

KENYA AFFORDABLE HOUSING FINANCE PROJECT
**Terms of Reference for Consultancy Services to Develop a Strategy for
Kenya’s Geodetic Reference System and Large Scale Mapping**

I. Introduction and Background

The Government of the Republic of Kenya (GOK) has received financing from the International Bank for Reconstruction and Development (IBRD) towards the cost of the Kenya Affordable Housing Finance Project whose overall development objective is of expanding access to affordable housing finance to targeted beneficiaries. The project has two main components:

- Support to the Kenya Mortgage Refinance Company (KMRC); and
- Technical Assistance (TA) to the Ministry of Lands and Physical Planning (MoLPP).

The project supports one of GOK’s priority areas for the next five years (“the Big Four”) - affordable housing – and the GOK expects to deliver 500,000 new housing units by 2022. Urban housing in Kenya is not affordable for the majority of the urban population and the GOK has developed an Affordable Housing Strategy to address the issue of unaffordability. The unaffordability stems from the cost of financing, the short loan tenors, the cost of land and construction, and from inefficient property registration.

The Affordable Housing Finance Project supports the GOK’s Affordable Housing Strategy on two fronts: expanding affordable housing finance via the provision of long-term funding and improving the enabling environment by addressing inefficiencies in property registration and land administration. It will build on the transformative reforms introduced by the 2009 National Land Policy (NLP) which led to the consolidation of 11 Land Acts into 4 Acts i.e. the Land Act, the Land Registration Act, the National Land Commission Act and the Community Land Act, all of which now form the backbone of land management in Kenya.

To enhance implementation of additional land sector reforms, the MOLPP intends to use funds from the TA component of the Kenya Affordable Housing Finance Project to hire a Surveying and Mapping Consulting firm to help address structural constraints in the existing land management system in Kenya. These include legal, regulatory, administrative and institutional constraints to addressing persistent land tenure insecurity and inequality. An assessment will be done to comprehensively document the constraints and, from this assessment, a roadmap will be developed to guide the MOLPP in its reforms to improve the equitable use of land for all Kenyans. These particular terms of reference are for a Consulting firm to develop a strategy for upgrading the geodetic reference system and to complete the on-going base mapping of the country by supporting large-scale mapping.

II. Objectives of the Assignment

The overall objective of this assignment is the provision of Technical Assistance to the MOLPP to develop a strategy for Large-Scale Mapping and development of a Modern Geodetic Reference System for Kenya so as to improve the quality and reliability of spatial data for land administration in Kenya. The specific objectives of the assignment are:

- To review the status of the Geodetic Reference System (GRS) and of Topographic and Cadastral Mapping in Kenya, and analysing relevant regulations and technical specifications in these areas;
- To develop strategies for a modern Geodetic Reference System and for Large-Scale Mapping to support land administration and management in compliance with international standards;
- To develop Technical Specifications and Requirements for the establishment of a modern Geodetic Reference System and for Large Scale Mapping; and
- Transferring knowledge and building capacity for the Client's personnel.

The client's intent is to hire a Consulting firm with relevant professional qualifications and practical experience to provide services according to the scope outlined below so as to achieve the objectives outlined above.

III. Scope of Services and Specific Tasks

There are 4 main tasks:

1. Reviewing the status of the Geodetic Reference System (GRS) as well as that of the Topographic and Cadastral Mapping in Kenya while analysing the relevant regulations and technical specifications in this area;
2. Developing strategies and designs for a modern Kenya GRS for Large-Scale Mapping so as to support land administration and management in compliance with international standards;
3. Developing Technical Requirements and Specifications to:
 - a. support a Request for Bids (RFB) for the upgrading of the current GRS, including expanding the network of Continuously Operating Reference Stations (CORS) and a Horizontal and Vertical Geodetic Network;
 - b. establish a precise Geoidal Model for Kenya;
 - c. support a Request for Bids for Large Scale Mapping of the developed/urban areas in the country for purposes of land administration and management; and
4. Transferring knowledge and building the capacity of the client's staff to strengthen and increase sustainability of land administration and management services.

