		
	Other	Low Density (Outer)		61	3058	1,178	245	500	0.5	0.6	1.0		
	Village	Peripheral and Villages (Inner)		55	5102	11,582	-	500	-	5.8	5.8		
	Village	Peripheral and Villages (Outer)		180	16625	23,694	-	500	-	11.8	11.8		
	High	Expansion - High Density	HD5	79	5,979	47,733	71	500	-	23.9	23.9		
	High	Expansion - High Density	HD8	522	39,467	55,689	71	500	-	27.8	27.8		
	Medium	Expansion - Medium Density	MD3	899	133,165	30,951	101	500	10.3	15.5	25.8	111.6	
	High	Infill - High Density	IHD3	187	34,597	6,564	71	500	2.0	3.3	5.3		
	Medium	Infill- Medium Density	IMD4	1,098	159,364	31,822	101	500	12.9	15.9	28.8		

Table continued overleaf

LGA	-	-	-	GROSS AREA (HA)	2036 (POPULATION PER ZONE)	EMPLOYMENT 2036	WATTS/ PERSON FOR RESIDENTIAL POPULATION	WATTS/ PERSON FOR EMPLOYMENT POPULATION	DEMAND LOAD FOR RESIDENTIAL POPULATION AT PRIMARY SUBSTATION LEVEL (mw)	DEMAND LOAD FOR EMPLOYMENT POPULATION AT PRIMARY SUBSTATION LEVEL (mw)	TOTAL LOAD AT PRIMARY SUBSTATION LEVEL (mw)	TOTAL LOAD PER ZONE (EXISTING AND NEW) AT PRIMARY SUBSTATION LEVEL (mw)	TOTAL LOAD PER ZONE AT PRIMARY SUBSTATION LEVEL (mw)
EGBEDA	Core	Urban High Density (Inner)	EXISTING	191	90,761	47,225	71	500	3.1	23.6	26.7	229.1	405.9
	Other	Medium Density (Inner)		3,859	606,886	200,000	101	500	41.1	100.0	141.1		
	Other	Low Density (Inner)		957	48,277	34,934	245	500	3.3	17.5	20.7		
	Other	Low Density (Outer)		40	1,999	58,448	245	500		29.2	29.2		
	Village	Peripheral and Villages (Inner)		67	6,154	15,759		500		7.9	7.9		
	Village	Peripheral and Villages (Outer)		52	4,799	6,840		500		3.4	3.4		
	High	Expansion - High Density	HD4	206	15,547	53,284	71	500		26.6	26.6	176.9	
	Medium	Expansion - Medium Density	MD2	5,024	744,357	74,436	101	500	67.7	37.2	104.9		
	High	Infill - High Density	IHD2	160	29,700	43,014	71	500		21.5	21.5		
	Medium	Infill - Medium Density	IMD3	725	105,265	33,129	101	500	7.3	16.6	23.9		
TOTAL				**81,996**	**11,610,415**	**4,092,785**	**8,888**	**-**	**955**	**2,046**	**3,001**	**-**	**-**

The light orange cells represent the total demand loads (mw) of the existing areas at the primary substation level, whereas the grey cells represent the same for the new expansion areas per zone.

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APPENDIX 2: TELECOMS

Table A.2: Triple Play Telecommunication Network Bandwidth Calculations

LGA			ZONE NAME	NET BUILDABLE AREA (HA)	RESIDENTIAL UNITS PER HA	PERSONS PER HA	2016 (POPULATION PER ZONE)	2036 (POPULATION PER ZONE)	EMPLOYMENT 2016	EMPLOYMENT 2036	TELEPHONE CONNECTIONS 2016				TELEPHONE CONNECTIONS 2036				NEEDED EXCHANGES
											CONNECTIONS PER RESIDENTIAL	CONNECTIONS PER EMPLOYMENT	TOTAL CONNECTIONS PER LGA	BANDWIDTH (MEGABITS/S)	CONNECTIONS PER RESIDENTIAL	CONNECTIONS PER EMPLOYMENT	TOTAL CONNECTIONS PER LGA	BANDWIDTH (MEGABITS/S)	
IBADAN NORTH	Core	Urban High Density (Inner)		324	30	472	179960	180,860	56874	44713	9,722	1,137	24,832	868,792	9,722	894	26,820	849,335	phase 1: one new exchange with 99,500 connections. Needed BW: 6,280 Gb/s phase 2: same exchange upgraded to 102,063 connections. Needed BW: 6,298 Gb/s
	Other	Medium Density Inner		898	12	156.5	165252	166,078	29225	63985	10,770	584		454,195	10,770	1,280		482,004	
	Other	Low Density Inner		33	10	50.2	1931	1,941	114497	191304	327	2,290		52,338	327	3,826		83,061	
IBADAN NORTH EAST	Core	Urban High Density (Inner)		549	30	472	304,802	306,326	96,328	75,731	16,467	1,927	22,097	1,471,491	16,467	1,515	21,970	1,438,536	
	Other	Medium Density Inner		189	12	156	34,607	34,780	72,022	86,282	2,263	1,440		148,129	2,263	1,726		159,537	
IBADAN NORTH WEST	Core	Urban High Density (Inner)		171	30	472	94,700	95,173	29929	23,529	5,116	599	9,875	457,181	5,116	471	10,001	446,942	
	Other	Medium Density (Inner)		329	12	156.5	60,539	60,842	10706	23,441	3,946	214		166,392	3,946	469		176,580	
IBADAN SOUTH EAST	Core	Urban High Density (Inner)		382	30	472	211,949	213,009	66,983	52,661	11,451	1,340	18,665	1,023,224	11,451	1,053	18,736	1,000,308	
	Other	Medium Density (Inner)		459	12	156.5	84,466	84,888	14,938	32,705	5,505	299		232,156	5,505	654		246,369	
	Other	Low Density (Inner)		7	10	50.2	412	414	73	160	70	1		1,425	70	3		1,459	
IBADAN SOUTH WEST	Core	Urban High Density (Inner)		338	30	472	187895	188,834	59382	46685	10,151	1,188	24,031	907,098	10,151	934	24,536	886,783	
	Other	Medium Density (Inner)		963	12	156.5	177294	178,181	31354	68648	11,555	627		487,294	11,555	1,373		517,129	
	Other	Low Density (Inner)		50	10	50.2	2952	2,967	522	1143	500	10		10,207	500	23		10,455	

Table continued overleaf

LGA			ZONE NAME	NET BUILDABLE AREA (HA)	RESIDENTIAL UNITS PER HA	PERSONS PER HA	2016 (POPULATION PER ZONE)	2036 (POPULATION PER ZONE)	EMPLOYMENT 2016	EMPLOYMENT 2036	TELEPHONE CONNECTIONS 2016				TELEPHONE CONNECTIONS 2036				NEEDED EXCHANGES
											CONNECTIONS PER RESIDENTIAL	CONNECTIONS PER EMPLOYMENT	TOTAL CONNECTIONS PER LGA	BANDWIDTH (MEGABITS/S)	CONNECTIONS PER RESIDENTIAL	CONNECTIONS PER EMPLOYMENT	TOTAL CONNECTIONS PER LGA	BANDWIDTH (MEGABITS/S)	
LAGELU	Core	Urban High Density (Inner)		73	30	472	40735	40,939	420	25,000	2,201	8	48,746	176,731	2,201	500	87,926	216,058	phase 1: one new exchange with 48,746 connections. Needed BW: 1,696 Gb/s phase 2: same exchange upgraded to 87,926 connections. Needed BW: 3,356 Gb/s
	Other	Medium Density (Inner)		2,325	12	156.5	428135	430,276	75,715	75,000	27,904	1,514		1,176,734	27,904	1,500		1,176,161	
	Other	Low Density (Inner)		896	10	50.2	52898	53,163	40,799	32,383	8,957	816		195,458	8,957	648		192,091	
	Other	Low Density (Outer)		40	7	50.2	2368	2,380	9,355	19,558	281	187		9,355	281	391		13,436	
	Village	Peripheral and Villages (Inner)		155	10	92	16806	16,890	46,394	90,254	1,553	928		49,611	1,553	1,805		67,155	
	Village	Peripheral and Villages (Outer)		440	10	92	47591	47,828	0	0	4,397	0		87,939	4,397	0		87,939	
	High	Expansion - High Density	HD3	55	22			20,784	0	66,804	0	0		0	1,223	1,336		204,691	
	Medium	Expansion - Medium Density	MD1	559	19			169,646	0	10,121	0	0		0	10,344	202		421,867	
	Medium	Expansion - Medium Density	MD7	22	19			6,634	0	13,449	0	0		0	404	269		26,939	
	Medium	Expansion - Medium Density	MD8	228	19			69,236	0	7,178	0	0		0	4,222	144		174,611	
	Medium	Infill - Medium Density	IMD2	728	19			221,102	0	33,646	0	0		0	13,482	673		566,190	
	Medium	Infill - Medium Density	IMD7	204	19			62,031	0	58,814	0	0		0	3,782	1,176		198,347	
		Industry	ID7						0	13,909	0	0		0	0	278		5,563	
		Industry	ID8						0	12,721	0	0		0	0	254		5,088	

Table continued overleaf

LGA			ZONE NAME	NET BUILDABLE AREA (HA)	RESIDENTIAL UNITS PER HA	PERSONS PER HA	2016 (POPULATION PER ZONE)	2036 (POPULATION PER ZONE)	EMPLOYMENT 2016	EMPLOYMENT 2036	TELEPHONE CONNECTIONS 2016				TELEPHONE CONNECTIONS 2036				NEEDED EXCHANGES
											CONNECTIONS PER RESIDENTIAL	CONNECTIONS PER EMPLOYMENT	TOTAL CONNECTIONS PER LGA	BANDWIDTH (MEGABITS/S)	CONNECTIONS PER RESIDENTIAL	CONNECTIONS PER EMPLOYMENT	TOTAL CONNECTIONS PER LGA	BANDWIDTH (MEGABITS/S)	
AKINYELE	Core	Urban High Density (Inner)		258	30	472	143511	144,228	45,355	39,894	7,753	907	49,798	692,826	7,753	798	100,590	684,088	phase 1: one new exchange with 49,798 connections. Needed BW: 2,031 Gb/s phase 2: same exchange upgraded to 100,590 connections. Needed BW: 4,210 Gb/s
	Other	Medium Density (Inner)		1,628	12	156.5	299709	301,208	53,003	120,511	19,534	1,060		823,753	19,534	2,410		877,759	
	Other	Medium Density (Outer)		409	12	156.5	75295	75,671	13,316	18,967	4,907	266		206,949	4,907	379		211,470	
	Other	Low Density (Inner)		980	10	50.2	57863	58,153	10,233	22,405	9,798	205		200,045	9,798	448		204,914	
	Other	Low Density (Outer)		329	7	50.2	19445	19,543	3,439	7,529	2,305	69		47,471	2,305	151		49,107	
	Village	Peripheral and Villages (Inner)		15	10	92	1570	1,578	364	608	145	7		3,047	145	12		3,145	
	Village	Peripheral and Villages (Outer)		260	10	92	28148	28,288	12,065	20,159	2,601	241		56,838	2,601	403		60,076	
	High	Expansion - High Density	HD1	80	22			30,403	0	112,480	0	0		0	1,788	2,250		323,040	
	Low	Expansion - Low Density	LD1	2,197	14			305,096	0	20,908	0	0		0	30,510	418		1,237,112	
	Medium	Infill- Medium Density	IMD1	639	19			194,045	0	107,422	0	0		0	11,832	2,148		559,217	

Table continued overleaf

LGA			ZONE NAME	NET BUILDABLE AREA (HA)	RESIDENTIAL UNITS PER HA	PERSONS PER HA	2016 (POPULATION PER ZONE)	2036 (POPULATION PER ZONE)	EMPLOYMENT 2016	EMPLOYMENT 2036	TELEPHONE CONNECTIONS 2016				TELEPHONE CONNECTIONS 2036				NEEDED EXCHANGES
											CONNECTIONS PER RESIDENTIAL	CONNECTIONS PER EMPLOYMENT	TOTAL CONNECTIONS PER LGA	BANDWIDTH (MEGABITS/S)	CONNECTIONS PER RESIDENTIAL	CONNECTIONS PER EMPLOYMENT	TOTAL CONNECTIONS PER LGA	BANDWIDTH (MEGABITS/S)	
IDO	Core	Urban High Density (Inner)		142	30	472	78,720	79,114	24,878	21,330	4,253	498	72,085	380,037	4,253	427	166,337	374,359	phase 1: 2 new exchanges with 36,042 connections each, (MD6): no exchange provisioned. Needed BW: 2,595 Gb/s Phase 2: same 2 exchanges upgraded to 93,813 connections and BW of 2,629 Gb/s each and a new exchange at MD6+ID5 with 7,536 connections. Needed BW: 1,064 Gb/s
	Other	Medium Density (Inner)		3,345	12	156.5	615,817	618,896	163,156	133,892	40,136	3,263		1,735,977	40,136	2,678		1,712,566	
	Other	Low Density (Inner)		1,779	10	50.2	105,036	105,561	56,962	49,188	17,785	1,139		378,485	17,785	984		375,376	
	Other	Low Density (Outer)		36	7	50.2	2,113	2,124	8,816	13,972	250	176		8,536	250	279		10,598	
	Village	Peripheral and Villages (Inner)		21	10	92	2288	2,300	1,962	4,305	211	39		5,013	211	86		5,950	
	Village	Peripheral and Villages (Outer)		366	10	92	39566	39,763	33,919	56,673	3,656	678		86,678	3,656	1,133		95,780	
	High	Expansion - High Density	HD7	48	22			17,957	0	46,987	0	0		0	1,056	940		159,680	
	Medium	Expansion - Medium Density	MD5	3,204	19			973,067	0	46,987	0	0		0	59,333	940		2,410,923	
	Medium	Expansion - Medium Density	MD6	381	19			115,674	0	7,879	0	0		0	7,053	158		288,436	
	Low	Expansion - Low Density	LD3	326	14			45,270	0	6,478	0	0		0	4,527	130		93,132	
		Industry	ID4						0	30,798	0	0		0	0	616		12,319	
		Industry	ID5						0	16,262	0	0		0	0	325		6,505	
	Medium	Infill- Medium Density	IMD6	894	19			264,857	0	141,342	0	0		0	16,554	2,827		775,217	

Table continued overleaf

LGA			ZONE NAME	NET BUILDABLE AREA (HA)	RESIDENTIAL UNITS PER HA	PERSONS PER HA	2016 (POPULATION PER ZONE)	2036 (POPULATION PER ZONE)	EMPLOYMENT 2016	EMPLOYMENT 2036	TELEPHONE CONNECTIONS 2016				TELEPHONE CONNECTIONS 2036				NEEDED EXCHANGES
											CONNECTIONS PER RESIDENTIAL	CONNECTIONS PER EMPLOYMENT	TOTAL CONNECTIONS PER LGA	BANDWIDTH (MEGABITS/S)	CONNECTIONS PER RESIDENTIAL	CONNECTIONS PER EMPLOYMENT	TOTAL CONNECTIONS PER LGA	BANDWIDTH (MEGABITS/S)	
OLUYOLE	Core	Urban High Density (Inner)		0.20	30	472	112	113	36	49,171	6	1	78,240	543	6	983	203,194	79,159	phase 1: 2 new exchanges, each has 39,120 connections. Needed BW: 2,570 Gb/s phase 2: each exchange is upgraded to 101,597 connections. Needed BW: 7,687 Gb/s
	Other	Medium Density (Inner)		3,833	12	156.5	705724	709,252	124,807	92,025	45,996	2,496		1,939,687	45,996	1,840		1,913,461	
	Other	Medium Density (Outer)		0.13	12	156.5	24	24.49	85,510	120,753	2	1,710		68,472	2	2,415		96,666	
	Other	Low Density (Inner)		2,382	10	50.2	140687	141,390	24,880	21,521	23,821	498		486,381	23,821	430		485,037	
	Other	Low Density (Outer)		22	7	50.2	1294	1,301	229	501	153	5		3,160	153	10		3,268	
	Village	Peripheral and Villages (Inner)		86	10	92	9254	9,300	7,934	13,256	855	159		20,274	855	265		22,402	
	Village	Peripheral and Villages (Outer)		214	10	92	23120	23,235	19,820	33,116	2,136	396		50,649	2,136	662		55,967	
	High	Expansion - High Density	HD6	103	22			39,010	283	78,000	0	6		452	2,295	1,560		308,376	
	Medium	Expansion - Medium Density	MD4	4,573	19			1,354,875	0	76,124	0	0		0	84,680	1,522		3,448,086	
		Industry	ID1						0	74,267	0	0		0	0	1,485		29,707	
		Industry	ID2						0	38,427	0	0		0	0	769		15,371	
		Industry	ID3						0	30,168	0	0		0	0	603		12,067	
		Industry	ID6						0	189,121	0	0		0	0	3,782		75,648	
	High	Infill - High Density	IHD4	18	22			6,939	0	60,838	0	0		0	406	1,217		129,803	
	Medium	Infill-Medium Density	IMD5	1,345	19			398,554	0	19,450	0	0		0	24,910	389		1,011,944	

Table continued overleaf

LGA			ZONE NAME	NET BUILDABLE AREA (HA)	RESIDENTIAL UNITS PER HA	PERSONS PER HA	2016 (POPULATION PER ZONE)	2036 (POPULATION PER ZONE)	EMPLOYMENT 2016	EMPLOYMENT 2036	TELEPHONE CONNECTIONS 2016				TELEPHONE CONNECTIONS 2036				NEEDED EXCHANGES
											CONNECTIONS PER RESIDENTIAL	CONNECTIONS PER EMPLOYMENT	TOTAL CONNECTIONS PER LGA	BANDWIDTH (MEGABITS/S)	CONNECTIONS PER RESIDENTIAL	CONNECTIONS PER EMPLOYMENT	TOTAL CONNECTIONS PER LGA	BANDWIDTH (MEGABITS/S)	
ONA ARA	Core	Urban High Density (Inner)		614	30	472	340794	342,498	107,703	84,380	18,412	2,154	59,991	1,645,246	18,412	1,688	87,090	1,607,929	phase 1: one new exchange with 59,991 connections. Needed BW: 2,982 Gb/s phase 2: same exchange upgraded to 87,090 connections. Needed BW: 4,312 Gb/s
	Other	Medium Density (Inner)		2,139	12	156.5	393786	395,755	69,641	66,990	25,665	1,393		1,082,324	25,665	1,340		1,080,203	
	Other	Medium Density (Outer)		28	12	156.5	5107	5132	903	30,819	333	18		14,035	333	616		37,968	
	Other	Low Density (Inner)		909	10	50.2	53669	53,938	9,491	20,781	9,087	190		185,546	9,087	416		190,061	
	Other	Low Density (Outer)		52	7	50.2	3043	3058	538	1,178	361	11		7,429	361	24		7,685	
	Village	Peripheral and Villages (Inner)		47	10	92	5077	5102	4,352	11,582	469	87		11,121	469	232		14,013	
	Village	Peripheral and Villages (Outer)		153	10	92	16542	16625	14,181	23,694	1,528	284		36,239	1,528	474		40,044	
	High	Expansion - High Density	HD5	16	22			5,979	0	47,733	0	0		0	352	955		104,511	
	High	Expansion - High Density	HD8	104	22			39,467	0	55,689	0	0		0	2,322	1,114		274,829	
	Medium	Expansion - Medium Density	MD3	449	19			133,165	0	30,951	0	0		0	8,323	619		357,672	
	High	Infill - High Density	IHD3	92	22			34,597	0	6,564	0	0		0	2,035	131		173,310	
	Medium	Infill- Medium Density	IMD4	538	19			159,364	0	31,822	0	0		0	9,960	636		423,867	

Table continued overleaf

LGA			ZONE NAME	NET BUILDABLE AREA (HA)	RESIDENTIAL UNITS PER HA	PERSONS PER HA	2016 (POPULATION PER ZONE)	2036 (POPULATION PER ZONE)	EMPLOYMENT 2016	EMPLOYMENT 2036	TELEPHONE CONNECTIONS 2016				TELEPHONE CONNECTIONS 2036				NEEDED EXCHANGES
											CONNECTIONS PER RESIDENTIAL	CONNECTIONS PER EMPLOYMENT	TOTAL CONNECTIONS PER LGA	BANDWIDTH (MEGABITS/S)	CONNECTIONS PER RESIDENTIAL	CONNECTIONS PER EMPLOYMENT	TOTAL CONNECTIONS PER LGA	BANDWIDTH (MEGABITS/S)	
EGBEDA	Core	Urban High Density (Inner)		163	30	472	90310	90,761	60,069	47,225	4,879	1,201	57,745	486,432	4,879	944	120,717	465,881	phase 1:one new exchange with 57,745 connections. Needed BW: 2,353 Gb/s phase 2: same exchange upgraded to 120,717 connections. Needed BW: 5,011 Gb/s
	Other	Medium Density (Inner)		3,280	12	156.5	603867	606,886	115,188	200,000	39,357	2,304		1,666,449	39,357	4,000		1,734,299	
	Other	Low Density (Inner)		813	10	50.2	48037	48,277	14,134	34,934	8,134	283		168,328	8,134	699		176,648	
	Other	Low Density (Outer)		34	7	50.2	1989	1,999	5,090	58,448	236	102		6,752	236	1,169		28,095	
	Village	Peripheral and Villages (Inner)		57	10	92	6124	6,154	8,018	15,759	566	160		14,523	566	315		17,619	
	Village	Peripheral and Villages (Outer)		44	10	92	4776	4,799	4,094	6,840	441	82		10,462	441	137		11,561	
	High	Expansion - High Density	HD4	41	22			15,547	0	53,284	0	0		0	915	1,066		158,416	
	Medium	Expansion - Medium Density	MD2	2,512	19			744,357	0	74,436	0	0		0	46,522	1,489		1,920,440	
	High	Infill - High Density	IHD2	79	22			29,700	0	43,014	0	0		0	1,747	860		208,586	
	Medium	Infill - Medium Density	IMD3	355	19			105,265	0	33,129	0	0		0	6,579	663		289,665	
TOTAL							6,017,708	11,610,415	1,859,886	4,092,785	428,907	37,198	466,105	20,505,908	786,062	81,856	867,918	37,195,670	

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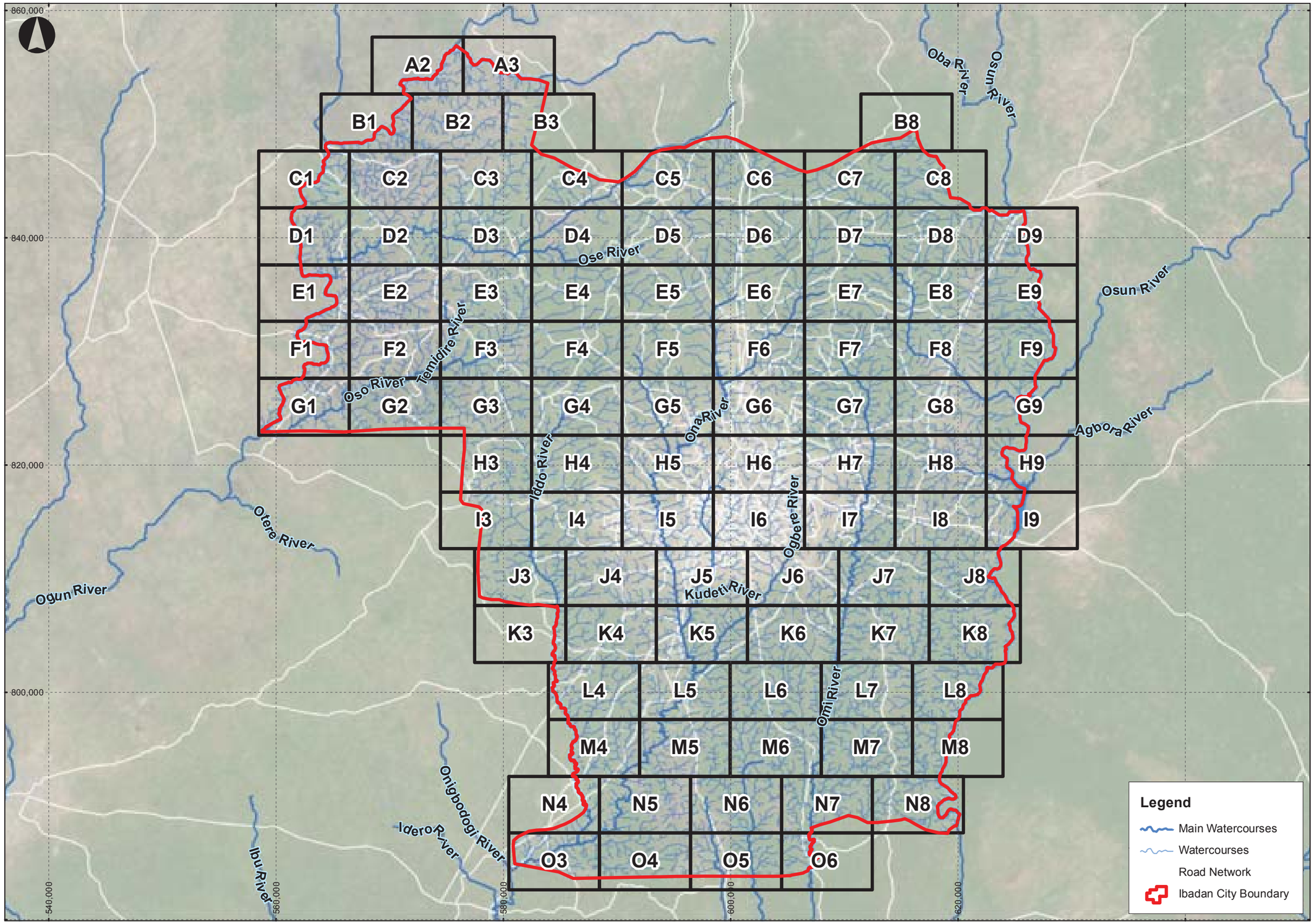
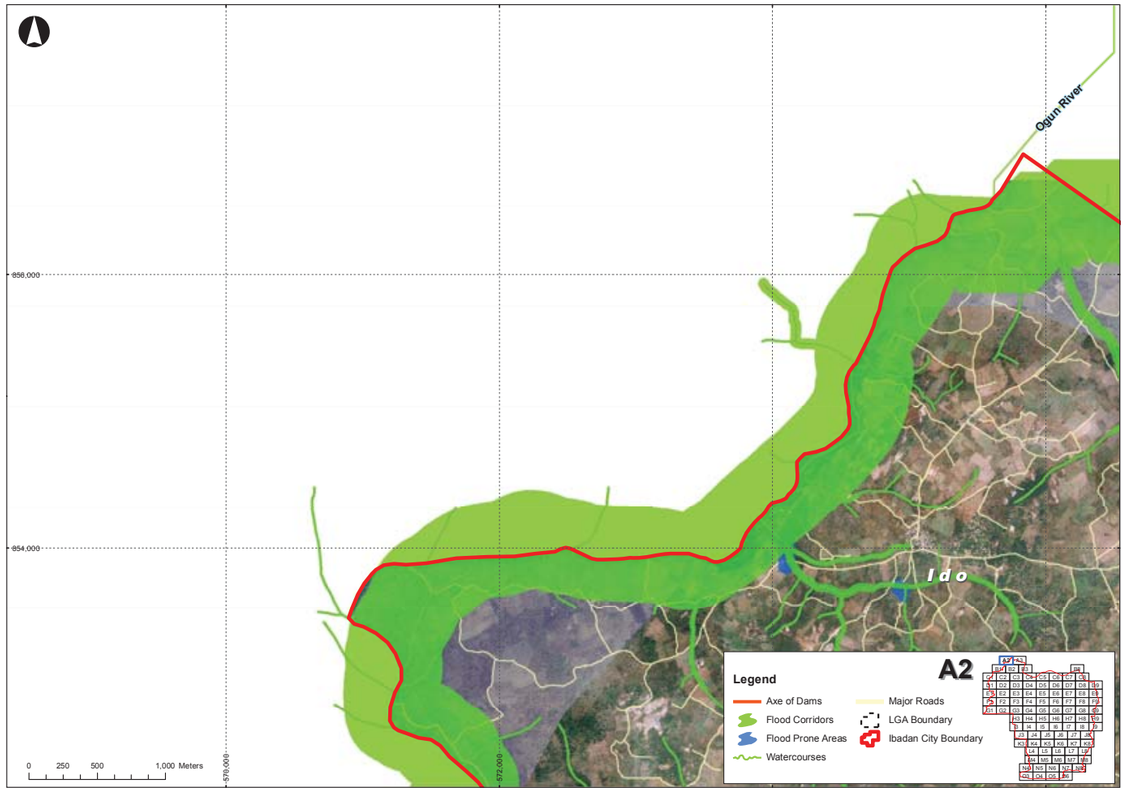
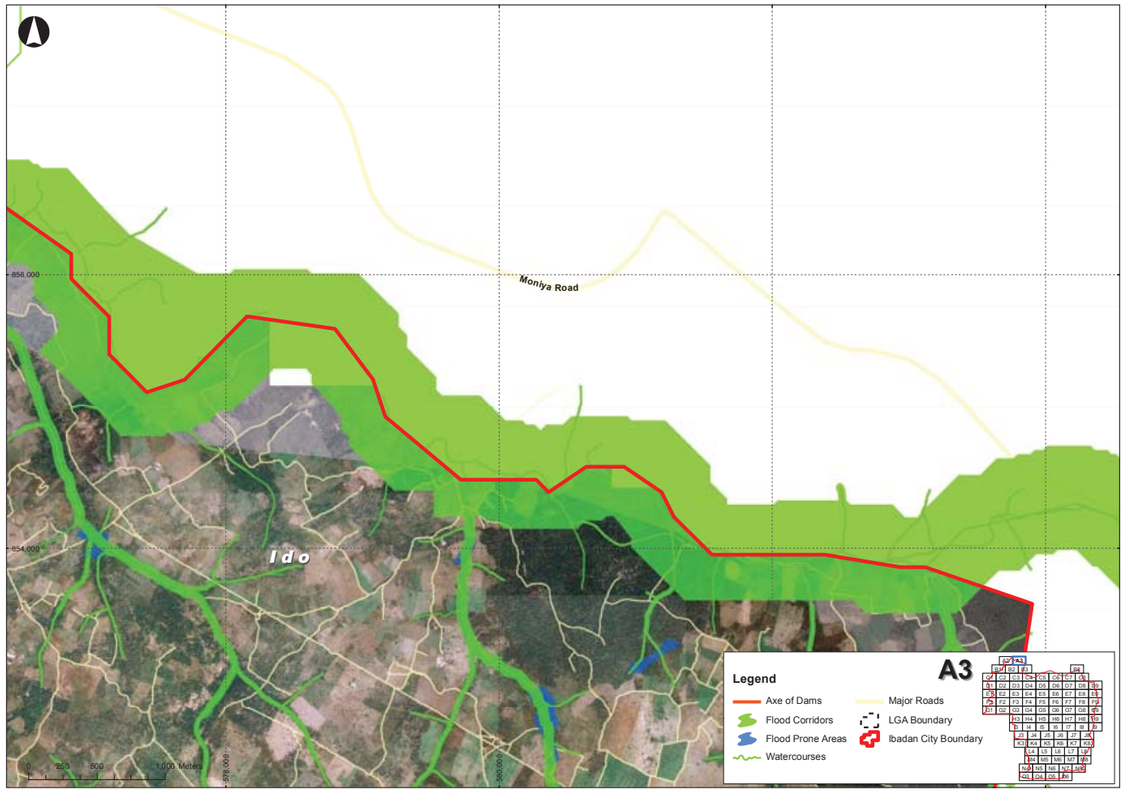
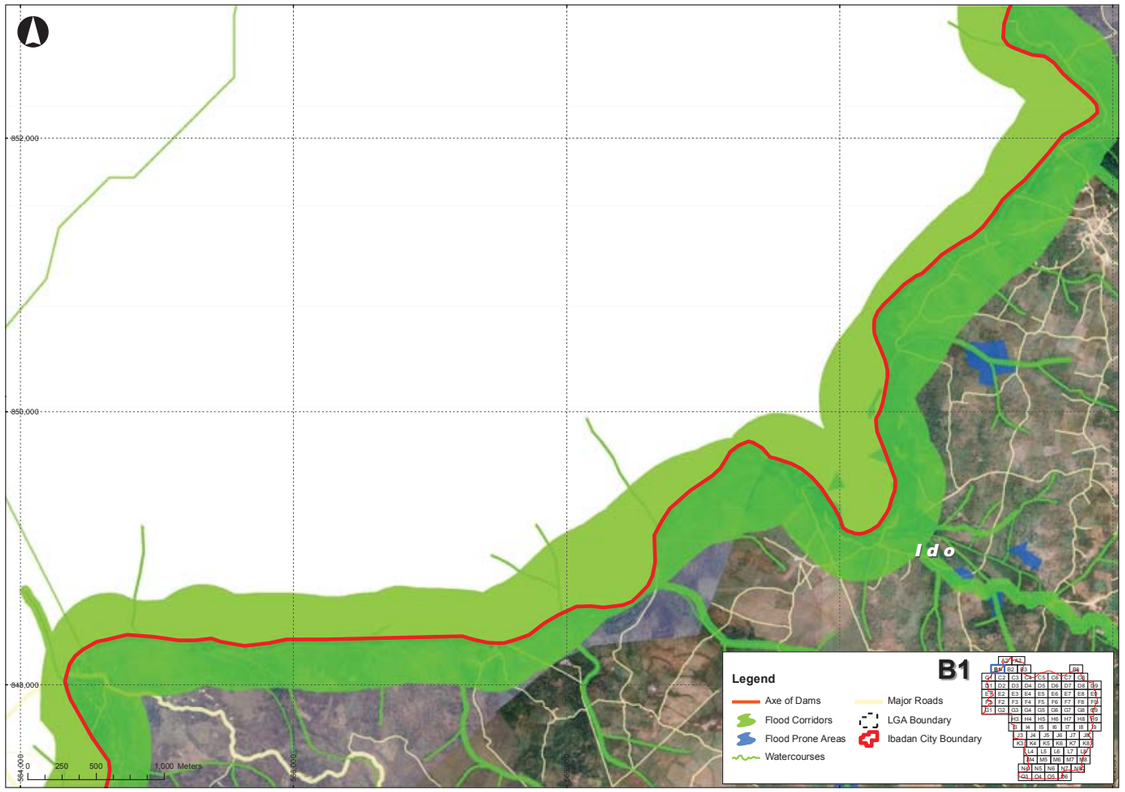
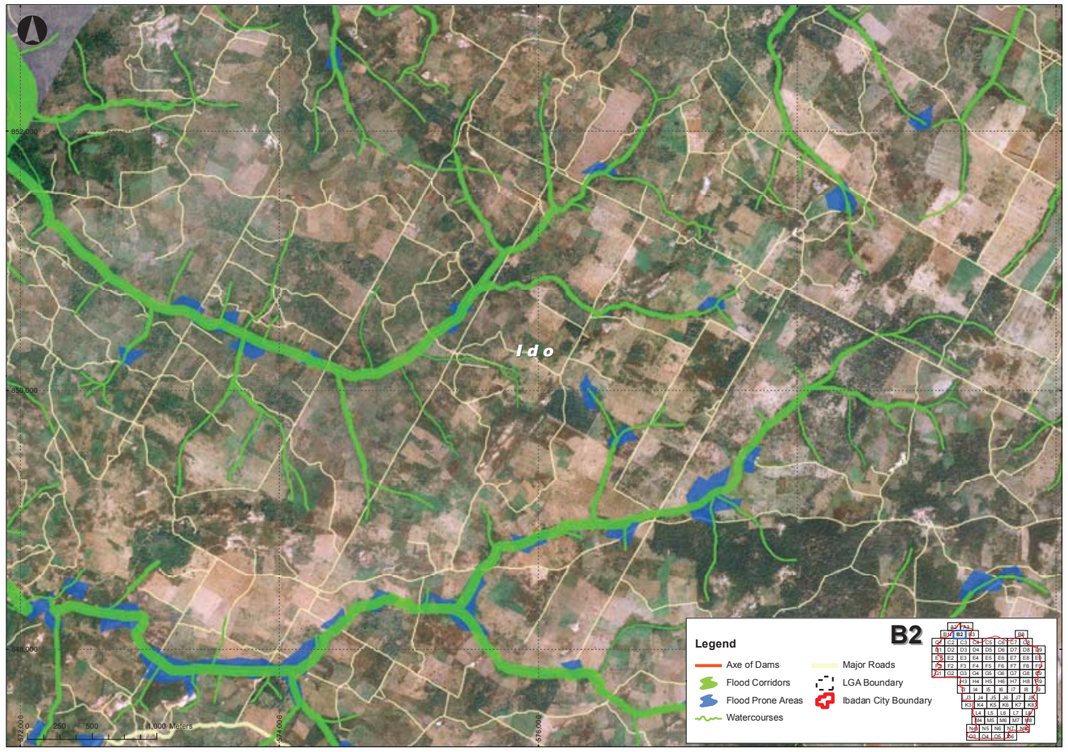
APPENDIX 3: FLOOD INUNDATION MAPS

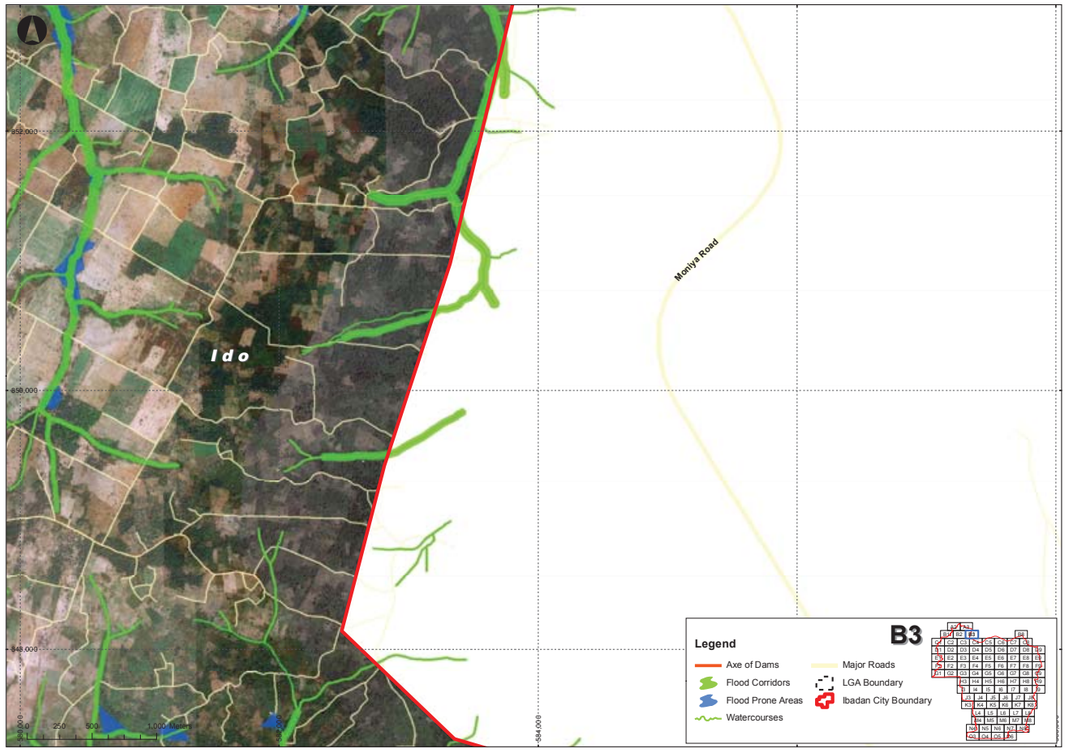


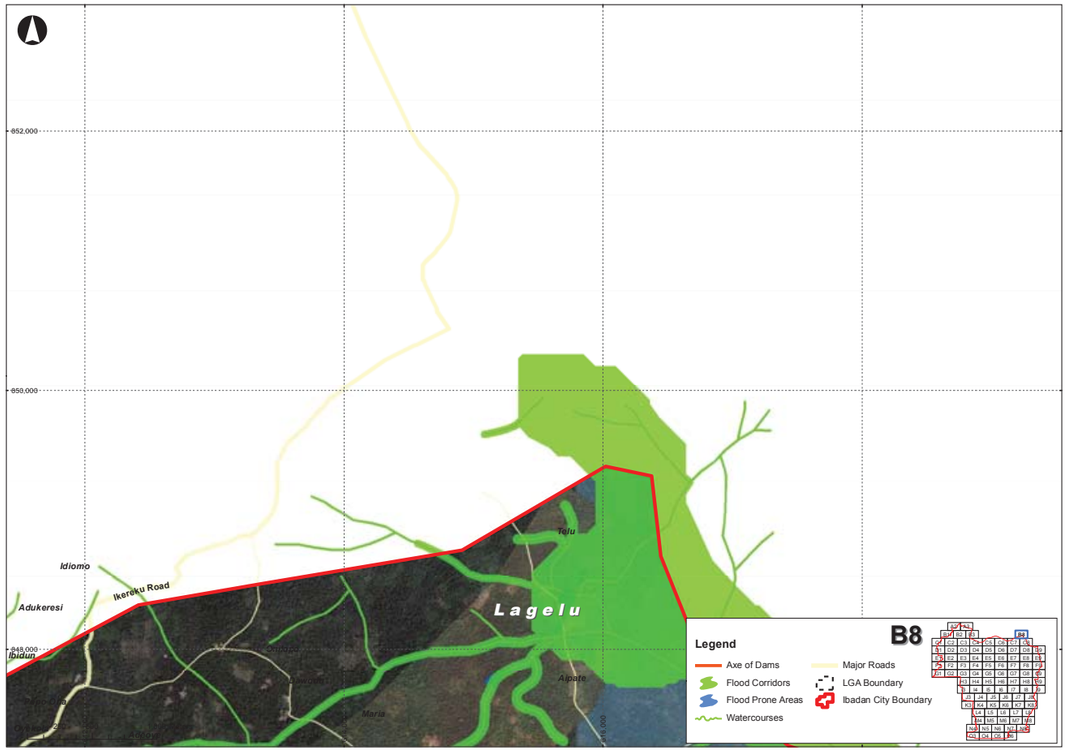

Ogun River
Ido
858,000
854,000
576,000
572,000
0 250 500 1,000 Meters
A2
Legend
Axe of Dams
Flood Corridors
Flood Prone Areas
Watercourses
Major Roads
LGA Boundary
Ibadan City Boundary

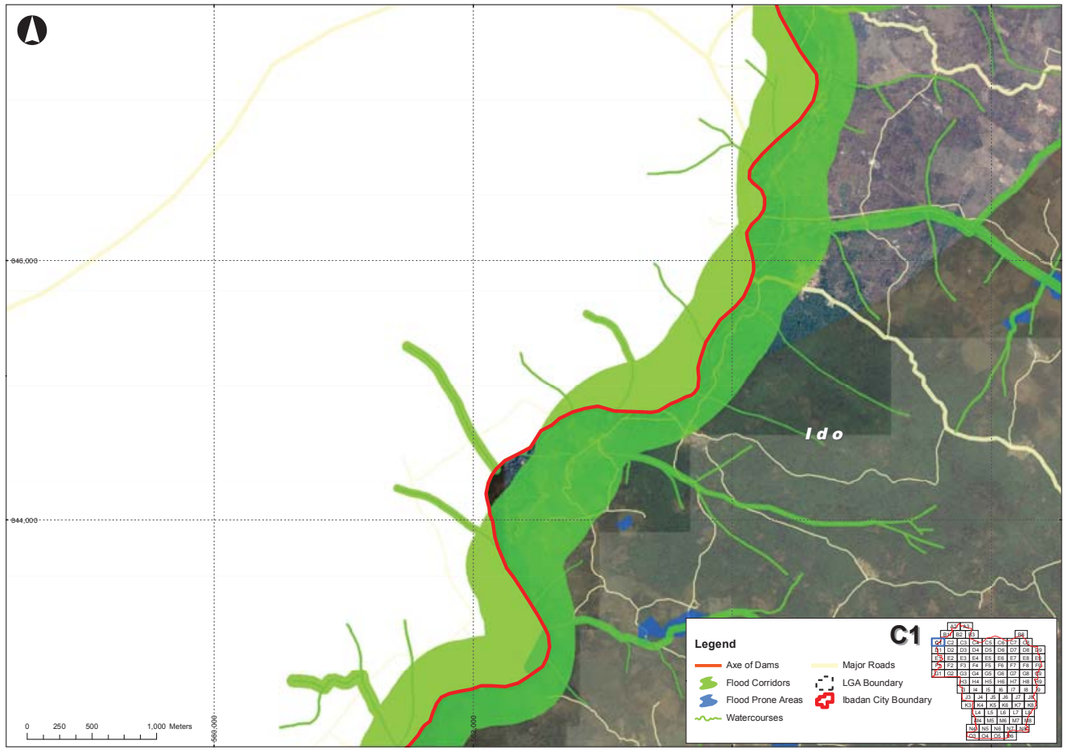

Moniya Road
Ido
856,000
854,000
578,000
580,000
0 250 500 1,000 Meters
A3
Legend
Axe of Dams
Flood Corridors
Flood Prone Areas
Watercourses
Major Roads
LGA Boundary
Ibadan City Boundary

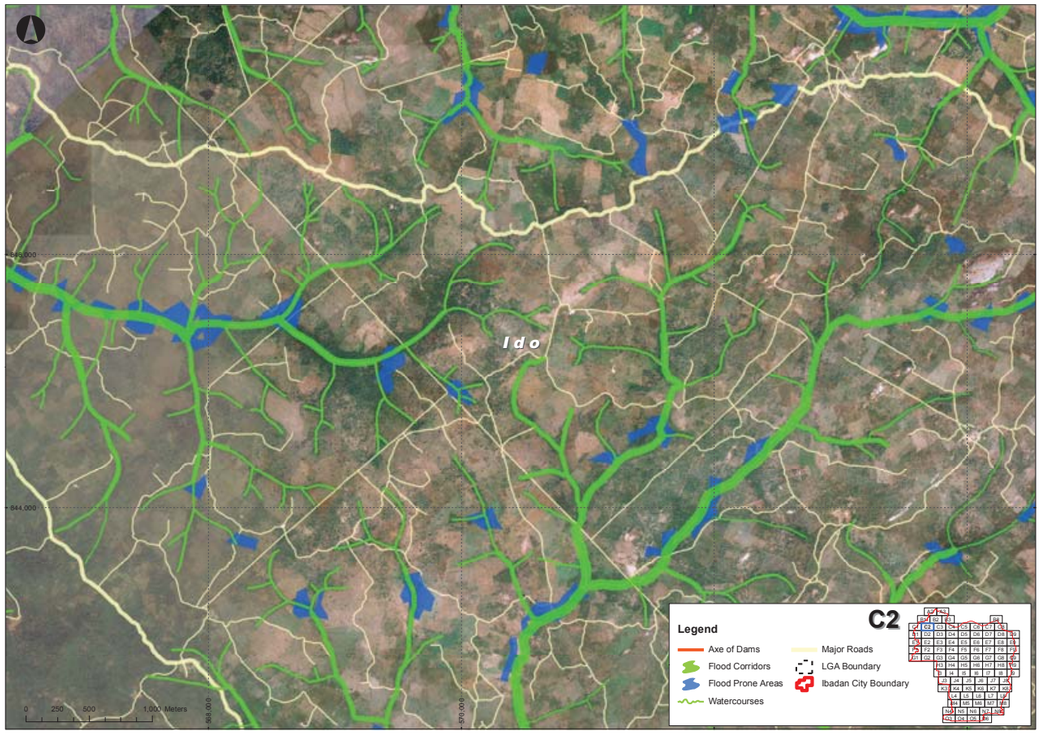

852,000
850,000
848,000
564,000
568,000
0 250 500 1,000 Meters
Ido
B1
Legend
Axe of Dams
Flood Corridors
Flood Prone Areas
Watercourses
Major Roads
LGA Boundary
Ibadan City Boundary

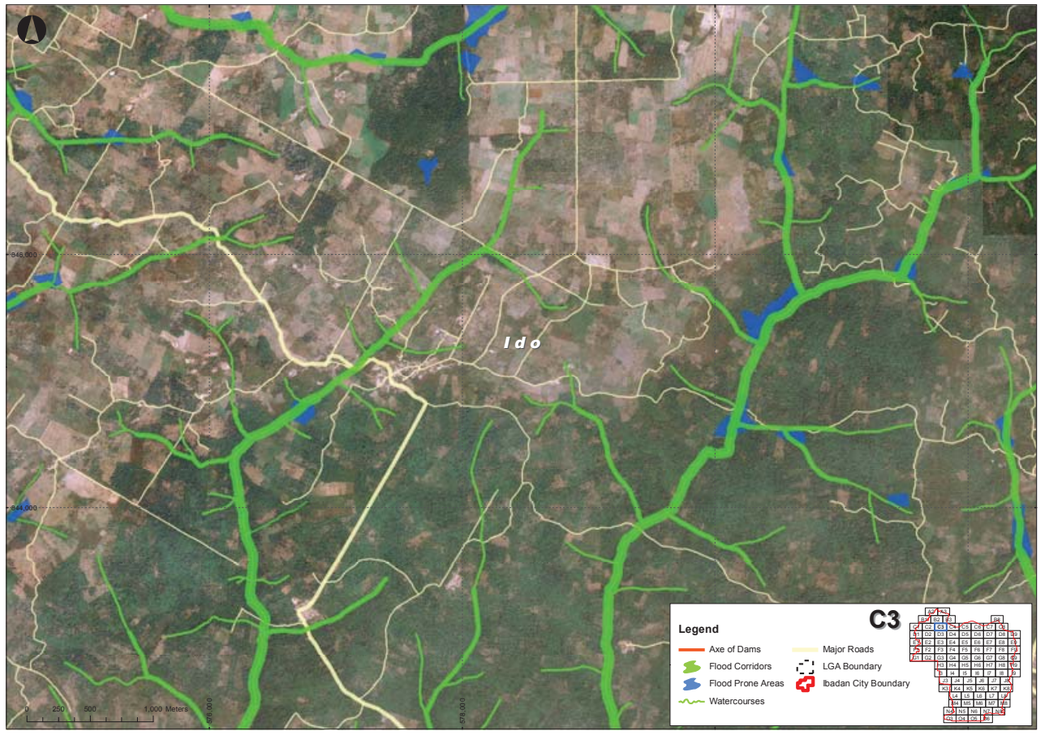

Ido
B2
Legend
Axe of Dams
Flood Corridors
Flood Prone Areas
Watercourses
Major Roads
LGA Boundary
Ibadan City Boundary
0 250 500 1,000 Meters

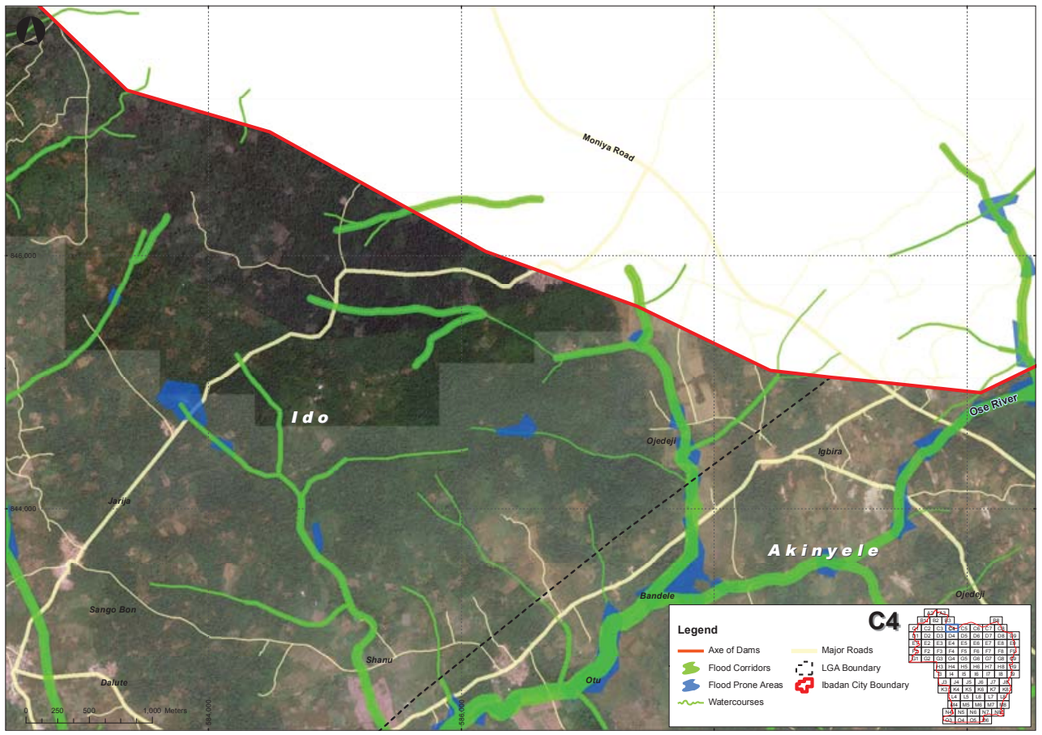

Ido
Moniya Road
B3
Legend
Axe of Dams
Flood Corridors
Flood Prone Areas
Watercourses
Major Roads
LGA Boundary
Ibadan City Boundary
0 250 500 1,000 Meters

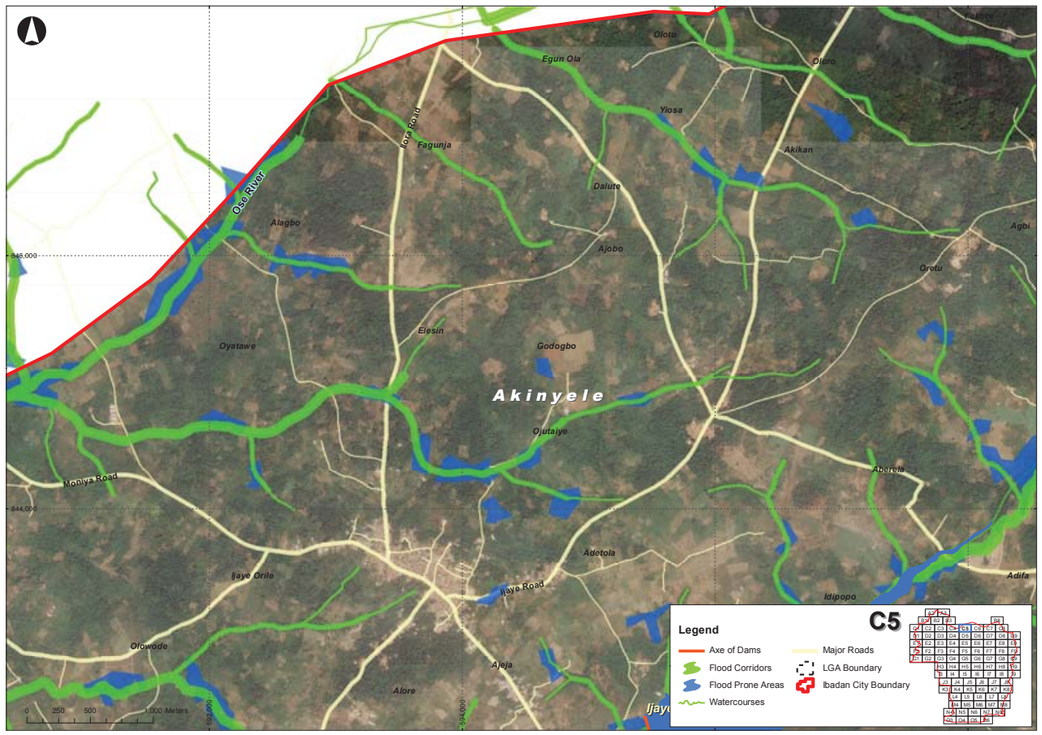

852,000
850,000
848,000
Idiomo
Ikereku Road
Adukeresi
Ibidun
Lagelu
Telu
Alpate
Maria
B8
Legend
Axe of Dams
Flood Corridors
Flood Prone Areas
Watercourses
Major Roads
LGA Boundary
Ibadan City Boundary

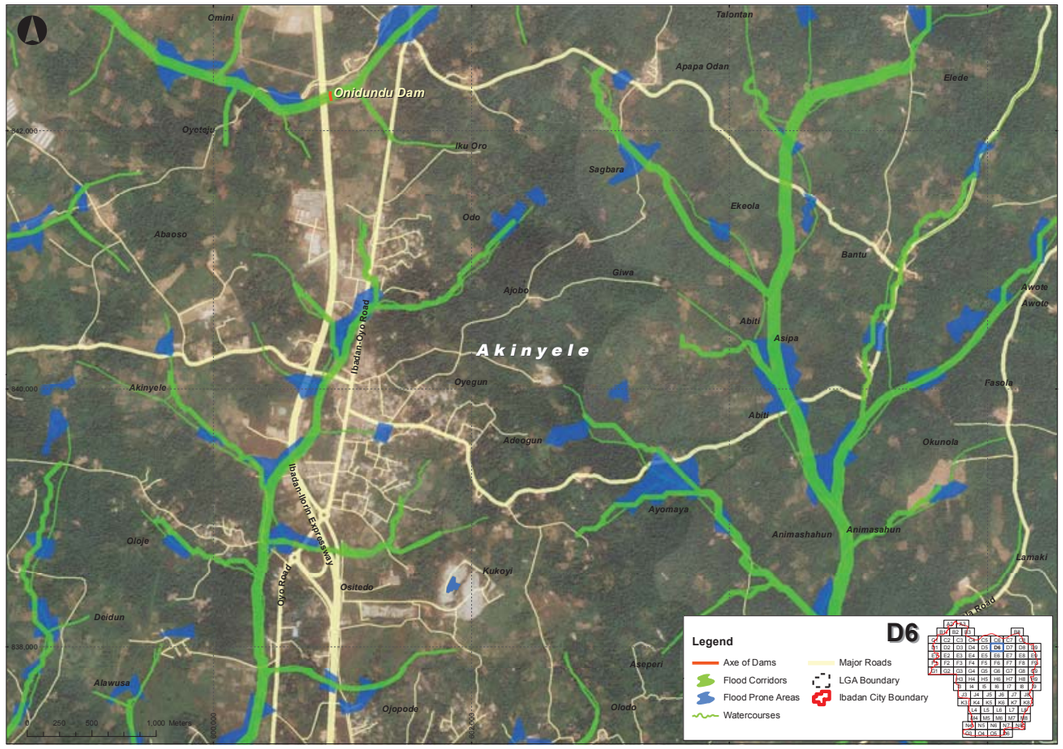

846,000
844,000
Ido
C1
Legend
Axe of Dams
Flood Corridors
Flood Prone Areas
Watercourses
Major Roads
LGA Boundary
Ibadan City Boundary
0 250 500 1,000 Meters

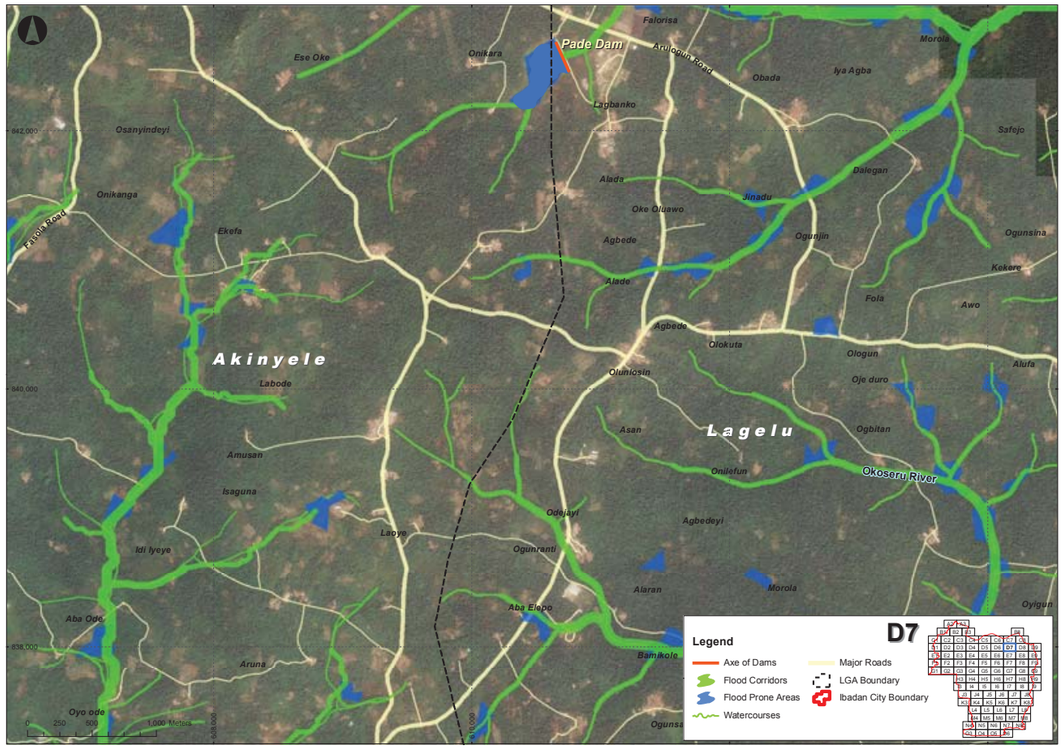

Ido
C2
Legend
Axe of Dams
Flood Corridors
Flood Prone Areas
Watercourses
Major Roads
LGA Boundary
Ibadan City Boundary

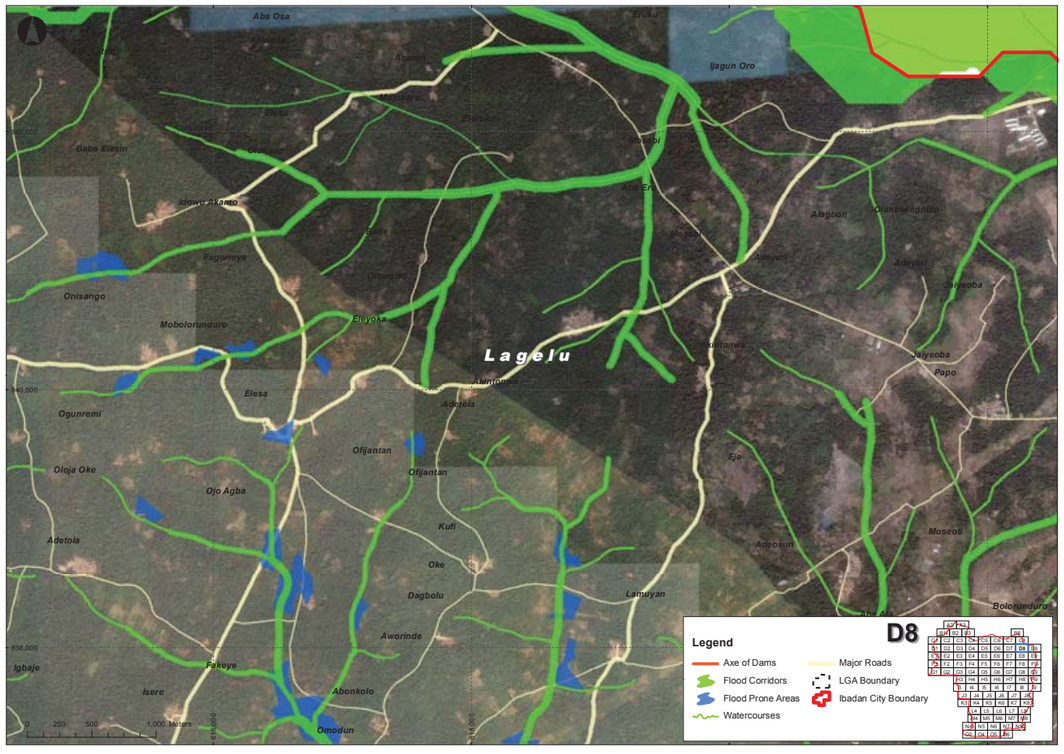

Ido
C3
Legend
Axe of Dams
Flood Corridors
Flood Prone Areas
Watercourses
Major Roads
LGA Boundary
Ibadan City Boundary

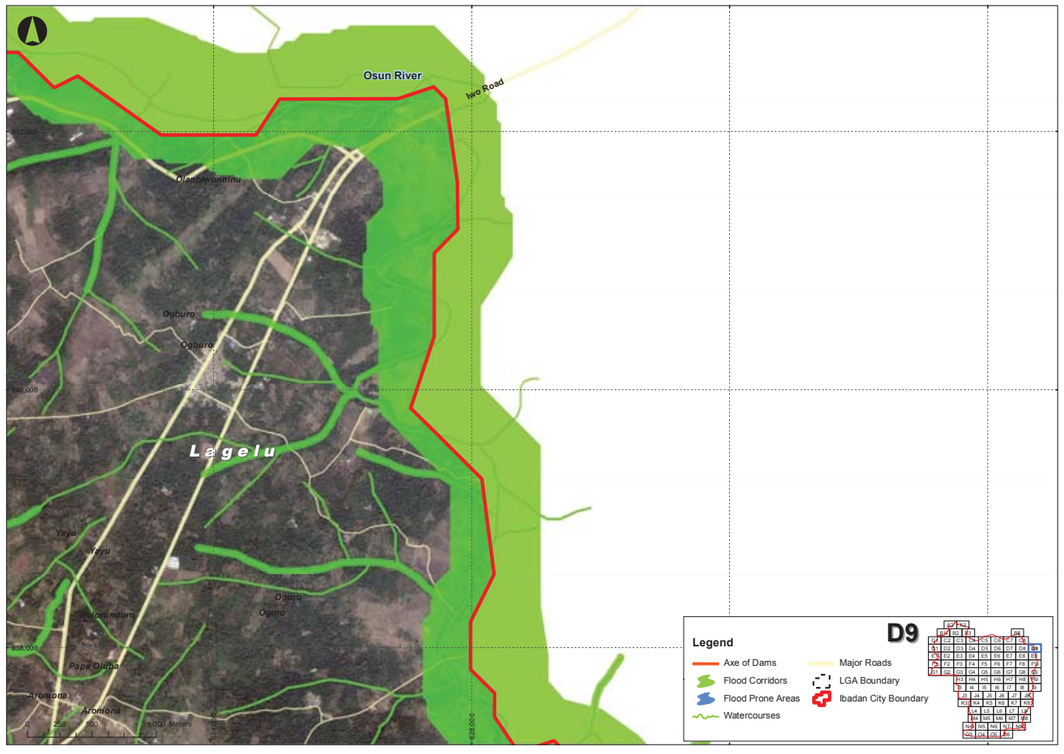

Moniya Road
Ido
Ojedeji
Igbira
Ose River
Akinyele
Bandele
Ojedeji
Sango Bon
Shanu
Otu
Dalute
C4
Legend
Axe of Dams
Flood Corridors
Flood Prone Areas
Watercourses
Major Roads
LGA Boundary
Ibadan City Boundary

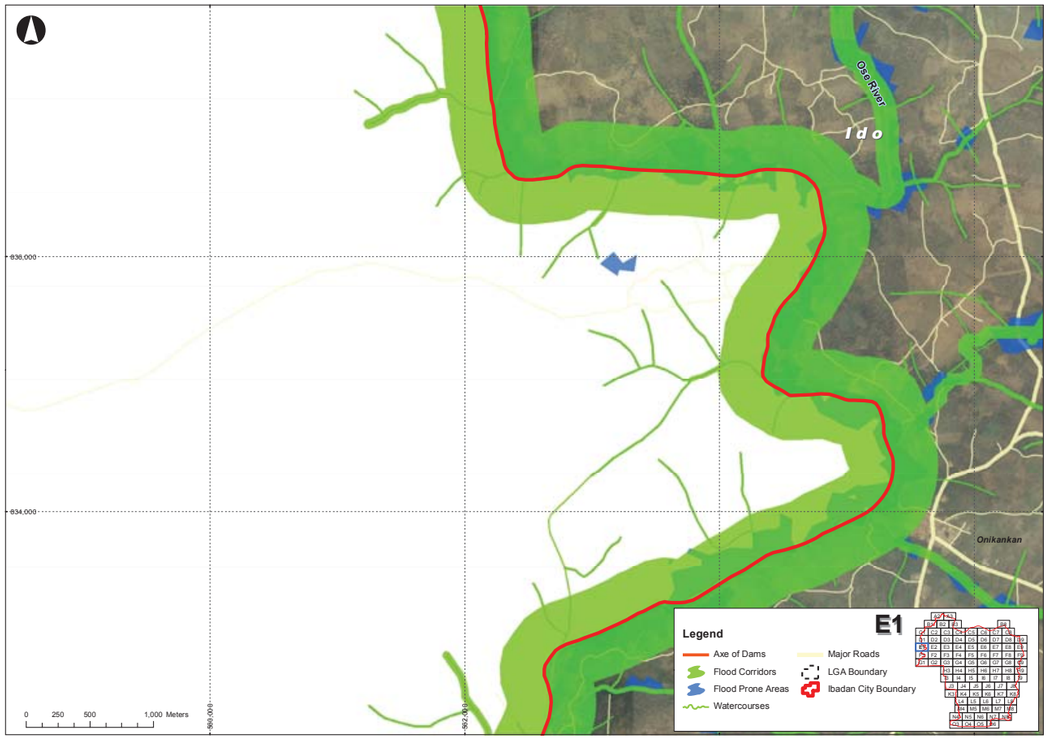

Egun Ola
Olotu
Yiosa
Fagunja
Akikan
Dalute
Ose River
Alagbo
Ajobo
Agbi
Oyatawe
Elesin
Godogbo
Akinyele
Ojutaiye
Moniya Road
Adetola
Ijaye Orile
Ijaye Road
Idipopo
Adifa
Olowode
Ajeja
Alore
C5
Legend
Axe of Dams
Flood Corridors
Flood Prone Areas
Watercourses
Major Roads
LGA Boundary
Ibadan City Boundary

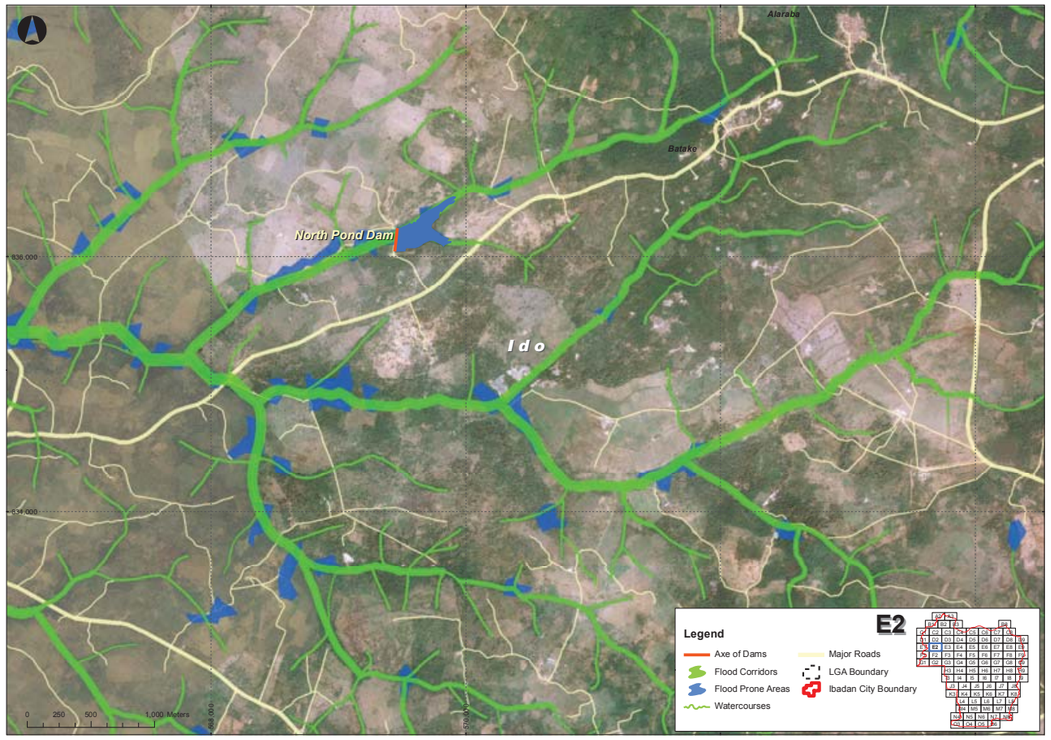

Omini
Talontan
Onidundu Dam
Apapa Odan
Elede
Oyetoja
Iku Oro
Sagbara
Odo
Ekeola
Abaoso
Bantu
Giwa
Ajobo
Awote
Awoto
Abiti
Asipa
Akinyele
Ibadan-Oyo Road
Oyegun
Fasola
Akinyele
Abiti
Adeogun
Okunola
Ayomaya
Animashahun
Animasahun
Lamaki
Kukoyi
Ibadan-Ilorin Expressway
Oja Kuye
Oloje
Ositedo
Deidun
Asaperi
Alawusa
Ojopoda
Olodo
Legend
Axe of Dams
Flood Corridors
Flood Prone Areas
Watercourses
Major Roads
LGA Boundary
Ibadan City Boundary
D6

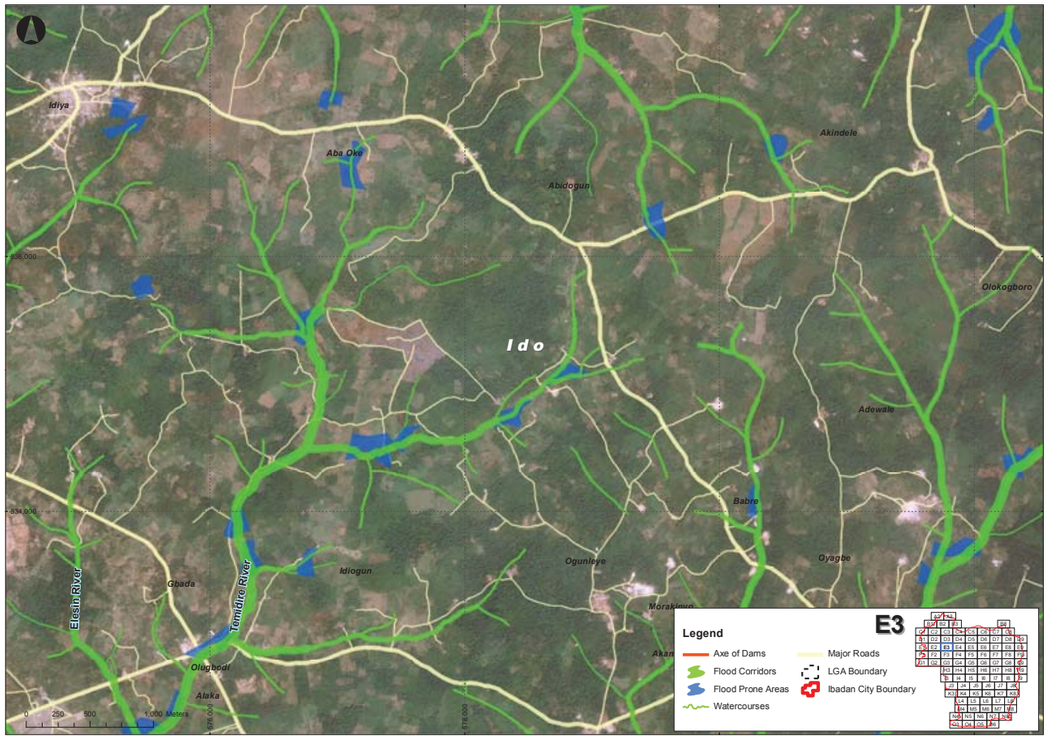

Falorisa
Pade Dam
Ese Oke
Onikara
Aru Ojuwo Road
Morola
Obada
Iya Agba
Lagbanko
Osanyindeyi
Safejo
Alada
Dalegan
Onikanga
Jinadu
Oke Oluawo
Ekefa
Agbede
Ogunjin
Ogunsina
Ekefa Road
Alade
Kekere
Fola
Awo
Agbede
Akinyele
Olokuta
Ologun
Alufa
Labode
Oluniosin
Oje duro
Asan
Lagelu
Ogbitan
Amusan
Onilefun
Okoseru River
Isaguna
Odejayi
Agbedeyi
Idi Iyeye
Laoye
Ogunranti
Alaran
Morola
Aba Elopo
Oyigun
Aba Ode
Bamikolo
Aruna
Oyo ode
Ogunsa
Legend
Axe of Dams
Flood Corridors
Flood Prone Areas
Watercourses
Major Roads
LGA Boundary
Ibadan City Boundary
D7

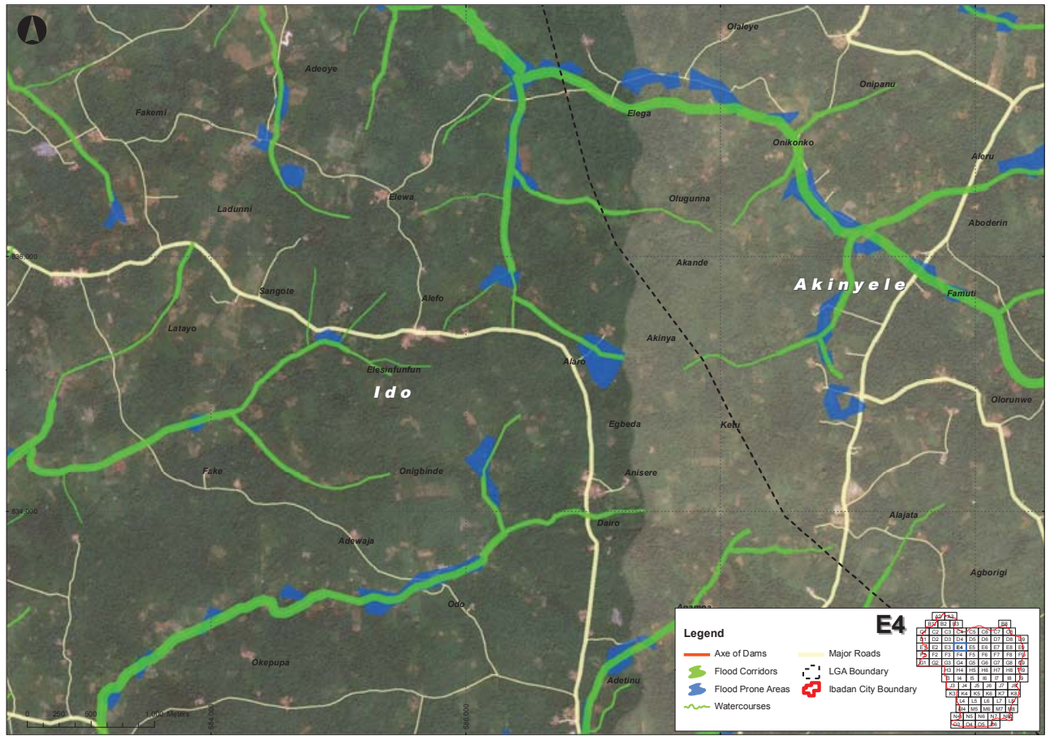

Aba Osa
Ijagun Oro
Baba Elesin
Idewu Ajano
Alagbon
Oranbiolorunbo
Fagorioye
Adeyeri
Onisango
Ijayeoba
Mobolorunduro
Eluyoba
Lagelu
Elesa
Papo
Ogunremi
Ofijantan
Oloja Oke
Ojo Agba
Adetola
Kufi
Oke
Dagbolu
Lamuyan
Bolorunduro
Aworinde
Igbaje
Fakeye
Isere
Abonkolo
Omodun
Legend
Axe of Dams
Flood Corridors
Flood Prone Areas
Watercourses
Major Roads
LGA Boundary
Ibadan City Boundary
D8

