



# **Census mapping methodology using remote sensing and GIS technology**

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## 1. Introduction

The use of satellite imagery, aerial photography and GIS techniques in the census mapping process enables an organization to accurately demarcate the whole country within a prescribed and correct geographic frame. The purpose of this document is to describe the specific methodology to be implemented during the census mapping process, as well as ancillary processes, definitions or methodologies that are relevant to the main process.

### 1.1 Census Cartography Definition

Before enumeration is undertaken, the country is divided into smaller units of about equal population size, each of which will be assigned to at least one enumerator to enumerate its total population. The smaller units are called Standard Enumeration Areas (EAs). For the purpose of this document, the acronym EA will be used to denote a EA. Census Mapping is the process of dividing the country into smaller units of land, during which EA boundaries and type are clearly described and the number of communally based services is identified.

### 1.2 Objectives of Census Mapping

The main objective of census mapping is to subdivide the country into small Standard Enumeration Areas (EAs), each of which will be assigned a unique identification code on the basis of the country's administrative divisions.

**The demarcation of EAs should be such that they satisfy the following requirements:**

- a) boundaries and starting points are clearly identifiable.
- b) boundaries of EAs should not cut across existing District, Constituency or Ward or place name boundaries. All social boundaries should be respected.
- c) EAs should not overlap with one another.
- d) each EA should be of a reasonable size (in population and land area).

This will ensure that every person in the country is enumerated in the census, i.e. no one should be missed or double counted.

**Other aims include:**

- Determining the location of the population in advance of the enumeration in order to make possible the recruitment, training and allocation of a sufficient number of enumerators to ensure that enumeration is completed in time without omissions or duplications;
- Establishing the framework for sample surveys prior, during or after enumeration;
- Enabling the census organization to provide results for areas whose locations are known;
- To update the Place Name layer
- In the case of The Gambia to maintain and capture the Geo-reference Compound Information that is used for EA demarcation

## 2. Existing Census Mapping Methodology

A digital EA dataset for the Gambia already exists. The dataset was created by the GIS Unit of GBOS utilizing the existing infrastructure. The EA data set need to be updated according to the latest Lands and Surveys data obtained by GBOS.

The existing EA maps were created as part of the Census Mapping exercise for the 2003 Census. The Methodology used for Census Mapping for the 2003 Census is outdated. It does not take into account the latest available technology that will:

- reduce the census mapping fieldwork costs
- reduce the total time to complete the census mapping field work
- make the final EA maps more accurate
- improve the overall Census

As mentioned in the report, the GIS/Cartography staff is very familiar with the existing census mapping methodology. A new methodology taking into account the existing methodology and new technology, was developed in conjunction with the GBOS staff.

**The basic steps in the existing Census Mapping Methodology are:**

- Obtain maps
- Field work annotation on maps
  - Identify area
  - Identify Town Boundary on detail map
  - Annotate Town Boundary on Map
  - Identify Compound on detail map
  - Annotate Compound on map
- Capture Information on Compound
- Office Demarcation
- Census Enumerator Map creation

### 2.1 Obtain maps

Existing hardcopy maps were obtained from the Department of Lands and Surveys. Detail Town Layout maps indicating the streets, street blocks, erven boundaries and building were available for some towns. 1:50 000 Topographical maps were obtained for the other areas.

The previous census Enumerator Maps were also used as a starting point.

### 2.2 Fieldwork Annotation on maps

The basic fieldwork annotation methodology:

Identify and annotate the area and Town boundaries on the maps and annotate any changes to the town layout. Where no backdrop on the maps exists, annotate the town layout from scratch.

Compounds are then identified and annotated on the maps. (Please refer to concepts and definitions for an explanation of compounds). Each compound is given a unique number per map.

Landmarks are also identified and annotated on the maps that will be used as reference and navigational points on the final EA maps.