1. Reviewing and assessing GRS and Topographic and Cadastral Mapping

The Consulting firm should carry out a detailed review of the state of GRS, and of Topographic and Cadastral Mapping in Kenya including a review and analysis of actual regulations and technical specifications on the geodetic network, land survey, topographic and cadastral mapping, gravimetric survey and geoidal computation. The review and assessment should include:

- the existing horizontal and vertical geodetic datums, coordinate systems, order/class of horizontal and vertical geodetic network, configuration and

layouts of the networks, estimated accuracies of horizontal and levelling networks, assessment of the type of the network, number of points (initialling established and actual), type of monumentation, density of the horizontal and levelling networks, existing CORS network (including those that are privately-operated), number of stations, type of monumentation, configuration of CORS network, and other information required to assess the state and compliance of GRS with modern requirements;

- the state of the topographic and cadastral mapping and land surveys, scales of mapping, coordinate systems and map projections, type of mapping, estimated accuracy, coverage of the country, including built up areas at large scale mapping, specifications and standards used for mapping, years of mapping and actuality of maps, availability of digital map data sets, type of data (raster and vector), data models used for spatial data capturing and maintenance, information system used to manage digital data sets and data bases, availability of aerial photography and satellite imagery (analogue and digital), imagery resolution and specifications, years of imagery capturing, source of imagery data and other information required to assess the state of base mapping and large scale mapping;
- availability of the gravimetric survey data and information for the territory of the country, its accuracy and density; availability of the gravimetric network points; classes of the network, its accuracy and layout; and geoidal model availability, accuracy and specifications;
- assessment of geospatial data needs of the Ministry, its departments, counties, sub-counties, municipalities, government agencies and private organisations for land administration and management for various purposes including physical planning and environmental protection; and preparation of relevant recommendations and justification for adoption of a modern geodetic reference system; and
- review and analysis of the related regulations, technical specifications and requirements for the geodetic reference network and mapping, data models and their compliance with modern standards, specifications and regulations; and recommendations to improve the regulations and specifications in terms of quality and reliability of geospatial data and information.

Based on the above, the Consulting firm should prepare a Technical Report on the findings of the current state and on the needs and recommendations in the areas of geospatial data, geodetic network and base mapping for different sectors of the economy. The consulting firm should also carry out workshops for the stakeholders to discuss the findings and recommendations in order to get relevant feedback to enrich the final version of the report for submission to the client.

2a. Developing Strategies and Designs for KGRS

Based on the Technical Report with findings and recommendations on the state and assessment of the geospatial data needs endorsed by the client, the consulting firm should prepare a Design, strategy roadmap and implementation plan for a modern Kenya Geodetic Reference System (KGRS) as well as an estimated cost of the program. The term KGRS in this ToR includes: the design and establishment of CORS and a passive Geodetic Control Network (GCN); and the establishment of a precise levelling network as well as a precise Geoidal Model for entire country.

The KGRS is to be used across all state and non-state agencies in the country for all land surveys, topographic and cadastral mapping, and any other type of spatial data capture, management and dissemination. The KGRS should be built using modern Global Navigation Satellite System (GNSS) technology with the objective to establish a network of CORS and GCN points, regularly covering the territory of the country, as a part of the African Geodetic Reference Frame (AFREF). The design and development strategy of KGRS should include:

- A Proposal and justification for establishing a modern Geodetic Horizontal and Vertical Datum and a New Coordinate Reference System (NCRS) for Kenya based on AFREF requirements and specifications. The proposal should also include: analysis of advantages of a new coordinate system and vertical datum; proposals and approaches to determining transformation parameters to an NCRS; and a way forward and implications for legacy spatial data transformation;
- The design and expansion of the existing CORS Network and the Network Control Centre (NCC) including: configuration and layout of the network; technical specifications for the equipment for the stations as well as the equipment of NCC; requirements for monumentation; a description of stations based on UNAVCO recommendations; Internet communication to the NCC; specification for Real Time Kinematic (RTK) services; data computation; and network monitoring requirements;
- design of horizontal and vertical Geodetic Control Network (GCN) including: proposed configuration and layout of the horizontal network, and control points monumentation; specifications and technical requirements of GNSS observation and required positional accuracy of points; network computation and adjustment requirements; configuration and layout of the levelling network; specifications for monumentation of benchmarks; requirements and specifications of network accuracy and observations, computations and adjustment; and requirements for description of location points, publishing of a catalogue of coordinates and heights, and use of the results;
- design of a precise Geoidal Model for Kenya, including: establishment of a gravimetric network of minimal configuration required to support gravimetric survey; layout of a network configuration; specifications and requirements for network gravimetric surveys, monumentation and computation; requirements and specifications of airborne gravimetric survey for geoidal modelling for earth movement; requirements of the model computation; and the geoidal model accuracy which should be about 3-5 cm;
- in cooperation with the client, prepare a strategy of establishing the KGRS including cost estimation, a Road Map and an Implementation Plan as well as the phasing and prioritization of establishing the network;
- assist the client in: preparing a relevant regulation on the new Datum; adopting a new geodetic reference and a new coordinate system for the country; preparing a Road Map for its implementation; and determining implications of the new system and approaches to resolving related issues; and
- Ensure that this design integrates the existing KGRS, coming up with parameters that will allow transformation.