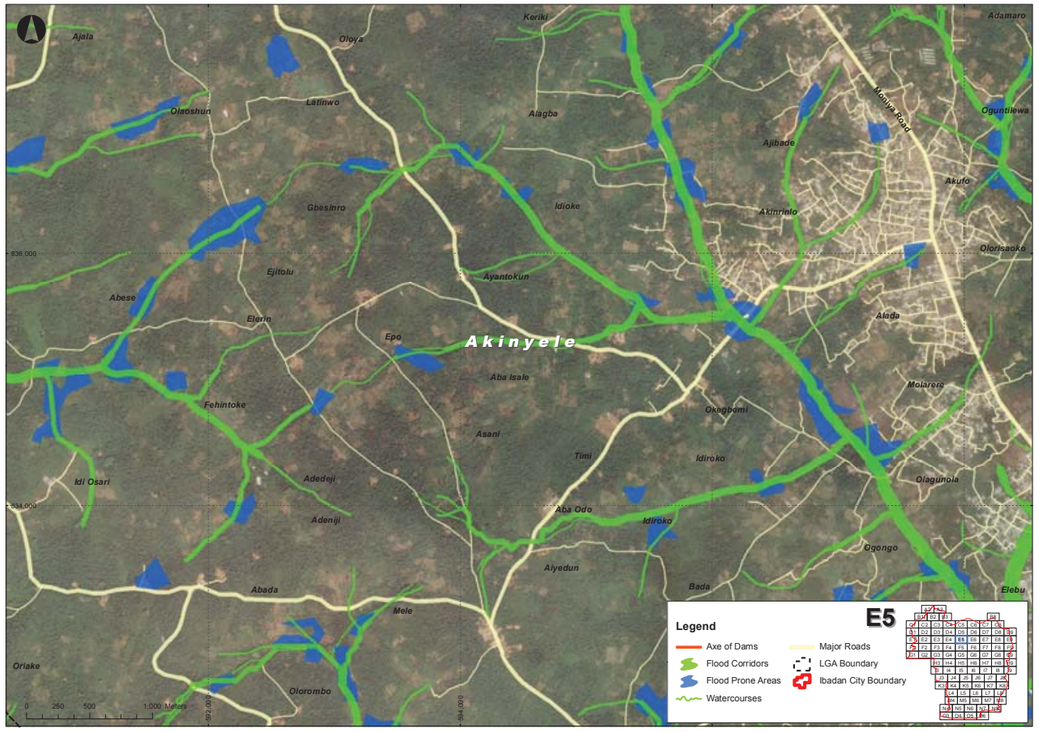

Osun River
Iwo Road
Ogburo
Lagelu
Yoyu
Papa Olona
Aromona
Legend
Axe of Dams
Flood Corridors
Flood Prone Areas
Watercourses
Major Roads
LGA Boundary
Ibadan City Boundary
D9

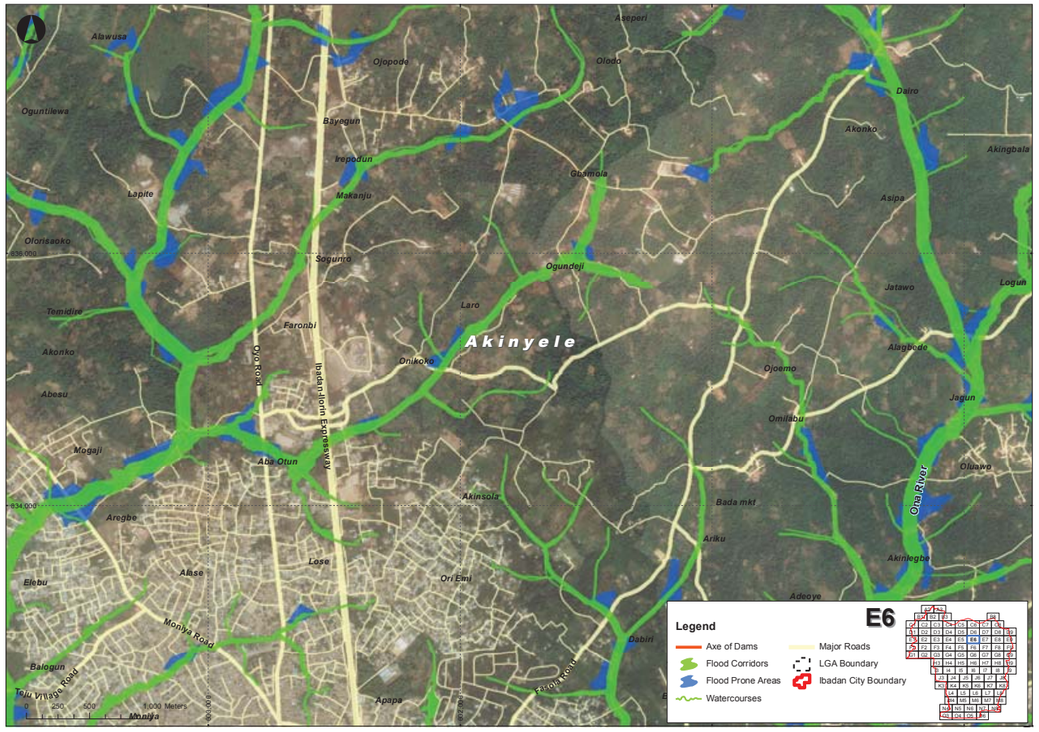

Oso River
Ido
Onikankan
E1
Legend
Axe of Dams
Flood Corridors
Flood Prone Areas
Watercourses
Major Roads
LGA Boundary
Ibadan City Boundary
0 250 500 1,000 Meters

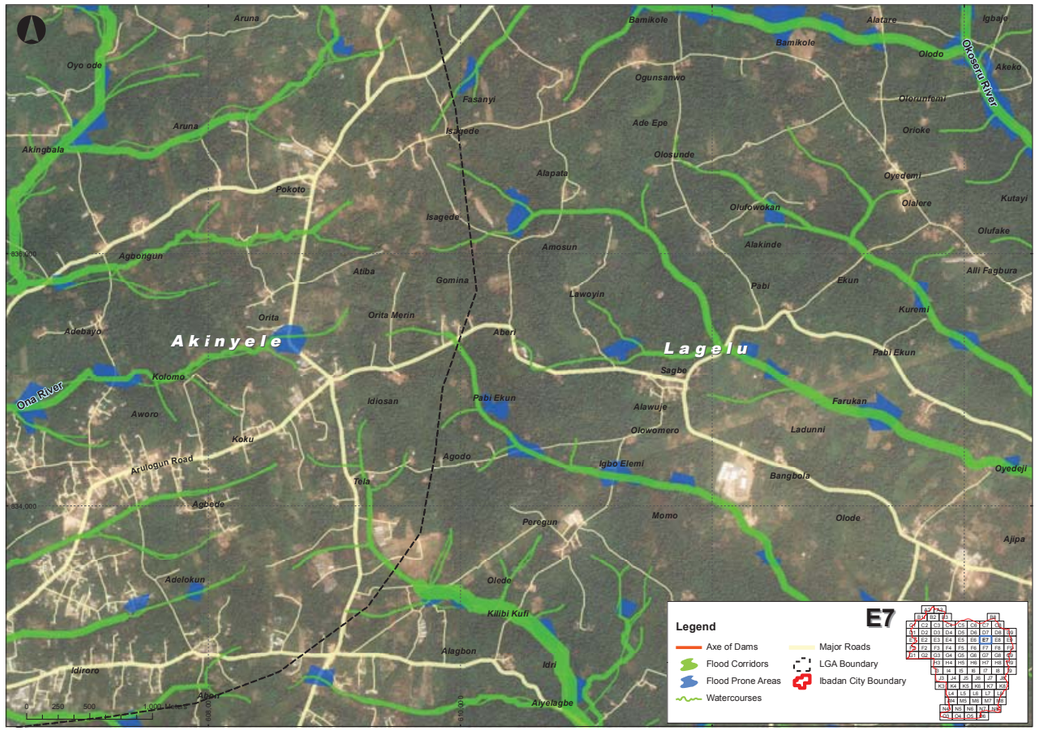

Alaraba
Batako
North Pond Dam
Ido
E2
Legend
Axe of Dams
Flood Corridors
Flood Prone Areas
Watercourses
Major Roads
LGA Boundary
Ibadan City Boundary
0 250 500 1,000 Meters

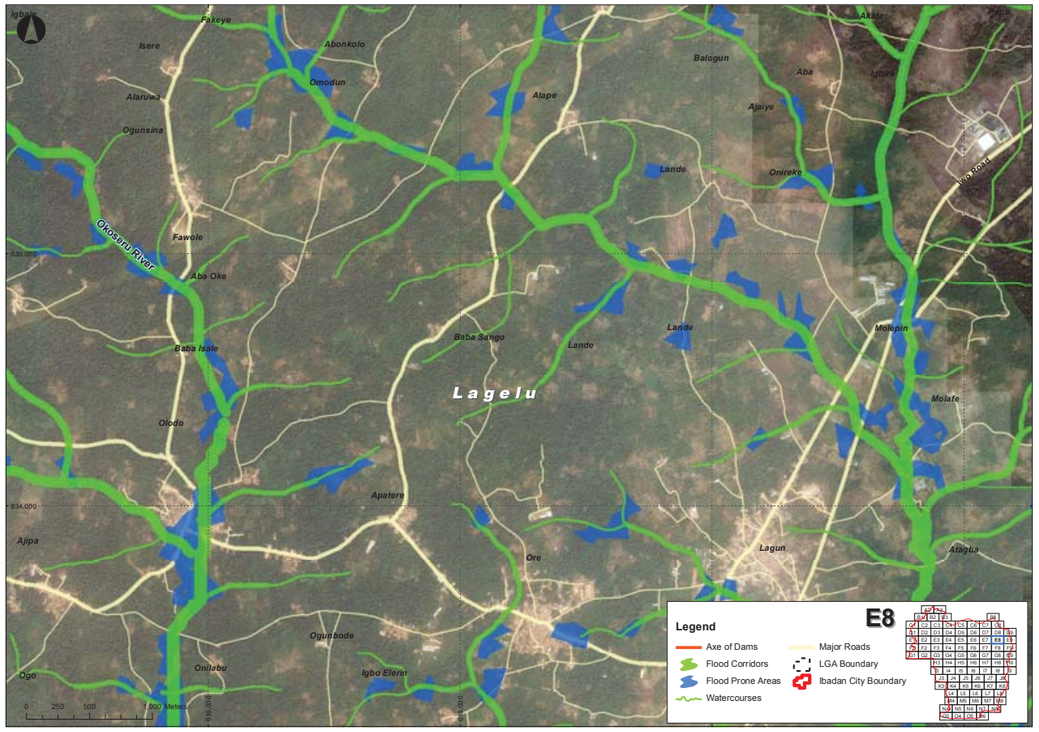

Idiya
Aba Oko
Abidogun
Akindele
Olokogboro
Ido
Adewale
Babre
Ogunleye
Oyagbe
Idiogun
Goada
Olugbodi
Alaka
Elesin River
Temidire River
E3
Legend
Axe of Dams
Flood Corridors
Flood Prone Areas
Watercourses
Major Roads
LGA Boundary
Ibadan City Boundary
0 250 500 1,000 Meters

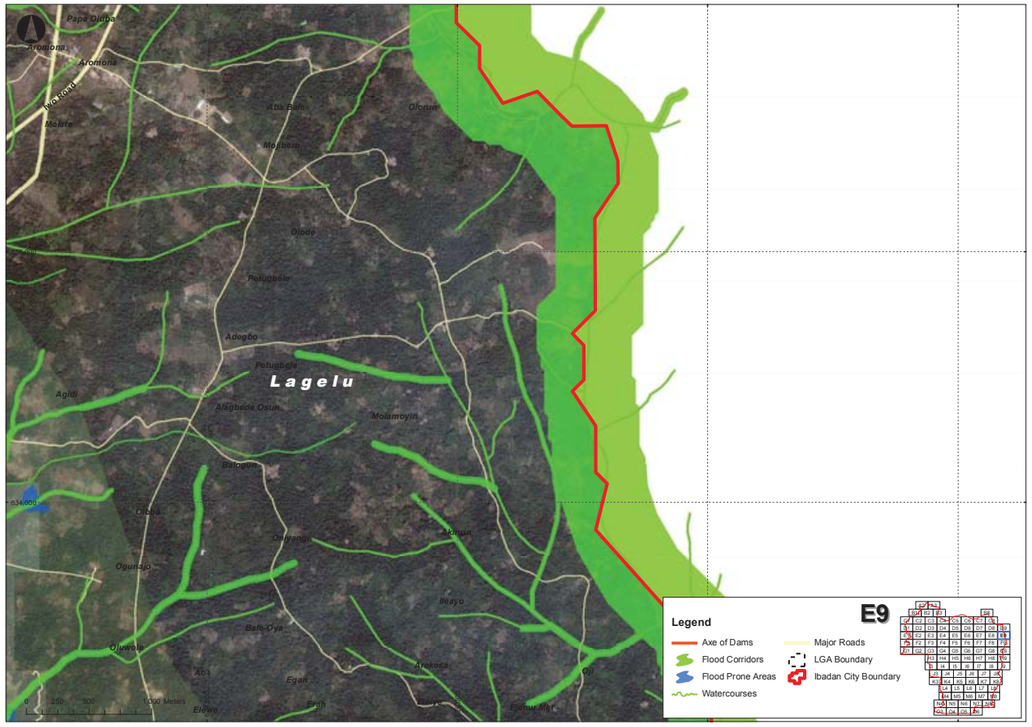

Olaleye
Adeoye
Fakemi
Elega
Onipanu
Onikonko
Akoru
Ladunni
Ewewa
Olugunna
Aboderin
Akande
Sangote
Alefo
Akinyele
Famuti
Latayo
Akinya
Afaro
Elesinfunfun
Ido
Olorunwe
Egbeda
Kehi
Fako
Onigbinde
Anisere
Dairo
Alajata
Adewaja
Agborigi
Gbo
Okepupa
Adetinu
E4
Legend
Axe of Dams
Flood Corridors
Flood Prone Areas
Watercourses
Major Roads
LGA Boundary
Ibadan City Boundary

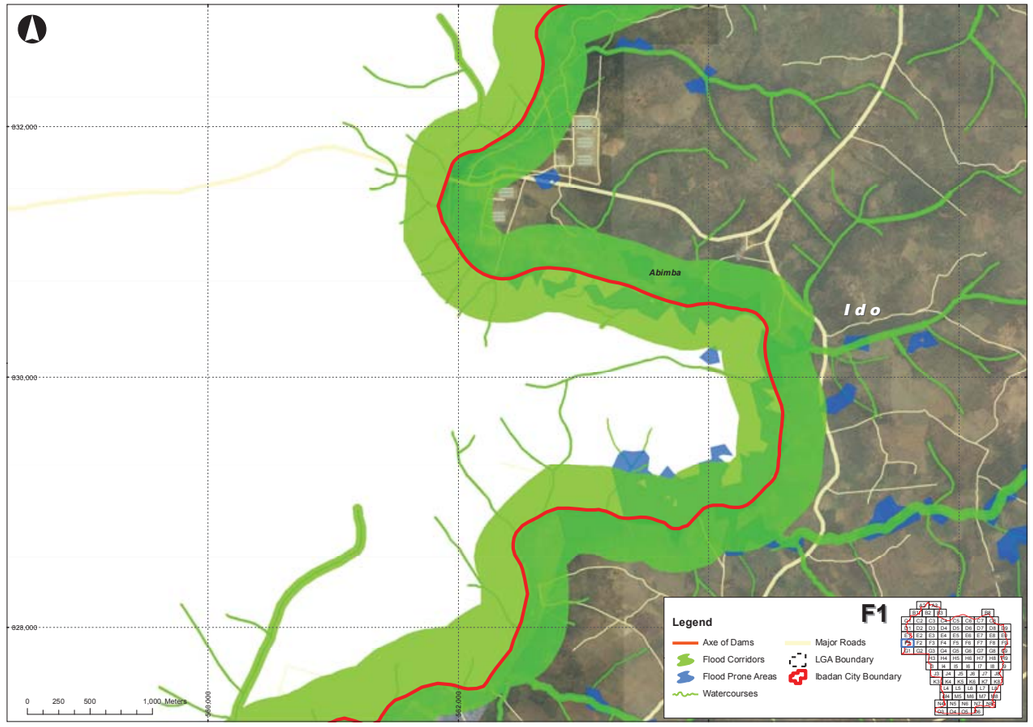

E5
Akinyele
Legend
Axe of Dams
Flood Corridors
Flood Prone Areas
Watercourses
Major Roads
LGA Boundary
Ibadan City Boundary

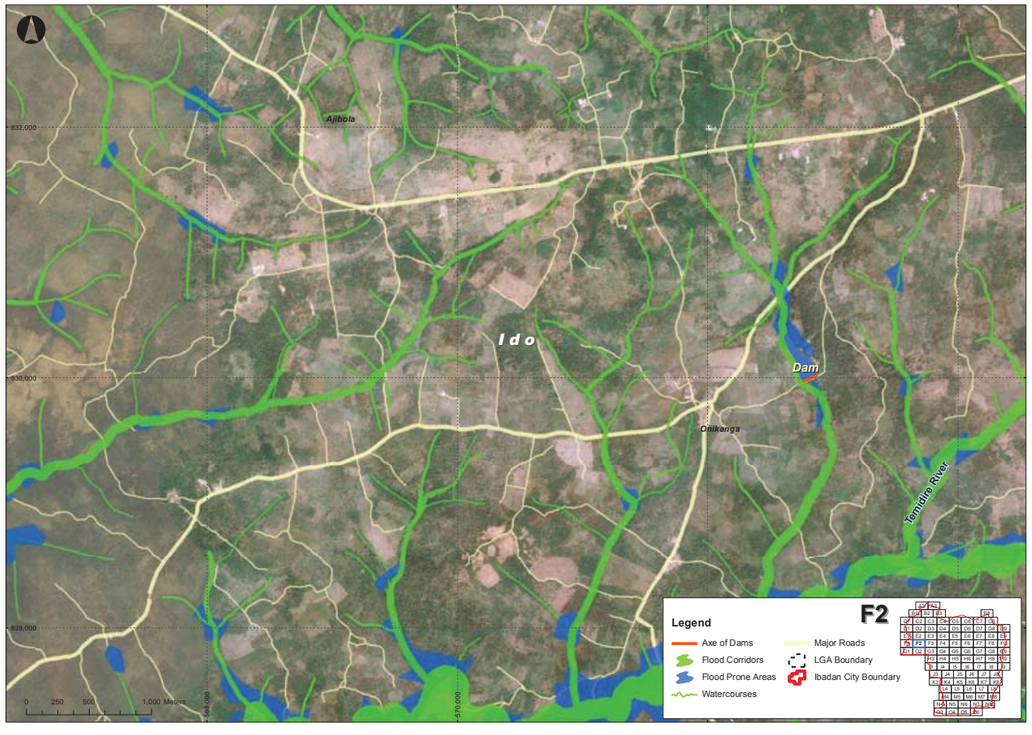

E6
Akinyele
Legend
Axe of Dams
Flood Corridors
Flood Prone Areas
Watercourses
Major Roads
LGA Boundary
Ibadan City Boundary

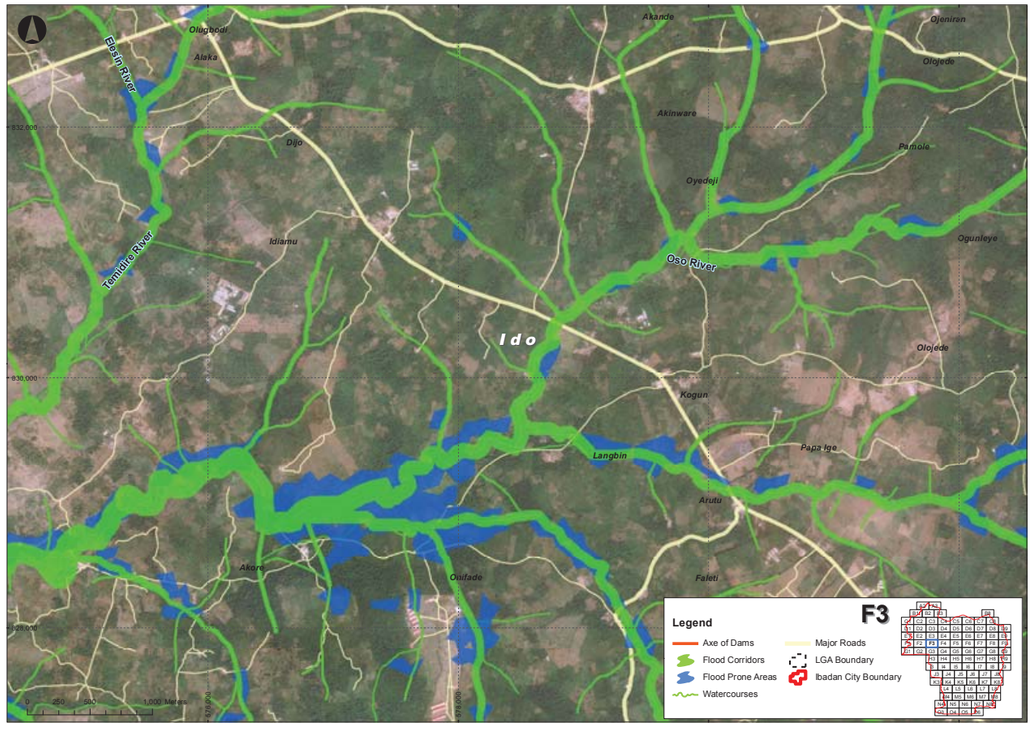

E7
Akinyele
Lagelu
Legend
Axe of Dams
Flood Corridors
Flood Prone Areas
Watercourses
Major Roads
LGA Boundary
Ibadan City Boundary

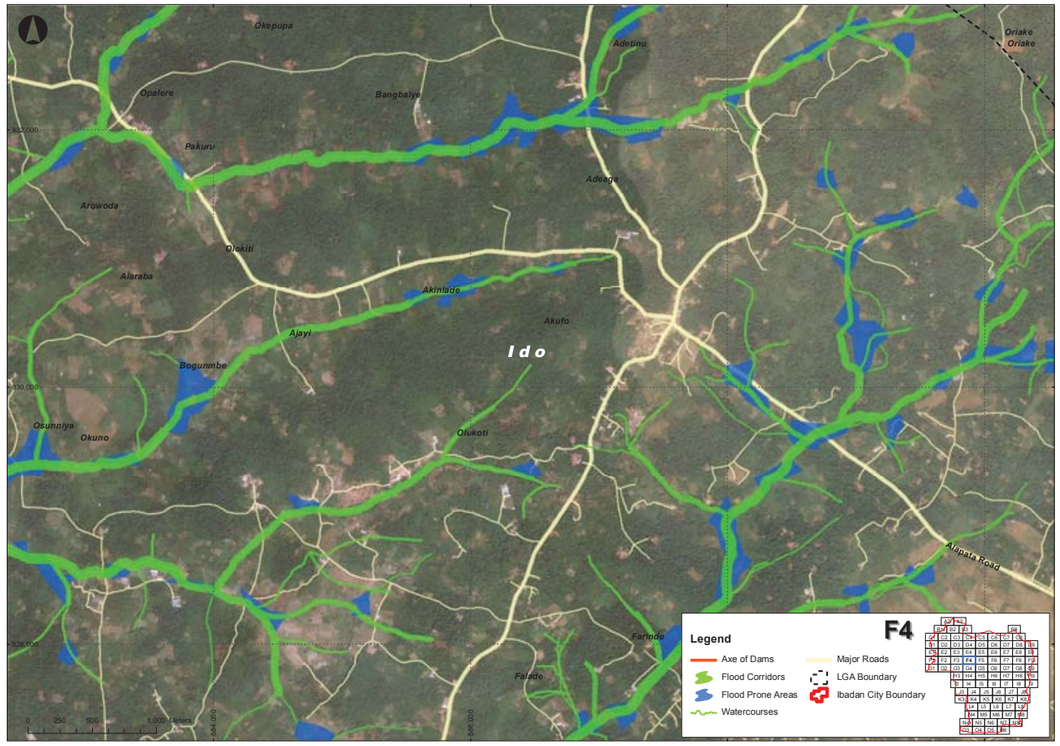

E8
Lagelu
Legend
Axe of Dams
Flood Corridors
Flood Prone Areas
Watercourses
Major Roads
LGA Boundary
Ibadan City Boundary

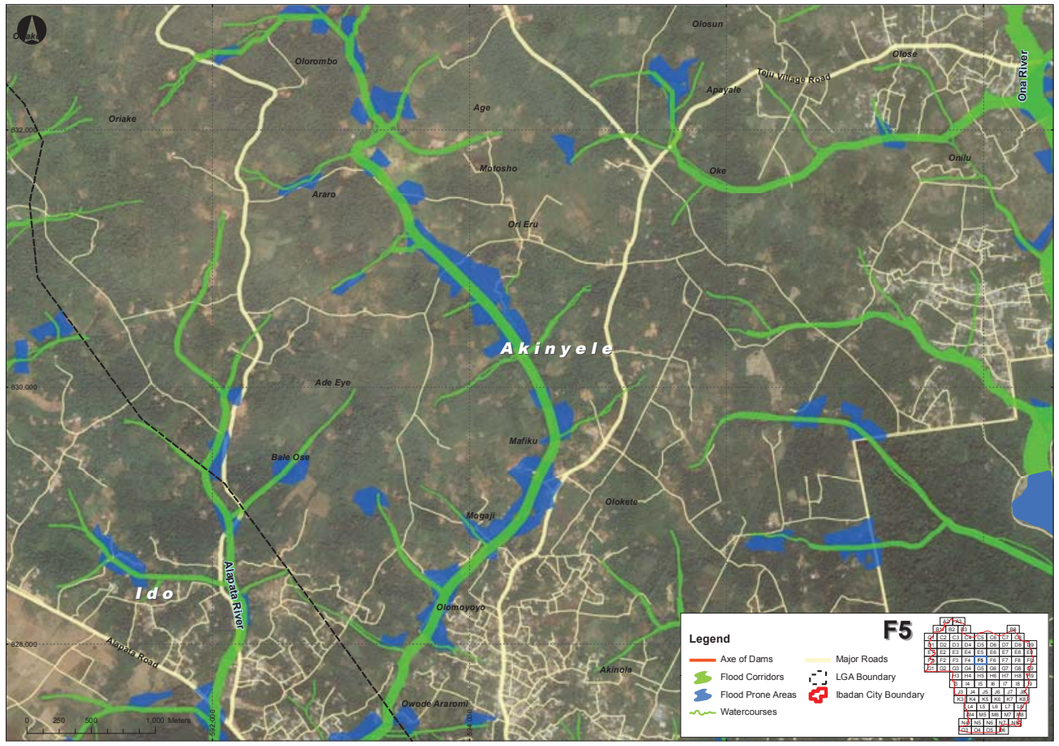

Lagelu
Legend
E9
Axe of Dams
Flood Corridors
Flood Prone Areas
Watercourses
Major Roads
LGA Boundary
Ibadan City Boundary

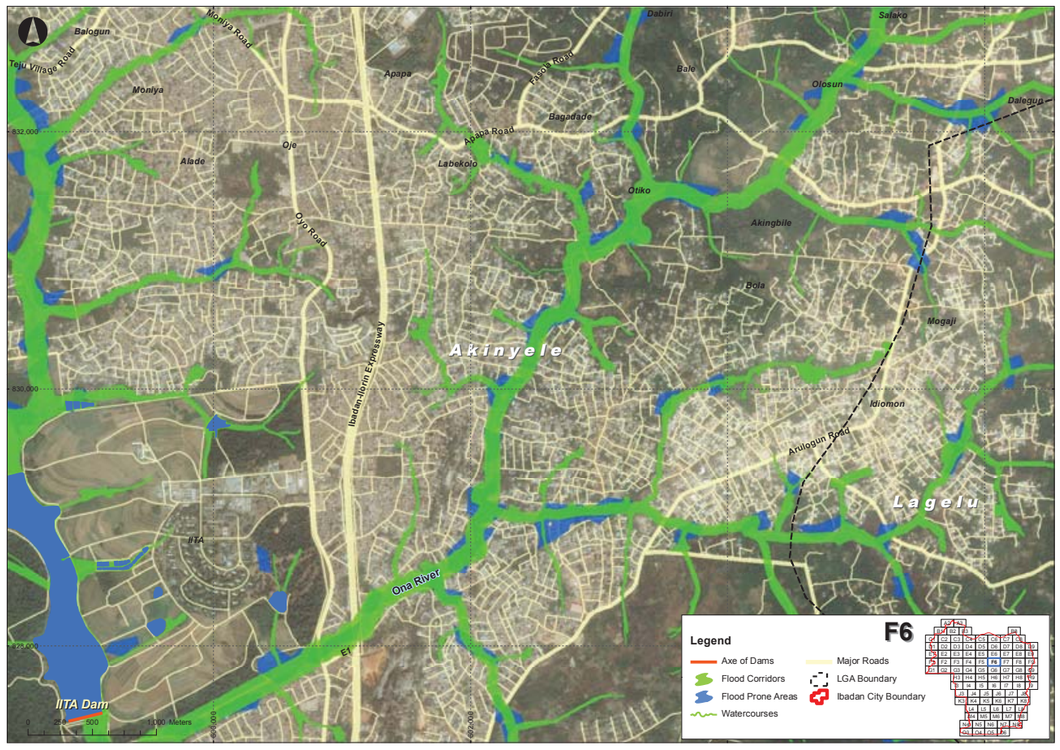

Abimba
Ido
Legend
F1
Axe of Dams
Flood Corridors
Flood Prone Areas
Watercourses
Major Roads
LGA Boundary
Ibadan City Boundary

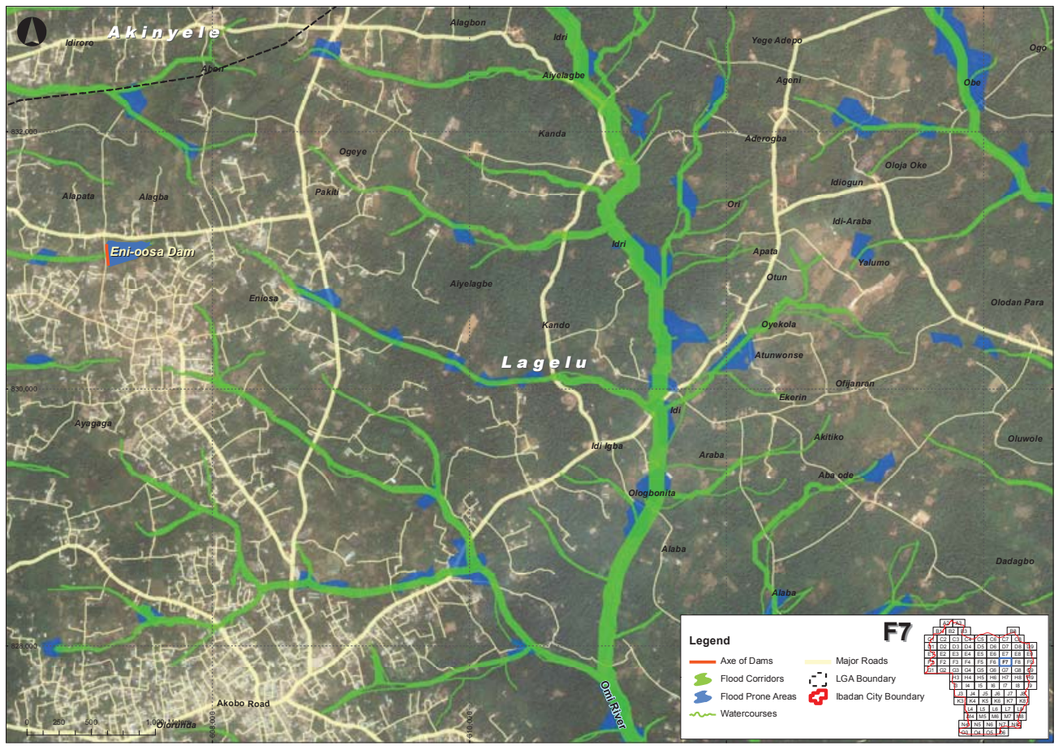

Ajibola
Ido
Dam
Onikanga
Temidire River
Legend
F2
Axe of Dams
Flood Corridors
Flood Prone Areas
Watercourses
Major Roads
LGA Boundary
Ibadan City Boundary

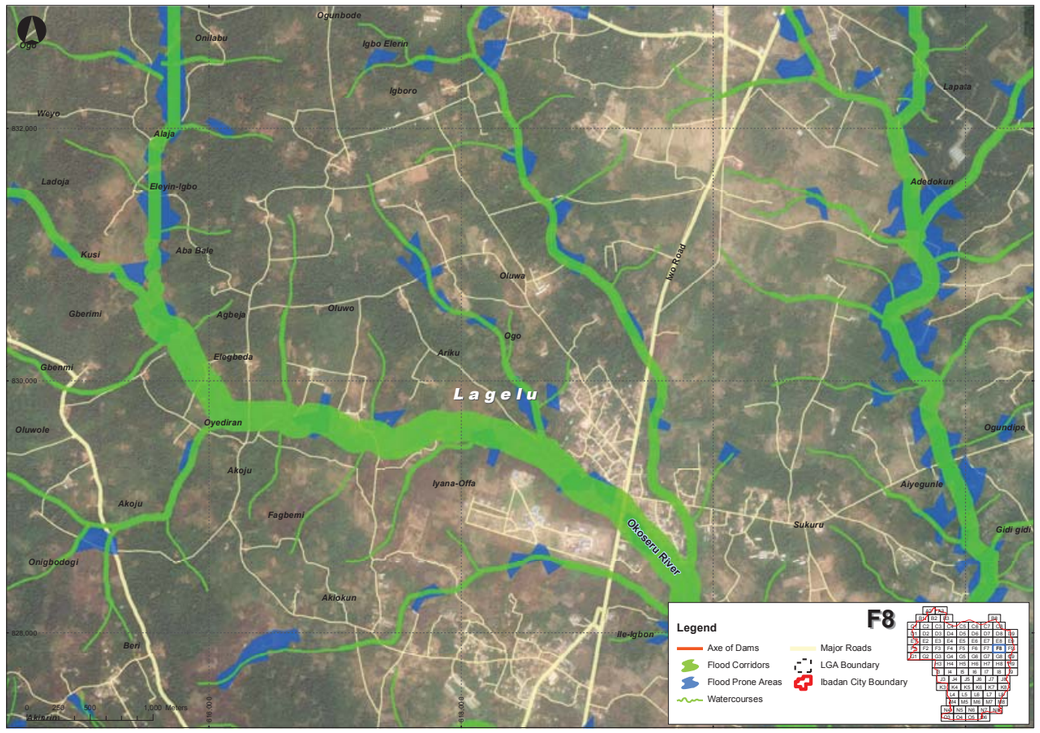

Elesin River
Temidire River
Oso River
Ido
Akande
Akinware
Oyedeji
Idiamu
Kogun
Langbin
Arutu
Onifade
Legend
F3
Axe of Dams
Flood Corridors
Flood Prone Areas
Watercourses
Major Roads
LGA Boundary
Ibadan City Boundary

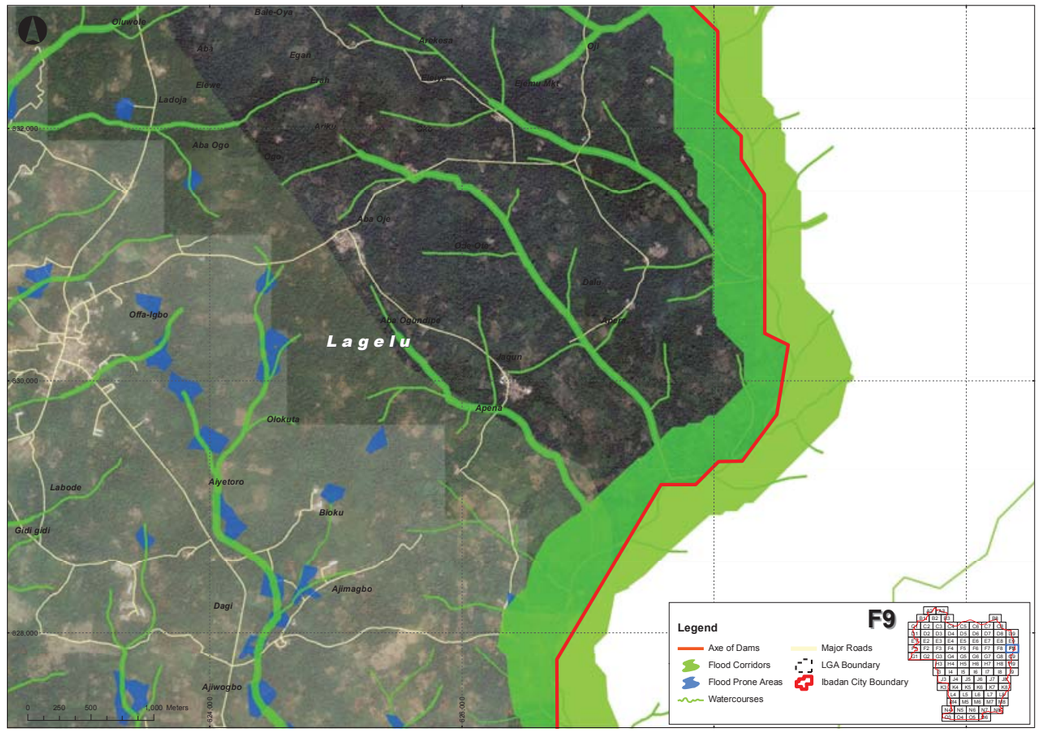

Okepupa
Adetinu
Oriake
Opalere
Bangbaiye
Pakuru
Adeaga
Arowoda
Olokiti
Alaraba
Akinlade
Akufo
Ajayi
Ido
Bogunmbe
Osunniya
Okuno
Olukoti
Alapata Road
Farinde
Falade
Legend
F4
Axe of Dams
Flood Corridors
Flood Prone Areas
Watercourses
Major Roads
LGA Boundary
Ibadan City Boundary

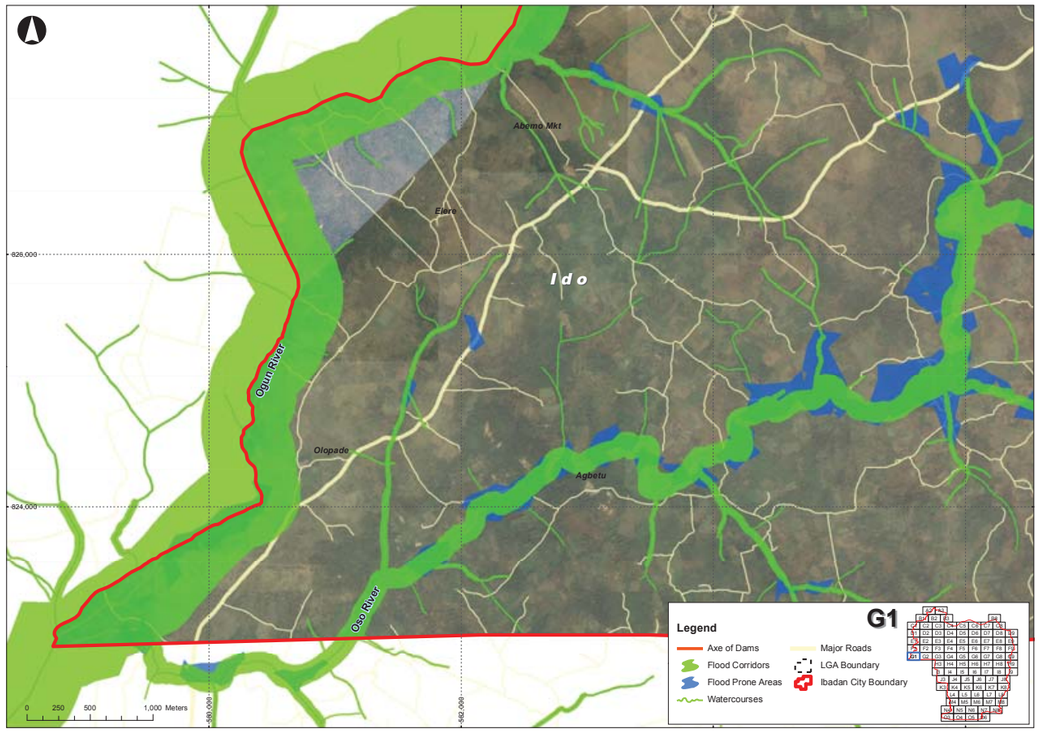

Olosun
Olorombo
Oriake
Age
Apayale
Teju Village Road
Ona River
Motosho
Oke
Onilu
Araro
Ori Eru
Akinyele
Ade Eye
Mafiku
Bale Ose
Oloketo
Mogaji
Ido
Alapata River
Alapata Road
Olomoyoyo
Akinola
Owode Araromi
Legend
F5
Axe of Dams
Flood Corridors
Flood Prone Areas
Watercourses
Major Roads
LGA Boundary
Ibadan City Boundary

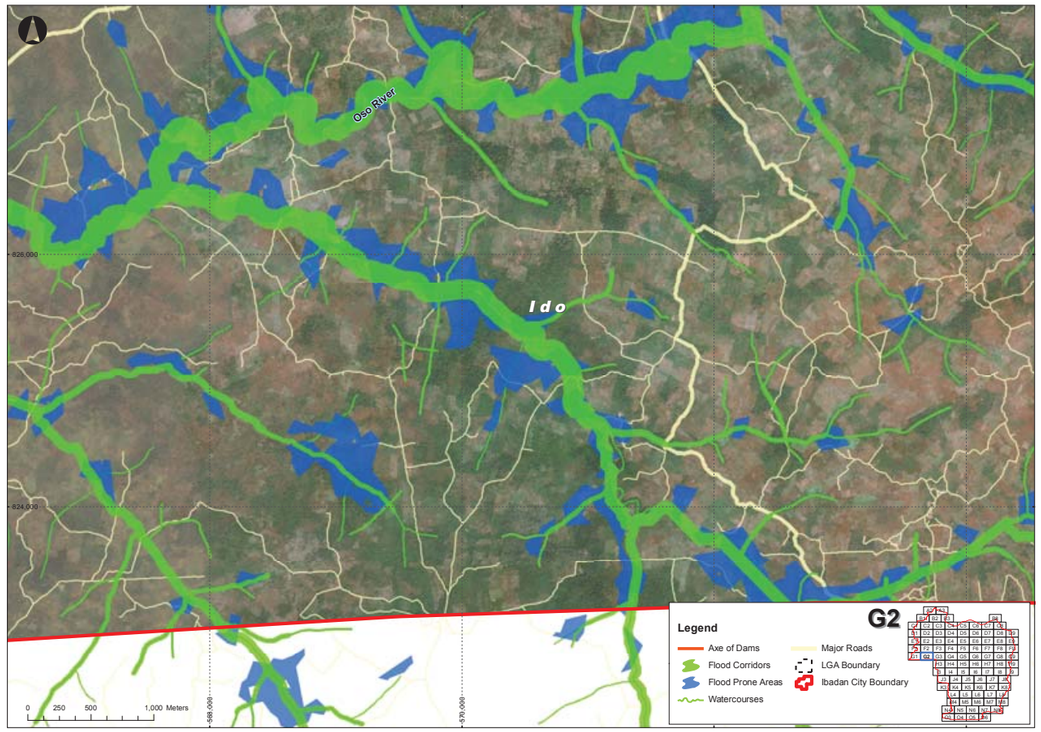

Balogun
Moniya Road
Teju Village Road
Moniya
Apapa
Dabiri
Salako
Bale
Olosun
Dalegun
Bagadade
Apapa Road
Alade
Oje
Labekolo
Otiko
Oyo Road
Akingbile
Bola
Mogaji
Akinyele
Ibadan-Ilorin Expressway
Idiomon
Arulogun Road
Lagelu
IITA
Ona River
IITA Dam
Legend
F6
Axe of Dams
Flood Corridors
Flood Prone Areas
Watercourses
Major Roads
LGA Boundary
Ibadan City Boundary

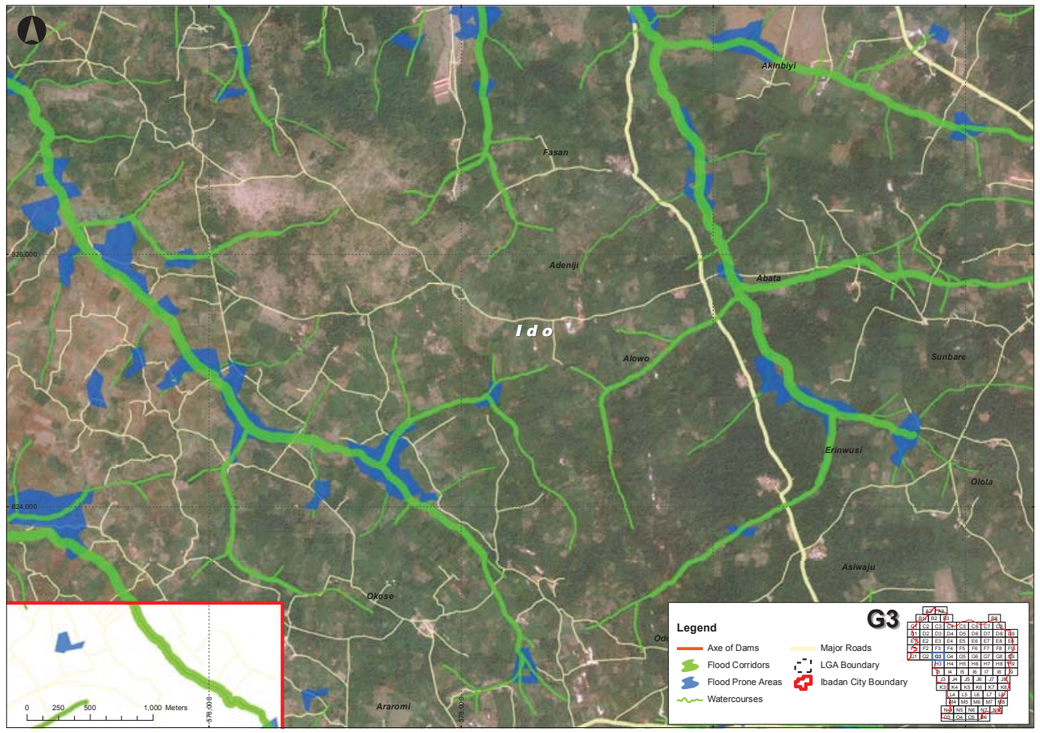

Akinyele
Idiroro
Alagbon
Idri
Yege Adepo
Ogo
Aiyelagbe
Agoni
Obe
Kanda
Aderogba
Ogeye
Oloja Oke
Alapata
Alagba
Pakiti
Idiogun
Ori
Idi-Araba
Eni-oosa Dam
Idri
Apata
Yalumo
Otun
Aiyelagbe
Eniosa
Olodan Para
Kando
Oyekola
Lagelu
Atunwonse
Ofijanran
Ekerin
Ayagaga
Idi
Akitiko
Oluwole
Idi Igba
Araba
Aba ode
Ologbonita
Alaba
Dadagbo
Alaba
Akobo Road
Omi River
Legend
F7
Axe of Dams
Flood Corridors
Flood Prone Areas
Watercourses
Major Roads
LGA Boundary
Ibadan City Boundary

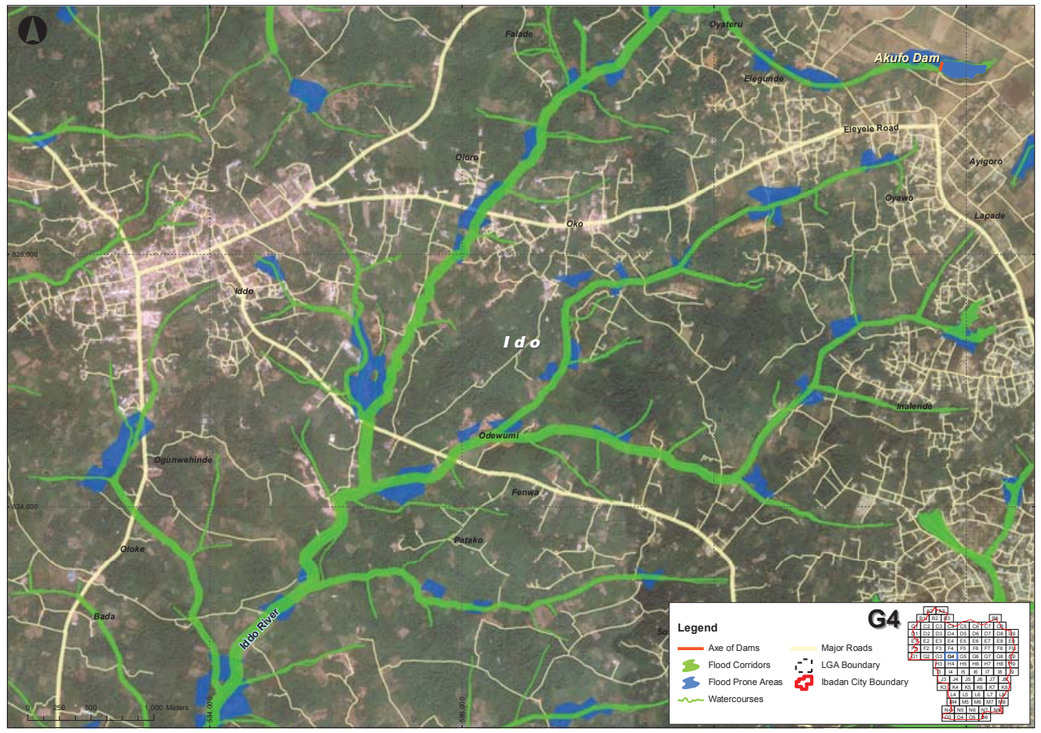

Lagelu
Okoseru River
Legend
F8
Axe of Dams
Flood Corridors
Flood Prone Areas
Watercourses
Major Roads
LGA Boundary
Ibadan City Boundary

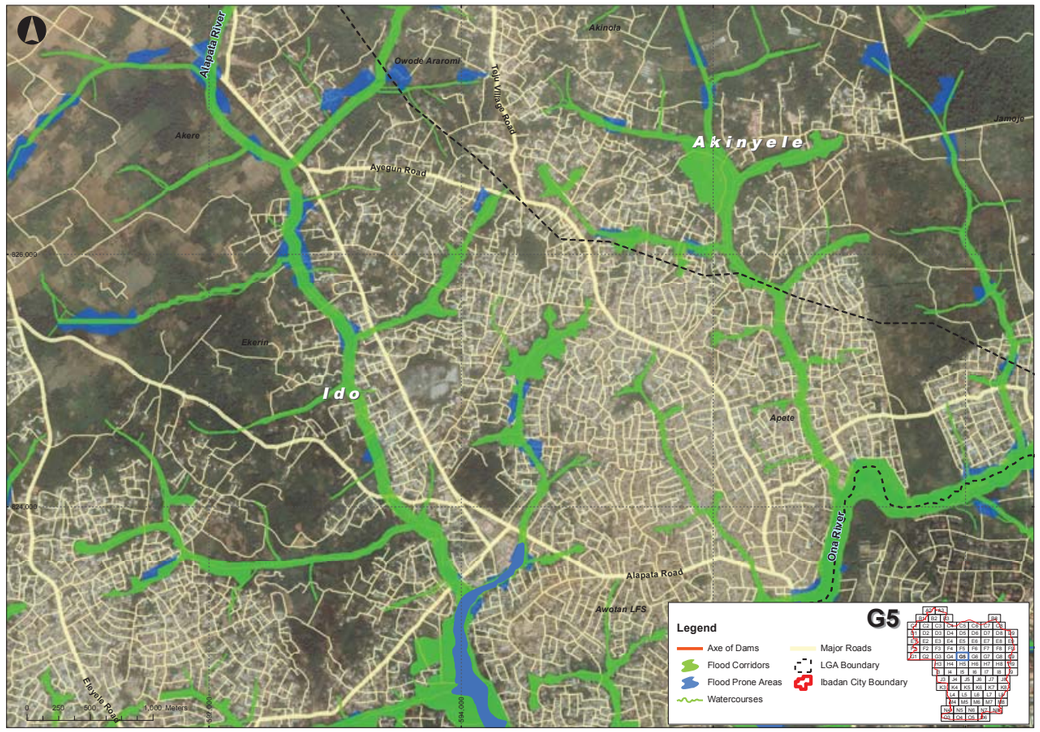

Lagelu
Legend
F9
Axe of Dams
Flood Corridors
Flood Prone Areas
Watercourses
Major Roads
LGA Boundary
Ibadan City Boundary

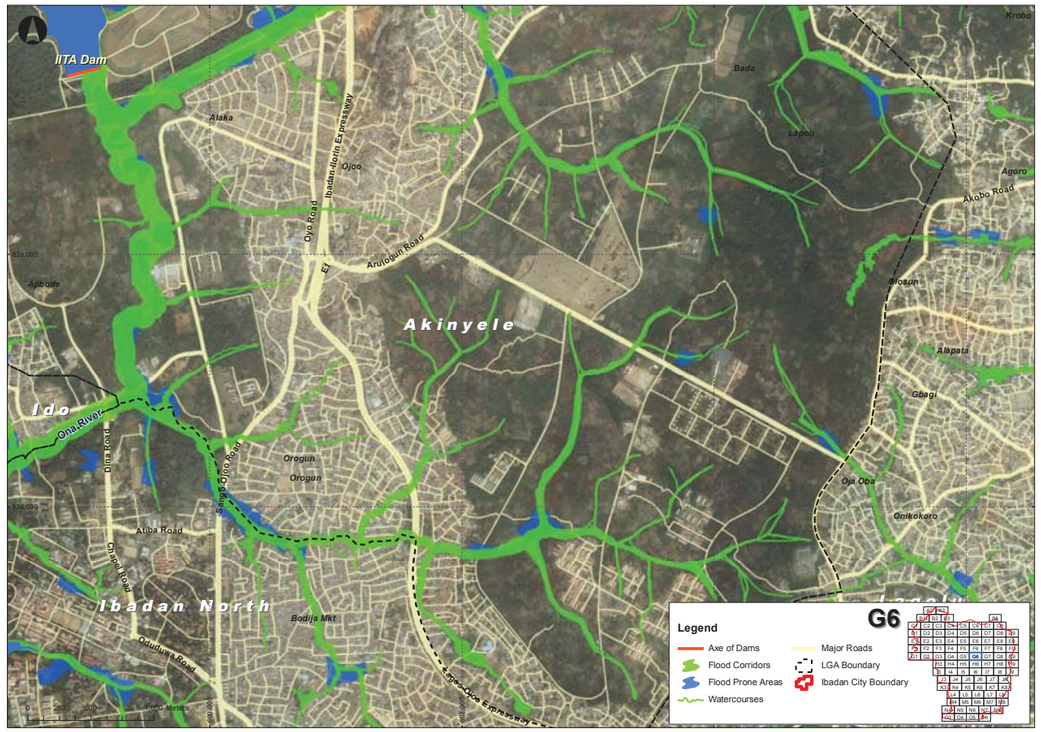

Ido
Ogun River
Oso River
Legend
G1
Axe of Dams
Flood Corridors
Flood Prone Areas
Watercourses
Major Roads
LGA Boundary
Ibadan City Boundary

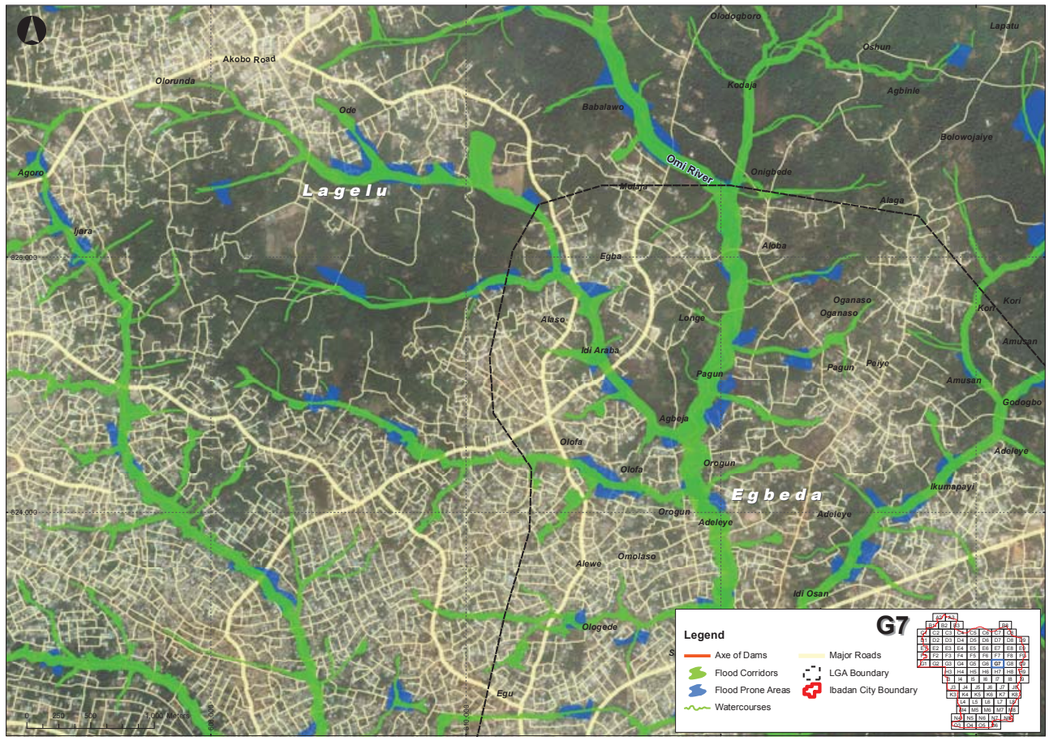

Oso River
Ido
Legend
G2
Axe of Dams
Flood Corridors
Flood Prone Areas
Watercourses
Major Roads
LGA Boundary
Ibadan City Boundary

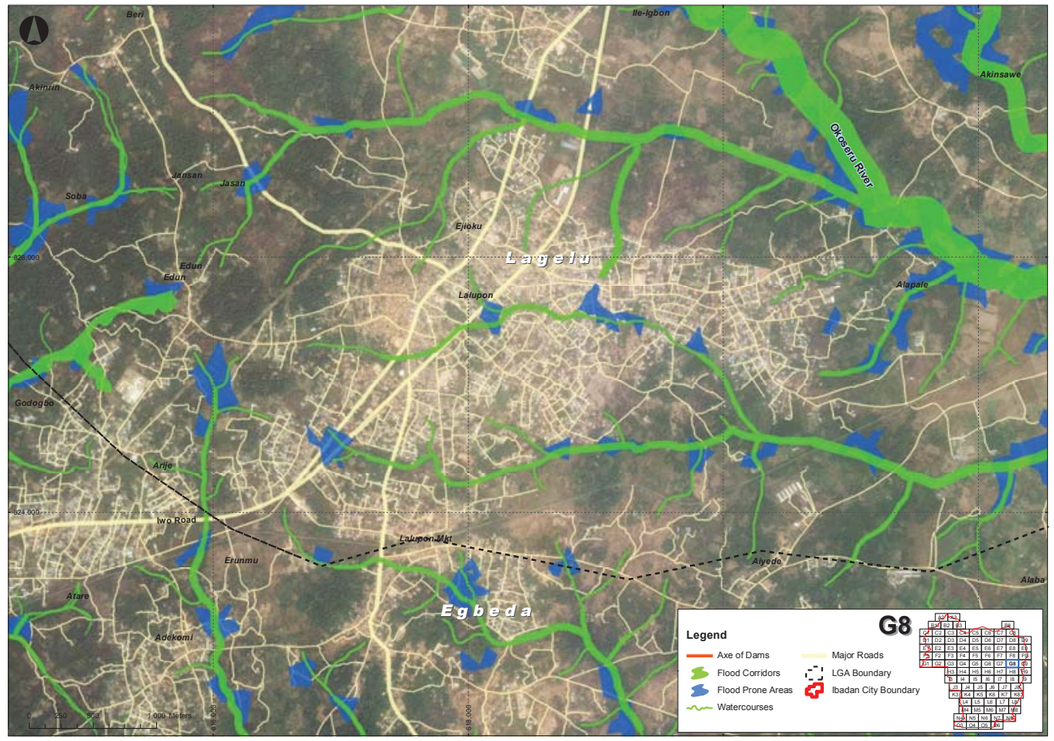

G3
Legend
Axe of Dams
Flood Corridors
Flood Prone Areas
Watercourses
Major Roads
LGA Boundary
Ibadan City Boundary
Ido
Akinbiyi
Fasan
Adeniji
Abata
Alowo
Sunbare
Erinwusi
Olota
Asiwaju
Okose
Araromi
0 250 500 1,000 Meters

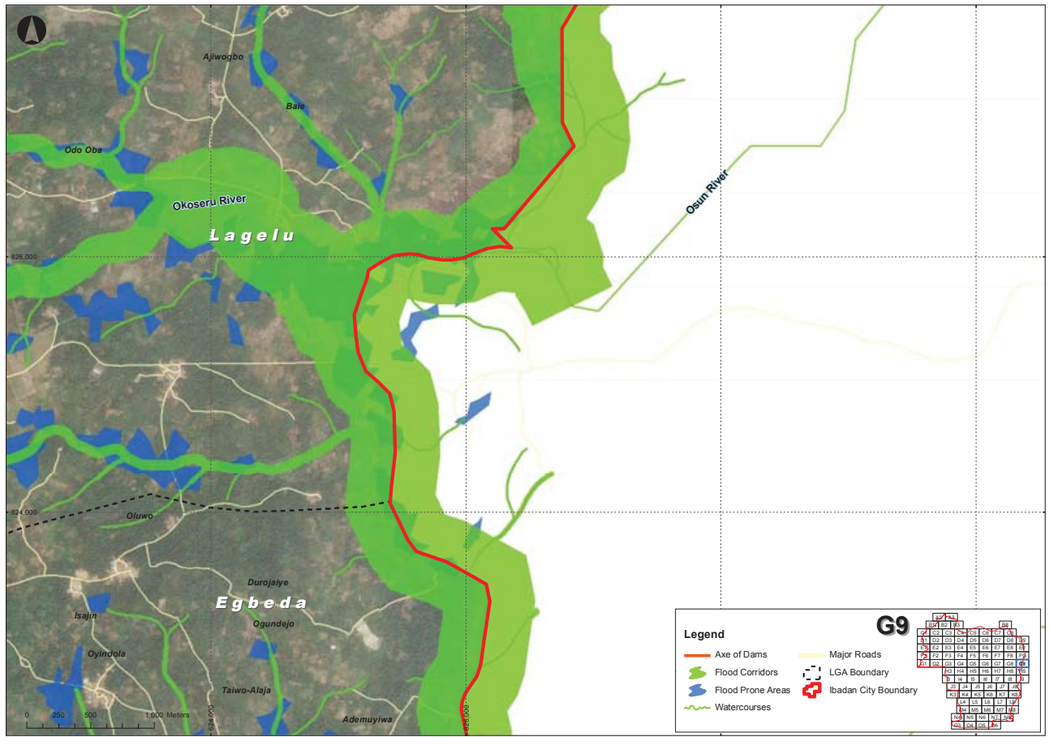

G4
Legend
Axe of Dams
Flood Corridors
Flood Prone Areas
Watercourses
Major Roads
LGA Boundary
Ibadan City Boundary
Ido
Akufo Dam
Falade
Oyateru
Elegunde
Eleyele Road
Ayigoro
Oyawo
Lapade
Ojoro
Oko
Iddo
Odewumi
Ogunwehinde
Fenwa
Patako
Oloke
Bada
Iddo River
0 250 500 1,000 Meters

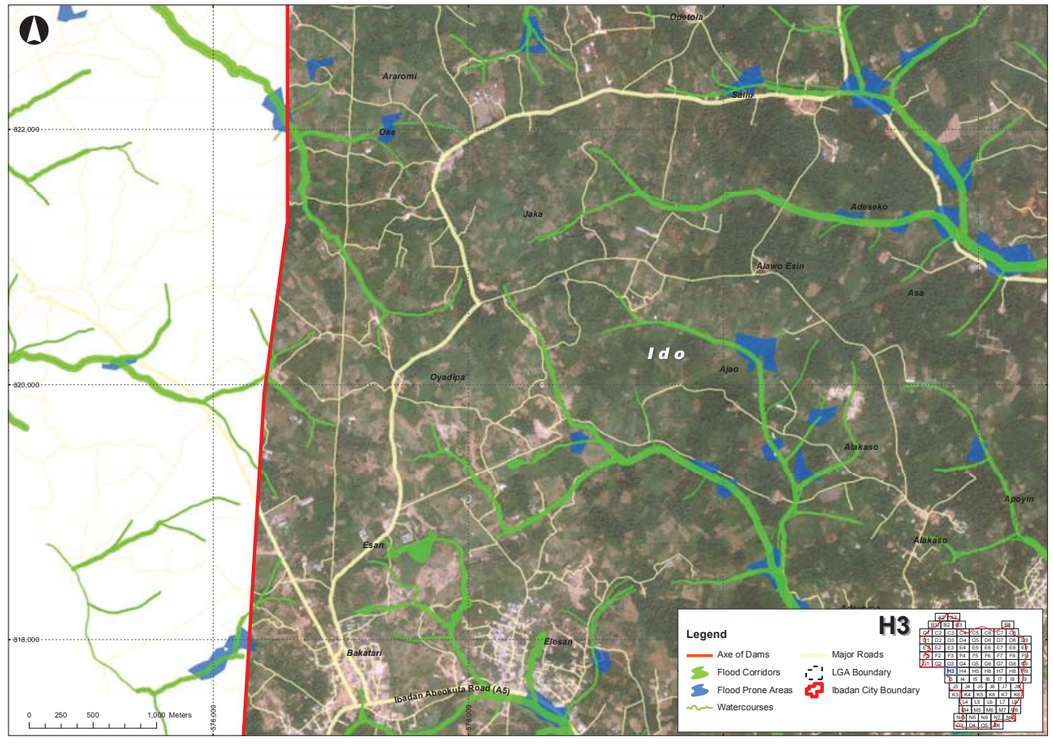

G5
Legend
Axe of Dams
Flood Corridors
Flood Prone Areas
Watercourses
Major Roads
LGA Boundary
Ibadan City Boundary
Akinyele
Ido
Alapata River
Owode Araromi
Akinola
Akere
Ayegun Road
Ekerin
Apete
Ona River
Alapata Road
Awotan LFS
Elayele Road
0 250 500 1,000 Meters

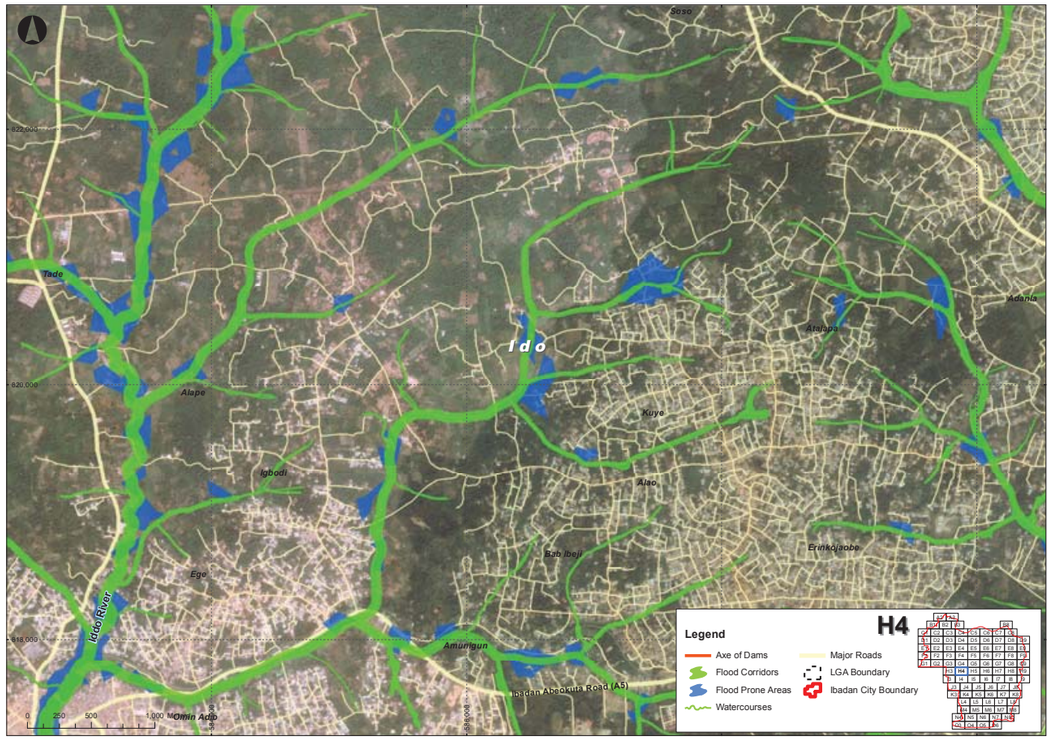

G6
Legend
Axe of Dams
Flood Corridors
Flood Prone Areas
Watercourses
Major Roads
LGA Boundary
Ibadan City Boundary
IITA Dam
Alaka
Ojoo
Ibadan-Ilorin Expressway
Oyo Road
Arulogun Road
Akinyele
Ido
Ona River
Orogun
Atiba Road
Ibadan North
Bodija Mkt
Oduduwa Road
Akobo Road
Agoro
Alapata
Gbagi
Oja Oba
Onikokoro
Krobo
Bada
Lapon
Ajibode
0 250 500 1,000 Meters

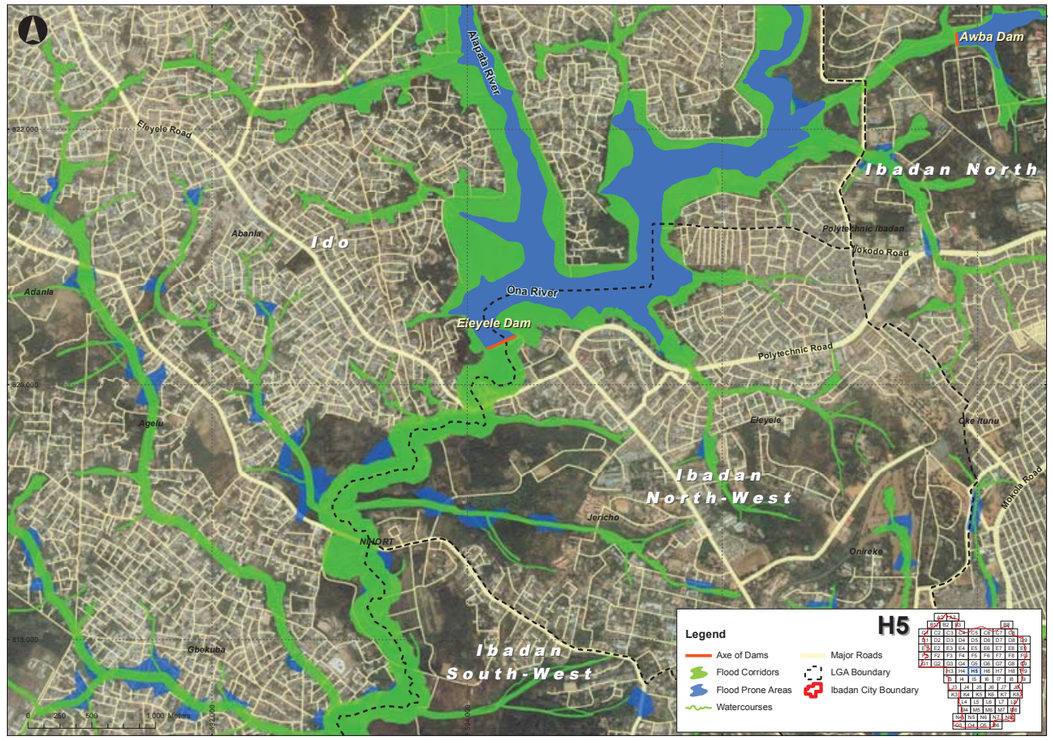

G7
Legend
Axe of Dams
Flood Corridors
Flood Prone Areas
Watercourses
Major Roads
LGA Boundary
Ibadan City Boundary
Lagelu
Egbeda
Omi River
Akobo Road
Olorunda
Ode
Agoro
Ijara
Babalawo
Kodaja
Oshun
Agbinle
Bolowojaiye
Onigbede
Alaga
Aloba
Egba
Alaso
Idi Araba
Longe
Oganaso
Pagun
Peiye
Kori
Amusan
Godogbo
Agbeja
Olofa
Orogun
Adeleye
Ikumapayi
Omolaso
Alewe
Idi Osan
Ologede
Egu

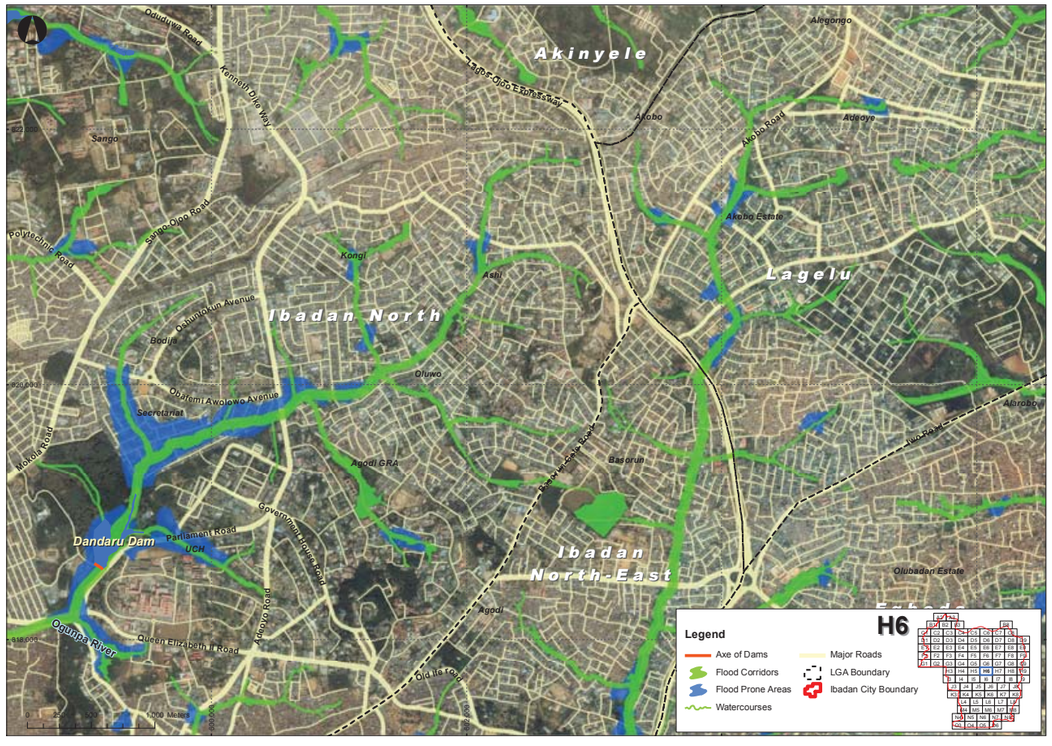

G8
Legend
Axe of Dams
Flood Corridors
Flood Prone Areas
Watercourses
Major Roads
LGA Boundary
Ibadan City Boundary
Lagelu
Egbeda
Okoseru River
Ile-Igbon
Akinsawe
Jasan
Soba
Ejioku
Edun
Lalupon
Alapale
Godogbo
Arije
Iwo Road
Lalupon Mkt
Erunmu
Aiyede
Alaba
Atare
Adekomi

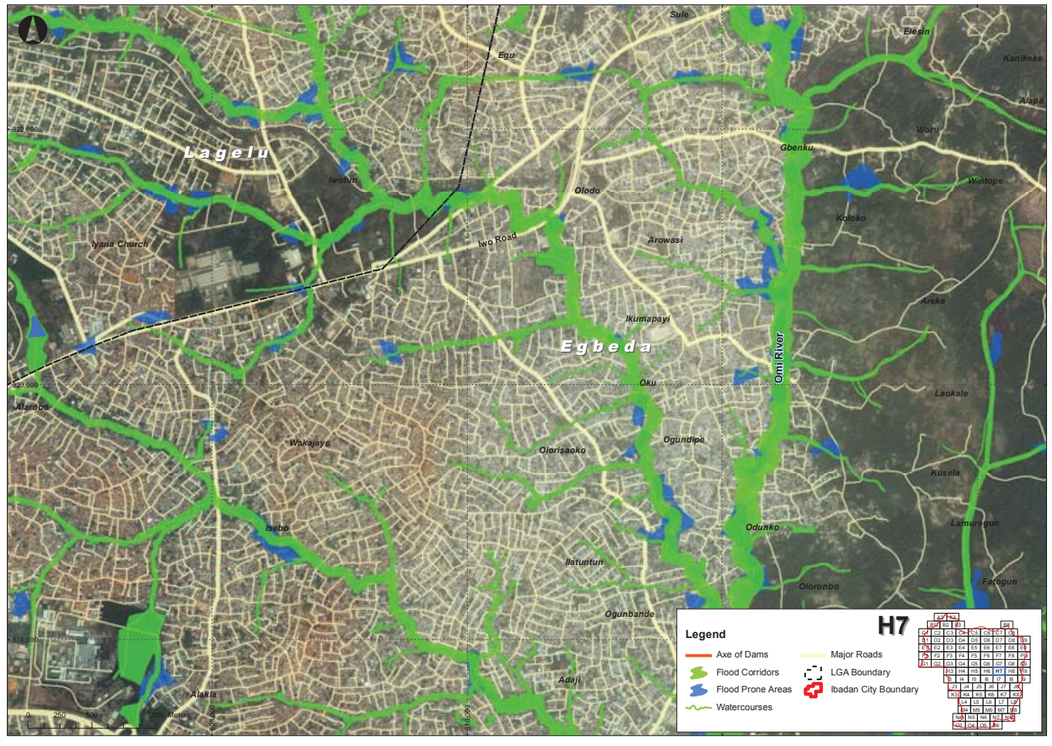

G9
Legend
Axe of Dams
Flood Corridors
Flood Prone Areas
Watercourses
Major Roads
LGA Boundary
Ibadan City Boundary
Lagelu
Egbeda
Okoseru River
Osun River
Ajiwogbo
Bale
Odo Oba
Oluwo
Durojaiye
Ogundejo
Isajin
Oyindola
Taiwo-Alaja
Ademuyiwa

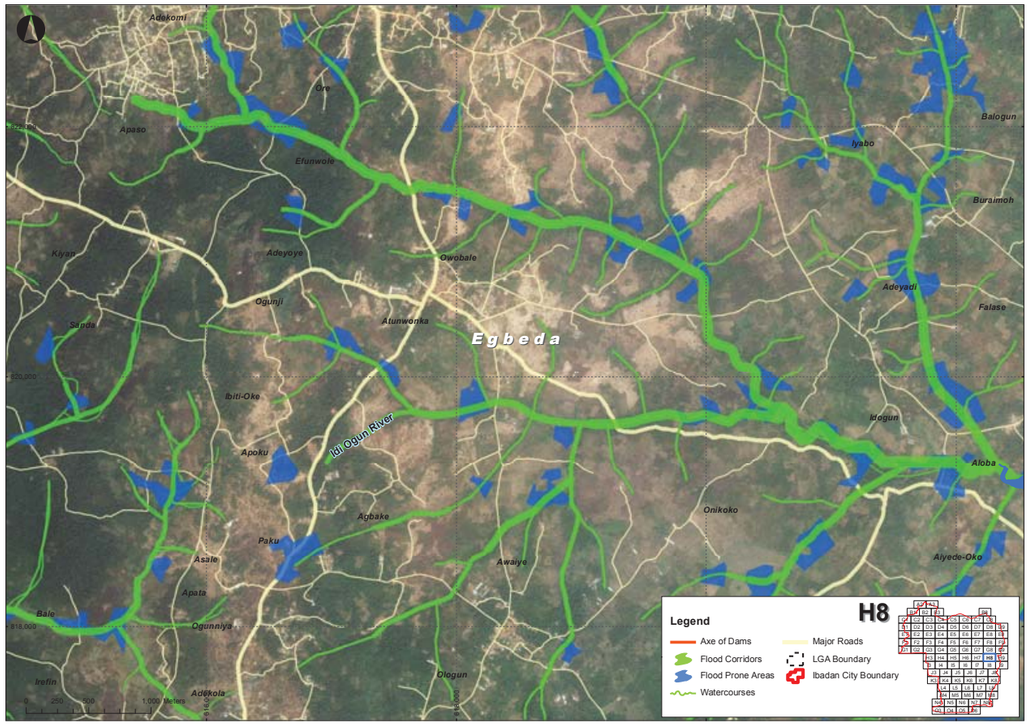

H3
Legend
Axe of Dams
Flood Corridors
Flood Prone Areas
Watercourses
Major Roads
LGA Boundary
Ibadan City Boundary
Ido
Odetola
Araromi
Oke
Jaka
Adeseko
Alawo Esin
Asa
Oyadipa
Ajao
Alakaso
Apoyin
Esan
Bakatari
Elesan
Ibadan Abeokuta Road (A5)

