

DEVELOPING FLOOD RISK MAP FOR GAMA

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Introduction

❑ Flooding-

- A major environmental problem in GAMA
- Annual event since 1995
- Devastating effects on both life and property.
- Floods in June-August (2009) left six dead, 15,616 displaced and GH¢ 1,777,214.00 worth of items destroyed in Accra (NADMO, 2009)
- Urgent need to address it and reverse losses





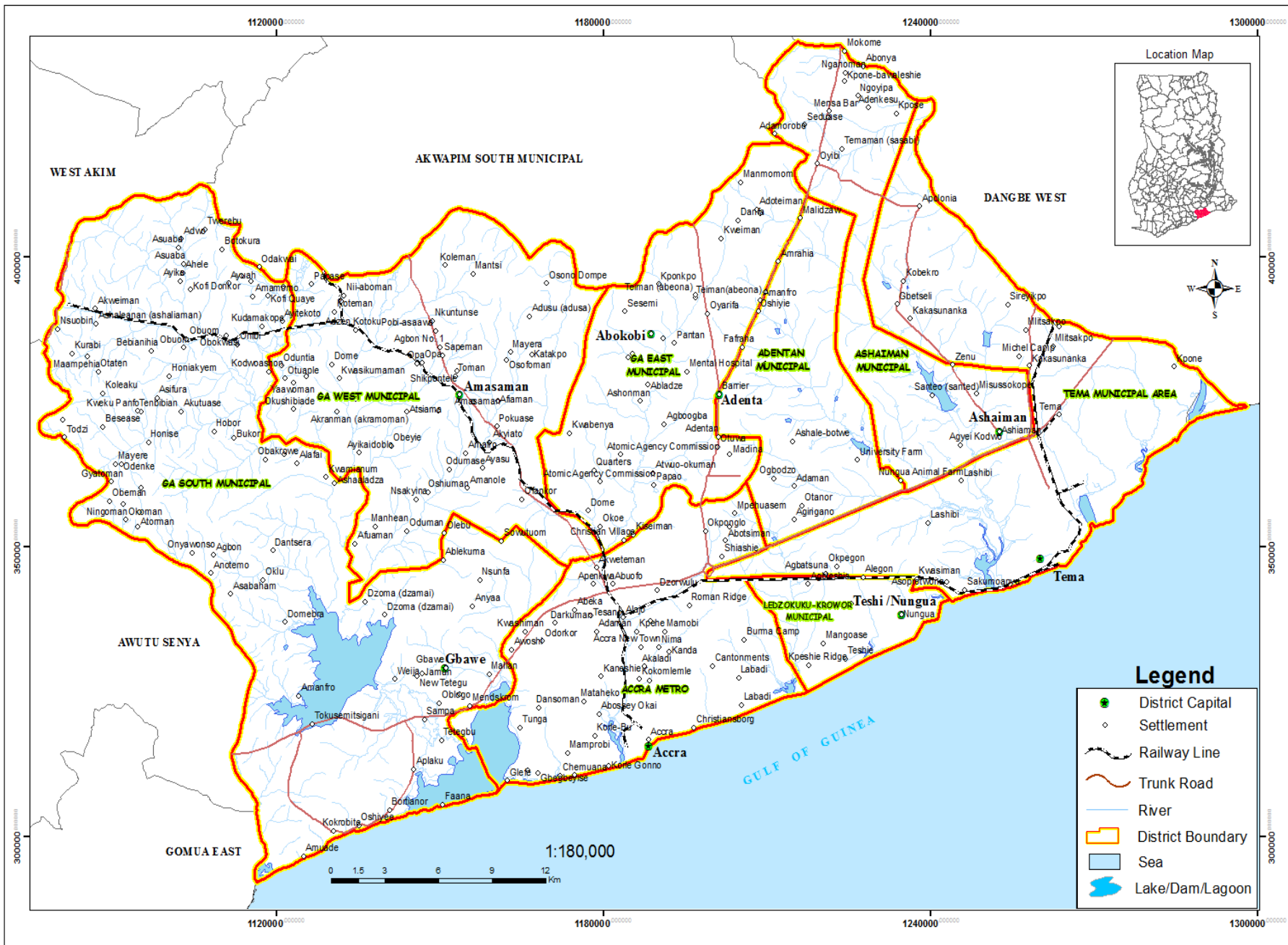
Objectives

- ❑ Develop a robust method of identifying broad-scale flood risk zones for GAMA
- Flood risk mapping based on certain defined factors; topography, soil, rainfall, drainage and landuse
- A flood map showing current flood situation in GAMA

Study Area

- Accra forms part of a large built-up area called the Greater Accra Metropolitan Area (GAMA) in the Greater Accra Region.
- GAMA - Eight administrative districts namely; Accra Metro (AMA), Tema Metro (TMA), Ashaiman (AshMA), Ledzokuku-Krowor (LekMA), Adentan (AdMA), Ga-East (GEMA), Ga-West (GWMA) and Ga-South (GSMA).