The establishment of the KGRS should be done in a few phases, depending on the needs of various sectors of the economy, starting from the priority areas with most active economic developments and robust communication network, and gradually covering entire territory. The design of KGRS should be based on the use of modern GNSS technology and methodology, digital equipment for levelling, digital gravimeters for network establishment, and airborne gravimetric survey for Geoidal Model computation.

The Consulting firm should analyse the needs of the land sector in a modern vertical datum and reference system and should provide justification for the update and restoration of the levelling network, including the need for: establishing or upgrading the existing Tide Gauges for hydrographic monitoring of the sea level; and for updating the Mean Sea Level (MSL) determination and vertical datum for the country based on modern concept and approaches in this domain.

The CORS network design should include an assessment of the existing Network Control Centre (NCC) to ensure that it will: monitor the CORS network; process the data from the CORS stations; monitor gravimetric surveys; and provide Real Time Kinematic (RTK) Services to customers for surveying and mapping, navigation, , precision agriculture etc.

The Gravimetric Survey of the territory and the computation of the accurate Geoidal Model should enable: establishment of a uniform vertical reference for the entire territory; broadcasting of the 3D corrections for precise RTK positioning services; and obtaining of optometric heights for surveying, mapping and spatial data capturing for different purposes.

The Consulting firm should prepare a draft Technical Report articulating a strategy for establishing the KGRS and submit it to the Client for endorsement. A workshop should be carried out for all stakeholders to discuss the Strategy and provide feedback to feed into the final version of the report.

2b. Developing Strategies and Designs for Large Scale Mapping

Based on the Technical Report with findings and recommendations on the state and assessment of geospatial data needs endorsed by the Client, the Consulting firm should prepare the Design, Strategy, Road Map and Implementation Plan for Large Scale Mapping. The design and strategy should be based on achievements of GNSS, digital mapping and geospatial data management technology and on the achievements of Information and Communication Technology (ICT).

The strategy should envisage the use of modern digital mapping, spatial data capturing and processing technology so as to establish high resolution Digital Ortho-rectified Imagery (DOI), Digital Elevation Model (DEM) and Vector Map datasets for the entire country, which will serve as the base dataset for land administration and management including cadastral survey, land registration, land valuation and physical planning; the datasets will also serve the need for environmental protection and other needs of the economy.

The design and strategy development for Large Scale Mapping should include at minimum:

- The design of Large Scale Mapping, coverage of the country with the base maps at different scales, resolution and accuracy depending on the needs of

- the land sector and of the economy as a whole;
- The selection and justification of possible options and methodology of digital imagery capturing, imagery resolution sources and radiometric characteristics for the large scale mapping of urban areas;
- The development of a Strategy of Large Scale Mapping, a road map and an implementation plan, depending on the needs and availability of resources and on estimates of the cost of this mapping for different options; and
- A strategy and methodology for production of a Vector Base Map of different resolutions and details, depending on their potential use and priority areas.

The strategy should include justification of different options of imagery capturing for large-scale mapping, including aerial photography or use of high resolution satellite imagery as well as cost/efficiency analysis from the perspective of multiuse of the imagery by multiple state and non-state agencies and the cost of licencing and maintenance.

In addition, the strategy should include the acquisition of very high resolution ortho-rectified imagery for the country from the digital airborne or satellite data and information, including imagery of a resolution of 0.1 metres Ground Sample Distance (GSD) for the cities and other built up areas and of a resolution of about 0.3-0.5 metres GSD for other territories of the country.

