



REPUBLIC OF KENYA
MINISTRY OF ENVIRONMENT
WATER AND NATURAL RESOURCES
(MEWNR)



COAST WATER
SERVICES BOARD
(CWSB)

Water and Sanitation Service Improvement Project (WaSSIP)

Loan Nos.: IDA 4376-KE and CKE3010-1

Consultancy Services for Water Supply Master Plan for Mombasa and Other Towns Within Coast Province



Volume II Water Supply Master Plan Album of Maps and Geographic Data

December 2013

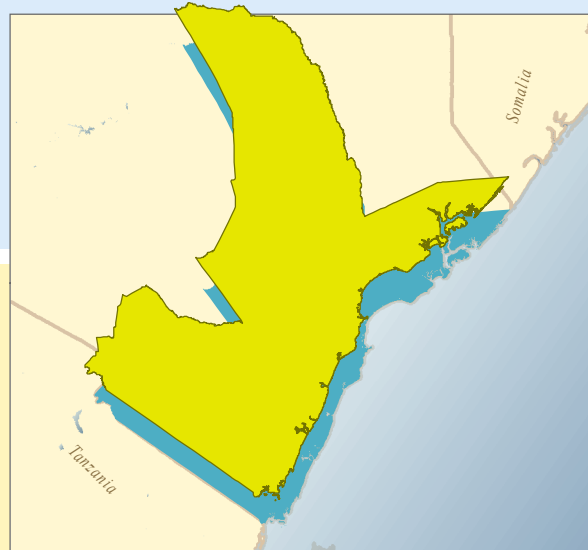
KE-24890-R14-179



in association with



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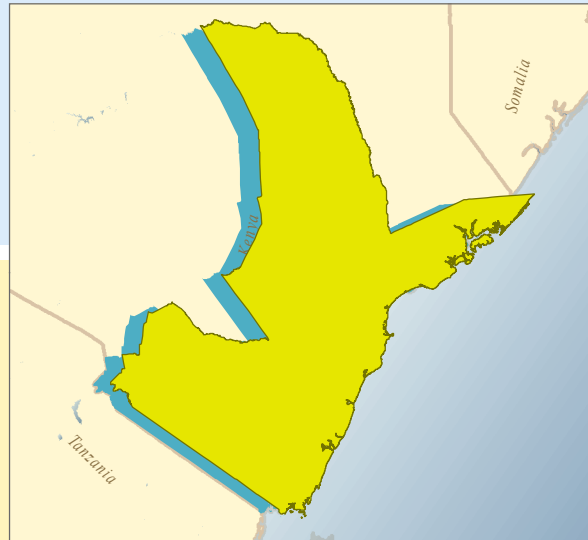
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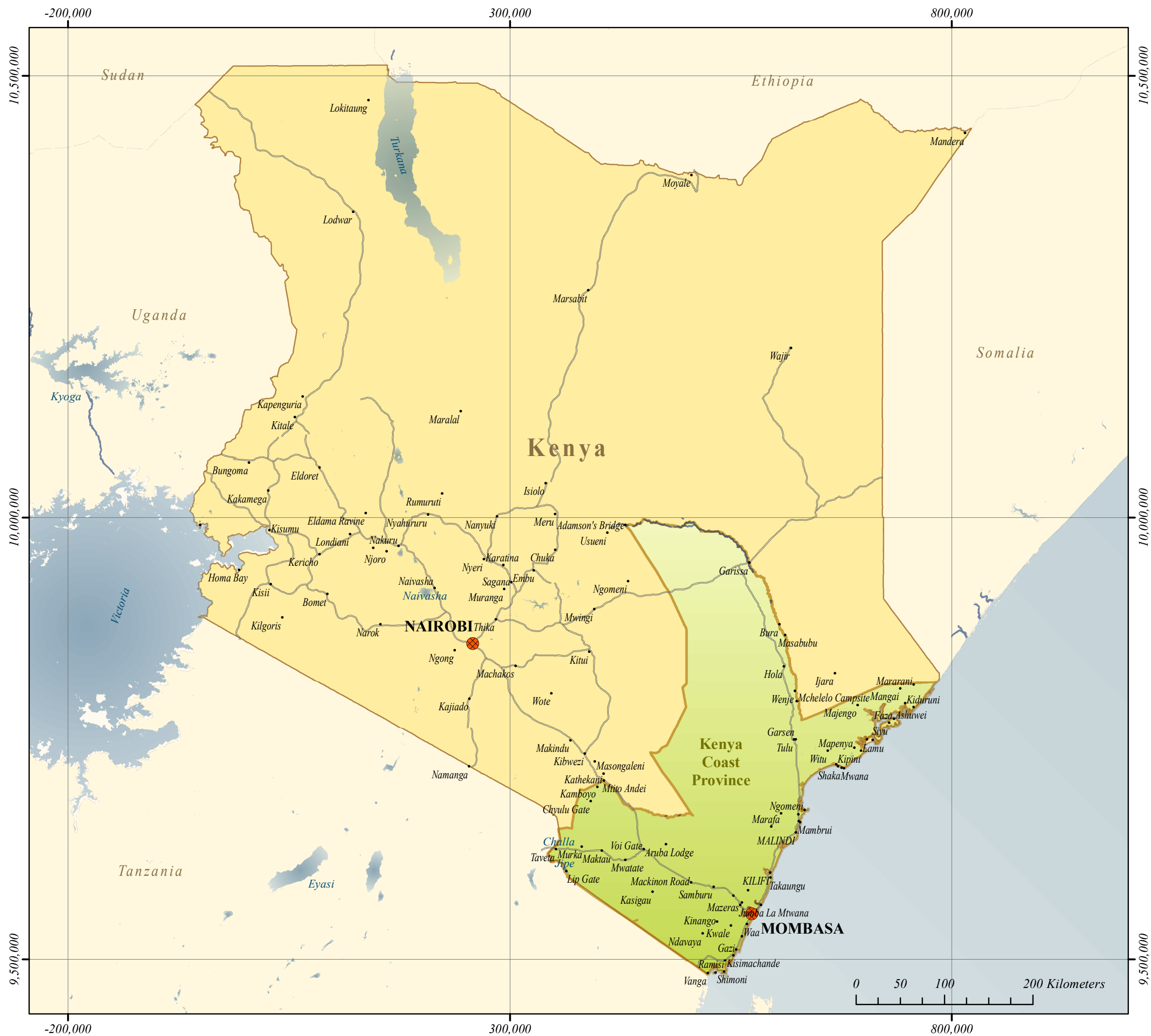
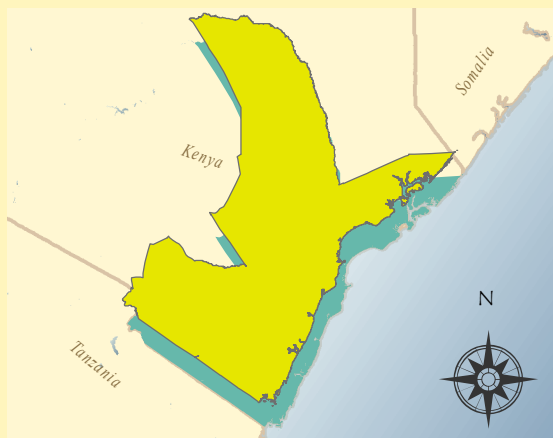
Water Supply Master Plan for
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Within the Coast Province