### 2.3 Compound attribute capturing

As mentioned the compounds are given a unique number, this number together with the following attributes are then captured per compound on a separate data capturing sheet:

- No of households in compound
- Name of head of compound
- Address of compound

### 2.4 Office Demarcation

The fieldwork maps together with the attribute data is then used to demarcate the areas into new sizable area maps called Enumeration Areas (EA). The existing fieldwork maps are traced and the EA demarcation takes place on the new duplicate map.

The parameters for an EA in the Gambia are:

- +- 500 people per EA
  - Urban Areas: 70 compounds
  - Rural areas: 30 – 50 compounds
- EA boundary follow natural and manmade features
  - Rivers
  - Mountains/ridges
  - Dams
  - Roads
  - Erven boundaries

Every EA is given a unique number based on the Administrative areas of the country.

The Gambia consists of 8 Local Government Areas and 40 districts within the 8 Local Government boundaries. Every Local Government is and District is given its own unique number.

The EAs are arranged per District and numbered in sequential order. An EA number consist of 5 characters:

1<sup>st</sup> character: Local Government Area

2<sup>nd</sup> character: District

3<sup>d</sup>, 4<sup>th</sup> and 5<sup>th</sup> characters: EA number within District

*Note: the number for the first District in the Banjul Local Government starts with 0*

### 2.5 Census Enumerator Area map creation

Copies are made from the new Demarcated EA maps to be distributed for the Census. 1 Copy per EA per Enumerator is made and another copy is made for Head Office.

## 3. New Census Mapping Methodology

**The basic steps in Census Mapping Methodology are:**

- GIS Implementation
- Imagery Coverage
- Creation of accurate geographic frame
- Deciding on EA parameters
- Office demarcation
- Map creation and printing
- Field verification and data capturing
- Office updating and correction

- Map creation and printing

### **3.1 GIS Implementation**

An operational GIS is the platform on which the whole methodology is built and therefore a necessity. An operational GIS consists of:

- Effective and relevant hardware, in place and operational, connected to a network
- Relevant and appropriate software
- Relevant, current, accurate and appropriate spatial and attribute data
- Skilled and experienced staff who understands the technology, methodology and processes
- Appropriate and accurate methodology

Only once the GIS is operational can the rest of the steps be undertaken.

### **3.2 Imagery coverage**

Specific action items under image coverage will include:

- Determine desired area of coverage
- Determine type or types of base imagery required
- Obtain quotes and determine cost
- Order imagery
- Receive and process imagery
- Store imagery in appropriate format and load as part of database

### **3.3 Creation of accurate geographic frame**

EA's forms the smallest building block of the Geographic Frame and falls within the Districts, which in turn falls within the Local Government areas. The EAs, District Boundaries and the Local Government Boundaries have to be re-digitised in order to fit the corresponding features on the imagery.

Since the existing EA and District Boundaries were derived from old topographic maps sheets, the accuracy is not sufficient.

Only once the District Boundary Layer of the geographic frame has been created, can the re-demarcation and updating of EA boundaries begin.

### **3.4 Deciding on EA parameters**

A decision must be made and guidelines determined for the following parameters:

- EA Type definitions – Determine the types of EAs to be demarcated
- Settlement type definitions
- EA Size definitions – Determine the size of the EAs to be demarcated by type
- Determine the demarcation rules pertaining to EA location, boundary creation and attribute creation.
- Determine the correct EA geo-code

Only once all the relevant EA parameters have been determined, can actual EA demarcation commence.

### **3.5 Office demarcation**

Office demarcation entails the process by which one demarcates EAs through on-screen digitizing and GIS functionality using the newly procured imagery as a backdrop. The minimum information to be loaded and displayed on the GIS before demarcation can commence are:

- The relevant satellite imagery
- The Country boundary
- The Local Government Boundaries
- The District boundaries
- Topographical Data
- Town Layout Maps
- Place name points and boundaries
- Roads
- School points
- Health facility points

The 2003 Census EA maps will also be used during the office demarcation process.