Furthermore, the strategy should include establishment of high resolution Digital Ortho-rectified Imagery for the entire territory, which will serve as the background data set for land administration, cadastral survey and land registration. In addition, the strategy should include production of accurate DEM, including Digital Terrain Model (DTM) as well as Vector Map data sets for cities and other areas according to the Data Model and Data Catalogue. The existing Data Model and Data Catalogue should also be reviewed and updated by the Consulting firm in cooperation with the client and another consultancy responsible for data modelling¹. The Data Model will be used in future by all institutions or private businesses involved in surveying and spatial data capture to secure the uniformity and accuracy of the spatial data and to facilitate data exchange and integration.

The Consulting firm should prepare a draft Technical Report on the Strategy of Large-Scale Mapping and submit it to the Client for endorsement. A one day workshop should be carried out for all stakeholders to discuss the strategy and provide feedback to inform the final version of the report.

3. Developing Detailed Technical Requirements and Specifications

(a) General requirements to Document

The Consulting firm, based on the design, strategy and implementation plan of the KGRS and Large-Scale Mapping developed in the stages above and endorsed by the Client, should prepare draft Technical Requirements and Specifications (TRS) as follows:

- Technical Requirements and Specifications for the establishment of KGRS ready for use to Request for Bids and in the tendering process;
- Technical Requirements and Specifications for the Gravimetric Survey and Geoidal computation for Kenya for use to Request for Bids and in the

¹ Consultancy services for Data Modelling for Land Administration and Management by the MLPP

- tendering process; and
- Technical Requirements and Specifications for large scale mapping of the developed/urban areas in the country, for use in the Request for Bids and in the tendering process.

The TRS are to enable the client undertake procurement of required services and works according to the Strategy and Implementation Plan for KGRS and Large-Scale Mapping. The TRS should be based on modern ICT, GNSS, digital technology and on a clear methodology of national geodetic network establishment, spatial data and imagery capture and processing. It should be prepared at a high level of technical standards, and should be compliant with the World Bank Regulations, Requirements and Request for Bids (RFB) Standard Procurement Documents (SPD).

The TRS document for KGRS and Large-Scale Mapping should consist of two logical parts: i) general requirements; and ii) detailed technical requirements and specifications.

General Requirements Documentation. This part of the document for both KGRS and Large-Scale Mapping should include: background information on the existing geodetic reference datum and system in Kenya; layouts of existing horizontal, vertical and CORS networks (including those privately-owned); coverage of the country with topographic and cadastral maps at different scales; a brief regarding completed and on-going projects on spatial data and information including the ongoing base mapping exercise; project inception requirements; organisation and safety of field work procedures; data submission, control and acceptance arrangements; products and document acceptance/rejection criteria; Quality Assurance and Quality Control (QAQC) requirements; required quantities of product and document deliverables; requirements on the bidder's qualifications, experience, and technical and financial capacity; estimated implementation plan as well as other necessary requirements; and clear and detailed technical specifications and requirements that will enable the bidders to provide competitive bids and allow them to propose new methods of data production based on their experience gained from similar projects.

Detailed Technical Specifications Documentation. This part of the document, depending on the type of deliverables, should include: i) specifications for detailed design and expansion of the existing CORS network, NCC and network computation and adjustment; ii) specifications for detailed design and establishment of passive Geodetic Control Network and network computation and adjustment; iii) specifications for the design and establishment of Precise Levelling Network and network computation and adjustment; iv) Technical Specifications and requirements for the gravimetric Survey and Geoidal Model computation; and v) technical requirements and specifications for Large Scale Mapping. Detailed requirements regarding detailed technical specifications as well as some templates on the content of such documents are provided in the relevant chapters and annexes below.

(b) Detailed Technical Specifications for KGRS

The part of the document on detailed Technical Requirements and Specifications for KGRS should include:

- ***CORS network design and expansion*** should detail technical requirements and specifications (both government and privately operated CORS) which take into account the earlier work done by in establishing the CORS. In

addition to what is indicated above, it should include: i) requirements for network design and reconnaissance; ii) sites monumentation requirements; iii) network accuracy specifications; iv) site security requirements; v) NCC and required equipment and communication technical specifications; vi) CORS network observations, computation and monitoring requirements; vii) RTK services specifications and requirements; and viii) other specifications and requirements to ensure a phased approach to the establishment of a modern CORS network that will provide efficient and reliable RTK and post-processing positioning services for the customers.