Map 1

Regional Map
& Area of Interest



 Kenya Coast Province

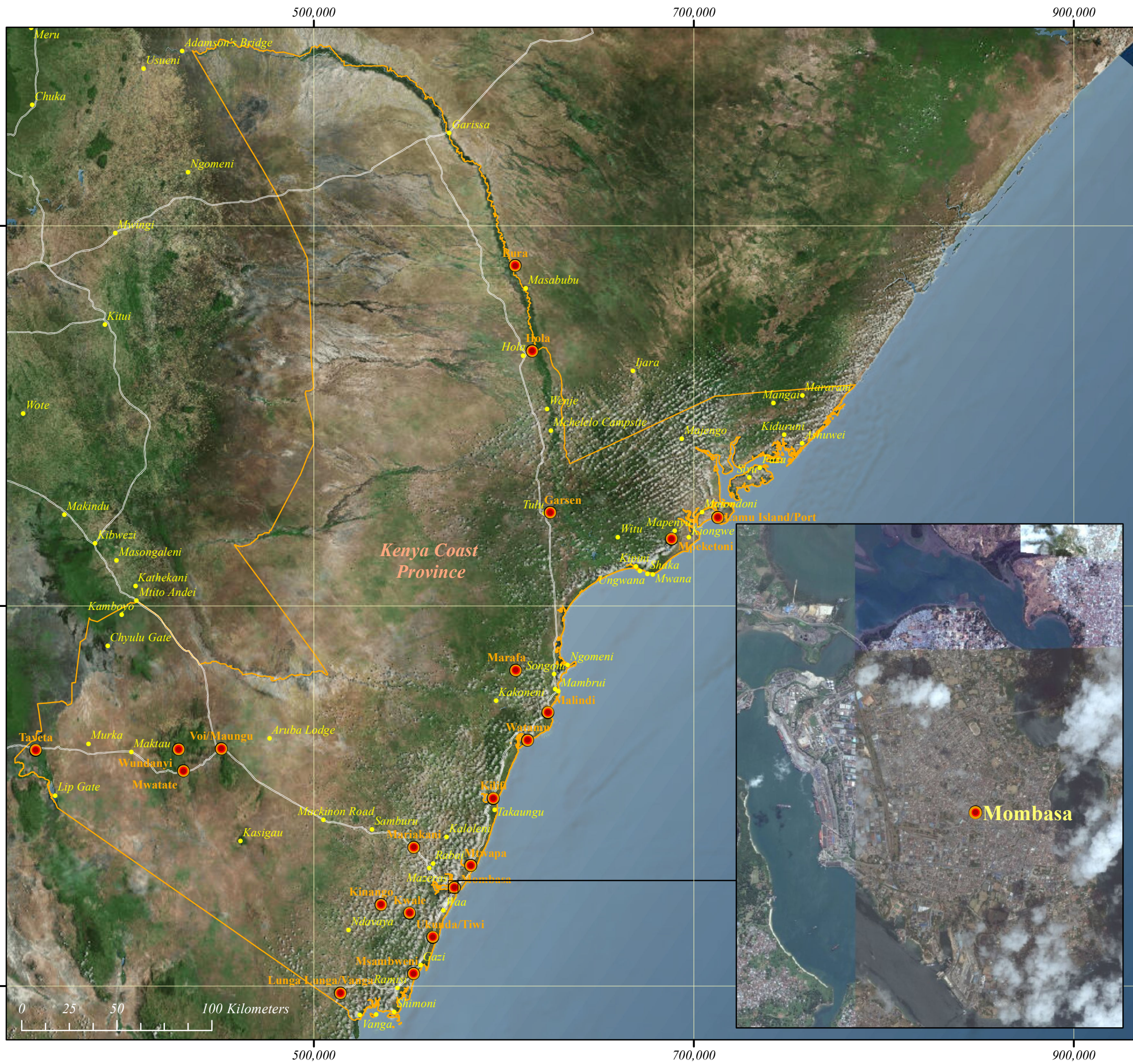
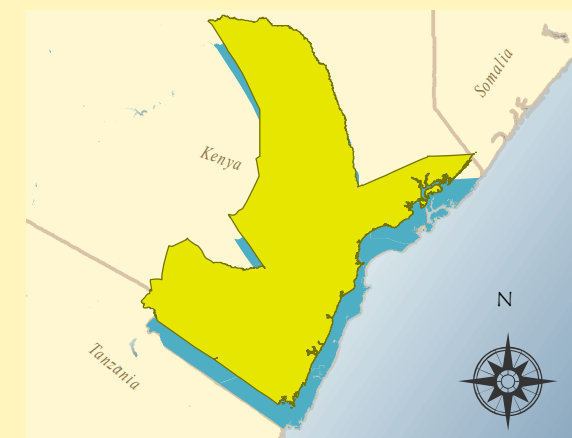


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Map 2
Coast Province
Satellite View

-  Population Centres
-  Kenya Coast Province

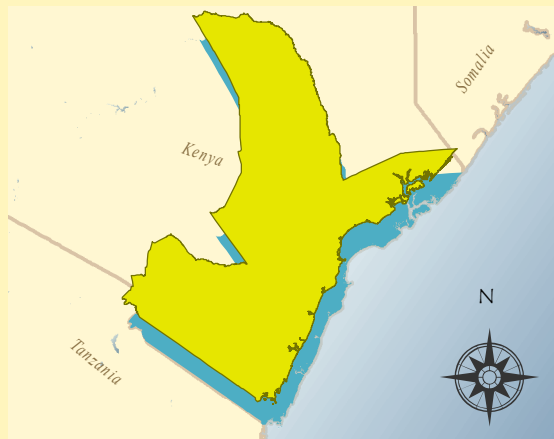


Water Supply Master Plan for
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Within the Coast Province



Map 3
Coast Province
Administrative Units by
Counties and Districts

- Major Cities and Water Demand
- County Boundaries
- Districts Boundaries**
- KALOLENI
- KILIFI
- KILINDINI
- KINANGO
- LAMU
- MALINDI
- MATUGA
- MOMBASA
- MSAMBWENI
- TAITA
- TANA DELTA
- TANA RIVER
- TAVETA



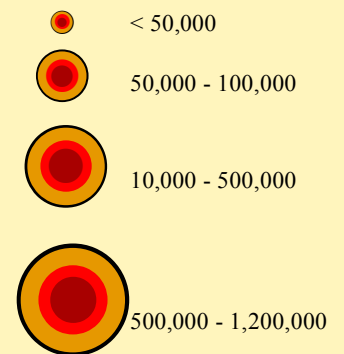
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Map 4

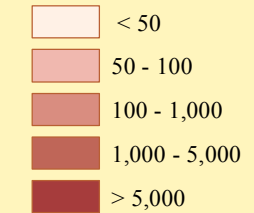
Coast Province
Townships and Population

Major Population (2012)

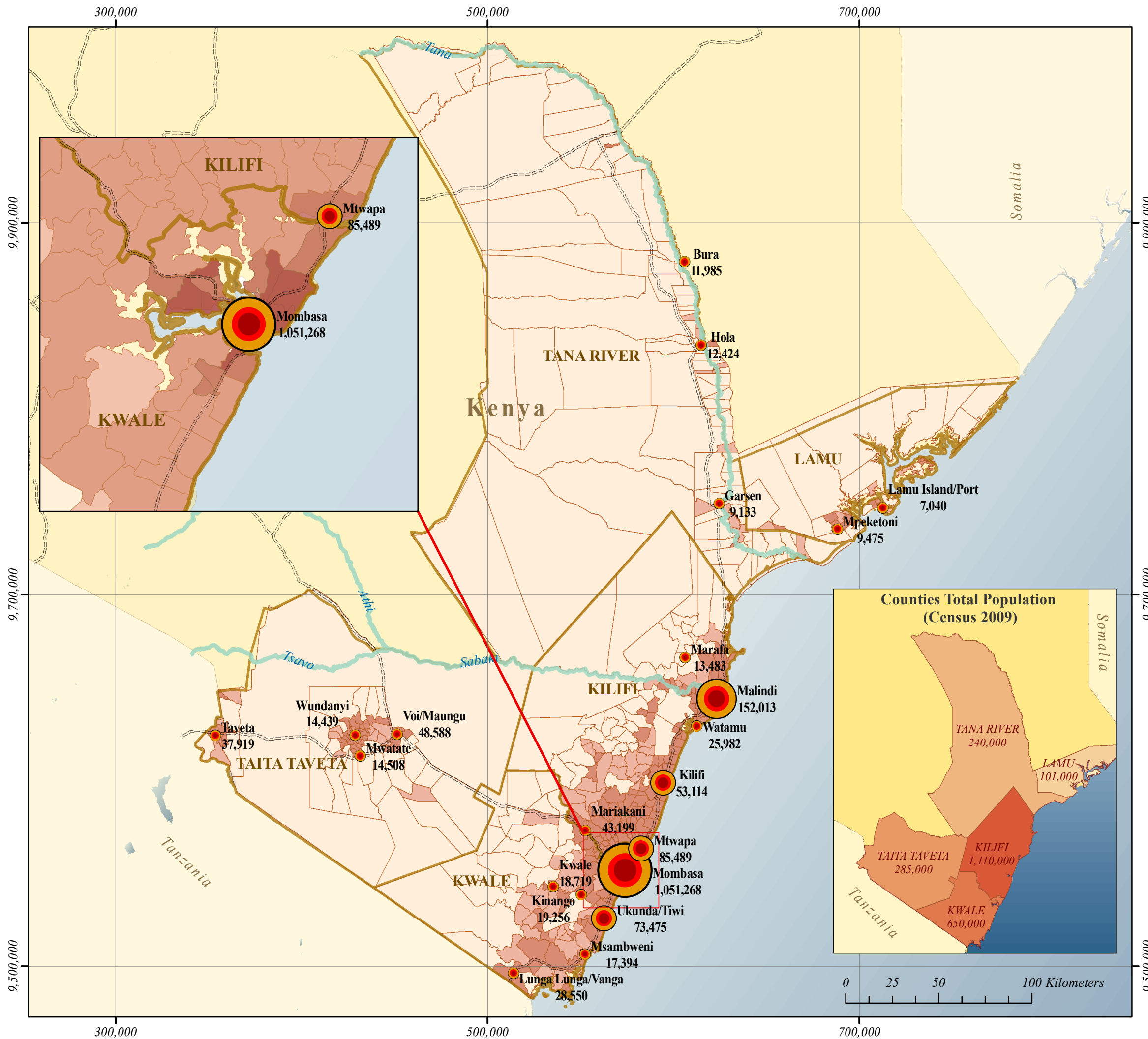
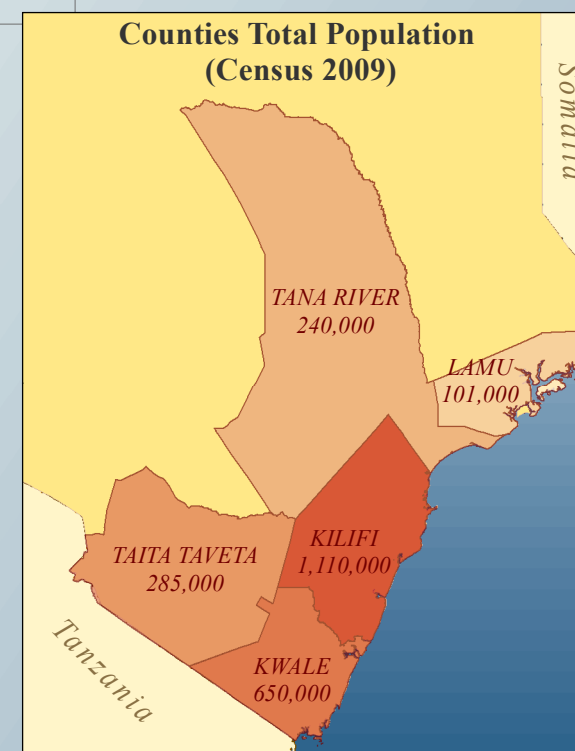