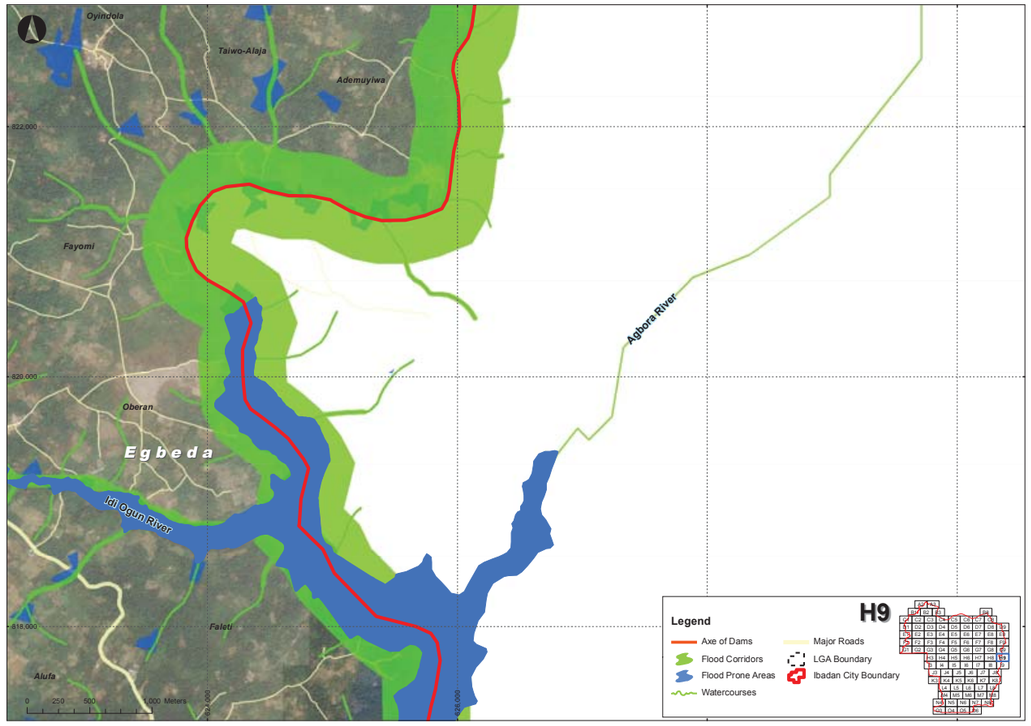

Sasa
Tade
Ido
Adanla
Ataiyese
Alape
Kuye
Igboodi
Aiso
Bab Ibeji
Erinkojaobe
Ege
Ido/Ijoko Road
Amuingun
Ibadan Abeokuta Road (A5)
Omin Ado
H4
Legend
Axe of Dams
Flood Corridors
Flood Prone Areas
Watercourses
Major Roads
LGA Boundary
Ibadan City Boundary

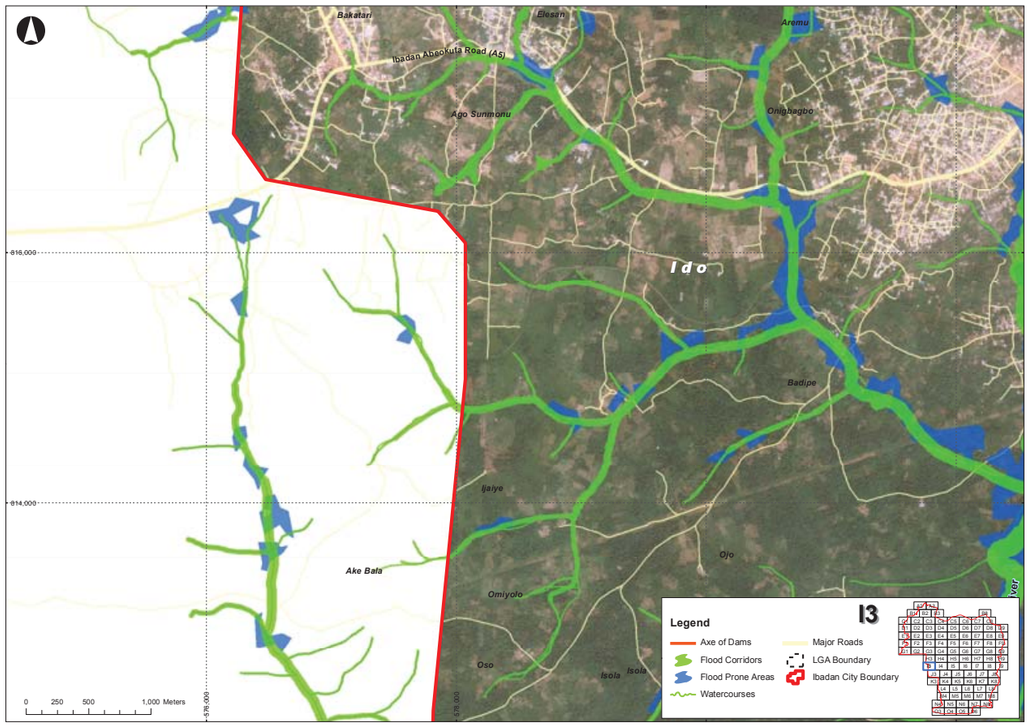

Awba Dam
Alapata River
Eleyele Road
Ibadan North
Abanla
Ido
Polytechnic Ibadan
Idikodo Road
Adanla
Ona River
Eleyele Dam
Polytechnic Road
Agella
Eleyele
Ode Itunu
Ibadan North-West
Jericho
NNPORT
Onireke
Idikodo Road
Gbokiiba
Ibadan South-West
H5
Legend
Axe of Dams
Flood Corridors
Flood Prone Areas
Watercourses
Major Roads
LGA Boundary
Ibadan City Boundary

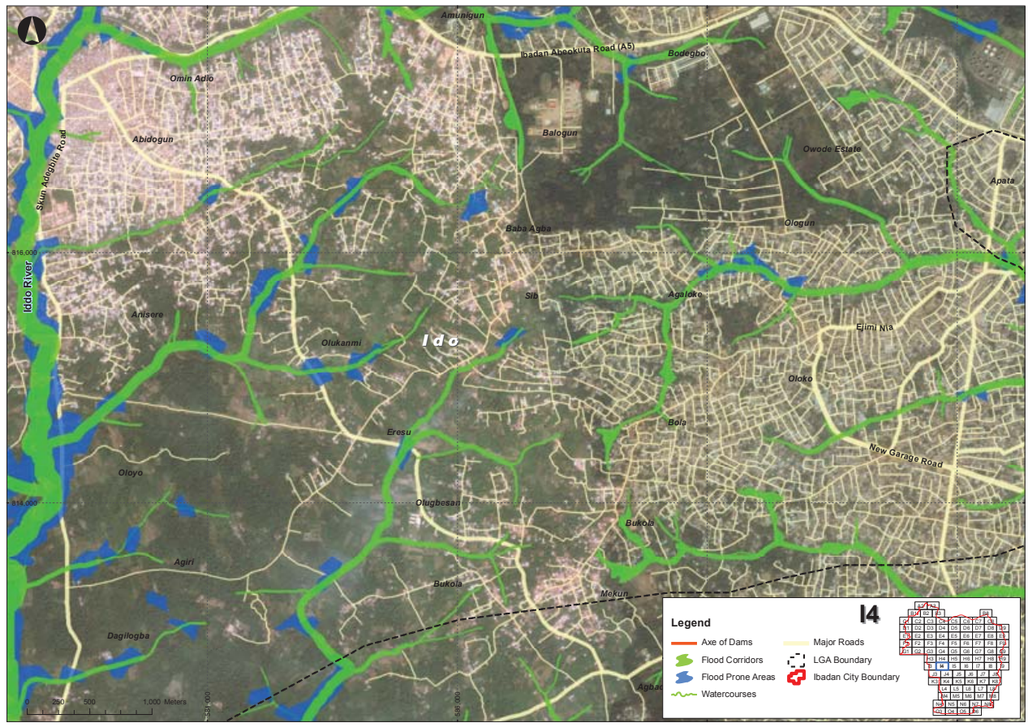

Akinyele
Alegongo
Oduduwa Road
Kennath Dike Way
Sango
Akobo
Atidoyo
Alolita Road
Sango-Ojoo Road
Polytechnic Road
Akobo Estate
Lagelu
Kongi
Ashi
Ibadan North
Bodija
Ohanuiogun Avenue
Oluwo
Ojaja I Awolowo Avenue
Secretariat
Agbowo
Agodi GRA
Basorun
Idi-Ape
Dandaru Dam
Parliament Road
UCH
Government House Road
Olubadan Estate
Ibadan North-East
Agodi
Queen Elizabeth II Road
Ogunpa River
H6
Legend
Axe of Dams
Flood Corridors
Flood Prone Areas
Watercourses
Major Roads
LGA Boundary
Ibadan City Boundary

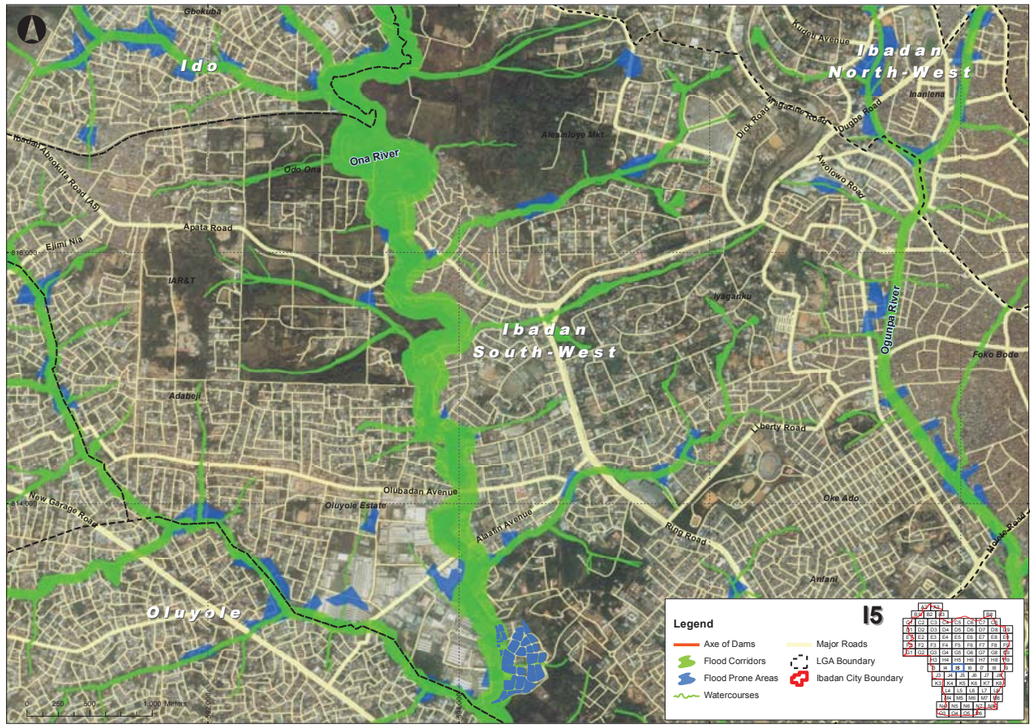

Sule
Egu
Elesin
Kanikeke
Alapa
Lagelu
Iwofin
Gbenku
Wortu
Olodo
Iwo Road
Arowasi
Wattope
Kolioko
Iyana Church
Areke
Ikumapayi
Egbeda
Oku
Omi River
Laokale
Alaobo
Wakajaye
Oguntipo
Olorisaoka
Kusela
Isabo
Odunko
Lamuregun
Ilatuntun
Oloronbo
Fatogun
Ogunbando
Adeji
Alaka
H7
Legend
Axe of Dams
Flood Corridors
Flood Prone Areas
Watercourses
Major Roads
LGA Boundary
Ibadan City Boundary

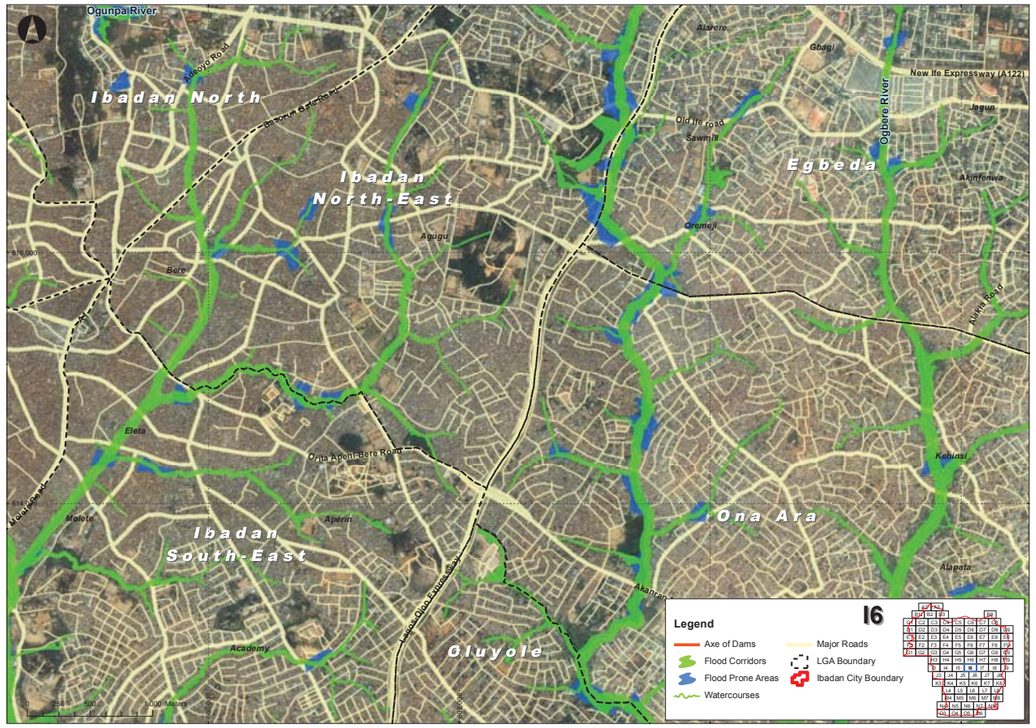

H8
Legend
Axe of Dams
Flood Corridors
Flood Prone Areas
Watercourses
Major Roads
LGA Boundary
Ibadan City Boundary
Egbeda
Idi Ogun River
Adekomi
Apaso
Efunwole
Owobale
Adeyoye
Ogunji
Atunwonka
Ibiti-Oke
Apoku
Agbake
Paku
Asale
Apata
Ogunniya
Bale
Irefin
Adekola
Awaiye
Onikoko
Idogun
Aloba
Aiyede-Oko
Adeyadi
Falase
Buraimoh
Iyabo
Balogun
Ore

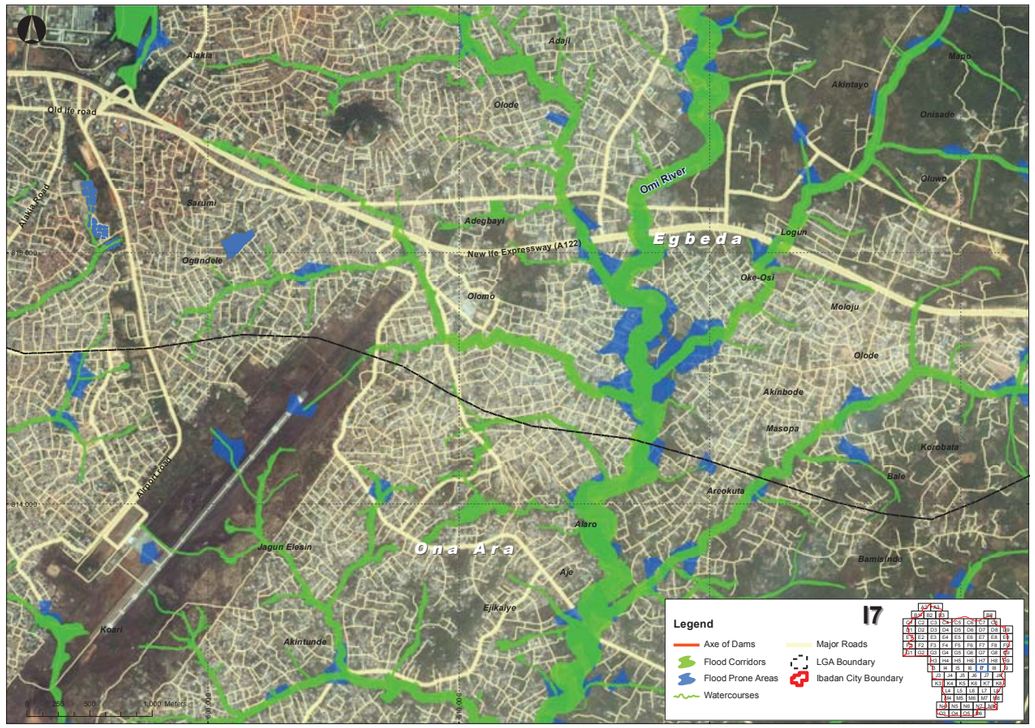

H9
Legend
Axe of Dams
Flood Corridors
Flood Prone Areas
Watercourses
Major Roads
LGA Boundary
Ibadan City Boundary
Egbeda
Idi Ogun River
Agbora River
Oyindola
Taiwo-Alaja
Ademuyiwa
Fayomi
Oberan
Faleti
Alufa

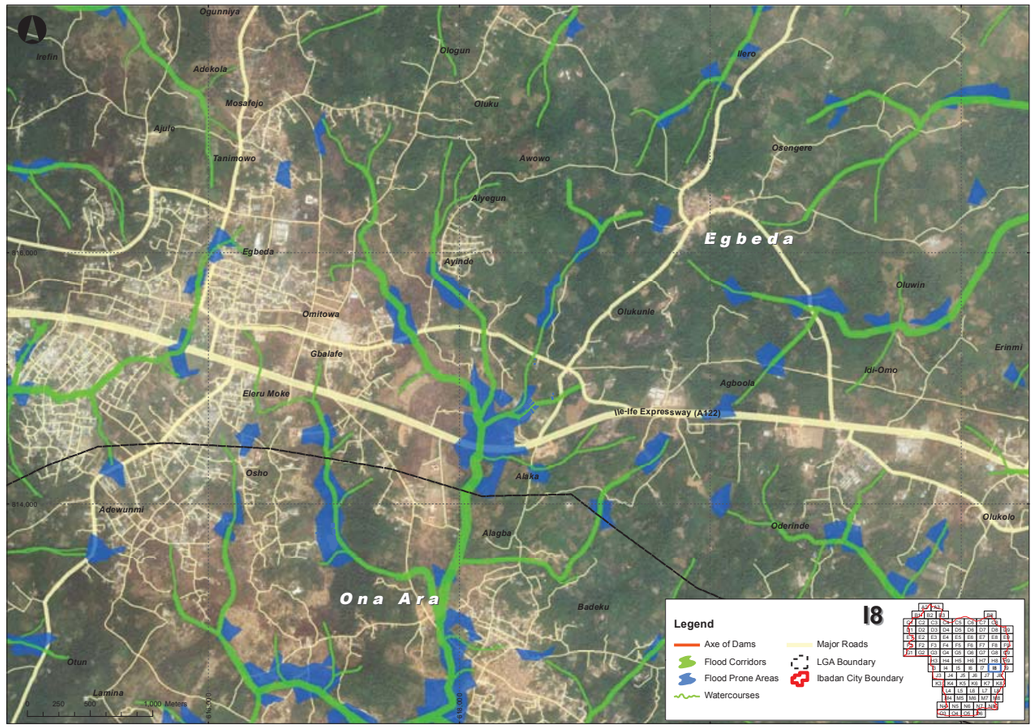

I3
Legend
Axe of Dams
Flood Corridors
Flood Prone Areas
Watercourses
Major Roads
LGA Boundary
Ibadan City Boundary
Ido
Ibadan Abeokuta Road (A5)
Bakatari
Elesan
Aremu
Ago Sunmonu
Onigbagbo
Badipe
Ijaiye
Ojo
Omiyolo
Oso
Isola
Ake Bala
0 250 500 1,000 Meters

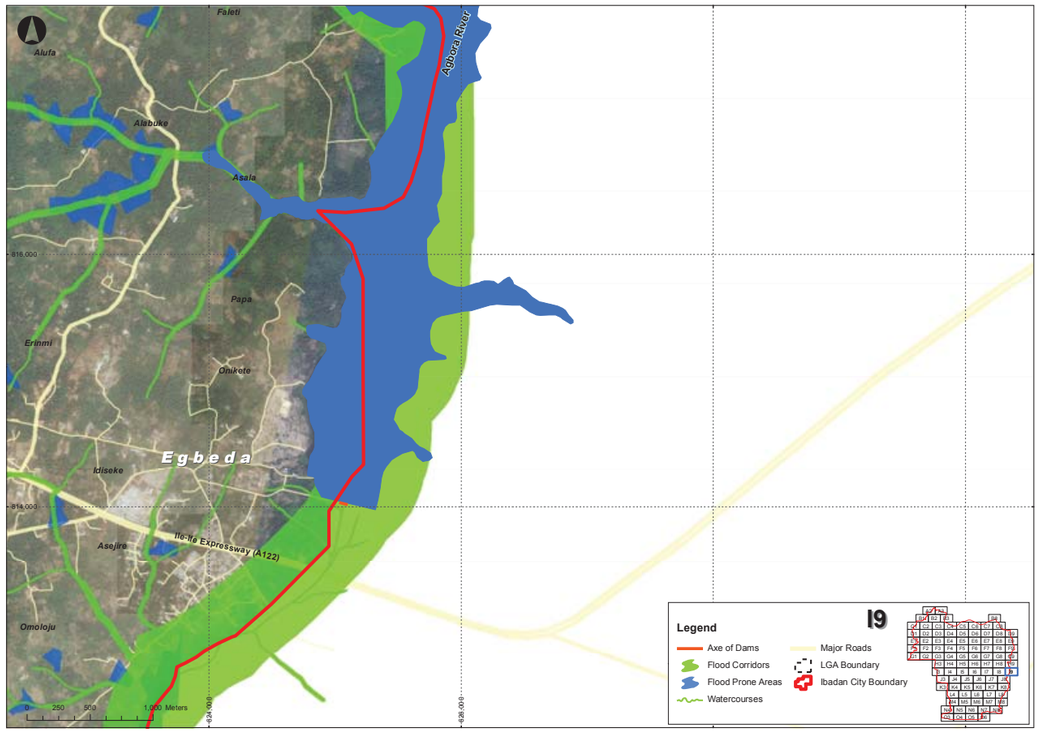

I4
Legend
Axe of Dams
Flood Corridors
Flood Prone Areas
Watercourses
Major Roads
LGA Boundary
Ibadan City Boundary
Ido
Ibadan Abeokuta Road (A5)
Amunigun
Bodegbo
Omin Adio
Abidogun
Balogun
Owode Estate
Apata
Ologun
Baba Agba
Sib
Agaloko
Ejimi Nla
Oloko
Bola
New Garage Road
Anisere
Olukanmi
Eresu
Oloyo
Olugbesan
Bukola
Agiri
Dagilogba
Mekun
Iddo River
Skun Adegbite Road

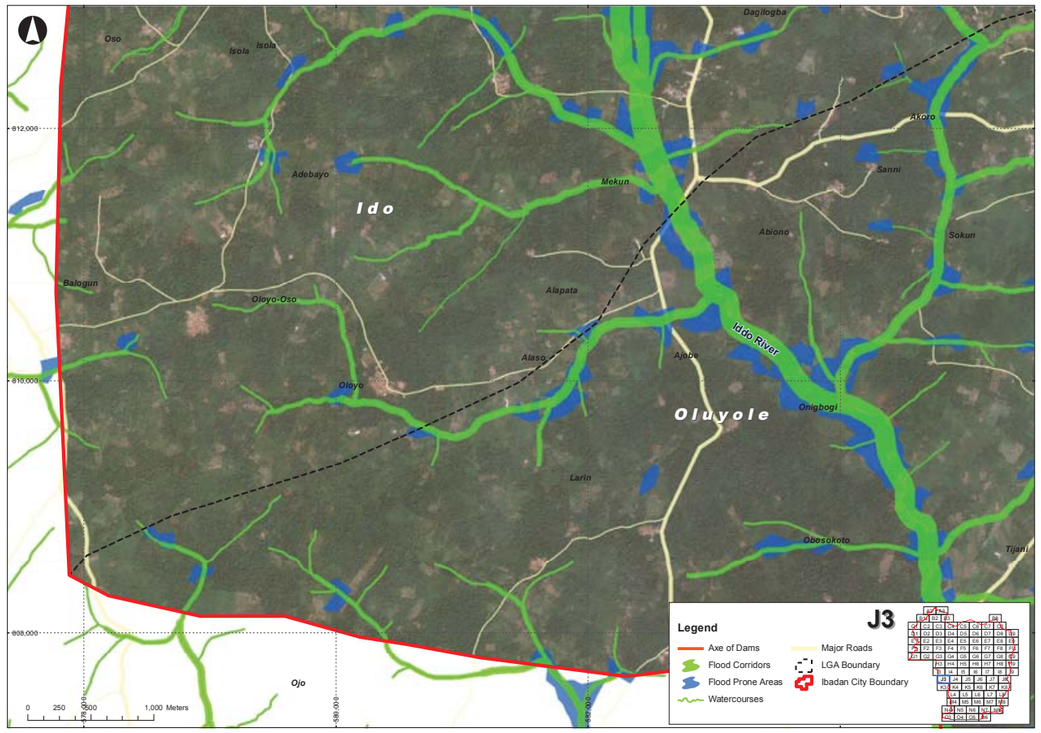

Ido
Ibadan North-West
Ibadan South-West
Oluyole
Ona River
Ogunpa River
Ibadan-Abeokuta Road (A5)
Apata Road
Ojo Oba
Eleyele
IAR&T
Ayegunle
Foko Bode
Adabeji
Liberty Road
Olubadan Avenue
Oluyole Estate
New Garage Road
Akanni Avenue
Ring Road
Oke Ado
Anfani
Ikolaba
Kinnira Avenue
Inalende
Amuloye Mkt
Dugbe Road
Molowo River
Legend
Axe of Dams
Flood Corridors
Flood Prone Areas
Watercourses
Major Roads
LGA Boundary
Ibadan City Boundary
15

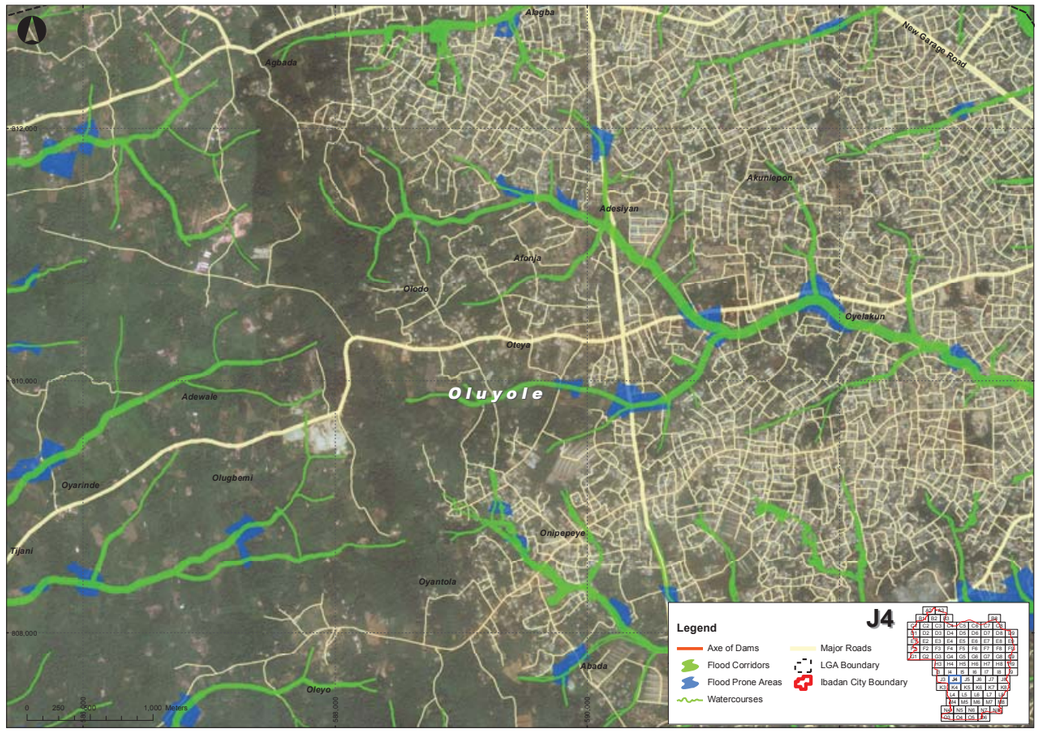

Ogunpa River
Ibadan North
Ibadan North-East
Ibadan South-East
Ona Ara
Oluyole
Egbeda
Ogbere River
Akanran-Apata-Bere Road
Eleta
Bere
Agugu
Aperin
Melete
Academy
Alarere
Gbagi
New Ife Expressway (A122)
Jagun
Sawmill
Old Ife road
Oremeji
Akinfenwa
Kehinsi
Alapata
Legend
Axe of Dams
Flood Corridors
Flood Prone Areas
Watercourses
Major Roads
LGA Boundary
Ibadan City Boundary
16

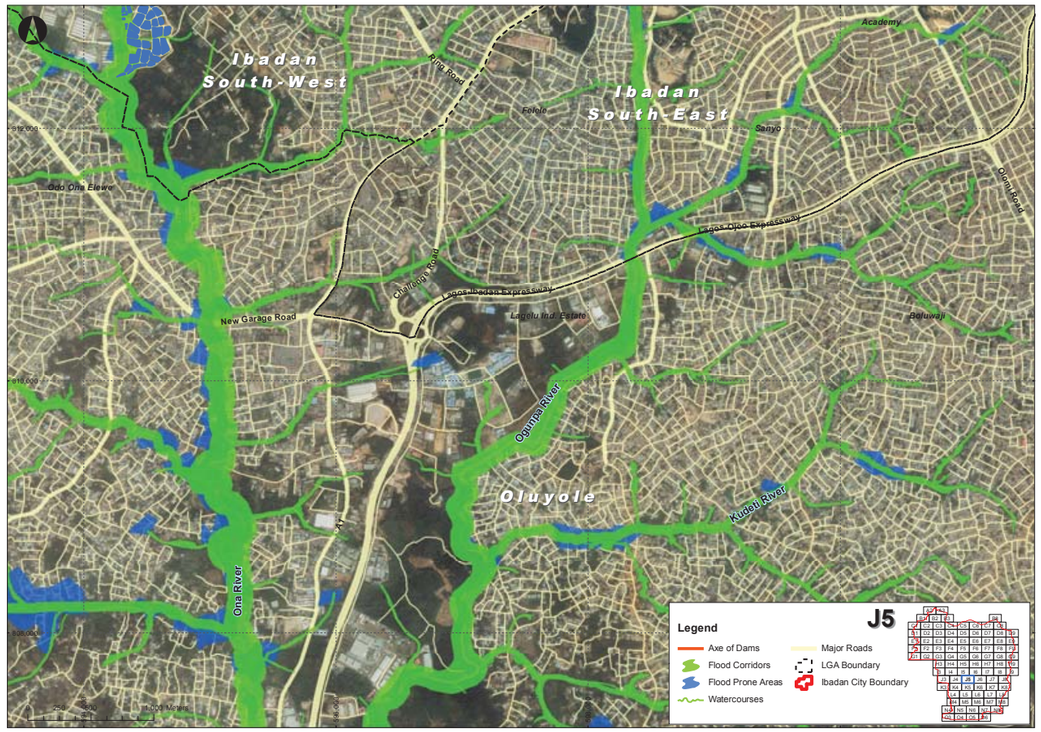

Ona Ara
Egbeda
Omi River
Ibadan-Abeokuta Road (A5)
Old Ife road
Alaka
Adoji
Olode
Akintayo
Onisado
Maple
Cluwa
Logun
Adegbayi
Ogandele
Olomo
Oke-Osi
Moloju
Akinbode
Masopa
Koribata
Bale
Areokuta
Alaro
Ajo
Ejikalye
Bamisile
Jagun Elesin
Akintunde
Koori
Samuni
New Ife Expressway (A122)
Legend
Axe of Dams
Flood Corridors
Flood Prone Areas
Watercourses
Major Roads
LGA Boundary
Ibadan City Boundary
17

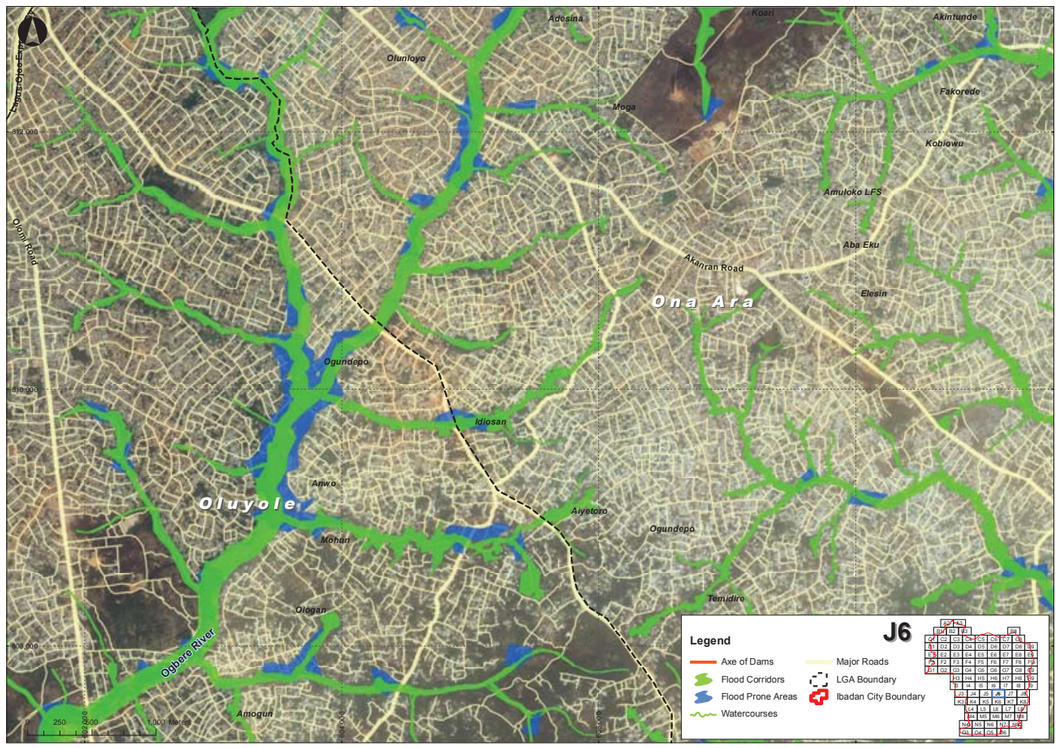

Ona Ara
Egbeda
Ogunniya
Irefin
Adekola
Mosafejo
Ajuji
Tanimowo
Ologun
Oluku
Awowo
Aiyegun
Ayinde
Egbeda
Omitowa
Gbalafe
Eleru Moke
Osho
Adewunmi
Otun
Lamina
Alagba
Badeku
Osengere
Oluwin
Olukunle
Agboola
Ikii-Omo
Erinmi
Ife-Ife Expressway (A122)
Alaka
Oderinde
Olukolo
Legend
Axe of Dams
Flood Corridors
Flood Prone Areas
Watercourses
Major Roads
LGA Boundary
Ibadan City Boundary
18

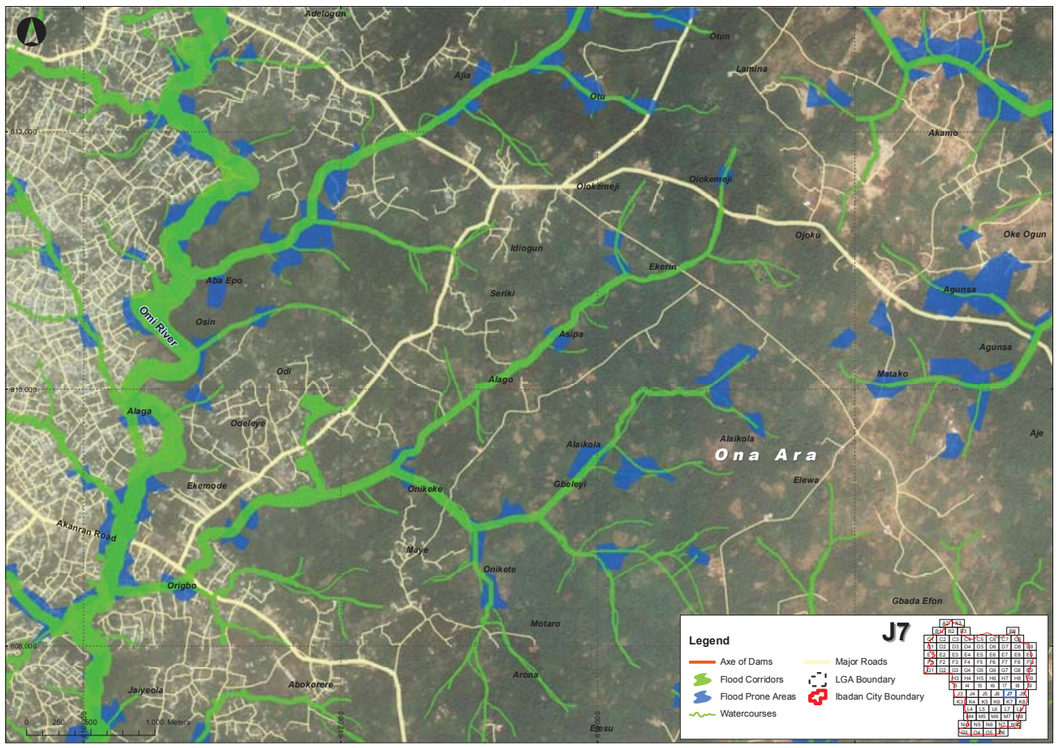

Faleti
Alufa
Abiola River
Afabuke
Asala
Papa
Erinmi
Onikoto
Egbeda
Idiseke
Asejire
Ilorin Expressway (A122)
Omoloju
816,000
814,000
812,000
808,000
I9
Legend
Axe of Dams
Flood Corridors
Flood Prone Areas
Watercourses
Major Roads
LGA Boundary
Ibadan City Boundary
0 250 500 1,000 Meters

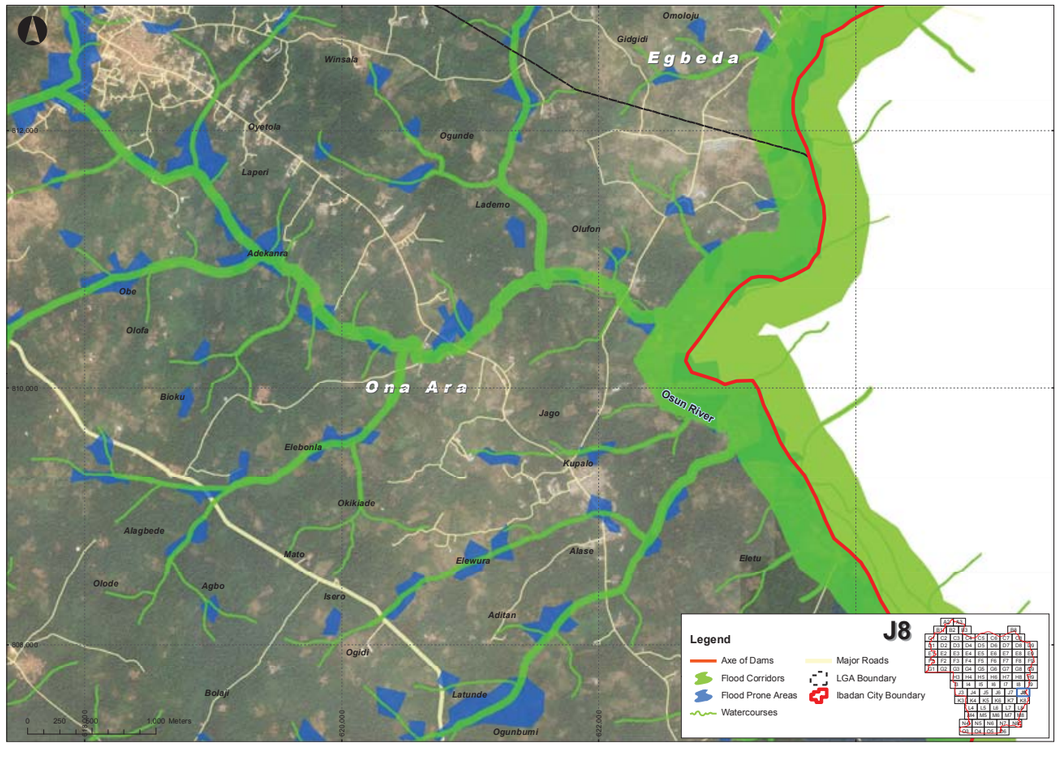

Oso
Isola
Dagilogba
Akoro
Adebayo
Ido
Mekun
Sanni
Abiono
Sokun
Balogun
Oloyo-Oso
Alapata
Iddo River
Alaso
Ajapo
Oloyo
Oluyole
Onigbogi
Larin
Obesokoto
Tijani
Ojo
812,000
808,000
J3
Legend
Axe of Dams
Flood Corridors
Flood Prone Areas
Watercourses
Major Roads
LGA Boundary
Ibadan City Boundary
0 250 500 1,000 Meters

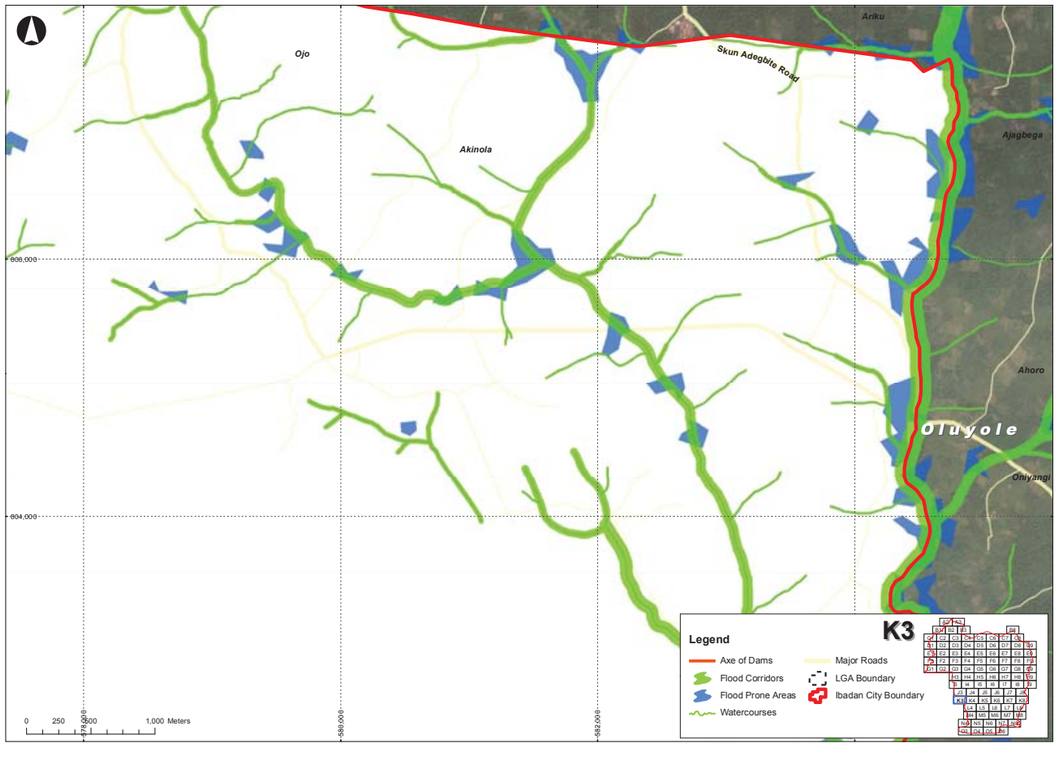

Alegba
Agbada
New Garage Road
Akunlepon
Adesiyan
Atonja
Olodo
Oyejakun
Oteya
Oluyole
Adewale
Olugbemi
Oyarinde
Onipepeye
Tijani
Oyantola
Abada
Oleyo
812,000
810,000
808,000
J4
Legend
Axe of Dams
Flood Corridors
Flood Prone Areas
Watercourses
Major Roads
LGA Boundary
Ibadan City Boundary
0 250 500 1,000 Meters

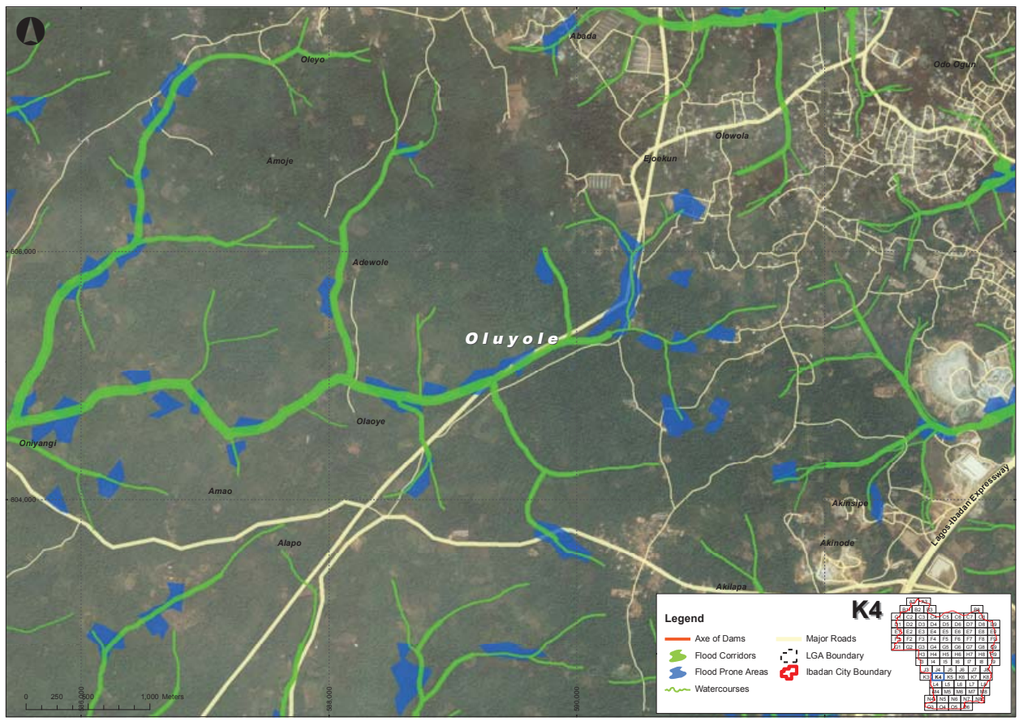

Ibadan South-West
Ibadan South-East
Ring Road
Academy
Felele
Sanyo
Olomi Road
Ogbo Ona Elewe
Lagos-Ibadan Expressway
Oluyole Road
New Garage Road
Lagelu Ind. Estate
Beluwah
Ogunpa River
Oluyole
Kuseju River
Ona River
Ojoo
Ibadan Main
J5
Legend
Axe of Dams
Flood Corridors
Flood Prone Areas
Watercourses
Major Roads
LGA Boundary
Ibadan City Boundary

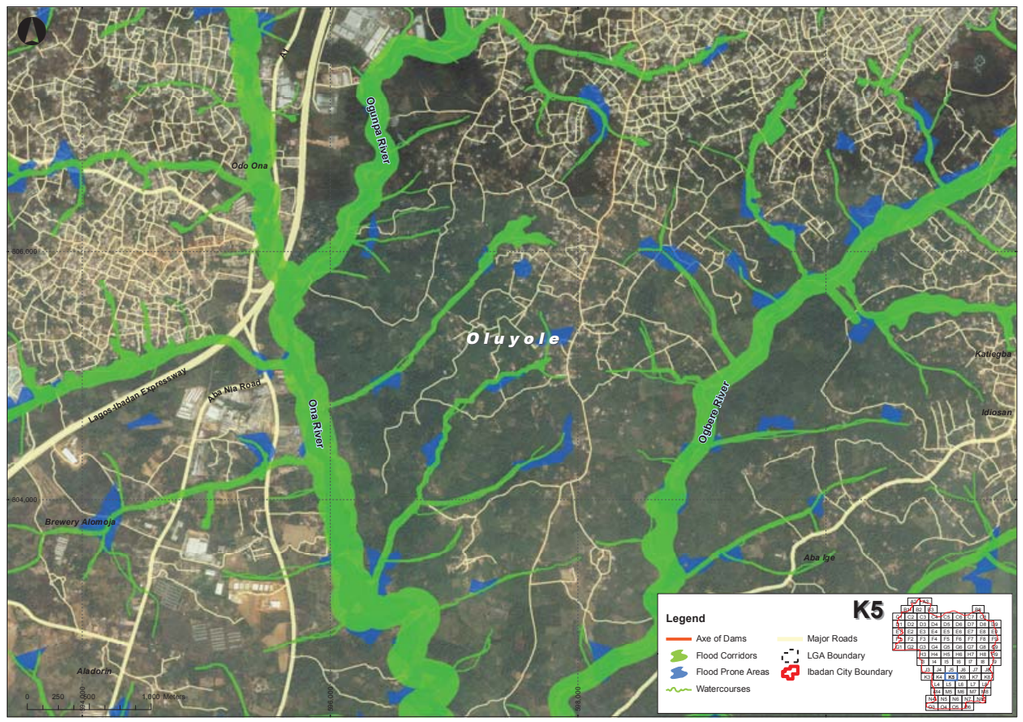

Adesina
Koari
Akintunde
Olunloyo
Moga
Fakorede
Kobiowu
Amuloko LFS
Aba Eku
Akanran Road
Ona Ara
Elesin
Ogundepo
Idiosan
Oluyole
Anwo
Aiyetoro
Ogundepo
Mohun
Ologan
Temidire
Ogbere River
Amogun
Legend
J6
Axe of Dams
Flood Corridors
Flood Prone Areas
Watercourses
Major Roads
LGA Boundary
Ibadan City Boundary

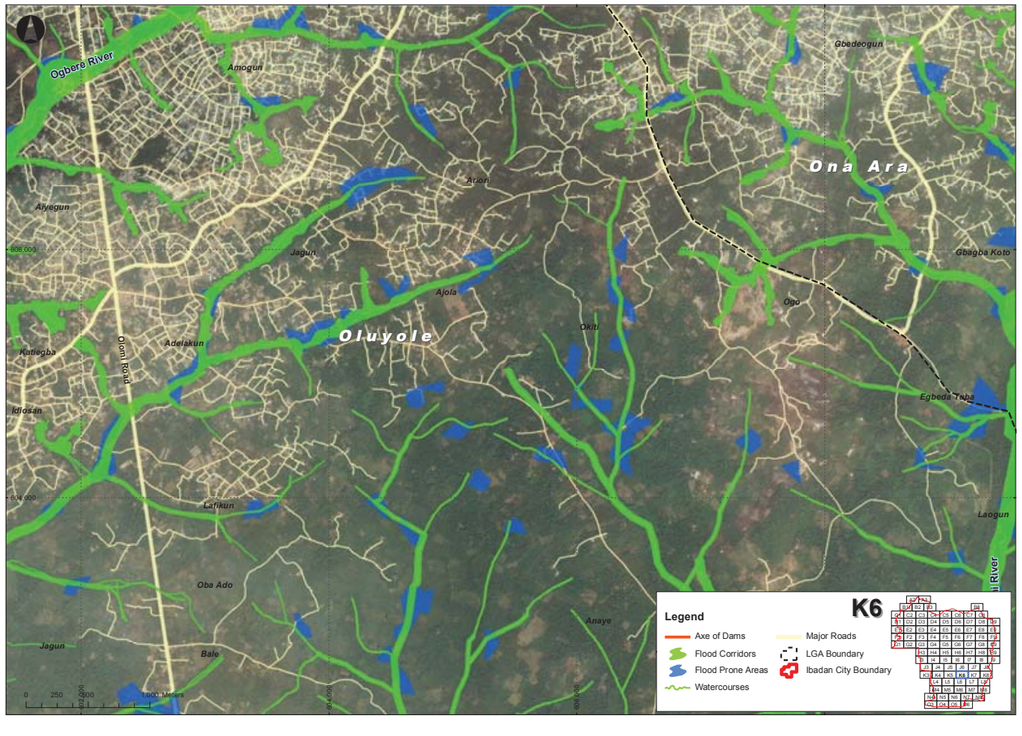

Adelogun
Otun
Lamina
Ajia
Otu
Akamo
Olokemeji
Olokemeji
Ojoku
Oke Ogun
Idiogun
Ekerin
Aba Epo
Seriki
Agunsa
Omi River
Osin
Asipa
Agunsa
Odi
Alago
Matako
Alaga
Odeleye
Alaikola
Alaikola
Ona Ara
Aje
Ekemode
Onikeke
Gbeleyi
Elewa
Akanran Road
Maye
Onikete
Origbo
Gbada Efon
Motaro
Arona
Jaiyeola
Abokorere
Legend
J7
Axe of Dams
Flood Corridors
Flood Prone Areas
Watercourses
Major Roads
LGA Boundary
Ibadan City Boundary

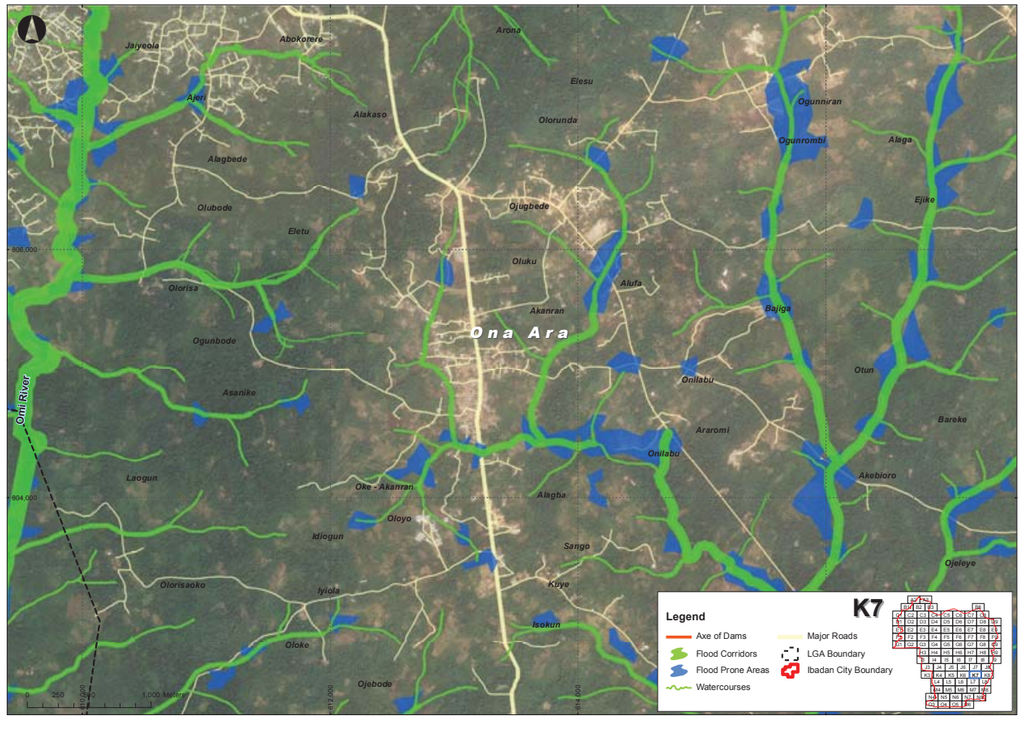

Omoloju
Gidgidi
Egbeda
Winsala
Oyetola
Ogunde
Laperi
Lademo
Olufon
Adekanra
Obe
Olofa
Bioku
Ona Ara
Jago
Osun River
Elebonla
Kupalo
Okikiade
Alagbede
Mato
Elewura
Alase
Eletu
Olode
Agbo
Isero
Aditan
Ogidi
Bolaji
Latunde
Ogunbumi
Legend
J8
Axe of Dams
Flood Corridors
Flood Prone Areas
Watercourses
Major Roads
LGA Boundary
Ibadan City Boundary

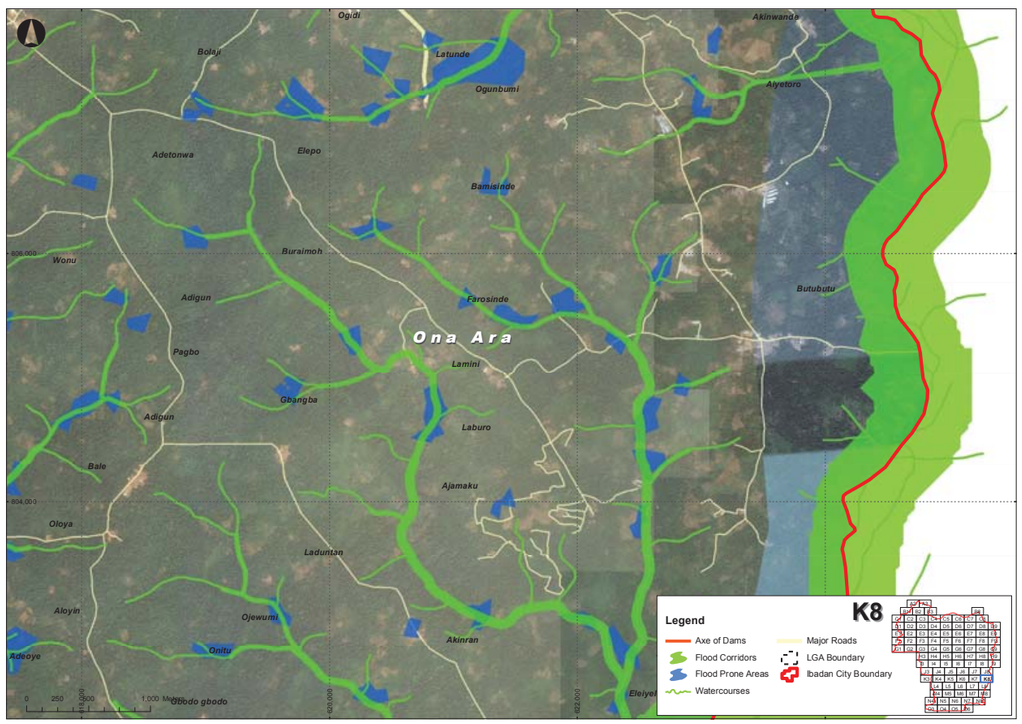

Ariku
Ojo
Skun Adegbite Road
Akinola
Ajagbega
Ahoro
Oluyole
Oniyangi
Legend
K3
Axe of Dams
Flood Corridors
Flood Prone Areas
Watercourses
Major Roads
LGA Boundary
Ibadan City Boundary

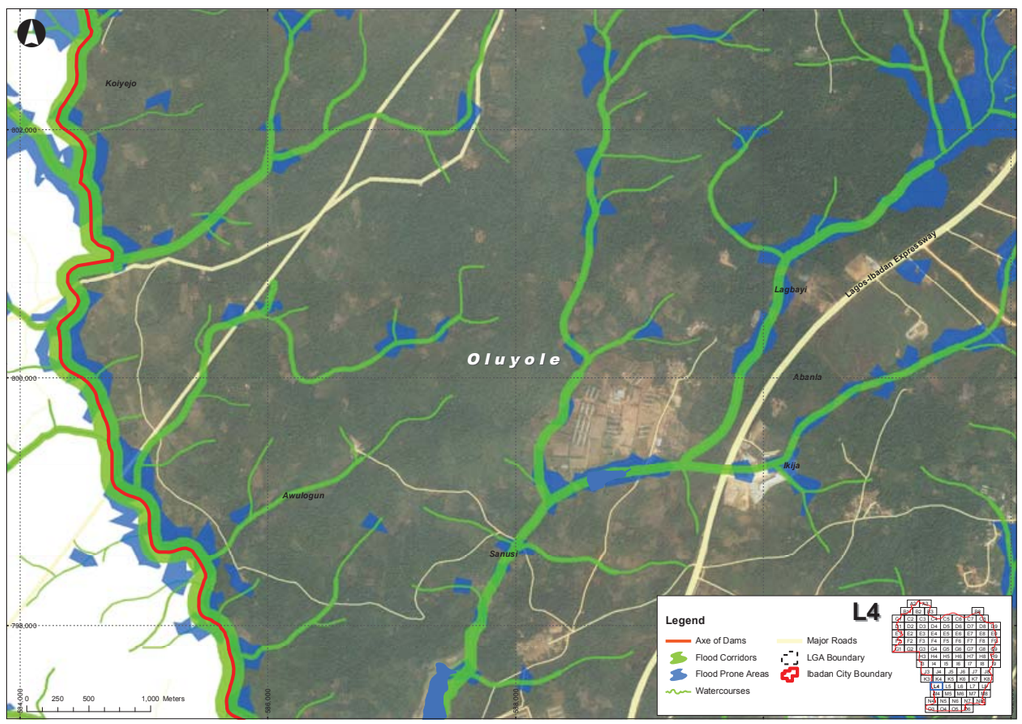

K4
Oluyole
Legend
Axe of Dams
Flood Corridors
Flood Prone Areas
Watercourses
Major Roads
LGA Boundary
Ibadan City Boundary

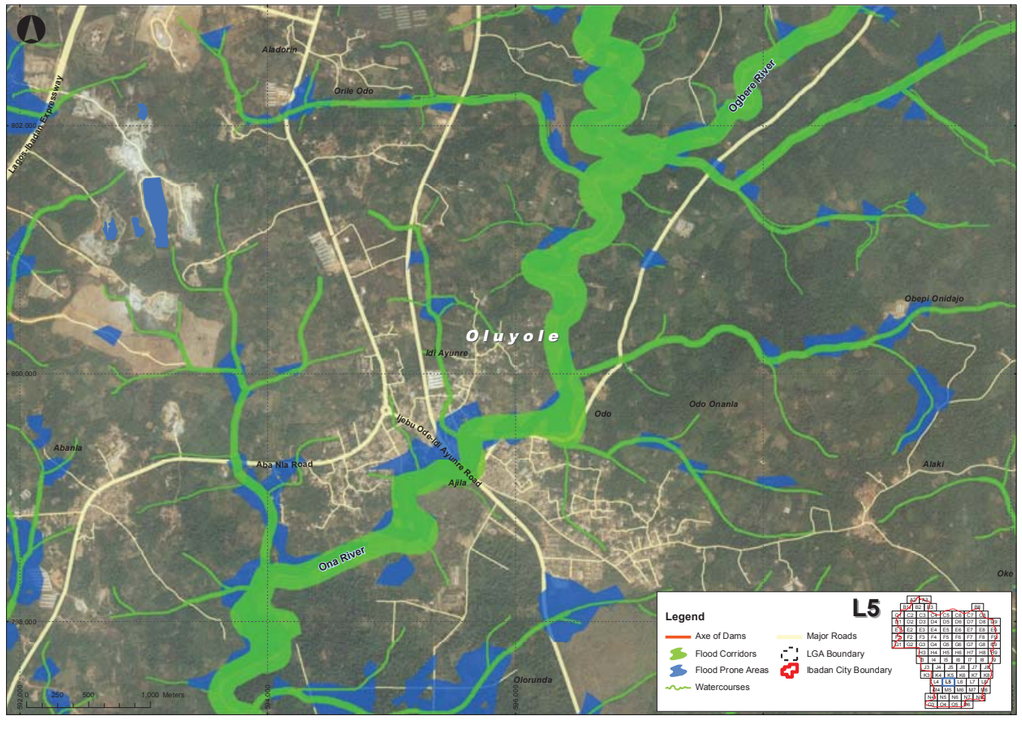

K5
Oluyole
Ogunpa River
Ona River
Ogbere River
Legend
Axe of Dams
Flood Corridors
Flood Prone Areas
Watercourses
Major Roads
LGA Boundary
Ibadan City Boundary

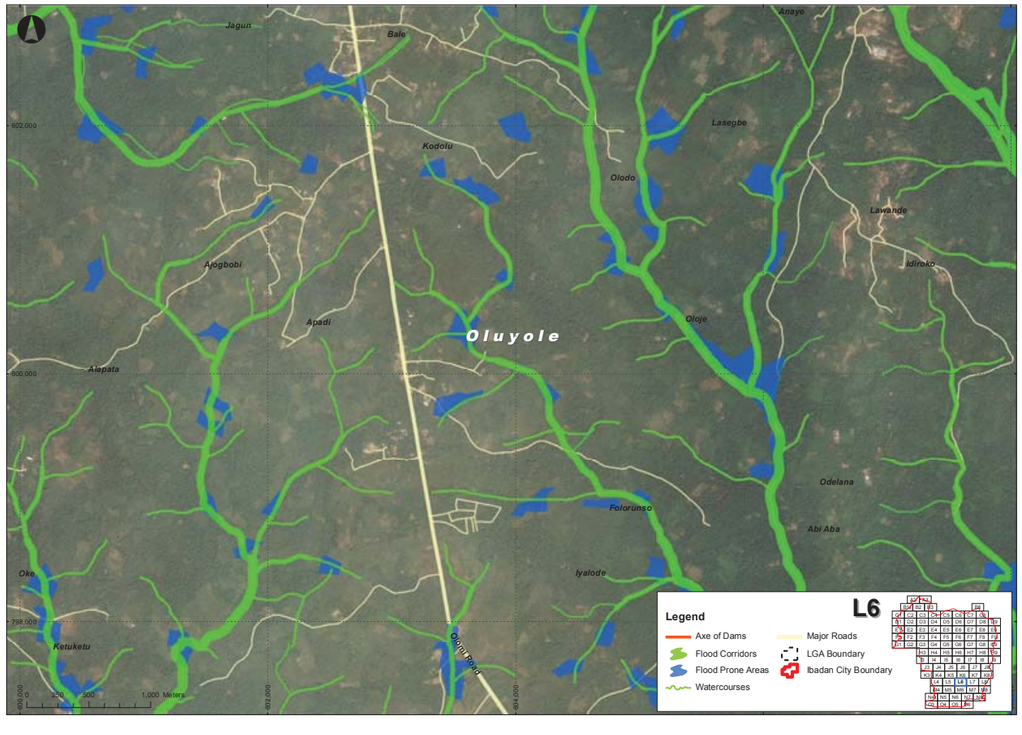

K6
Ona Ara
Oluyole
Ogbere River
Legend
Axe of Dams
Flood Corridors
Flood Prone Areas
Watercourses
Major Roads
LGA Boundary
Ibadan City Boundary

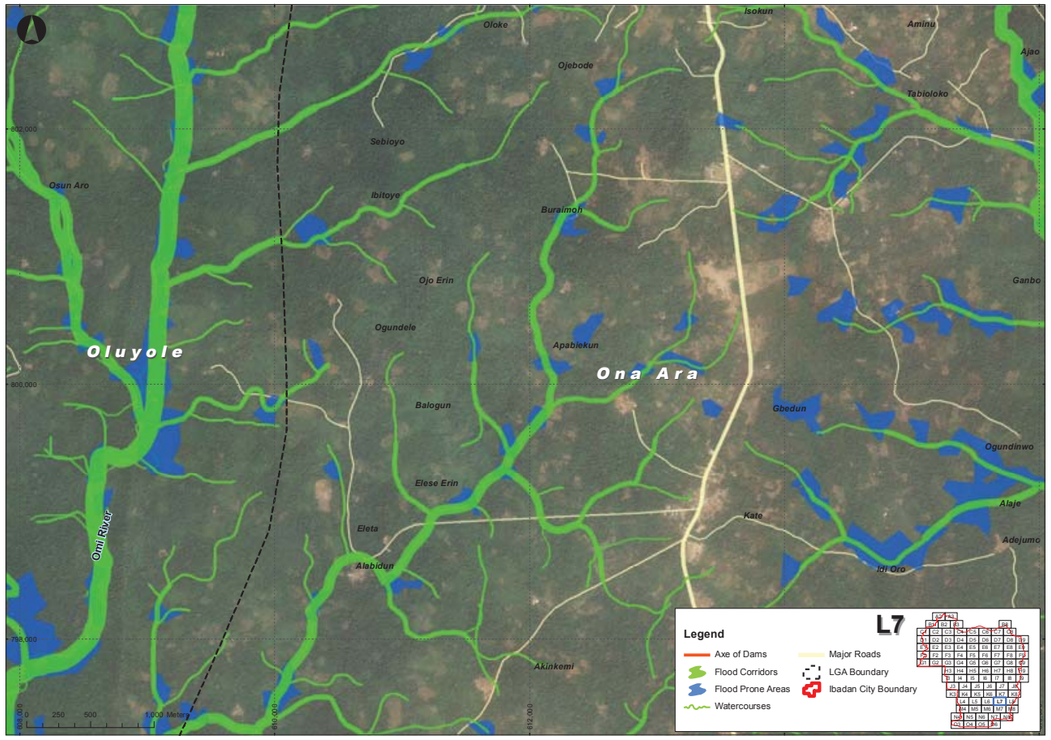

K7
Ona Ara
Omi River
Legend
Axe of Dams
Flood Corridors
Flood Prone Areas
Watercourses
Major Roads
LGA Boundary
Ibadan City Boundary

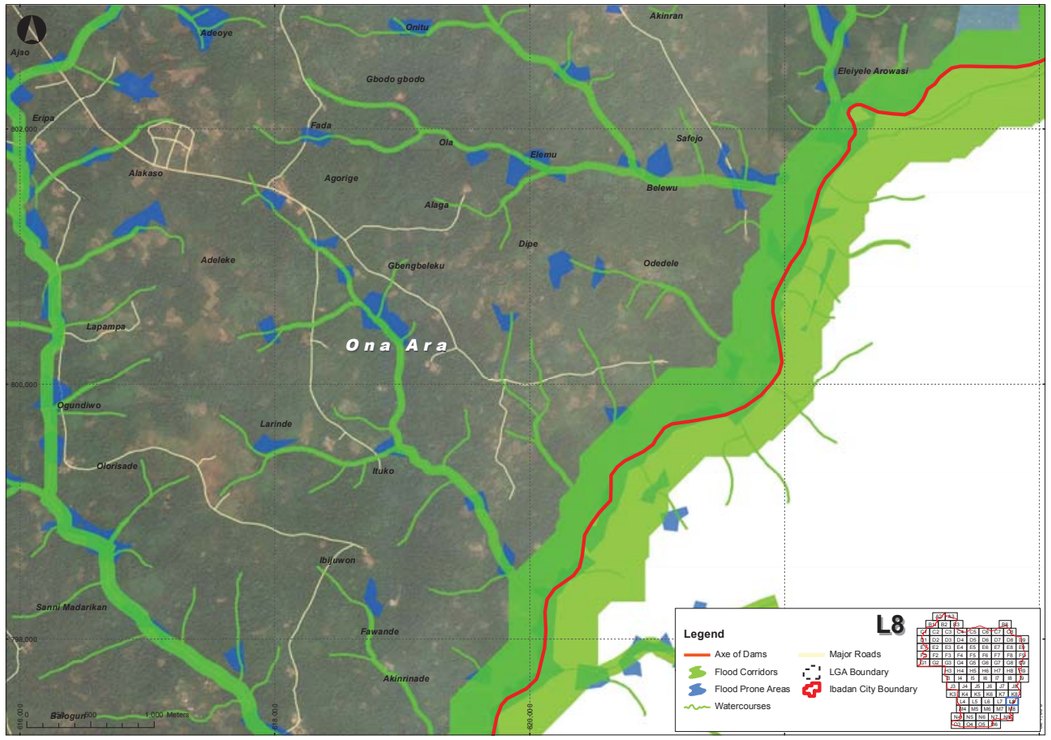

K8
Ona Ara
Legend
Axe of Dams
Flood Corridors
Flood Prone Areas
Watercourses
Major Roads
LGA Boundary
Ibadan City Boundary

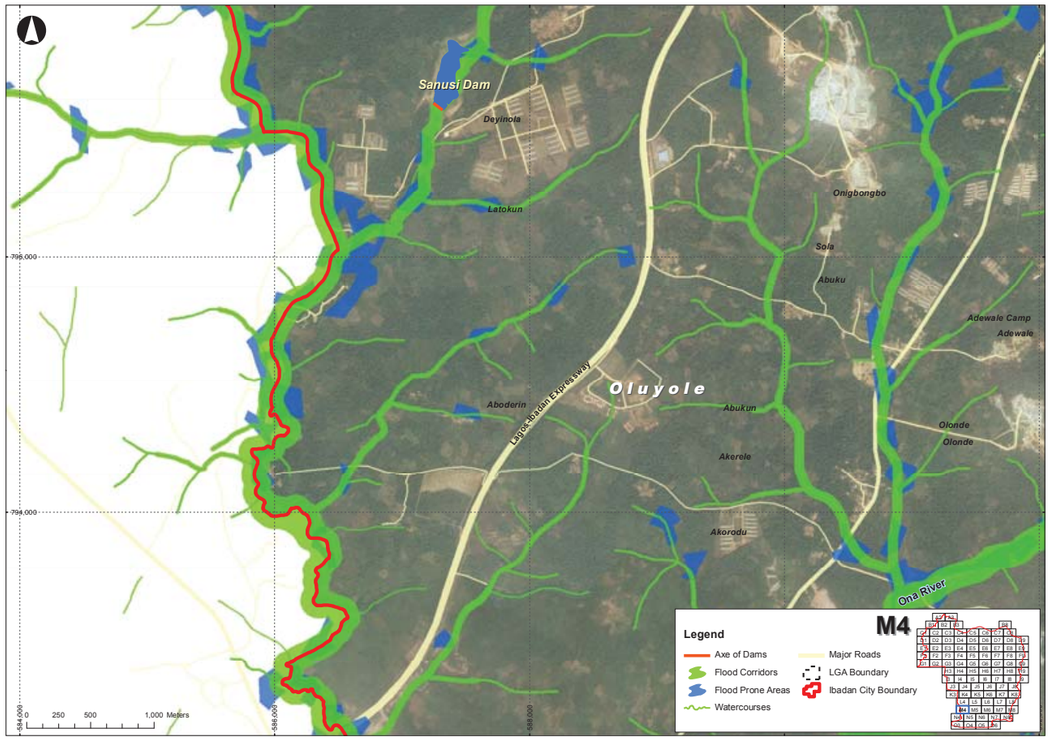

L4
Oluyole
Legend
Axe of Dams
Flood Corridors
Flood Prone Areas
Watercourses
Major Roads
LGA Boundary
Ibadan City Boundary

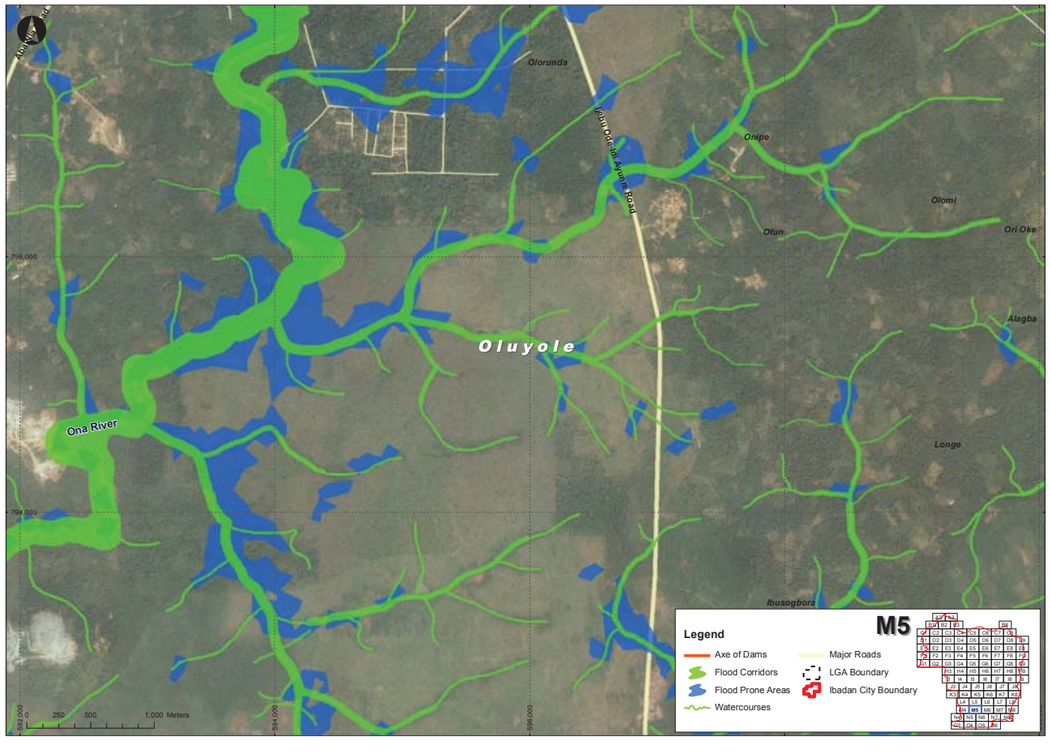

L5
Oluyole
Ona River
Legend
Axe of Dams
Flood Corridors
Flood Prone Areas
Watercourses
Major Roads
LGA Boundary
Ibadan City Boundary

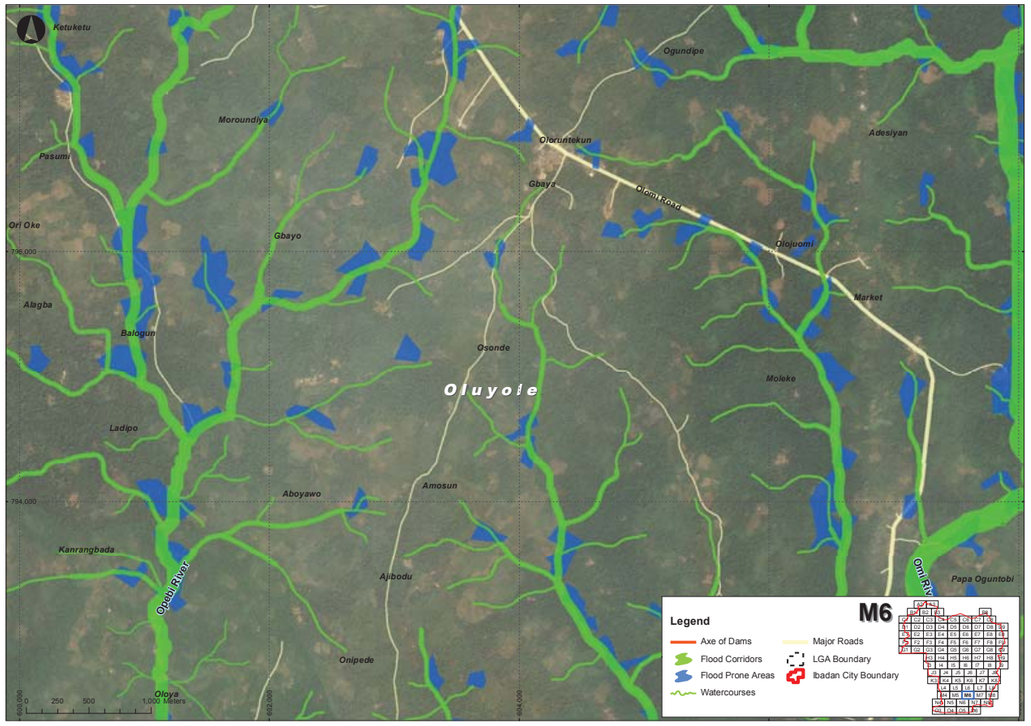

L6
Oluyole
Legend
Axe of Dams
Flood Corridors
Flood Prone Areas
Watercourses
Major Roads
LGA Boundary
Ibadan City Boundary