### **3.6 Field Capturing and Verification**

Field verification entails the process by which the information captured and created in the GIS office, is verified and updated in the field. This includes the EA data, Geo-referenced Compound data, landmarks, and topographical features such as roads and rivers. Maps will be printed for the field workers to use in the field. The EA boundary, size and shape will be verified against the set criteria. The fieldworkers will suggest any changes for the EA by indicating this on the map. In addition, the fieldworker will also capture data of the compound using GPS technology. The existing data will be verified and updated and any new data will be captured. Other information such as landmarks will also be verified and captured, and any changes will be annotated.

### **3.7 Office updating and verification**

Once all the fieldwork for an EA has been completed the updated information must be included in the GIS. The Geo-referenced Compound data captured on the GPS is also downloaded and loaded in the GIS. The compound data is an essential part of the methodology as it supports the decision making process regarding merging or splitting of EAS when looking at the EA size parameters. The fieldworkers suggestions regarding alterations to the EA delineation will also be taken into account and changed accordingly. The final decision to change the EA will be made in the GIS office. The decision to change an EA can only be made once all the above mentioned information has been loaded and together with the annotated fieldwork maps, an informed decision can be made.

### **3.8 Map Creation and Printing**

The map creation can now commence. Map creation entails creation of Census Enumeration Maps as well as all other maps associated with the management of the actual census. Census Enumeration Map Standards must be put in place in order to address the following issues:

- What features must be included on the maps?
- What colors must be used for the features on the maps?
- What is the best scale to be used?
- When must a map be split into more than one map?
- What other descriptive information must be included on the maps?
- What listing form information should be included with the map?
- Will the maps be A4, A3, A2 or A1 in size?
- Can a LaserJet printer be used or should a plotter be used?

- Will the maps be printed in duplicate?
  - Will the maps be printed on water proof paper?
  - Will water resistant print cartridges be used when using the plotter?
- Only when the above mentioned topics have been addresses can the printing/plotting commence.

## 4. The Gambia proposed Geographic Frame

### 4.1 Administrative frame

- 8 Local Government Areas
- 40 Districts within the 8 local Gov areas
- Supervisor Areas
- Enumerator Areas

### 4.2 Geocode

The basic geocode will be constructed according to the geographic frame. It is imperative for proper GIS spatial and attribute analysis that the geocode accurately reflects the geographic frame and administrative hierarchy of the country. The 2013 Census EA geocode will consist out of 12 digits and adhere to the following structure:

Geographic Frame	Local Government	District	SA		EA		
Digit	1	2	3	4	5	6	7

### 4.3 Settlement types

Demarcation will adhere to the following settlement types:

- Urban: All proclaimed and gazetted urban areas
- Rural: All rural, traditional and other areas not gazetted as urban
- Institutions: Large institutional settlements such as hotels

### 4.4 Main EA Types

Demarcation will adhere to the following EA types:

- Vacant EAs: In order to ensure the accuracy of spatial demographic and census indicator statistical analysis and map creation, settled areas cannot be demarcated as part of large unsettled areas such as grazing land and natural forest areas since it will spatially misrepresent any statistical analysis. Therefore, large vacant areas will be demarcated as a separate entity which will add to the credibility and relevancy of GIS analysis and dissemination. The attribute data will indicate the type of vacant EA and name
- Urban EAs: These are all predominantly residential EAs within proclaimed and gazetted urban settlements which consist of low cost or shack housing, medium cost housing and high cost housing.
- Rural EAs: These are all predominantly residential type EAs within rural settlements
- Agricultural EAs: These are EAs covering predominantly agricultural land and settlements

- State/Parks: These represent all large tracks of state owned land such as national forests as well as national parks and reserves.
- Industrial/Mining: These are EAs predominantly covering industrial or mining settlements or areas

#### 4.5 EA Subtypes

An EA subtype is a further definition to illustrate any subordinate types aspects of the EA, for example if there is an institution present as part of the larger EA. The subtype will be captured as part of the attribute information of the EA.

The following subtypes have been identified and will be used where relevant:

- No subtype
- Part institution – where a small institution is part of the EA

#### 4.6 EA Size Parameters

The EA size parameters have been chosen to ensure a balance between geographical size and population size while keeping in mind that the enumerator should comfortably be able to visit all households within the EA within the specified enumeration time frame. The existing EA size parameters will be used.