MAP OF GREATER ACCRA METROPOLITAN AREA (GAMA)



Methodology

- Geographic Information Systems (GIS) Approach

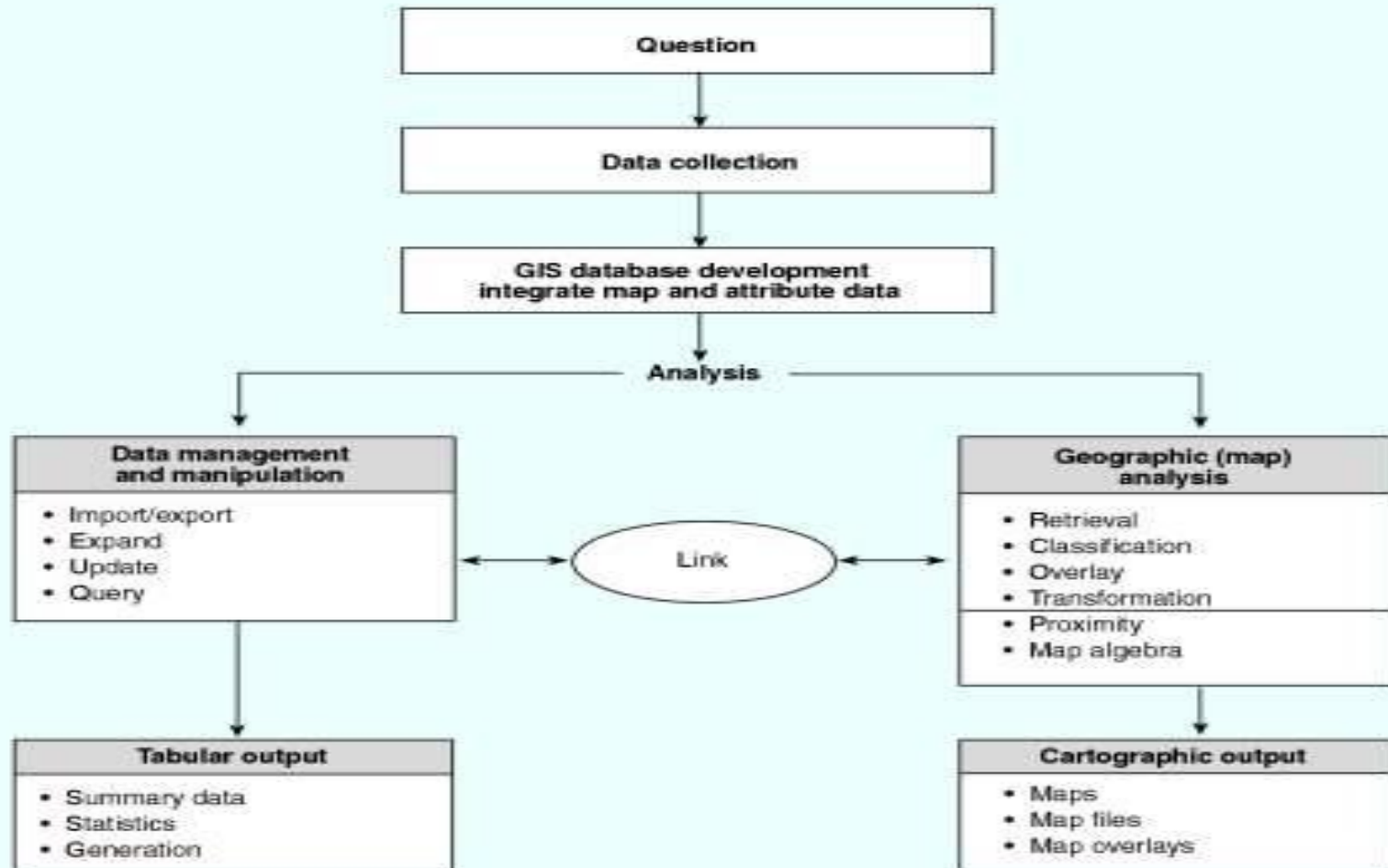


Figure 1: The GIS Model

Source: Ward *et al.* (2004): www.pubmedcentral.nih.gov/edirect3

Flood Risk Mapping

□ Data Input (Defined-factors)