County Boundaries

Administrative Units Population Density



Counties Total Population
(Census 2009)



0 25 50 100 Kilometers

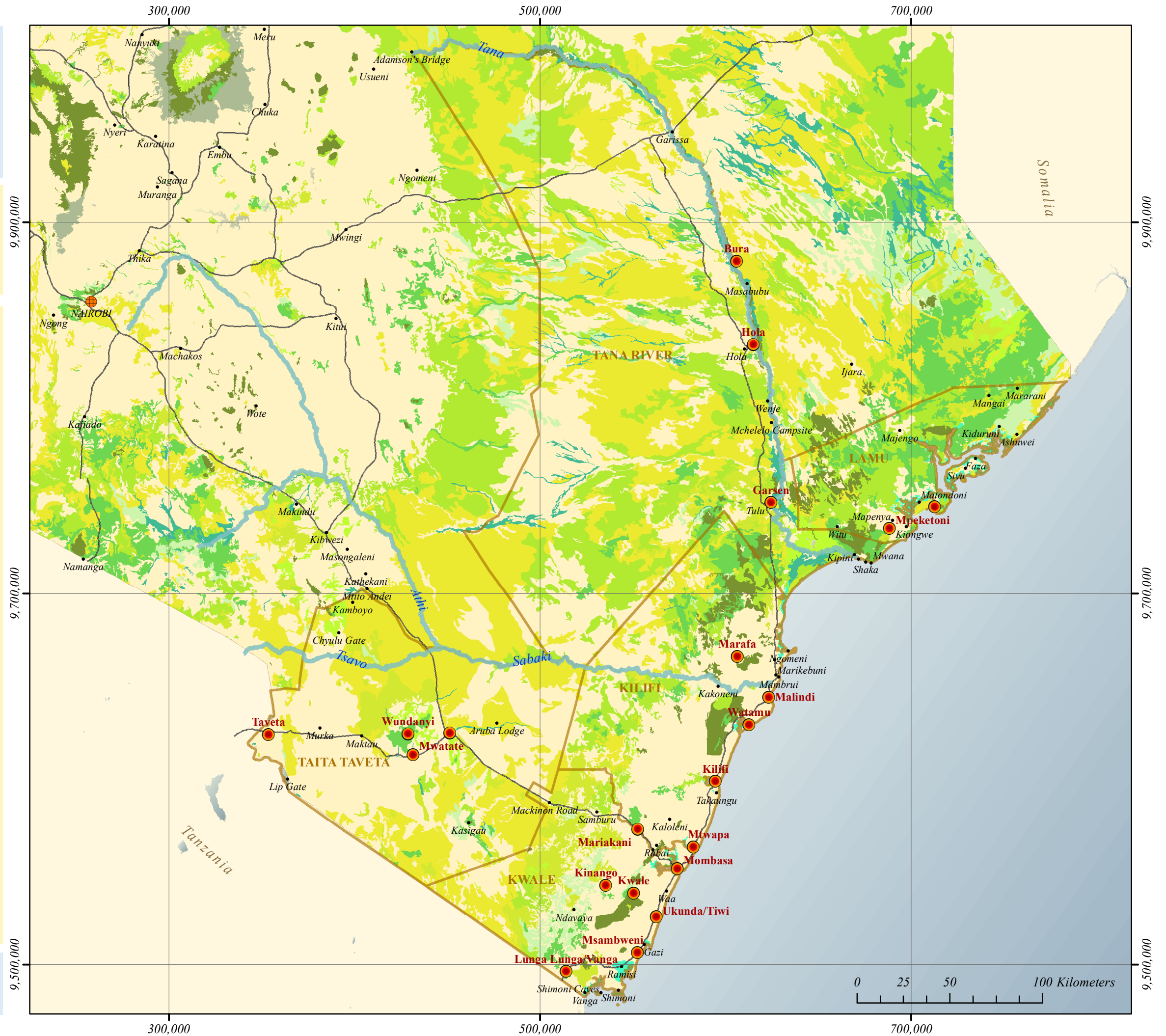
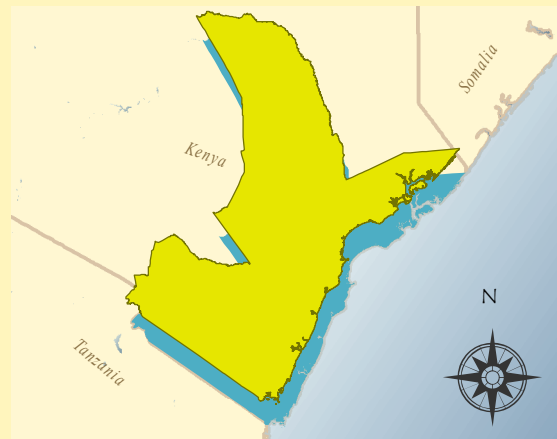


Water Supply Master Plan for
Mombasa and Other Towns
Within the Coast Province



Map 5
Natural
Vegetation Cover

- Population Centres
- County Boundaries
- Vegetation**
- Closed shrubs
- Closed to open woody vegetation (thicket)
- Closed trees
- Closed trees on temporarily flooded land
- Mangrove (trees)
- Multilayered trees (broadleaved evergreen)
- Open low shrubs (40-65% crown cover)
- Open shrubs (40-45% crown cover)
- Open trees (40-65% crown cover)
- Very open trees (15-40% crown cover)
- No natural vegetation cover