- ***Passive Geodetic Control Network design and establishment*** technical requirements and specifications. In addition to the above, it should include: i) requirements for network design and reconnaissance; ii) points monumentation requirements; iii) network accuracy/orders specifications; iv) required GNSS equipment and methodology of network observation; v) technical specification and software for computation and adjustment including for use of research (for academic software in addition to commercial software); and vi) other specifications and requirements to ensure a phased approach to the establishment of passive GCN for land administration and spatial data capture.
- ***Precise Levelling Network design and establishment*** technical requirements and specifications. In addition to the above, it should include: i) requirements for network design and reconnaissance; ii) benchmarks monumentation requirements; iii) network accuracy/orders specifications; iv) required equipment and methodology of network observation; v) technical specification and software for computation and adjustment; and vi) other specifications and requirements to ensure a phased approach to the establishment of a precise levelling network for land administration and spatial data capture.

In addition, it should include other requirements and specifications informed by the experience of the Consulting firm from implementing similar projects elsewhere, which will ensure a phased approach to KGRS development and establishment of accurate and reliable KGRS as per KGRS Strategy and Design.

(c) Detailed Technical Specifications for Gravimetric Survey and Geoidal Model

The technical requirements and specifications for the Gravimetric Survey and Geoidal Model Computation should be based on the design of the Gravimetric Network and Geoidal Model for Kenya. The document should contain the information according to the general requirements provided above and detailed technical requirements and specifications. The part of the document on detail Technical Requirements and Specifications for Gravimetric Survey and Geoidal Computation should include at a minimum:

- design of the establishment of the gravimetric network of minimal configuration to support gravimetric survey of the territory, layout of the network, required accuracy of the network, monumentation of the gravimetric points of different classes of accuracy, methodology of field observation, minimal specification and requirements on the equipment, safety of field observation, network observation processing, and adjustment and values computation;

- design of the airborne gravimetric survey for the precise Geoidal Model computation, flight plan requirements, minimal specifications of the equipment and aircrafts, airborne gravimetric survey technical specifications, requirements on other data, and information required for Geoidal computation (DTM, geological data etc.) to ensure vertical accuracy of the Geoidal Model better than 3-5 cm, depending on the areas;
- requirements and specifications for the Geoidal Model computation, minimal requirements on the methodology and software, and final results and geoidal model format requirements; and
- other requirements and specifications based on the experience of the Consulting firm from similar projects implemented in other countries which will ensure the establishment of an accurate gravimetric network and the carrying out of airborne surveys for establishment of a precise Geoidal Model as per strategy and design.

(d) Detailed Technical Specifications for Large Scale Mapping

The part of document on detailed Technical Requirements and Specifications for Large Scale mapping should, in addition to the general requirements, include at a minimum:

- requirements on the source of digital imagery (airborne or satellite imagery specifications) including the resolution as Ground Sample Distance, radiometric resolution, maximum clouds coverage allowed etc.;
- Ground Control Points (GCP) requirements and specifications;
- GCP surveying requirements and specifications;
- minimal specifications of the aerial camera and navigation equipment in the case of aerial photography option;
- specifications for Digital Elevation Models for imagery ortho-rectification;
- digital imagery data processing, ortho-rectification and production of the DOI mosaics;
- specifications of resolution and positional accuracy of DOI;
- specifications and requirements for Vector Map Data production; requirements for imagery restitution, vectorization and DTM/DSM production;
- vector data accuracy and topology requirements;
- Data Model and Data Catalogue for the Vector Map data;
- standardized symbolization for large scale mapping (symbols that are used to identify features on the ground); and
- Other specifications and requirements to ensure a phased approach to large scale mapping of the territory and the availability of accurate and reliable digital large scale mapping data for the land administration sector and the economy as a whole.

4. Capacity Building and knowledge transfer

Knowledge transfer and capacity building of client's personnel in the conceptual design of KGRS and Large Scale Mapping, and preparation of required regulations and documentation to enable the personnel supervise the KGRS and Large Scale Mapping establishment and management of implementation of relevant projects, is an important task of the consultancy services and is required to ensure sustainability of the process.

This assignment requires participation of the Client's personnel and local experts in the overall process, contributing to the assessment of the geodetic reference system and mapping and in the assessment of the needs of different agencies and organizations. Knowledge of local environment, conditions and procedures is very important for the success of the assignment and for achieving its objectives.