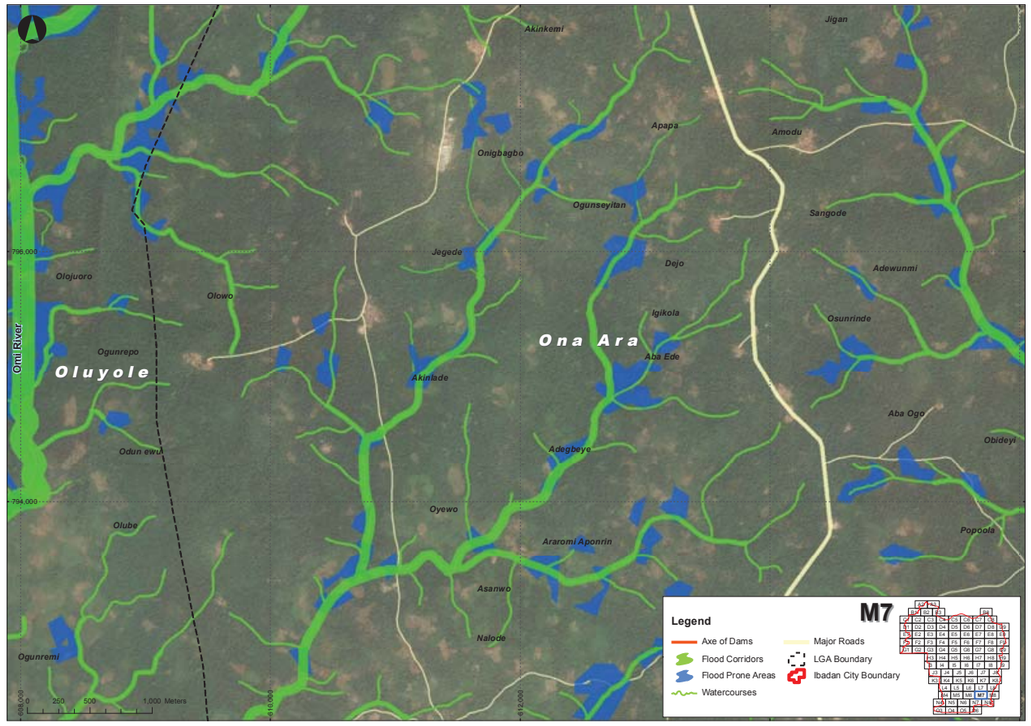

L7
Legend
Axe of Dams
Flood Corridors
Flood Prone Areas
Watercourses
Major Roads
LGA Boundary
Ibadan City Boundary
Oluyole
Ona Ara
Omi River
Oloke
Isokun
Aminu
Ajao
Ojebode
Tabioloko
Sebioyo
Osun Aro
Ibitoye
Buraimoh
Ojo Erin
Ganbo
Ogundele
Apabiekun
Balogun
Gbedun
Ogundinwo
Elese Erin
Alaje
Eleta
Kate
Adejumo
Alabidun
Idi Oro
Akinkemi

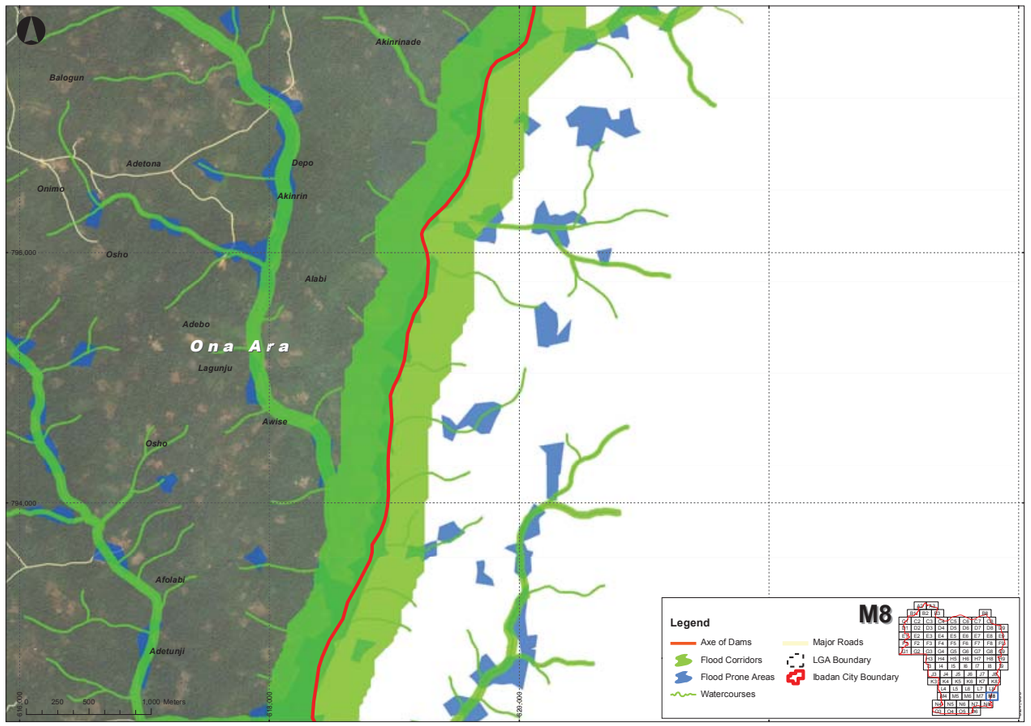

L8
Legend
Axe of Dams
Flood Corridors
Flood Prone Areas
Watercourses
Major Roads
LGA Boundary
Ibadan City Boundary
Ona Ara
Adeoye
Onitu
Akinran
Ajao
Gbodo gbodo
Eleiyele Arowasi
Eripa
Fada
Ola
Elemu
Safejo
Alakaso
Agorige
Belewu
Alaga
Dipe
Adeleke
Gbengbeleku
Odedele
Lapampa
Ogundiwo
Larinde
Olorisade
Ituko
Ibijuwon
Sanni Madarikan
Fawande
Akinrinade
Balogun

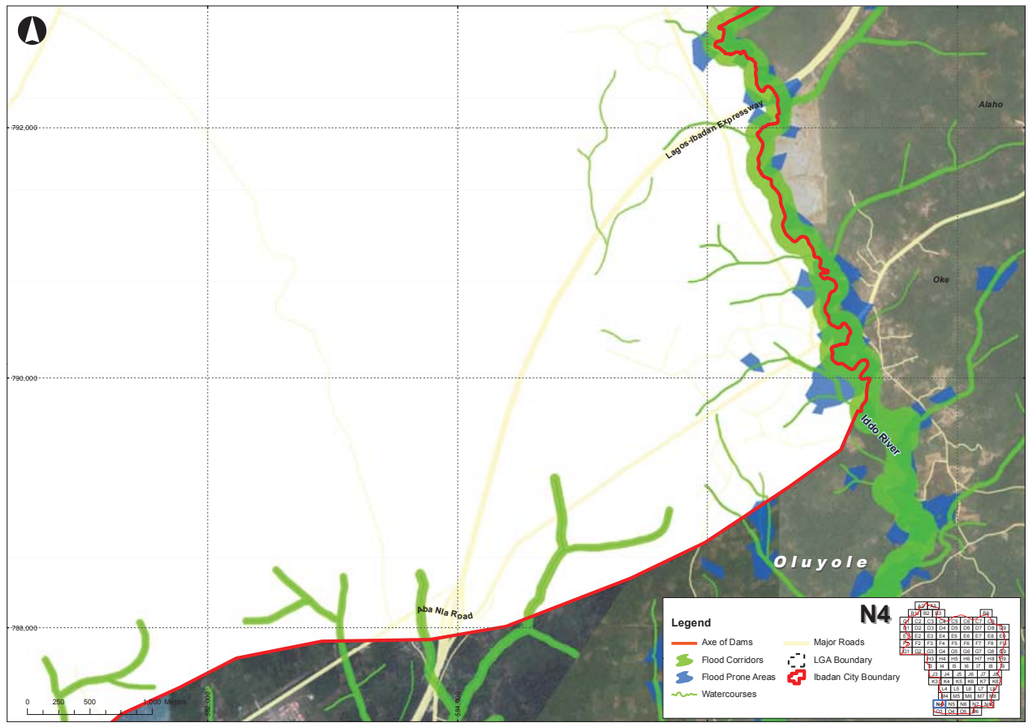

M4
Legend
Axe of Dams
Flood Corridors
Flood Prone Areas
Watercourses
Major Roads
LGA Boundary
Ibadan City Boundary
Sanusi Dam
Deyinola
Latokun
Onigbongbo
Sola
Abuku
Adewale Camp
Adewale
Oluyole
Aboderin
Abukun
Olonde
Olonde
Akerele
Akorodu
Ona River
Lagos-Ibadan Expressway

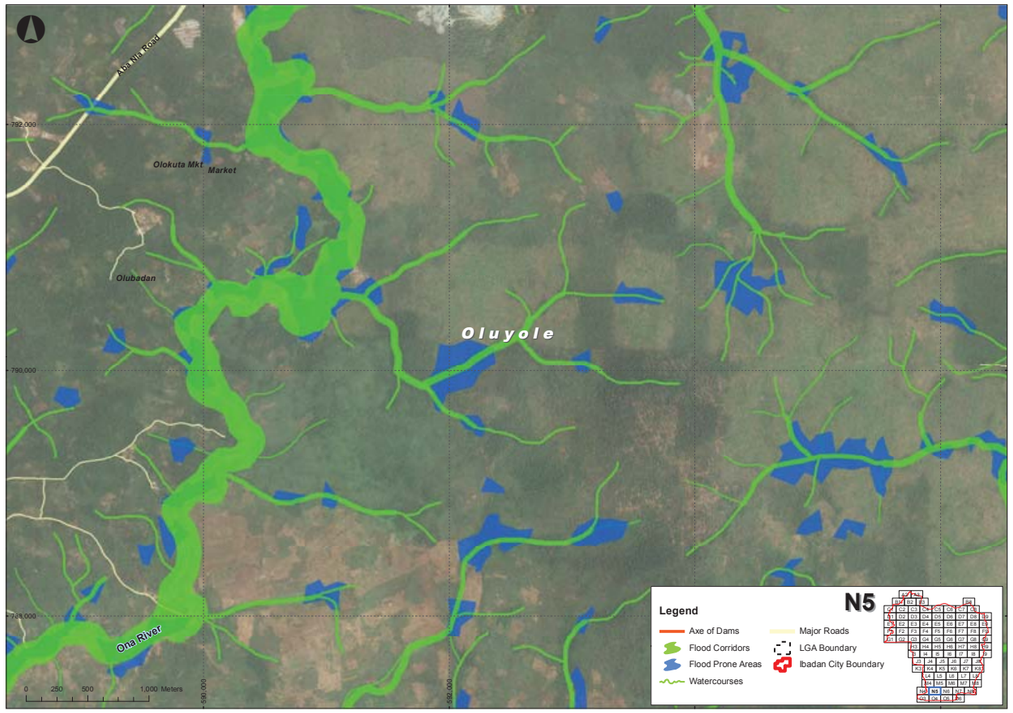

M5
Legend
Axe of Dams
Flood Corridors
Flood Prone Areas
Watercourses
Major Roads
LGA Boundary
Ibadan City Boundary
Olorunda
Onipe
Olomi
Otun
Ori Oke
Alagba
Oluyole
Ona River
Longe
Ibusogbora

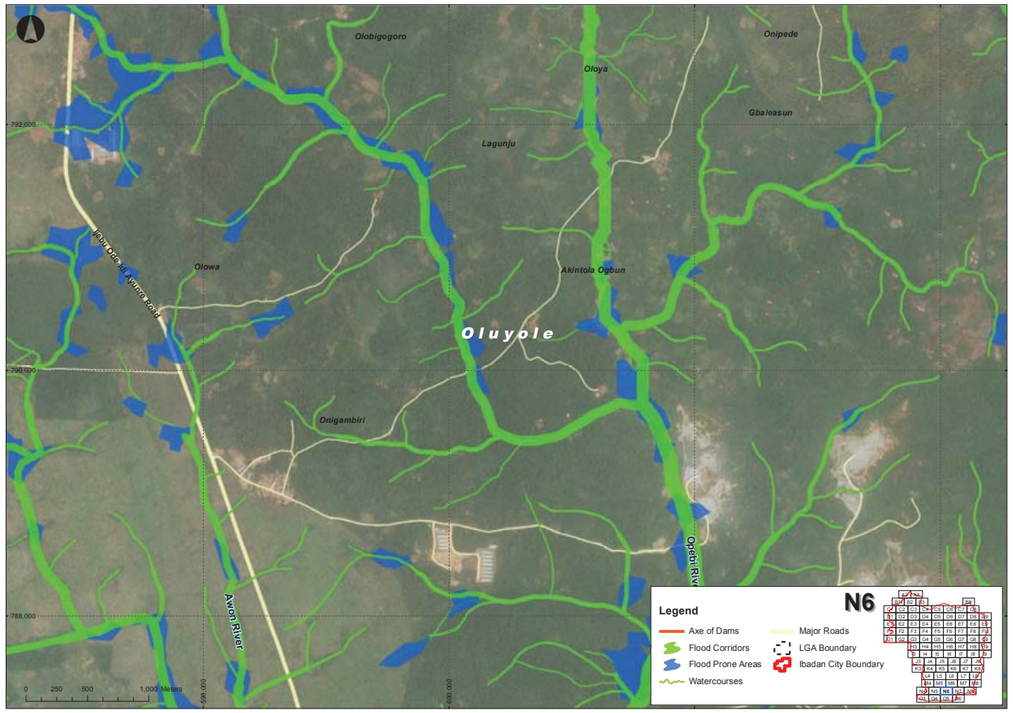

M6
Legend
Axe of Dams
Flood Corridors
Flood Prone Areas
Watercourses
Major Roads
LGA Boundary
Ibadan City Boundary
Oluyole
Ketuketu
Moroundiya
Pasumi
Ori Oke
Alagba
Balogun
Ladipo
Kanrangbada
Gbayo
Osonde
Aboyawo
Amosun
Ajibodu
Onipede
Oloya
Ogundipe
Oloruntekun
Gbaya
Olomi Road
Olojuomi
Adesiyan
Market
Moleke
Papa Oguntobi
Opubi River
Omi River

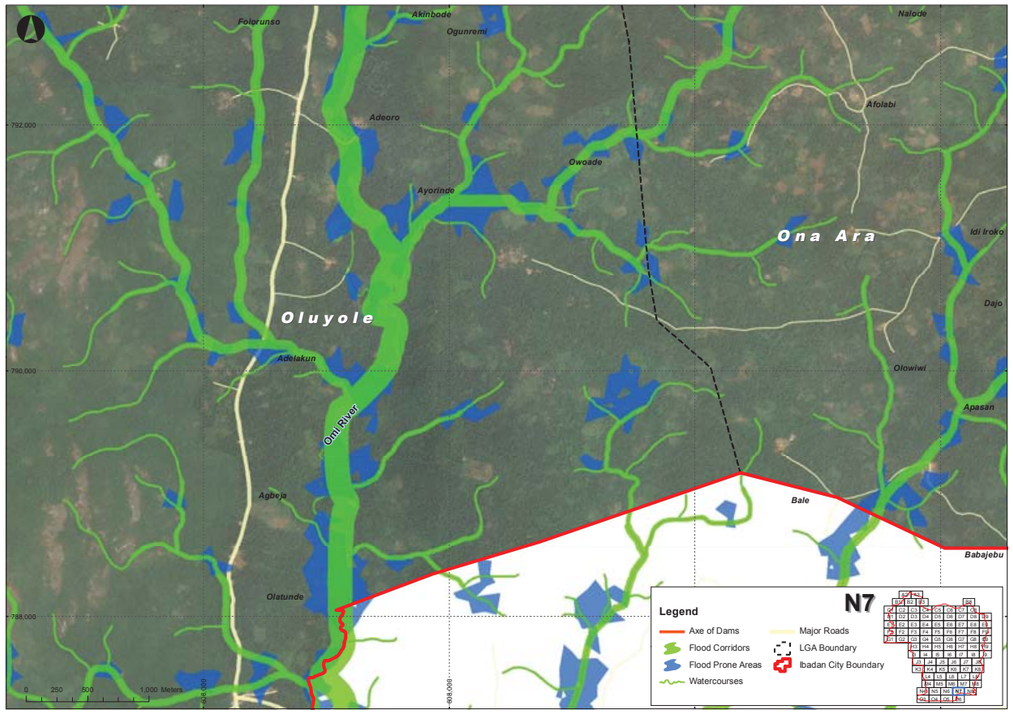

M7
Legend
Axe of Dams
Flood Corridors
Flood Prone Areas
Watercourses
Major Roads
LGA Boundary
Ibadan City Boundary
Ona Ara
Oluyole
Akinkemi
Jigan
Apapa
Amodu
Onigbagbo
Ogunseyitan
Sangode
Jegede
Dejo
Adewunmi
Olojuoro
Olowo
Igikola
Osunrinde
Ogunrepo
Aba Ede
Akinlade
Aba Ogo
Obideyi
Odun ewu
Adegbeye
Oyewo
Popoola
Olube
Araromi Aponrin
Asanwo
Nalode
Ogunremi
Omi River

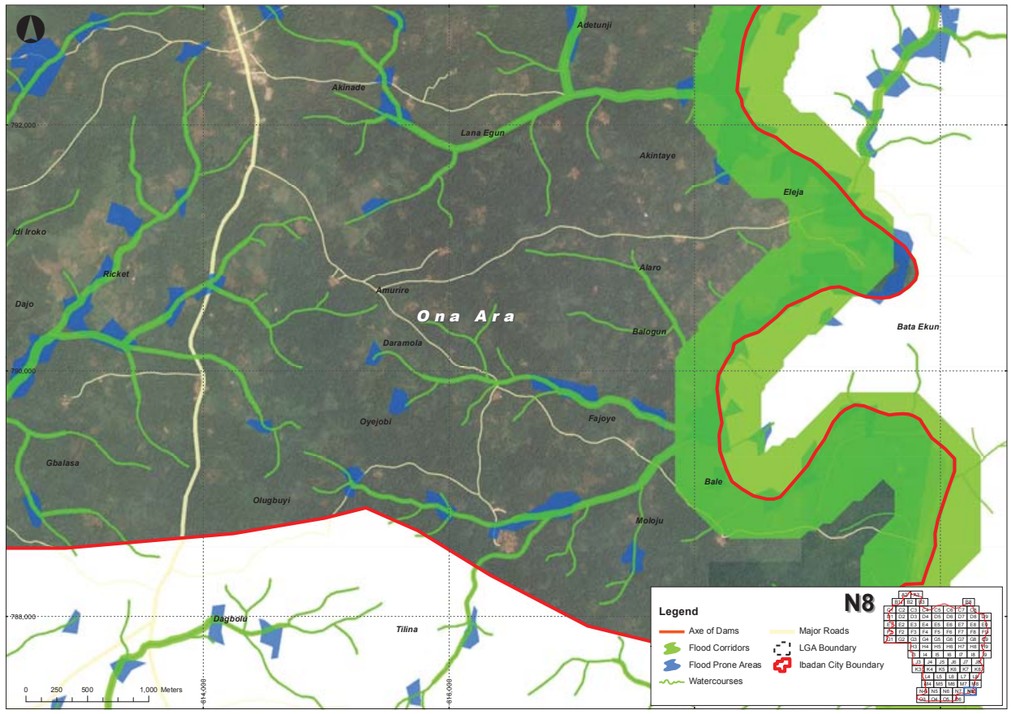

M8
Legend
Axe of Dams
Flood Corridors
Flood Prone Areas
Watercourses
Major Roads
LGA Boundary
Ibadan City Boundary
Ona Ara
Akinrinade
Balogun
Adetona
Depo
Onimo
Akinrin
Osho
Alabi
Adebo
Lagunju
Awise
Osho
Afolabi
Adetunji

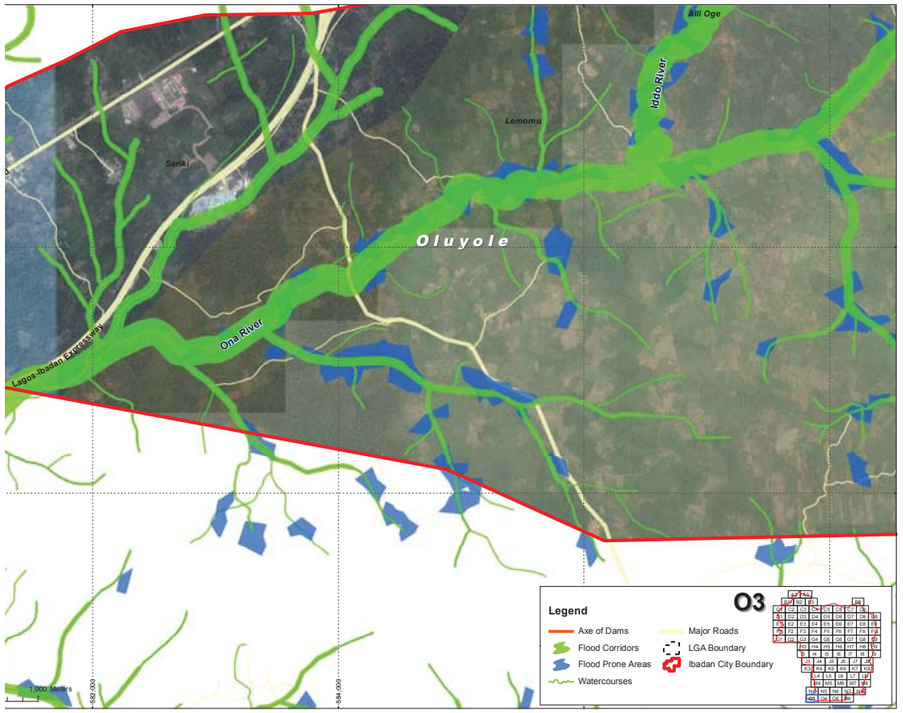

N4
Legend
Axe of Dams
Flood Corridors
Flood Prone Areas
Watercourses
Major Roads
LGA Boundary
Ibadan City Boundary
Oluyole
Lagos-Ibadan Expressway
Alaho
Oke
Iddo River
Aba Nla Road

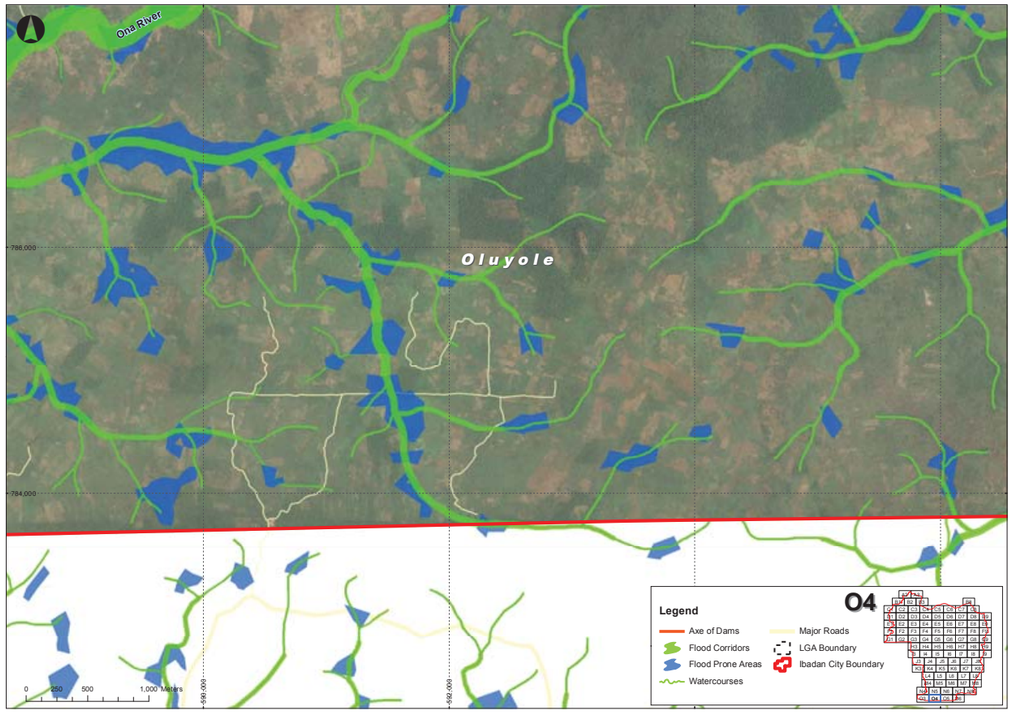

Abeokuta Road
Olokuta Mkt
Market
Olubadan
Oluyole
Ona River
N5
Legend
Axe of Dams
Flood Corridors
Flood Prone Areas
Watercourses
Major Roads
LGA Boundary
Ibadan City Boundary

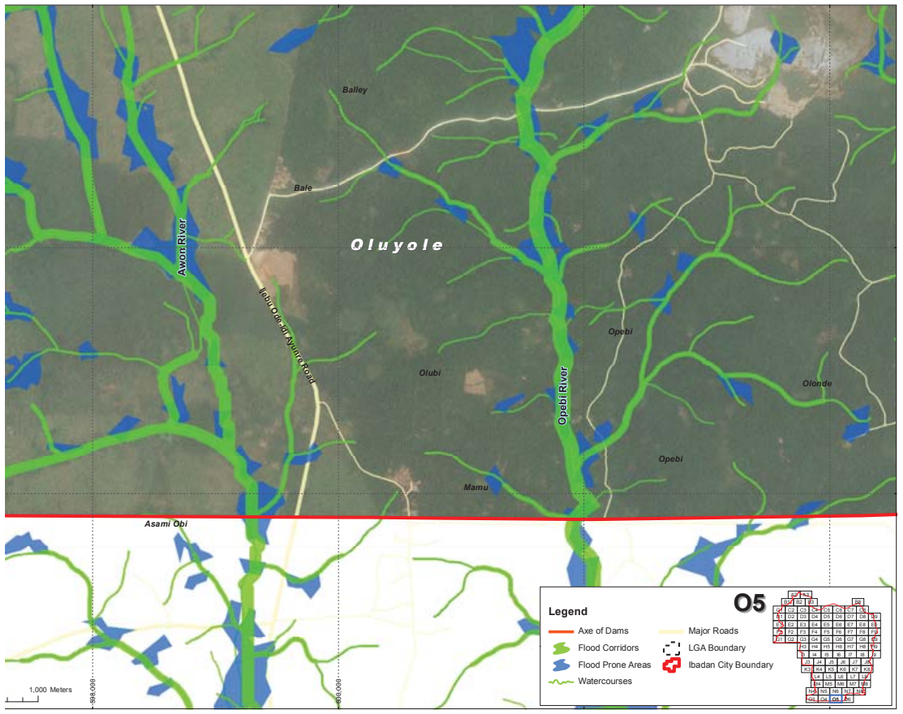

Olobigogoro
Onipede
Oloya
Gbaleasun
Lagunju
Olowa
Akintola Ogbun
Oluyole
Onigambiri
Awon River
Opobi River
N6
Legend
Axe of Dams
Flood Corridors
Flood Prone Areas
Watercourses
Major Roads
LGA Boundary
Ibadan City Boundary


Folorunso
Akinbode
Ogunremi
Nalode
Adeoro
Afolabi
Owoade
Ayorinde
Ona Ara
Idi Iroko
Oluyole
Dajo
Adelakun
Olowiwi
Apasan
Omi River
Agbeja
Bale
Babajebu
Olatunde
N7
Legend
Axe of Dams
Flood Corridors
Flood Prone Areas
Watercourses
Major Roads
LGA Boundary
Ibadan City Boundary


Adetunji
Akinade
Lana Egun
Akintaye
Eleja
Idi Iroko
Ricket
Alaro
Amurire
Dajo
Ona Ara
Balogun
Bata Ekun
Daramola
Oyejobi
Fajoye
Gbalasa
Bale
Olugbuyi
Moloju
Dagbolu
Tilina
N8
Legend
Axe of Dams
Flood Corridors
Flood Prone Areas
Watercourses
Major Roads
LGA Boundary
Ibadan City Boundary


Alli Oge
Iddo River
Lemomu
Seriki
Oluyole
Ona River
Lagos-Ibadan Expressway
O3
Legend
Axe of Dams
Flood Corridors
Flood Prone Areas
Watercourses
Major Roads
LGA Boundary
Ibadan City Boundary
1,000 Meters


Ona River
Oluyole
O4
Legend
Axe of Dams
Flood Corridors
Flood Prone Areas
Watercourses
Major Roads
LGA Boundary
Ibadan City Boundary
0 250 500 1,000 Meters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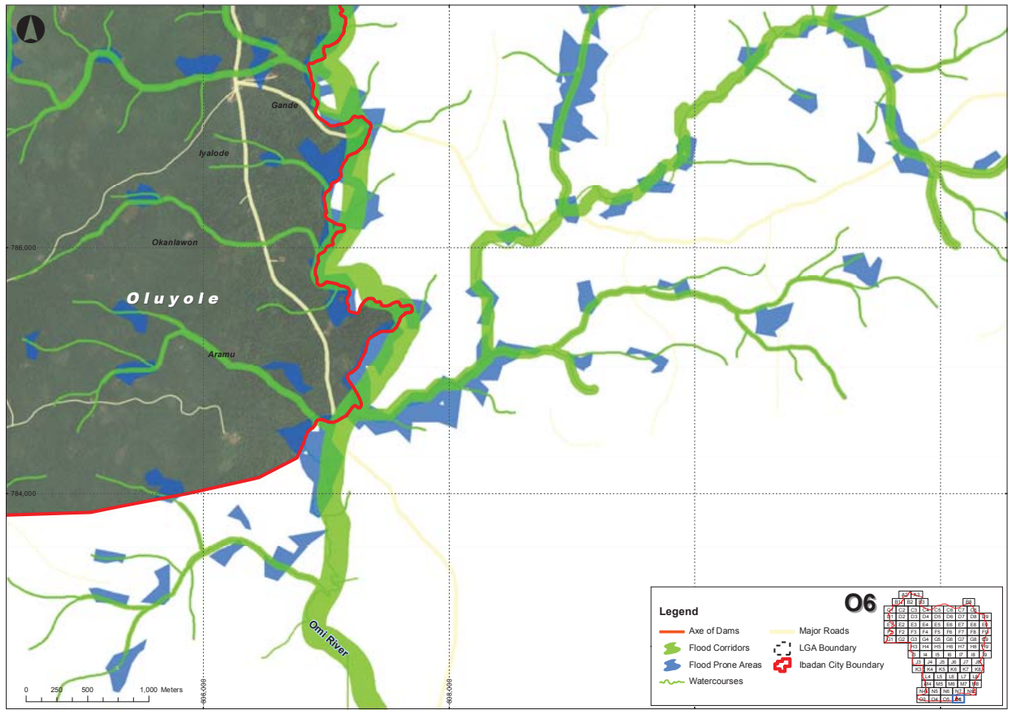
Oluyole
Awon River
Ibadan-Ibadan Expressway
Opebi
Olubi
Opebi River
Olonde
Opebi
Mamu
Asami Obi
O5
Legend
Axe of Dams
Flood Corridors
Flood Prone Areas
Watercourses
Major Roads
LGA Boundary
Ibadan City Boundary
1,000 Meters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Iyalode
Okanlawon
Oluyole
Aramu
Omi River
O6
Legend
Axe of Dams
Flood Corridors
Flood Prone Areas
Watercourses
Major Roads
LGA Boundary
Ibadan City Boundary
0 250 500 1,000 Meters

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APPENDIX 4: FLOW DISCHARGES OF DRAINAGE SUB-CATCHMENTS

Table A.3: Flow Discharges of Drainage Sub-Catchments

Major Basin	Basin ID	Area (km2)	Discharge (m3/s)
A	A1	9.80	46.3
	A2	8.32	61.6
	A3	67.23	467.7
	A4	34.02	175.8
	A5	18.67	130.3
	A6	31.14	211.7
	A7	5.38	46.3
	A8	9.04	116.7
	A9	4.01	35.3
	A10	12.01	83.6
	A11	3.83	34.1
	A12	30.22	274.8
	A13	7.44	55.1
	A14	6.86	55.4
	A15	10.34	48.4
	A16	22.10	167.7
	A17	25.09	139.7
	A18	0.50	6.2
	A19	30.77	151.3
	A20	29.23	145.9
	A21	22.64	89.7
	A22	7.40	57.6
	A23	6.43	48
	A24	43.96	223.8
	A25	3.63	28.1
	A26	6.20	44
B	B1	49.84	374
	B2	22.52	212.7
	B3	6.10	82.6
	B4	6.77	58.1
	B5	20.91	171.1
	B6	9.27	74.8
	B7	26.60	306.9
	B8	9.70	59.9
	B9	7.56	68.6
	B10	48.44	232.5
	B11	44.77	472.4
	B12	11.70	88.6
	B13	12.22	86.6
	B14	27.73	212.3
	B15	1.75	27.3

Major Basin	Basin ID	Area (km2)	Discharge (m3/s)
B	B16	16.55	171.7
	B17	15.30	110.4
	B18	13.90	67
	B19	4.59	40
	B20	19.82	171.4
	B21	27.69	211.4
	B22	5.50	45.5
	B23	15.55	115.2
	B24	16.08	77.1
	B25	21.09	160.2
	B26	12.92	100.6
	B27	11.65	27.7
	B28	5.72	38.2
	B29	28.49	184.5
	B30	44.20	246.2
	B31	12.26	44.8
	B32	5.86	39.7
	B33	8.92	97.1
	B34	11.80	84.4
	B35	6.44	48.7
C	C1	48.63	337.8
	C2	4.26	46.7
	C3	10.01	91.1
	C4	28.32	185.2
	C5	2.57	23.5
	C6	19.29	143.4
	C7	6.42	34.7
	C8	35.37	267.3
	C10	5.94	36.6
	C11	6.71	46.1
	C12	32.09	243.9
	C13	6.87	46
	C14	25.63	198.2
	C15	38.42	214.7
	C16	1.48	14.3
	C17	27.73	216.8
	C18	5.65	39.3
	C19	30.33	168.4
	C20	14.93	116.8
	C21	13.74	49
D	D1	37.40	193.1

Major Basin	Basin ID	Area (km2)	Discharge (m3/s)
D	D2	17.79	100.4
	D3	7.33	71.8
	D4	33.51	278.2
E	E1	52.69	304.9
	E2	9.69	53.2
F	F1	31.51	125.1
	F2	28.56	273.8
	F3	45.27	292
G	G1	46.31	292.8
	G2	18.79	186.9
	G3	7.55	54.8
H	H1	64.99	321.9
	H2	26.42	197.3
	H3	5.13	32.9
J	J1	47.75	283.9
	J2	13.90	148
	J3	7.04	41.6
	J4	31.65	198.7
	J5	6.04	50.6
	J6	43.27	351.2
	J7	4.62	47.3
	J8	40.99	293
	J9	16.55	154.8
	J10	6.13	61.6
	J11	30.58	219.5
K	K1	37.12	277.2
	K2	29.98	192.5
	K3	28.73	212.1
	K4	20.05	137.3
	K5	24.69	145.9
L	L1	10.66	57.5
	L2	17.37	87.4
	L3	17.53	91.5
	L4	19.24	68.6
	L5	17.77	58.3
	L6	33.74	89.3
	L7	20.04	82.8
	L8	1.09	12.6
M	M1	19.43	83.4
	M2	11.87	71.9

Major Basin	Basin ID	Area (km2)	Discharge (m3/s)
M	M3	17.67	78.9
	M4	23.18	83.4
	M5	3.96	22.6
	M6	15.57	64.6
	M7	10.89	56.1
	M8	45.74	149.5
	M9	14.39	67.7
N	N1	26.90	98.8
	N2	13.21	71.6
	N3	11.00	48.4
	N4	4.69	42.6
	N5	23.75	92.4
	N6	22.15	87.3
	N7	32.16	98.2
	N8	29.51	115.7
	N9	11.25	64.7
	N10	12.38	45
	N11	5.04	21.6
	N12	9.20	50.5
	N13	1.64	16.1
Q	Q1	17.18	81.3
R	R1	33.65	102.1
	R2	18.03	70.9
	R3	26.61	114.9
	R4	2.40	33.1
	R5	22.86	99.7
	R6	13.07	78.1
	R7	32.12	124.6
	R8	5.92	55.9
	R9	10.48	54.9
	R10	14.39	86.6
	R11	22.68	125
	R12	26.40	102.5
	R13	23.11	94.7
	R14	4.58	42
	R15	27.27	138.3
	R16	42.54	145
	R17	12.64	59.7
	R18	32.73	96.6
	R19	33.08	140.7

Major Basin	Basin ID	Area (km2)	Discharge (m3/s)
R	R20	44.13	126.3
	R21	11.89	45.4
T	T1	29.60	117.3
	T2	20.88	108
	T3	25.78	99
	T4	7.04	49.9
	T5	24.99	107.5
	T6	28.65	113.7
	T7	2.23	18
	T8	7.26	39.9
	T9	17.16	72.1
	T10	0.86	11.2
	T11	27.58	96.5
	T12	56.98	153.6
	T13	6.49	33.7
	T14	25.52	115.6
T	T15	18.81	100.1
U	U1	48.12	271.5
	U2	7.54	52.3
V	V1	68.18	277.5
W	W1	56.38	137.6
	W2	13.78	69
X	X1	40.12	92.2
	X2	47.37	174.3
	X3	11.70	46.8
Y	Y1	15.31	93.5
	Y2	18.06	108.1
	Y3	11.96	65.9
	Y4	27.94	116.5
Z	Z1	19.9	149.25
	Z2	27.36	205.2

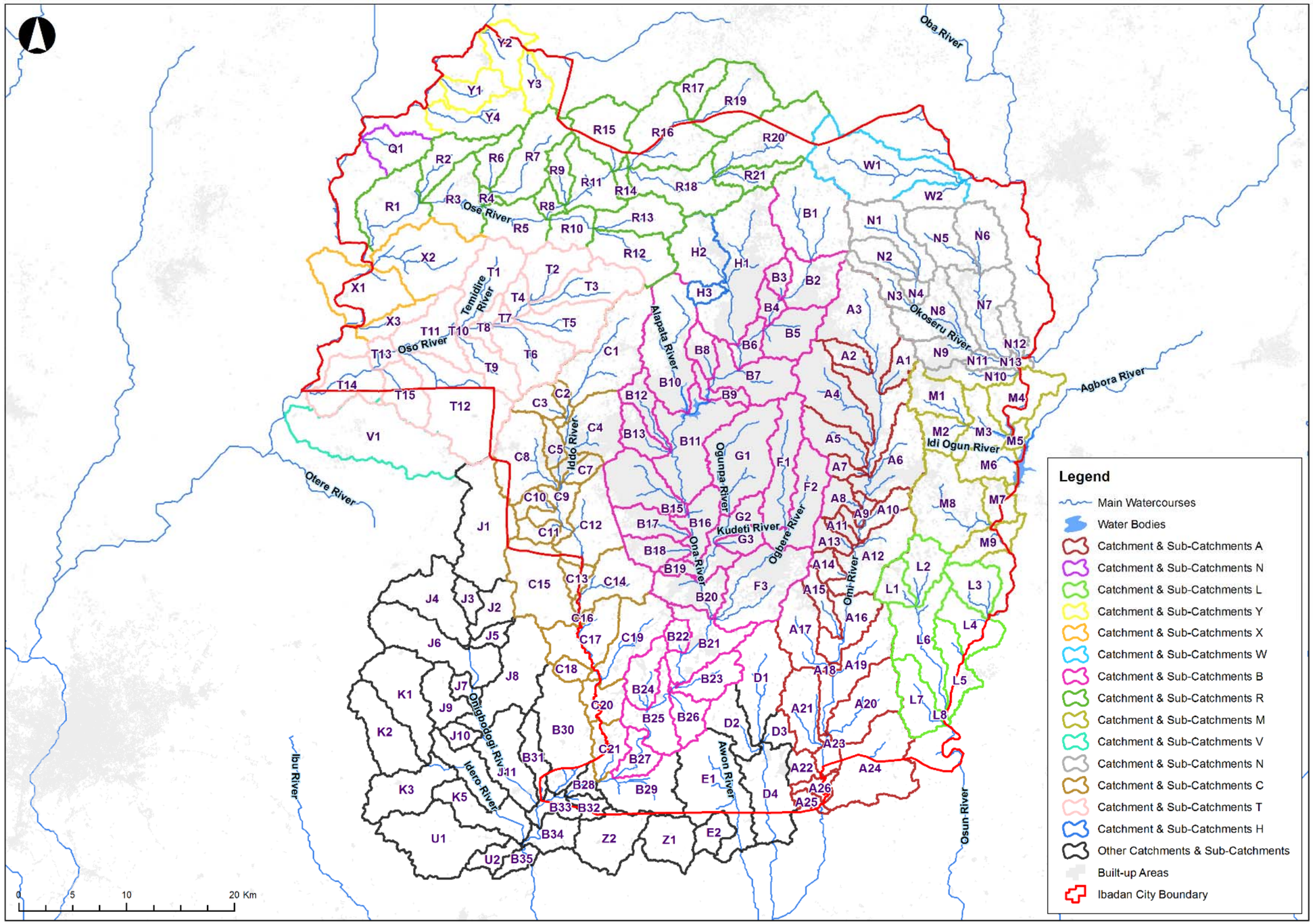


Figure A.1: Minor Catchments (Sub Catchments) in Ibadan

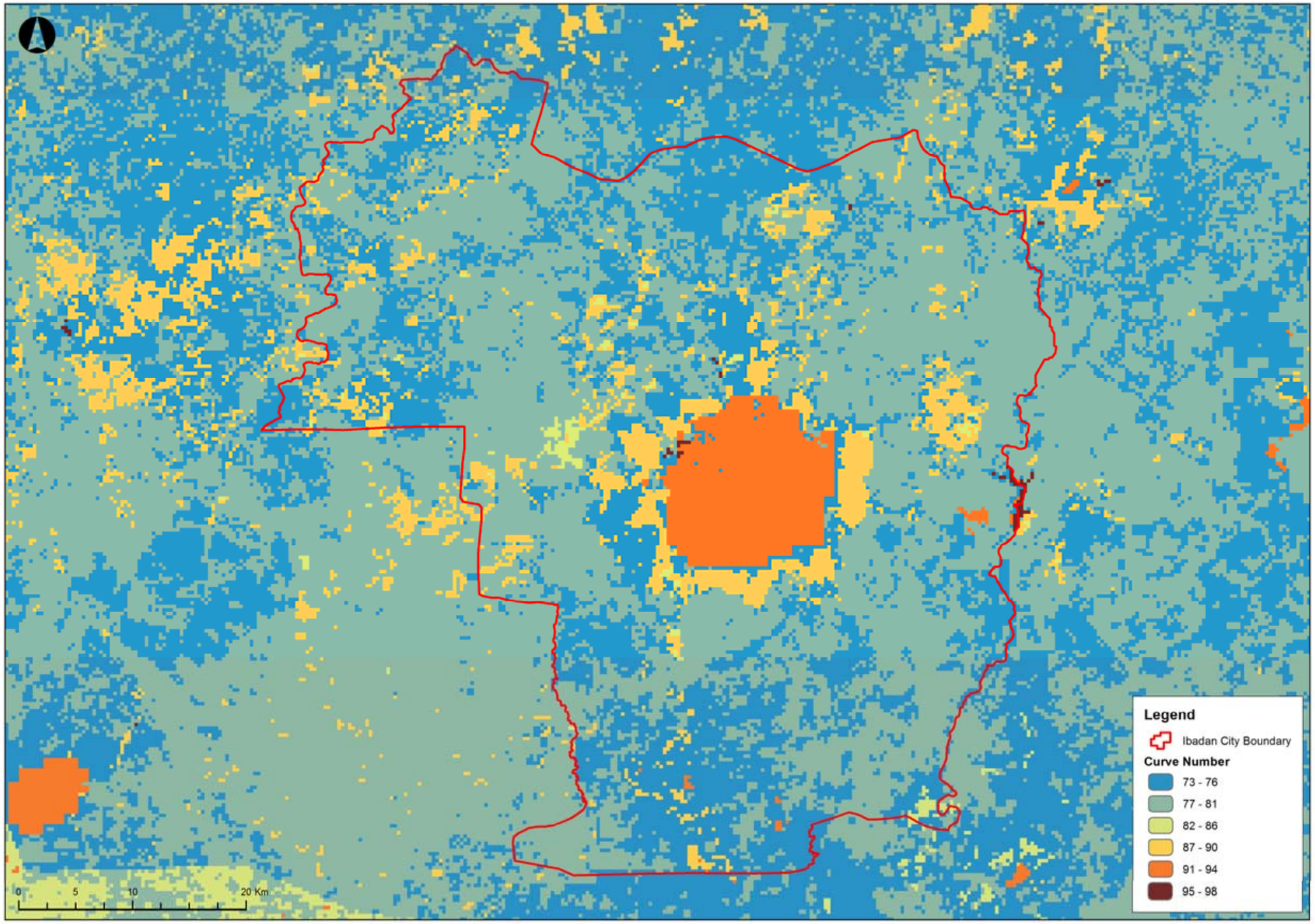


Figure A.2: Curve Number (CN) Map for Ibadan Hydraulic Analysis

CCSUSTAINABLE DRAINAGE SYSTEMS

Appropriately designed, constructed and maintained Sustainable Drainage Systems (SUDS) are an important tool for mitigating many of the adverse effects on the environment of stormwater runoff.

Choosing the appropriate BMPs to form a SUDS can, however, be difficult. Geological, hydrological, environmental, cost and location factors must be considered, to ensure the most appropriate technologies are employed.

This appendix provides an overview of the key characteristics associated with 19 generic BMPs[1], so that the benefits and risks of each technique can be better understood.

Each technique is presented as a data sheet, containing:

1) **Description of the technique** - to identify its purpose
2) **Picture** - showing an example of the application in use
3) **Key design criteria** - denotes specific considerations at the siting, design and construction stages
4) **Advantages** - highlights the benefits of the technique
5) **Disadvantages** - notes design and performance related issues, such as land take or irrigation requirements
6) **Performance** - indicates the techniques potential for flow attenuation and treatment
7) **Treatment Train Suitability** - notes suitability as a primary or secondary treatment technique
8) **Site Suitability** - confirms the techniques suitability in different land uses, such as residential and commercial/industrial
9) **Cost Implications** - indicates if land take, capital and maintenance costs are expected to be high
10) **Pollutant Removal** - notes the techniques' treatment, or not, of total suspended solids, nutrients and heavy metals
11) **Key Maintenance Requirements** - lists any maintenance considerations, such as debris removal

[1] Guidance is heavily drawn from CIRIA UK SUDS Handbook (2007) which is a best practice guidance manual on the planning, design, construction and maintenance of Sustainable Drainage Systems.

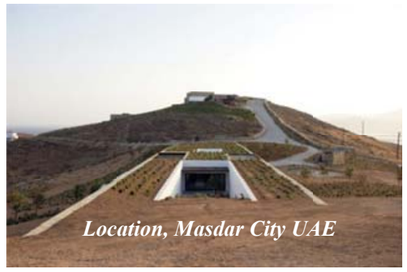
Preparation of Ibadan City Urban Master Plan Drainage Considerations

1 SITE LAYOUT

1.1 DESCRIPTION

Site layout includes two concepts:

- Good design for site roads and buildings to help minimise impervious surfaces, as they prevent infiltration and increase runoff and pollutant loadings e.g. ensuring bunding of above ground oil or chemical storage tanks.
- Good site management techniques to manage the quantity and/or quality of the runoff at source. For example; frequent weeping of impervious surfaces to reduce pollution build up, minimising the application of chemicals on landscaped areas, and ensuring adequate procedures are in place to deal quickly with spillage of materials using dry rather than wet techniques.



Location, Masdar City UAE

1.2 KEY DESIGN CRITERIA

- Review development Masterplan and implement pollution prevention and optimum site layout and design, wherever possible
- Roads and buildings onsite should follow natural landforms wherever possible
- Natural drainage paths should be preserved by appropriate design of road layouts and buildings
- Clearing and grading of site should be kept to a minimum
- Filling or grading of natural depressions and ponding areas should be avoided
- Open space should be maximised, and integrated with drainage design wherever possible

ADVANTAGES • Manage stormwater (quantity and quality) as close to source as possible • Prevent potential damaging impacts rather than mitigating them • Offers simple, non-structural methods for runoff management (that are often lower cost and lower maintenance than structural controls) • Reduced construction costs • Increased property values • More open space • More pedestrian/user-friendly environments • More aesthetically pleasing and naturally attractive landscapes • Integration of biodiversity and habitat provision **DISADVANTAGES** • Risk of silt blockage • Disposal areas required • Silt can be toxic, safe waste management required • Non-manual methods can be expensive • Effectiveness during high flow conditions varies	**PERFORMANCE** • Peak flow reduction • Volume reduction • Water quality treatment • Amenity potential • Ecology potential **TREATMENT TRAIN SUITABILITY** • Source control • Conveyance • Site system • Regional system **SITE SUITABILITY** • Residential • Commercial/industrial • High density • Retrofit • Contaminated sites/sites above vulnerable groundwater **COST IMPLICATIONS** • Land take • Capital cost • Maintenance **POLLUTANT REMOVAL** • Total suspended solids • Nutrients • Heavy metals	 Excellent Excellent Excellent Excellent Excellent Yes Yes Yes Yes Yes Yes Yes Yes Yes Low-High (depends on site design & procedures) Medium-High (depends on site design & procedures)
KEY MAINTENANCE REQUIREMENTS	***** Varies depending on site design	

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2 GREEN ROOFS

2.1 DESCRIPTION

Green roofs comprise vegetation cover over a geotextile drainage layer. They cover roof surface space and are designed to intercept and retain precipitation, reducing the volume of runoff.



2.2 KEY DESIGN CRITERIA

Design for interception storage

- Minimum roof pitch of 1 in 80, maximum 1 in 3 (unless specific design features are included)
- Structural roof strength must provided for the full additional load of saturated green roof elements
- Multiple (hydraulic) outlets to reduce risks from blockages
- Lightweight soil medium and appropriate vegetation

ADVANTAGES

- Can generate aesthetic qualities
- Typical soil type has a high retention capacity
- Additional advantages can include energy efficiency (from cooling in the summer and added insulation in the winter), reduction of the 'Urban Heat Island Effect", sound insulation and amenity value.

DISADVANTAGES

- As with water harvesting limited effect unless wide scale implementation
- Not popular solutions for developers
- Cost (when compared to conventional runoff systems)
- Not appropriate for steep roofs
- Maintenance of roof vegetation important, especially to avoid damage to roof lining/ structure

PERFORMANCE	
• Peak flow reduction	Medium
• Volume reduction	Medium
• Water quality treatment	Good
• Amenity potential	Good
• Ecology potential	Good
TREATMENT TRAIN SUITABILITY	
• Source control	Yes
• Conveyance	No
• Site system	No
• Regional system	No
SITE SUITABILITY	
• Residential	Yes
• Commercial/industrial	Yes
• High density	Yes
• Retrofit	No
• Contaminated sites/sites above vulnerable groundwater	Yes
COST IMPLICATIONS	
• Land take	None
• Capital cost	Low-High (depending on roof type and capacity)
• Maintenance	Medium
POLLUTANT REMOVAL	
• Total suspended solids	Medium
• Nutrients	High
• Heavy metals	Medium

KEY MAINTENANCE REQUIREMENTS

- Irrigation during establishment of vegetation
- Litter removal
- Inspection for bare patches and replacement of plants

3 RAINWATER HARVESTING (ON-PLOT)

3.1 DESCRIPTION

Structures are created to capture and store water during rainfall events for non-potable water supply.
Equipment can include cisterns, barrels and tanks. Systems can be designed to maximise capture from roofs and hard surfaces during extreme events, and can significantly contribute to runoff reduction.



3.2 KEY DESIGN CRITERIA

- Design dependent on demand requirements, contributing surface area, stormwater management requirements, and seasonal rainfall characteristics
- First flush often diverted away from tank

ADVANTAGES

- With careful design, can provide source control of stormwater runoff
- Reduces demand on mains water
- Structures can be at surface or subsurface
- Simple to install and low cost
- Potential reuse of water

DISADVANTAGES

- Negligible impact unless incorporated into a system wide suite of measures and adopted by all households
- Water quality / maintenance can be an issue if reuse is for domestic purposes
- Potential risks to public health
- May lack aesthetic appeal and require additional costs to mitigate impacts (e.g. Camouflage structures)
- Larger scale systems can be complex and costly to install

PERFORMANCE	
• Peak flow reduction	High
• Volume reduction	High
• Water quality treatment	Poor
• Amenity potential	Poor
• Ecology potential	Poor
TREATMENT TRAIN SUITABILITY	
• Source control	Yes
• Conveyance	No
• Site system	No
• Regional system	No
SITE SUITABILITY	
• Residential	Yes
• Commercial/industrial	Yes
• High density	Yes
• Retrofit	Yes
• Contaminated sites/sites above vulnerable groundwater	Yes
COST IMPLICATIONS	
• Land take	None
• Capital cost	High
• Maintenance	Medium
POLLUTANT REMOVAL	
• Total suspended solids	High
• Nutrients	Low
• Heavy metals	Low

KEY MAINTENANCE REQUIREMENTS

- Regular inspection and cleaning of collection systems, filters, valves and pumps

4 PERMEABLE SURFACES

4.1 DESCRIPTION

Pervious surfaces are generally pavements, suitable for pedestrian and/or vehicular traffic, that allow water infiltration through the surface and into the subsoil. The water is temporarily stored before infiltration to the ground, reuse, or discharge to a watercourse or other drainage system.

Different concrete, asphalt, synthetic plastic and grass surface/paving types are available, offering different levels of infiltration (e.g. total infiltration, partial infiltration).



Location: North Carolina,

4.2 DESIGN CRITERIA

- Pervious surfaces and sub-base to be structurally designed for site purpose and design vehicular loading
- Surface infiltration rate should normally be an order of magnitude greater than the design rainfall intensity
- Temporary subsurface storage volume to meet requirements for infiltration and /or controlled discharge
- Geotextile may be specified as a filtration treatment component near the top of the structure
- Soil and other material must be prevented from contaminating the pavement surface and substructure

ADVANTAGES	
• Effective in removing urban runoff pollutants	
• Lined systems can be used where infiltration is not desirable, or where soil integrity would be compromised (allows for capture and treatment)	
• No additional land take, allows dual use of space	
• Easily available materials	
• Visually acceptable	
• Can be built/integrated into other storm water management systems	
• Estidama compliant	
• Good community acceptability	
• Surfaces are generally proven to be effective, and have a wide application of uses in car parking/hardscape areas	
DISADVANTAGES	
• Cannot be used where large sediment loads may be washed/carried onto the surface	
• Risk of long term clogging and weed growth if poorly maintained	
• Surfaces can be easily damaged	
• The performance of porous pavements is not proven (suffer from blockages of pores), especially if used on heavily trafficked urban roads.	
• Economies of scale are not present (can be 2-3 times the cost of conventional asphalt paving)	
KEY MAINTENANCE REQUIREMENTS	
• Sweeping	
PERFORMANCE	
• Peak flow reduction	Good
• Volume reduction	Good
• Water quality treatment	Good
• Amenity potential	Poor
• Ecology potential	Poor
TREATMENT TRAIN SUITABILITY	
• Source control	Yes
• Conveyance	No
• Site system	Yes
• Regional system	No
SITE SUITABILITY	
• Residential	Yes
• Commercial/industrial	Yes
• High density	Yes
• Retrofit	Yes
• Contaminated sites/sites above vulnerable groundwater (with liner)	Yes
COST IMPLICATIONS	
• Land take	Low
• Capital cost	Mediun
• Maintenance	Low
POLLUTANT REMOVAL	
• Total suspended solids	High
• Nutrients	High
• Heavy metals	High

- Regular brushing and vacuuming

5 SILT REMOVAL DEVICES

5.1 DESCRIPTION

A manhole or similar prefabricated structure used to remove silt from runoff. Normally, the devices have an integrated lower storage/separation chamber (where the oils and liquids separate and suspended solids settle to the bottom) and an upper by-pass chamber to allow normal flow to continue.

5.2 KEY DESIGN CRITERIA

- Establish appropriate silt removal frequencies
- Maintenance and monitoring plan should be developed during the design phase



Location: San Diego, USA

ADVANTAGES	
• Useful in areas where silt accumulation risks are significant	
• Filters a wide range of pollutants e.g. oils, grime, silts	
• Can be used as standalone device or part of a SUDS treatment plan e.g. with an urban wetland to remove development pollutants	
• Allows for pollutant storage	
• Located underground	
• Suited to urban catchments up to 5 ha	
• Minimises need for excavation de-silting e.g. from ponds	
DISADVANTAGES	
• Risk of silt blockage	
• Disposal areas required	
• Silt can be toxic, controlled waste disposal required	
• Variable effectiveness during high flow conditions	
PERFORMANCE	
• Peak flow reduction	Poor
• Volume reduction	Poor
• Water quality treatment	Good
• Amenity potential	n/a
• Ecology potential	n/a
TREATMENT TRAIN SUITABILITY	
• Source control	Yes
• Conveyance	No
• Site system	No
• Regional system	No
SITE SUITABILITY	
• Residential	Yes
• Commercial/industrial	Yes
• High density	Yes
• Retrofit	Yes
• Contaminated sites/sites above vulnerable groundwater	Yes
COST IMPLICATIONS	
• Land take	Low
• Capital cost	High
• Maintenance	High
POLLUTANT REMOVAL	
• Total suspended solids	High
• Nutrients	Low
• Heavy metals	Low
KEY MAINTENANCE REQUIREMENTS	
Inspection for silt blockages and removal where necessary	

6 FILTER DRAINS

6.1 DESCRIPTION

Filter drains are trenches that are filled with permeable material. Surface water from the edge of paved areas flows into the trenches, is filtered and conveyed to other parts of the site. A slotted or perforated pipe may be built into the base of the trench to collect and convey the water.



6.2 KEY DESIGN CRITERIA

- Excavated trench 1-2m depth filled with stone aggregate
- Effective upstream pre-treatment to remove sediment and file silts
- Observation/access points for maintenance of perforated pipe components

ADVANTAGES	
• Used to filter and covey stormwater	
• Reduces pollutant load discharged to receiving areas	
• Can be easily incorporated into site landscaping and fit well beside roads	
DISADVANTAGES	
• High clogging potential without effective pre-treatment	
• Not suitable in sites with fine clays/silts in upstream catchments	
• Build-up of pollution/blockages difficult to see	
• High historic failure rate due to poor maintenance, wrong siting or high debris input	
• Limited to relatively small catchments	
• High cost of replacing filter material should blockage occur	
PERFORMANCE	
• Peak flow reduction	Medium
• Volume reduction	Low
• Water quality treatment	High
• Amenity potential	Low
• Ecology potential	Low
TREATMENT TRAIN SUITABILITY	
• Source control	No
• Conveyance	Yes
• Site system	No
• Regional system	No
SITE SUITABILITY	
• Residential	
• Commercial/industrial	Yes
• High density	Yes
• Retrofit	Yes
• Contaminated sites/sites above vulnerable groundwater	Yes Yes
COST IMPLICATIONS	
• Land take	Low
• Capital cost	Medium (if liner required)
• Maintenance	Medium
POLLUTANT REMOVAL	
• Total suspended solids	High
• Nutrients	Low
• Heavy metals	Low
KEY MAINTENANCE REQUIREMENTS	
• Regular inspection for signs of clogging	
• Removal of sediment from pre-treatment system	
• Removal and cleaning or replacement of stone	

7 SWALES

7.1 DESCRIPTION

Swales are long, shallow channels used to store and convey surface run-off. Depending on the design of the system, they can also allow or prohibit infiltration and reduction in flow rates. Swale channels can be vegetated, comprising grass or other ground covering plant, or non-vegetated, comprising stabilised sand, rock and gravel (see image)



7.2 KEY DESIGN CRITERIA

- Limit velocities during extreme events to 1-2 m/s, depending on soil type, to prevent erosion
- Maintain flow height of water during frequent events below the top of the vegetation (typically 100mm)
- Maximum side slopes of 1 in 3 (where soil conditions allow)
- Minimum base width normally 0.5m

ADVANTAGES	
Unvegetated	
• No planting and therefore no supplementary irrigation requirements	
• Erosion control	
• Generally very low maintenance	
• Easily integrated as a landscape feature	
Vegetated	
• Easily integrated into irrigated landscape feature. If integrated into detention/retention basins, runoff is stored and reused or slowly discharged into stormwater collection system	
• Pollution/blockages are visible, easily trapped,	
• Maintenance can be incorporated into general landscape management	
DISADVANTAGES	
Unvegetated	
• Not suited to dense urban areas	
• Litter trap	
Vegetated	
• Intensive maintenance	
• Not well suited to arid climates	
• Aesthetics – litter trap	
• Not suited to steep areas	
• Limited opportunities to use trees for landscaping	
• Risk of blockages in connecting pipework	
PERFORMANCE	
• Peak flow reduction	Medium
• Volume reduction	Medium
• Water quality treatment	Medium-Low
• Amenity potential	Medium
• Ecology potential	Medium-Low
TREATMENT TRAIN SUITABILITY	
• Source control	Yes
• Conveyance	Yes
• Site system	Yes
• Regional system	No
SITE SUITABILITY	
• Residential	Yes
• Commercial/industrial	Yes
• High density	No
• Retrofit	No
• Contaminated sites/sites above vulnerable groundwater (with liner)	Yes
COST IMPLICATIONS	
• Land take	High
• Capital cost	Low (Medium if vegetated)
• Maintenance	Medium
POLLUTANT REMOVAL	
• Total suspended solids	High
• Nutrients	Low
• Heavy metals	Medium
KEY MAINTENANCE REQUIREMENTS	
• Litter removal, repair of eroded or damaged areas	
• Grass cutting and removal of cuttings, if vegetated	
• Clearing of inlets, culvers and outlets from debris and sediment	

8 PIPE NETWORKS

8.1 DESCRIPTION

Pipes are commonly used to provide conveyance and drainage connectivity for a site.

8.2 KEY DESIGN CRITERIA

- Pipe size and depth to be appropriate for stormwater network, using runoff rates calculated for the development and checked against hydrograph methods (drainage methods)
- Size should be at least 150mm in diameter
- Not laid flatter than 1 in 150
- Should be designed on the premise that all hard surfaces contribute runoff at the normal rate, even it if is attenuated or reduced in volume by other SUDS components



Location: Birmingham,

ADVANTAGES	
• Can absorb rainfall in the region of 30-50mm/hr (residential uses)	
• Flexible in design, suitable for range of land uses e.g. agriculture, residential, commercial	
• Complement other SUDS techniques, e.g. runoff from swales	
• Located above or below ground	
• Pipes can be perforated, to allow infiltration	
DISADVANTAGES	
• Risk of long term failure/flooding due to pipe capacities being overloaded by high rainfall events	
• Network can require modifications, may require authority approval	
• Detailed modelling of the drainage system can be required for larger/complex systems	
PERFORMANCE	
• Peak flow reduction	Good
• Volume reduction	Poor
• Water quality treatment	n/a
• Amenity potential	n/a
• Ecology potential	n/a
TREATMENT TRAIN SUITABILITY	
• Source control	No
• Conveyance	Yes
• Site system	Yes
• Regional system	Yes
SITE SUITABILITY	
• Residential	Yes
• Commercial/industrial	Yes
• High density	Yes
• Retrofit	Yes
• Contaminated sites/sites above vulnerable groundwater	Yes
COST IMPLICATIONS	
• Land take	Low
• Capital cost	High
• Maintenance	Low/Medium
POLLUTANT REMOVAL	
• Total suspended solids	n/a
• Nutrients	n/a
• Heavy metals	n/a
KEY MAINTENANCE REQUIREMENTS	
• Inspection for blockages	
• Debris removal from inlet/outlet	

9 FILTER STRIPS

9.1 DESCRIPTION

Filter strips are vegetated strips of land designed to accept runoff as overland flow from upstream developments. They lie between a hard-surfaced area and a receiving stream, surface water collection, treatment or disposal system. They treat runoff by vegetative filtering, and promote settlement of particulate pollutants and infiltration.

9.2 KEY DESIGN CRITERIA

- Recommended minimum width of 6m
- Runoff from an adjacent impervious area must be evenly distributed across the filter strip, with a water depth <50mm for the water quality treatment event
- Slopes not exceeding 1in 20, minimum 1in 50



Location: North Carolina, USA

ADVANTAGES	
• Well suited to implementation adjacent to large impervious areas	
• Encourages evaporation and can promote infiltration	
• Easy to construct and low construction cost	
• Effective pre-treatment option	
• Easily integrated into landscaping and can be designated to provide aesthetic benefits	
DISADVANTAGES	
• Large land requirement	
• Not suitable for steep sites	
• Not suitable for draining hotspot runoff or for locations where risk of groundwater contamination, unless infiltration is prevented	
• No significant attenuation or reduction of extreme event flows	
• Require irrigation	
PERFORMANCE	
• Peak flow reduction	Poor
• Volume reduction	Poor
• Water quality treatment	Medium
• Amenity potential	Low
• Ecology potential	Medium
TREATMENT TRAIN SUITABILITY	
• Source control	Yes
• Conveyance	No
• Site system	Yes
• Regional system	No
SITE SUITABILITY	
• Residential	Yes
• Commercial/industrial	Yes
• High density	Yes
• Retrofit	No
• Contaminated sites/sites above vulnerable groundwater (unless infiltration prevented)	No
COST IMPLICATIONS	
• Land take	High
• Capital cost	Low
• Maintenance	Low
POLLUTANT REMOVAL	
• Total suspended solids	Medium
• Nutrients	Medium
• Heavy metals	Medium
KEY MAINTENANCE REQUIREMENTS	
• Require irrigation	
• Mowing	
• Repair of eroded or damaged areas	

10 SAND FILTER

10.1 DESCRIPTION

Sand filters are composed of single or multi-chambered structures designed to treat surface water runoff. Run-off initially flow into a temporary ponding area above the filter, before flowing through a sedimentation chamber. The water then percolates through the sand bed, either into the underlying soil or into a collection system. They can be designed with an impervious lining or to allow infiltration, depending on the soil type. They are best suited to industrial or semi-industrial sites where storm water is likely to mix with surface pollutants before draining away.



Location: Portland, USA

10.2 KEY DESIGN CRITERIA

- Filter depths of 0.45 - 0.6m
- Sand sizes of 0.5 - 1.0mm
- Combined volume of sedimentation and filter chamber should provide >75% of treatment volume in temporary storage before filtration
- Minimum sedimentation chamber length: width ratio 2:1

ADVANTAGES	**PERFORMANCE**	
• Offers flexibility of design	• Peak flow reduction	Poor
• Very effective for removing TSS from run-off and can retain other contaminants	• Volume reduction	Poor
	• Water quality treatment	Good
• Suitable for retrofits and in tightly constrained urban locations	• Amenity potential	Poor
• Possible use to achieve - Section PW-2 ' Storm Water Management' of Estidama's Pearl Community Rating System recommends the removal of 80% of TSS, 95% removal of litter, and 90% removal of hydrocarbons from rain water before entering any surface water removal network.	• Ecology potential	Poor
	TREATEMENT TRAIN SUITABILITY	
	• Source control	No
	• Conveyance	No
	• Site system	Yes
	• Regional system	No
DISADVANTAGES	**SITE SUITABILITY**	
• Not recommended for areas with high sediment content in runoff	• Residential	No
	• Commercial/industrial	Yes
• Long detention times can support algae growth and lead to filter clogging	• High density	Yes
	• Retrofit	Yes
• Negative aesthetic appeal, possible odour problems	• Contaminated sites/sites above vulnerable groundwater (with liner)	Yes
• Not suitable for large catchment areas	**COST IMPLICATIONS**	
• High capital cost	• Land take	Low
• The requirement for continuous maintenance, and the infrequency of rainfall would limit their yearlong effectiveness.	• Capital cost	High
	• Maintenance	High
• Generation of contaminated solid waste requiring appropriate disposal.	**POLLUTANT REMOVAL**	
	• Total suspended solids	
	• Nutrients	High
	• Heavy metals	Low
		High
KEY MAINTENANCE REQUIREMENTS	• Inlet/sedimentation basin cleaning	
• Regular performance inspection	• Replacement or rehabilitation of top filter layer	
• Litter/debris removal	• Vegetation management around filter	

11 RAINWATER HARVESTING (OFF-PLOT)

11.1 DESCRIPTION

The use of natural depression or creation of artificial terraces, swales and other features to reduce run-off speed and provide a landscaping feature.



Location: Middle East

11.2 KEY DESIGN CRITERIA

- Design dependent on demand requirements, contributing surface area, stormwater management requirements, and seasonal rainfall characteristics

ADVANTAGES	**PERFORMANCE**	
• Simple to install and relatively low cost	• Peak flow reduction	Medium
• Can make use of local materials	• Volume reduction	Medium
• Can be used to promote traditional construction approaches/skills	• Water quality treatment	Medium
	• Amenity potential	High
• Potentially very attractive landscape feature	• Ecology potential	High
• Additional water attenuation by infiltration	**TREATMENT TRAIN SUITABILITY**	
	• Source control	Yes
•	• Conveyance	Yes
	• Site system	Yes
	• Regional system	No
DISADVANTAGES	**SITE SUITABILITY**	
• Negligible impact unless incorporated into a system wide suite of measures	• Residential	Yes
	• Commercial/industrial	Yes
• May require supplementary watering if landscaped	• High density	No
	• Retrofit	No
	• Contaminated sites/sites above vulnerable groundwater	No
	COST IMPLICATIONS	
	• Land take	High
	• Capital cost	Low
	• Maintenance	Low
	POLLUTANT REMOVAL	
	• Total suspended solids	Low
	• Nutrients	Low
	• Heavy metals	Low
KEY MAINTENANCE REQUIREMENTS		
• Inspection and removal of debris from terraced areas		
• After heavy flood events, some maintenance of terraced/bank walls may be required		

12 INFILTRATION TRENCH

12.1 DESCRIPTION

Infiltration trenches are shallow excavations filled with rubble or rocks that create temporary subsurface storage for storm water. They allow runoff to transfer into the surrounding soils from the bottom and sides of the trench. They are smaller than infiltration basins, and generally do not have an outlet pipe.



Location: Rhode Island, USA

12.2 DESIGN CRITERIA

- Excavated trench 1-2m depth, filled with stone aggregate
- Effective upstream pre-treatment to remove sediment and fine silts
- Infiltration should not be used where groundwater is vulnerable or to drain pollution hotspots
- Observation wells/and or access points for maintenance of perforated pipe components

ADVANTAGES

- Infiltration can significantly reduce both runoff rates and volumes.
- Infiltration provides a significant reduction in the pollutant load discharged to receiving body
- Trenches can be incorporated easily into site landscaping and fit well beside roads

DISADVANTAGES

- High clogging potential without effective pre-treatment - not for sites with fine particled soils (clays/silts) in upstream catchment
- Build-up of pollution/blockages difficult to see
- High historic failure rate due to poor maintenance, wrong siting or high debris input
- Limited to relatively small catchments

PERFORMANCE

Peak flow reduction	Medium
Volume reduction	High
Water quality treatment	High
Amenity potential	Low
Ecology potential	Low

TREATMENT TRAIN SUITABILITY

Source control	Yes
Conveyance	Yes
Site system	No
Regional system	No

SITE SUITABILITY

Residential	Yes
Commercial/industrial	Yes
High density	Yes
Retrofit	Yes
Contaminated sites/sites above vulnerable groundwater (with liner)	No

COST IMPLICATIONS

Land take	Medium
Capital cost	Low (Medium if liner required)
Maintenance	Medium

POLLUTANT REMOVAL

Total suspended solids	High
Nutrients	Low/Medium
Heavy metals	High

KEY MAINTENANCE REQUIREMENTS

- Regular inspection for signs of clogging
- Removal of sediment from pre-treatment system
- Removal and cleaning or replacement of stone

13 SOAKAWAYS

13.1 DESCRIPTION

Soakaways are square or circular excavation areas for draining runoff. The supporting structure is filled with rubble/backfill, or lined with brickwork, pre-cast concrete, polyethylene rings or some other geocellular structure. They can be grouped together to drain large areas, such as highways



Location: Surrey, UK

13.2 KEY DESIGN CRITERIA

- Design to meet site drainage standards - generally 1 in 10 or 1 in 30 year flood event
- Site infiltration rate assumed for design should be based on appropriate site investigations and should include an appropriate factor of safety
- Appropriate pre-treatment is required
- If (back) fill is used, the material should provide >30% void space
- Minimum distance of 1m from the base to the seasonally high groundwater table
- Minimum distance of 5m from foundations

ADVANTAGES

- Minimal net land take
- Provides groundwater recharge
- Good volume reduction and peak flow attenuation
- Good community acceptability
- Easy to construct and operate
- Can be retrofitted

DISADVANTAGES

- Not suitable for poor draining soils
- Field investigations required to confirm infiltration rates
- Not suitable for locations where infiltrating water may put structural foundations at risk, or where infiltrating water may adversely affect existing drainage patterns
- Not appropriate for draining polluted runoff
- Increased risk of groundwater pollution
- Some uncertainty over long term performance

PERFORMANCE

Peak flow reduction	Good
Volume reduction	Good
Water quality treatment	Good
Amenity potential	Poor
Ecology potential	Poor

TREATMENT TRAIN SUITABILITY

Source control	Yes
Conveyance	No
Site system	Yes
Regional system	No

SITE SUITABILITY

Residential	Yes
Commercial/industrial	Yes
High density	Yes
Retrofit	Yes
Contaminated sites/sites above vulnerable groundwater	No

COST IMPLICATIONS

Land take	Low
Capital cost	Low
Maintenance	Low

POLLUTANT REMOVAL

Total suspended solids	Medium
Nutrients	Low
Heavy metals	Medium

KEY MAINTENANCE REQUIREMENTS

- Removal of sediments/debris from pre-treatment device
- Monitoring performance (using observation well)

14 BIORETENTION

14.1 DESCRIPTION

Bioretention areas are excavation cells with shallow surface depressions that can be used to capture, treat and infiltrate roof, road and parking lot runoff from small drainage areas. They contain a gravel layer along the bottom and a prepared soil bed above, that filters and treats runoff and provides a growing medium for specially selected vegetation planted on the surface. They are aimed at managing and treating runoff from frequent rainfall events, and can also be referred to as rain gardens, biofilters and bioswales.



Location: York, United Kingdom

14.2 KEY DESIGN CRITERIA

- Sufficient area to temporarily store the Water Quality Tr Volume at a depth <0.15m on the surface
- The water quality treatment event should half drain within provide adequate capacity for multi-event scenarios
- Minimum depth to groundwater of 1m, if unlined
- Overflow/bypass facilities for extreme events

ADVANTAGES	
• Can be planned as landscaping features	
• Very effective in removing urban pollutants	
• Can reduce volume and rate of runoff	
• Flexile design, can fit into landscape	
DISADVANTAGES	
• Requires landscaping and management	
• Require regular rain fall events or irrigation	
• Susceptible to clogging if surrounding landscape is poorly managed	
• Not suitable for areas with steep slopes	
PERFORMANCE	
• Peak flow reduction	Medium
• Volume reduction	Medium/High
• Water quality treatment	Good
• Amenity potential	Good
• Ecology potential	Medium
TREATMENT TRAIN SUITABILITY	
• Source control	Yes
• Conveyance	No
• Site system	Yes
• Regional system	No
SITE SUITABILITY	
• Residential	Yes
• Commercial/industrial	Yes
• High density	No
• Retrofit	Yes
• Contaminated sites/sites above vulnerable groundwater (with liner)	Yes
COST IMPLICATIONS	
• Land take	High
• Capital cost	Low
• Maintenance	Medium
POLLUTANT REMOVAL	
• Total suspended solids	High
• Nutrients	Low
• Heavy metals	High
KEY MAINTENANCE REQUIREMENTS	
• Regular inspection	
• Litter, debris removal	
• Replacement of mulch layer/vegetation management	
• Soil spiking and scarifying	

15 PONDS

15.1 DESCRIPTION

Ponds can provide both stormwater attenuation and treatment. They are designed to support emergent and submerged aquatic vegetation along their shoreline. Runoff from each rain event is detained and treated in the pool.

The retention time promotes pollutant removal through sedimentation and the opportunity for biological processes to reduce nutrient concentrations



Location: Auckland, New Zealand

15.2 KEY DESIGN CRITERIA

- Permanent pool volume for water quality treatment
- Temporary storage volume for flow attenuation
- Upstream sediment pre-treatment
- Length: width ratio between 3:1 and 5:1Minimum depth for open water areas of 1.2m
- Maximum depth of permanent pool of 2m
- Side slopes <3:1 for slopes

ADVANTAGES	
• Can cater for all storms e.g. 1 in 100 yr flood	
• Good removal capability of urban pollutants	
• Can be used where groundwater is vulnerable, if lined	
• Good community acceptability	
• High potential ecological aesthetic and amenity benefits	
• May add to local property values	
DISADVANTAGES	
• No reduction in runoff volume	
• Anaerobic conditions can occur without regular inflow	
• Land take may limit use in high density sites	
• May not be suitable for steep sites, due to requirements for high embankments	
• Susceptible to colonisation by invasive species, leading to increased maintenance	
• Perceived with health and safety risks, may lead to fencing and isolation of the pond	
• Mosquitoes can be an issue	
PERFORMANCE	
• Peak flow reduction	Good
• Volume reduction	Poor
• Water quality treatment	Good
• Amenity potential	Good
• Ecology potential	Good
TREATMENT TRAIN SUITABILITY	
• Source control	No
• Conveyance	No
• Site system	Yes
• Regional system	Yes
SITE SUITABILITY	
• Residential	Yes
• Commercial/industrial	Yes
• High density	No
• Retrofit	No
• Contaminated sites/sites above vulnerable groundwater (with liner)	Yes
COST IMPLICATIONS	
• Land take	High
• Capital cost	Medium (High with liner)
• Maintenance	Medium
POLLUTANT REMOVAL	
• Total suspended solids	High
• Nutrients	Medium
• Heavy metals	High
KEY MAINTENANCE REQUIREMENTS	
• Litter, debris removal	
• Inlet/outlet cleaning	
• Management of vegetation coverage	
• Sediment monitoring and removal when required	

16 WETLANDS

16.1 DESCRIPTION

Wetlands provide both stormwater attenuation and treatment. They comprise shallow ponds and marshy areas, covered almost entirely in aquatic vegetation.
Wetlands detain flows for an extended period to allow sediments to settle and promote the removal of contaminants by vegetation and aerobic decomposition.