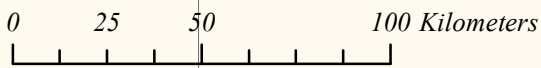
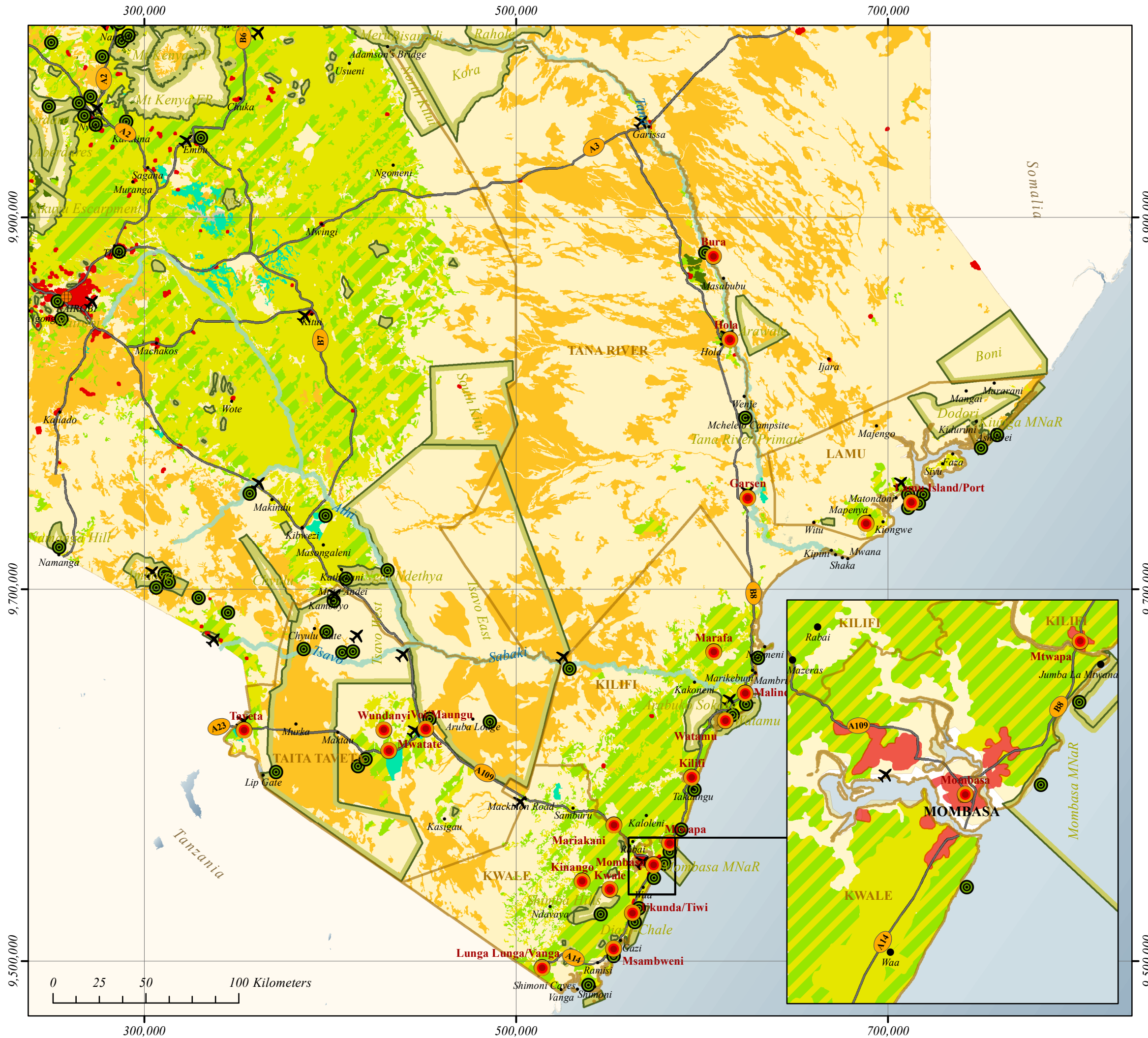
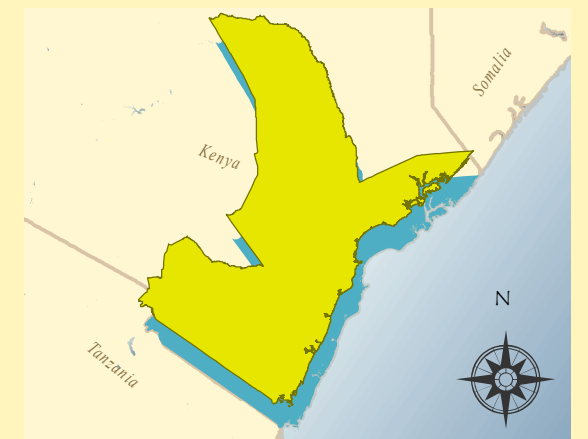


Water Supply Master Plan for Mombasa and Other Towns Within the Coast Province



Map 6 Land Use

- Population Centres
- Airfield
- Lodge/ Campsite
- County Boundaries
- Major roads
- Urban/ built-up
- Protected area
- Range lands
- Irrigated crops
- Scattered natural veg. & rainfed crops
- Rainfed crops
- Forest plantation
- Natural vegetation cover

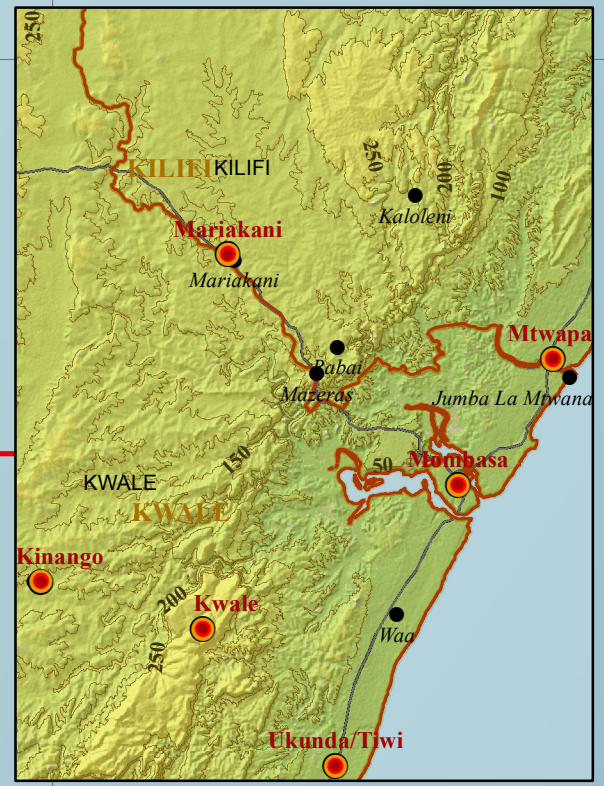
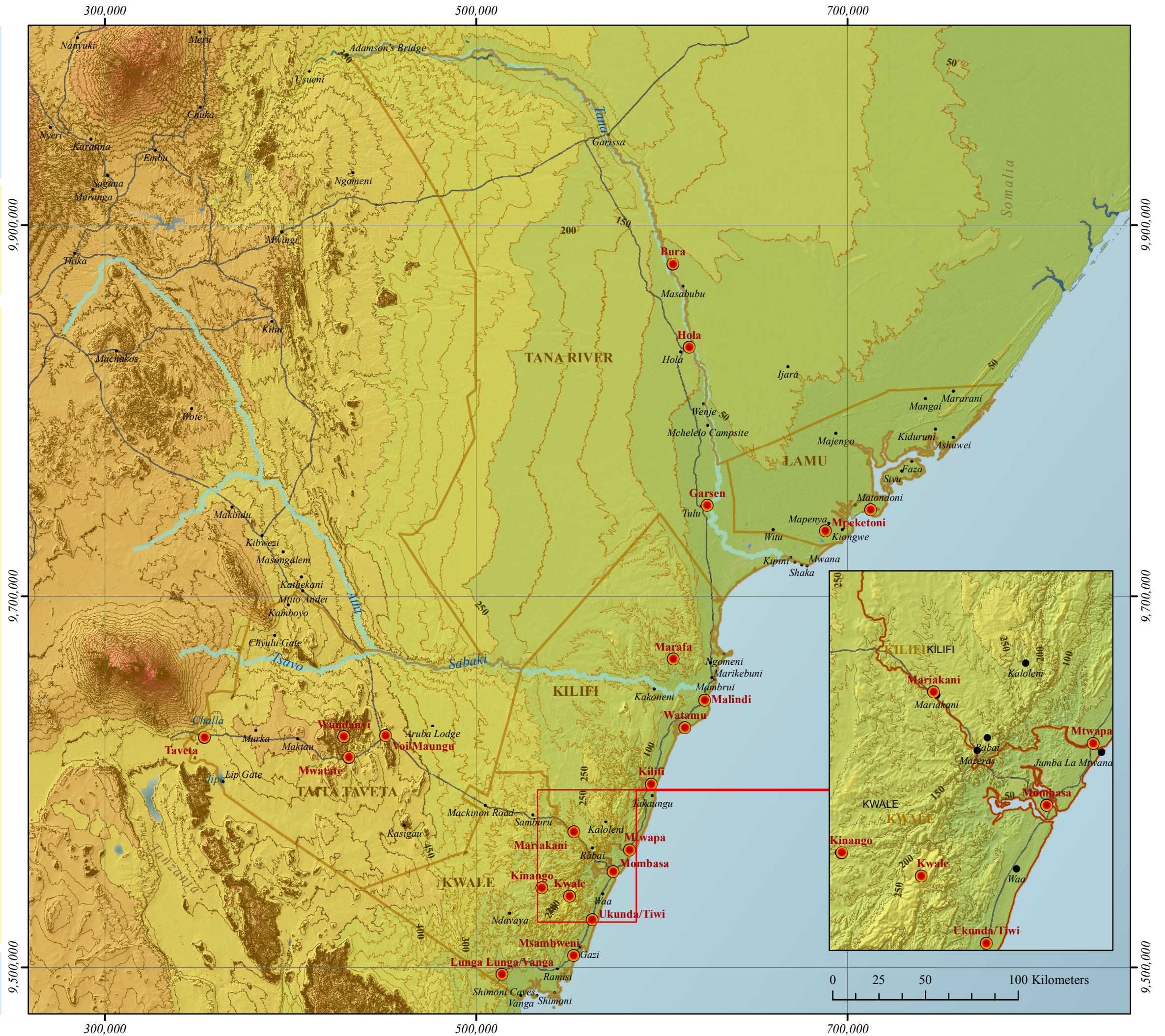
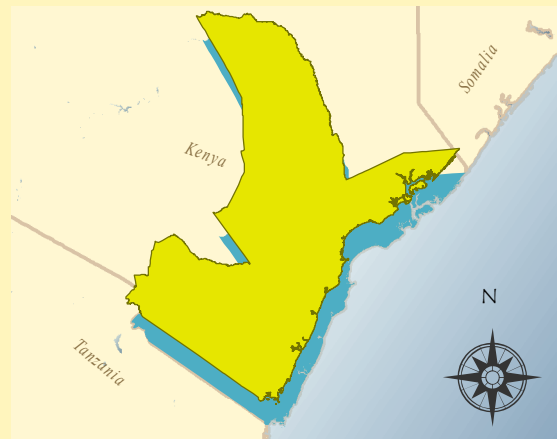