Since EAs are demarcated from digital imagery using modern GIS techniques, dwelling units (DU) are used as size indicators instead of households.

The following sizes are specified:

- +- 500 people per EA
  - Urban Areas: 70 compounds
  - Rural areas: 30 – 50 compounds

EA TYPE	PRESCRIBED SIZE
VACANT (STATE/PARKS/AGRICULTURAL)	<100 Square km
URBAN	70 Compounds (+-500 people)
RURAL	30 – 50 Compounds (+-500 people)

#### 4.7 EA Attribute Table

ATTRIBUTE	DESCRIPTION	DATA TYPE
EA_NUMBER	Relevant EA geo-code	Number
PROVINCE	Relevant province code	Number
DISTRICT	Relevant district code	Number
CONSTITUENCY	Relevant constituency code	Number
WARD	Relevant ward code	Number
CSA	Relevant CSA code	Number
EA_TYPE	Relevant EA type code	Number
EA_SUBTYPE	Relevant EA subtype code	Number
EA_NAME	Primary Place Name	Text

## 5. CONCEPTS AND DEFINITIONS

The most important concepts we are defining are:

### 5.1 Enumerator Areas - what are they?

As we have seen, the purpose of census mapping is to divide each district into small manageable geographical units called Enumerator Areas (EAs). The whole country should be covered in this process.

A EA is a small unit of about equal population size, each of which will be assigned to a single enumerator to enumerate its total population. A EA has distinct boundaries that are describable. Its size is determined by a number of factors, among which the most important are, but not limited to, and not in order of priority: -

- a number of dwelling units
- easily manageable by at least one enumerator for the specified period of enumeration
- topographically accessible
- unique in that it should not cut through any administrative boundary
- EAs do not and should not overlap
- EA should have a unique number

An enumerator area number is a unique -digit number given to a EA for purposes of record keeping and coding.

### 5.2 A Household

A household is either:

A one-person household, defined as an arrangement in which one person provides his or her own food or other essentials for living without combining with any other person to form part of a multi-person household, OR

A multi-person household defined as a group of two or more persons living together who make common provision for food or other essentials for living.

- the persons in a group may pool their incomes and have a common budget to a greater or lesser extent;
- they may be related or unrelated persons or a combination of persons both related and unrelated.

### 5.3 Head of Household

A *head of household* is the person that the household regards as such, and is usually the person who assumes responsibility for decision- making in the household. The head could be either a male or female. NB. There should be one head of a household.

Where property is equally owned and responsibilities of both the husband and the wife are seen as equal, then age should be considered to determine who the head of the household is.

### 5.4 Head of household, acting

A person, who assumes decision-making responsibility of the head of household in the absence of the designated head, is regarded as the *acting head of household*, sometimes referred to as reference person.

### 5.5 Dwelling(s)

Type of dwelling refers to various types of structures used for accommodation. Such structures include - houses, townhouses, flats/apartments, hostels, huts, shacks, semi-detached houses, and sometimes structures that are not intended for human occupation.

### 5.6 Dwelling unit

A dwelling unit is a unit of accommodation of a household that may be vacant or shared by more than one household. Dwelling unit, housing unit, living quarters and stands can be used interchangeably.

### 5.7 Compound

A compound is a group of households that can easily be identified as such. Usually a compound will have a head of the compound that is appointed by the occupants of the households.

### 5.8 Physical address

A physical address is a physical location of a dwelling unit of household(s). It consists of a number and street name, e.g. 625 Church Street.

### 5.9 House number

A house number is a number indicated on the household.

## 6. Basic Demarcation Rules

Based on global recommendations and past experiences the following guiding factors are recommended for EA delineation.