- Landuse/landcover (Vegetation and built-up/bare ground) for landuse mapping (Landsat ETM +) taken on 30/12/2005.
- Topography (Elevation and Slope) using Digital Elevation Model (DEM) taken in 2000.
- Rainfall
- Soil formation
- Drainage (rivers and other water bodies)

□ PROCEDURE

- Landsat ETM+ image processing into landuse/landcover classes (built-up/bare, vegetation and water bodies) using Erdas Imagine 9.2.
- Using point data to represent areas of spatial variability of specific parameters helps provide an understanding of interdependence and importance of factors (Poyry,2008; Nyarko, 2002).
- Assign score/weight to defined data sets-landuse, topography/slope, rainfall, geology and drainage. See Table 1.

Table 1. Themes with assigned Score (weight)

Layer	Criteria	Weight (Score)
Landuse	Forest/Agriculture	1
	Built-up and bare land/Non-forest	2
Topography	Elevation	2
	Slope	1
Geology	Soil types	1
Rainfall	Rainfall distribution	1
Drainage	Distribution of water bodies	1

- “Weighted” overlay analysis using the Spatial Analyst Tool (ArcGIS 9.3)
- A “weighted” layer derived from combination of defined data sets (landuse/landcover, topography/slope, rainfall, geology and drainage)
- Composition of flood risk map in ArcGIS 9.3
- Recoding of flood risk zones into (5):
 - Very high, High, Medium, Low and Very Low.

Current Flood Situation

□ Materials

- Base Map of GAMA
- Garmin GPSMAP 76CSx handheld GPS
- Current flood communities (NADMO,2011)

□ Procedure

- Field survey to determine flood areas in affected communities
- Taking of point/areas using handheld GPS
- Development of flood database in Excel

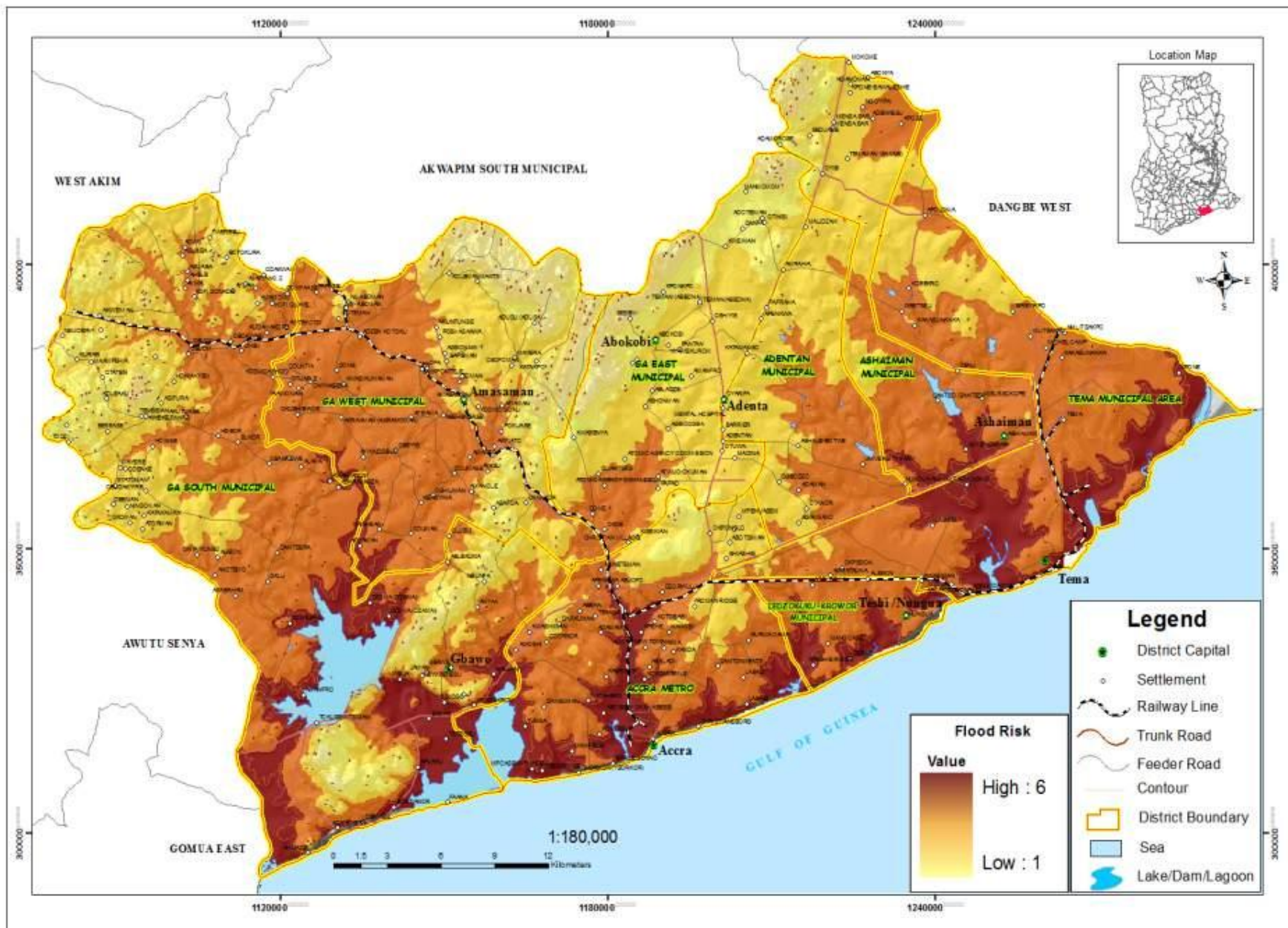
Procedure cont.