Water Supply Master Plan for Mombasa and Other Towns Within the Coast Province



Map 7 Surface Elevation

- Population Centres
 - County Boundaries
- Elevation (meters above sea level)**
- < 0 m
 - 0 - 50 m
 - 50 - 100 m
 - 100 - 250 m
 - 250 - 500 m
 - 500 - 1,000 m
 - 1,000 - 2,000 m
 - 2,000 - 3,000 m
 - 3,000 - 4,000 m
 - > 4,000 m

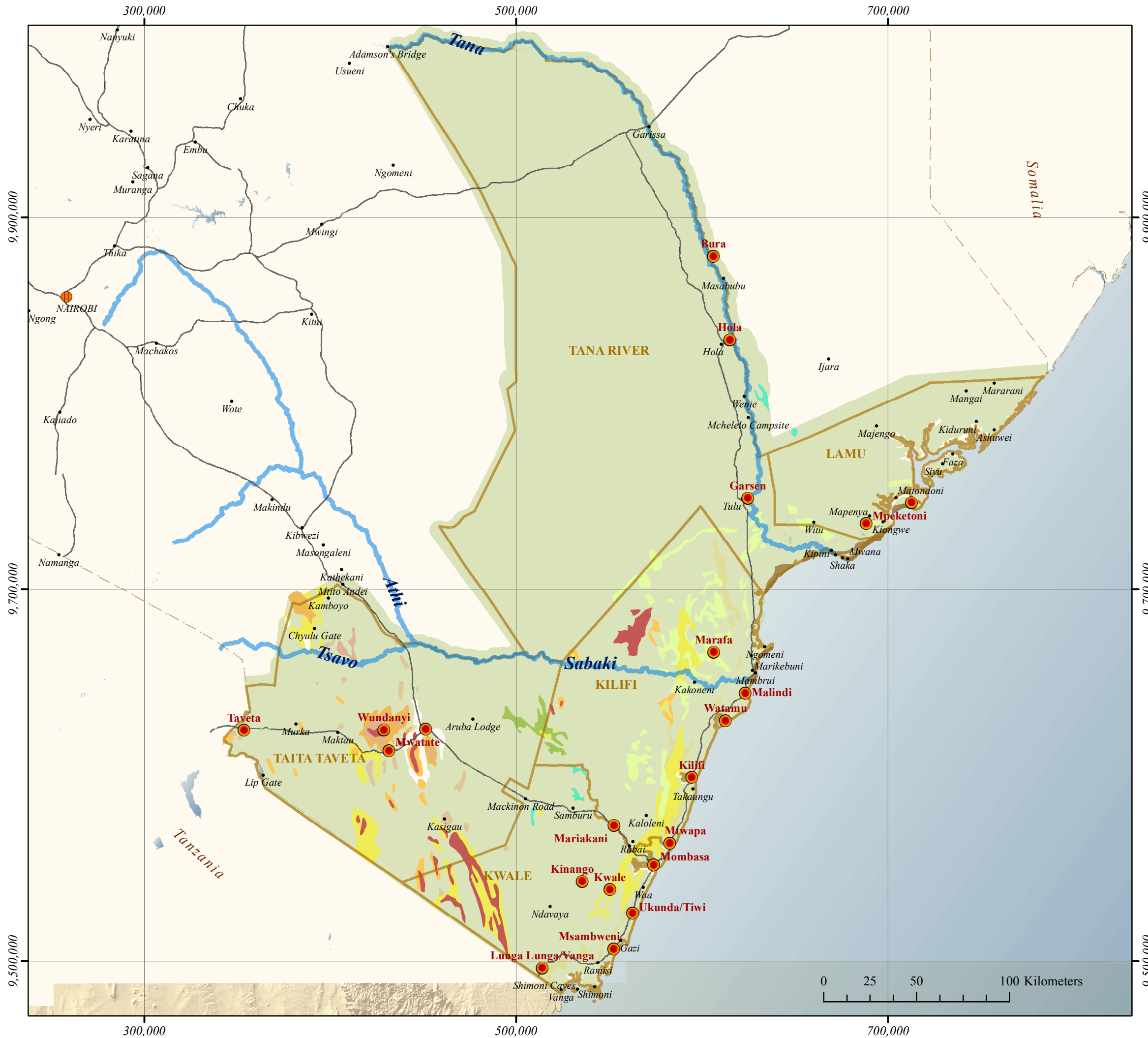
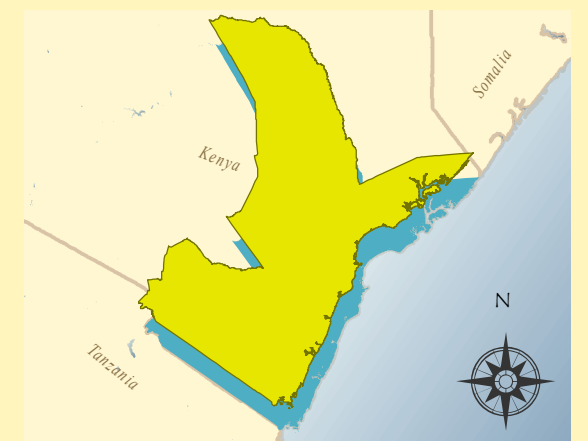


Water Supply Master Plan for Mombasa and Other Towns Within the Coast Province



Map 8 Surface Physiography

- Population Centres
- County Boundaries
- Landforms**
- Valley floor
- Depression
- Plain
- Plateau
- Dissected plain
- Low - gradient footslope
- Medium - gradient hill
- High - gradient hill
- Medium - gradient escarpment
- Medium - gradient mountain
- Mountainous highland
- Ridges