### 6.1 EA Boundaries

- An EA should be delineated within the lowest order of administrative divisions and in consideration of other sub-division/social structures for which the census data are to be reported.
- As far as possible, the boundaries of EAs should be made identifiable by delineating along some permanent (preferably physical) feature such as rivers, ridges, a street etc. Where such features are non-existent, the imaginary boundary lines may be drawn and identified with reference to prominent buildings or other bench mark features.
- An EA delineated within the urban areas should not extend over the adjoining rural areas.
- All EAs have to be demarcated within the defined geographic and social boundary framework.
- Superimposed EA boundaries must follow and match the most recent officially proclaimed administrative boundaries

- As far as possible, boundaries should be demarcated on physical and visible features that makes geographic and demarcation sense.
- Where EA boundaries do not fit properly on the underlying backdrop data, it must be corrected, moved and shifted to fit.
- Each map layout of a EA should point out an easily identifiable, permanent, physical starting point for the sake of the enumerator.

## 6.2 Size and shape

- EAs in an administrative area should cover its entire space in an exhaustive and mutually exclusive manner. That is, every parcel of land area should be allocated to one or the other EA and no gaps or overlaps must occur.
- An EA should be of a compact size, to the possible extent and must not have any outlying pockets.
- In the areas of sparse population distribution, the territorial size of EAs should be such that the respective enumerators can cover them by walking during the specified period of enumeration.
- As far as possible the enumeration areas should have population closer to the prescribed size.
- EAs should be demarcated as closed, contiguous polygons, without any gaps or overlaps, and within the specified size criteria as set by GBOS.
- Vacant areas should be demarcated on-screen as far as possible and then verified in the field if the need arises.
- Access to each part of the area should, as far as possible, be relatively easy.

## 7. Office demarcation, re-demarcation, updating and correction methodology

### 7.1 Inputs before demarcation can commence

Before demarcation can commence certain inputs need to be in place in order for one to make demarcation decisions effectively. The most basic inputs needed would be location, type and size.

**Location:** Where is this settlement? What is the name of this settlement? Are there any distinct social or administrative boundaries within this settlement?

**Type:** What type of settlement is this, urban or rural?

**Size:** What is the size of the settlement? Given the size criteria of the demarcation parameters, how would you go about breaking the settlement up into small puzzle pieces of relatively the same size and structure type?

Collectively, we can refer the information noted above as **general demarcation information**, the minimum amount of information we would need to demarcate a given settlement.

Once all this information has been accounted for, we need one more item to begin demarcation, our base map data.

## 7.2 Basic principles

The basic principles of your methodology is as follow:

- Find the relevant area you want to demarcate
- Remember, demarcation must be done systematically so as to not miss any areas. The best way would be to use village locations and 2003 EA boundaries
- Once the specific area has been identified, assess the following:
  - Determine the settlement type of the EA
  - Determine the size of the EA
  - Determine the EA boundaries using physical features (roads, rivers, footpaths, fences etc) as far as possible.
  - Determine a permanent and physical starting point as far as possible.
  - Determine the geocode of the EA according to location and type.
  - The 2003 Census EA maps must be used as a guide when demarcating the new EAs. These maps will not only be very handy in order to determine EA boundaries, but also in adding landmark information. There is a lot of landmark information provided on those maps which must be captured onto the GIS during the office demarcation phase. This information will also assist the field mappers during the field verification process.
  - Make sure that proper GIS rules are used when capturing and editing the data. The EA layer must be “clean”. The vertexes of the EA boundary should run on top of the neighboring EAs vertexes. Where vector line or polygon data is used for delineating the boundary the vertexes should also be on top of the vector data vertexes. The EA boundary topology must be maintained and there must be no open spaces or gaps.

## 7.3 Basic Processes

### Location

Use the boundary specifications as set out in the Demarcation Rules. All EA boundaries must fit to the backdrop. If not, why? All rules should be followed as far as possible. Reasons must be given for exceptions.

Boundaries must adhere to:

- Country boundaries
- Local Government boundaries
- District boundaries

Other social boundaries, such as section boundaries within informal settlements and the like. Ensure that stands or plots are not split by EA boundaries. Use the 2003 Census EA maps where necessary.

### Place Names

Determine the most correct place name from the additional spatial and attribute data available. Alternative names should also be listed. Use the 2003 Census EA maps where necessary.