- Import database into ArcGIS 9.3
- On-screen digitizing of points taken from the field into polygons/areas
- Composition of map (Display, editing and analysis of layers)
- Final current Flood situation map

Results

- Flood Risk Map
- Current Flood Situation Map

MAP OF GAMA: FLOOD RISK



□ Summary of results

- Significantly large area of High risk zone.
- Low-lying areas of GAMA relatively more likely to get flooded than areas on relatively higher elevations.
- Many areas of GAMA situated in the Very High flood risk zones are found to also have elevations of below 50m above sea level (eg. Alajo, Glefe and part of Lashibi)

Results- Flood risk map

- Similarly, significant areas of the High Risk zone lie in the range of 50m to 150m contours.
- For the Medium Risk zone, many areas have elevations of 150m – 250m above sea level.
- The Low and Very Low zones also fall significantly in the range 300m-400m and above 400m contours respectively on the map.

The map displays the Greater Accra Region of Ghana, with the following details:

- Geographical Features:** The Gulf of Guinea is to the south. The map shows various municipalities and districts, including Akwapim South Municipal, Ga West Municipal, Ga East Municipal, Adenta, Ashaiman, Tema, and Accra.
- Legend:**
 - District Capital (indicated by a green dot)
 - Settlement (indicated by a black dot)
 - Railway Line (indicated by a black line with cross-ticks)
 - Trunk Road (indicated by a red line)
 - Feeder Road (indicated by a grey line)
 - River (indicated by a blue line)
 - Contour (indicated by a brown line)
 - District Boundary (indicated by a yellow line)
 - Sea (indicated by a light blue area)
 - Lake/Dam/Lagoon (indicated by a darker blue area)
 - Flood Zones (indicated by a light blue hatched area)
- Scale:** The scale is 1:180,000, with a scale bar showing distances from 0 to 12 km.
- Location Map:** An inset map in the top right corner shows the location of the Greater Accra Region within Ghana.
- Coordinates:** The map includes latitude and longitude coordinates along the edges, ranging from 1120000 to 1300000 longitude and 300000 to 400000 latitude.