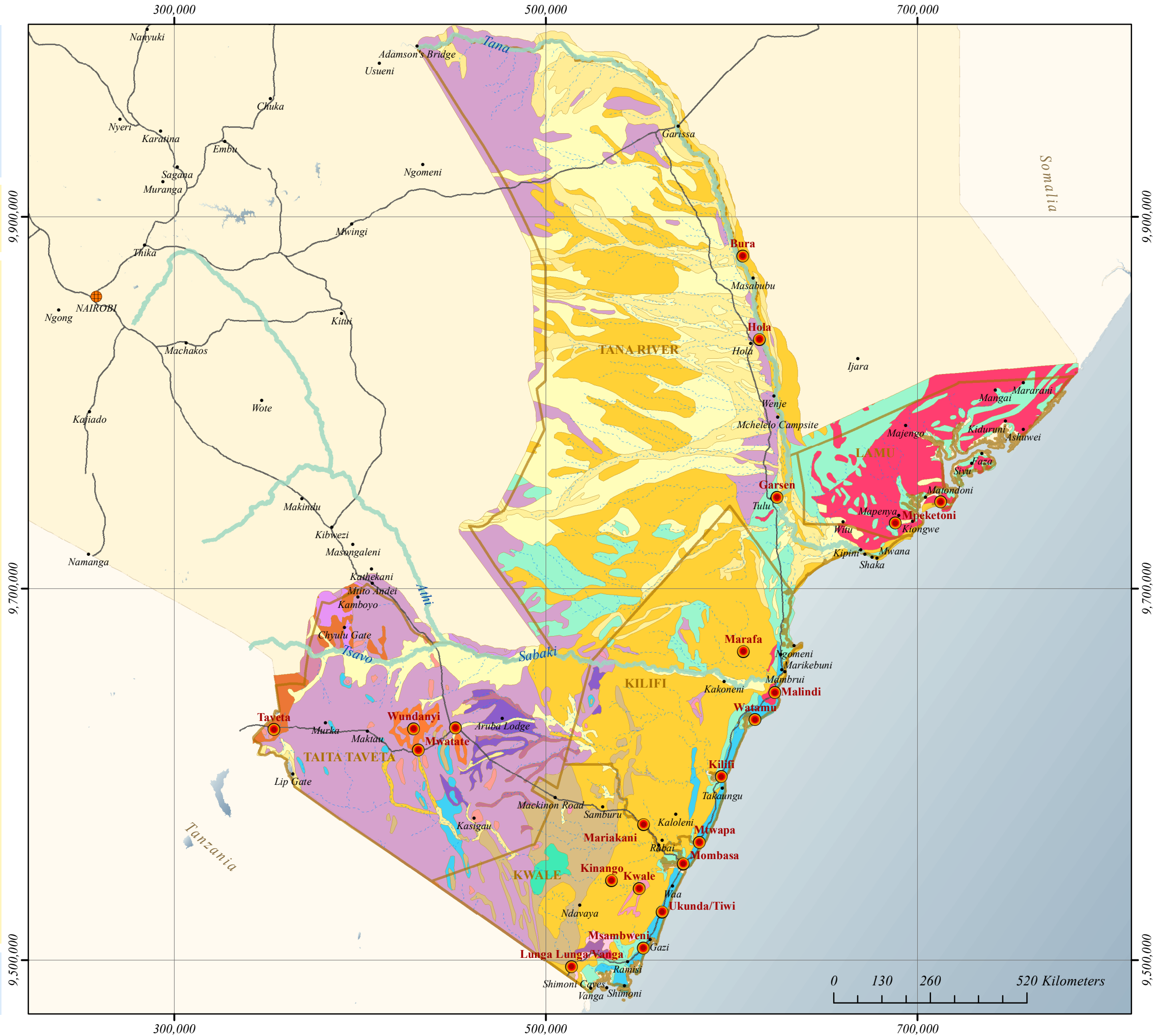
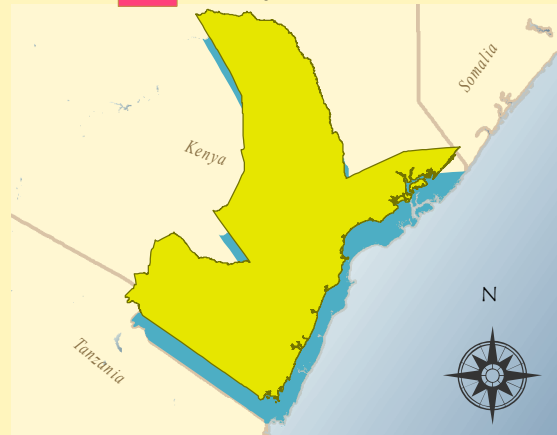


Water Supply Master Plan for Mombasa and Other Towns Within the Coast Province



Map 9 Lithology

- Population Centres
- County Boundaries
- LITHOLOGY**
- Fluvial
- Eolian unconsolidated rock
- Lacustrine unconsolidated rock
- Sandstone, greywacke, arkose
- Siltstone, mudstone, claystone
- Conglomerate, breccia
- Marine unconsolidated rock
- Shale
- Limestone, other carbonate rocks
- Diorite-syenite
- Granite
- Acid metamorphic rock
- Basic igneous rock
- Basalt
- Gneiss, migmatite
- Gneiss rich in ferro-magnesian minerals
- Andesite, trachyte, phonolite
- Igneous rock
- Pyroclastic unconsolidated rock
- Metamorphic rock
- Ultrabasic igneous rock



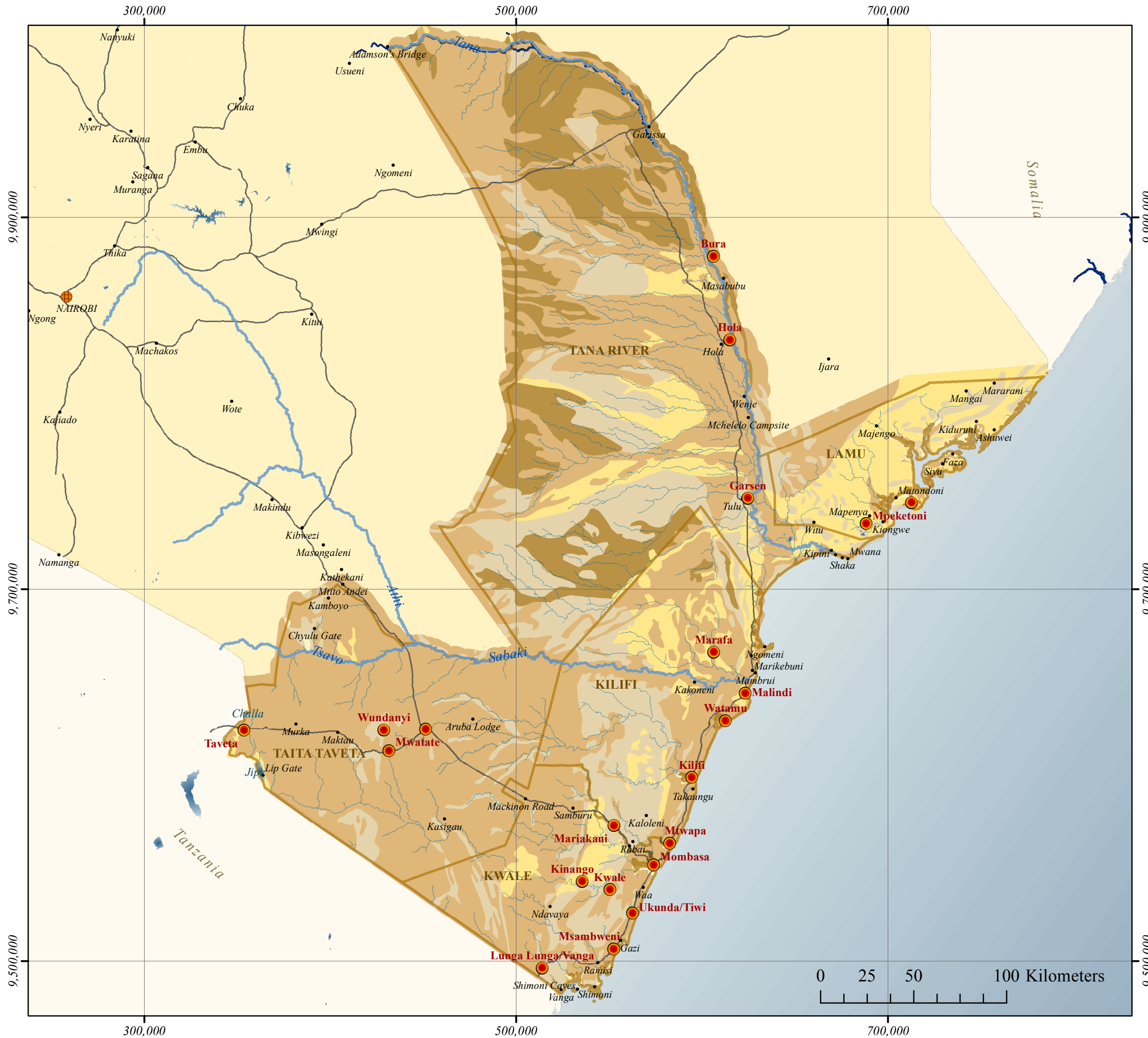
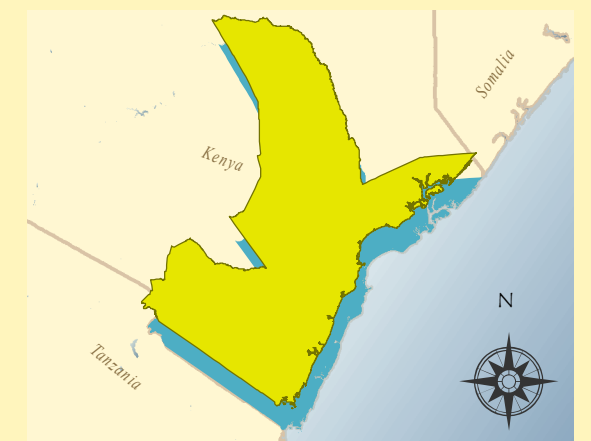
Water Supply Master Plan for Mombasa and Other Towns Within the Coast Province