### Shape

Make sure that the EA has a logical shape.

### **Size**

Each EA needs to be demarcated according to specified size criteria. If not possible, the reasons should be flagged as part of the EA attribute structure. Use the 2003 Census EA maps as a guide.

### **EA Number**

Make sure the EA is geo-coded correctly according to the prescribed geo-code structure.

### **EA Type**

Determine the correct classification by using the available digital and hardcopy data. If doubt exists, flag the EA to be verified in the field.

### **EA Sub Type**

Determine the correct classification. If doubt exists, flag the EA for field verification.

### **Accessibility to the EA**

Is the EA easily accessible by means of roads or footpaths?

### **The boundaries**

Does the EA boundary make sense, i.e. it must not cut across national roads, rivers, mountain ranges etc. Moreover, the boundaries must not cut into another social or administrative area. All EA boundaries should concur with the Demarcation Rules.

### **Mobility within the EA**

Can the enumerator move along easily within the EA, or is the terrain very difficult to negotiate. There should be no un-crossable obstacles (mountain ranges, big rivers etc.) within a EA.

### **Vacant EAs**

All vacant EAs should be demarcated on-screen with the use of existing digital and hardcopy information as far as possible. Those that can not be dealt with by on-screen demarcation needs to be flagged for fieldwork verification. The following needs to be kept in mind when making decisions during on-screen demarcation of vacant land:

- Determine, with the use of current satellite photography, aerial photography or conventional fieldwork whether the EA is still vacant.
- The large vacant areas should be split into smaller, more manageable units
- Again, boundaries should as far as possible follow identifiable, physical features and should adhere to basic demarcation principles as set out in the demarcation rules for refugees: The camp would be a EA on its own.

## **7.4 Block of flats and apartments**

From the imagery, carefully determine buildings that might be flat or apartment blocks. Also make use of cadastral information where relevant to determine the occurrence of apartment blocks. Flag these EAs so that they can be investigated during the fieldwork verification phase.

## **8. Map creation and printing**

Once a specific constituency, district or province has been completely demarcated, the GIB will have to create and print A3 size EA verification maps for every single EA. These field verification maps will then be distributed to the relevant centers where they will be provided to the relevant mappers to conduct the field verification exercise.

## 9. Field verification

The following methodology will be implemented during field verification:

### 9.1 Protocol issues

Working on a settlement level, it is important to make your presence and purpose known and clear to the local Chief, Headman, Councilor or manager in order for you to continue your work in the area safely and without hassles. Informed people are cooperative people.

### 9.2 Fieldwork verification processes

- Make sure you have all the relevant demarcation information at hand, as well as the photo map.
- Follow fieldwork protocol
- In other words, **ORIENTATE** the photomap. Look for structures or features on the map that you can identify on the ground, such as a pond, community hall, prominent fence etc. Remember these photos are colour therefore you can also use "the house with the blue roof" to help you orientate the photo map and determine where you are. If you see a prominent feature on the map but you do not know where it is or what it is, do not be afraid to ask the locals to point you in the right direction. Some people can pick features quite easily by looking at a photo.
- Once the photomap is orientated, determine the EA you want to verify.
- Drive or walk round the boundary of the EA to verify the starting point, the boundary itself as well as the prominent landmarks as far as possible.
- If there is a problem with the starting point (it might be a structure that was there when the photo was taken but has since been removed), correct it by choosing another starting point that appears both on the ground and on the map.
- Determine the names of the prominent landmarks (school, police station, church, hospital etc.) and write it next to the appropriate number on the EA annotation list.
- The same applies to structures/dwelling that were flagged by the office demarcation staff.
- If the landmark is a normal house, find out the name of the head of the household or house number (if available) and write it next to the appropriate number.
- Determine whether the area name you gave the EA in the office is the correct one, if not correct it.
- If the EA boundary is incorrect for some reason, you should also correct it, bearing in mind that it will have an effect on the neighbouring EA's boundary.
- Remember to adhere to administrative boundaries. Adhering to administrative and social boundaries gives more credibility to the dissemination process, since census information can accurately be displayed at different geographic levels, such as region, district, ward, village, sub-village, town or suburb.
- Verify the EA according to location and type.
- Remember that no overlaps of EAs or gaps between neighbouring EAs should occur. It is easy to check this on the photo map when you have completed the section on which you were working. Make sure that the whole area that you were supposed to cover, has been done
- Ensure that your quick count listing is done accurately
- When a situation occurs where you are verifying one part of a settlement and another person's the rest of the settlement, make sure that every person is exactly sure which area he or she is responsible for. Areas can easily be missed or even verified twice by different people, therefore communication and coordination is of utmost importance.