Location: Port Fraser, Australia

16.2 KEY DESIGN CRITERIA

- Water quality treatment volume, detained within or above the permanent water body
- Shallow, temporary storage volume for attenuation
- Upstream sediment pre-treatment or equivalent
- Continuous baseflow
- Combination of deep and shallow areas (maximum depth <2m)
- Length: width ratio of greater than 3:1
- Shallow side slopes

ADVANTAGES	
• Significant ecological, aesthetic, amenity benefits	
• Good removal capability of urban pollutants	
• if lined, can be used where groundwater is vulnerable	
• Good community acceptability	
• Can add value to local property	
DISADVANTAGES	
• Land take is high	
• Requires baseflow	
• Limited depth range for flow attenuation	
• May release nutrients during non-growing season	
• Little reduction in runoff volume	
• Not suitable for steep sites	
• Susceptible to colonisation by invasive species, that can increase maintenance	
• Performance vulnerable to high sediment flows	
• Perceived health and safety risks may result in fencing and isolation of wetland	
• Mosquitoes can be an issue	
KEY MAINTENANCE REQUIREMENTS	
• Litter, debris removal	
• Inlet/outlet cleaning	
• Management of vegetation coverage	
• Sediment monitoring and removal when required	
PERFORMANCE	
• Peak flow reduction	Good
• Volume reduction	Poor
• Water quality treatment	Good
• Amenity potential	Good
• Ecology potential	Good
TREATMENT TRAIN SUITABILITY	
• Source control	No
• Conveyance	Yes
• Site system	Yes
• Regional system	Yes
SITE SUITABILITY	
• Residential	Yes
• Commercial/industrial	Yes
• High density	Unlikely
• Retrofit	Unlikely
• Contaminated sites/sites above vulnerable groundwater (with liner)	Yes
COST IMPLICATIONS	
• Land take	High
• Capital cost	High
• Maintenance	Low/Medium
POLLUTANT REMOVAL	
• Total suspended solids	High
• Nutrients	Medium
• Heavy metals	High

17 DETENTION BASINS

17.1 DESCRIPTION

Detention basins are surface storage basins that provide flow control through attenuation of stormwater runoff. They are designed to hold a specific amount of flow for a minimum duration period (e.g. 24 hours). Rainwater is directed to the basins, which flows through the system, allowing sediment particles and associated pollutants to settle out. They do not have a permanent water supply.



Location: Nevada, USA

17.2 KEY DESIGN CRITERIA

- Detention volume to manage design storms via constrained outflow
- Minimum length: width ratio of 2:1
- Maximum side slopes of 1:4 for maintenance and safety reasons, unless the situation allows steeper slopes to be used
- Bioretention and/or wetland or micropools at outlets is desirable for enhanced pollution control

ADVANTAGES	
• Can cater for a wide range of rainfall events	
• Can be used where groundwater is vulnerable, if lined (increases evaporative loss)	
• Simple to design and construct	
• Potential for dual/multipurpose land use e.g. football pitch, landscaped/habitat area	
• Easy to maintain	
DISADVANTAGES	
• Detention depths may be constrained by system inlet and outlet levels	
• Potential safety risk is not used throughout year	
• In certain areas, sand and litter can accumulate resulting in the need for maintenance	
KEY MAINTENANCE REQUIREMENTS	
• Litter/trash removal	
• Inlet/outlet cleaning	
• Vegetation management	
• Sediment monitoring and removal when required	
PERFORMANCE	
• Peak flow reduction	Good
• Volume reduction	Poor
• Water quality treatment	Medium
• Amenity potential	Good
• Ecology potential	Medium
TREATMENT TRAIN SUITABILITY	
• Source control	No
• Conveyance	No
• Site system	Yes
• Regional system	Yes
SITE SUITABILITY	
• Residential	Yes
• Commercial/industrial	Yes
• High density	Yes
• Retrofit	Yes
• Contaminated sites/sites above vulnerable groundwater (with liner)	No / Yes
COST IMPLICATIONS	
• Land take	Medium
• Capital cost	Low
• Maintenance	Low
POLLUTANT REMOVAL	
• Total suspended solids	Medium
• Nutrients	Low
• Heavy metals	Low

18 INFILTRATION BASINS

18.1 DESCRIPTION

Infiltration basins are shallow vegetated depressions designed to receive and store runoff, and infiltrate it gradually into the ground.


Location: Maryland,

18.2 DESIGN CRITERIA

- Effective pre-treatment required to remove sediments and fine silts prior to infiltration
- Designed to infiltrate the water quality treatment volume, as a minimum
- Infiltration should not be used where groundwater is vulnerable or to drain pollution hotspots

ADVANTAGES	PERFORMANCE	
• Reduces the volume of runoff from a drainage area	• Peak flow reduction	Average
• Can be very effective at pollutant removal via filtering through the soils	• Volume reduction	Good
• Contributes to groundwater recharge and baseflow augmentation	• Water quality treatment	Good
• Simple and cost-effective to construct	• Amenity potential	Good
• Changes in performance are easy to observe	• Ecology potential	Good
DISADVANTAGES	**TREATMENT TRAIN SUITABILITY**	
• Potentially high failure rates due to improper siting, poor design and lack of maintenance, especially if appropriate pre-treatment is not incorporated	• Source control	No
• Require irrigation to maintain vegetation	• Conveyance	No
• Comprehensive geotechnical investigations required to confirm suitability for infiltration	• Site system	Yes
• Not appropriate for draining pollution hotspots where high pollution concentrations are possible	• Regional system	No
• Requires a large, flat area	**SITE SUITABILITY**	
• Can be unsightly, especially when they clog	• Residential	Yes
	• Commercial/industrial	Yes
	• High density	No
	• Retrofit	No
	• Contaminated sites/sites above vulnerable groundwater (with liner)	No
	COST IMPLICATIONS	
	• Land take	High
	• Capital cost	Low
	• Maintenance	Low
	POLLUTANT REMOVAL	
	• Total suspended solids	High
	• Nutrients	Medium
	• Heavy metals	High

KEY MAINTENANCE REQUIREMENTS

- Regular inspections for signs of deterioration in performance, clogging and other blockages
- Litter removal
- Inlet cleaning
- Vegetation management and irrigation
- Regular removal of sediment from pre-treatment

19 GEOCELLULAR/MODULAR SYSTEMS

19.1 DESCRIPTION

Systems constructed with a network of high void ratio areas that can allow water to infiltrate and be stored.

Typically, geocellular systems are honeycomb shaped structures, with perforated distribution pipe work running under or through the structure. Modular systems are box shaped, with inlet/outlet pipe work connected to the sides of the structure.


Location: New South Wales,

19.2 DESIGN CRITERIA

- Standard storage design uses restricted discharge which determines max storage volumes
- Structural design to relevant standards for appropriate surface loadings
- Appropriate geotextile/geomembrane for wrapping

ADVANTAGES	PERFORMANCE	
• Modular and flexible	• Peak flow reduction	Good
• Dual usage, infiltration and/or storage	• Volume reduction	Good (with infiltration)
• Can be installed beneath public open spaces or heavily trafficked areas	• Water quality treatment	Poor
• Tend to be more cost-effective than traditional alternatives	• Amenity potential	Poor
• High void ratio (up to ~90%) and therefore high storage capacity, compared to traditional systems like stone filled Soakaways	• Ecology potential	Poor
• Lightweight, easy to install and robust	**TREATMENT TRAIN SUITABILITY**	
DISADVANTAGES	• Source control	Yes
• Material can be expensive	• Conveyance	Possible
• Requires regular maintenance inspections	• Site system	Yes
• Does not provide water quality treatment	• Regional system	Yes
	SITE SUITABILITY	
	• Residential	Yes
	• Commercial/industrial	Yes
	• High density	Yes
	• Retrofit	Yes
	• Contaminated sites/sites above vulnerable groundwater (with liner)	Yes
	COST IMPLICATIONS	
	• Land take	Medium
	• Capital cost	High
	• Maintenance	Low
	POLLUTANT REMOVAL	
	• Total suspended solids	Low
	• Nutrients	Low
	• Heavy metals	Low

KEY MAINTENANCE REQUIREMENTS

- Regular inspection of silt traps, manholes, pipework and pre-treatment devices, with removal of sediment and debris as required

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APPENDIX 6: WATER

Table A.4: Water Demand Breakdown of the Proposed and Existing Urban areas Based on the Proposed Planning Strategy

LGA	LAND USE TYPE		ZONE NAME	POPULATION 2036	EMPLOYEES 2036	RESID. AVERAGE WATER DEMAND (M3/D)	EMP. AVERAGE WATER DEMAND (M3/D)	AVERAGE WATER DEMAND (M3/D)
IBADAN NORTH	Urban High Density (Inner)	-	180,860	44713	16,277	1,341	17,619	17,619
	Medium Density Inner	-	166,078	63985	18,269	1,920	20,188	20,188
	Low Density Inner	-	1,941	191304	213	5,739	5,953	5,953
IBADAN NORTH EAST	Urban High Density (Inner)	-	306,326	75,731	27,569	2,272	29,841	29,841
	Medium Density Inner	-	34,780	86,282	3,826	2,588	6,414	6,414
IBADAN NORTH WEST	Urban High Density (Inner)	-	95,173	23,529	8,566	706	9,271	9,271
	Medium Density (Inner)	-	60,842	23,441	6,693	703	7,396	7,396
IBADAN SOUTH EAST	Urban High Density (Inner)	-	213,009	52,661	19,171	1,580	20,751	20,751
	Medium Density (Inner)	-	84,888	32,705	9,338	981	10,319	10,319
	Low Density (Inner)	-	414	160	46	5	50	50
IBADAN SOUTH WEST	Urban High Density (Inner)	-	188,834	46685	16,995	1,401	18,396	18,396
	Medium Density (Inner)	-	178,181	68648	19,600	2,059	21,659	21,659
	Low Density (Inner)	-	2,967	1143	326	34	361	361

Table continued overleaf

LGA	LAND USE TYPE		ZONE NAME	POPULATION 2036	EMPLOYEES 2036	RESID. AVERAGE WATER DEMAND (M3/D)	EMP. AVERAGE WATER DEMAND (M3/D)	AVERAGE WATER DEMAND (M3/D)
LAGELU	Urban High Density (Inner)	-	40,939	25,000	3,684	750	4,434	4,434
	Medium Density (Inner)	-	430,276	75,000	47,330	2,250	49,580	49,580
	90% of Low Density (Inner)	-	47,847	29,145	5,263	874	6,137	6,137
	50% of Low Density (Outer)	-	1,190	9,779	131	293	424	424
	Expansion - High Density	HD3	20,784	66,804	1,871	2,004	3,875	3,875
	Expansion - Medium Density	MD1	169,646	10,121	18,661	304	18,965	18,965
	Expansion - Medium Density	MD7	6,634	13,449	730	403	1,133	1,133
	Expansion - Medium Density	MD8	69,236	7,178	7,616	215	7,831	7,831
	Infill - Medium Density	IMD2	221,102	33,646	24,321	1,009	25,331	25,331
	Infill - Medium Density	IMD7	62,031	58,814	6,823	1,764	8,588	8,588
	Industry	ID7	-	13,909	-	417	417	417
	Industry	ID8	-	12,721	-	382	382	382

Table continued overleaf

LGA	LAND USE TYPE		ZONE NAME	POPULATION 2036	EMPLOYEES 2036	RESID. AVERAGE WATER DEMAND (M3/D)	EMP. AVERAGE WATER DEMAND (M3/D)	AVERAGE WATER DEMAND (M3/D)
AKINYELE	Urban High Density (Inner)	-	144,228	39,894	12,981	1,197	14,177	14,177
	Medium Density (Inner)	-	301,208	120,511	33,133	3,615	36,748	36,748
	75% of Medium Density (Outer)	-	56,754	14,225	6,243	427	6,670	6,670
	85% of Low Density (Inner)	-	49,430	19,044	5,437	571	6,009	6,009
	60% of Low Density (Outer)	-	11,726	4,518	1,290	136	1,425	1,425
	Expansion - High Density	HD1	30,403	112,480	2,736	3,374	6,111	6,111
	Expansion - Low Density	LD1	305,096	20,908	45,764	627	46,392	46,392
	Infill-Medium Density	IMD1	194,045	107,422	21,345	3,223	24,568	24,568

Table continued overleaf

LGA	LAND USE TYPE		ZONE NAME	POPULATION 2036	EMPLOYEES 2036	RESID. AVERAGE WATER DEMAND (M3/D)	EMP. AVERAGE WATER DEMAND (M3/D)	AVERAGE WATER DEMAND (M3/D)
IDO	Urban High Density (Inner)	-	79,114	21,330	7,120	640	7,760	7,760
	Medium Density (Inner)	-	618,896	133,892	68,079	4,017	72,095	72,095
	90% of Low Density (Inner)	-	95,005	44,270	10,451	1,328	11,779	11,779
	Low Density (Outer)	-	2,124	13,972	234	419	653	653
	Expansion - High Density	HD7	17,957	46,987	1,616	1,410	3,026	3,026
	Expansion - Medium Density	MD5	973,067	46,987	107,037	1,410	108,447	108,447
	Expansion - Medium Density	MD6	115,674	7,879	12,724	236	12,961	12,961
	Expansion - Low Density	LD3	45,270	6,478	6,791	194	6,985	6,985
	Industry	ID4	-	30,798	-	924	924	924
	Industry	ID5	-	16,262	-	488	488	488
	Infill-Medium Density	IMD6	264,857	141,342	29,134	4,240	33,375	33,375

Table continued overleaf

LGA	LAND USE TYPE		ZONE NAME	POPULATION 2036	EMPLOYEES 2036	RESID. AVERAGE WATER DEMAND (M3/D)	EMP. AVERAGE WATER DEMAND (M3/D)	AVERAGE WATER DEMAND (M3/D)
OLUYOLE	Urban High Density (Inner)	-	113	49,171	10	1,475	1,485	1,485
	Medium Density (Inner)	-	709,252	92,025	78,018	2,761	80,778	80,778
	Medium Density (Outer)	-	24.49	120,753	3	3,623	3,625	3,625
	90% of Low Density (Inner)	-	127,251	19,369	13,998	581	14,579	14,579
	70% of Low Density (Outer)	-	910	351	100	11	111	111
	Expansion - High Density	HD6	39,010	78,000	3,511	2,340	5,851	5,851
	Expansion - Medium Density	MD4	1,354,875	76,124	149,036	2,284	151,320	151,320
	Industry	ID1	-	74,267	-	2,228	2,228	2,228
	Industry	ID2	-	38,427	-	1,153	1,153	1,153
	Industry	ID3	-	30,168	-	905	905	905
	Industry	ID6	-	189,121	-	5,674	5,674	5,674
	Infill - High Density	IHD4	6,939	60,838	624	1,825	2,450	2,450
	Infill-Medium Density	IMD5	398,554	19,450	43,841	583	44,424	44,424

Table continued overleaf

LGA	LAND USE TYPE		ZONE NAME	POPULATION 2036	EMPLOYEES 2036	RESID. AVERAGE WATER DEMAND (M3/D)	EMP. AVERAGE WATER DEMAND (M3/D)	AVERAGE WATER DEMAND (M3/D)
ONA ARA	Urban High Density (Inner)	-	342,498	84,380	30,825	2,531	33,356	33,356
	Medium Density (Inner)	-	395,755	66,990	43,533	2,010	45,543	45,543
	Medium Density (Outer)	-	5132	30,819	565	925	1,489	1,489
	95% of Low Density (Inner)	-	51,241	19,742	5,637	592	6,229	6,229
	85% of Low Density (Outer)	-	2600	1,002	286	30	316	316
	Expansion - High Density	HD5	5,979	47,733	538	1,432	1,970	1,970
	Expansion - High Density	HD8	39,467	55,689	3,552	1,671	5,223	5,223
	Expansion - Medium Density	MD3	133,165	30,951	14,648	929	15,577	15,577
	Infill - High Density	IHD3	34,597	6,564	3,114	197	3,311	3,311
	Infill-Medium Density	IMD4	159,364	31,822	17,530	955	18,485	18,485

Table continued overleaf

LGA	LAND USE TYPE		ZONE NAME	POPULATION 2036	EMPLOYEES 2036	RESID. AVERAGE WATER DEMAND (M3/D)	EMP. AVERAGE WATER DEMAND (M3/D)	AVERAGE WATER DEMAND (M3/D)
EGBEDA	Urban High Density (Inner)	-	90,761	47,225	8,169	1,417	9,585	9,585
	Medium Density (Inner)	-	606,886	200,000	66,758	6,000	72,758	72,758
	80% of Low Density (Inner)	-	38,622	27,947	4,248	838	5,087	5,087
	85% of Low Density (Outer)	-	1,699	49,681	187	1,490	1,677	1,677
	Expansion - High Density	HD4	15,547	53,284	1,399	1,599	2,998	2,998
	Expansion - Medium Density	MD2	744,357	74,436	81,879	2,233	84,112	84,112
	Infill - High Density	IHD2	29,700	43,014	2,673	1,290	3,963	3,963
	Infill - Medium Density	IMD3	105,265	33,129	11,579	994	12,573	12,573
TOTAL			**11,328,391**	**3,768,216**	**1,221,693**	**113,046**	**1,334,739**	**1,334,739**

Table A.5: Population Distribution Estimates per Water Zones

LAND USE TYPE	POPULATION														
	Z1	Z2	Z3	Z4	Z5	Z6	Z7	Z8	Z9	Z10	Z11	Z12	Z13	Z14	Total
Low Density (Inner)	-	20,708	25,287	43,234	22,004	18,854	29,286	26,454	57,089	47,616	61,068	36,076	3,451	23,323	414,451
Low Density (Outer)	-	4,387	7,353	26	2,480	253	2,381	174	198	712	-	2,124	-	-	20,088
Medium Density (Inner)	-	11,612	169,670	340,103	148,156	33,122	41,031	454,396	73,229	332,883	469,997	201,049	800,483	511,813	3,587,542
Medium Density (Outer)	-	43,078	13,675	-	-	-	5,132	-	-	-	-	-	-	-	61,885
Urban High Density (Inner)	-	-	82,677	61,551	40,939	-	-	17,684	-	-	50,689	45,622	477,267	905,425	1,681,855
Expansion - Low Density	-	298,990	6,162	-	-	-	-	-	-	-	5,273	39,940	-	-	350,366
Expansion - Medium Density	115,674	-	42	6,592	204,410	762,484	118,916	30,593	631,110	677,260	414,351	558,376	-	46,838	3,566,647
Expansion - High Density	-	16,618	13,785	-	20,784	10,111	50,882	-	-	39,010	-	17,957	-	-	169,147
Infill- Medium Density	-	69,026	160,749	181,363	109,756	45,635	133,450	41,652	151,374	195,858	139,348	125,315	-	51,647	1,405,173
Infill - High Density	-	-	-	-	-	21,110	43,187	-	-	6,939	-	-	-	-	71,236
Total Residential Population	115,674	464,419	479,400	632,869	548,528	891,570	424,264	570,953	913,001	1,300,279	1,140,727	1,026,459	1,281,201	1,539,045	11,328,391
Projected Existing Urban Areas Employees	-	25,112	140,258	128,766	128,682	31,906	57,751	110,367	18,291	81,428	152,854	86,576	641,851	407,152	2,010,993
New Urban Areas Employees	7,879	120,186	183,796	72,624	104,749	155,582	194,989	15,428	42,869	206,739	95,012	146,544	-	5,152	1,351,549
Industry	16,262	-	-	-	26,630	-	-	-	-	331,983	-	30,798	-	-	405,673
Total Employees	24,141	145,298	324,054	201,391	260,060	187,488	252,740	125,794	61,160	620,150	247,866	263,918	641,851	412,304	3,768,215
OVERALL TOTAL POPULATION	**139,815**	**609,717**	**803,454**	**834,260**	**808,589**	**1,079,058**	**677,004**	**696,747**	**974,161**	**1,920,430**	**1,388,593**	**1,290,377**	**1,923,052**	**1,951,349**	**15,096,606**

Table A.6: Average Water Demand Estimates per Water Zones

LAND USE TYPE	AVERAGE DAILY WATER DEMAND (M^3/D)														
	Z1	Z2	Z3	Z4	Z5	Z6	Z7	Z8	Z9	Z10	Z11	Z12	Z13	Z14	Total
Low Density (Inner)	-	2,278	2,782	4,756	2,420	2,074	3,221	2,910	6,280	5,238	6,717	3,968	380	2,566	45,590
Low Density (Outer)	-	483	809	3	273	28	262	19	22	78	-	234	-	-	2,210
Medium Density (Inner)	-	1,277	18,664	37,411	16,297	3,643	4,513	49,984	8,055	36,617	51,700	22,115	88,053	56,299	394,630
Medium Density (Outer)	-	4,739	1,504	-	-	-	565	-	-	-	-	-	-	-	6,807
Urban High Density (Inner)	-	-	7,441	5,540	3,685	-	-	1,592	-	-	4,562	4,106	42,954	81,488	151,367
Expansion - Low Density	-	44,849	924	-	-	-	-	-	-	-	791	5,991	-	-	52,555
Expansion - Medium Density	12,724	-	5	725	22,485	83,873	13,081	3,365	69,422	74,499	45,579	61,421	-	5,152	392,331
Expansion - High Density	-	1,496	1,241	-	1,871	910	4,579	-	-	3,511	-	1,616	-	-	15,223
Infill- Medium Density	-	7,593	17,682	19,950	12,073	5,020	14,680	4,582	16,651	21,544	15,328	13,785	-	5,681	154,569
Infill - High Density	-	-	-	-	-	1,900	3,887	-	-	625	-	-	-	-	6,411
Total Residential Average Water Demand	12,724	62,713	51,051	68,385	59,104	97,448	44,788	62,451	100,430	142,112	124,677	113,237	131,387	151,186	1,221,693
Projected Existing Urban Areas Employees	0	753	4,208	3,863	3,860	957	1,733	3,311	549	2,443	4,586	2,597	19,256	12,215	60,330
New Urban Areas Employees	236	3,606	5,514	2,179	3,142	4,667	5,850	463	1,286	6,202	2,850	4,396	-	155	40,546
Industry	488	-	-	-	799	-	-	-	-	9,959	-	924	-	-	12,170
Total Employees Average Water Demand	724	4,359	9,722	6,042	7,802	5,625	7,582	3,774	1,835	18,605	7,436	7,918	19,256	12,369	113,046
TOTAL AVERAGE WATER DEMAND	**13,448**	**67,072**	**60,773**	**74,426**	**66,905**	**103,073**	**52,370**	**66,225**	**102,265**	**160,716**	**132,113**	**121,154**	**150,642**	**163,556**	**1,334,739**

Table A.7: Individual Existing Zones to be Supplied Privately

LGA	LAND USE TYPE	POPULATION 2036	EMPLOYEES 2036	RESIDENTIAL AVERAGE WATER DEMAND (m^3/d)	EMPLOYEES AVERAGE WATER DEMAND (m^3/d)	AVERAGE WATER DEMAND TO BE SUPPLIED BY PRIVATE BOREHOLES (m^3/d)	PEAK DAY DEMAND TO BE SUPPLIED BY PRIVATE BOREHOLES (m^3/d)
LAGELU	10% of Low Density (Inner)	5,316	3,238	585	97	682	852
	50% of Low Density (Outer)	1,190	9,779	131	293	424	530
	Peripheral and Villages (Inner)	16,890	90,254	1,858	2,708	4,565	5,707
	Peripheral and Villages (Outer)	47,828	-	5,261	-	5,261	6,576
AKINYELE	25% of Medium Density (Outer)	18,918	4,742	2,081	142	2,223	2,779
	15% of Low Density (Inner)	8,723	3,361	960	101	1,060	1,325
	40% of Low Density (Outer)	7,817	3,012	860	90	950	1,188
	Peripheral and Villages (Inner)	1,578	608	174	18	192	240
	Peripheral and Villages (Outer)	28,288	20,159	3,112	605	3,717	4,646
IDO	10% of Low Density (Inner)	10,556	4,919	1,161	148	1,309	1,636
	Peripheral and Villages (Inner)	2,300	4,305	253	129	382	478
	Peripheral and Villages (Outer)	39,763	56,673	4,374	1,700	6,074	7,593
OLUYOLE	10% of Low Density (Inner)	14,139	2,152	1,555	65	1,620	2,025
	30% of Low Density (Outer)	390	150	43	5	47	59
	Peripheral and Villages (Inner)	9,300	13,256	1,023	398	1,421	1,776
	Peripheral and Villages (Outer)	23,235	33,116	2,556	993	3,549	4,437
ONA ARA	5% of Low Density (Inner)	2,697	1,039	297	31	328	410
	15% of Low Density (Outer)	459	177	50	5	56	70
	Peripheral and Villages (Inner)	5,102	11,582	561	347	909	1,136
	Peripheral and Villages (Outer)	16,625	23,694	1,829	711	2,540	3,174
EGBEDA	20% of Low Density (Inner)	9,655	6,987	1,062	210	1,272	1,590
	15% of Low Density (Outer)	300	8,767	33	263	296	370
	Peripheral and Villages (Inner)	6,154	15,759	677	473	1,150	1,437
	Peripheral and Villages (Outer)	4,799	6,840	528	205	733	916
TOTAL		**282,024**	**324,569**	**31,023**	**9,737**	**40,760**	**50,950**

APPENDIX 7: STAKEHOLDER ENGAGEMENT ACTIVITY REPORT

OYO STATE
GOVERNMENT

IBADAN
CITY MASTERPLAN

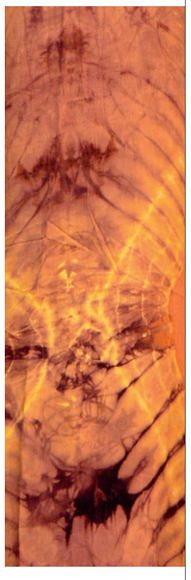
Stakeholder Engagement Activity Report

November 2017 Rev2









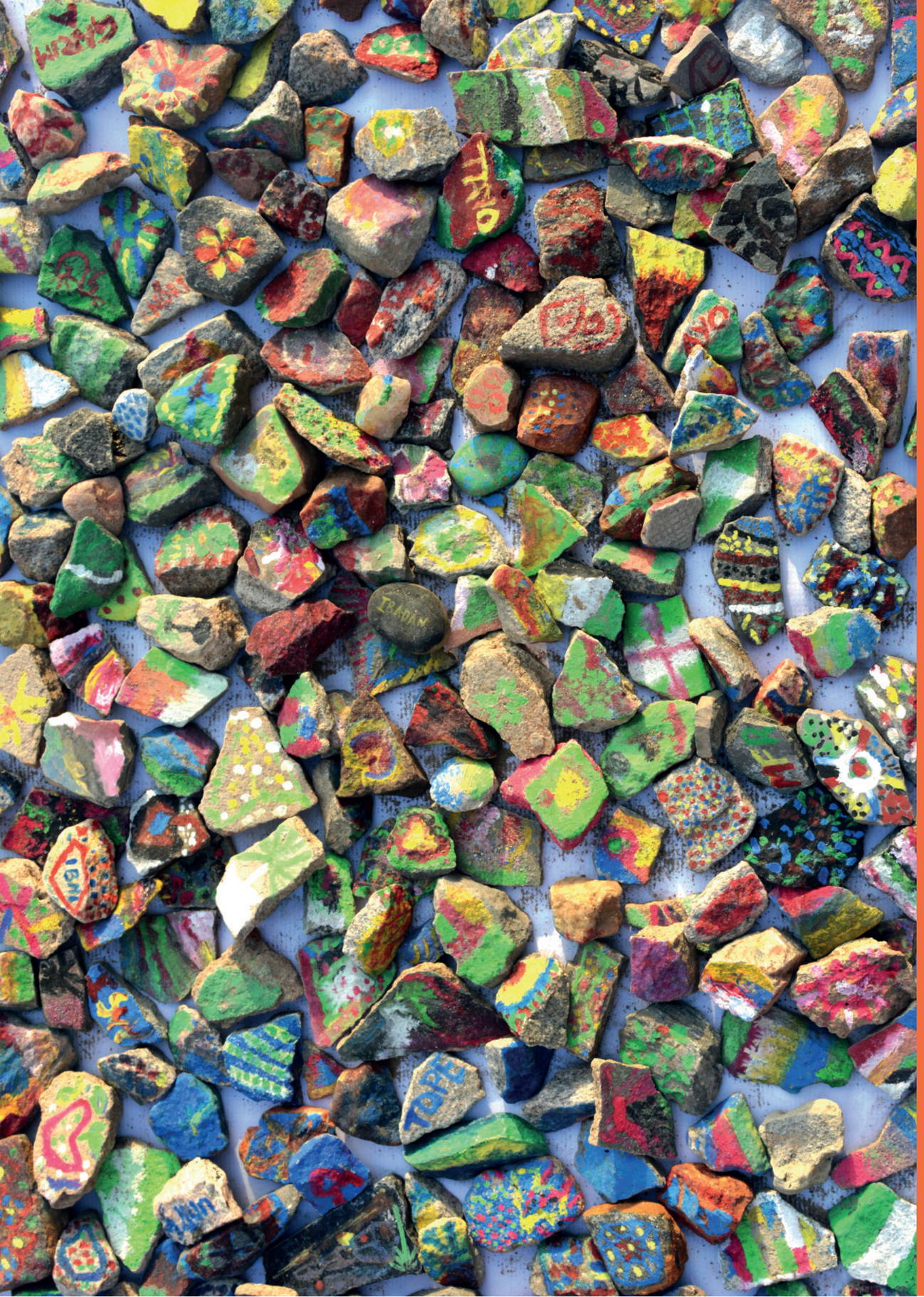










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List Of Abbreviations

ATOPCON	Association of Town Planning Consultants of Nigeria
BRT	Bus Rapid Transit
CBOs	Community Based Organisations
CDAs	Community Development Associations
CDCs	Community Development Committee
DUPs	Detailed Urban Plans
ERCs	Emergency Response Centres
IDA	Ibadan Development Authority
IUFMP	Ibadan Urban Flood Management Project
LCDA	Local Community Development Authority
LGAs	Local Government Administrations
LRT	Light Rail Transit
MDAs	Ministries, Departments and Agencies
MP	Masterplan
NIA	Nigerian Institute of Architects
NIS	Nigerian Immigration Services
NISER	National Institute of Social and Economic Research
NITP	Nigerian Institute of Town Planners
NGOs	Non-Government Organisations
OSPDA	Oyo State Physical Planning and Development Authority
PCs	Personal Computers
PIU	Project Implementation Unit
SE	Stakeholder Engagement
SEP	Stakeholder Engagement Plan
SESA	Strategic Environmental and Social Assessment
TOPREC	Town Planners Registration Council of Nigeria
WBP	Western By Pass



Executive Summary

EXECUTIVE SUMMARY

This report presents the Stakeholder Engagement activities which have been undertaken from June 2016 to October 2017 for the development of the Ibadan City Masterplan project. It provides a description of:

- The stakeholder engagement approach applied throughout the masterplan development;
- Activities undertaken at each phase of the masterplan project (including various stakeholder engagement methods used and stakeholders involved); and,
- The key outcomes of stakeholder engagement activities undertaken.

The table below provides a summary of all stakeholder engagement activities undertaken for the Ibadan City Masterplan project.

SUMMARY OF STAKEHOLDER ENGAGEMENT ACTIVITIES			
DATE	**TECHNIQUE USED**	**STAKEHOLDER CONSULTED**	**OUTCOMES**
PHASE 1: RESEARCH AND COLLABORATION			
8 June 2016	Initial Data Request Letters	State Ministries, Departments and Agencies	Collection of baseline data.
20 July 2016	Data Gathering Workshop	State Ministries, Departments and Agencies, Media and other organisations	Collection of baseline data.
July to September 2016	Semi-structured interviews	State Ministries, Departments and Agencies	Collection of baseline data.
PHASE 2: ANALYSIS, VISIONING AND FRAMEWORK DEVELOPMENT			
3 – 21 October 2016	Semi-structured data gathering meetings	Local government and Community Development Associations	Collection of baseline data.
15 – 16 November 2016	Workshop	Local government representatives and Community Development Committee Chairmen	Identification of priority issues/challenges and ways these can be addressed through the development of scenarios for Ibadan.
18 & 21 November 2016	Presentation	State Ministries and Academic Institutions	Identification of priority issues/challenges and ways these can be addressed through the development of scenarios for Ibadan.
PHASE 3: DRAFT AND FINAL MASTERPLAN			
Draft Masterplan			
21 – 29 March 2017	Presentation	• The Governor of Oyo State, His Excellency Abiola Ajimobi • Technical Committee and MDAs • NGOs and CBOs • Local Government Senior Management • Professional Bodies • Academics • Traditional Rulers • Political Leaders/House of Assembly	Feedback on the Draft Masterplan

Table continuned overleaf

DATE	TECHNIQUE USED	STAKEHOLDER CONSULTED	OUTCOMES
21 – 28 March 2017	Open Houses	General Public	Feedback on the Draft Masterplan
29 March 2017	Stationary Exhibition	General Public	Feedback on the Draft Masterplan
31 March 2017	Mobile Exhibition	General Public	Feedback on the Draft Masterplan
Final Masterplan			
July 2017	Presentation	• The Governor of Oyo State, His Excellency Senator Ishaq Abiola Ajimobi and the Executive Council; • The Ibadan Urban Flood Management Project Implementation Unit; and, • Representatives of various stakeholder groups (these representatives included, but were not limited to: LGAs, CDAs, Businesses, NGOs and Professional Bodies).	Feedback on the Final Masterplan
Detailed Urban Plans (DUPs)			
26 September – 5 October 2017	Presentation	• Sub-Technical Committee and State MDAs; • Local Government Senior Management; • Academics and Professional Bodies; and, • Representatives of Local Government, Religious Leaders, NGOs and Community Organisations.	Feedback on DUP
	Exhibitions	General Public in the 5 Inner LGAs: • Ibadan North; • Ibadan North West • Ibadan South West • Ibadan North East and, • Ibadan South East	

The continuous, inclusive process of stakeholder engagement developed for the Ibadan City Masterplan project has played a significant role in the development of the Ibadan City Masterplan. From the initial stages of the project stakeholders contributed their time and local knowledge allowing the Consultant to gain an understanding of the baseline conditions of Ibadan. This understanding has been vital in the development of the Draft and Final Masterplan for Ibadan where stakeholder feedback has provided a key part of project development.

Figure 1.1: Ibadan

1. Introduction

1 INTRODUCTION

1.1 PROJECT BACKGROUND

On August 26th 2011, 187.5 mm of rain fell over the city of Ibadan during a five hour period, resulting in the overflow of the Eleyele reservoir. The overflow resulted in the death of more than 120 people as well as serious damage to personal properties and government infrastructure.

Following this flooding event, the Executive Governor of Oyo State, his Excellency, Senator Ishaq Abiola Ajimobi, set up a task force on flood prevention and management. The outcome of studies undertaken by the task force was a report containing short, medium and long term recommendations to the state government. These recommendations included the proposal to prepare three masterplans for the city being:

- Ibadan City Masterplan;
- Solid Waste Masterplan; and,
- Drainage Masterplan.

Thus, the Oyo State Government, with technical and financial assistance from the World Bank, established the Ibadan Urban Flood Management Project (IUFMP) to oversee the preparation of these plans. The Project Implementation Unit (PIU) (the Client) for the IUFMP, commissioned Dar (the Consultant) to prepare the masterplan for the city of Ibadan, comprising its 11 Local Government Areas (LGAs) (Figure 1.2).

In order for the masterplan to meet the needs of Ibadan, it must be supported by those it affects and it must embody and reflect their aspirations, aims and objectives for the development of the city. This support is achieved through the implementation of a detailed stakeholder engagement process which aims to capture the views of relevant stakeholders.

The purpose of this Stakeholder Engagement Activity Report is to present all Stakeholder Engagement (SE) activities which have been undertaken at each phase of the Ibadan City Masterplan project.

1.2 PURPOSE OF THE REPORT

The involvement of stakeholders in the development of the Ibadan City Masterplan project has been invaluable in agreeing a way forward for Ibadan. From the initial stages of the project, stakeholders contributed their time and local knowledge allowing the Consultant to gain an understanding of the baseline conditions of Ibadan. This understanding has been vital in the development of the Draft and Final Masterplan for Ibadan where stakeholder feedback has provided a key part of project development.

This report aims to present all SE activities which have been undertaken at each phase of the Ibadan City Masterplan Project as well as the key findings of these activities.

In order to achieve this aim, the report has been set out as follows:

- Section 2: provides a summary of the SE approach adopted for the Ibadan City Masterplan project;
- Section 3: describes all the SE activities undertaken to date by phases of the masterplan – this includes descriptions of the activities, photographs and key findings at each phase of the Ibadan City Masterplan Project;
- Section 4: describes the online platforms established for the Ibadan City Masterplan Project; and,
- Section 5: describes the conclusion.



Ibadan's 11 LGAs:
Ido
Akinyele
Lagelu
Egbeda
Ona Ara
Oluyole
Ibadan North
Ibadan North East
Ibadan South East
Ibadan South West
Ibadan North West

Figure 1.2: Map of Ibadan's 11 LGAs



Figure 1.3: View from Bowers Tower

2. Stakeholder Engagement Approach

2 STAKEHOLDER ENGAGEMENT APPROACH

The International Finance Corporation (IFC) has defined stakeholders as “persons or groups who are directly or indirectly affected by a project, as well as those who may have interests in a project and/or the ability to influence its outcome, either positively or negatively”.[1] Stakeholder engagement has been defined as “A two-way, continuous process of communication between a project and each of its stakeholders which continues throughout the life of the project”.[2] In line with international requirements, a continuous process of stakeholder engagement has been adopted for the development of the Ibadan City Masterplan project as shown in Figure 2.1.

The inclusive and continuous SE process outlined in Figure 2.1 is being followed in order to support the development of the Masterplan as it progresses by:

- Ensuring adequate information is provided to stakeholders in a timely manner and in a form they understand; and,
- Obtaining feedback from stakeholders for the development of the masterplan so that they can influence the decision making process.

A summary of these tasks has been provided in the subsequent sections which have been numbered accordingly. A detailed analysis of the SE approach has been provided in the Final Ibadan City Masterplan Report (N16011-0100D-RPT-PM-06 REV0) submitted to the Client in June 2017.



Figure 2.1: Stakeholder Engagement Process

1 International Finance Corporation (IFC) (2007) Stakeholder Engagement: A Good Practice Handbook for Companies Doing Business in the Emerging Markets. www.ifc.org/enviro Accessed June 2017.
2 Reddy, G., Smyth, E. and Steyn, M. (2015) Land Access and Resettlement: A Guide to Best Practice. Greenleaf Publishing.



Figure 2.2: Road South of Ibadan

2.1 SET ENGAGEMENT OBJECTIVES

Prior to undertaking SE, clear objectives need to be set to ensure the SE process for the masterplan remains focused.[2] The overall objective of SE is to obtain and retain broad stakeholder support to enable the project to develop, operate and expand. In order to maintain the focus of SE, it is useful to disaggregate stakeholders and develop engagement objectives for each group.

The IUFMP stakeholder engagement process began in 2013 and was still being undertaken at the time of developing the SE process for the Ibadan City Masterplan project. It was identified that conducting the SE for the IUFMP alongside the Ibadan City Masterplan may result in confusion amongst stakeholders. There was also a risk of stakeholder fatigue due to the numerous stakeholder consultation sessions that would occur around the same time. It was therefore important that the objectives of consultation for the Ibadan City Masterplan project were made clear to stakeholders and that they understood the outcomes. Table 2.1 describes the SE objectives for each phase of the masterplan development.

Table 2.1: Stakeholder Engagement Objectives

MASTERPLAN PHASE		MASTERPLAN PHASE OBJECTIVE	SE OBJECTIVE
Phase 1: Research and Collaboration		Obtain information on Ibadan in order to develop a baseline understanding of the city, its characteristics and challenges.	• Identify stakeholder groups; • Introduce the project; • Provide information to stakeholders; • Obtain information from stakeholders: in order to help establish an appropriate context for Ibadan; • Identify opportunities and constraints: establishing a physical/development context for the masterplan; and, • Identify previous projects, programmes and activities undertaken in order to learn positive attributes which will support the development of a successful masterplan.
Phase 2: Analysis, Visioning and Framework Development	Phase 2a: Diagnostics	• Identify priority issues facing Ibadan; and • Identify areas of opportunity for Ibadan.	• Introduce the project and describe the masterplan process; • Identify priority issues and opportunities for Ibadan; and, • Obtain initial stakeholder feedback and perceptions.
	Phase 2b: Visioning Scenario Preparation	Develop a long-term vision for the city of Ibadan which entails setting out goals and strategic objectives for sustainable urban and spatial planning.	• Define the priorities of the masterplan (e.g. balancing environmental issues with economic growth); and, • Discuss broad planning options.
Phase 3: Elaboration of the Masterplan		Develop the draft and final Ibadan City Masterplan.	• Present the Draft Masterplan to stakeholders; • Obtain feedback on the Draft Masterplan; and, • Present the Final Masterplan to stakeholders.
Phase 4: Detailed Urban Plans		Develop the DUP	• Present the DUP to stakeholders; and • Obtain feedback on the DUP.

2.2 IDENTIFY AND ASSESS STAKEHOLDERS

The objective of the stakeholder identification and assessment process is to identify a comprehensive list of project stakeholders, to fully understand and prioritise the list of stakeholders and ensure a solid basis on which to prepare a targeted approach to SE. A clear understanding of project stakeholders is required in order to ensure a sufficiently targeted SE process.[2]

Stakeholder identification and assessment is also an ongoing process requiring regular review and updates. As the Ibadan City Masterplan project has progressed, further details of stakeholder groups and their interests have been identified and assessed.

In order to identify and assess stakeholders for the Ibadan City Masterplan project, the Consultant initially undertook a review of the stakeholder list developed by the IUFMP and found it to be comprehensive in addressing the full spectrum of potential stakeholders and representative in that all (probable) stakeholder groups or categories are adequately represented. Furthermore, the terms of the Client's Request for Proposal (RfP) requires this list to provide guidance for the development of the Consultant's SE process. The Consultant's review confirmed that the IUFMP stakeholder list is consistent with IFC guidance and is a firm basis for the development of the stakeholder engagement approach.

Adopting the IUFMP stakeholder list, two broad categories of Stakeholders have been defined as listed below. Each group is important to the masterplan development process and their "buy-in" to the final masterplan is necessary. However, these two groups differ greatly in character and therefore have very different views, priorities and opinions.

- **Technical Input Group:** Stakeholders who provide valuable technical information to the development of the masterplan.
- **Community Groups:** Stakeholders who are able to represent a broad spectrum of opinion in the community including most importantly the views of the disadvantaged such as marginalised, poor communities, young persons and women's groups.

Stakeholders consulted as part of the Ibadan City Masterplan are as follows:

- Technical Input Group:
  - The Governor of Oyo State, his Excellency, Senator Ishaq Abiola Ajimobi
  - Political Leaders/ House of Assembly
  - State Ministries, Departments and Agencies (MDAs)
  - Academic institutions
  - Professional Bodies
- Community Group:
  - Local Government Administrations[3] (LGAs)
  - Community Development Committee (CDC) Chairmen
  - Community Development Associations (CDAs)
  - Non-Government Organisations (NGOs)
  - Community Based Organisations (CBOs)

3 LGAs represent a formal component of the administrative framework; although they have been included in the community group, they also have technical units/division which can provide important information to the development of the masterplan. They have been included in the community group as being the administrative unit that is closest to representing grassroots communities.

2.3 SELECTION OF ENGAGEMENT TECHNIQUES

A wide range of engagement methods are available for use in SE however the choice of a particular method or suite of methods is a function of many factors for example: technical criteria, budget, timeframe and regulatory requirements.

It is also important to determine, when developing an approach to SE which method(s) of engagement is/are most appropriate for each stakeholder group identified.

Table 2.2 provides a summarised description of the SE techniques used for the Ibadan City Masterplan project.

Table 2.2: Description of Stakeholder Engagement Techniques Selected

STAKEHOLDER ENGAGEMENT TECHNIQUE USED	DESCRIPTION
Data Gathering Workshop (Figure 2.4 on page 26)	An interactive workshop was undertaken with State MDAs at the start of the project which provided an opportunity for the various MDAs to work with each other in identifying key issues and opportunities facing Ibadan from their perspective.
Semi-Structured Interview (Figure 2.4 on page 26)	Semi- structured interviews allow an interviewer to get responses to specific questions and contexts from respondents. Structured interviews were undertaken with MDAs to obtain key information required to inform the baseline for the development of Ibadan City Masterplan.
Structured Data Gathering Meeting (Figure 2.5 on page 26)	These are similar to the semi-structured interviews however these were undertaken with a larger audience (200 people). Specific questions were prepared in advance of the meetings in order to focus the responses received. Structured data gathering meetings were held with all LGAs and their respective CDAs in order to obtain key information required to inform the baseline for the development of the Ibadan City Masterplan.
Visioning & Scenario Preparation Workshops (Figure 2.6 on page 26)	Workshops are a commonly used technique effective in engaging with stakeholders, obtaining information and their buy-in to a project. Interactive workshops were undertaken at the Masterplan visioning and scenario preparation stage to involve the local government and CDC Chairmen in the development of the framework masterplan scenarios.
Presentations (Figure 2.6 on page 26)	Presentations provide an effective way to disseminate information and obtain feedback from stakeholders about a project. Presentations have been made to various stakeholder groups at different phases of the masterplan development.
Open House (Figure 2.7 on page 27)	An open house provides a more informal setting for providing project information and obtaining feedback from stakeholders. An open house format was used to present the Draft Masterplan to communities within the 11 LGAs. At the open house project information was displayed on boards and stakeholders were encouraged to provide feedback either through written format (i.e. through the use of comment forms) or orally (i.e. by speaking to the Consultant staff present). People were also encouraged to partake in a creative, interactive session of rock art painting at the open house. This art exercise was in-keeping with the informal engagement setting, and also provided stakeholders with a means to contribute directly to the Final Masterplan.
Stationary Exhibition (Figure 2.8 on page 27)	A temporary exhibition of the Draft Masterplan was set up in a local shopping mall as a means of engaging with the general public. Project information leaflets were distributed and people provided their opinions and comments verbally about the project.
Mobile Exhibition (Figure 2.8 on page 27)	The mobile exhibition provided an interactive means of engagement with the general public. A bus, playing an audio script describing the Ibadan City Masterplan project played on a PA system, was driven through the main areas of the city in order to inform people about the project and to distribute project leaflets.
Online Platforms (Figure 2.9 on page 27)	The Ibadan Masterplan website and Twitter account were set up in order to provide project information and updates as well as to obtain feedback and comments from members of the public.



Figure 2.3: Ibadan Rooftops

2 - STAKEHOLDER ENGAGEMENT APPROACH

Selected Photos of Stakeholder Engagement Techniques





Figure 2.4: Data Gathering Workshop and Structured Interviews





Figure 2.5: Structured Data Gathering Meetings





Figure 2.6: Visioning Scenario Workshops and Presentations





Figure 2.7: Open House





Figure 2.8: Stationary and Mobile Exhibition





Figure 2.9: Online Platforms

2.4 STAKEHOLDER ENGAGEMENT PLAN

In order to ensure that SE is carried out effectively, a detailed Stakeholder Engagement Plan (SEP) is required. The plan sets out when engagement will occur, how and which stakeholder groups will be involved. Section 3 of this report presents the details of SE as undertaken for the Ibadan City Masterplan project.

2.5 IMPLEMENTATION OF STAKEHOLDER ENGAGEMENT

Once the plan for SE was developed and agreed with the Client, the SE process was undertaken. For the Ibadan City Masterplan project, SE began in Phase 1 and has been carried out continuously throughout the Masterplan development. SE activities, stakeholders involved and key outcomes have been described in detail in Section 3.

2.6 MONITOR AND REPORT PROGRESS

Monitoring is required to provide the information necessary to review, update and adjust the SE process. SE has been monitored for the Ibadan City Masterplan project by:

- Ensuring that events have been undertaken within budget and schedule; and
- By obtaining stakeholder feedback.

Reporting of SE activities has been undertaken as follows:

- The inclusion of SE chapters within masterplan report submissions;
- The drafting and submission of this Stakeholder Engagement Activity Report.

At the end of each MP phase, the SEP is also reviewed and updated accordingly.

Figure 2.10: Signing in at an LGA meeting (opposite)

3. Stakeholder Engagement Undertaken To Date

3 DESCRIPTION OF STAKEHOLDER ENGAGEMENT UNDERTAKEN

This section provides detailed descriptions of all stakeholder engagement activities undertaken for the Ibadan City Masterplan from Phase 1 to date (Phase 3).

SE activities have been described in this section by each masterplan phase and includes detailed information on the following:

- Techniques used;
- Stakeholders consulted; and,
- Outcomes of SE.



Figure 3.1: Stakeholders viewing the Exhibition Boards (opposite)

3 - STAKEHOLDER ENGAGEMENT UNDERTAKEN

3.1 PHASE 1: RESEARCH AND COLLABORATION - STAKEHOLDER ENGAGEMENT ACTIVITIES

In Phase 1, SE was undertaken with the aim to obtain information on Ibadan in order for the Consultant to develop a baseline understanding of the city, its characteristics and challenges. Table 3.1 provides a summary of SE activities undertaken in Phase 1. A detailed description has been provided in the subsequent sections.

Table 3.1: Summary of Stakeholder Engagement Activities

TECHNIQUE USED	STAKEHOLDER CONSULTED	OUTCOMES
Initial Data Requests (Section 3.1.1)	• Ministry of Agriculture; • Ministry of Information, Culture and Tourism; • Ministry of Education, Science and Technology; • Ministry of Environment and Habitat; • Ministry of Health; • Ministry of Justice; • Ministry of Trade, Investment and Cooperatives; • Ministry of Women Affairs, Community Development, Social Welfare and Poverty Alleviation; • Ministry of Works and Transport; • Ministry of Youth and Sports; • Nigeria Communication Commission; • Office of the Surveyor General; • Oyo State Road Maintenance Agency; • Oyo State Solid Waste Management Agency; • Department of Urban and Regional Planning, Polytechnic Ibadan; • Water Corporation; • Housing Corporation; • Rural Water Supply and Sanitation Agency; • Bureau of Statistics; • National Population Commission; • Planning Commission; • Ministry of Local Government and Chieftaincy; • Ministry of Lands, Housing and Urban Development; • Ministry of Urban and Physical Planning, Ogun State; • Ogun/Osun River Basin Development Authority; and, • Ibadan Electricity Distribution Company.	Collection of baseline data
Data Gathering Workshop (Section 3.1.2)	• IUFMP; • Office of the Surveyor General • Water Corporation; • Oyo State Public Works Department; • Ministry of Housing Land and Urban Development; • National Population Commission; • Oyo State Housing Corporation; • Ministry of Works and Transport; • Ministry of Environment and Water; • Ibadan Electricity Distribution Company; • Bureau of Statistics; • Oyo State Solid Waste Management Agency; • Ministry of Women Affairs, Community Development, Social Welfare and Poverty Alleviation; • Nigerian Tribune; • Dept. of Urban and Regional Planning Polytechnic; • Ministry of Agriculture Natural Resources and Rural Development; • Ministry of Local Government and Chieftaincy Matters; • Ministry of Education Science and Technology; • Federal School of Surveying; • Ministry of Information Culture &Tourism; • Ministry of Youth & Sports; • Nigerian Institute of Town Planners (NITP); • Permanent Secretary Office of the Government; • Oyo State Police Department; and, • Ministry of Justice.	Collection of baseline data

Table continuned overleaf

Table continuned overleaf

TECHNIQUE USED	STAKEHOLDER CONSULTED	OUTCOMES
Semi-structured Interviews (Section 3.1.3)	• Water Corporation; • Ministry of Housing Land and Urban Development; • National Population Commission; • Oyo State Housing Corporation; • Ministry of Works and Transport; • Ministry of Environment and Water; • Ibadan Electricity Distribution Company; • Bureau of Statistics; • Oyo State Solid Waste Management Agency; • Ministry of Women Affairs, Community Development, Social Welfare and Poverty Alleviation; • Department of Urban and Regional Planning Polytechnic; • Ministry of Agriculture Natural Resources and Rural Development; • Ministry of Local Government and Chieftaincy Matters; • Ministry of Education Science and Technology; • Ministry of Information Culture &Tourism; • Ministry of Youth & Sports; • Transmission Company of Nigeria; • Office of the Surveyor General; • Rural and Water Sanitation Agency; • Oyo State Planning Commission; • Project Implementation Unit; • Ministry of Justice; • Oyo State Emergency Management Agency; • Ministry of Health; • Ministry of Trade, Investment and Cooperatives; • Nigeria Communication Commission; and, • Oyo State Road Maintenance Agency.	Collection of baseline data

3.1.1 Initial Data Requests

These requests were made to the Client on 8 June 2016 and included requests for relevant data from the State MDAs listed in Table 3.1. These MDAs were selected based on the specific baseline information requirements of the Consultant.

3.1.2 Data Gathering Workshop

To supplement the information received from the data requests, a one-day data gathering workshop was undertaken with State MDAs on 20 July 2016. MDAs and organisations were invited based on the specific baseline information required by the Consultant. A total of 85 attendees were present at this workshop and the attendees consisted of representatives of State MDAs and organisations as listed in Table 3.1 (Figure 3.2 on page 38).

The aims of the workshop were to:

- Introduce the masterplan;
- Understand the roles and responsibilities of the various State MDAs; and
- Gain an initial understanding of the issues and opportunities facing Ibadan from the perspective of the MDAs. This understanding is important as it informs the development of the strategy supporting the masterplan to 2036.

3 - STAKEHOLDER ENGAGEMENT UNDERTAKEN

The data gathering workshop was structured as follows:

- A presentation was made describing the context of the Ibadan City Masterplan project, the broad aims and the methodology for developing the masterplan;
- Attendees were invited to ask questions on the presentation;
- MDAs were provided an opportunity to briefly present their roles and responsibilities to the Consultant and other attendees in order to give the Consultant a background understanding of the legal and institutional framework;
- An interactive group session was undertaken. Attendees were split into groups and given 45 minutes to identify five key issues and five opportunities for development in Ibadan under the following topics:
  - Infrastructural Facilities and Utilities;
  - Land Use;
  - Solid Waste Management;
  - Water & Environment;
  - Informal Settlements;
  - Rural Communities; and,
  - Transportation.

The main outcomes from the interactive group session are listed below. These outcomes were common across all topic areas:

- The lack of a strategic plan for Ibadan has resulted in challenges in many aspects of development;
- Population growth has resulted in challenges with regards to inadequate infrastructure facilities and utilities;
- A lack of institutional arrangements at all levels which has led to inefficient development in Ibadan; and,
- A requirement for stronger enabling laws in order to encourage enforcement which will ultimately aid efficient land use development in Ibadan.

A detailed analysis of the outcomes from the group session can be found in the Ibadan City Masterplan Diagnostics Report (N16011-0100D-RPT-PM-02 REV0 submitted in October 2016 and N16011-0100D-RPT-PM-02 REV1 submitted in June 2017).













Figure 3.2: Images from one-day Data Gathering Workshop with State Ministries

3.1.3 Semi - Structured Interviews

Based on the information requested and the subsequent data gathering workshop, structured one-to-one interviews were conducted with MDAs and other organisations (from July to September 2016) to gather key information to inform the baseline understanding of Ibadan. Examples of the semi-structured interviews are as follows:

- What do you think the masterplan should especially take into consideration? (This question was asked to find out the specific concerns of the MDA).
- Is there any data or documentation concerning the study area that the Consultant should be aware of when undertaking an assessment?
- Are there any specific policies/guidelines/regulations of the MDA which could affect the masterplan?
- In your opinion (the opinion of the MDA) what would be of the most concern to the communities within and surrounding the project area?
- Are there other organisations/Departments/Ministries the Consultant should be in contact with regarding the Ibadan City Masterplan?

The MDAs interviewed were selected based on the specific baseline information required. Figure 3.3 shows the structured interview held with the Water Corporation on the 22nd July 2016. MDAs and organisations interviewed have been listed in Table 3.1.

The main findings of the semi-structured interviews were as follows:

- The rapid population growth has increased pressure on services and infrastructure in the city;
- Roads are in poor condition and inaccessible;
- Urban areas have expanded rapidly and haphazardly over the years;
- Houses in the core area are in poor condition and there is a lack of basic facilities and utilities;
- There is little interaction between MDAs; and,
- There is a shortage of resources in existing MDAs.

A detailed analysis of the outcomes from the group session can be found in the Ibadan City Masterplan Diagnostics Report (N16011-0100D-RPT-PM-02 REV0 submitted in October 2016 and N16011-0100D-RPT-PM-02 REV1 submitted in June 2017).



Figure 3.3: Structured interview held with the Water Corporation

3.2 PHASE 2: ANALYSIS, VISIONING AND FRAMEWORK DEVELOPMENT - STAKEHOLDER ENGAGEMENT ACTIVITIES

Phase 2 of the Ibadan City Masterplan was divided into two sub-phases:

1. 2a: Diagnostics: Continues with the data collection from Phase 1. In the Diagnostics Phase information was collected from stakeholders and through research in order to identify the priority issues and areas of opportunity in Ibadan. In order to collect this data from stakeholders, structured data gathering meetings were undertaken. These are described in detail in 3.2.1.
2. 2b: Visioning and Scenario Preparation: Based on the data collected in Phases 1 and 2, the Project team, with contributions from stakeholders, developed a Vision for the City of Ibadan. The development of this Vision entailed setting out what the people of Ibadan see as their long term goals and strategic objectives for sustainable urban and spatial planning. In order to develop this Vision with stakeholders, a series of workshops and presentations were undertaken. These are described in detail in 3.2.2.

Table 3.2 provides a summary of all SE activities undertaken in Phase 2. A detailed description has been provided in subsequent sections.

Table 3.2: Summary of Stakeholder Engagement Activities

TECHNIQUE USED	STAKEHOLDER CONSULTED	OUTCOMES
SUB-PHASE 2A: DIAGNOSTICS		
Semi - structured data gathering meetings	• LG; and, • CDAs.	Collection of baseline data.
SUB-PHASE 2B: VISIONING AND SCENARIO PREPARATION		
Workshop	• LG Representatives; and, • CDC Chairmen (as representatives of the CDAs).	Understanding of priority issues/ challenges and ways these can be addressed in the development of scenarios for Ibadan.
Presentation	• State Ministries; and, • Academic Institutions (University of Ibadan, the Ibadan Polytechnic and the National Institute of Social and Economic Research).	

3 - STAKEHOLDER ENGAGEMENT UNDERTAKEN

3.2.1 Sub-phase 2a: Diagnostics - Structured Data Gathering Meetings with LGAs and CDAs

The Consultant, together with an independent, local stakeholder facilitation specialist met with representatives of the LG and CDAs from the 3rd to the 21st of October 2016. Over 1,200 attendees were present at these meetings (LGAs and CDAs). Representatives of the LGAs and CDAs were selected based on the specific information required in order to develop a baseline for Ibadan. The LGA representatives included, but were not limited to the following:

- The LGA Chairman;
- Head of the LGA/LGA Administrator;
- Director of Town Planning;
- Director of Health;
- Director of Education; and
- Director of Social Services

CDA leaders in attendance represented community groups such as traditional leaders, women, youth etc.

The structure of these meetings has been described in the following sections.

Meetings with LGA Representatives

The LGA representatives in attendance included:

- The Chairman of the LG,
- The head of the LG, and,
- Representatives from the town planning, education and social services and health services departments.

The Consultant introduced the project and described the process being followed for the masterplan development as well as the objectives for meeting with the LGs. The stakeholder facilitation specialist then led a question and answer session to obtain information on the key areas of improvement within the LGA and opportunities for development. Figure 3.4 to Figure 3.14 show LGA meetings undertaken in October 2016 for all 11 LGAs.



Figure 3.4: LGA meetings - Ibadan North



Figure 3.5: LGA meetings - Akinyele



Figure 3.6: LGA meetings - Ibadan North West



Figure 3.7: LGA meetings - Ibadan North East



Figure 3.8: LGA meetings - Egbeda



Figure 3.9: LGA meetings - Ibadan South East



Figure 3.10: LGA meetings - Ibadan South West



Figure 3.11: LGA meetings - Oluyole



Figure 3.12: LGA meetings - Lagelu



Figure 3.13: LGA meetings - Ido



Figure 3.14: LGA meetings - Ona Ara

3 - STAKEHOLDER ENGAGEMENT UNDERTAKEN

Meetings with CDA Representatives

Representatives included leaders of some of the following associations:

- Traditional leaders;
- Women;
- Youth; and,
- Workers.

These meetings followed the same structure as those of the LGs, i.e. the masterplan development process was introduced and described to the CDAs and this was followed by a question and answer session facilitated by the stakeholder facilitation specialist. Figure 3.15 to Figure 3.25 show the CDA meetings undertaken in October 2016.



Figure 3.15: CDA meetings - Ibadan South West



Figure 3.16: CDA meetings - Lagelu



Figure 3.17: CDA meetings - Ona Ara



Figure 3.18: CDA meetings - Ido



Figure 3.19: CDA meetings - Oluyole



Figure 3.20: CDA meetings - Ibadan South East



Figure 3.21: CDA meetings - Ibadan North West



Figure 3.22: CDA meetings - Egbeda



Figure 3.23: CDA meetings - Ibadan North East



Figure 3.24: CDA meetings - Ibadan North



Figure 3.25: CDA meetings - Akinyele

Key Findings

Key findings of the meetings with LGAs and CDAs have been summarised as follows:

- Lack of proper land use planning in Ibadan;
- Lack of utilities and infrastructure (roads, water supply and electricity);
- Flooding and subsequent erosion;
- Need for a drainage plan and channelisation of rivers and streams;
- Protection of areas of cultural heritage;
- Lack of schools, health and recreational facilities;
- Need for planned market areas;
- Need for central car parking spaces;
- Economic development – support for areas of agricultural opportunity;
- Lack of public toilets;
- Need for adequate street lighting; and,
- Need for an efficient system of solid waste disposal.

3.2.2 Sub-phase 2b: Visioning and Scenario Preparation - Urban (15/11/2016) and Rural (16/11/2016) LGA Workshops

Based on the findings from Phase 1 and Sub-phase 2a and in preparation of suitable planning scenarios for Ibadan, two workshops were held with LGA representatives and Community Development Committee (CDC) Chairmen in November 2016. The workshops were held over two days, to accommodate for the variances in the more urban, core LGAs (this workshop was held on the 15th of November 2016, Figure 3.26) versus the rural LGAs (this workshop was held on the 16th of November 2016, Figure 3.27).

Approximately 100 attendees were present in total for both workshops. The attendees represented the urban LGAs (i.e. Ibadan North, Ibadan North East, Ibadan North West, Ibadan South East and Ibadan South West) and rural LGAs (i.e. Akinyele, Ido, Lagelu, Egbeda, Ona Ara and Oluyole) and consisted of representatives of the LGAs as listed below. These representatives were selected based on the specific input required in order to develop a framework scenario for Ibadan and included:

- The LGA Chairman;
- Head of the LGA/LGA Administrator;
- Director of Town Planning;
- Director of Health;
- Director of Education;
- Director of Social Services; and
- The CDC Chairman (representative of the CDAs).

At these workshops stakeholders participated in interactive sessions in order to identify development priorities for Ibadan as well as various ways these priorities should be addressed. Due to the large number of stakeholders involved, the workshops were spread across two days between Urban and Rural LGAs.

Stakeholders were presented with findings of the Diagnostics Report (submitted by the Consultant in October 2016, N16011-0100D-RPT-PM-02 REV0) along with broad framework scenarios for the development of the masterplan.

3 - STAKEHOLDER ENGAGEMENT UNDERTAKEN

The workshops consisted of interactive group sessions where stakeholders were asked to participate in two tasks:

1. For the first task stakeholders were divided into several groups and provided with a list of 13 issues, established from the Diagnostics Report and they were asked to identify five issues from the list provided which the masterplan should address in order of their perceived priority.
2. For the second task, stakeholders were required to (in their original groups) identify solutions to the issues identified in Task 1 and report back under the following headings:
   a. Policy interventions;
   b. Legislative interventions;
   c. Spatial interventions; and
   d. Land designations.



Figure 3.26: Urban LGA Group Discussion



Figure 3.27: Rural LGA Group Discussion

Key Outcomes of the Workshops

The priority development issues identified during the group sessions were as follows:

- The Core Area: Needs to be redeveloped, however compensation should be provided to communities should any resettlement be necessary;
- Expansion of Urban Areas: Representatives of the rural LGAs expressed a concern that the population growth and expansion will result in a replication of the Core Area in the rural LGAs;
- Roads: Major roads need to be developed to promote accessibility and encourage socio-economic development in Ibadan;
- Commercial Opportunities: Development of designated market spaces and trading areas in conjunction with the development of agricultural areas to promote economic development in Ibadan;
- Refuse (waste disposal): Designated sites for the development of landfills and the provision of education to the general public about the importance of proper waste disposal;
- Town planning system: A good institutional set up is required to support the implementation of the masterplan; and,
- Infrastructure: Basic infrastructure facilities need to be provided to improve the quality of life of communities in Ibadan.

A detailed analysis of the outcomes from the group session can be found in the Ibadan City Framework Scenarios Report (N16011-0100D-RPT-PM-03 REV0 submitted in December 2016 and N16011-0100D-RPT-PM-03 REV1 submitted in June 2017).

3.2.3 Sub-phase 2b: Stakeholder Presentations

Presentations were held with State Ministries (Figure 3.28) and Academics from the University of Ibadan in November 2016.

State Ministries – 18/11/16

The Consultant presented current findings as set out in the Diagnostics Report as well as framework planning scenarios to approximately 60 attendees.

Academics (Students and Professors at the University of Ibadan) – 21/11/16

During this stakeholder engagement session the Consultant described the rationale and process for the development of the masterplan, presented key findings to date and described the framework planning scenarios to the 65 attendees.

Key outcomes from presentations made to State MDAs and Academics in Sub-Phase 2b were obtained through feedback sessions and include:

- Population: The development of masterplan scenarios needs to take into account the fact that the last population census underestimated the population of Oyo State.
- Land use:
  - The need for the masterplan to designate complementary land uses adjacent to each other;
  - Land acquisitions need to be addressed appropriately; and,
  - The need for the masterplan to include existing recreational facilities and emerging commercial hubs in the land use analysis.
- Dissemination of information:
  - Promotion of the masterplan needs to be carried out via a wide variety of media outlets (e.g. radio, television and newspapers).
- Infrastructure:
  - The masterplan needs to consider transport infrastructure such as Light Rail Transit (LRT) and Bus Rapid Transit (BRT).
- Core Area:
  - Detailed studies are required into the slum areas as they are complex.



Figure 3.28: Presentations were held with State Ministries

3.3 PHASE 3 STAKEHOLDER ENGAGEMENT ACTIVITIES

Table 3.3 provides a summary of all SE activities undertaken in Phase 3. A detailed description has been provided in subsequent sections.

Table 3.3: Summary of Stakeholder Engagement Activities undertaken in Phase 3

TECHNIQUE USED	STAKEHOLDER CONSULTED	OUTCOMES
DRAFT MASTERPLAN		
Presentation	• Technical Committee and MDAs • NGOs and CBOs • Local Government Senior Management • Professional Bodies • Academics • Traditional Rulers • The Governor of Oyo State, His Excellency Abiola Ajimobi • Political Leaders/House of Assembly	Feedback on the Draft Masterplan
Open Houses	General public	Feedback on the Draft Masterplan
Stationary Exhibition		
Mobile Exhibition		
FINAL MASTERPLAN		
Presentation	• The Governor of Oyo State, His Excellency Senator Ishaq Abiola Ajimobi and the Executive Council; • The Ibadan Urban Flood Management Project Implementation Unit; and, • Representatives of various stakeholder groups (these representatives included, but were not limited to: LGAs, CDAs, Businesses, NGOs and Professional Bodies).	Feedback on the Final Masterplan

3.3.1 Draft Masterplan

The Draft Masterplan Report (N16011-0100D-RPT-PM-04 REV0), submitted in March 2017, formed the basis of what was to become the Final Masterplan (N16011-0100D-RPT-PM-06 REV0) which was submitted to the Client in June 2017. The Draft Masterplan was therefore presented to stakeholders with the intention of taking on board comments from various stakeholder engagement activities which took place across March 2017.

In order for the Draft Masterplan to be presented to stakeholders and to ensure their comments and feedback were obtained effectively, four different types of stakeholder activities were undertaken. This section of the report presents:

- The various activities that were undertaken (Presentations, Open Houses, Stationary and Mobile Exhibitions);
- A description of the structure of these activities;
- A description of the stakeholders who attended the activities; and,
- Key outcomes.

Presentations

Presentations were made to various stakeholder groups as shown in Table 3.10 in order to provide information on the Draft Masterplan, including:

- How the Draft Masterplan was produced; and,
- What the Draft Masterplan includes for all 11 LGAs.

Stakeholders were encouraged to provide their feedback. Over 200 stakeholders attended these presentations. Table 3.4 provides the schedule of presentations undertaken in March 2017. Figure 3.29 to Figure 3.34 show these presentation sessions.

Table 3.4: Summary of Stakeholder Engagement Activities undertaken in Phase 3

STAKEHOLDER	DATE
Technical Committee and MDAs	21/3
NGOs and CBOs	22/3
Local Government Senior Management	23/3
Professional Bodies (NITP, ATOPCON, TOPREC, NIA, NIS, Chamber of Commerce)	24/3
Academics (University of Ibadan & Ibadan Polytechnic)	
Traditional Rulers	27/3
The Governor of Oyo State, His Excellency Abiola Ajimobi	28/3
Political Leaders/House of Assembly	29/3

3 - STAKEHOLDER ENGAGEMENT UNDERTAKEN



Figure 3.29: Technical Committee and MDAs - Question & answer session



Figure 3.32: NGOs and CBOs - Question & answer session



Figure 3.30: Local Government Senior Management - Question & answer session



Figure 3.33: Local Government Senior Management - Question & answer session



Figure 3.31: Traditional Rulers



Figure 3.34: Meeting with the Goverrnor

The Draft Masterplan was presented to communities at each of the 11 LGAs through the use of display boards and interactive sessions in an Open House format. The Open House format was selected in order to engage with these communities in an informal manner and to promote a more relaxed environment to discuss the contents of the Draft Masterplan. Over 1000 stakeholders were engaged with at the Open Houses.

Table 3.5 shows the schedule of the Open Houses undertaken.

Table 3.5: Schedule of Open Houses

DATE	LGA
21/3/17	Ibadan North
21/3/17	Ibadan North West
22/3/17	Ido
22/3/17	Egbeda
23/3/17	Akinyele
23/3/17	Lagelu
24/3/17	Ibadan South West
24/3/17	Ibadan North East
27/3/17	Oluyole
27/3/17	Ona Ara
28/3/17	Ibadan South East

The following structure was followed for each of the Open Houses:

The Consultant team arrived at the venues and set up the following:

- Project Banners (Figure 3.35 and Figure 3.36): The project banner was placed at the entrance or outside the venues to attract the communities' attention and to allow easy identification of who the consultant team is and what the session was about.
- A reception desk (Figure 3.37 and Figure 3.38) was placed at the entrance of the venue and covered in traditional African fabric. A member of the Consultant team was also assigned to the reception desk to provide a warm, friendly welcome to members of the community attending the session, to ensure they sign the attendance register and provide them with a project information leaflet
- Project leaflets were designed by the Consultant in English and Yoruba to provide information to stakeholders (see Figure 3.66), including:
  - What the masterplan is;
  - The project timeline;
  - What the Consultant team has done to date;
  - The reason for consultation; and,
  - To provide stakeholders with a schedule of events.
- 11 display boards set up around the room (Figure 3.39 and Figure 3.56 to Figure 3.65). Further details on the display boards have been provided in Table 3.6.
- Comments forms and boxes (Figure 3.43): Comments forms were provided in English and Yoruba and comments boxes were covered with the project logo.
- Rock art work (Figure 3.44 and Figure 3.45): This initiative was set up as a way to engage with communities in a more informal manner, to find out how they feel about the Masterplan and find out how they see Ibadan. The exercise was a way to show people that the Consultant team are approachable and communities were encouraged to be creative and have fun in illustrating how they view Ibadan and what is important to them. The aim was to then take photographs of these painted rocks to illustrate the Final Masterplan Report to be submitted in June 2017 and allowed everyone who participated in this exercise to be involved in the drafting of the Final Masterplan Report.

Once the venues were set up, stakeholders were welcomed at the door and encouraged to walk around and look at the display boards, leave comments and partake in the rock painting for approximately two hours. The Consultant team (inclusive of the independent facilitator) was available to explain the boards (Figure 3.41).

After the two hours, stakeholders were seated for a presentation of the boards and a question and answer session (Figure 3.44).

3 - STAKEHOLDER ENGAGEMENT UNDERTAKEN

Table 3.6: Summary of Display Boards (Figure 3.56 to Figure 3.65)

DISPLAY BOARD		SUMMARY OF CONTENT
1	Introduction	Introduced the project, described what the masterplan is and why it is required. This board also provided a description of the purpose of the consultant's visit and a summary of what has been done on the project to date.
2	Ibadan in 2017: Our Findings	Provided a description of the opportunities and constraints in Ibadan, Ibadan's Growth and the key principles of the masterplan.
3	Flooding in Ibadan	The flooding event of 2011 was a major catalyst for the masterplan project and this board described the flooding event and highlighted some of the causes.
4	Stakeholder Engagement	This board highlighted the main issues brought to light during stakeholder consultations held with communities in October 2016.
5	The Draft Masterplan	This board presented the Draft Masterplan for Ibadan.
6	Masterplan Components	Various components of the Draft Masterplan were highlighted in this board, including: • Open Space/Flooding • City Expansion • Road Network • Public Transport • Land Use • Core Area Regeneration
7	Vision for Ibadan	This board provided a visual representation of what is proposed in the Draft Masterplan: • Satellite towns • Expansion areas • Core Area • Industry • Social Infrastructure • Open Spaces/Flooding • Circular Road • Public Transport
8	Infrastructure Design	Description of infrastructure facilities proposed as part of the Masterplan: • Solid Waste Management • Electricity • Telecoms • Drainage • Water Network Options • Sewage Network Options
9	LGA-specific Board	A different board was produced for each LGA within Ibadan to show the planning strategy for each LGA.
10	Get Involved	This board encouraged people to get involved and tell us what they think. It also described the ways in which stakeholders can get in touch i.e. through the website, twitter, by writing to the Oyo State Ministry of Lands, Housing and Physical Planning etc.
11	Feedback	The last board was designed for people to provide quick feedback on post-it notes and to stick these on the board.



Figure 3.35: Project Banner



Figure 3.36: Project Banner



Figure 3.37: Reception Desk



Figure 3.38: Reception Desk at entrance



Figure 3.39: Display Boards



Figure 3.40: Display Boards



Figure 3.41: The Consultant explaining one of the display boards



Figure 3.42: Question and Answer Session



Figure 3.43: Comments forms and boxes

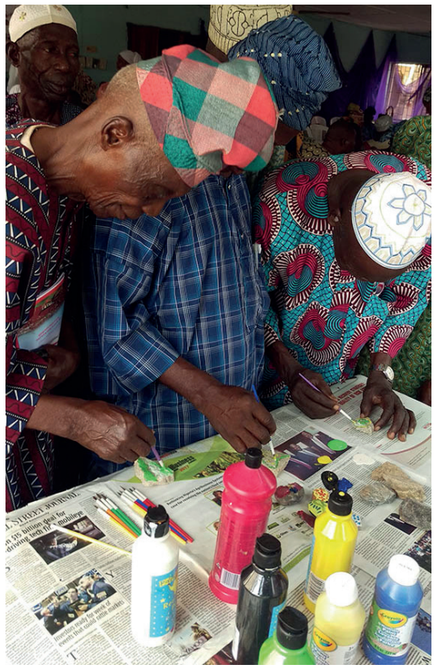


Figure 3.44: Rock Art Painting



Figure 3.45: Rock Art Painting



Figure 3.46: Rock Art Painting

Stationary Exhibition

A stationary exhibition of the Ibadan City Masterplan project was set up in at Dugbe Shopping Mall as a means for the Consultant to engage with the general public (Figure 3.48 and Figure 3.49). The Consultant team met with approximately 500 people during this exhibition which started at 10:30am and ended at 3:30pm on 29 March 2017. Leaflets were distributed and comments recorded.



Figure 3.48: School children looking at the Stationary Exhibition

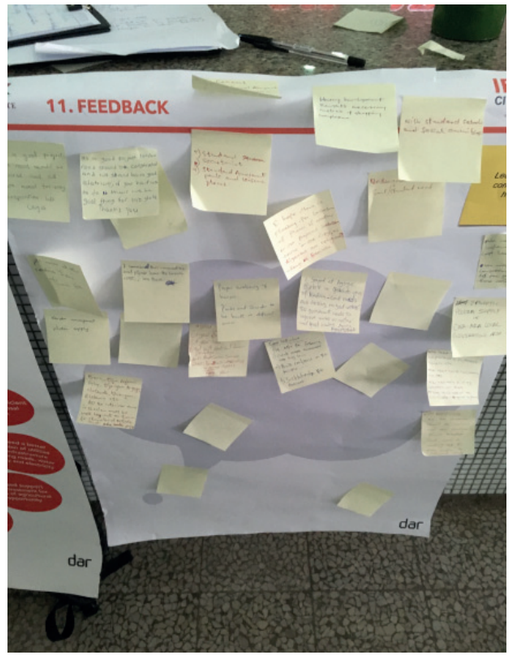


Figure 3.49: Stationary Exhibition Feedback



Figure 3.50: Stationary Exhibition Set up



Figure 3.51: Engaging with Stakeholders



Figure 3.47: Rock Art Paintings

Mobile Exhibition

On the final day of consultation (31 March 2017) for Phase 3 of the Ibadan City Masterplan, a mobile exhibition was carried out through the centre of Ibadan. The Client, Consultant team and government officials wore Ibadan City Masterplan branded merchandise and followed a bus (Figure 3.52) around main areas in Ibadan. On the bus, a script of the project was played in English and Yoruba through a Public Announcing (PA) system. The project team stopped at various key locations (Bodija Market, Mapo, Mokola Roundabout etc.) to distribute leaflets (Figure 3.53) and meet with members of the public. A new project leaflet was designed for the mobile exhibition. This activity was important in creating awareness of the project amongst the general public.





Figure 3.52: Mobile exhibition bus and Mapo Hall in the background



Figure 3.53: Leaflet Distribution



Figure 3.54: A Stakeholder reading the leaflet





Figure 3.55: Ibadan Masterplan branded hats and t-shirts

Stationary Exhibition Boards

OYO STATE

1. INTRODUCTION

IBADAN
CITY MASTERPLAN
www.ibadan-masterplan.com

What is the Ibadan Masterplan?



By 2036, Ibadan and its wider region will be a model sustainable and resilient city where development addresses the population's needs, with thriving employment, providing a high quality of life for all.

The Ibadan masterplan sets out a blueprint for future change to the year 2036. It includes proposals for land uses, buildings, open spaces, utilities and transport, which go hand in hand with a plan that explains how it will be delivered. It must be:

Visionary - To raise aspirations and provide a clear picture for the future.

Deliverable - To show how the masterplan will become reality.

Flexible - To ensure the masterplan is responsive and adaptable to change.

Participatory - To provide all stakeholders with a means of expressing their needs and priorities to help shape the masterplan.



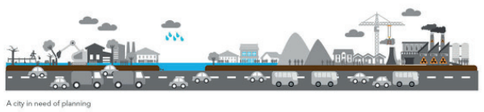
Ibadan's 11 LGAs

Why do we need a Masterplan?

Sub-Saharan cities are booming, demographically and economically. It is estimated by the African Development Bank that the percentage of people living in cities will jump from 40% in 2010 to 84% by 2060. Such unprecedented growth will require robust planning and an increase in social services.

A masterplan provides an area with structure which can be followed for a defined period and coordinates development in a planned and controlled manner. The development of a masterplan for Ibadan will give all those involved the opportunity to think about and help shape physical change on a large scale.





A city in need of planning



A well balanced city

Why are we here today?

We are here today to present to you our vision of Ibadan for the future.
This exhibition is here to show you our research into your city of Ibadan and to present the Draft Masterplan to you.
We want you to understand WHAT we are doing here and WHY and importantly to give YOU the opportunity to FEEDBACK to us your views.

Project Progress

We are here

JULY	DECEMBER	MARCH	MAY
2016		2017	
Project Commenced	Data collection and initial discussions with stakeholders	Mapping opportunities for the future (the Development Framework)	Draft Masterplan	Final Masterplan

dar

Figure 3.56: Exhibition Board 1

OYO STATE

2. IBADAN IN 2017 OUR FINDINGS

IBADAN
CITY MASTERPLAN
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Our analysis has identified a number of opportunities and constraints in Ibadan, and it is clear that the city faces many challenges. However it is also a vibrant city with a strong sense of identity. These issues have informed the overall vision for Ibadan as well as the aims and objectives that inform the masterplan.