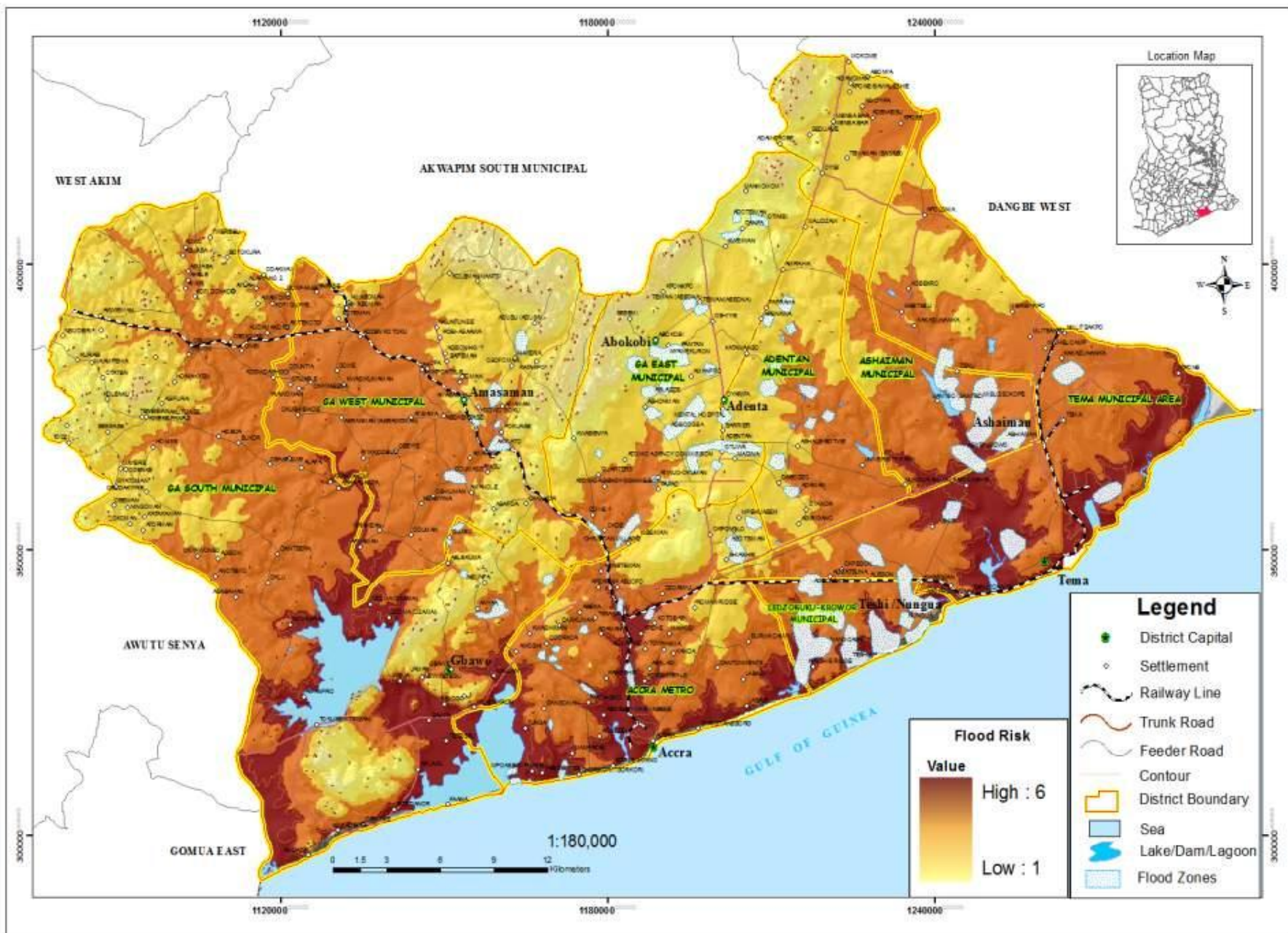
□ Observations

- Flood areas in GAMA mostly found in low lying areas.
- Flood areas in most instances closely associated with drainage systems.
- Some natural waterlogged areas encroached upon by human settlements (eg, South of Pentecost University College, Sowutuom).
- Poor drainage systems hence inability of run-off to flow easily to safe grounds (eg, Middle East, Ashaiman).

☐ Observations

- Flood areas have elevation ranging between -7.3 m below sea level – 105.8 m above sea level.
- About 99.9% have elevation of less than 100m above sea level
- Similarly, 74% of the flood areas lie below 50m contour.
- Current flood areas mostly situated in the Ashaiman, Ledzokuku-Krowor, Ga-East and Ga-South than in the AMA, Ga-West District, Adentan Municipal and Tema Metro.

MAP OF GAMA: FLOOD RISK AND CURRENT FLOOD SITUATION



THE END

THANK YOU