To get maximum efficiency and contribution of the Client's personnel, the capacity building activities should be properly distributed, coordinated and aligned with other activities to ensure efficiency in capacity building, allow the Client's personnel to understand the process and to be ready to participate in all the activities involved in conceptual design and strategy development for KGRS and Large Scale Mapping.

The knowledge transfer and capacity building in general should include:

- Workshops to discuss each one of the main deliverables, as per the requirements of this ToR – all together at the minimum 5 (five) workshops with an estimated average number of participants of about 40 people for each;
- A workshop (training course) on modern trends in Geodetic Reference Systems establishment, Large Scale Mapping and use of Information and Communication Technology, Digital Data and Imagery capturing and use – estimated about 2 days duration for about 50 people;
- A training course on new technology, requirements, standards, regulations, and methods of spatial data capturing and large scale mapping, including overview of equipment and tools – 2 to 3 days for about 10 to 20 of the Client's key personnel;
- A coaching approach and other capacity building methods can also be used to enhance the capacity of the client's personnel and to achieve the capacity building objectives; and
- Other activities as might be considered necessary based on the Consulting firm's experience from implementing similar projects in developing countries.

The consulting firm, based on its experience from similar assignments, can also propose additional or alternative methods of knowledge transfer and capacity building for the client's personnel, involved in design and strategy development, considered necessary to improve capacity and to ensure sustainability of development and implementation processes.

The knowledge transfer and capacity building should also include support to the Client to prepare and undertake a **public information and sensitization campaign** to communicate to the professionals and to the public in general the message regarding new geodetic reference system and large scale mapping and their advantages for the economy. The support to the campaign should include: assistance in formulation of key messages; support in the design of dissemination materials including leaflets and posters to be used in the campaign; preparation of presentations; preparations necessary for media campaigns; participation in the campaign; support in preparation of seminars for the stakeholders; and carrying out any other measures that will make the public information and sensitization campaign successful. Detailed support for the public information and sensitization campaign should be discussed and agreed at the Inception Stage.

The capacity building methodology and training activities should be discussed and agreed with the Client at the Inception Stage and, thereafter included in the final

Implementation Plan. The final Implementation Plan approved by the client will be contractually binding to the Consulting firm. The Consulting firm should present a concise report at the completion of this activity. The report should include results and recommendations on capacity building needs for the future system.

IV. Required Personnel

The assignment is estimated to be completed within 12 months (48 weeks) and the estimated consultancy staff inputs are 55 person months. This includes the inputs of the team leader, and experts with international and local experience.

Table xx: Indicative list of experts and inputs

Experts	Person Months
Team Leader	12
Geodesist	8
CORS Network Specialist	7
Gravimetric Network Design & Survey, and Geoidal Computation Specialist	10
GIS Specialist	4
Photogrammetric	10
LIMS Specialist	4
TOTAL	55

Qualifications of the team leader and key experts are as follows:

1. *The Team Leader qualification requirements are as follows:*

- Master’s degree or equivalent in geodesy, surveying and mapping or related disciplines and a minimum of 15 years of practical experience after graduation;
- A minimum of 10 years of experience of international project work in national geodetic reference networks design and establishment, surveying and mapping projects development and implementation in developing countries, including Sub-Saharan Africa;
- A minimum of 5 years of experience at the position of project manager or team leader for similar assignments, and documented confirmation of successful completion of such projects;
- Good understanding of modern trends and developments in the area of geodesy, geoidal modelling, mapping and surveying;
- Practical experience of geodetic control network, base mapping and large scale mapping needs assessment, development of strategic documents, previous experience of design of national geodetic networks, base mapping, large scale mapping etc.;
- Practical experience in preparing technical specifications for national geodetic networks, base mapping and large scale mapping development and documented confirmation of such experience from other projects;
- Good knowledge of geodesy, surveying and mapping regulations, modern

- standards and methodologies from different countries;
- Good knowledge of the World Bank requirements and regulations for project design and bid documentation preparation;
- Good Computer and Software skills including professional software for spatial data capturing, processing and management, office and project management applications, understanding of professional software and tools for business process mapping and reengineering and data modelling;
- Good reporting and presentation skills, and good knowledge of report preparation techniques;
- Good organisation and communication skills, and ability to work in multi-cultural environments, organize and manage team work, and cooperate with the stakeholders; and
- Good English language skills at professional level.