Assets

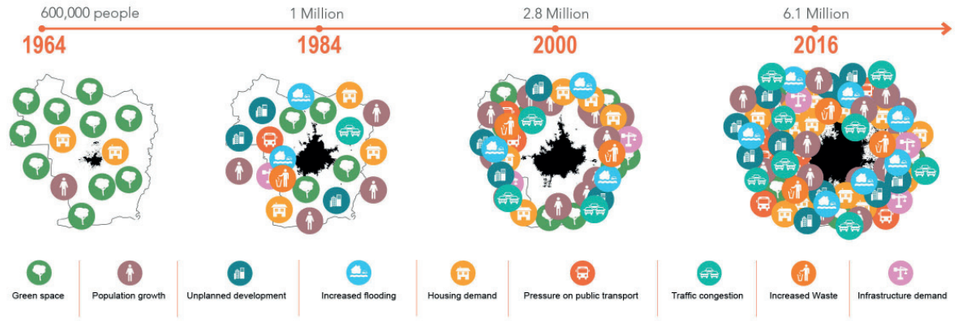


Issues

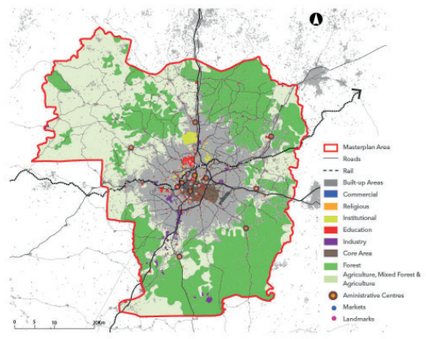


Ibadan's Growth

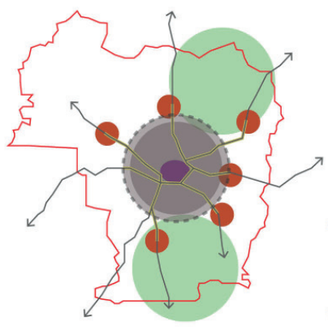
There is increasing pressure on the city's resources as the population grows.



Ibadan in 2017



The Key Masterplan Principles



- Urban expansion to house the increased population.
- Major interventions that promote the development of a city with more than one main centre.
- A new role for the existing LGA administrative centres as satellite towns.
- New transport connections.
- Regeneration of the core area while minimising disruption to existing settlements and communities.
- Protection of valuable forests and dense vegetated areas in the north and south.

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Figure 3.57: Exhibition Board 2

Stationary Exhibition Boards (continued)

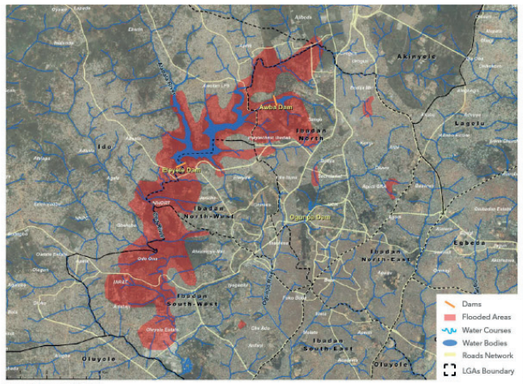
OYO STATE

3. FLOODING IN IBADAN

IBADAN CITY MASTERPLAN
www.ibadan-masterplan.com

The Catalyst for the Masterplan

On 26th August 2011, a rainfall downpour of 187.5 mm occurred in about 4-5 hours, resulting in the overflow of the Eleyele reservoir, causing the death of more than 120 people and inflicting serious damage to infrastructure (many bridges collapsed, roads washed away, and substantial property was lost.) Following the floods, the Executive Governor of Oyo State, his Excellency, Senator Ishaq Abiola Ajimobi, set up a task force on flood prevention and management, the UFMP (Urban Flood Management Plan). Aided with the assistance of the World Bank, it was identified that three masterplans were required to address the issues of the rapidly growing city: a land use plan (this study), a drainage masterplan, and a solid waste masterplan.



Extent of August 2011 Flood


Rescue team


Damaged infrastructure


Collapsed structures


Water damage


Flooded buildings


Rising waters close to settlements


Ogunpa channel


Damaged river crossing


Rubbish blocking the Ogunpa channel

Human Causes of Flooding

In the aftermath of the 2011 flood, studies (including one by the World Bank) were undertaken to establish the causes and identify the short, medium and long-term initiatives required to address this issue. It was recognised that damage from the flood was increased by encroachment into floodplains, neglected maintenance of drains and channels and debris in the waterways. The case of urban flooding of Ibadan is a typical example of man-made flood disaster.

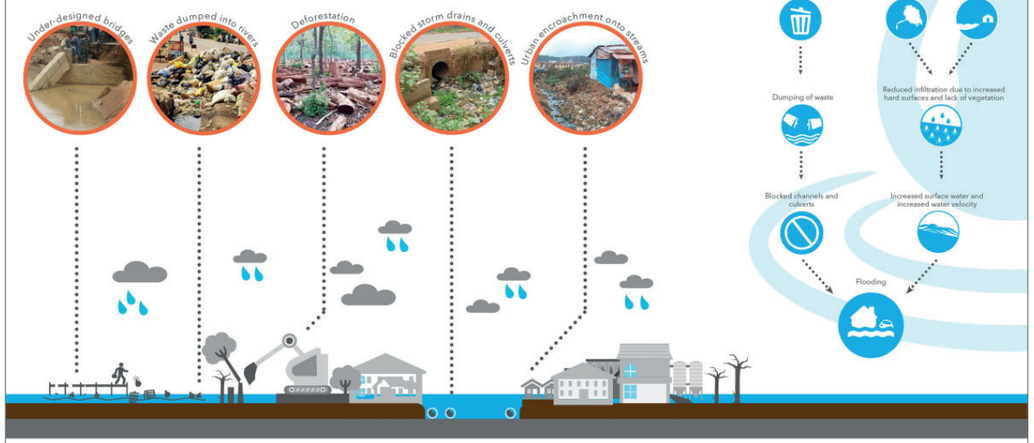


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Figure 3.58: Exhibition Board 3

OYO STATE

4. STAKEHOLDER ENGAGEMENT

IBADAN CITY MASTERPLAN
www.ibadan-masterplan.com

Ibadan Speaks Out

Stakeholder Consultation in October 2016 brought to light many issues in Ibadan.
This is what you told us.



dar

Figure 3.59: Exhibition Board 4

Stationary Exhibition Boards (continued)

OYO STATE GOVERNMENT

5. THE DRAFT MASTERPLAN

IBADAN CITY MASTERPLAN
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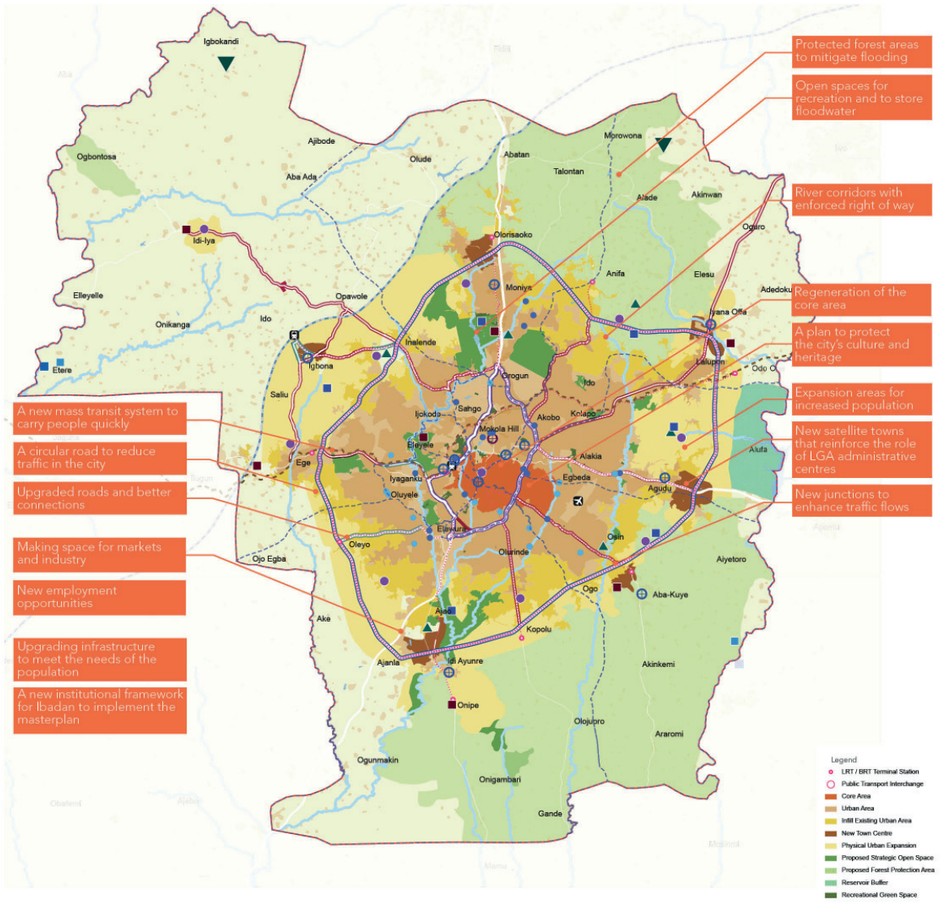
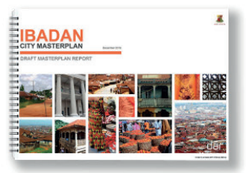
Our Proposal

The map below illustrates the Draft Masterplan for Ibadan. This provides direction for future growth and development and identifies key interventions and development areas for the next 20 years. We invite you to take a closer look and to ask us questions.





Draft Masterplan

This Draft Masterplan forms the third stage in the project's five stage development. The process of preparing this report has involved a wide range of stakeholders, who have contributed significant amounts of time and local knowledge to support the Consultant in putting together the Draft Masterplan. This Draft Masterplan is intended to form the basis of what will become the Final Masterplan in May 2017. It is therefore presented as a document that will be amended to take onboard comments from the stakeholder engagement.

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Figure 3.60: Exhibition Board 5

OYO STATE GOVERNMENT

6. MASTERPLAN COMPONENTS

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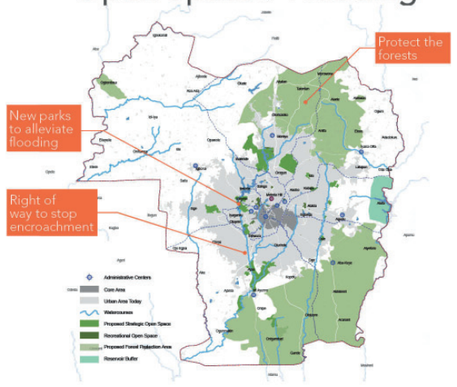
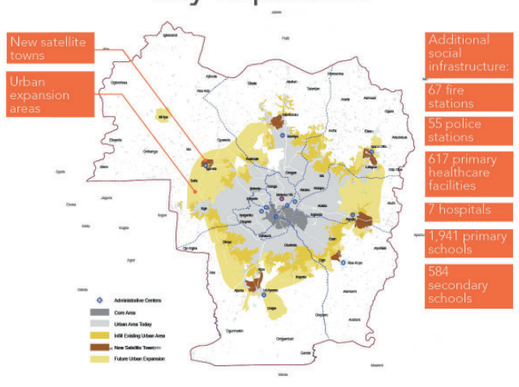
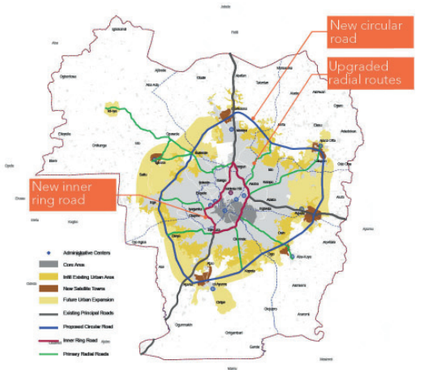
Open Space / Flooding



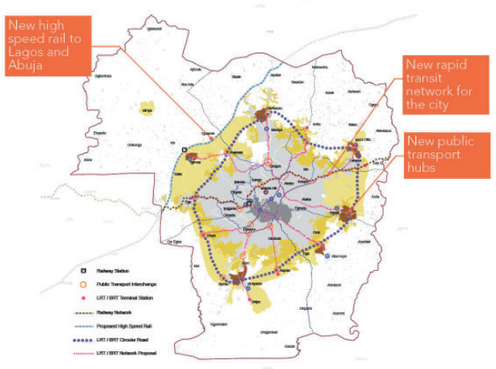
City Expansion



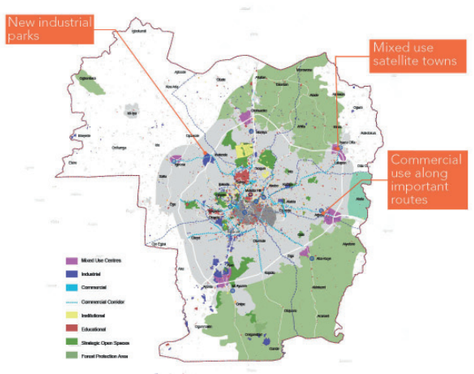
Road Network



Public Transport



Land Use



Core Area and Regeneration

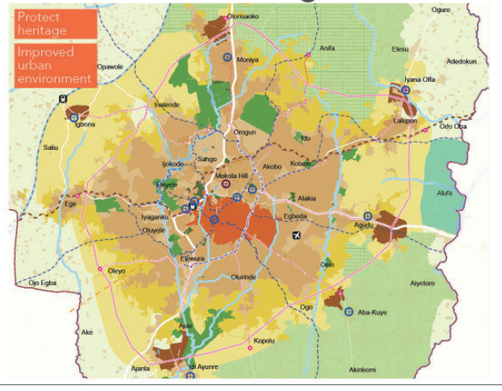


Figure 3.61: Exhibition Board 6

Stationary Exhibition Boards (continued)



Figure 3.62: Exhibition Board 7

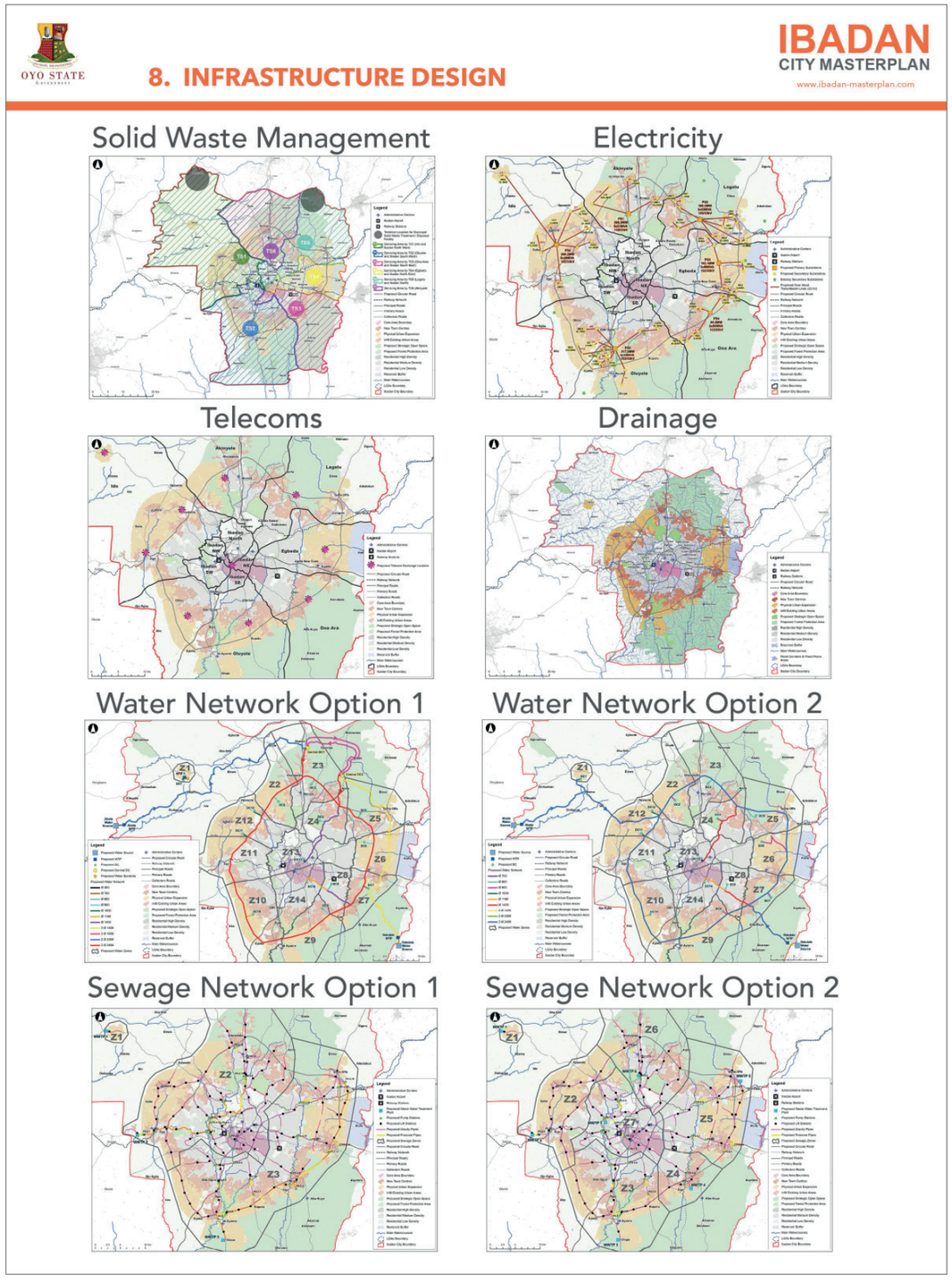


Figure 3.63: Exhibition Board 8

Stationary Exhibition Boards (continued)



Figure 3.64: Exhibition Board 10

3 - STAKEHOLDER ENGAGEMENT UNDERTAKEN

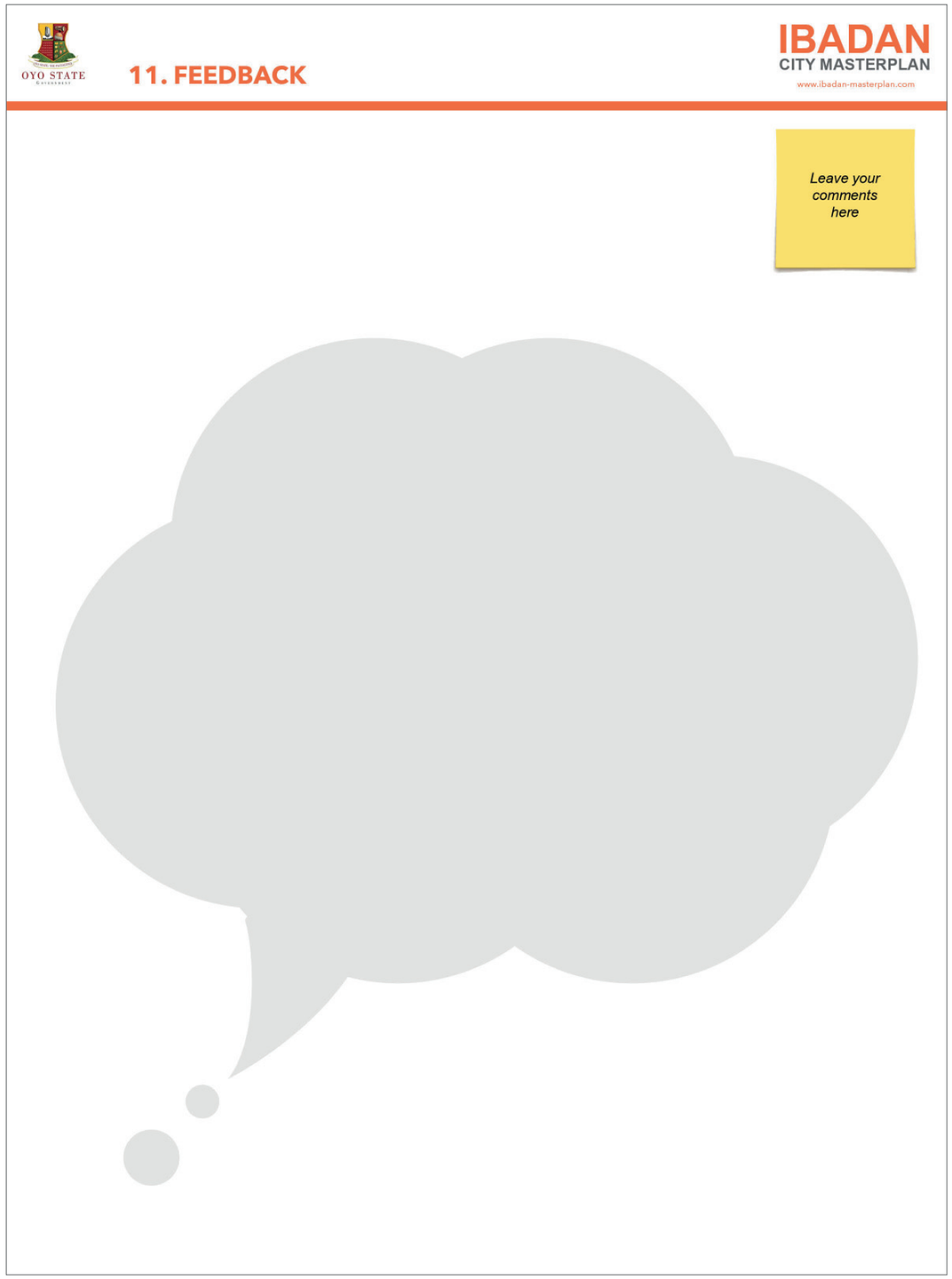


Figure 3.65: Exhibition Board 11

WHAT DO YOU THINK ?

ARE WE MISSING ANYTHING ?

Let's open up a dialogue

How do you currently feel about Ibadan? Do you feel safe? Can you travel around easily? Can you easily acces facilities and services? Do you feel protected from flooding?

This draft masterplan is for your city. We want to hear from you so we make it relevant to your needs.

dar

March 2017

Any questions?

Take a leaflet home

Visit Our Website
www.ibadan-masterplan.com

Leave your comments

Follow us on twitter
@IbadanMplan

Write to Oyo State
Ministry of Lands, Housing and Physical Planning
Agodi, Ibadan
Oyo State, Nigeria
5129, Secretariat
P.O.B. Ibadan

Oyo State Government

IBADAN
CITY MASTERPLAN

Oyo State Government has initiated a long-term vision for the city of Ibadan. We now have a Draft Masterplan to present to you.

We want your feeback and opinions.
Tell us what you think.

Project Timeline

- July 2016 — Project Commenced
- Data collection and initial discussions with stakeholders
- Dec 2016 — Mapping opportunities for the future Development Framework
- March 2017 — We are here — Draft Masterplan
- May 2017 — Final Masterplan



Why do we need a Masterplan?

A masterplan is a long-term vision for the city (to 2036) which will be used to guide the use of land within Ibadan and help to address:

- Provision for population growth.
- Preventing future flooding episodes.
- Attracting investment and business growth.
- Providing better infrastructure.
- Giving better transport connections.
- The location and quality of houses.
- Providing land for new jobs.
- The location of open spaces and recreational areas.
- Environmental, historic and culturally important areas which need protection.
- Who implements the strategy and how.

Our progress

This project began in July 2016 and is expected to be completed by the end of 2017.

The first stages of the project were about getting a detailed understanding of the 11 LGAs that make up the city of Ibadan. In order to do this, the Consultant met in October 2016 with state government ministries, each of the local government chairmen, and senior staff and representatives from community groups in each LGA.

In March 2017, we have been presenting the Draft Masterplan. The comments we receive will inform the final masterplan where possible.

Why should you participate?

It is important that you participate in the Masterplan process as it is a plan for the future of Ibadan and will affect the things you do every day.

At this stage of the project, the Consultant has developed a Draft Masterplan. **This draft is open to comments and review.** The proposals are not yet fixed, which is why it is an important step in the process. All representations on what is being presented will be taken into account in the revised document.

Ibadan - Our vision

This map shows the Draft Masterplan for Ibadan

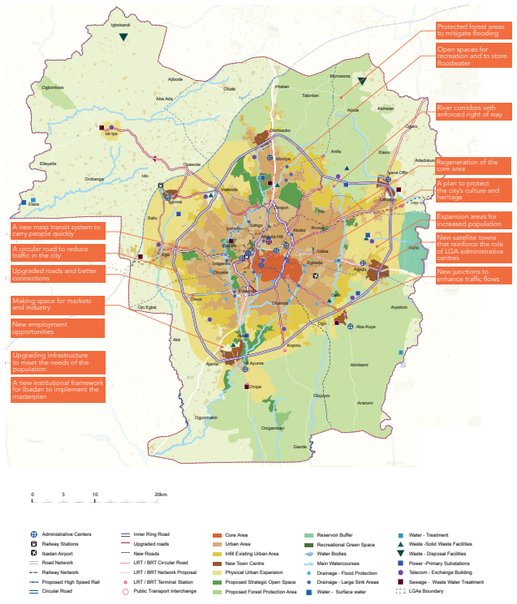


Figure 3.66: Project leaflet for the mobile exhibition

Figure 3.67: Mobile Exhibition bus (opposite)

Key Outcomes – Draft Masterplan Consultation

This section presents the key outcomes from SE session undertaken for the Draft Masterplan. The key concerns of the stakeholders have been summarised thematically as follows:

- Masterplan Implementation:
  - Financial planning for masterplan implementation;
  - Strategies for monitoring and updating the masterplan;
  - A guided, phased approach to masterplan implementation should be developed;
  - A legal framework should be implemented to support delivery of the masterplan;
  - Cleary defined roles need to be established for the Ibadan Development Authority (IDA);
  - Clearly defined roles and responsibilities for masterplan implementation; and,
  - A well-defined institutional framework is important to ensure masterplan success.
- Land Use/Infrastructure Allocation shown in the Draft Masterplan:
  - Strategies need to be developed to stop encroachment onto the Circular Road alignment;
  - Open spaces need to be developed;
  - Planned transport networks need to be taken into account;
  - Designated lay-bys and bus stops must be included in the masterplan in order to relieve the congestion in the city;
  - Independent transport routes need to be designed for Heavy Goods Vehicles to separate them from standard traffic; and,
  - Rural markets should be identified in the masterplan in order to plan for their upgrade.
- Core Area:
  - A detailed plan is required for the regeneration of the core area of Ibadan; and,
  - A compensation strategy needs to be developed if regeneration of the core area leads to displacement/ loss of livelihood.
- Consultation/Awareness Raising:
  - A communication strategy should be developed to disseminate information on the masterplan as it progresses.



Figure 3.68: Local Life (opposite)

3.3.2 Final Masterplan

The Final Ibadan City Masterplan was presented to stakeholders during presentations in July 2017. These stakeholders consisted of:

- The Governor of Oyo State, His Excellency Senator Ishaq Abiola Ajimobi and the Executive Council (Figure 3.69);
- The Technical Committee of the IUFMP Implementation Unit (Figure 3.70); and,
- Representatives of various stakeholder groups (these representatives included, but were not limited to: LGAs, CDAs, Businesses, NGOs and Professional Bodies) (Figure 3.71).

The presentation provided attendees with the following information on the Ibadan City Masterplan:

- Project context and status;
- Diagnostics;
- Development Framework;
- Final Masterplan; and,
- Next Steps.

Key Outcomes – Final Masterplan Consultation

This section presents the key outcomes from SE session undertaken for the Final Masterplan. The key concerns of the stakeholders have been summarised thematically as follows:

- Masterplan Implementation
  - A detailed phasing structure for masterplan implementation – detail to be provided regarding; which people will be involved in implementation, how will implementation be carried out and more clarity on phasing strategy.
  - A roadmap for implementation is required. The 'scope' of the masterplan should change from 2016 – 2036 to 2018 – 2038.
  - Monitoring and Evaluation - the masterplan should account for the monitoring and evaluation at each phase of implementation. A system is required for evaluation/monitoring.
  - A legal framework is required for implementation.
  - Planning and development guidelines need to be included in the Final Masterplan to guide development into the future.
  - A funding strategy is required for Masterplan implementation.
  - Communication is an important part of masterplan implementation. An itinerary should be put together to plan for communication to allow the general public to be able to access all masterplan project information.
- Ibadan Development Authority
  - IDA case study- the development of the IDA is a good idea, need to use case study examples from other cities (e.g. Dubai).
  - More detail is needed regarding the composition of the IDA.

3 - STAKEHOLDER ENGAGEMENT UNDERTAKEN



Figure 3.69: Presenting the Masterplan to The Governor of Oyo State,

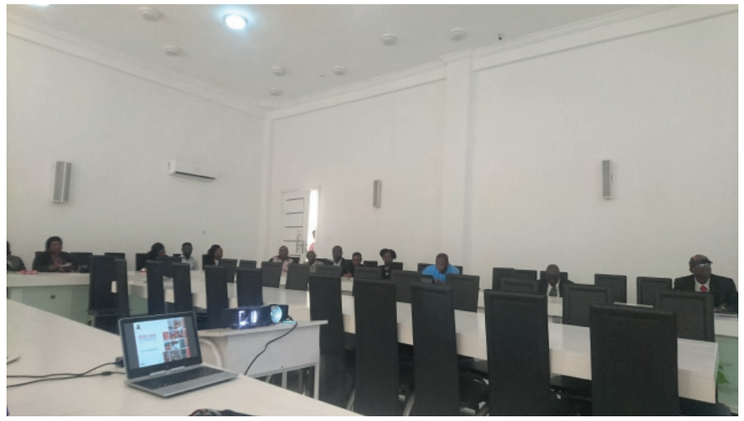


Figure 3.70: Presenting the Masterplan to The Technical Committee of the IUFMP Implementation Unit



Figure 3.71: Presenting the Masterplan to LGAs, CDAs, Businesses, NGOs and Professional Bodies

3.4 PHASE 4: DETAILED URBAN PLANS

A significant aspect in the development of the DUP was the interactive data gathering workshop undertaken with State MDAs on 13 July 2017 in Ibadan (Figure 3.73 to Figure 3.74).

Exhibition boards were put up around the room to allow attendees to gain an overview of the Final Masterplan and to provide an introduction to the Detailed Urban Plans (DUPs).

A presentation, which was structured as below, was made to the attendees:

- Project Context and Status: A summary of work undertaken since project inception.
- Flood Prone Area:
  - Description of the intervention area;
  - Summary of the causes of flooding;
  - Description of existing conditions; and,
  - Group discussion.
- Circular Road:
  - Preferred Route;
  - Flood Plain Context; and,
  - Context Scenarios.
- Core Area:
  - The extent of the core area – 6,400ha;
  - Existing conditions:
  - Road status;
  - Street connectivity;
  - Flood corridors;
  - Collapsed buildings; and,
  - Ibadan heritage.

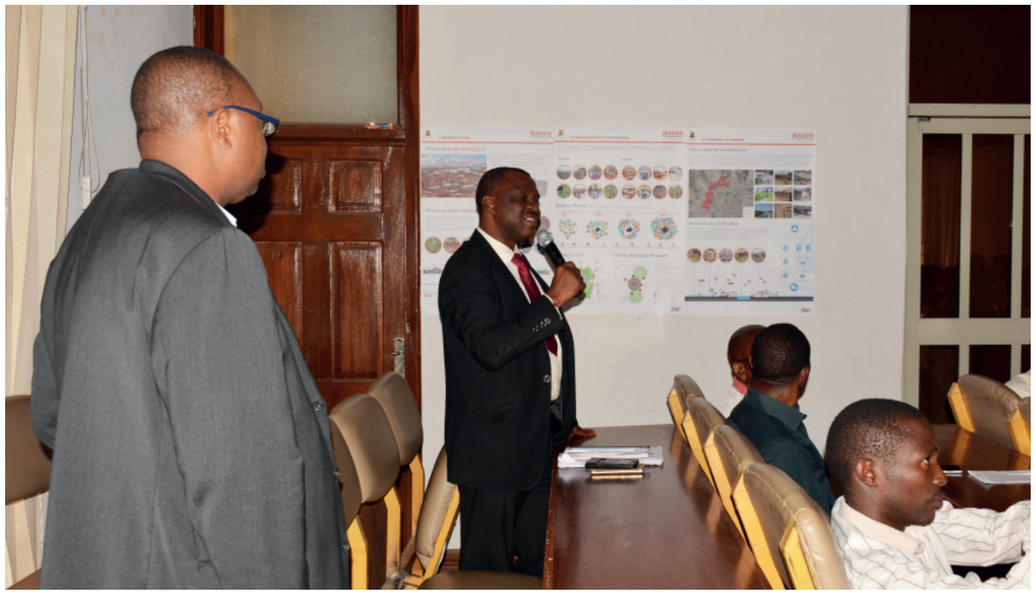


Figure 3.72: Feedback Session at the DUP Workshop

3 - STAKEHOLDER ENGAGEMENT UNDERTAKEN



Figure 3.73: Attendees at the DUP Workshop



Figure 3.74: Group Discussion at the DUP Workshop

Group Discussion on Flood Prone Areas

Discussion 1:

The general group discussion was introduced when attendees were shown the scenario in Figure 3.75 and asked what would be the best way (in their opinion) to proceed/develop the flood prone areas?



Figure 3.75: Scenario shown to Attendees to Initiate General Discussion 1

3 - STAKEHOLDER ENGAGEMENT UNDERTAKEN

Obstructions/Structures affected by the Flood Prone Area Right of Way

- A cost/benefit analysis will need to be undertaken to understand the effects of obstructions;
- Building standards need to be obtained – understand the process involved;
- Need to consider having a plan in place which will prevent vacant land from being overtaken. The plan should include consultation (in order to identify areas of importance).
- Considerations for dealing with obstructions/structures affected by the Flood Prone Area Right of Way:
  - Financial;
  - Buy-in/support of communities – can be achieved by creating awareness amongst communities – people need to be educated as to the dangers of building in the flood prone area Right of Way;
  - Enforcement from land agency as government capacity is weak (political and economic);
  - Education and enlightenment of the people; and
  - Consultation.
- The resettlement of people should be planned for in the subsequent stages of the masterplan;
- Attitude of people needs to be changed (i.e. people need to be educated);
- Conduct a survey of affected areas before building in order to sensitise people;
- Organise a town meeting to educate people on the dangers of staying in a flood prone area;
- Consider existing land use;
- Develop an inner city Environmental and Social Regeneration Plan;
- Sell the positives to the people i.e. get them to understand what the benefits would be;
- Develop a community planning organisation to manage improper development; and
- Research case study examples of slum regeneration in developing countries around the world, specifically development of slums in flood prone areas with high populations.

Discussion 2:

In cases where buildings are still in good condition and also have tombs/graves of their relatives within the property, what should be done? (Figure 3.76)

The discussions which followed have been summarised as follows:

- One of the attendees commented that if the residents of that house were selling, they would still sell it even with the grave/tomb. The same principle applies to evacuation; the issue is not the tomb, it is that the house is situated in a place it should not have been.
- People need to be educated about the risks involved in living in flood prone areas.
- Encroachment into these areas needs to be prevented.
- A resettlement policy/plan is required for the subsequent stages of the masterplan and the policy should address:
  - Compensation to those who need to be relocated and have building approval; and,
  - Identify who is to pay for this compensation.



Figure 3.76: Scenario shown to Attendees to Initiate General Discussion 2



Figure 3.77: Members of the Technical Committee looking at the DUP presentation boards (opposite)

Discussion 3:

Attendees were shown case study examples of solutions to developing flood prone areas in other parts of the world (Figure 3.78 to Figure 3.82). A general discussion was initiated regarding the practicality of implementing these solutions in Ibadan.



Figure 3.78: Cheonpyeong River, Korea





Figure 3.80: Rhone River, Lyon, France



Figure 3.81: Mekong River, Thailand and Laos



The following section summarises the discussions which followed:

- A concern was raised regarding the cost of implementing some of the examples shown in the presentation; however, another attendee at the workshop countered this comment by saying that the safety of the people is more of a priority than money/finances.
- It was also mentioned that before examples like the ones shown can be implemented in Ibadan, issues such as waste disposal need to be addressed.
- The public need to change their attitude (towards waste disposal) to implement these kinds of examples in Ibadan – this attitudinal change will come from providing education.
- The example shown in the presentation of the case study in Thailand where the area was transformed to support agricultural development – seems more practical, achievable and realistic in Ibadan.
- Fundamental problems need to solved first – waste disposal, public defaecation etc.
- Priority issues which need to be addressed are:
  - Legislation – enforcement laws need to be developed and adhered to. It was suggested that a task force be set up which would allocate responsibility for monitoring adherence to the law; and
  - Enlightenment – the public need to be educated and made aware of the plans for the flood prone areas in order to ensure their support and buy-in.
- The scenario in the case-study can be achieved in Ibadan if the following aspects are in order:
  - Professionals in the built and environment sectors need to act appropriately;
  - Local leaders need to be involved in regeneration plans;
  - Adequate infrastructure needs to be provided;
  - Enforcement/laws are in place;
  - A dedicated Task Force is set up to ensure enforcement; and,
  - An Environmental Sanitation Campaign is initiated.

3 - STAKEHOLDER ENGAGEMENT UNDERTAKEN

3.4.1 Group Discussion on the Core Area

A presentation was made to the attendees describing the following:

- The extent of the core area – 6,400ha;
- Existing conditions:
- Road status;
- Street connectivity;
- Flood corridors;
- Collapsed buildings; and
- Ibadan heritage.

Discussion:

The general question which attendees were asked was: ‘What would your plan of action be for the Core Area?’

There was also an initial discussion as to what exactly determined the core area boundary. The term “inner core” was also used.

Discussions which followed have been summarised in the following section:

- Buildings that cannot be preserved need to be identified;
- Roads need to be introduced;
- Compensation should be provided as a last resort only if valid documentation for property ownership/ approval exists and
- Efforts should be made to upgrade, conserve, rehabilitate and resettle instead of total removal in order to achieve community improvement.

It should be noted that the comments raised with regards to discussions on the core area were similar to those raised during group discussions on the Flood Prone Area.

3.5 PRESENTATIONS

Once the DUPs were developed SE was carried from the 26th of September to the 5th of October 2017 to present these to various stakeholder groups.

Presentations of the DUPs were made to the following stakeholders:

- Sub-Technical Committee and State MDAs (Figure 3.83);
- Local Government Senior Management (Figure 3.84);
- Academics and Professional Bodies (Figure 3.85); and,
- Representatives of Local Government, Religious Leaders, NGOs and Community Organisations (Figure 3.86).



Figure 3.83: Sub-technical Committee and MDAs



Figure 3.84: Local Government Senior Management

3 - STAKEHOLDER ENGAGEMENT UNDERTAKEN



Figure 3.85: Academics and Professional Bodies



Figure 3.86: LGA Groups

3.6 EXHIBITIONS

Exhibitions were held at the five inner LGAs in order to present the DUPs:

- Ibadan North (28/09);
- Ibadan North West (29/09);
- Ibadan South West (03/10);
- Ibadan North East (04/10); and,
- Ibadan South East (05/10).

The exhibition format was chosen as the most effective stakeholder engagement method as it allowed for consultation to be undertaken in an informal manner. Attendees were asked to register and were given leaflets and comment forms which they could fill in and drop in the comments box provided (Figure 3.87 and Figure 3.88). Attendees were welcomed to the session and taken through the display boards (Figure 3.89 and Figure 3.90). Attendees were also asked to participate in a creative art session of painting an outline of their handprint. This exercise was set up to encourage participants to be creative and to show their engagement with the masterplan as each handprint was a symbol of their individuality, stakeholders were meant to feel as if they have left their 'print' on the Ibadan City Masterplan (Figure 3.91 to Figure 3.93).



Figure 3.87: Leaflets, Comment Forms and the Comments Box



WHAT DO YOU THINK ?

ARE WE MISSING ANYTHING ?

Let's continue our dialogue

This masterplan and the Detailed Urban Plans (DUPs) are for your city.

We want to hear from you so we can make it relevant to your needs.

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Sept/Oct 2017

Any questions?

Take a leaflet home

Visit Our Website
www.ibadan-masterplan.com

Leave your comments

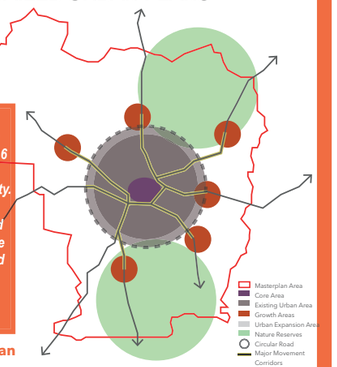
Follow us on twitter
@IbadanMplan

Write to Oyo State
Ministry of Lands, Housing and Physical Planning
Agodi, Ibadan
Oyo State, Nigeria
5129, Secretariat
P.O.B. Ibadan

Oyo State Government

IBADAN
CITY MASTERPLAN

DETAILED URBAN PLANS



The Oyo State Government has been working since mid 2016 to develop the first masterplan for your city. This process involves the drafting of Detailed Urban Plans, which are currently being worked on and which we are presenting to you in October 2017.

The Key Masterplan Principles

Visionary - Raise aspirations and provide a clear picture for the future.

Deliverable - Show how the masterplan will become reality.

Flexible - Ensure the masterplan is responsive and adaptable to change.

Participatory - Provide all stakeholders with a means of expressing their needs and priorities to help shape the masterplan.

The Ibadan Masterplan sets out a blueprint for future change to the year 2036. It includes proposals for land uses, buildings, open spaces, utilities and transport, which go hand in hand with policies to aid implementation.

- Urban expansion to house the increasing population.
- Major interventions that promote the development of a city with more than one centre.
- A new role for the existing LGA administrative centres as growth centres.
- New transport connections.
- Regeneration of the core area while minimising disruption to existing settlements and communities.
- Protection of valuable forests and dense vegetated areas in the north and south.

dar

What are the Detailed Urban Plans (DUPs)?

One of the components of the Ibadan City Masterplan is the preparation of Detailed Urban Plans (DUPs). These are areas that have been selected to provide clear and detailed guidance for implementation of the masterplan.

The Detail Urban Plans are:
- Flood Prone Areas
- The Circular Road
- The Core Area

CIRCULAR ROAD

The purpose of this Detailed Urban Plan (DUP) is to provide a framework to guide development along a 1km Area of Intervention of the Circular Road.

This includes proposed locations for:
- New schools
- Upgrades to roads and pavements
- New fire stations
- New Healthcare facilities
- Embankments/Levees
- New LRT
- New industrial areas
- New commercial areas
- New and protection of existing green and open spaces





FLOOD PRONE AREAS

The planning strategy will guide the use of land along the floodplains and the low lying areas within the designated flood prone areas. Several methods of flood mitigation/prevention shall be employed including:

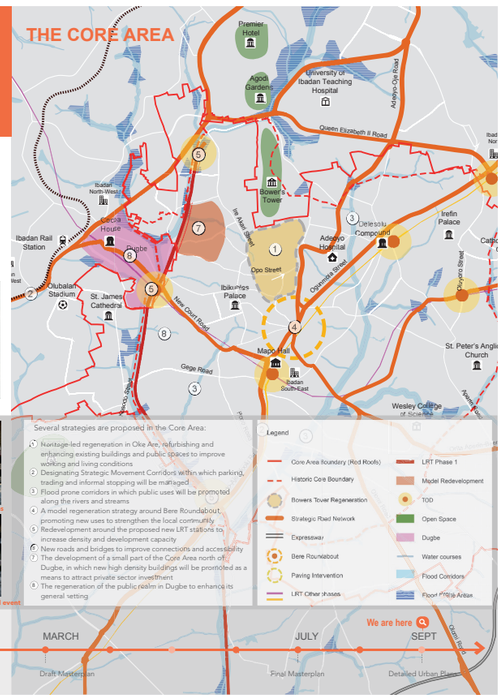
- Channelisation,
- Urban Agriculture,
- Water Storage System for community squares,
- Areas of zero development along floodplains,
- Embankments/Levees
- Dynamic public space - community plaza











Project Progress

JULY **2016** — Project Commenced

Data collection and initial discussions with stakeholders

DECEMBER **2017** — Mapping opportunities for the future (Development Framework)

MARCH — Draft Masterplan

JULY — Final Masterplan

We are here

SEPT — Detailed Urban Plans

Figure 3.88: DUP Leaflet



Figure 3.89: Ibadan North DUP Exhibition



Figure 3.90: Ibadan North DUP Exhibition

3 - STAKEHOLDER ENGAGEMENT UNDERTAKEN



Figure 3.91: Creative Hand Painting



Figure 3.92: Creative Hand Painting

3.6.1 Key Findings

Overall, the DUPs were well received. Comments received from stakeholders were generally positive and have been summarised as follows:

- Masterplan Implementation
  - Requirement for a phasing structure for masterplan implementation;
  - Concern regarding how to manage existing development taking place. The current development does not take into cognisance the masterplan.
  - Enforcement needs to be strengthened as part of the masterplan implementation process.
  - Queries were raised as to the funding of masterplan implementation and where this will be sourced from.
- Circular Road
  - What is the proposed strategy to reclaim setbacks from the RoW in already developed locations?
  - Development has been taking place quite rapidly along the Circular Road. Has the Circular Road DUP taken these developments into account?
- Core Area
  - How does the DUP for the Core Area ensure that heritage does not become obsolete?



Figure 3.93: Creative Hand Painting

4. Online Platforms

4 ONLINE PLATFORMS

As part of the SE process an online platform has been created known as the Knowledge Hub. This platform is a vital tool for communication and connectivity and is a place where information is stored and shared. It consists of:

- The Ibadan City Masterplan Website – provides an important point of contact with the public and is essential for stakeholder engagement and data collection, the website address is: **www.ibadan-masterplan.com**; and,
- The Project Intranet – connects people working on the project, enabling quick and easy file sharing, discussion forums and social networking to facilitate efficient and collaborative working.

In addition to this a Twitter account has been established. This has proven to be an effective tool for engaging with the general public, not only to provide project information and updates but to also obtain feedback and opinions. Figure 4.1 provides an outline of the homepages for all three online platforms.

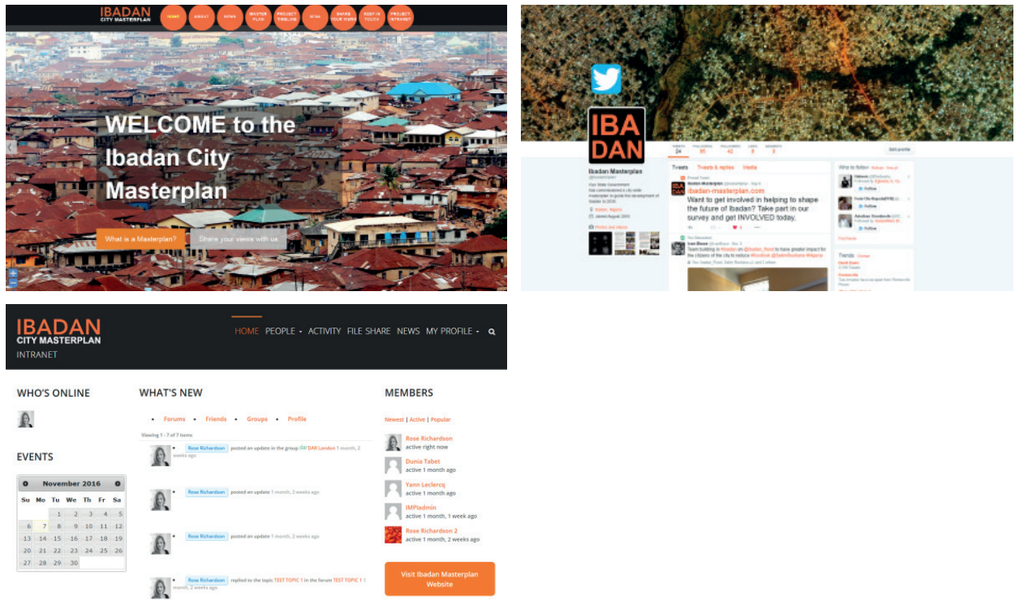


Figure 4.1: Homepage of all three Online Platforms



Figure 4.2: Website – Responsive Design

4.1 USER EXPERIENCE

The number of smart phone users in Nigeria increased by 4.5 million between 2014 and 2016, with a projected increase of a further 8 million by 2019. The Ibadan City Masterplan website has been created to allow ease of use across all electronic platforms, including Personal Computers (PCs), tablets and mobile smartphones as shown in Figure 4.2.

4.2 IBADAN CITY MASTERPLAN WEBSITE - WWW.IBADAN-MASTERPLAN.COM

4.2.1 Content

- About - Describes Location, History, Community Engagement, Project Development and Key players involved.
- News – This page features all recent news related to the project. It acts as a project Blog and is regularly updated.
- Masterplan –Introduces the concept of a masterplan. It outlines what a masterplan is, why it is required and describes how it will benefit Ibadan.
- Project Timeline – Introduces the phases of the project.
- SESA – Describes the Strategic Environmental and Social Assessment. This is a vital part of the masterplan development as it assesses the potential impacts of changes to the social and physical environments of Ibadan.
- Share your Views – Perhaps the most important function of the website. This is a survey which is open to the general public. The aim of the survey is to obtain vital information from as many stakeholders as possible; this includes local officials, business owners and residents of Ibadan and surrounding areas.
- Keep in Touch – An opportunity for the user to contact us, so they can be kept updated on the progress of the project.

4.2.2 Sharing Knowledge

The Knowledge Hub acts as a two way exchange of information between stakeholders and the consultant. In order to affect real change in Ibadan, it is important to understand the issues faced by those who live in Ibadan and the implications of these. By way of an online survey, vital knowledge is obtained from stakeholders on the problems facing Ibadan. As part of the SESA process, stakeholders can leave feedback on their ideas and opinions of the masterplan process and be part of decision making process for the Ibadan City Masterplan (Figure 4.3).

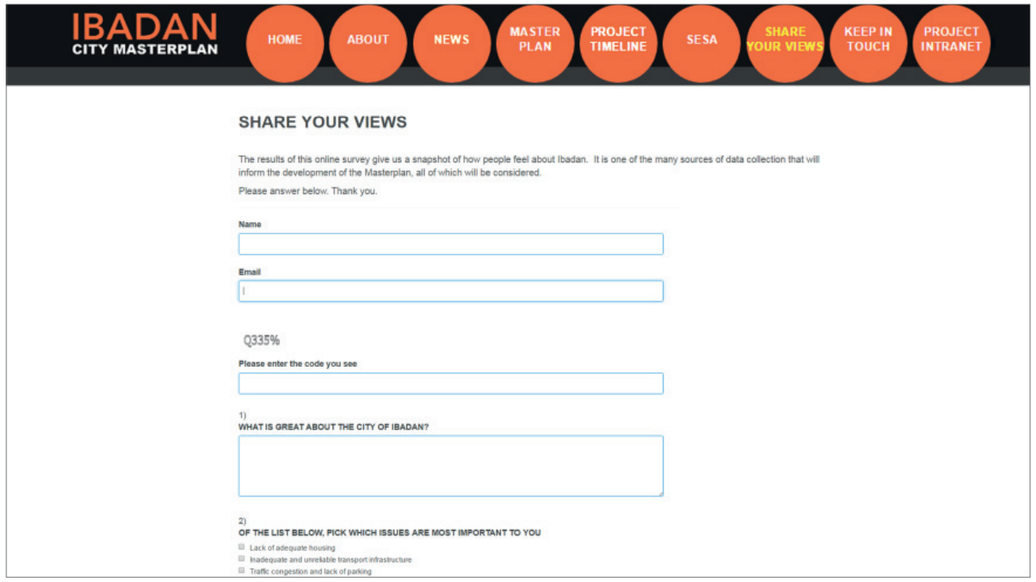


Figure 4.3: Ibadan City Masterplan Website – Online Survey

4.2.3 Examples of survey Questions

These include:

- What is great about the City of Ibadan?
- Which issues are most important to you?
- How could life be made easier?
- What are the biggest issues facing young people?
- What are the biggest issues facing elderly people?
- Explain in your own words what Ibadan should be like in the future.

4.2.4 Keeping in Touch

Stakeholders are encouraged to provide their contact details on the website so they can be kept up to date on the project progress. This valuable feature of the project website allows the consultant to have direct contact with all stakeholder groups (Figure 4.4).



Figure 4.4: Ibadan City Masterplan Website - Keep in Touch page

4.2.5 Privacy and Data Storing

All information, including survey results and contact details are stored in a secure and private server. Contact details are never shared with external parties and can only be accessed by Project Managers and Administrators.

4.2.6 Project Intranet

The Intranet is an internal website available to those working on the project (Figure 4.5). It is a private network that allows individuals directly involved in the masterplan process to exchange information and to connect with other key players involved. Intranet functions include:

- Uploading & sharing project documents;
- Sharing news and events;
- Social networking;
- Connect with other members either publicly or privately;
- Discussion forums;
- Newsletter subscription; and,
- Security - it is a private network, the administrator invites people to join.

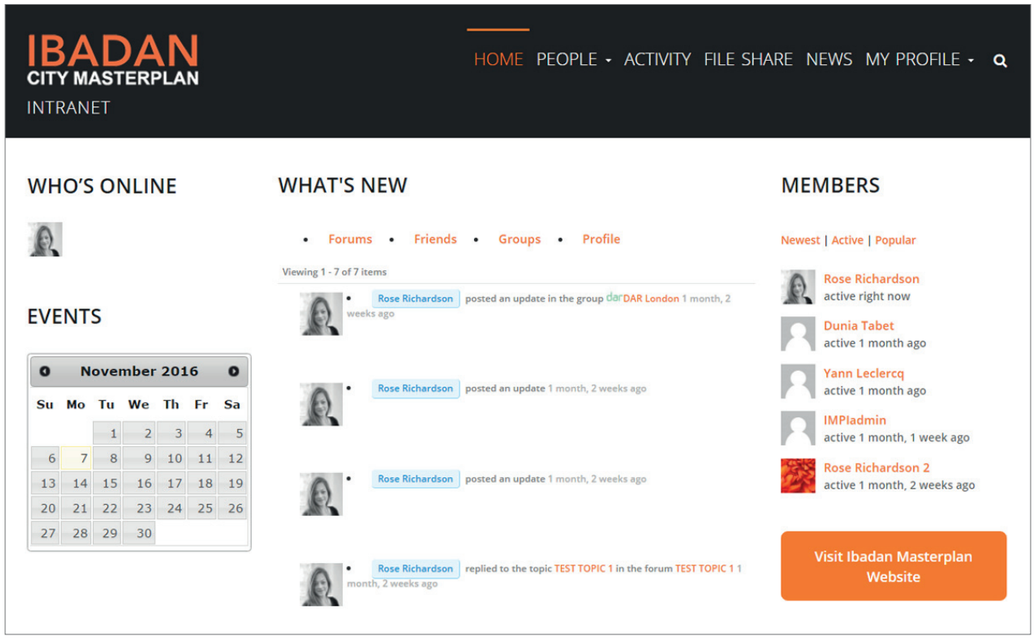


Figure 4.5: Intranet - Home page

4.2.7 Becoming a member of the Intranet

The editor of the Intranet sends an invitation to potential new members of the intranet community, setting a prescribed level of access (Figure 4.6). The access level provided determines the functionality of the intranet e.g. posting comments, uploading documents and drawings to the file share drive, chatting with other members in forums, creating group discussions, subscribing to the monthly newsletter and much more.

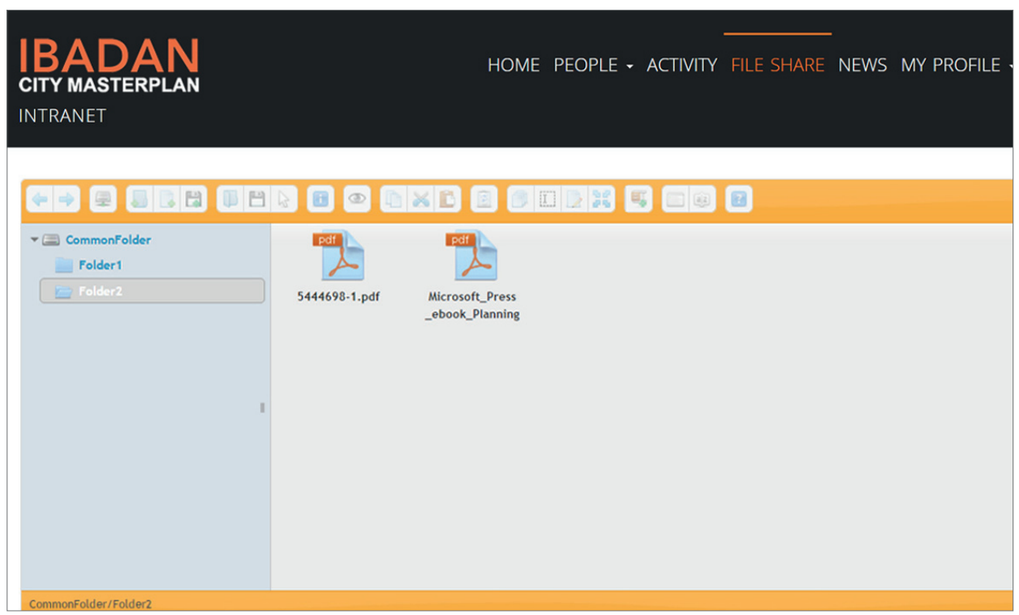


Figure 4.6: Intranet – File Share page

Social Media – Twitter

Social media is an important part of everyday life and a vital tool for communication and collaboration. The consultant provides regular news, updates and general information regarding the project and related projects via its Twitter page (shown in Figure 4.7). Connections have been made with people, businesses and local governments across Oyo State, ensuring that as many people as possible are involved in the development of the Ibadan City Masterplan.

The link to the Ibadan City Masterplan Twitter page is: **twitter.com/IbadanMplan.**

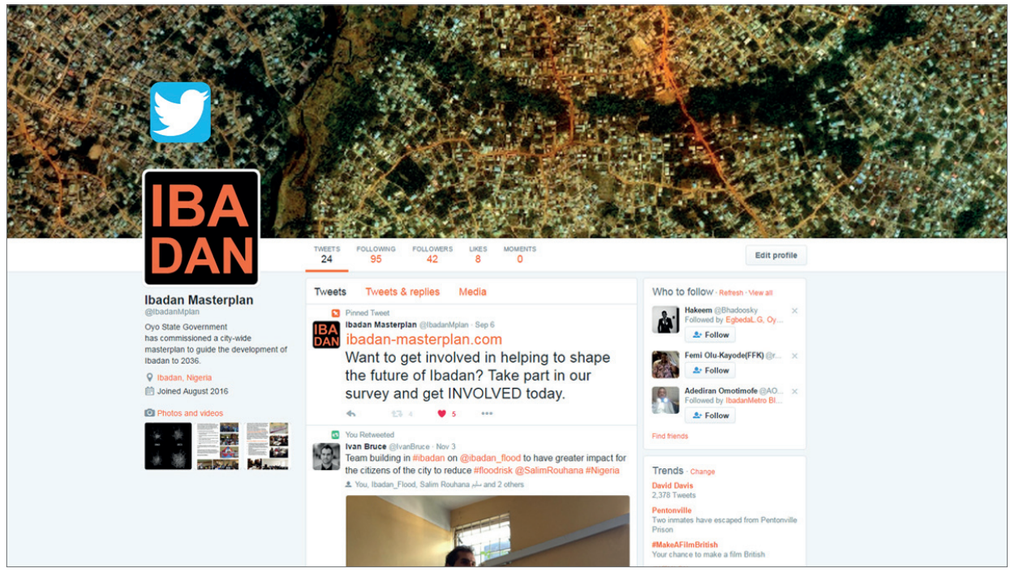


Figure 4.7: Twitter - Home page

Monitoring and updating

All three online platforms – Website, Intranet and Twitter are monitored and updated regularly. Survey results received from the website are collated together with general feedback and contact details. With this information, project updates and news can be sent out accordingly.

Comments Received

Feedback received from the Ibadan Masterplan Website includes requests to be updated on the progress of the Masterplan as well as suggestions on the Strategic Environmental and Social Assessment (SESA) process. The suggestions made regarding the SESA process are as follows:

- Environmental opportunities and risks should be evaluated based on consultation with key stakeholders.
- Provision of concrete recommendations to address the technical, institutional, governance and policy gaps and capacity building needs should be proposed.
- Project site specific safeguard instruments (e.g. ESIAs, ESMPs and RAP) are carried out before implementing the proposed Masterplan.

5. Conclusion

5 CONCLUSION

The SE process undertaken for the Ibadan City Masterplan was designed to reach stakeholders at all levels and to occur continuously throughout the phases of masterplan development. Key findings and comments raised at SE sessions changed with the development of the masterplan. In the initial phases, the Consultant aimed to get a better understanding of Ibadan (i.e. the key issues and development priority areas), however as the masterplan was being developed comments received moved more towards gaining feedback on the various masterplan scenarios, the draft and final masterplan as well as the DUP.

Overall, the SE sessions were well-received and stakeholders showed an understanding of what the masterplan entails.



Figure 5.1: Rock Paintings (opposite)

APPENDIX 8: TERMS OF REFERENCE

Section 7. Terms of Reference

IBADAN URBAN FLOOD MANAGEMENT PROJECT

Terms of Reference for the Elaboration of the:

IBADAN CITY URBAN MASTER PLAN;
DETAILED URBAN PLANS; and
CAPACITY BUILDING AND INSTITUTIONAL DEVELOPMENT PROGRAM

A. INTRODUCTION

1. Ibadan is the capital of Oyo State, Nigeria. The city has for long been of historical, economic and administrative importance in the regional context. She was the capital of the old Western State of Nigeria. The city has overtime witnessed rapid population growth and urbanization which is largely uncontrolled and haphazard in nature since there is no conscious Master Plan to guide her growth.

2. The resultant effects is seen in poor road and drainage networks, inaccessibility problems, incompatible land uses, slums and urban squalor, inadequate provision of social amenities/facilities like potable water supply, electricity, schools, health facilities and poor solid waste management. All these has contributed in making the city vulnerable to natural disasters such as the flooding witnessed on August 26th, 2011 in which many lives and properties were lost.

3. The present State Government has decided to tackle these problems head long by setting up the IBADAN URBAN FLOOD MANAGEMENT PROJECT (IUFMP) with the assistance of the WORLD BANK (WB) to prepare city master plan for Ibadan to ensure coordinated physical growth, improved socio-economic development, enhanced living standards of residents as well as better service delivery that would make the city resilient to stress and responsive to natural disasters, especially flooding.

B. BACKGROUND

4. Ibadan emerged as a war camp around 1830 which later grew into a full-fledged town and later attained the status of a city-state with the largest population size in Yoruba land. The landscape of Ibadan is dotted with Hills, Rivers, Valleys and flood plains. Given its strategic location between forestland and grassland, its proximity to the savannah made it a focal point of transportation routes-Roads, Rail and Air as it grew and expanded. Ibadan Region extends for about 55km from Asejire at the borders of Osun state in the East, to Agemo in the West; and for about 70km from Iroko/Motunde in the North to Mamu in the South.

5. Ibadan land consists of 11 Local Governments Areas which have 5 principally urban and 6 peri- urban / largely rural areas. Between 1970 and 1982, Ibadan was estimated to have developed from 103.8 square km to about 130.5 square km.

6. With the 1991 population census Ibadan had a population density of 475.11 compared to 296.54 persons per square kilometer in 1963. The population census of 2006 however put the region's population at 2,550,593 which accounted for 45.61% of the overall Oyo State population.

The projected 2010 figures had it as 3,135,845 with a land area of 3,850 sq.km and a population density of 814.511/ km.

7. Ibadan (Yoruba: *Ìbàdàn* or fully (Ìlú) Ẹ̀bá-Ọ̀dàn, (the city at) the edge of the savannah) is the capital city of Oyo State and the third largest metropolitan area, by population, in Nigeria, after Lagos and Kano, with a population of 3, 565, 810 people according to the 2013 estimate by Oyo State government. Ibadan is also the largest metropolitan geographical area. At Nigerian independence, Ibadan was the largest and most populous city in the country and the third in Africa after Cairo and Johannesburg. Ibadan is located 128 km inland northeast of Lagos and 530 km southwest of Abuja, the federal capital, and is a prominent transit point between the coastal region and the areas to the north (Fourchard, 2003).

8. In terms of economy, the economic base of Ibadan has been transformed from an agricultural based to a more diversified economic activities which embraces basically, commercial, educational, governmental, industrial and agro-allied enterprises including some flourishing local craft industry.

9. As the capital of Oyo state, Ibadan is the center for all Government functions and houses the primary cultural and educational centers. In addition, Ibadan and its region constitute the most important industrial center in the state due to its huge human resources and supporting industrial developments helped by its nodal network to other major towns and cities in the country. Ibadan's economy has diversified from mainly agriculture and today, the region is well known for its pacesetting status in education and industrial growth.

10. Despite the city's strong economic base and competitive advantages, local officials face serious difficulties in development planning and managing the city's rapid growth; in delivering and maintaining infrastructure services for the rapidly growing population; in meeting investors' infrastructure and service needs; in securing the investment flows needed to expand employment and service delivery; and in defining effective and sustainable urban development policies.

11. One of the main challenges confronting Ibadan today is its uncontrolled rapid and sporadic development. With the growth in the economy as well as an influx of migrants, Ibadan has experienced significant and rapid population growth[7]. This rapidly increasing population and economic revival have created a strong demand for land with urban growth leapfrogging into the hitherto rural areas, often with little access to basic infrastructure. In recent years while the market responded quickly to accommodate the growing population, the legislative arrangements and institutional structures necessary to achieve planned and sustainable development have yet to be put in place. Car ownership too has increased with a similar rapidity, resulting in serious traffic congestion and parking problems, especially in the center of the city

12. The region faces other important socio-economic challenges such as underemployment, limited skills levels in the workforce, limited access to poorly maintained infrastructure and social services, limited access to commercial credit, limited land availability for settlement expansion and significant barriers to land access for urban uses.

13. In terms of urban governance, a highly centralized decision-making process has acted as a major constraint on any attempts by local governments to address urban problems. Administratively, Ibadan is divided into eleven Local Government Areas. The Governor of the State is empowered to organize elections through the state Independent Electoral Commission (OYSIEC) to appoint Executive Chairmen for the administration of the Local Government Areas (LGAs).Local

Executive Authorities are responsible for coordinating the delivery of core public services and utilities such as education, culture, public health, and communications, which are financed directly from the Federation Accounts

14. Unclear interactions and limited financial and human resources of local governments have led to a variety of problems such as the absence of updated land use planning; transportation planning; most importantly land management and a comprehensive development vision. Furthermore, in the last fifteen years, the State Government has made a lot of progress to adopt the planning legislation to improve planning administration with the enactment of the Oyo State Urban and Regional Planning Board (URPB) Law of 2001 and to reflect changes in the system. The planning governance systems require radical review, supported by institutional development and capacity building activities which did not follow as expected even when the URPB Law of 2001 was replaced by the Ministry of Physical Planning and Urban Development Law of 2012. In addition, local governments battle with the issues of limited availability of funding and serviced land; difficult access to industrial and commercial land; deficient and poorly maintained local infrastructure and utility networks; and the inadequacy of municipal services (especially solid waste collection and disposal). Ibadan has never been guided by any Master Plan.

15. Besides not having a master plan to guide her development, the present map material in Ibadan is also partially outdated. The Office of the Surveyor-General in the state has made some progress in updating current maps; however most of them are not in digital format suitable for GIS environment.

16. Overtime, Ibadan has experienced great changes in its social, economic, cultural and governance structures and systems. The challenge facing planners, decision makers/managers and implementers is to "manage the change" and prepare their systems so they have the capacity to respond to change, both in the short and long term.

17. Governments across the world confront similar challenges when faced with the issue of reforming their planning processes. Environmental and community pressures have mounted in recent years, as growing and changing populations place more stress on limited land and other resources. At the strategic level, most governments are working towards accommodating growth in a sustainable manner, producing affordable land; planning and building new infrastructure; making better use of existing underused land in well-serviced locations; and ensuring improved environmental outcomes. An Effective Planning System (EPS) is vitally important in achieving these tasks and achieving community and environmental wellbeing. Such a system should have the capacity to accommodate disparate individual activities, investment and risk-taking decisions, lifestyle choices, aspirations and values so as to ensure that the rights and preferences of individuals are moderated or filtered to take into account broader social and environmental needs.

C. OBJECTIVES OF THE REQUIRED SERVICES

18. The ultimate goal of the required services of the Consultant is to support the Government of Oyo state in re- positioning Ibadan city as a competitive, open and socio-economically inclusive and equitable city in the sub region.

To achieve the above, the following objectives are to be considered:

(i) to prepare and elaborate, through a participatory and cross-sectoral approach, a coherent and realistic Master Plan aimed at defining the framework of sustainable urban development of Ibadan city by addressing its socio-economic needs and expectations;

(ii) to identify the development issues and potentials of Ibadan city and make a long term vision for the city and to prepare the Master Plan in accordance with the vision for the development;

(iii to ensure and promote growth of Ibadan city in line with the guiding principles of the Master Plan and control any unplanned growth by private or public sector;

(iv to prepare Conceptual Ibadan Land Use/Zoning /Structure plans;

(v) to prepare action area plans specifically for the flood-prone areas, the city gateway corridors and settlements outwards the proposed Circular Road with a view to addressing key development priorities, and provide overall guidance and coordination;

(vi) to put in place effective monitoring and evaluation system to ensure proper implementation of the Ibadan City Master Plan.

D. EXPECTED RESULTS AND OUTCOMES

D.1. Inception: This activity will be kick-started with an inception report that outlines the consultant's understanding of clients' needs and the critical issues to be covered in this exercise. The consultant will also prepare a detailed methodology, detailed timeline and deliverables planning that clarifies and holds them responsible for the conduct of the activity.

D.2. The Strategic Vision – Preparation Of The Ibadan City Urban Master Plan (ICUMP)

19. The Oyo State Government of Nigeria intends to carry out the preparation of an all-embracing, all inclusive, sustainable and implementable Ibadan City Master Plan (ICMP) to address the following strategic issues:

20. Preparation of a spatial economic and social vision for Ibadan City (Capital City of Oyo State) on the 2035 horizon: this will take into account the existing socio-economic situation of the city, and the city's non-oil based growth potential. This will reflect the Government of Oyo State's commitment to encourage growth in the non-oil economy, and promote private sector-led activities (SMEs, etc.), especially as important factors in generating new jobs and opportunities.

21. The strategy for the metropolitan region will need to fit within the broad national objective for economic growth and diversification. Certain projects that can support the competitive advantages of the region in the long term must be identified and amplified. Such projects must then be incorporated in ICUMP and the city's land use plans.

22. ***Key sectors to be considered and harnessed are:***

(i) The Agricultural Sector**:** Urban agriculture and food production; Farm Settlements; Rural based agriculture; Agricultural research and training; Livestock production/animal husbandry

(ii) Natural Resources Development, including: Forest resources (Timber production & afforestation); Land resources; Water resources development for irrigation, electricity/energy, domestic consumption, fishing & recreation (boating); and Mineral resources.

(iii) Commerce, Trade and Investments including: a) the Development of Central Business Districts (CBD), Redevelopment of existing traditional markets Siting and development of

Neighborhood Markets and Emerging shopping centers, Modern Motor Parks , bus stops ;and Attracting foreign and local investors on trade, commerce and industrial development.

(iv) **Mines, Power and Industry:** The Ibadan city Urban Master Plan should encourage the development of manufacturing, tertiary and service industries. Policies that will encourage development of industrial estates, cottage and agro-based industries, especially within the corridors of the proposed circular road should be evolved; Strategies to develop the existing Industrial park along Ibadan-Lagos Expressway should also be developed. Other areas include Quarrying and mining operations and Development of Industrial Estates/ Cottage Industries

(v) **Public Utilities:** Effective Solid Waste Management System, Waste to Energy and Waste to Wealth options, Waste-water Recycling, Normal (national grid) and alternative power supply, Telecommunications system and urban water supply.

(vi) **Social Services Infrastructure:** Education and Vocational development at all levels (formal and informal), Health and Medical services at all levels an categories, Recreation and Leisure–(Stadia, Games village, Cottage, Sports centers); Fire and Safety services, Culture and tourism development.

(vii) **Urban Transport:** Effective and functional road network including development of alternative linkage roads,, rail system and airport.

23. ***Spatial considerations:***

(i) Spatial Development and Urban Expansion

- The Ibadan City Master Plan should take cognizance of the need for the development of the existing built-up/urban core areas and to determine whether the existing public infrastructural facilities, utilities and services are under, fully or over-utilized and whether there is room for further development.
- The plan must also consider the need for lateral expansion of the urban areas to cater for increased population. The present shape of the city's outward growth and the directions in which lateral expansion can take place must equally be determined.
- The Ibadan City Master Plan should encourage the growth of conurbations in-between the frontier Local Government headquarters. A diffused ring strategy of the outward growth of the conurbations should be adopted.
- The plan should, at all cost, curtail sporadic outward growth, the plan should eliminate the waste of ill-considered sporadic developments everywhere.
- The Master Plan should also envisage a physical planning strategy for the planning of the transport structure for the alignment of transport routes, networks and system as a major determinant of the functional relationship between the city's activity areas.

(ii) *Land use Planning & Development.* The preparation of Ibadan city master plan should evolve a physical planning strategy designed to make the most efficient use of the land and other natural resources of the city and should focus on:

- Facilitate Improved access to land for public use
- Encourage Zoning Regulation
- Support development of serviced plots for improved housing delivery
- Promoting greener and cleaner city

- The development of a network of intra and inter connected roads. There is also an urgent need to incorporate the rapidly expanding outlying settlements into the city by connecting them through roads transport and by extending basic urban services (water, sanitation), including ensuring access to education and health facilities.
- Population Distribution/ balancing growth. The Ibadan City Master Plan is to be prepared to accommodate a potential population based on current growth rate, the anticipated growth patterns and the city's 2013 estimated population of 3, 565, 810 million. Current planning principles have often been breached while developments have occurred outside current planning boundaries. Redevelopment activities which are often inconsistent with proposed plans are common. As a result, densities have increased, especially in central parts of the city,
- Efficient and functional Land use development Pattern
- Urban Renewal/ city Regeneration

24. **Methodology:**

- Undertake comprehensive survey of the existing land use patterns in the city.
- Compile an inventory of unique, historical, cultural and scenic areas for the purpose of preservation.
- Identify and assess the existing infrastructural facilities, services, and projects for the urban growth for the period 2015-2035.
- Undertake studies to identify major physical, socio-economic, demographic, and environmental potentials, problems and constraints/ challenges.
- Conduct inventory and assessment of the physical features (such as land, water, geology, soil, forest, minerals, etc) and demographic data (human resources) of the city with a view to conceptualizing appropriate physical and spatial standards and strategies for their development, utilization, and conservation.
- Formulate spatial policies in respect of population distribution, urbanization (housing policy), land and water resources utilization, environmental planning and management, industries, power projects, major transportation projects, channelization, and other socio-physical infrastructure following the State's Development Outlines within the regional and national integration framework.
- Identify development corridors and assess their growth potentials and incorporate them in the phased development plans such that it will anticipate economic changes, consolidate numerous economic and productive poles clearly identified as nationally attractive. Such urban spaces should be structured around economic poles and should facilitate and support the emergence of Small and Medium Enterprises taking part in city economic development and contributing to job creation and diversification.
- Integrate the other sectoral plans, such as the Strategic Urban Sanitation Plan, Solid Waste Master Plan, Public Health Master Plan, Integrated Urban Flood Risk Management and Drainage Master Plan, Environmental and Social Management Framework, Transportation Plan, Recreational Master Plan, Resettlement Policy Framework, as well as Ecological Management Plan, into the Urban Master Plan that will be produced in a compatible framework.
- Identify and hold consultative meetings (including town hall forums) with all relevant stakeholders, (line ministries, Government Officials, Academia, NGO"s, the town people, etc) and establish partnerships to be in place.

- Formulate development policy for open spaces, roads, streams/rivers, rail, oil-pipeline and other setbacks
- Clearly define an elaborate procedure of approval of the Master Plan by getting it validated by the stakeholders and passed into law to provide the planning document with institutional, legal weight and framework.
- Consideration should be given to the *natural ecosystem*, the water bodies, the ecological areas and areas of historic values when preparing the master plan for the purpose of preservation and development.
- *Cultural heritage* sites and places that represent a huge and varied collection of human creations should be identified and preserved. The Ibadan City Master Plan should indicate plans and strategies for the development of culture and tourism.
- *Urban Mobility and Transportation Management*: Land use and transportation planning are highly inter-related. Land use shapes and determines the demand for transportation. On the other hand, the provision of roads and other means of transport changes land values and alter the intensity with which land is used, thus uttering the general pattern of land use. Consequently, the Ibadan City Master Plan should evolve effective traffic and transportation management policies accompanied by strategic traffic and transportation management plan.

25. The preparation of the ICMP will be divided into 3 major **Sub-phases:** (i) The Diagnostic; (ii) Scenario Preparation; and (iii) the elaboration of the Master Plan.

26. Throughout the project, the Consultant is expected to consult and closely cooperate with key stakeholders, and encourage partnerships in Ibadan, including, but not limited to: the Ministry of Physical Planning and Urban Development; the Local Government Authorities (LGAs) and Municipalities; the Directors of the Town Planning Offices in the 11 Local Government Areas, Heads in the relevant line Ministries including representative bodies of the private sector, key economic actors, the representatives of civil society (i.e. academics, NGOs, etc.) and the popular sector (CBOs, opinion leaders, traditional chiefs etc.

27. It is expected that the Ibadan City Master Plan will provide strategies for the rejuvenation of the core areas of the city and by identifying the spatial development and redevelopment opportunities for the city centre and slum sites within plan boundaries. This is expected to contribute to reduction of socio-economic inequalities and improving quality of life through better access to urban basic services in the core areas.

D.3. Operationalizing the ICUMP – Preparation of Detailed Urban Plans

28. On the basis of the ICUMP, the consultant will validate the pre-selected priority expansion and urban design areas. The objective of those Detailed Urban Plans (DUPs) are to provide the Oyo State Government with concrete and operational platform to implement the ICUMP in selected high priority areas via:

- ✓ creating internationally competitive settlements with the capacity to be part of the global production chain,;
- ✓ properly managing the urban rural 'divide' and the transfer of land use;
- ✓ better addressing issues of access and equity;
- ✓ affordability, specifically affordable housing;
- ✓ ecological integrity; and
- ✓ energy efficient settlement patterns.

29. The Detailed Urban Plans will be for selected priority areas and will specify in details the layouts of specific land use, land cover including number and type of dwelling units, estimated residential site density for a given population, number, type and location of industries and public infrastructures (pry, secondary and tertiary schools), type, location of commercial activities and estimated commercial floor spaces and employment target, recreational activity areas, estimated park areas and other relevant details should be provided in the plans.

30. Those DUPs will cover the following priority areas:

- **Corridor Area (Circular Road) Development:** Specific action plan to address the related land uses, economic and social development impacts that may result from development along the corridor sites of the proposed Circular road in Ibadan. It will indicate the actual distance from the carriage way to each side of the right of way to be developed. The plan must prevent haphazard and illegal development within the circular road corridor in Annex A.
- **Flood-prone areas:** While natural disasters cannot be prevented, measures should be taken to reduce the impact of flood on immediate and remote neighborhoods. Proper physical planning is an important tool to use to regulate urban development as per the extent of damage anticipated and to prevent further encroachment into the flood plains and water sheds. The plan must prevent haphazard and illegal development within the flood-prone areas in Annex B.
- **Core Areas/Inner city**: Ibadan city has a large portion of highly dilapidating and decaying urban core areas. When planning for inner city, cognizance should be taken of areas to conserve and those areas to be rehabilitated or redeveloped. The strategy of either embarking on Inner City Environmental and Socio-Economic Regeneration and/or need to restructure the existing neighborhoods within the built-up areas may be considered. The plan must prevent haphazard and illegal development within the Core Areas/Inner City in Annex C.