- Verify the size, shape and general characteristics of the EA
- Determine whether an Enumerator will be able to complete the EA in the allotted time frame
- Remember to look after the photomaps, they are a valuable and restricted resource. All maps have to be filed properly and stored safely. During fieldwork, make sure to fold them neatly, keep them from getting wet and dirty and make sure they are not torn. If by some chance a map is torn, repair it immediately with clear sticky tape.
- Once every EA in the area have been verified and the EA annotation list completed, you can view the verification process as complete.

### 9.3 Basic Fieldwork processes

#### **Initial preparation**

Gather all relevant demarcation information and photomaps. While in the field, check the EA as a whole as well as the surrounding EAs.

#### **Location**

Use the boundary specifications as set out in the Demarcation Rules. All EA boundaries must fit to the backdrop. If not, why? All rules should be followed as far as possible. Reasons must be given for exceptions.

#### **Place Names**

Determine the most correct place name for the area that the EA falls within. Alternative names should also be listed; this information can be gathered from the local population. Also determine and note all relevant sub-place names.

#### **Shape**

Make sure that the EA has a logical shape. Eliminate "octopus" EAs; try to minimize EAs with the following shapes U, L, Π, ∪, ∩, ∠, Π, 7

#### **Size**

Each EA needs to be demarcated according to specified size criteria. Determine whether the EA complies with the criteria. If not, the EA should be corrected.

#### **EA Type**

Determine if the EA was correctly classified.

#### **EA Sub Type**

Determine the sub type of the EA, where applicable.

#### **Accessibility to the EA**

Is the EA easily accessible by means of roads? If not, what alternative transport can be used? As a last resort, the EA should be re-demarcated.

#### **Starting Point**

Is the starting point clearly identifiable?

#### **The boundaries**

Does the EA boundary make sense, i.e. it must not cut across national roads, rivers, mountain ranges etc. Moreover, the boundaries must not cut into another social or administrative area. All EA boundaries should concur with the Demarcation Rules as far as possible.

### **Mobility within the EA**

Can the enumerator move along easily within the EA, or is the terrain very difficult to negotiate. There should be no uncrossable obstacles (mountain ranges, big rivers etc.) within a EA.

### **Quick count**

Do the household quick count according to the prescribed methodology

#### **9.4 Vacant EAs**

The following should be considered when demarcating vacant areas in the field:

- Determine if there are any areas within the EA that is not vacant anymore.
- If not, the part that has population should either be incorporated into a neighbouring populated EA, or, if the population is big enough, should be demarcated as a EA on its own.
- The large vacant areas should be split into smaller, more manageable units
- Again, boundaries should as far as possible follow identifiable, physical features and should adhere to basic demarcation principles as set out in the demarcation rules.

#### **9.5 Institutions**

All institutions in the Gambia is currently demarcated and incorporated as part of the surrounding EA.

#### **9.6 Block of flats and apartments**

Identify possible apartment buildings or hostels within the EA, using the flagged information as well as canvassing the EA and using the knowledge of the local populace. Determine the name as well as the amount of flat units within the building. Add the corresponding landmark number to the list with the corresponding flat name and number of units so that it can be added to the GIS database back at the office.

Considering all the information given above, it should be clear that there are some steps that are relatively similar for office and fieldwork demarcation. The main purpose of EA verification should never be forgotten, which is to verify the correctness of the office demarcation, as well as to gather information regarding prominent landmarks, flats and institutions.