2. The Key Experts qualification requirements are as follows:

The Consultant firm should propose a Team of key experts based on its experience of similar assignments that will guarantee the best quality professional consultancy services and achievement of the results of this assignment in accordance with the TOR requirements. The **Consultant** should have strong experience in the following areas: i) Geodesy and Land Surveying; ii) CORS Network Design and Implementation; iii) Gravimetric Network design, Gravimetric Survey and Geoidal Computation; iv) GIS, Spatial Data Management; v) Mapping, Remote Sensing and Photogrammetry; vi) Information and Communication Technology. In addition, the Consultant should have strong knowledge and experience of mapping and surveying policy in East Africa, preferably in Kenya, and have demonstrated experience in successfully undertaking similar assignment. The minimum qualification requirements for the key experts depending on their proposed positions are as follows:

- Master's degree or equivalent in the relevant disciplines for each expert and a minimum of 15 years of practical experience in their disciplines in land administration sector after graduation;
- A minimum of 10 year of experience as key experts in international projects in national geodetic networks establishment, gravimetric survey and geoidal computation, GIS, GNSS and Land Information Management Systems implementation in developing countries, preferably in Sub-Saharan Africa;
- Practical experience in national geodetic networks, base mapping and large scale mapping assessment and analysis, review of the regulation and technical standards and requirements in these areas, previous experience in projects designs and preparation of, road maps etc.
- Strong experience in the design and implementation of nation-wide projects for geodetic network establishment, base mapping and large scale mapping in developing countries, preferably in Sub-Saharan Africa;
- Proven experience of successful assignments in similar positions in land administration projects in developing countries, preferably in Sub-Saran Africa;
- Practical experience in CORS Networks and NCC design and system architecture development, system security and security controls, and in communication networks analysis and design etc.;
- Documented experience in preparing technical specifications and

requirements for bid documents, knowledge of the World Bank requirements and regulations for project design and bid documentation preparation;

- Good computer and software skills, and practical experience in the use of professional software for data base management (including Commercial Off the Shelf (COTS) and Open Source software), data capturing and processing, GIS software and other software required to carry out the assignment;
- Good communication skills and ability to work in multicultural environments and under time pressure, and experience in using participatory approaches during assignments;
- Good reporting, writing and presentation skills; and
- English language skills to carry out the assignment.

3. Local Experts and Personnel qualification requirements

Combining international and local expertise is paramount to the success of the assignment. The Consultant firm must include local experts in the team as resource persons in different domains relevant to the assignment. The local experts should include mainly specialists in Geodesy and Land Survey, Topographic Mapping and Cadastre, with good knowledge of national regulations and technical instructions in the surveying and geodesy, ICT or any other areas considered necessary for the assignment. The minimum qualification requirements for the local experts depending on their proposed positions are as follows:

- Master's degree or equivalent in relevant disciplines and a minimum of 15 years of practical experience in the relevant fields after graduation;
- Good professional record and proven experience in the fields;
- Practical experience in situation assessment and analysis in relevant fields, preparation of assessment and analytical reports, and previous experience in preparing conceptual and road map reports;
- Experience in or knowledge of implementing international projects;
- Strong experience in design of land information management systems in developing countries, preferably in Sub-Saharan Africa;
- Good communication skills and ability to work in multicultural environments and to achieve results under time pressure;
- Good computer and software skills, and practical experience in the use of office software necessary for the assignment as well as professional software relevant to the assigned positions;
- Good reporting, writing of documents and presentation skills; and
- Fluent spoken and written English language skills.

The Consultant firm can hire other local personnel as considered necessary to complete the assignment successfully.

V. Client's Input and Responsibilities

The client, MoLPP, will provide required services including: working space and meeting rooms; professional and support counterpart personnel to work with the consultants; existing reports on relevant studies; and information on any on-going but related initiatives.

VI. Estimated Outputs

The consultant firm should produce at least 6 outputs:

- Inception report;

- A report on review of the GRS and Large Scale Mapping and needs assessment:
- A report of the KGRS and Large Scale Mapping Design and Strategy;
- Technical specifications and requirements for the Bid Documents:
- Final Assignment Report; and
- Capacity building report.