D.4. CAPACITY BUILDING & INSTITUTIONAL DEVELOPMENT

31. Although the ICUMP will be the main delivery mechanism, it should be supported by the necessary institutional arrangements and capacity building mechanisms. The analysis and related content of the ICUMP and the Detailed Urban Plans shall include, but not be limited to:

- the national development objectives and context;
- the anticipated economic development in the region the environmental considerations for the region
- key considerations, guiding principles, constraints, etc. for the spatial development and planning of the region and the related individual land use plans; and
- process for monitoring of developments and for adjusting plans, as appropriate.

32. The capacity and Institutional Development aspect of Ibadan City master Plan will be designed to meet the data gaps, the technical gaps and the institutional/legal framework gaps. It should be noted from the onset that the plan preparation will involve integration of the relevant institutions (MDAs) and other stakeholders in all facets of plan preparation and implementation. Consequently, there will be need to organize the stakeholders into **Partnership Committees** for specified tasks. There will also be need to organize Training of Trainers on specific responsibilities.

33. Among others, the following capacity gaps are identified:

- Field data collection, analysis and technical presentation/reporting,

- Computer appreciation and software utilization on data capturing and manipulation
- Geographic Information System (GIS)/AutoCAD utilization skill
- Master Plans Implementation Monitoring and Evaluation
- Review of the extant physical planning and urban development laws and spatial regulations

34. Among others, **the consultants shall build an integrated Geographic Information System (GIS)** capable of holding as much information as possible through geo-referenced and searchable data records in compatible databases, to meet planning and land management requirements.

35. To build essential human capacities, targeted trainings will be designed and conducted for key Staff of Ministry of Physical Planning and Urban Development, the PIU of the IUFMP and other policy decision making arms of government. In total, five (5) specific training workshops for 30 personnel in Ibadan (in addition to elaboration workshops needed), will be organized and covered as part of this consultancy.

36. In addition, an intensive training targeting the core staff of the Ministry of Physical Planning and Urban Development and IUFMP-PIU on Master Plan Preparation / Implementation (Training of Trainers) will be organised and covered as part of the Consultancy.

E. <u>BASIC DATA CAPTURING NEED</u>

37. In collaboration with the Office of the Surveyor General, the consultant shall acquire at least 0.6m resolution Quickbird Satellite Imageries covering (about 4,000km^2) for the Ibadan City Master Plan.

38. In collaboration with the Office of the Surveyor General, utilize at least 0.6m resolution Quickbird Satellite Imageries to provide between 1:2,500 – 1:10,000 up-to-date digital map for Ibadan City covering approximately 4,000km^2 for the conceptual framework of Ibadan City Land use Zoning Plan. The digital map specifications are to be agreed upon with the Client (Ibadan Urban Flood Management Project, Ministry of Physical Planning & Urban Development and Office of the Surveyor General). The maps are to be produced in hard copy and in digital (GIS ready) format[8]. The Consultant is expected to adopt this scope of work in the production of the map information;

- Establishment of relevant Geodetic Ground Controls for the mapping work.
- Acquisition of 0.6m Resolution Quickbird Satellite Imageries
- Digital Mapping at Scales 1:2,500 – 1;10,000
  - Detailed Urban Plan for Priority Areas (1:1000 & 1:2,500)
  - Other Maps (1:10,000; 1:25,000; 1;50,000 & 1: 100,000)
- GIS Database Creation
- GIS Applications
- Production of Bathymetric Charts
- Capacity Building.

39. The consultant shall develop a policy and standards in the adoption of GIS and PIS[9] in the field of urban planning and for the preparation and implementation of development plans; identify the information sharing protocols and policies with all stakeholders in the process, including government stakeholders who are responsible for identifying and implementing downstream investments.

[8] All plans to be produced are in GIS ready computer readable format with proper geographical references enabling change of scale. There should be properly built links between the map/GIS data and attribute data supporting thematic mapping and utilization of geo-referenced plan material.

APPENDIX 9: ENVIRONMENTAL AND SOCIAL REVIEW

ENVIRONMENTAL AND SOCIAL REVIEW

This section presents a broad, high level environmental and social review of the proposed draft masterplan for Ibadan City.

METHODOLOGY

This high level review has been guided by relevant indicators as defined by the United Nations (UN) Sustainable Development Goals (SDGs). Social impacts have also included those defined by the International Association for Impact Assessment (IAIA)[1]. Both the SDGs and the impacts have been adapted for use by the Consultant where appropriate.

REVIEW

Flood Plain Management

Maintain vegetation upstream in flood plains to protect against downstream urban flooding

Issues

It has been increasingly recognised that the changes in land use through urbanisation, leads to an increase in flooding. Removing vegetation and soil, grading the land surface, and constructing drainage networks increase runoff to streams from rainfall. As a result, the peak discharge, volume, and frequency of floods increase in nearby streams. In undeveloped areas such as forests and grasslands, rainfall collects and is stored on and in the vegetation, in the soil column, or in surface depressions. When this storage capacity is filled, runoff flows slowly through soil as subsurface flow. In contrast, urban areas, where much of the land surface is covered by roads and buildings, there is less capacity to store rainfall.

Interventions

It is essential that undeveloped areas of Ibadan that lie within the catchment basins of rivers upstream of the urban environment are kept free from development. By leaving this land undeveloped, the vegetation and soil column can absorb the rainfall, and then release it relatively slowly into the rivers and hence into the urban areas. By reducing the flow rate of rainfall into the rivers, the peak discharge, volume and flooding of the urban rivers can be minimised.

Given that the rivers flowing into Ibadan are from catchments to the north-east of the metropolitan area, the masterplan recognises that this land must remain undeveloped and has therefore reserved these areas as “Forest Protection Area”.

Control land uses in the vicinity of water supply reservoirs to preserve water quality

Issues

Land uses in the vicinity of water supply reservoirs require careful management to ensure that inappropriate land uses are controlled. Land clearance on the banks of reservoirs leads to soil erosion and flow of sediment into the reservoir, increasing sediment loading of the water as well as infilling of the reservoir, and reducing its water-holding capacity. Shoreline soils and vegetation have a role to play in absorbing and retaining pollutants that will otherwise enter the reservoir body. This includes illegal dumping of waste into the water and along the banks. Retention of shoreline buffer vegetation provides important habitat for wildlife, recreation and a valuable visual aesthetic.

Interventions

Ensure that buffer zones are in place at all reservoirs in the Ibadan project area. This includes a buffer zone limiting development at the Asejire reservoir. As reported by Tijani, Olaleye and Olubanjo (2011)[2], the dense forest surrounding Eleyele reservoir has reduced from 3.38 km^2 in 1984 to 3.01 km^2 in 2004, and was projected to have decreased to 2.52 km^2 by 2014. Clearly the buffer zone is necessary to protect further vegetation loss, but controlling development and clearance must be enforced to ensure that the buffer zone has a real effect.

Air Quality

Air Quality - minimise the human impact of particulate matter (PM10 & PM2.5), gases and organic compounds

Issues

Poor air quality in urban environments gives rise to serious health issues, and by reducing air pollution levels, countries can reduce the burden of disease from stroke, heart disease, lung cancer, and both chronic and acute respiratory diseases including asthma. The World Health Organisation (WHO) estimates that in 2012 there were 3 million deaths worldwide as a result of poor air quality (urban and rural environments)[3]. Key parameters to be considered are particulate matter (PM^{10} and $PM^{2.5}$), nitrogen dioxide, sulphur dioxide and hydrocarbons. Given the health impacts of poor air quality in urban environments it is essential to include interventions where possible. Typically these might include: policies and investments supporting cleaner transport systems, cleaner power generation, energy efficiency throughout the urban environment, cleaner industries and municipal waste management, and reduced outdoor burning.

Interventions

The most significant intervention within the control of the masterplan will be the siting and construction of the proposed circular road. By channelling heavy traffic around this road, it is anticipated, that traffic driving through the centre of Ibadan will be reduced, with associated improvements to air quality in the central urban areas.

Ecology

Ensure conservation, restoration and sustainable use of freshwater ecosystems (rivers and lakes)

Issues

Aside from their inherent value, freshwater ecosystems in the Ibadan urban environment assist in the assimilation of pollutants released into the drainage network. They must therefore be preserved in locations where they are currently thriving and restored in locations where they have deteriorated.

Interventions

Reserved buffers alongside the main waterways, notably the Ona River and portions of the Ogbere river, will restrict development within these areas, and in so doing, allow the freshwater ecosystems along the banks of these rivers to regenerate.

1 Source: Vanclay, F. 2003 International Principles for Social Impact Assessment. Impact Assessment & Project Appraisal 21(1), 5-11. http://dx.doi.org/10.3152/147154603781766491.

2 Tijani, Olaleye and Olubanjo (2011) Impact of Urbanization on Wetland Degradation: A Case Study of Eleyele Wetland, Ibadan, South West Nigeria. Proceedings of the Environmental Management Conference, Federal University of Agriculture, Abeokuta, Nigeria, 2011.

3 World Health Organisation (WHO) http://www.who.int/mediacentre/factsheets/fs313/en/.

Promote sustainable forest management, reduce deforestation and promote afforestation. Reduce degradation of natural habitats and halt biodiversity loss

Issues

The establishment of forest reserves in Nigeria was at its peak during colonial times. Although a number of these reserves can still be identified within the Ibadan locality, they now comprise a reduced forest area as woodland has been cut down for fuel and conversion of land to agriculture or settlements.

Interventions

Where extensive tracts of forest to the south-east of Ibadan can still be identified these have been designated as Forest Protection Areas (FPA). The southern FPA includes Gambari Forest Reserve. Although this reserve, as with other forest reserves in Ibadan, has undergone deforestation and land degradation, the wider Gambari area does not appear to have been as extensively deforested. This is perhaps due to the management of large tracts of plantation forest, where tree species such as teak have been grown to supply durable wood for furniture and other uses.

As previously discussed in relation to flood plain management, the area to the north-east of Ibadan is also designated as FPA within the masterplan.

To the north-west of the masterplan area lies the previously extensive Ijayie Forest Reserve. Little of this original forest remains as land has been lost to agriculture. However a tract of hill forest remains in the vicinity of Ogbontosa and this has also been designated as FPA, in order to protect what remains of this once large reserve.

WASTE MANAGEMENT

Increase the percentage of urban solid waste regularly collected, processed and recycled

Issues

It is reported that around 70% of generated solid waste within the Ibadan built-up area is dumped into the drainage systems, on empty land plots, and on pavements and footpaths[4], and in so doing has significantly contributed to the issues of flooding. Currently, waste collection services are provided by Oyo State Solid Waste Management Authority (OYOWMA), by local government areas and by the private sector.

Interventions

The consultant has prepared recommendations for the improvement of solid waste management throughout the Ibadan district. This involves both institutional regulations and sustainable implementation measures. Recommendations for an integrated Site Waste Management Plan (SWMP) have included: solid waste storage, collection/transfer, and ultimate treatment and disposal[5].

Resettlement

Limit the need for resettlement of established communities

The draft masterplan aims to limit the need for resettlement of established communities and will propose selective redevelopment of established communities hence necessitating minor relocations.

Issues

Minor resettlement may be required however at this stage of the masterplan it is difficult to determine the exact numbers and locations. Details may only be obtained during the development of the Detailed Urban Plans (DUPs).

Interventions

Resettlement Action Plans (RAPs) are required where any resettlement is required as part of the Project proposals and is unavoidable. There are three types of Resettlement Action Plan (RAP): Full RAP; Abbreviated RAP; Land Acquisition and Compensation Plan (LACP).

The essential components of a RAP are the following:

- Identification of project impacts and affected populations,
- A legal framework for land acquisition and compensation,
- A compensation framework,
- A description of resettlement assistance and restoration of livelihood activities,
- A detailed budget,
- An implementation schedule,
- A description of organizational responsibilities,
- A framework for public consultation, participation, and development planning,
- A description of provisions for redress of grievances,
- A framework for monitoring, evaluation, and reporting.

Population Growth

Identifies sufficient land for future population growth

Ibadan has seen a rising population growing at an estimated 2.4% per annum. A major outcome of the rapid population growth of the city over the years is the substantial pressure on social services and urban infrastructure which has resulted in large gaps in provision.

The draft masterplan proposes:

- New expansion areas around the Circular Road to accommodate the future population,
- Densification around new urban centres,
- Infill at the periphery of the city.

The proposed masterplan will have the capacity to accommodate approximately 12 million people by 2036.

4 Ibadan City Masterplan, Diagnostics Report, Section 9.1 Solid Waste.

5 Ibadan City Masterplan, Development Framework Scenarios Report, Section 6.1 Solid Waste.

Issues

The expected growth in population could potentially have the following impacts on the existing population:

- Way of life: that is, how the population live, work, play and interact with each other on a daily basis.
- Traditional culture: that is, their shared beliefs, customs, values and language or dialect. Ibadan has important cultural history and it will be important to preserve this history. With the growing population and proposed changes to Ibadan, there may be an influx of migrant population to Ibadan which could result in the loss of traditional culture.

Interventions

- Way of life: This will improve as the development of administrative centres (a component of the masterplan) will enhance the efficiency of urban areas providing convenience for residents in terms of ease of access to goods, services and job opportunities.
- Traditional culture: In developing the masterplan areas of historical and cultural importance have been identified and will be protected in order to preserve the traditions and identity of Ibadan.

Decision Making

Ensure responsive, inclusive, participatory and representative decision-making at all levels

Issues

The draft masterplan could impact/affect the following:

- Community structure: its cohesion, stability, character, services and facilities.
- Political systems: the extent to which people are able to participate in decisions that affect their lives, the level of democratisation that is taking place and the resources provided for this purpose.

Interventions

Development of the masterplan will provide communities and the local government with a sense of ownership. This will allow Local Government Authorities (LGAs) to have a stronger influence in promoting the development and implementation of necessary policies. Decentralised areas will allow for the restructure of local administration and the promotion of greater community participation.

Flooding

Reduce the number of people affected by flooding and the number of housing units damaged or destroyed

During the Diagnostics Phase of the project, it was discovered that building within the floodplains commonly occurs in Ibadan, particularly in the core areas.

Issues

The risk of flooding is increased because of the human tendency to use the river flood plain to cope with community demands. This is because water is easily available for drinking and for commercial uses and also floodplain land is often flat and easier to develop than hilly land. Due to insufficient understanding about the occurrence of large floods and an appreciation of their consequences, people are often tempted by the apparent benefits of utilising such areas. As a result of developing within the floodplain, such people are the first victims of any flood occurrence.

Interventions

The masterplan promotes management which safeguards people from the effects of flooding, for example by protecting rainfall-absorbing forest cover where possible, and in so doing reduces the peak flow during flood events. The masterplan also identified that illegal settlement in flood plains is common, and recommends proper land zoning, in order to prevent development in flood plains. In addition, identifying designated emergency evacuation points for populations to gather at, in the event of future flooding events.

Green and Public Spaces

Provision of inclusive and accessible green and public spaces

The benefits of having access to urban green space have been well documented and include: greater happiness, improved health, decreased anger, less fatigue, reduced feelings of depression and increased attention levels.

Issues

In 2008, for the first time in history, urban population outnumbered rural population, and by 2050 it is anticipated that two-thirds of the world population will be living in urban environments. Given this anticipated increase in urban population, it is imperative that the Ibadan masterplan along with all urban masterplans incorporates accessible green space.

Interventions

Existing green urban spaces in Ibadan will be safeguarded from development, for example Mokola Hill and Agodi Gardens. Further areas have been identified and mapped as “Strategic Open Space” in order to safeguard areas that will be further developed as accessible green space.

Agricultural Development

Promotes agriculture as a predominant sector contributing to the economy and supporting job creation

Agriculture in urban and peri-urban areas of Ibadan is an important activity in which different socio-economic and demographic classes are engaged, including in related activities as input suppliers, processors, marketers and transporters. Refer also to Section 5.5 of the Ibadan City Masterplan Diagnostics Report, and

Ibadan’s Urban and Peri-urban Agriculture (UPA) systems feature fresh vegetables, cereal and root crops, and a rapidly growing livestock sector in peri-urban areas that includes fish farming. Poultry, eggs and fish produced in Ibadan not only provide for the city but in addition, day-old chicks and eggs are transported to other parts of the country and to other West African countries including Chad, Guinea, Republic of Benin, Togo, and Mali. Peri-urban farmers play a significant role in supplying food to the city, as more than two-thirds of farmers sell more than half their agricultural produce in Ibadan and nearby towns and cities.

Issues

Rapid urban development and population growth in peri-urban areas have negative implications for the availability of agricultural land and for the urban environment. The city has grown at a tremendous rate since the oil boom of the 1970s, and most of the growth is occurring radially in peri-urban areas, and often on environmentally sensitive lands that are used for agriculture and that provide important environmental services, namely floodwater management. As this growth pattern is likely to continue, the city could engulf a significant portion of present-day peri-urban areas, with outlying rural areas developing into new peri-urban ones. Less land will be available for agricultural activities in the city and the hydrology of the catchment area will be further affected by the loss of vegetation cover and subsequent concretisation of land surfaces for settlements and urban infrastructure.

Interventions

The United Nations Environment Programme (UNEP) assessed and made recommendations for agricultural development in Ibadan and reported their findings in their 2014 publication, “Building Urban Resilience – Assessing Urban and Peri-urban Agriculture in Ibadan”. Their report demonstrated that the UPA sector in Ibadan provides a critical source of fresh, nutrient dense foods for the city’s food basket, and is an important livelihood resource for those engaged in UPA. The report also demonstrated, however, that the sector was facing critical challenges to its long-term sustainability stemming from unregulated urban sprawl, environmental degradation, and extreme climatic events. The assessment offered key recommendations as follows:

- Devise policies that recognise and support urban and peri-urban agriculture,
- Encourage a leadership role by the State Ministry of Agriculture,
- Bring greater visibility to UPA in urban land-use planning,
- Address pollution risks to water use and management,
- Support robust waste-to-resource management planning,
- Strengthen urban food supply chains to risks of disruption from flooding,
- Bolster climate risk management and adaptive capacities,
- Address critical knowledge needs and capacity gaps.

The draft masterplan aims to protect agricultural land from encroachment. It is envisaged that, the development of outer administrative centres can lead to improved agricultural administration in the surrounding peri-urban and rural areas.

APPENDIX 10: APPROVAL ORDER

APPROVAL ORDER

INTRODUCTION

The Ibadan Masterplan forms a 20 year spatial planning strategy that will shape development from 2018 through to 2036. It directs growth in targeted places and identifies key infrastructure projects that will support the Ibadan in becoming a regional hub for Oyo State. This approval order provides a summary of planning regulations defined within the Ibadan Masterplan. It is intended to guide decision making and development by Oyo State Government and provide certainty to acceptable forms and content of development proposals.

A series of detailed urban plans (DUPs) have been prepared covering the following topics:

- Flood prone areas
- Core Area
- Circular Road

The DUPs contain detailed guidance and potential projects to be implemented. They should be read alongside the masterplan and this approval order.

PLANNING STRATEGY

Spatial Development Strategy

The Ibadan Masterplan contains several land uses zones which promote appropriate development to specific areas in line with the objectives of the plan. The planning strategy sets out the broad spatial development strategy, indicating the spatial hierarchy of activity centres, and detailed land use development regulations.

New Development Areas

Growth Centres

New Development Areas (NDA):

Policy NDA1: Growth Centres are to be developed outside the existing urban area. These will comprise of high density, mixed use developments and will be fully accessible by public and private transport, including pedestrians and cyclists.

Urban Expansion Areas

New Development Areas (NDA):

Policy NDA2: Urban expansion areas are to be developed around the existing urban area and proposed Growth Centres. These will comprise of medium density residential developments with other associated uses.

Infill Areas

New Development Areas (NDA):

Policy NDA3: Infill areas are to be developed on the periphery of the existing urban area. New development within infill areas shall reinforce the strength and value of existing communities and respect the existing character.

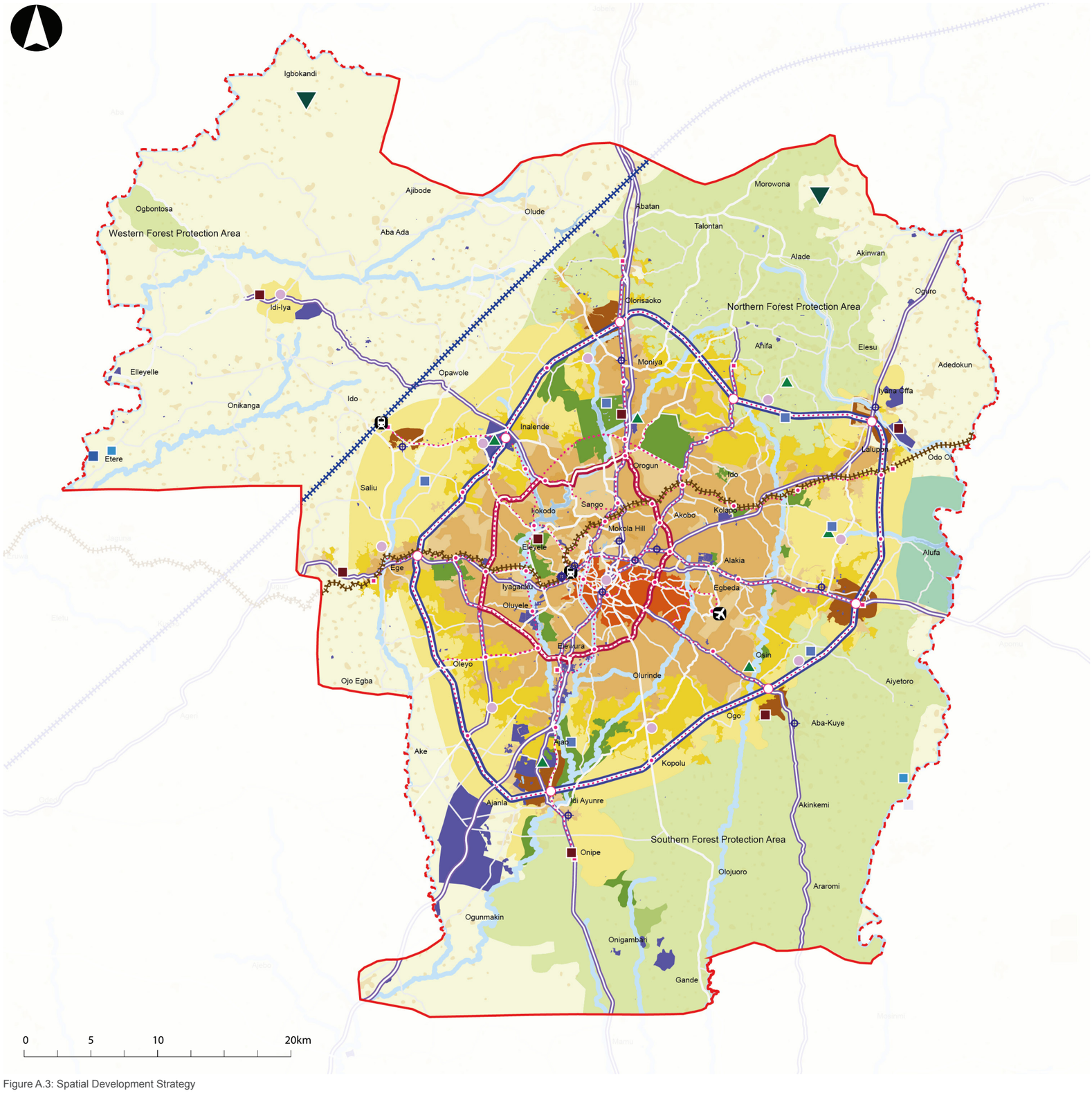


Figure A.3: Spatial Development Strategy

Development Principles

This section describes a number of development design principles to guide development within Growth Centres, Urban Expansion Areas and Infill Areas. Within existing urban areas, the existing Oyo State spatial standards continue to apply.

Plot and Block Sizing

- **Low density standard block sizes** comprise of four standard low density plots (30m x 24m) back-to-back with a local 10m road dividing them. In this way, properties always front onto a road and blocks have a road hierarchy. A typical block is 240m wide (10 plots) and 130m deep (4 plots and a 10m road) (Figure 3.6);
- **Medium density standard block sizes** comprise of four standard medium density plots (30m x 18m) back-to-back with a local 10m road dividing them. In this way, properties always front onto a road and blocks have a road hierarchy. A typical block is 180m wide (10 plots) and 130m deep (4 plots and a 10m road) (Figure 3.8);
- **High density standard block sizes** comprise of two standard high density plots (30m x 15m) back-to-back. Due to expected high volumes of traffic in high density areas, local 10m roads have not been provided. Roads will typically be 18m wide. A typical block is 150m wide (10 plots) and 60m deep (2 plots) (Figure 3.9);
- **Standard plot sizes can be combined** for larger developments;
- **Low density area typical building heights are 1-2 storeys;**
- **Medium density area typical building heights are 2-4 storeys;**
- **High density area typical building heights are 4-6 storeys;**
- **Taller buildings may be permitted** where appropriate (for instance near LRT stations);
- **Limit the removal of existing structures** to reduce impact on existing communities;
- **Infill development is medium or high density;**
- **No development on flood corridors and flood prone areas.** These spaces can be used as public open space when not flooded.

Transport

- **Permeability.** All areas should have a direct and legible road network (Figure 3.7);
- **Upgrade existing roads** and connect to new roads to ensure new communities are integrated with existing ones (Figure 3.7);
- **Road network planned around flood corridors and flood prone areas** (Figure 3.10).
- **Culvert to be provided where it is absolutely necessary for a road to cross a river,** to allow for river flow;

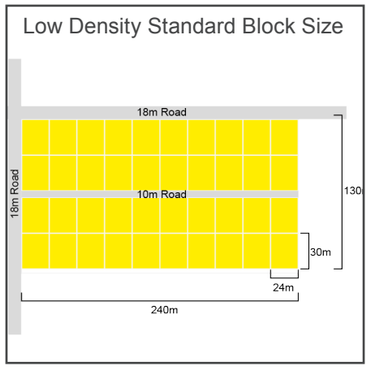


Figure A.4: Low Density Standard Block Size

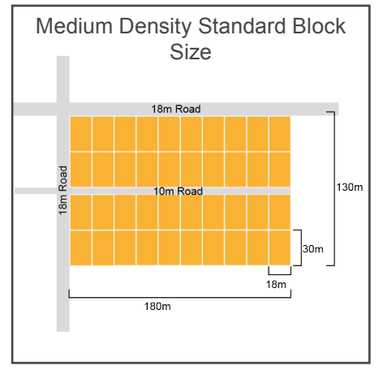


Figure A.6: Medium Density Standard Block Size

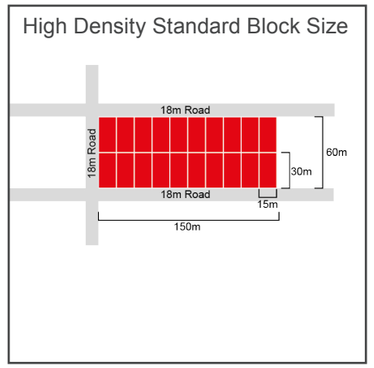


Figure A.7: High Density Standard Block Size

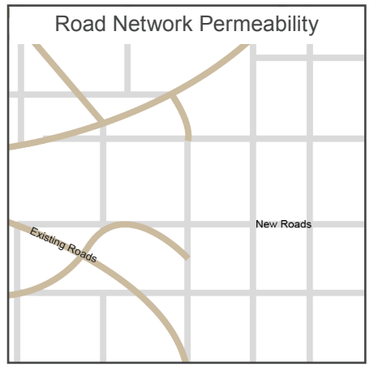


Figure A.5: Permeable Road Network, Upgraded Roads Connect to New Roads

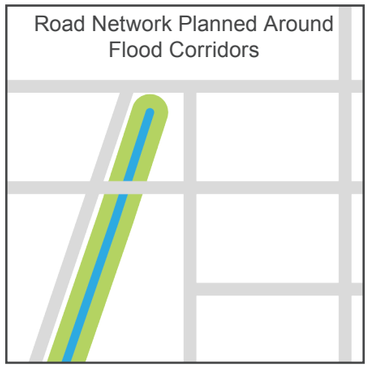


Figure A.8: Road Network Planned Around Flood Corridors and Flood Prone Areas

ZONING REGULATIONS FOR URBAN EXPANSION AREAS

The zoning regulations offer a set of coherent guidelines to regulate the use and development of urban expansion areas in Ibadan. They provide a useful tool to control and guide new development and create an attractive environment where people would want to live.

The main objectives are:

- To provide guidance to plan for new residential communities and meet their housing needs.
- To provide a variety of housing typologies and mix in density alongside meeting housing targets.
- To enable other land uses that provide facilities or services to meet the needs of residents.

For zoning of the urban expansion areas, residential density is used as a basis to provide a range across the city, as follows (an as illustrated in Figure 3.26):

- Residential Area 1 (RA1) - High Density;
- Residential Area 2 (RA2) - Medium Density;
- Residential Area 3 (RA3) - Low Density.

Uses

Uses define the types of additional and complimentary development allowed within a particular residential zone. These are categorised into permitted uses, conditional uses and prohibited uses, as follows:

- Permitted Uses (those that are permitted) - A use that is allowed outright in a particular zone, as it is unlikely to give rise to significant adverse impacts. Any proposed development must meet the development standards of the zone.
- Conditional Uses (those that may be permitted) - A use that is not allowed outright, although it may have beneficial aspects and serve important public interests. Examples of conditional uses in residential zones include agriculture, schools, religious institutions, and fire stations. Conditional use regulations are needed because such uses may have significant adverse effects on the environment, overburden public services, change the desired character of the area, or create a significant nuisance. It may be appropriate to allow the use when there are minimal impacts, allow the use with conditions that reduce impacts, or deny the use if impacts cannot be reduced. Limits on the amount of visitors to the site, the size of the facility, or other aspects of the use are examples of conditions to reduce impacts.
- Prohibited Uses (those that are not permitted) - Some types of uses or development are prohibited in certain zones.

Each residential zone within Ibadan has been assigned permitted, conditional and prohibited uses. The uses for each residential zone are indicated in Table 3.4. Further details on the residential zones and density is set out in Section 3.2.3.

Zoning Standards for Residential Zones

The zoning standards regulate and guide development within the designated new residential zones. Zoning is an important tool for guiding development and use of land, curbing the misuse of land and promoting rational and orderly development of the built environment. The plot coverage restrictions should be strictly enforced as these provide the opportunity for green space to be integrated into the context of residential areas. Each plot should be encouraged to use the undeveloped part for gardens that provide amenity benefits and the opportunity for small-scale urban agriculture, which assists with ensuring local food security. Maximising green space also contributes to reducing surface water runoff, which helps to mitigate flood risk.

The zoning standards seek to control the plot area, sizes, plot coverage and setbacks of a building. The tables below set out the zoning standards for each new residential zone.

Table A.8: RA1 Zoning Standards

RESIDENTIAL AREA ZONE - RA1	STANDARDS
Plot Density	High Density
Plot Area (Sqm)	450.00
Plot Size Options (m)	15.0 X 30.0
Maximum Plot Coverage	50%
Minimum Front Setback (m)	5.0
Minimum Back Setback (m)	1.8
Minimum Left Setback (m)	1.8
Minimum Right Setback (m)	1.8

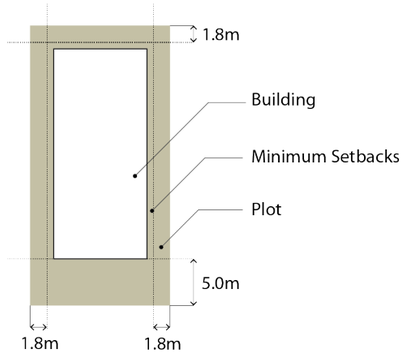


Figure A.9: RA1 Standard Plot

Table A.9: RA2 Zoning Standards

RESIDENTIAL AREA ZONE - RA2	STANDARDS
Plot Density	Medium Density
Plot Area (Sqm)	540.00
Plot Size Options (m)	18.0 X 30.0
Maximum Plot Coverage	45%
Minimum Front Setback (m)	4.5
Minimum Back Setback (m)	1.8
Minimum Left Setback (m)	3.0
Minimum Right Setback (m)	1.8

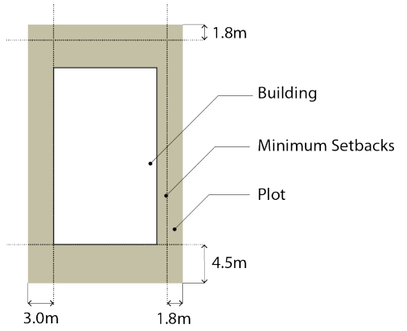


Figure A.10: RA2 Standard Plot

Table A.10: RA3 Zoning Standards

RESIDENTIAL AREA ZONE - RA3	STANDARDS
Plot Density	Low Density
Plot Area (Sqm)	720.00
Plot Size Options (m)	24.38 X 30.0
Maximum Plot Coverage	40%
Minimum Front Setback (m)	6.0
Minimum Back Setback (m)	3.0
Minimum Left Setback (m)	3.0
Minimum Right Setback (m)	3.0

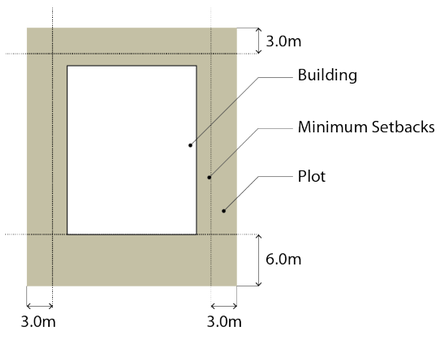


Figure A.11: RA3 Standard Plot

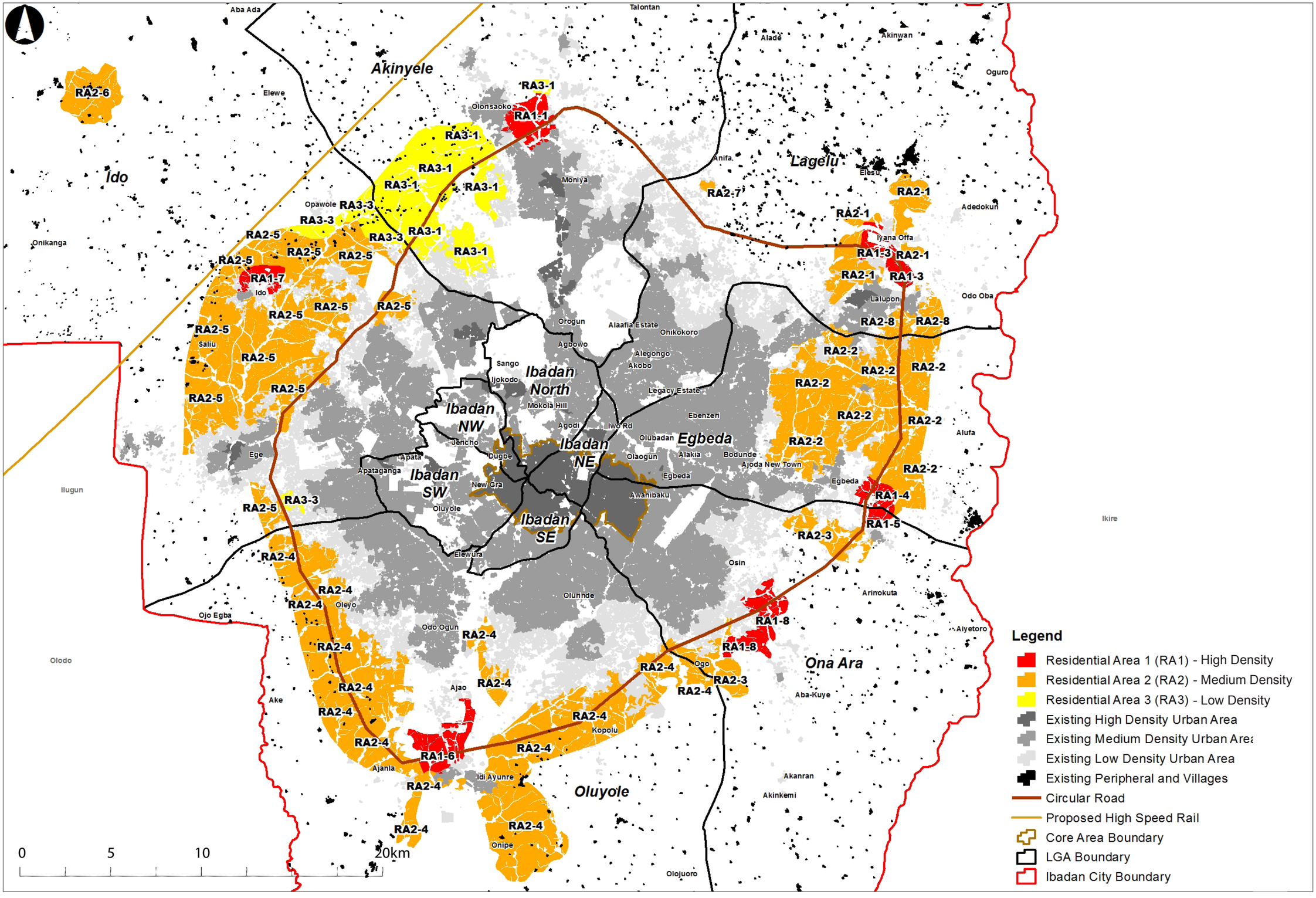


Figure A.12: Residential Zoning Map

Table A.11: Residential Permitted, Conditional and Prohibited Uses

RESIDENTIAL AREA ZONE	PERMITTED USE	CONDITIONAL USE	PROHIBITED USE
RA 1	**Residential** - duplexes, maisonettes, apartments/flats. **Commercial** - retail, shopping centres, commercial centres, convenience shopping, local/weekly markets, offices and business hubs.. **Leisure and Recreation** - hotels, motels, guest houses, restaurants, cafes, sports facilities. **Educational facilities** - high schools, colleges, universities, research institutes, training centres, vocational centres, primary schools, secondary schools. **Health Facilities** - clinics, hospitals, primary health centres, secondary health centres. **Social and Cultural Institutions** - clubs, theatres, concert halls, auditoriums, cinema halls, exhibition halls and art galleries, libraries, community centre, visitor centres. **Transport Infrastructure** - roads, rail, bus stops, rail stations, car parks, taxi ranks. **Open Spaces** - parks, gardens, playgrounds, public squares, urban agriculture. **Public Buildings** - LGA headquarters, other government offices, banks and other financial institutions. **Other Community Facilities** - Police stations, fire stations.	**Other Community Facilities** - Places of worship, cemeteries. **Commercial** - Petrol filling stations. **Leisure and Recreation** - Stadiums, amusement parks. **Infrastructure and Utilities** - Mobile phone base stations.	**Industrial** - Printing press, publishing houses, manufacturing, mills, petrochemical and steel industries, mineral works, gas works, water works, metal fabrication. **Light Industry** - wood works, shoe factory, garment industry, motor repair workshop, dry cleaning, watch repairs, cobblers, electronic repairs, welding workshop, agro-based, allied industries, logistics/warehousing facilities.. **Open Spaces** - zoos, zoological gardens, botanical gardens. **Infrastructure and Utilities** - solid waste and sewage treatment plants, electric power stations, water pumping stations. **Transport Infrastructure** - bus depots, truck depots, lorry depots, motor parks, rail yards, airport. **Leisure and Recreation** - amusement parks, golf courses, resorts. **Residential** - detached houses, villas, cottages.
RA 2	**Residential** - detached houses, duplexes, maisonettes, apartments/flats. **Commercial** - retail, commercial centres, convenience shopping, local/weekly markets, offices. **Leisure and Recreation** - hotels, motels, guest houses, restaurants, cafes, sports facilities, stadium, clubs. **Educational Facilities** - primary, secondary and high schools, colleges, training centres, vocational centres. **Health Facilities** - primary and secondary health centres. **Social and Cultural Institutions** - auditoriums, cinema halls, exhibition halls and art galleries, library, community centre, clubs, concert halls, theatres. **Transport Infrastructure** - roads, bus stops, rail stations, car parks, taxi ranks, bus depots, truck depots, lorry depots, car parks, railways. **Open Spaces** - parks, gardens, playgrounds, public squares, urban agriculture. **Public Buildings** - government offices, banks and other financial institutions. **Other Community Facilities** - Places of worship, police stations, fire stations, cemeteries.	**Light Industrial** - wood works, shoe factories, garment industries, motor repair workshops, dry cleaning, watch repairs, cobblers, electronic repairs, welding workshops, agro-based, allied industries. **Residential** - villas, cottages. **Commercial** - shopping centres, business hubs. **Leisure and Recreation** - stadiums, amusement parks, golf courses, resorts. **Educational Facilities** - universities, research institutions. **Health Facilities** - clinics, hospitals. **Social and Cultural Institutions** - visitor centres. **Open Space** - zoos, zoological gardens, botanical gardens. **Public Buildings** - government offices. **Infrastructure and Utilities** - Solid waste/sewage treatment plants, electric power station, water pumping stations, Mobile phone base stations.	**Industrial** - Printing press, publishing houses, manufacturing, mills, petrochemical and steel industries, mineral works, gas works, water works, metal fabrication), logistics/warehousing facilities. **Transport Infrastructure** - airports. **Public Buildings** - government offices.
RA 3	**Residential** - villas, cottages, detached houses. **Commercial** - retail, convenience shopping, local/weekly markets. **Leisure and Recreation** - restaurants, cafes, sports facilities. **Educational Facilities** - primary and secondary schools. **Health Facilities** - primary and secondary health centres. **Social and Cultural Institutions** - cinema halls, library, community centres. **Transport Infrastructure** - roads, rail, bus and rail stops, car parks, taxi stands. **Open Spaces** - parks, gardens, playgrounds, urban agriculture. **Public Buildings** - government offices, banks and other financial institutions. **Other Community Facilities** - Places of worship, police stations, fire stations, cemeteries. **Light Industrial** - wood works, shoe factories, garment industry, motor repair workshops, dry cleaning, watch repairs, cobblers, electronic repairs, welding workshops, agro-based, allied industries.	**Commercial** - Shopping centres, business hubs. **Educational Facilities** - Universities, research institutions. **Infrastructure and Utilities** - solid waste and sewage treatment plants, electric power stations, water pumping stations. **Commercial** - commercial centres, offices. **Leisure and Recreation** - golf courses, resorts, stadiums, amusements parks. **Social and Cultural Institutions** - auditoriums, cinemas, exhibition halls, art galleries. **Open Space** - zoos, zoological gardens, botanical gardens. **Infrastructure and Utilities** - Mobile phone base stations. **Transport Infrastructure** - Solid waste/sewage treatment plants, electric power station, water pumping stations, bus depots, truck depots, lorry depots, car parks, railways, airports.	**Public Buildings** - government offices. **Industrial** - Printing press, publishing houses, manufacturing, mills, petrochemical and steel industries, mineral works, gas works, water works, metal fabrication, logistics/warehousing facilities. **Residential** - duplexes, maisonettes, apartments/flats. **Health Facilities** - Hospitals. **Social and Cultural Institutions** - visitor centres.

Regeneration of the Core Area (RCA):

Policy RCA1:

Urban regeneration will enhance Ibadan's Core Area and Dugbe. This will be achieved by undertaking the following improvements:

- Upgrading and widening roads and pavements, where required, to improve the flow and safety of traffic and pedestrians in the local street network to allow for access from utility vehicles.
- Constructing new secondary and tertiary roads in order to improve connectivity within the Core Area.
- When upgrading existing roads and constructing new roads, ensure that:
  - Designated areas for car parking and danfo lay-bys are provided in order to meet parking needs.
  - Restrictions on parking/stopping outside of designated areas are properly enforced in order to prevent unauthorised parking/stopping.
  - Opportunities to lay upgraded or new utilities infrastructure within roads are taken.
  - Sufficient road widths are provided to accommodate the above and to allow access by utilities vehicles.
- Supporting the refurbishment or redevelopment of dilapidated buildings.
- Underaking public realm improvements.
- Upgrading or developing new water, sewerage, waste and electricity infrastructure, where required.
- Upgrading traditional market facilities, where required.

Policy RCA2:

The streetscape and public realm in Dugbe will be enhanced and improved to provide a welcoming and attractive environment for pedestrians and cyclists.

LAND USE DISTRIBUTION

Residential (R) Land Use:

Policy R1: New Residential areas are to be developed according to a range of high, medium and low densities.

Policy R2: New and existing residential areas are to be integrated with the emerging transport and infrastructure proposals.

Policy R3: New residential areas must be accessible and well connected to the local road network.

Policy R4: Existing residential areas should retain a predominant residential character and use.

Commercial and Mixed Use (CMU) Land Use:

Policy CMU1: Commercial activity is to be promoted within the proposed urban expansion areas, with a particular focus on the high density Growth Centres.

Policy CMU2: Local Centres will be distributed across the urban expansion areas and urban infill in order to provide services and facilities in close proximity to local communities.

Policy CMU3: In order to encourage vitality and diversity in centres, a range of land uses related to commercial activity including retail, markets (formal and informal), shopping centres, hotels, markets, banks and offices will be provided in combination with other uses such as residential and community facilities. A higher degree of mixed uses will be promoted in the Growth Centres in particular.

Industry (I) Land Use:

Policy I1: New industrial development is to be planned and developed in the following areas:

- Idi-Iya,
- Inalende,
- Ajanla,
- Iyana Offa/ Lalupon.

Agriculture (AG):

Policy AG1: No development will be permitted on land designated as Agriculture. Exceptions are made to structures that are directly related to agriculture, including storage facilities, farms or other ancillary buildings and structures. Such developments, if required, should:

- Minimise any negative visual impact on the agricultural land.
- Be limited in scope and in the amount of building footprint.

Policy AG2: All land identified for agriculture is to be preserved predominantly for agricultural use.

Open Space and Recreation (OS):

Policy OS1: Strategic Open Space will be used for recreation or open space. No development is permitted in land designated as Strategic Open Space.

Policy OS2: No development is permitted in designated Forest Protection Areas other than to support sustainable forestry-related facilities, for tourism or managed harvesting.

Policy OS3: Tree felling is not permitted in Forest Protection Areas, unless exceptional circumstances can be demonstrated and the proposal is supported by a management strategy that leads to a net increase in tree coverage

Policy OS4: Existing recreation facilities will be enhanced within the existing urban areas.

Policy OS5: Recreation facilities within open spaces that run along the river corridors will be used for water retention during flood events.

Policy OS6: An equitable distribution of open space will be provided across Ibadan.

Policy OS7 : A comprehensive survey of trees and vegetation should be undertaken. Those that are identified as significant should be retained and protected from felling.

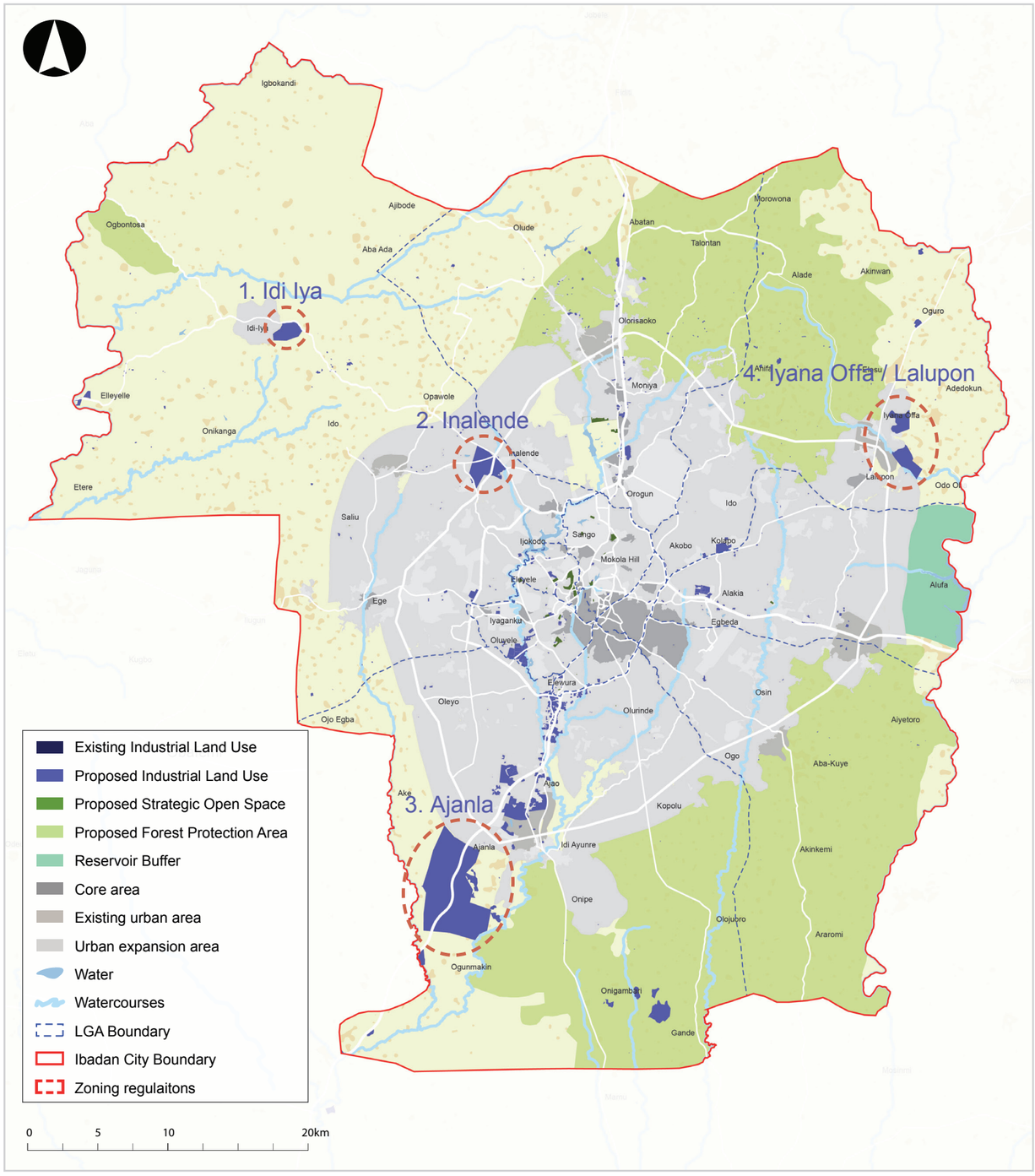


Figure A.13: Industrial Land use 2036

Social Infrastructure Provision

This section outlines the strategy for the provision of education, health, security and cemeteries.

Education

The masterplan proposes an adequate and equitable distribution of education facilities in the new expansion areas to meet the needs of the emerging population growth and should have easy access to public transport. It also proposes to meet the deficiency of educational facilities within the existing built-up areas where required.

Table A.12: Additional schools needed by 2036 at current levels of provision

PRIMARY SCHOOLS (1:3,000 PEOPLE)	SECONDARY SCHOOLS (1:10,000 PEOPLE)
1,421	584

Education (E):

Policy E1: The distribution of new educational facilities should seek to meet maximum walking distances from residential areas for primary schools and secondary schools should be 400m and 800m, respectively.

Policy E2: Education facilities are to be provided to meet the identified deficiency in the existing urban areas.

Health

The masterplan proposes an adequate and equitable distribution of health facilities in the deficient existing urban areas and the new expansion areas. New secondary level healthcare facilities will be provided in the proposed high density development areas while additional primary healthcare facilities will be distributed evenly throughout the proposed expansion areas.

Table A.13: Additional healthcare facilities needed by 2036 at current levels of provision

PRIMARY HEALTH FACILITIES (1:15,000 PEOPLE)
237

Table A.14: Proposed number of new additional secondary healthcare facilities by 2036

SECONDARY HEALTH FACILITIES
7

Health (H):

Policy H1: New primary health facilities will be developed to ensure all residents are within a 400m walking distance.

Policy H2: One secondary healthcare facility is to be provided in each of the new Growth Centres and the Idi-Iya expansion area, totalling 7 additional centres.

Policy H3: Health facilities are to be provided to meet the identified deficiency in the existing urban areas.

Cemeteries

Cemetery (CM):

Policy CM1: New cemeteries will be provided based on the annual population growth and death rate.

Policy CM2: Provision of new cemeteries will prioritise residential areas.

Policy CM3: New cemeteries will prioritise accessibility to road access and public transport facilities.

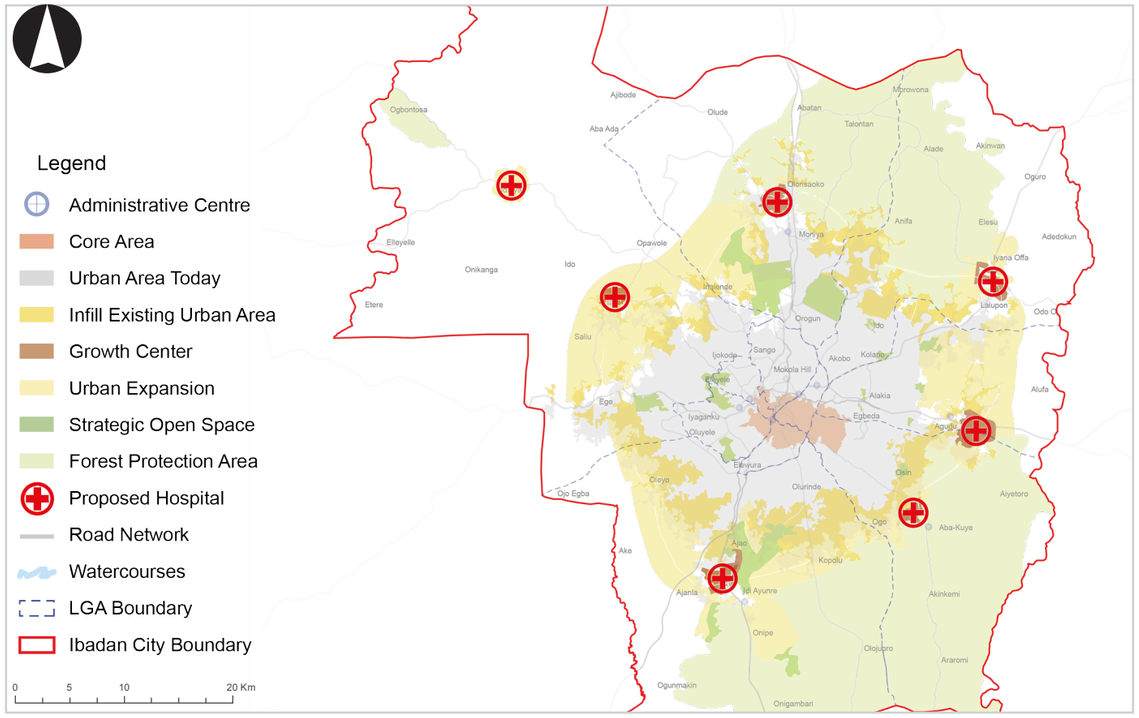


Figure A.14: Proposed distribution of new additional secondary healthcare facilities

Police Station

In Ibadan, there are currently 23 police stations, mostly located in the inner LGAs with a good provision in Ibadan North. There are large areas of deficiency in the periphery of the city. In order to map deficiencies and plan for future provision, a service catchment of 2.4km is used as this represents approximately 10 minutes driving time in a busy urban area. To provide police stations at this standard, the city will require an additional 55 police stations by 2036. Areas of existing deficiency should be provided for, and stations will be built alongside residential development in planned expansion areas. However, the provision of police stations should be prioritised in Growth Centres where the enhanced road network will improve response time.

Security (SE):

Policy SE1: Fire Stations will be provided based to ensure all residents are within 2.4km of at least one Fire Station.

Policy SE2: The provision of new fire stations will be prioritised in Growth Centres.

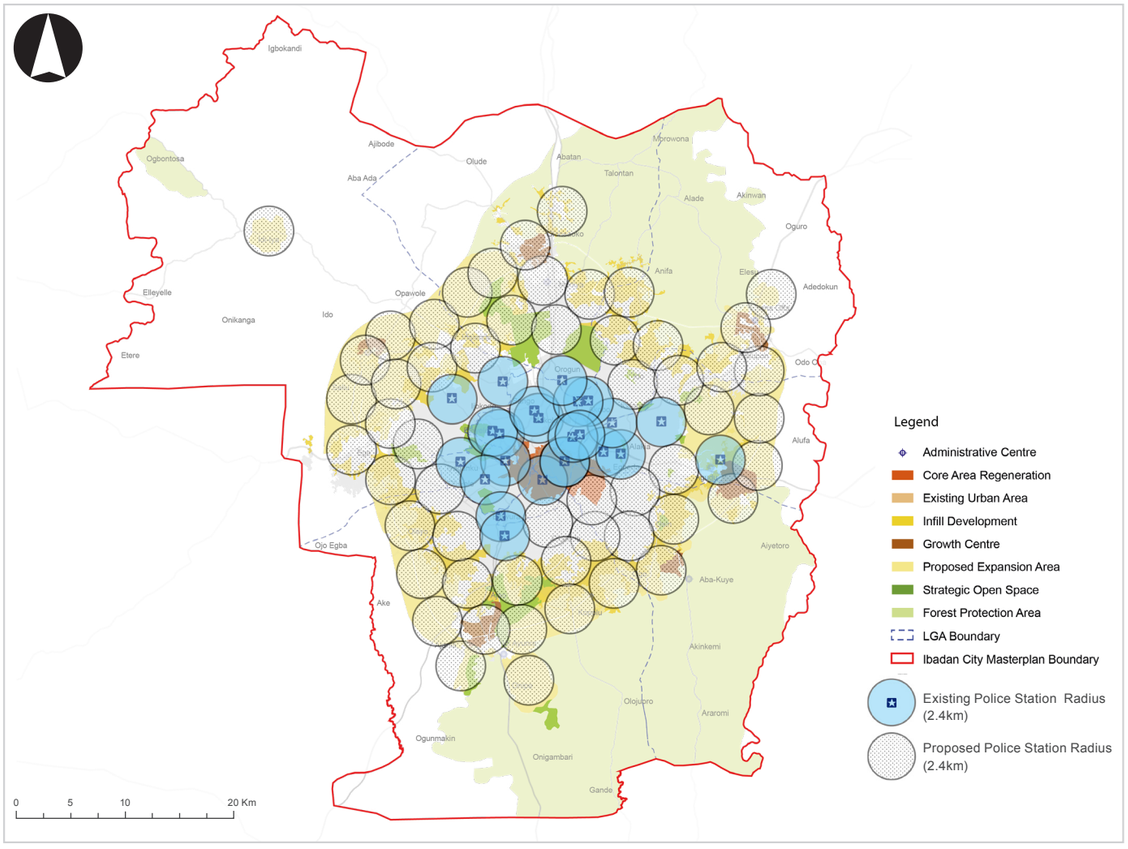


Figure A.16: Proposed Distribution of Police Stations

Fire Station

There are currently 7 fire stations in Ibadan: two within the core area, with the others in outer LGAs. In order to identify deficiencies and future need, a service catchment is used. 2.4km takes approximately 10 minutes to drive in a busy urban environment. This is a good response time for emergency services and is used to map existing and future provision. In order to cover the whole city and expansion areas, it is estimated that Ibadan will require 67 additional stations by 2036. As this represents an ambitious level of investment, it is proposed that the provision of fire stations is prioritised in Growth Centres, where emergency vehicles can benefit from the circular road and upgraded radial routes. This would extend their service catchment.

Security (SE):

Policy SE1: Fire Stations will be provided based to ensure all residents are within 2.4km of at least one Fire Station.

Policy SE2: The provision of new fire stations will be prioritised in Growth Centres.

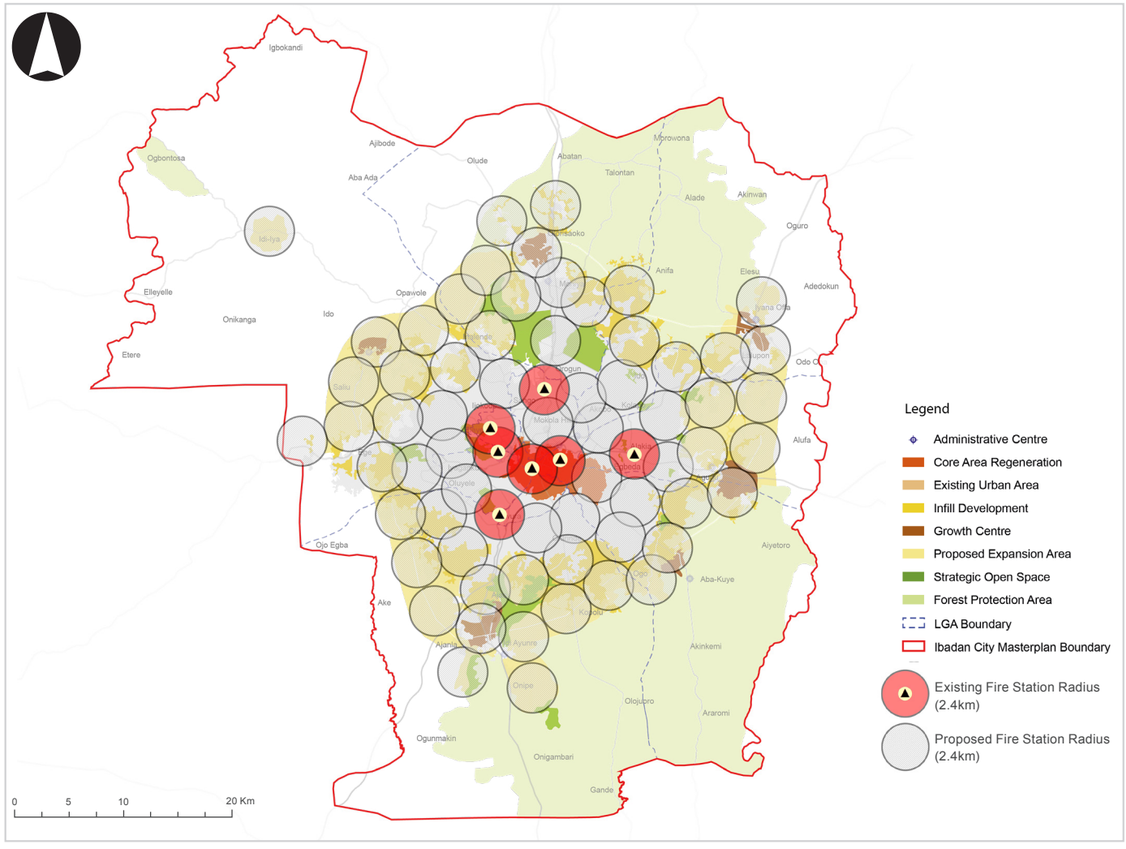


Figure A.15: Proposed Distribution of Fire Stations

CULTURE, HERITAGE AND TOURISM

This section discusses the principles of heritage conservation and outlines the potential for tourism in Ibadan. Although tourism and heritage are presented separately, the link between them cannot be over-emphasised.

Heritage

Ibadan contains many buildings of historic and cultural value. The history of the city can be interpreted through the built environment which includes traditional Nigerian structures, colonial-era architecture and modernist buildings built in the mid 20th century. The purpose of designating particular buildings and areas as heritage assets is to acknowledge their contribution to the urban environment and culture of the city. The actions and regulations that accompany heritage designation will vary depending on individual buildings and areas.

Heritage Buffer Zones

Heritage buffer zones are areas around historical buildings or sites which possess additional development restrictions. Within heritage buffer zones, the use and physical form is regulated in order to reinforce and enhance the conservation value of the building or site. Two layers of buffer zones comprising of a 25m and 50m buffer are demarcated from the boundary of the building/site curtilage. The 25m buffer zone consists of the immediate setting of a heritage building with greater associative value and therefore higher levels of restriction. The 50m buffer zone comprises of the wider context of the heritage building, and thus less restriction to development. This creates a transition and a gradient of the level of protection around the heritage site.

In order to protect historical buildings from incompatible uses, a breakdown of recommended permitted, conditional and prohibited uses within heritage buffer zones is provided in Table 3.9. Permitted uses are those which have no negative effect on a heritage building/site and therefore have no extra level of restriction applied. Conditional uses may be allowed within a heritage buffer zone. Prohibited uses will generally not be permitted within a buffer zone. There are separate levels of control for 25m buffers and 50m buffers.

Formalising Heritage Conservation

The buildings and sites identified in Figure 3.44 provide a starting point for a comprehensive list of Ibadan's built heritage. It should be added to over time as more buildings are identified and local expertise grows. It is suggested that the identification and protection of heritage assets be managed by the Ministry of Information, Culture and Tourism with a close relationship to the Bureau of Physical Planning and Development Control.

The locations and descriptions of protected heritage buildings and sites should be publicly available and used by local authorities for planning and development management. The owners/users of heritage buildings should be made aware of the formal protection and their role in the conservation process. This sensitisation will reduce the need for enforcement, which will be undertaken as part of the planning process.

25m and 50m heritage buffer zones should be demarcated for all identified heritage buildings and sites and made available to local authorities to assist in decision making.

Heritage (H):

Policy H1: Identified buildings and sites of special historic, cultural or architectural significance will be formally protected from demolition and significant alteration, to preserve and enhance their significance.

Policy H2: Development within a 25m or 50m heritage buffer zone of a heritage building/site must respect the historical context in terms of:

- Scale, height, mass, bulk and form of development;
- Plot sizes, plot coverage and street patterns;
- Building lines and setbacks;
- Roof line and roof forms;
- Streetscape rhythm and other streetscape elements;
- Architectural features and design elements applied on facades, and;
- Colour and use of materials.

Policy H3: Development within 50m of an identified heritage building will only be permitted where it is identified as an appropriate, permitted use. Conditional uses will be permitted providing that they do not harm the setting of the heritage building or site. Prohibited uses will not be allowed in heritage buffer zones.

Policy H4: If during construction works, evidence of archaeological findings are apparent, construction should be stopped and investigations undertaken to verify the value of these findings.

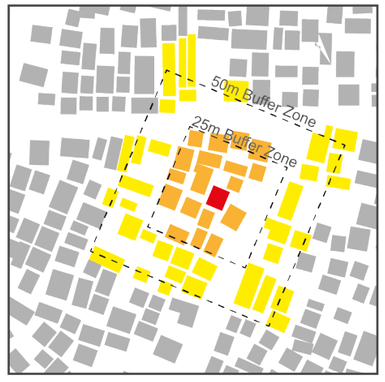


Figure A.17: Heritage Buffer Zones: Example 1

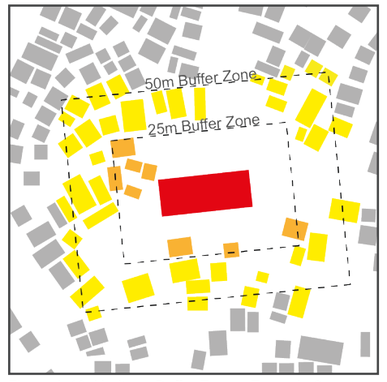


Figure A.18: Heritage Buffer Zones: Example 2

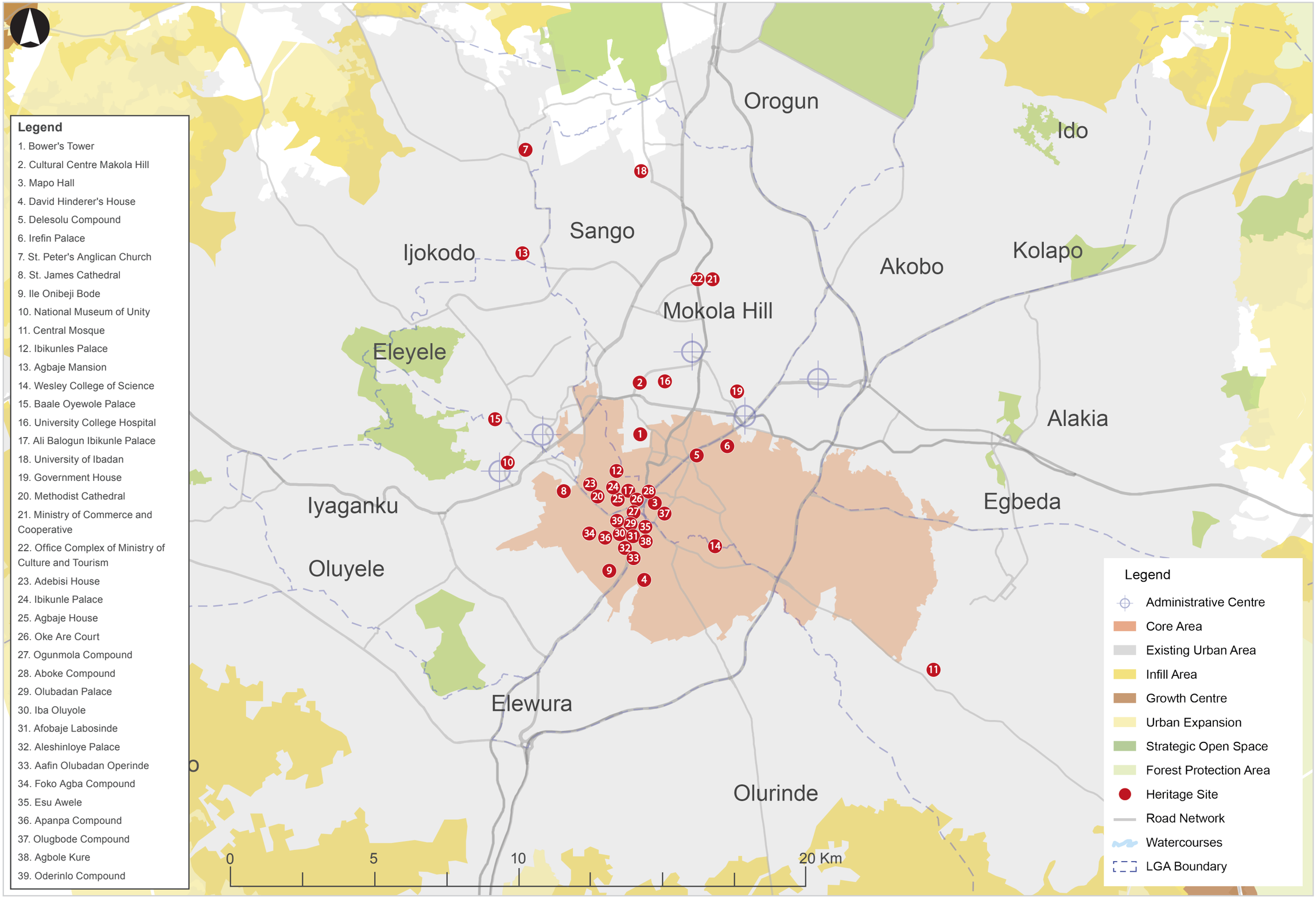


Figure A.19: Heritage Buildings and Sites

Table A.15: Permitted, Conditional and Prohibited Use Recommendations for Buffer Zones

BUFFER ZONE	PERMITTED USE	CONDITIONAL USE	PROHIBITED USE
25m Buffer Zone	• **Residential** - detached houses, duplexes, masionettes, row housing, apartments/flats, etc. • **Commercial** - retail, shopping centres, petrol stations, convenience shopping, local/ weekly markets, offices etc. • **Educational Facilities** - primary schools, secondary schools and universities. • **Leisure and Recreation** - hotels, restaurants, cafes, sports facilities, etc. • **Health Facilities** - primary and secondary health facilities, clinics. • **Government and Institutional** - theatres, concert halls, auditoriums, cinema halls, exhibition halls and art galleries, libraries, community centres, visitor centres, LGA headquarters, other government offices. • **Transport infrastructure** - roads, rail, bus stops, rail stops, taxi ranks, car parks, etc. • **Open Space** - parks, gardens, playgrounds, public squares, sports pitches, urban agriculture, etc. • **Community Facilities** - public toilets, fire stations, police stations, cemeteries. • **Places of Worship** - churches, mosques, other worship centres.	• **Light Industry** - wood works, shoe factories, garment industry, motor repair workshops, dry cleaners, watch repairs, cobblers, electronic repairs, welding workshops, warehousing, etc. • **Sports Facilities** - stadiums. • **Transport Infrastructure** - bus depots, truck depots, rail depots, airports.	• **Heavy Industry** - Petrochemical and steel industries, mineral works, gas works, water works, metal fabrication, etc. • **Infrastructure** - solid waste and sewage treatment plants, electric power stations, etc.
50m Buffer Zone	• **Residential** - detached houses, duplexes, maisonettes, row housing, apartments/flats, etc. • **Commercial** - retail, shopping centres, petrol stations, convenience shopping, local/ weekly markets, offices, etc. • **Leisure and Recreation** - hotels, restaurants, cafes, sports facilities, etc. • **Educational Facilities** - primary schools, secondary schools and universities • **Health Facilities** - primary and secondary health centres, clinics. • **Transport Infrastructure** - roads, rail, bus stops, rail stops, car park, taxi ranks, etc. • **Open Space** - parks, gardens, playgrounds, public squares, sports pitches, urban agriculture, etc. • **Government and Institutional** - theatres, concert halls, auditoriums, cinema halls, exhibition halls and art galleries, libraries, community centres, visitor centres, LGA headquarters, other government offices. • **Community Facilities** - public toilets, fire stations, police stations. • **Places of Worship** - churches, mosques, other worship centres. • **Light Industry** - wood works, shoe factories, garment industries, motor repair workshops, dry cleaners, watch repairs, cobblers, electronic repairs, welding workshops, warehousing, etc. • **Sports Facilities** - stadiums.	• **Transport Infrastructure** - bus depots, truck depots, lorry depots, rail depots, airports. • **Infrastructure** - solid waste and sewage treatment plants, electric power stations, etc.	• **Heavy Industry** - Petrochemical and steel industries, mineral works, gas works, water works, metal fabrication, etc.

DRAINAGE

Drainage (D): Establishment of Policies, Laws and Regulations

The laws and regulations governing development in Ibadan, as far as the recognition of flood hazards are concerned, are generally inadequate to protect the populace from floods. In this respect, the establishment of the following policies, laws and regulations is recommended:

Policy D1: Delimitation of Set-Backs: The existing statutory set-backs to the major streams and rivers are inadequate in the face of increased urbanisation in the city. It is highly necessary to review existing laws and regulations to accommodate the extent of natural flood plains of the streams and rivers for flood control. No development should be permitted in any area identified as prone to flooding.

Policy D2: Restrict Dumping Refuse in Unauthorised Locations: Empower and equip the Environmental Health Department of Local Governments within Ibadan Metropolis to enforce laws and regulations to prevent the indiscriminate dumping of refuse and waste in unauthorised locations.

Policy D3: Enforce Developers use Sustainable Urban Drainage Systems: Provide policies and regulations to enforce developers' use sustainable urban drainage systems and best management practice in order to ensure that storm water runoff remains with their same values prior to urbanisation.

Policy D4: Restrict Deforestation and Enforce Tree Protection: Provide policies and regulations to stop developers from damaging forests or the removal of trees by applying and executing strict penalties for such violations.

Policy D5: Climate Change Adaptation and Beautification: One of the most potent preventive measures against flooding is vegetation. The Oyo State Government should adopt a policy of "Greening" Ibadan through planting of trees and shrubs. This will reduce runoff and therefore flooding, preserve soil moisture and reduce the rate of atmospheric warming. Vegetation cover, especially trees along flood plains, also reduce the inland penetration of wind and water, as well as provide brief refuge from a rising tide. In addition to these ecological services, "greening" of the city has the potential to create employment opportunities, enhance the aesthetics of Ibadan, as well as create a conducive environment for recreation and the improvement of human health.

TRANSPORT

The Ibadan Masterplan proposes a number of strategies that seek to resolve congestion issues and improve connectivity. This will be undertaken by establishing a coherent road network with new and upgraded roads, upgraded provision of public transport and creating better options for pedestrians and cyclists.

Road Network

Roads are divided into four categories: Principal, Primary, Collection and Local. The masterplan proposes the use of the circular road that loop the city, allowing vehicular traffic to bypass the central core rather than pass through it. A clear hierarchy of roads is established. Table A.16 presents the different typologies and specifications proposed:

- **Principal Roads:** roads of regional or national significance that connect the major economic centres of the State and those centres to the national road network. They will often be expressways, with restrictions on access and prohibitions on stopping;
- **Primary Roads:** these connect the main urban areas within the State and main economic centres within the city, and link these areas to the Principal Road network. They may range in standard from two-lane single carriageway roads to multi-lane dual carriageways;
- **Collector Roads:** these collect traffic within urban and rural areas and feed that traffic onto the Primary or Principal Road networks. They will normally be two-lane roads but may be of a higher standard where traffic demands are high; and
- **Local Roads:** these provide access to neighbourhoods and to individual sites.

A number of new roads are proposed to enhance connectivity. These roads are identified as strategic additions to connect existing roads and alleviate congestion. Major new roads can be categorised as follows:

- Circular Road.
- Segments of road needed to complete the Inner Ring Road.
- Supporting Collector Roads connecting radial principal roads in new extension areas.

In order to create a functional network system, existing roads need to be upgraded to support the traffic flows. These roads can be separated in 3 different categories:

- Radial roads. Both primary roads that need to be widened, and collector roads that need to be upgraded to primary roads.
- Segments of road needed to complete the Inner Ring Road.
- Supporting Collector Roads connecting different scales of the road network.

Public Transport

Circular Road (CR):

Policy CR1: The Circular Road is planned as an expressway to direct through-traffic away from the urban core and built-up areas. Appropriate signage should be provided to assist in directing vehicles (particularly HGVs) away from the urban core and built-up areas.

Policy CR2: The alignment of the Circular Road should be re-evaluated to maximise benefits and reduce negative impacts.

Policy CR3: The design and impact on the relationship of the Circular Road with the adjacent built environment should be considered.

Inner Ring Road (IRR):

Policy IRR1: The Inner Ring Road is planned to provide improved connectivity within and around the urban core and to allow through-traffic to avoid the urban core.

Policy IRR2: The E1 Expressway from Elewura to Orogun will form part of the Inner Ring Road.

Policy IRR3: Existing roads require upgrading to a suitable standard.

Policy IRR4: New road segments may be required to complete the Ring Road.

Upgrading Roads (UR):

Policy UR1: Identified roads require upgrade in order to properly serve the proposed road network.

New Junctions (NJ):

Policy NJ1: 18 new/upgraded junctions are required to aid the proposed road network.

New Roads (NR):

Policy NR1: New roads are required to complete an interconnected radial road system.

Public Transport (PT):

Policy PT1: A BRT/LRT system will be introduced as a mass-transit public transport service.

Policy PT2: New interchanges, stations and termini will ensure seamless transit from one system to another.

Policy PT3: When upgrading existing roads and constructing new roads, designated areas for Danfo Laybys and bus stops will be implemented to ease access to and use of public transport.

Policy PT4: The Lagos-Kano-Nguru railway line and stations will be upgraded within the city of Ibadan and will supported with the creation of new stations close to high density urban areas in order for the network to form part of the inner city transit network.

Termini and Interchanges

All MRT systems require interchanges with other elements of the public transport system, and integration with other modes of transport such as cars, walking and cycling. A terminal is proposed in close proximity to each administrative centre and its surrounding high density expansion area to make these areas easily accessible and to improve connectivity. In addition to these termini, interchanges have been placed strategically along the network and key junctions have been identified as strategic areas to place further interchanges.

Parking strategy

In order to accommodate for the current and future demands of parking spaces, there is the need to have an array of solutions in place working at different scales.

- Park and Ride at each of the main road intersections with the Circular Road.
- Parking on main upgraded primary roads with designated parking lanes and on lay-bys for a short period of time to load and unload people or goods.

Pedestrian and Cyclist Strategy

Pedestrians and Cyclists (PC):

Policy PC1: The development of non-motorised modes of transport will be promoted.

Policy PC2: Pavements will be widened where possible and new roads designed to integrate cycle paths.

Policy PC3: Pavements are to be maintained and kept free from clutter and safe from passing vehicles

Policy PC4: The flood plain protection areas will be used as green corridors for pedestrians and cyclists.