Map 10

Topsoil Texture

- Population Centres
- County Boundaries
- Soil Texture**
- Sandy
- Loamy
- Clayey
- Very Clayey



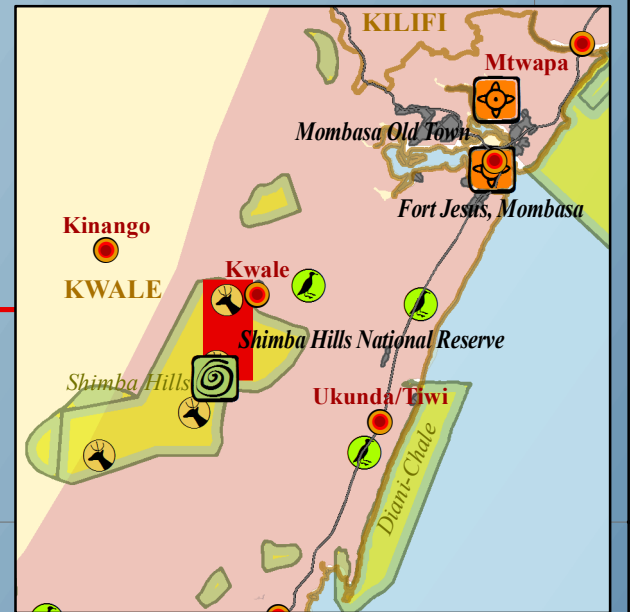
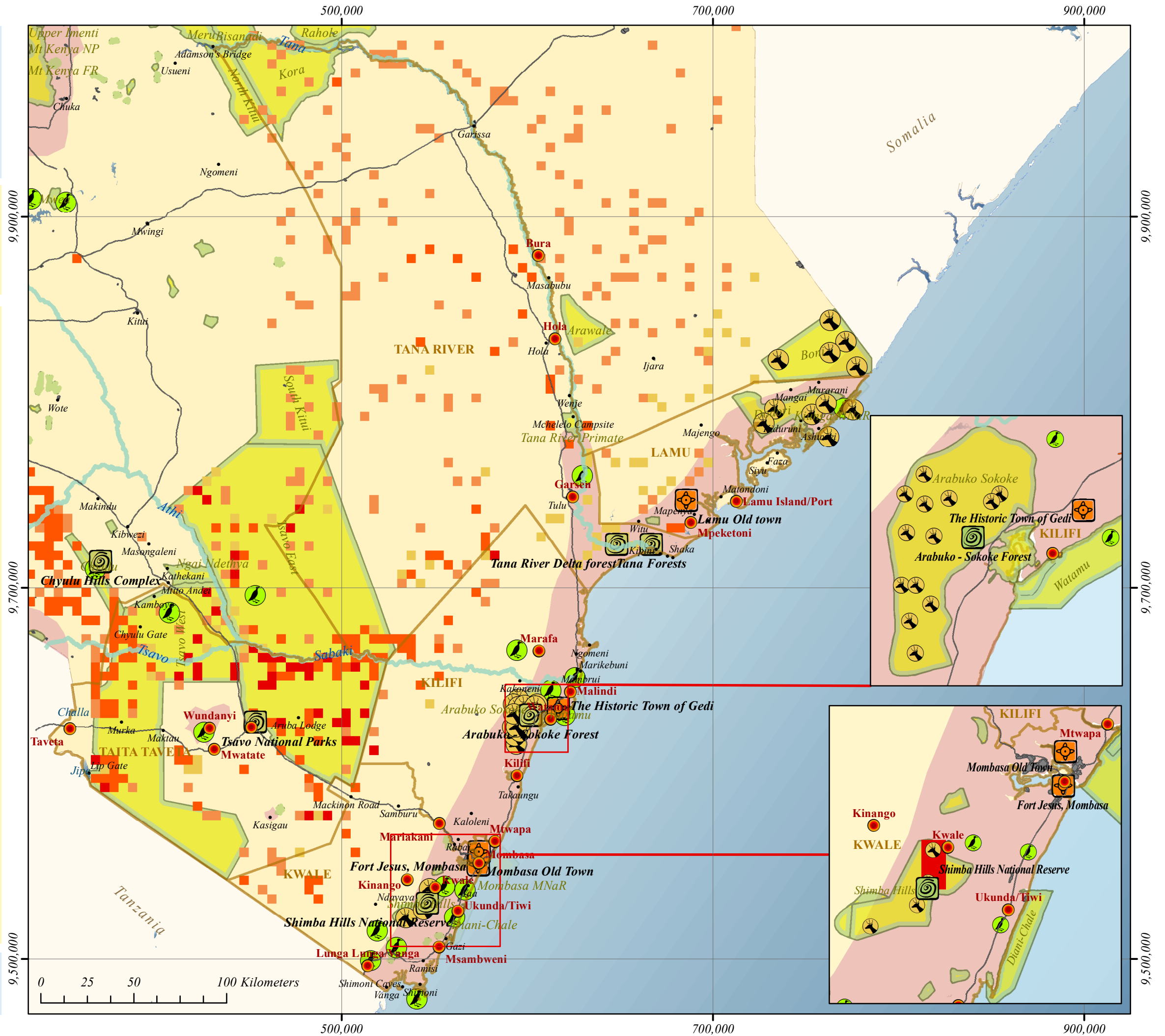
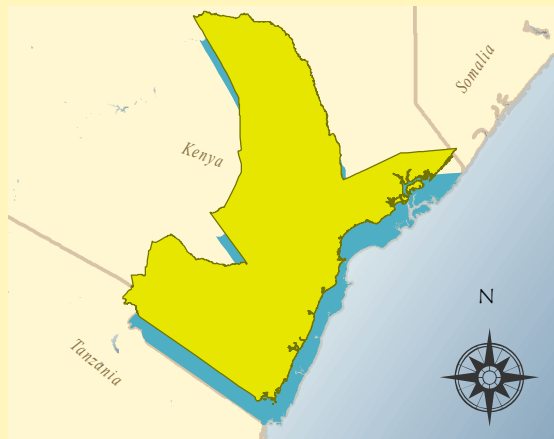
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Map 11

Terrestrial Wildlife
and Conservation

- Population Centres
- County Boundaries
- UNESCO Cultural site
- UNESCO Natural site
- Antelopes endemic to east
- Important bird area (IBA)
- Zebras
- Giraffes
- Elephants
- Buffalo
- Protected areas
- Endemic birds