Policy PC5: An extensive pedestrian and cyclist network that connects the green spaces in and around Ibadan will be created.

Table A.16 show some standard cross-sections specifications for new/improved roads and Figure A.20 to Figure A.22 illustrate the cross-sections.

Table A.16: Road types

TYPE	ROW	NO. LANES / CARRIAGEWAY	LANE WIDTH	BRT LANE	CYCLEWAY	FOOTWAY	PARKING	OUTER SHOULDER
Expressway (Principal road)	47.7m	6 / 2 (3-3)	3.65m	No	No	No	No	3.0m
Principal / Primary Road	37m	6 / 2 (3-3)	3.50m	No	Yes	Yes	No	2.5m
Principal / Primary Road with BRT	37m	8 / 3 (3-2-3)	3.50m	Yes	Yes	Yes	No	2.5m
Principal / Primary Road	30m	4 / 2	3.50m	No	Yes	Yes	No	2.5m
Collector Road	25m	4 / 2	3.50m	No	No	Yes	No	0.5m
Collector / Local Road	18m	2 / 1	3.50m	No	No	Yes	Yes	No
Collector / Local Road	15m	2 / 1	3.50m	No	No	Yes	Yes	No
Collector / Local Road	10m	2 / 1	3.50m	No	No	Yes	No	No

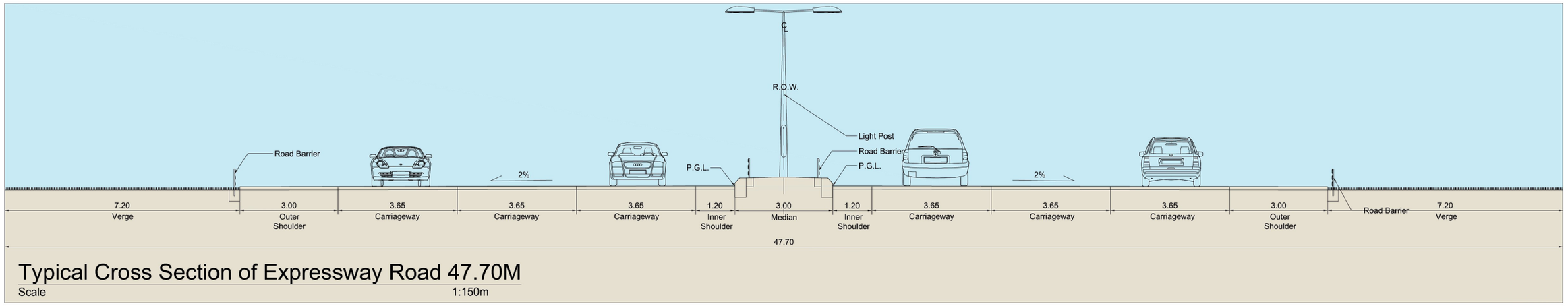
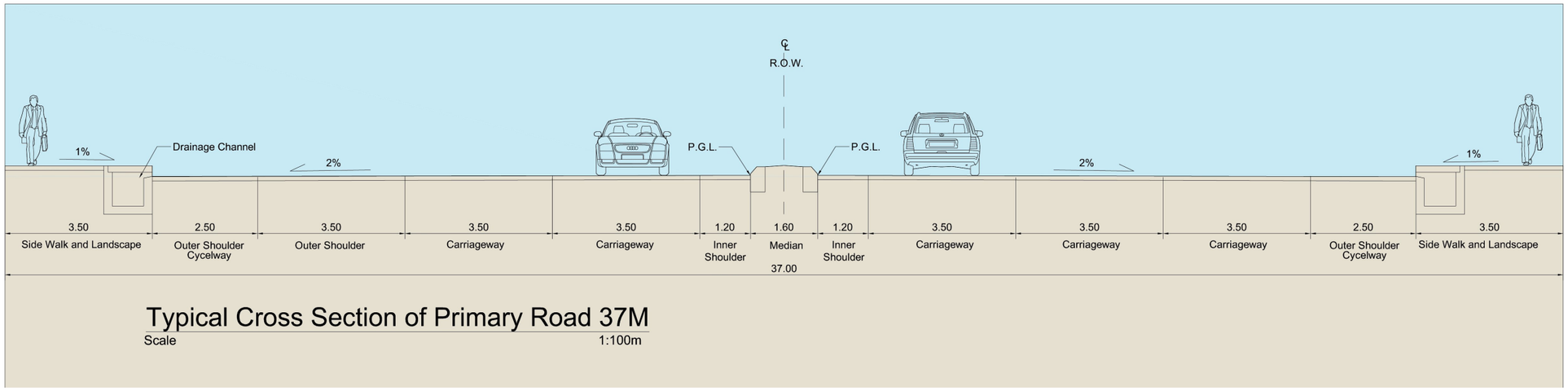


Figure A.20: Typical Cross Section for Expressway

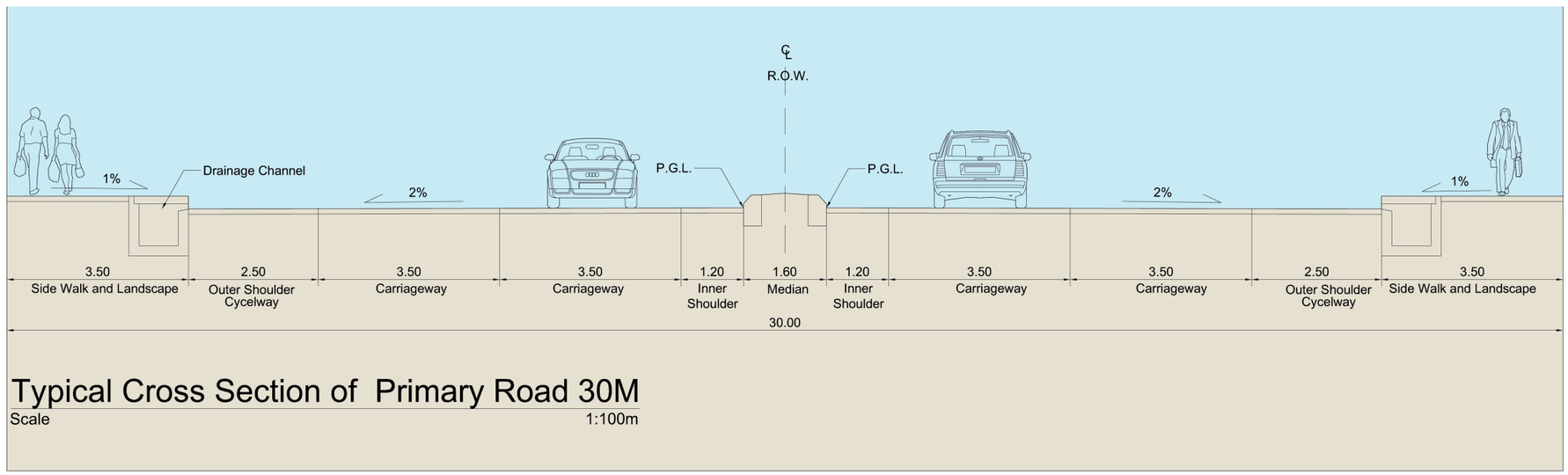


Typical Cross Section of Primary Road 37M

Scale 1:100m

Typical Cross Section of Primary Road with Central Bus Rapid Transit 37M

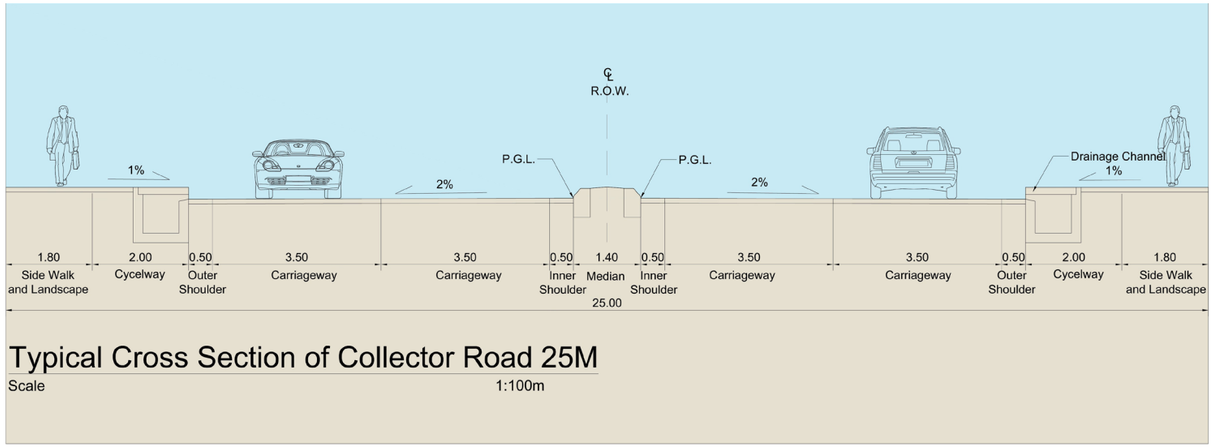
Scale 1:100m



Typical Cross Section of Primary Road 30M

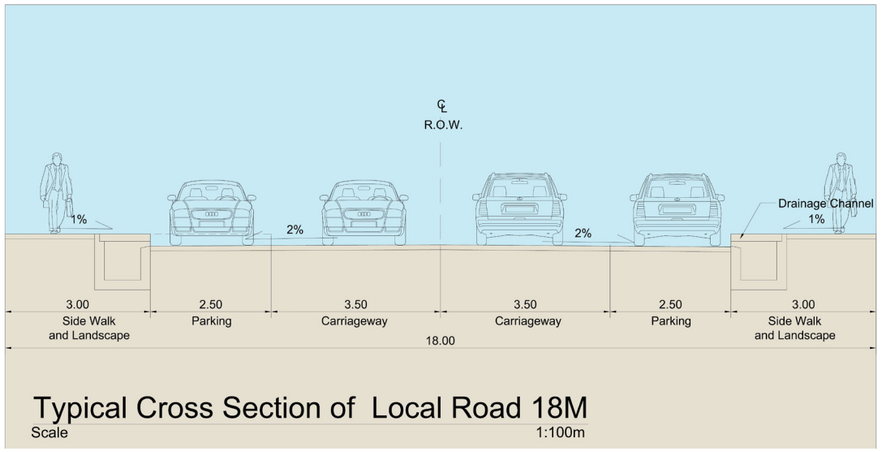
Scale 1:100m

Figure A.21: Typical Cross Section for Primary Roads



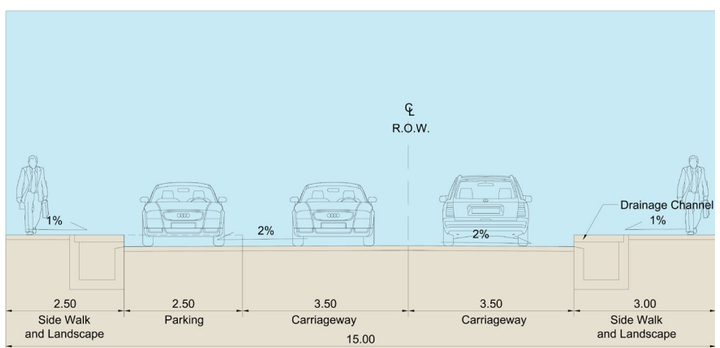
Typical Cross Section of Collector Road 25M

Scale 1:100m



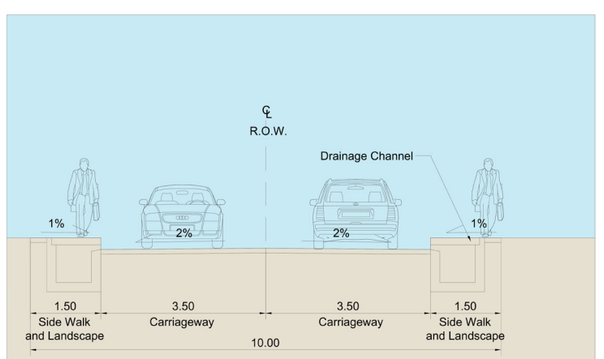
Typical Cross Section of Local Road 18M

Scale 1:100m



Typical Cross Section of Local Road 15M

Scale 1:100m



Typical Cross Section of Local Road 10M

Scale 1:100m

Figure A.22: Typical Cross Section for Collector and Local Roads

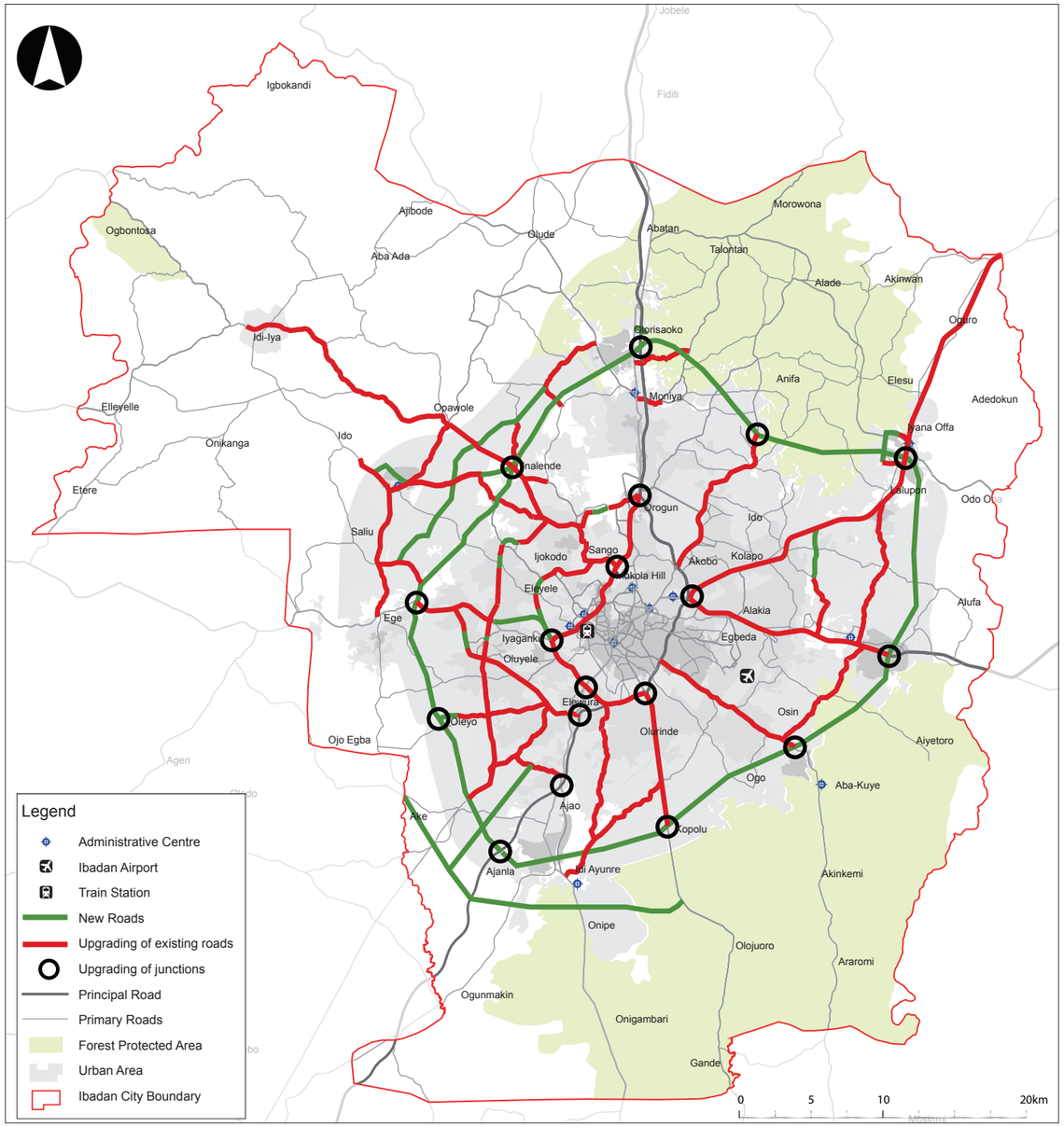


Figure A.23: New Roads and Roads For Upgrade

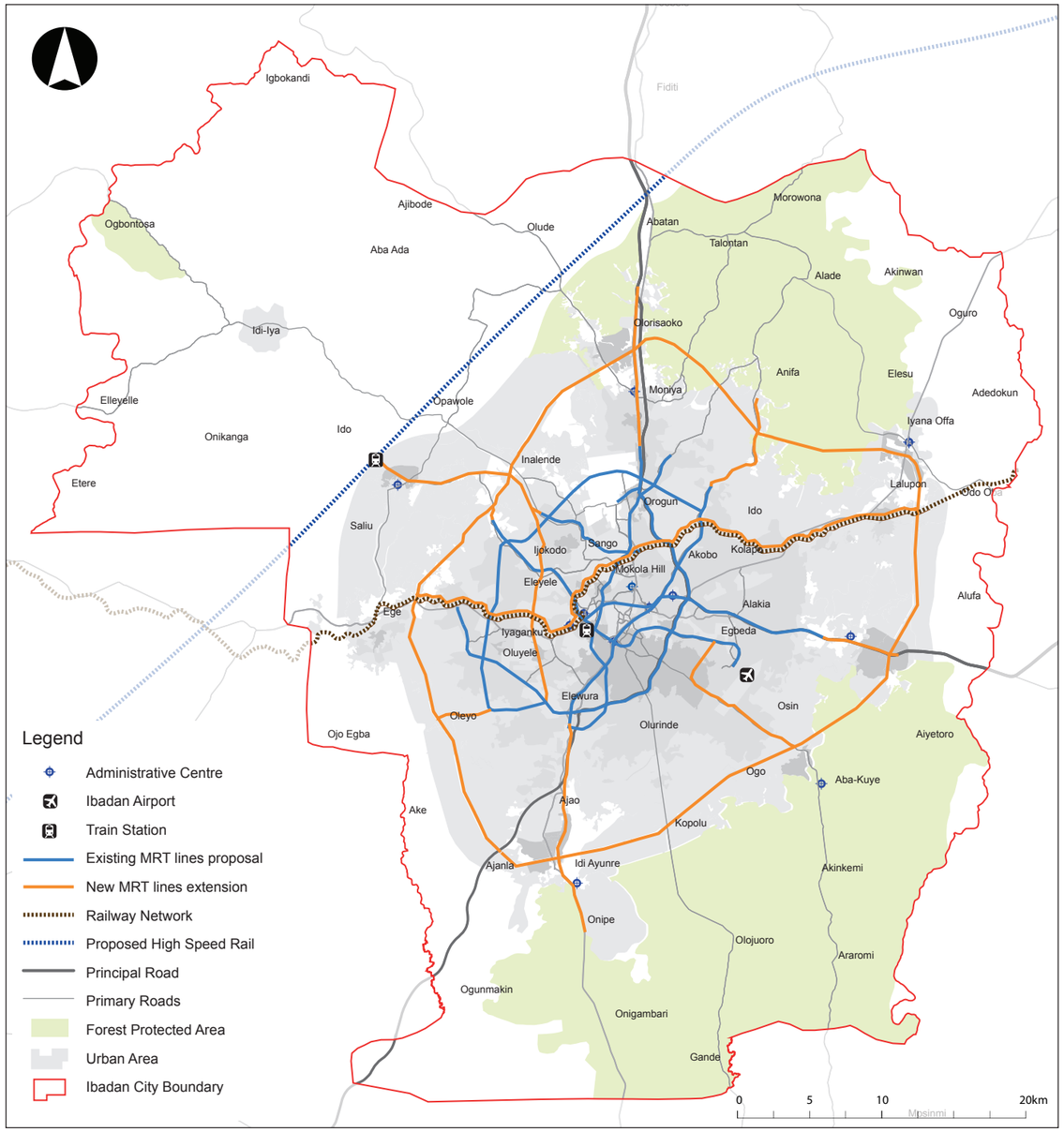


Figure A.24: Mass Transit Network Concept

SOCIO ECONOMIC FRAMEWORK

Box 1 - General Actions and Policies towards Informal Economic Activities

- Support State efforts to control on-street trading and modernise trading standards;
- Consider best practice approaches to market management that could be applied city-wide;
- Ensure transport development corridors allocate sufficient land for large scale and modern retail units and projects;
- Improve the physical infrastructure of the markets to support the promotion of safety and wellbeing of market participants; this includes the provision of appropriately placed toilets with hand-washing facilities, appropriate drainage system and removal of solid and liquid waste, etc.
- Develop programmes to improve the linkages between local agriculture, manufacturing and retail traders under a 'shop local, buy local' message;
- Consider greater specialisation of markets and explore options for new consumer sectors for specialised markets such as electrical products and IT.

Box 2 - Actions and Policies Towards Manufacturing

- Promoting effective partnership between the public and private sectors to develop and maintain reliable and affordable infrastructure such as power, roads and other facilities;
- Local government to commit to streamline the approvals process towards business by guaranteeing maximum turnaround times and a one-stop shop approach;
- Creating local-buyer initiatives for major planned infrastructure projects to ensure building materials and skills are sourced from local producers;
- Investing in common-facilities centres (partnership with MAN/ UNIDO) in priority sub-sectors such as food production and technology to overcome weak access to finance capital and equipment;
- Promote and strengthen backward and forward linkages between local food manufacturers, commercial farmers/peri-urban growers and food retailers to encourage larger-scale production throughout the supply chain and raise job creation;
- Ensure new expansion areas for development allocate sufficient land for small-scale and start-up manufacturers/workshops;
- Implementing significant financial sector reforms to stimulate the availability of funding to manufacturing companies (e.g. provision of loans at attractive interest rates, minimising the collateral requirements, etc.);
- The safeguarding and allocation of sites in the south/south west Ibadan for manufacturing expansion to leverage accessibility to the Lagos-Ibadan expressway and proximity to existing industrial clusters to be treated as a strategic priority;
- Support initiatives to expand small-scale local power generation projects to help plug gaps in electricity supply, such as those being explored by MAN;
- Create database of SME and large manufacturing enterprises by location in the urban areas, as proposed by the Ministry of Industry, Trade and Cooperatives;
- Follow-up on UNIDO recommendations for industry clusters and common facility centres;
- Matching industrial skills development to meet the requirements of industry through setting up industrial skills councils, serving as a main interface between the stakeholders who develop skills, and those who require skills.

Box 3 - Actions and Policies Towards Agriculture

- Planning framework to effectively safeguard productive agricultural land on the urban fringe and expansion areas;
- Foster involvement of NGOs for the provision of advisory of advisory and extension services to farmers;
- Improve the governmental research units to provide credible and up-to-date statistics;
- Offer training sessions to farmers and agricultural practitioners – this is essential as it will also develop and sustain strong linkages between agriculture and manufacturing sectors;
- Utilise the proposed inter-modal dry port at Lagelu LGA to promote agri-processing plants;
- Need for effective collaboration between academic and research institutions and stakeholders operating in the agribusiness industry;
- Implement a precautionary approach to development in areas of flood risk;
- Develop a macro drainage system to strengthen climate risk management in the face of current climate variability and extreme weather events;
- Implement a long-term strategy to provide wastewater treatment facilities for Ibadan to secure a reliable source of irrigation water;
- Establish solid waste transfer stations, solid waste pre-treatment facilities and solid waste treatment facilities in order to cope with the large amount of waste generated;
- Establish micro-credit programs for UPA farmers.

Box 4 - Actions and Policies Towards Utilities

- Establish electric substations required to feed Ibadan with relevant transformer ratings and voltage levels;
- Promote local employment and training programmes tied to the construction of new energy, water and wastewater distribution systems; ensure adequate technical training and capacity among the sector workforce to ensure breakdowns can be remedied effectively;
- Improve the business climate to attract foreign investors in the utilities sector;
- Promote local power generation projects and initiatives for both homes and businesses as a 'quick fix' and encourage and also services related to their operation and maintenance;
- Evolve a cost-reflective electricity tariff structure to (i) ensure fairness to consumers, (ii) to provide sufficient funding to finance activities of investors and (iii) achieve efficient operations.

Box 5 - Actions and Policies Towards Non-Retail Commercial Services

- Allow the interchanging of land use between residential, retail and business service uses especially in above ground units to promote mixed uses and variety in existing and proposed commercial centres;
- Ensure adequate supply of affordable commercial premises for start-up enterprises through dedicated sites and an appropriate sub-division policy;
- Promote transport-oriented commercial development around bus and rail stations;
- Encourage larger local firms to purchase commercial services locally;
- Encourage the university research institutes to expand their consultancy activities to strengthen the technical skills base for business services;
- Provide real estate units to accommodate all income groups rather than the highest income bracket only;
- Review policies towards the microfinance sector; extending credit durations/tenures/collateral requirements;
- Streamline State application and approval procedures/regulation towards business.

Box 6 - Actions and Policies Towards Education Sector

- Solving the problem of uneven distribution of educational facilities in order to improve access to education and educational quality across the whole city;
- Attracting suitably qualified staff through the provision of necessary support systems and incentives (e.g. the provision of free serviced housing);
- Introducing innovative techniques to provide access to education such as the use of ICT to establish a technical platform for remote learning;
- Revising training programmes and content and upgrading teaching tools for developing technical and professional skills;
- Focusing on technical and vocational skills development;
- Creating of skills councils responsible of matching skills acquisition to market needs.

Box 7 - Actions and Policies Towards Healthcare Sector

- Providing adequate health facilities to fill the gap in the highly dense areas that suffer from a shortage of healthcare services;
- Improving infrastructure and road access to major towns and urban centres in order to improve access to health facilities to all residents of Ibadan;
- Providing well-maintained equipment through partnering with the private sector;
- Assessing training needs to ensure that healthcare service providers have the required knowhow and competences;
- Establishing effective partnership between healthcare facilities and universities to develop adequate and appropriate manpower.

INFRASTRUCTURE

The Developer shall provide within the plot boundaries the following:

- Water supply, sewerage and irrigation services to habitable parts of any building in compliance with the standards set out by the Utility Service Authorities.
- Electrical power distribution installations in compliance with the Regulations set out by the Utility Service Authority.
- Telecommunication network installation in compliance with the Regulations set out by the Utility Service Authority
- Fire protection facilities shall be accordance with the recommendations, requirements and specifications of the Civil Defence.
- Surface Water drainage and disposal, in accordance with the recommendations of the Service Authority.

The developer has the right with the agreement of the Authorities to do some works outside the plot boundaries in order to connect to the infrastructure networks and to comply with Authority requirements.

Telecommunications and ELV Networks

Telecommunication installations shall comply with relevant the Service Authority requirements.

Service connection between the main inspection panel of a serviced site and the utility company infrastructure shall be paid for by the Developer.

All installations shall be subject to testing and approval of the Authority.

Power Supply and Distribution

Power supply installations shall comply with relevant the Service Authority requirements.

Service connection between the main inspection panel of a serviced site and the utility company infrastructure shall be paid for by the Developer.

All installations shall be subject to testing and approval of the Authority.

Solid Waste Management

Solid waste installations shall comply with relevant the Service Authority requirements.

Proper solid waste management practices would entail an adequate temporary storage of discarded solid waste material within the development prior to the collection of such quantities for transportation to further destination(s).

Water Supply

Water supply installations shall comply with the relevant Water Authority standards or, in the absence of these, British standards and/or the Uniform Plumbing Code (UPC) USA.

Water storage tanks shall be provided for every serviced site to accommodate for both the fire protection and the daily domestic water demand requirement. The minimum capacity of any storage tank should not be less than two days supply for domestic water use and 90 minutes of coverage for fire protection use.

The Developer shall submit a request for a service connection to the Service Authority upon completion of construction. All installations shall be subject to testing by the Service Authority in accordance with the relevant Regulations.

Wastewater Management

Wastewater installations shall comply with relevant the Service Authority requirements and or, in the absence of these, British standards.

All chambers for the disposal of foul sewerage from any building shall be adequately vented and impervious to liquids internally or externally.

Sewers must be of durable material and construction and watertight under all conditions. The internal diameter of any soil drain shall not be less than 150 mm.

Service connection between the main inspection chamber of a serviced site and the public infrastructure shall be paid for by the Developer.

Drains shall be laid in straight lines between changes of direction or gradient. Maximum distance between manholes shall be 30m. Manholes must be provided at each change of direction.

All installations shall be subject to testing and approval of the Authority.

BUILDING DESIGN GUIDELINES

The following building design guidelines provide guidance to be adopted for successful development integration with the Ibadan Masterplan.

General Rules

- All the structure to be constructed on the plots has to be in performance with the regulations and buildings design guidelines listed here with.
- If a building faces more than one road, the parking entry and exit is to be from secondary road.
- Adequate access entrances / exit shall be provided to the plots to minimize traffic congestion and hazards in public streets.
- Any earthwork (filling or cutting) shall be restricted to the plot limits.
- The developer must allocate a part of the plot for landscaping as per the regulations of each plot.
- Setbacks from all plot boundaries may apply to allow visual screening from the adjacent developments, to protect the privacy of individual plot owners and to allow access for fire appliances and service vehicles.
- Setbacks are measured from the plot boundaries and are implemented from the ground floor of all buildings.
- Landscape elements, including pergolas, earth modelling and decorative elements not bigger than 150sqm and safeguarding free access for fire fighters and other emergency services will be excluded from limitations as long as they are part of the plot landscape programme.
- All parts of the residential apartments and mixed use building shall be accessible to civil defence and fire fighting vehicles or personnel.
- All the access and exit to the plots and the parking areas should be hard surfaced and drained to the satisfaction of the Planning Authority.

Building Orientation

- Buildings must be oriented to the street with primary public functions located at the front of the building.
- On a corner site, the principal building shall be anchored at the corner and be designed to be visually attractive from both abutting streets.
- Within the constraints of the Master Plan's street network, building's orientation must incorporate such consideration as solar access in order to reduce energy consumption.

Forms and Articulation

- Building should be articulated to differentiate the major functional parts within them. Special attention should be given to the architectural expression, articulation of massing, and exterior finishing materials of proposed developments along main public roads, particularly the NS arterial (Commercial Character), and E-W collector street (along street of dreams)
- The office components should be expressed three dimension at the front face of the building by setting it forward from the functional background (industrial) and the use of higher quality finishes. Streets façades in particular must be articulated to establish scale and identity.
- Developments should avoid the use of large undifferentiated wall areas, textures, patterns, colours, secondary materials and building form variations, including forms inspired, but creatively transformed, of traditional Arabic architecture, should be incorporated into building elevations.
- Articulations should be achieved using architectural methods and details derived from language of sustainable (green) architecture.
- Solar protected glazing is encouraged on all street façades.
- Elements to which public relates such as the main entries, should be located and designed so as to be clearly identified from the entry drive way.
- Variations in massing and changes in heights and horizontal plans are encouraged; consider a break in façade for every 50 meters if the length of façade exceeds 100 meters.

Architectural Design Integrity

- Building Design in term of scale, architectural character, roof lines and building mass should be compatible with other buildings on neighbouring sites.
- Ancillary or secondary buildings shall be designed and constructed in consistence with the architecture of the principal building.
- The exterior of buildings shall be coordinated in design on all elevations with regard to colours, materials, architectural form and detailing to achieve design harmony and continuity. Painted or false detailing that detracts from the integrity of structures should be avoided.
- In commercial, Research / Developments, and Hi-Tech buildings, blank walls facing a street or outdoor pedestrian spaces should be avoided. Windows and glazing of the type that would allow a visual connection to the interior space from outside should be encouraged.

Exterior Materials

- Materials are to be of higher quality with a sense of permanence. Totally pre-fabricated and pre-engineered metal buildings are not acceptable. The use of sheets and profiled metal cladding is strongly discouraged as a primary cladding material and will be not accepted.
- All metal products must be preformed, pre-finished, and installed using the appropriate manufacturer's accessories. Panels systems are recommended for office commercial and laboratory components.
- Standard concrete block is not acceptable as an exterior finish. Where concrete block is employed, specific attention should be paid to colours, patterns, texture and finishes. All block must be installed in compliance with good industry practice.
- The predominant building palette should be steel tilt up or poured in place concrete with quality reveals, and panels systems or curtain wall style glazing for offices, labs, and commercial components.

Architectural Lighting

- Entrances to buildings should be illuminated to enhance their visibility.
- Where building façades comprise significant areas of opaque materials visible to public roads and paths, decorative flood lighting is encouraged to accent recessed or articulated surfaces.
- Where building mounted lighting is proposed on the front façade, it must be integrated with the architectural expression of the building.
- Architectural integrated exterior lighting and directional signage should be used to provide safe and convenient pedestrian circulation within development sites.
- State of Art energy efficient / solar powered electrical fixtures must be used for building lighting / illumination.
- Outside Illumination regarding the buildings and the internal plot traffic. This should guarantee the safeguarding of the object, but it should not interfere with the street lighting system nor should it blind by-passers or onlookers.

Windows and Entrances

- Windows sizes should respond to interior functions.
- Little openings windows for Residential buildings are just permitted.
- Main public entrances must be identified from streets.
- Employed and service entrances must be clearly marked by architectural as well as graphic means.
- All windows exposed to the sun penetration must be completed with sun controlling devices.

Roofscapes

- All roof equipment must be screened so that it is not visible from the streets and incorporated into the design in a manner consistent with the overall architecture of the building.
- Roof to equipment must be placed to minimize the exposure to the streets and public access routes.

SUSTAINABLE DEVELOPMENT

- Ibadan Masterplan should be planned and designed to address guidance for sustainable development and is encouraged to use LEED (Leadership in Energy and Environmental Design) or similar standards in the areas of sustainable sites, water efficiency, materials and resources and indoors environmental quality.
- Buildings should be designed to reduce energy consumption by incorporating such considerations as solar access, shading, maximizing the amount of daylight into the interior spaces and providing windows that can open (e.g. maximize the southern exposure with shading devices to minimize penetration to the interior of the high summer sun, maximize the amount of glazing and windows on the exterior walls, incorporating skylights, interior courtyards or terracing the building for daylight penetration into the interior).
- Consider using materials which have been manufactured from recycled or waste materials like paving blocks made from recycled or discarded asphalt tires, asphalt or use of fly ash in concrete mixtures.
- For landscaping purposes, maximize the quantity of native species and include planting material that is brought resistant, low water consumer and use wide shades trees.
- Consider using permeable materials for outdoors surfaces, subject to consideration for the water table in the area.
- Consider implementation of green roof systems, both in intensive and extensive planted with native types of grass and sedum.

DEFINITIONS

The following definitions apply to these regulations and guidelines:

Authority means the Lagos State Government or Ministry of Physical Planning and Urban Development, Local Government Department or any other body granted powers by the Lagos State Government to enforce these regulations.

Buffer zone means an area of land separating two distinct uses that softens or mitigates the effects of one land use on the other.

Building denotes any walled and roofed structure erected inside a plot above the ground level, used for living, working, storing or fabricating, and which abide to the conditions of the Planning Regulations of the plot.

Building height denotes the height of a building in meter measured from the finished pavement level to the top of the roof parapet or to the top of the coping tile of the pitched roof. The building height is measured along the midpoint of the building elevation facing the street that provides access to the plot. In cases where the plot is bounded by more than one street, the façade facing the main street, (or if not applicable, the façade having the longest frontage to the street) shall be taken for reference.

Building line denotes the vertical line that defines the outer face of the building façade.

Building permit is the licence that the Authority issues to allow construction work to proceed on a specific piece of plot, in accordance with approved plans, specifications and conditions.

Catchment area means the land area and population which is served by a particular infrastructure or institution, such as schools or fire stations.

Density means the quantity of people or units in a given area. Density is usually measured by the distribution of people per hectare, or the number of units per hectare.

Ecological corridor means a linked route of open land that aims to provide sufficient habitat to support flora and fauna. An ecological corridor will preserve natural settings while providing clear limits to urban development. It will allow for the uninterrupted movement of wildlife.

Embankment means a raised structure (as of earth or gravel) used especially to hold back water.

Expressway means the highest level road in the road hierarchy, which accommodates fast moving vehicles.

Ground Floor denotes the floor directly accessed from the finished site level fronting the main entrance to the building. It can be at the same level of the ground.

Heritage building means a structure which has special historical or cultural significance.

Floor Area Ratio (FAR): coefficient that denotes the ratio of the total built up area of buildings and structures on a given plot over the total land area of the plot. When calculating the FAR, the areas of the following shall not be counted as part of the total built up area:

Heritage conservation is the process of maintaining and managing change to a heritage asset in a way that sustains and where appropriate enhances its significance.

Informal area means unplanned settlements and areas where housing or any other human activity is not in compliance with current planning and building regulations.

Jetty means a structure, such as a wharf or landing pier, that projects into a body of water, at which boats can be docked.

Landscaping is the treatment and maintenance of a plot area or property with predominant vegetation such as ground cover, plants, shrubs or trees. It includes paving, bricks, rock work and other natural or decorative features in an organised manner designed to create a specific appearance.

Land use means the occupation or use of land or water area for any human activity or any purpose defined in the masterplan.

Mezzanine floor denotes a floor that can be accessed from the ground floor only and which covers a percentage or the entirety of the ground floor area excluding communal entrances, stairs and lift areas.

Natural assets are assets of the natural environment. These consist of biological assets (produced or wild), land and water areas with their ecosystems, subsoil assets and air.

Planning authority is the public body whose duty it is to carry out specific planning functions for a particular area.

Plot is a parcel of land defined by clear boundaries and coordinates.

Plot Coverage coefficient that denotes the ratio of the area of the building imprint (sum of the areas of the ground projections of the largest floor of all buildings on the plot) over the total land area of the plot. When calculating the plot coverage, the areas covered by roof projections and balconies, are to be counted as part of the building imprint. The areas covered by non-enclosed shade structures shall not be counted (i.e. car parking, gazebos, etc).

Plot frontage is the portion of the plot construed nearest to the street. All sides of a plot adjacent to streets are considered frontage.

Plot line any line bounding a plot herein defined.

Public facilities refers to buildings, streets, open spaces and car parks that are for public use and are financed privately or with public funds by the government or any other public sector body.

Raised planter means a container raised above the ground level in which plants are grown.

Regulations means the rules and statutes listed in this publication and other regulations issued by the “Authority” or any other rules issued in the future.

Road median means the reserved area that separates opposing lanes of traffic on divided roadways, such as divided highways, dual carriageways, and expressways.

Rural area means an area of land that predominantly contains a planted, open and non-urbanised setting and character. In rural areas, wildlife is more frequently found and agriculture is generally the predominant activity.

Sensitive site means a defined area of land whose soil properties, functions or historic characteristics may be readily or excessively affected by changes in its surroundings.

Setback means the distance separating the building line from the plot boundary line that must be left free of building. A setback may be specified as mandatory and in that case it shall define a build-to line that all buildings must adhere to. A setback may be specified as a minimum setback and in this case, the building line may adhere to it or be set back a distance larger than the specified minimum.

Softscape means the elements of landscape design such as soil, plants, shrubs or trees.

Structure denotes any constructed, erected material or combination of materials which requires being located on the ground.

Transport corridor means a generally linear area that is defined by one or more mode of transportation such as expressways, railways or public transit which share a common alignment and proximity. A corridor is multi-modal where more than one mode operates, and is uni-modal where only a single mode operates.

Typical floor is a floor that is similar to the floor that follows it or precedes it or both in area and structure.

Urban area means an area generally characterised by moderate and high density residential, commercial, and industrial development, and the availability of public services required to support that development.

Ventilation opening includes any means of ventilation whether permanently open or closable and which opens directly on to the external air, such as parts of a window which can be opened, louvres, ventilators, and any door opening directly to the external air. Any openings associated with mechanical systems are excluded.

APPENDIX 11: IMPLEMENTATION ARRANGEMENTS

1 INTRODUCTION

The tasks associated with the implementation of the Ibadan City Masterplan require cross-sectoral collaboration. In the Final Masterplan (March 2018), three options for institutional arrangements are outlined:

- Option A: No institutional changes, but focus on capacity building and improving the way the existing organisations operate.
- Option B: The creation of the Ibadan Development Authority to coordinate the work required to realise the Masterplan.
- Option C: The establishment of a Special Monitoring Unit to ensure that the cooperating MDAs have included in their rolling development plans and annual budgets those development projects required for the realisation of each phase of the Masterplan.

During discussions held in 2017 with Oyo State Government, a preference was expressed for Option A. It was felt that existing institutional arrangements should be relied upon as far as practicable to ensure that there is seamless continuity and as little disruption as possible. The Bureau of Physical Planning and Development Control has over the last few years gone through a number of changes in its set-up and there is no desire to amend this further.

Despite this, Option B and C have not been fully dismissed and are retained in the masterplan document should they be considered suitable options at a later date. The Consultant recommended Option B as a means to provide a delivery vehicle with the focus to ensure the masterplan is 'owned' by a single recognised body. In order to fast-track development and retain complete focus on the implementation of the masterplan itself, a delivery agency would not be distracted by other responsibilities.

This paper therefore presents a strategy for implementation of the Ibadan City Masterplan according to Option A. It provides details on the roles and responsibilities of the Bureau of Physical Planning and Development Control (BPPDC) and relevant Ministries, Departments and Agencies (MDAs) to ensure that the masterplan is implemented.

2 THE CURRENT INSTITUTIONAL ARRANGEMENTS FOR URBAN DEVELOPMENT

The development of urban areas involves many Ministries, Departments and Agencies (MDAs). The present arrangement for managing development divides the tasks along sectoral lines, with each MDA having its own area of responsibility. There is no single agency responsible for coordinating the efforts, although there are opportunities in the budgeting process. Responsibility for the various functions and activities required in the implementation of the masterplan as per the existing set-up are given below.

3 PLANNING FUNCTIONS

The functions covered by the former State Ministry of Lands, Housing and Physical Planning/Urban Development are central to the urban development process and for the planning and development of urban expansion in the State. The Ministry consisted of five directorates: for strategic physical planning, for development control, for land management, for research and for housing. Housing is represented by the Oyo State Housing Corporation responsible for sites and services, slum upgrade, and the construction of housing, commercial and industrial sites. In effect, its primary activity is the sale of plots for self-built units for the middle income rather than the poor.

Responsibility for the preparation and review of plans lay with the Strategic Physical Planning Directorate, which had two Assistant Directors, one responsible for the initiation of planning policy, the preparation and review of plans, and public enlightenment. The second was responsible for the upgrade of urban areas, community improvement, environmental management, the development of planning standards and mediation. Under the Director of Strategic Physical Planning there were also 33 District Planning Directors. However, these were not all adequately experienced as planners. The Directorate of Physical Development Control had two sub-directorates, one responsible for approving requests for development permits, and the other for monitoring and enforcement. A third Directorate, the Research and Statistics Directorate was shared with the Lands Directorate. The Lands Directorate is responsible for the sale of land to private developers in the urban areas, the valuation of land and the establishment of property tax. However, the proposed Lands Allocation Committee has never been established and approval of land sales is made by the Commissioner.

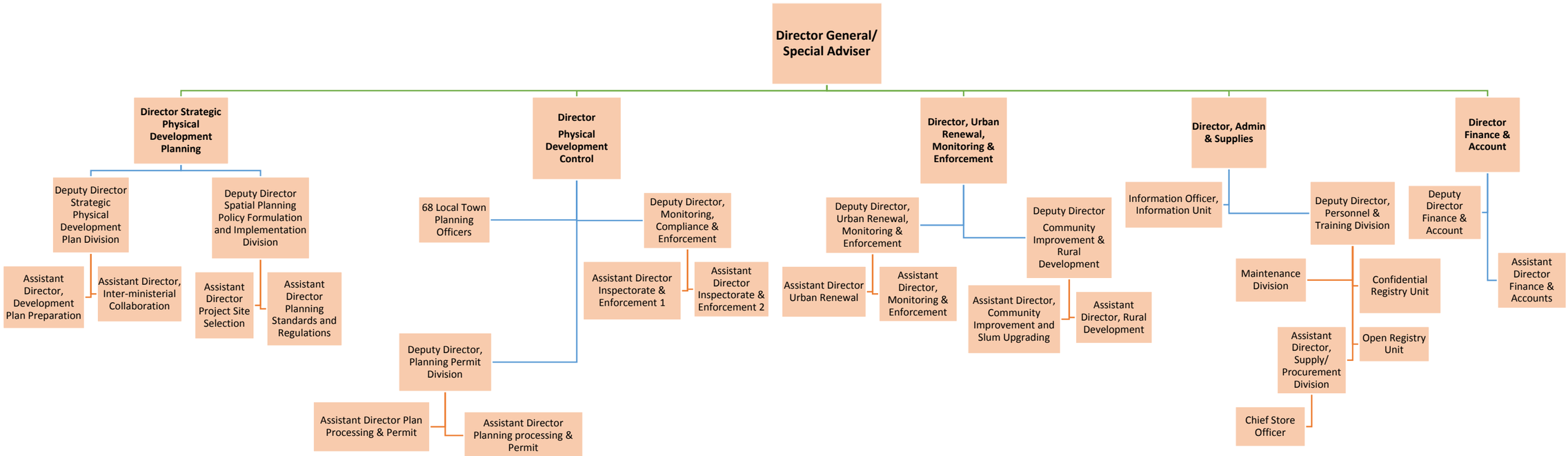


Figure 3.1: Bureau of Physical Planning and Development Control Organogram - Current Set-up

All of the above functions should now reside with the recently established Bureau of Physical Planning and Development Control (BPPDC) which sits in the Office of the Governor.

The BPPDC is currently divided into the following departments, as identified in Figure 3.1:

- Strategic Physical Development Planning;
- Physical Development Control;
- Urban Renewal and Environmental Management,
- Administration and Supplies; and
- Finance and Accounts.

All departments are either understaffed or lack adequate experience. Furthermore, there have been problems of funding with inadequate resources available for transport and security.

3.1 Land Titling

Land titling is the responsibility of the Deeds Registry and the Surveyor General who safeguards against duplication or overlapping claims. However, the system is manual and records take the form of hard copies, which are subject to distortion with age. There is currently no use of digitised plans and land records. The same problem is found in the Strategic Physical Planning Directorate, where GIS experience is limited.

3.2 Investments

Within Oyo State, responsibility lies with the Bureau of Investment Promotion, which is responsible for policy issues and records. Its mission is the promotion of sustainable investments. The state Ministry of Trade, Industry and Cooperatives (OSMTIC) has the mission "to promote economic activities through a structured approach for wealth creation, full employment of the people, prosperity in business and effective business management in a friendly business environment, improved standard of living of the people, effective utilisation of agriculture products and improve revenue profile of the State."[1] The objectives include:

- To stimulate the growth of existing Micro, Small and Medium Enterprises (MSMEs) and the emergence of new ones in the State.
- To promote the establishment of Agro-Allied cottage industries focusing on utilisation of local agricultural products, working with the relevant sectoral organisations.
- To put in place a legal and institutional framework that would facilitate the realisation of set strategic objectives.

In 2012, the Governor launched the RTR (Restoration, Transformation and Repositioning) Agenda to boost the economy of the State. This included tax breaks for investors and reduction in the cost of land purchase by up to 80% for non PPP investors. The spending plan prioritised infrastructure and social services, allocating 33.9% of spending to economic development, 29.3% to social services and 13.1% to regional development. Investments included, amongst others, infrastructure, streamlining the land purchasing and registration system, and investment in developing technological skills.[2]

Along with the OSMTIC, the State Planning Commission is responsible for the overall economic development strategy and "to prepare Development Plans designed to accelerate the development of the economy and guarantee a higher standard of living and happiness for the people."[3] Agri-based industries are one of the most important sources of industrial growth, using produce from high yield agricultural land. But the RTR also identified tourism and trade as important sectors and the need to clean up the environment, especially drain-clearing to prevent flooding. Clearly, coordinating these different agencies in the development policies and programmes to strengthen the economic base of Ibadan is complex.

3.3 Land Allocation

The power to distribute land lies with a number of MDAs. Under the 1978 Federal Land Use Act, all land is held on a lease that the Government has the power to revoke. For urban land, authority lies with the State government and for rural areas with the Local Government. The primary responsibility for land distribution in urban areas is with the Directorate of Lands, but for an external investor, approval should also be given by the Directorate of Strategic Physical Planning (now within the BPPDC under the Governor), and the Ministry of Works and Transport (OSMoWT) and the final approval given by the Commissioner of the Ministry responsible for land.

Under the 1978 Act, land required for the benefit of society may revert to the State without compensation being paid except for pre-existing developments and crops. In practice, where possible, the person losing the right to a piece of land is compensated by receiving an equivalent piece of land elsewhere. However, it does not take into account loss of business which results from compulsory acquisition. It is recommended that the system of compensation for land owners be reviewed and a more equitable system of compensation provided, which might include a land swap, but which should take into account the broader economic costs incurred by the person losing their land, including loss of business and the cost of re-establishing markets.

To obtain the right of use to a piece of land, the applicant having satisfied the Lands Directorate and the other agencies involved, receives a Certificate of Occupancy (CofO), which is registered in the Deeds Registry. Privately owned land, in the same ownership pre-dating the 1978 Federal Law can be registered, in which case the plot is surveyed by the Surveyor General's department and a 99-year lease is provided to the owner. Without this, the ownership of the land cannot be transferred officially.

The procedure for purchasing land in urban areas is under the remit of the Estates Department in the Ministry of Local Government and the BPPDC (previously the Department of Strategic Planning and Development). However, in rural areas, the procedure does not involve any planning approval, often involving the local chief and the current landowner's agreement to the sale. Land is then registered through the Surveyor General's department. If an external investor is the potential purchaser, the Bureau of Investment Promotion needs to be involved in the decision.

The system of approval of the sale of land needs to be made consistent in the rural as well as the urban parts of the whole of the Masterplan area, in all 11 local government areas. There may be a need for the whole of the masterplan area to be considered urban even if large parts are 'planned' as forestry reserves or agricultural land, to ensure that inappropriate development does not take place in areas which were formerly rural.

3.4 Roads and Drainage

Roads are divided into four categories: Principal, Primary, Collector and Local. Principal roads that are of strategic importance are the responsibility of the Federal Ministry of Works, while primary roads are the responsibility of OSMoWT. However, the distinction between the different classifications is not clearly stated nor used. Local Governments are primarily concerned with Local and some Collector roads, though some of the roads may be part of the Federal or State system. This confusion makes the planning and development of the main road networks within the urban area of the city difficult to delegate to any agency and raises the question of who should be involved. Drainage is mainly connected to road networks and so the authority responsible for building the roads also builds the drainage system. However, these systems are connected by primary drainage, which is under the remit of the Oyo State Ministry of Environment and Water Resources (OSMEWR), working through the Local Governments.

Clearance of drains around property is the responsibility of the property owner, while the Office of Drainage Services has overall responsibility for clearing the drainage system that falls under the State.

1 Web Page of Government of Oyo State, Ministry of Trade, Investments and Cooperatives. http://www.oyostate.gov.ng/ministries-departments-and-agencies/ministry-of-trade-investment-and-cooperatives/

2 Oxford Business Group 2013. https://www.oxfordbusinessgroup.com/overview/opening-doors-investment-state-set-serve-new-investors-it-streamlines-procedures-and-improves

3 Oyo State Government website.

3.5 Solid Waste

Solid waste is one of the major challenges to all local governments and Ibadan is no exception. Solid waste is also a major contributor to blocked drains and flooding. Solid Waste is the responsibility of the OSMEWR, working through the Oyo State Solid Waste Management Authority (OYOWMA), Local Governments and the private sector. Proposals for improving solid waste management includes the provision of safe and accessible waste collection facilities, the development of solid waste transfer stations, and the development of material recovery facilities for recyclable materials and the provision of properly prepared final disposal sites. It also requires large scale educational programmes to help develop improved SWM, such as the 3 Rs (Reduce, Recycle, Reuse). Solid waste production increases with the expansion of population and so the planning of the provision of these facilities needs to be properly integrated into the development process.

The New Environmental Law imposes strict penalties on improper waste disposal and was brought into effect in February 2017. The problems will be enforcement, with lack of manpower and because of opportunities for corruption.[1] The new laws will need to be accompanied by public education campaigns and simple ways of reporting violations. Overall, the performance of the responsible agencies needs to be monitored with power given to the monitoring body to remove or replace the officials that fail to perform as proposed. Under these laws, the first arrests had been made within a week of the laws implementation.[2]

3.6 Water Supply and Sanitation

Water provision throughout the rural areas is the responsibility of the Oyo State Rural Water Supply and Sanitation Agency (RUWSSA). This has responsibility for:

- Water supply: Provision of safe water for the communities through borehole construction.
- Sanitation: construction of communal ventilated improved pit/sanitary platform latrines and establishment / manufacturing of slab production centres.
- Planning monitoring and evaluation units (PM&E), community mobilisation and hygiene education: This is the software component and involves the mobilisation and enlightenment of all communities on water and sanitation activities.

In the urban areas, the supply is the responsibility of the Water Corporation of Oyo State (WCOS). In effect there is no public sanitation system, so the form of sanitation used is mainly pit latrines and latrines connected to septic tanks, although some larger institutions and industries have their own sewage treatment plant. The State has a programme, launched in 2016, to make Oyo State defecation-free by 2025. This involves the development of domestic and public toilets.

3.7 Power and Telecommunications

Following the break-up of the PHCN (Power Holding Company of Nigeria) and the privatisation of power generation and distribution, the Nigerian Electricity Regulation Commission was established in 2013. Power generation is handled by six companies while transmission of power lies with one company (TCN) for the whole of Nigeria. The distribution of power is the responsibility of the Ibadan Electricity Distribution Company. Development of the power system will therefore need to involve agreement with the respective companies. However, the main issue would appear to be the limited power generation capacity and the poor state of the transmission lines.

Telecommunications are provided by the private sector providers under the control of the Nigerian Communications Commission (NCC). Development of networks will be a decision of the individual providers with the agreement of the NCC.

1 Ajimobi reads riot act to environmental officers by Dele Ogunyemi. Daily Trust 12 January 2017 http://www.dailytrust.com.ng/news/environment/ajimobi-reads-riot-act-to-environmental-officers/128585.html#iHRIUbyPIRYrJLej.99

2 Inside Ibadan – Latest News https://ibadankiniso.com/another-10-arrested-in-ibadan-for-flouting-environmental-laws/

3.8 Tourism and Places of Historic and Cultural Interest

Responsibility for tourism development in Oyo State lies with the Oyo State Ministry of Information, Culture and Tourism, with its two wings, the Tourism Board and the Council for Arts and Culture. Their responsibilities include:

- to rejuvenate the Historical Monuments and Cultural Landmarks of Oyo State in order to attract tourists and gain strong socio-political and economic standing;
- to discover and promote new tourism sites;
- to regulate places of tourism and hospitality; and
- to develop the skills and capacity within the sector.

It also aims at harnessing members of the Yoruba race to promote and develop tourism.[3] A Daily Independent survey of tourists, carried out in January 2015, suggested that little had been done to realise these objectives.[4] However, this criticism may be deemed unfair with the opening of Agodi Gardens with its swimming pool, play area and with the promise of the development of a zoo. The question is whether other places of historic and cultural interest are being developed in the peripheral expansion areas and how much such places are being developed by private investors and aided by the State Government training programmes. The State Commissioner believes that the economic recession can be tackled by attracting more investments to the state's culture and tourism sector.[5]

3.9 Housing

Housing provision is predominantly developed by the private sector, individuals and companies. State housing tends to be provided by the respective Government Ministries and organisations who provide accommodation for staff. There are currently 100 identified slum areas requiring attention, but little capacity to deal with these areas[6] and where there is little if any public investment in infrastructure. It is important that the number of such areas do not increase and provision will need to be made for suitable serviced areas to meet the needs of the increasing population.

3.10 Education

Public Education is the responsibility of the Oyo State Ministry of Education (OSMOEd), who are responsible for planning, design and supervision of schools. A number of bodies play various roles, including:

- State Universal Basic Education Board (SUBEB) with its major function of the management of basic education, that is, primary schools in the State;
- Oyo State Post-Primary Teaching Service Commission (TESCOM) responsible, among others, for the appointment, promotion, postings, transfer, discipline, and termination of staff in the State Teaching Service;
- Board for Technical Education (BOTAVED) responsible for running of technical and vocational schools and hiring staff;
- Oyo State Agency for Non-Formal Education (ANFE); and
- Oyo State Scholarship Board.

Meeting the needs of the expansion of the city will require the cooperation and preparedness of all these bodies to play their role and requires consideration of their capacity to meet their responsibilities. The responsibility for design and construction of new educational facilities lies with the Ministry of Works and Transport.

3 Ministry of Culture and Tourism web page.

4 Source: allafrica.com/stories/201501160053.html

5 Oyo identifies culture, tourism as key to tackling recession by Yinka Adeniran, – The Point, October 29, 2016. http://www.thepointng.com/oyo-identifies-culture-tourism-as-key-to-tackling-recession/

6 Consultant's interview with O.G.Olutade and S.B. Taiwo (Head and Deputy Heads of Strategic Spatial planning Department of Ministry of Lands, Housing and Physical Planning, 1st August 2016.

3.11 Health

The provision of health facilities is the responsibility of the Oyo State Ministry of Health (OSMOH). The Hospital Management Boards are responsible for staffing their respective hospitals. The Boards also undertake minor repairs. Major works require the involvement of the OSMOH. The Ministry is also responsible for the training of workers in the sector, and for disease control and laboratories for testing water and food.

The Oyo State Ambulance Service provides free ambulance services in the State and is being expanded.

The main teaching hospital, University College Hospital is under the Ministry of Health of the Federal Government. Doubling the population will require increases in the capacity of the health sector, with more infrastructure and staff. This will need coordinating with plans for urban expansion.

3.12 Parks and Recreational Areas

There is no information available on the operation and maintenance of parks and open spaces.

3.13 Agriculture

Agriculture policy is the responsibility of Oyo State Ministry of Agriculture, Natural Resources and Rural Development (OSMOA). Agriculture is seen as the most important part of the State's economy and the Ministry's mission is to maximise the efficiency and effectiveness of this sector. The Diagnostic Report[7] for the Masterplan identified highly productive agricultural and woodland areas, which need to be protected. The near doubling of population will put considerable pressure on these lands. Planning and development control will be essential to this effort.

3.14 Security Services

Security services are provided by the police and fire services. Ibadan is served by the Oyo State Fire Service, which has 13 fire stations across the State including up to six that serve the peripheral city area.[8] The Federal Fire Service, which is part of the Federal Ministry of Interior, provides training for fire officers. The Ministry also includes the Nigerian Police Force, which is represented in Oyo State by the Oyo State Command. There are eight police stations in the core urban area.[9] Problems in the past have been the lack of funding for equipment and with the level of education of police officers. Training of fire officers is undertaken by the National Fire Academy.

These two agencies must work closely with the State Government in times of natural or man-made disasters. Their inputs are coordinated by the Oyo State Emergency Management Agency (OSEMA), which is an office directly under the Governor. Disaster Risk Management requires the planning and preparation of not only the first responders (which includes the ambulance services and hospitals) but pre-disaster planning. This includes the planning of how the state and voluntary organisations will respond to a disaster, the provision of suitable collection points or areas for temporary shelter for those affected, but also how to minimise the risk of disaster and finally how to ensure the efficient deployment of the rescue services and the evacuation of those affected by the disaster or at additional risk because of the first disaster. This requires the involvement of the physical planners, land management agencies, schools, health services, roads and public transport, the agencies responsible for power and water with those agencies that concerned with drainage and flood management.

7 Dar, 2017.

8 These include HQ, Agbowo Fire Station, Mapo Fire Station, Molete Fire Station, Aleshinloye Fire Station, New Gbagi Fire Station and Agugu Fire Station.

9 These are the Police HQ, Apete, Songo, Mokolo, Gbagi, Iyangkaku, Orita and Kuola.

4 RELEVANT MINISTRIES AND AGENCIES

Actions and policies within the Masterplan have been reviewed against the current roles and responsibilities of the BPPDC and MDAs. MDAs with specific masterplan-related roles are as follows:

- Ministry of Trade, Industry and Cooperatives,
- Ministry of Environment and Water Resources,
- Ministry of Works and Transport,
- Ministry of Information, Culture and Tourism,
- Ministry of Justice,
- Ministry of Agriculture, Natural Resources and Rural Development,
- Ministry of Education, Science and Technology,
- Ministry of Health,
- Ministry of Youth and Sports,
- Oyo State Fire Service,
- Ministry of Local Governments and Chieftaincy Matters, and
- Ministry of Women Affairs, Community Development, Social Welfare and Poverty Alleviation.

The tasks they are to be accountable for and respective roles within the Ibadan City Masterplan are provided in Figure 4.2. The MDAs which are not shown in the list are presumed to continue normal operation in the context of the masterplan.

5 PROPOSED ARRANGEMENTS

The preferred institutional framework option (Option A) requires the least structural realignment to existing arrangements. The MDAs retain their responsibilities. The major cost element is in equipping and training staff.

However, it will also require the passing of a new law that sets out the structure and responsibilities of the physical planning agency (in this case the Bureau of Physical Planning and Development Control – BPPDC). Improving the systems and capacity of the existing urban development agencies, the building of key infrastructure and the development of community and public facilities will all contribute to making Oyo State a more attractive location for investment.

The proposed planning law should include:

- The types of plans, identifying who is responsible for preparing the plans, the requirement for stakeholder consultation, system for plan approval, review and revision, the rights of appeal, etc.
- The functions of the Bureau: policy making, the preparation of a State-Wide Spatial Development Framework, special area plans (e.g. areas of strategic importance, urban regeneration, etc), quality control and supervision of District Planning Offices, preparation of planning regulations, etc.
- Clarification of the rights of citizens and other stakeholders to be consulted.
- Creation of an independent tribunal for appeals.
- Identification of a system of sanctions in law and the powers to review and revise these sanctions.
- The responsibility and requirement of implementing regulations, including Planning Guidelines, Planning Standards and Building Regulations.

Other key areas where institutional strengthening is required include:

- Development of a Land Use Management and Information System, with the training required to operate the system.
- Development of the abilities of all MDAs to prepare multi-year rolling programmes and budgets and to monitor progress.
- Development of the skills of the urban planners, including the preparation of development plans.

5.1 Land Use Management and Information System plus GIS Training

The 'architecture' of the land use monitoring and information system needs to be developed, which would clarify the geo-referencing system, the information to be collected, the rights to access the information, the rights to change or add to the data and the system for backup. The protocol for all of this needs to be agreed by the main users and supporters of the system. The system will need to be based on mapping produced from ortho-rectified imagery, flown or based on satellite imagery with control points. This imagery will need to be provided at agreed levels of accuracy dependent on the use for which it is being used. The images will need to be ground-truthed to verify the accuracy of the image. The preferred software will need to be chosen. While ArcGIS and ArcInfo provide simple ways of establishing the system, the wider use of such software is expensive and much of the freeware available is compatible and can be programmed to provide the same sort of data at the cost of the system designer. If such a software is preferred, there are no or limited costs for renewing the license. The choice is between the speed of implementation against long-term costs.

Once the system has been designed, staff need to be trained in the use of the system including transferring what was previously in hard copy, through scanning to digitised images and into accurate maps using the base maps provided by the preferred system of remote sensing. The task facing the State is the transfer of all hard copy titles and cadastre into soft copies. This task should be applied initially to new plots and plans and later should include historic documentation, as the latter task is likely to take a number of years. The state will also need to make an order that after a specified date, all land plot data and physical development plans must be produced in digital format based using the agreed system for coordinates. In the meantime, training can begin for members of the major land agencies to use the software. As the ICM provides some ArcGIS licenses, the first people have been given training in the use of this software and so are in a position to become the trainers of further groups. About 50 persons are identified as needing such training. Longer-term training will need to be taken forward and will take up to two years; the long-term programme for the digitisation and accurate recording of all the existing data will take up to ten years. In the meantime, all new data would be added in the format.

For this system to be implementable, a considerable amount of equipment is required to produce the digital maps and to store the data. Hard copies of maps and plans need to be stored in such a way that they do not deteriorate. Local surveyors will need to be trained in preparing their data in the accepted digital format and where they are unable to do this, an agreed system of fees should be imposed which would enable the private surveyor to have the Survey Department or Planning or Lands departments prepare the drawings in the new format.

5.2 Urban Planning Skills Development

As of January 2018, there were 384 staff working in the BPPDC. Of these, almost a quarter were registered as town planners with TOPREC, as illustrated in Figure 5.1. This illustrates significant capability within the Bureau.

In terms of qualifications, while all staff have achieved varying levels of educational achievement, an important number have acquired further education qualifications, as illustrated in Figure 4.2. Many staff have aquired more than one qualification.

However, the staff need greater experience. Few have experience in the development of strategic development plans, going beyond land use planning. This will be important for the application of the proposed revised integrated physical planning law. As part of the process, a review of the available training institutions, including skills and staff availability must be undertaken. The NITP have continuous professional development courses but each year offer a different area of study, which may not meet the needs of the planners in the Bureau. A review should be carried out with the help of the University of Ibadan, which currently offer post graduate courses, to provide courses which meet the needs of the Bureau and District office staff.

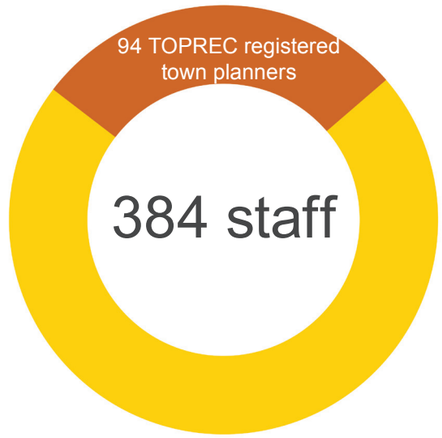


Figure 5.1: Composition of the BPPDC

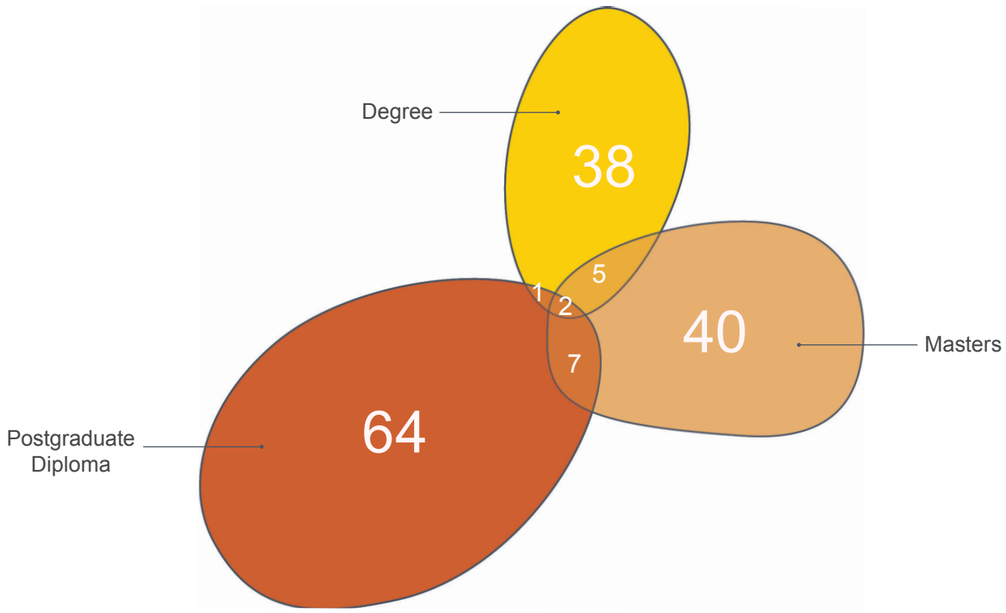


Figure 5.2: Qualifications

5.3 Ownership of the Masterplan

This paper identifies that a recognised body needs to 'take ownership' of the masterplan. Without one particular body tasked with coordinating its implementation, it is likely it will fail. This responsibility is therefore given to the BPPDC's Strategic Physical Development Planning department. Under its remit, it will lead the engagement with all MDAs and other stakeholders and ensure that each stakeholder is clear about their responsibilities. The proposed organogram of the BPPDC is shown in Figure 5.3.

A new Masterplan Implementation Unit is proposed to sit under the Strategic Physical Development Planning department within the BPPDC. It is to be headed by a project coordinator and staffed by an administrative secretary and four experts, with support staff. These roles will be reassigned from the existing staff count within the BPPDC. There is ample capacity within the existing count to identify the qualified personnel. Their roles and responsibilities are shown in Table 5.1 and Table 5.2.

Figure 4.4 identifies the roles and responsibilities for all other relevant MDAs.

5.4 Multi-Year Rolling Programmes and Annual Budget Preparation

All MDAs need to be able to produce multi-year rolling programmes and budgets. The programmes need to be linked to the phasing of development identified in the Masterplan and other State development plans and priorities. This will be undertaken in close association with the Ministry of Finance, Planning and Budget.

As shown in Figure 5.3, the Masterplan Implementation Unit (MIU) will be manned by a staff count of 14. As demonstrated in Figure 5.1, the BPPDC staff count already stands at almost 400. This means that redeployment can be undertaken from the existing departments specifically towards the new Masterplan Implementation Unit. In terms of staff therefore, no additional budget will be required.

In order to implement the masterplan, however, funding for the following will need to be incorporated into the budget:

- Project identification and kick-off for their individual delivery
- Further project studies/ commissions - consultancy fees
- Area Masterplans/ Area Frameworks - consultancy fees
- GIS Lab - ongoing management
- The Ibadan City Masterplan Website
- Ongoing evidence collection - for additional data
- Promotion and marketing of the masterplan
- Urban Observatory - implementation, maintenance and management

Additional tasks will need addressing and must be incorporated into the budgeting process.

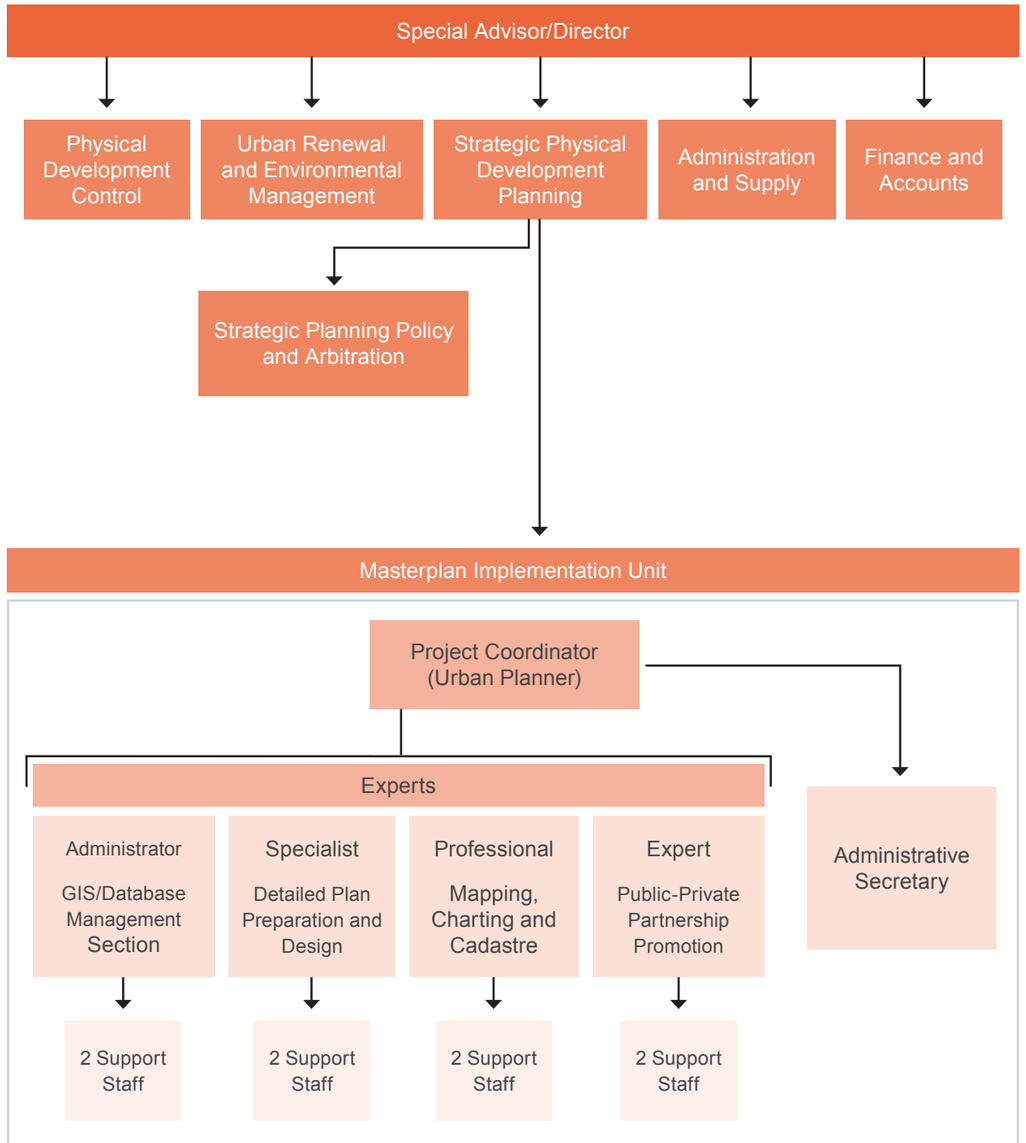


Figure 5.3: Proposed Bureau of Physical Planning and Development Control Organogram

Ministry/ Agency	Roles within the Ibadan City Masterplan		
Trade, Industry and Cooperatives	• Programme to develop the local supply chain • Improve existing markets • Provision of affordable commercial premises for start-ups	• Workforce upskilling • Create database of SMEs and large manufacturing enterprises • Modernise and streamline trading standards	• New market at Ibadan South West • New industrial estates • Control on-street trading
Ministry of Environment and Water Resources	• Sewage • Drainage • Channelisation	• Urban agriculture • Water supply • Solid Waste Management	• River corridors/ strategic open space
Works and Transport	• New roads • Road upgrades • Promote local employment and training programme	• Promote local energy generation projects • Circular Road • Ring road • Light rail	• Strategic Movement Corridors • Energy • Telecoms
Information, Culture and Tourism	• Advertise the Masterplan • Urban Observatory	• Identify and protect heritage assets • Develop a Tourism Strategy	• School of Heritage • Manage the database of heritage buildings
Justice	• Masterplan implementation law	• Financial sector reforms to stimulate availability of funding	
Agriculture, Natural Resources and Rural Development	• Capacity building/training • Micro-credit programme	• Engage with NGOs	
Education, Science and Technology	• Implement new schools • New sports academy		
Health	• Implementation of new health centres		
Youth and Sports	• Information dissemination		
Oyo State Fire Agency	• Implement new fire stations		
Local Government and Chieftaincy Matters	• Information dissemination		
Women Affairs, Community Development Social Welfare and Poverty Alleviation	• Information dissemination		

Figure 5.4: MDA Masterplan Responsibilities

Table 5.1: Bureau of Physical Planning and Development Control Masterplan Roles

BUREAU OF PHYSICAL PLANNING AND DEVELOPMENT CONTROL (BPPDC)		
DEPARTMENT	**RESPONSIBILITIES**	**DETAILS**
Strategic Physical Development Planning (Including Masterplan Implementation Unit)	Hold overall ownership of the Masterplan	• Coordinate and collaborate with the MDAs and LGAs/ LCDAs • Plan and monitor implementation • Facilitate the Masterplan's implementation • Champion the plan - advertise and promote it
	Review and update proposals and policies to ensure they properly address changing trends and issues	• Record comments and issues • Review and record updated and evolving evidence base • Target 5 year review of masterplan
	Development of sub-plans and implementation	• Commission lower level or layout plans, feasibility studies, design briefs, area masterplans or frameworks • Management of consultants producing plans or studies
	Inter-MDA coordination and engagement	• Regular meetings and presentations (at least once per annum) with each MDA to review the Masterplan's progress and implementation • Workshops to hand over Masterplan components for relevant MDAs to implement • Offer full-time availability for guidance and support to MDAs • Monthly status update meetings/ presentations
	Key Performance Indicators (KPIs)	• Ongoing monitoring of KPIs on an annual basis • Assessment of KPIs in Annual Monitoring Report • Publication of the results
	Capacity Building	• Organise departmental orientation and training to develop and expand skill base • Review of the available training institutions, including staff availability
	Finance Mechanisms	• In close association with the Ministry of Finance, Planning and Budget, produce multi-year rolling programmes and annual budgets • Link programmes to the phasing of development • Explore additional sources of funding for project implementation • Partner with the private sector for the delivery of key projects
	Masterplan Implementation	• Overseeing project delivery and construction
	GIS	• Develop and maintain a Land Use Management and Geographic Information System, supported by training for its operation • Transfer hard copy maps to digitised images
	Website	• Update the masterplan website on a regular basis
	Urban Observatory	• Establish and set-up the Ibadan Urban Observatory in the Core Area • Staff and manage the observatory • Establish and coordinate a regular programme of events
Physical Development Control	Review EIAs	• In collaboration with the Ministry of Environment and Water Resources, review EIAs prepared for all Masterplan sub-projects
	Enforcement of Development	• Conduct site visits to monitor, control and verify the progress of development • Develop and maintain a register of proposed developments which includes any additional requirements where compliance can be tracked
	Stakeholder Engagement	• Interact with NGOs and community groups on a regular basis to ensure involvement in masterplan implementation (i.e. information dissemination and feedback)
Urban Renewal and Environmental Management	Stakeholder Engagement	• Engagement with communities in the Core Area to agree on proposals
	Site identification and marking for emerging developments	• Site surveys • Information dissemination/ local sensitisation
	Overseeing of project delivery within the Core Area	• Onsite monitoring

Table 5.2: Masterplan Implementation Unit Staff Roles

MASTERPLAN IMPLEMENTATION UNIT	
ROLE	**RESPONSIBILITIES**
Project Coordinator	• Overseeing the day-to-day activities of the unit • Liaising with the project coordinator, Ibadan Urban Flood Management Project IUFMP • Responsible to the Director-General of the Bureau • Coordinating the implementation of the Masterplan in all the Local Government Area/Local Development Council Areas of Ibadan • Engagement with both public and private developers carrying out identified development projects • Preparing quarterly and annual progress reports for submission to the BPPDC • Provide briefings to Ministers and senior officers
Administrative Secretary	• Attending to correspondence • Keeping of records • Maintaining public relations • Attending to other functions that may be assigned
GIS/Database Management Administrator	• Carrying out GIS operation including data capturing and storage • Managing and updating the geo-database operation • Maintaining the whole layer and data sets • Handling correction and data entry activities after field surveys • Carrying out remote sensing in relation to satellite imagery • Conducting capacity building on GIS and data capturing methods
Detailed Plan Preparation and Design Specialist	• Preparing detailed plans and zoning regulations for different sectors • Issuing of clearance on proposal application in accordance with the stipulated land use • Ensuring land availability and keeping record of such • Designing of infrastructure and public facilities • Designing plans and proposals for change of use of land • Upgrading and renewing of older settlements which are to be preserved • Monitoring implementation of the Masterplan • Reporting any form of contravention on the Masterplan to the appropriate Physical Planning Enforcement Agency for necessary action • Engaging with stakeholders and the community • Monitoring to ensure high quality urban design, architecture, landscape design and sustainable and inclusive design is considered and forms part of all development proposals
Mapping, Charting and Cadastre Professional	• Handling all mapping activities including field surveys • Regularisation of records of land parcels • Preparation of maps • Digitising and geo-referencing of current analogue Cadastre maps • Rectifying of satellite imagery • Charting of proposals to ensure conformity with the masterplan
Public-Private Partnership Promotion Expert	• Identifying relevant stakeholders • Identifying and facilitating of suitable land parcels for ready investors/ developers • Designing terms and condition of engagement and monitoring the effectiveness of the services provided • Adopting the concept of public participation and involving communities in sustainable physical development • Promoting and publicising the contents of the Masterplan through the media • Developing policies and programmes for encouraging investment in tourism, commercial, industrial and housing development • Relating with MDAs and LGA/LCDAs on project development and for lease and acquisition of land for development purposes • Coordinating the preparation and supervising of physical development contracts

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