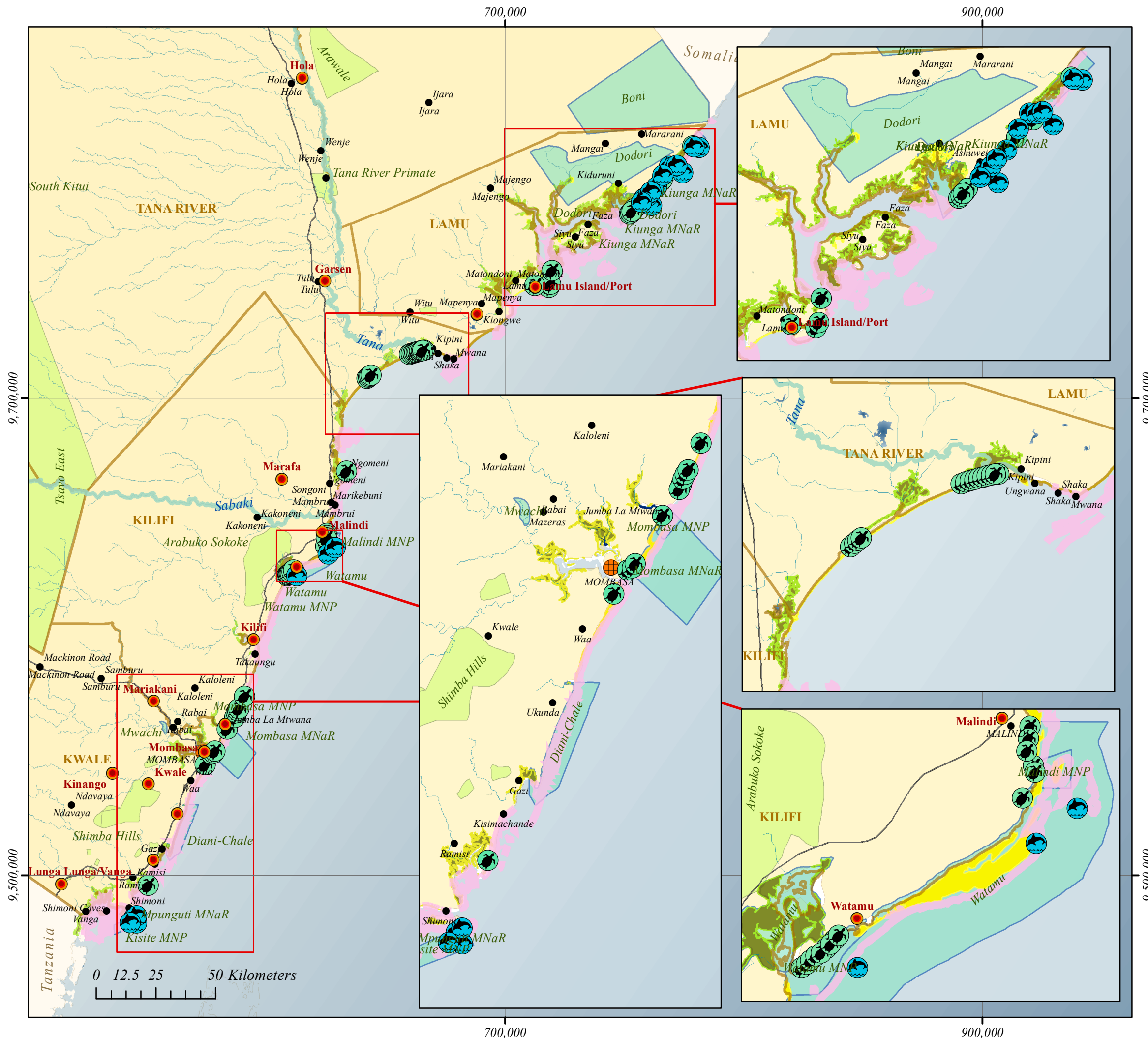
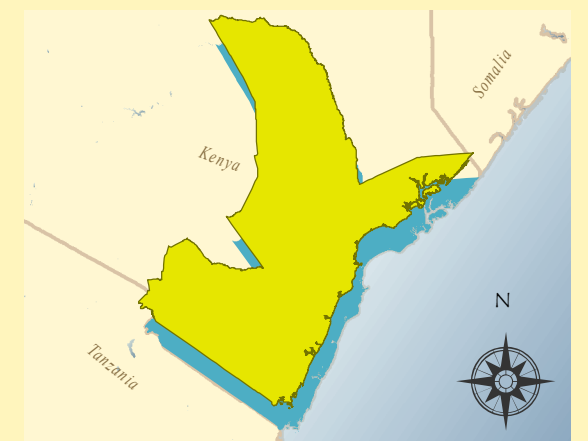
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Map 12

Marine, Coastal Wildlife and Conservation

- Population Centres
- County Boundaries
- Dugong and Dolphin Site
- Turtle breeding site
- Coral Reef
- County Boundaries
- Mangroves
- Sandy beaches
- Protected Area
- Marine Protected Area



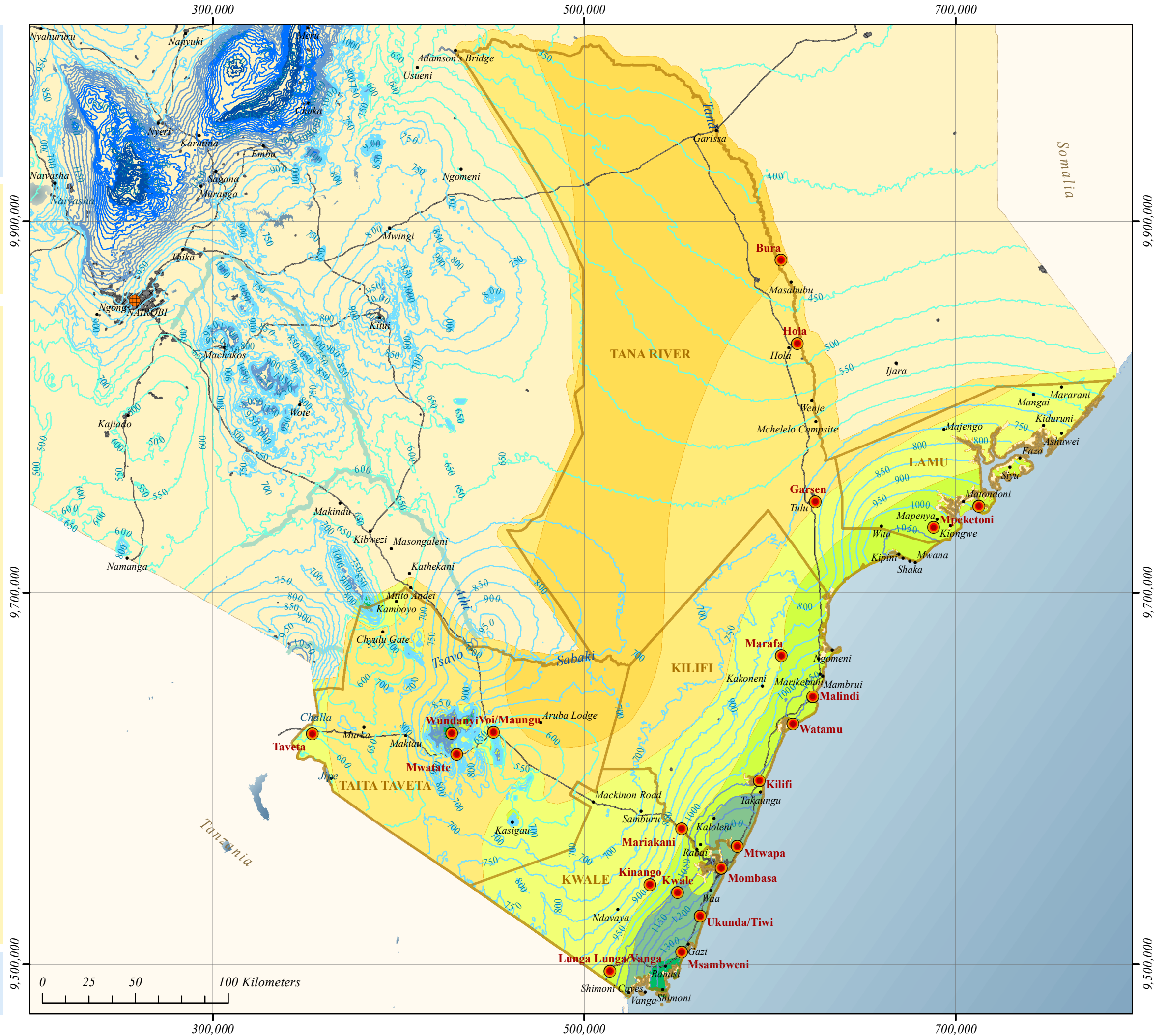
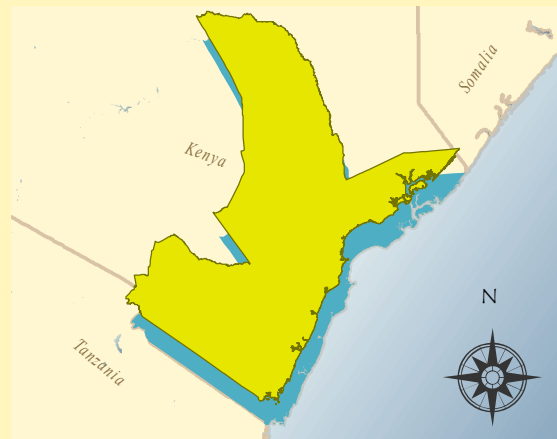
Water Supply Master Plan for
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Map 13

Annual Rainfall
and Climate Zones

- Population Centres
- County Boundaries
- Annual Average Rainfall**
- 200 - 650 mm
- 650 - 1,000 mm
- 1,000 - 1,400 mm
- 1,400 - 1,800 mm
- 1,800 - 2,600 mm
- Climate Zone**
- Sub-Humid
- Semi-Humid
- Semi-Humid to Semi-Arid
- Semi-Arid
- Arid
- Very Arid



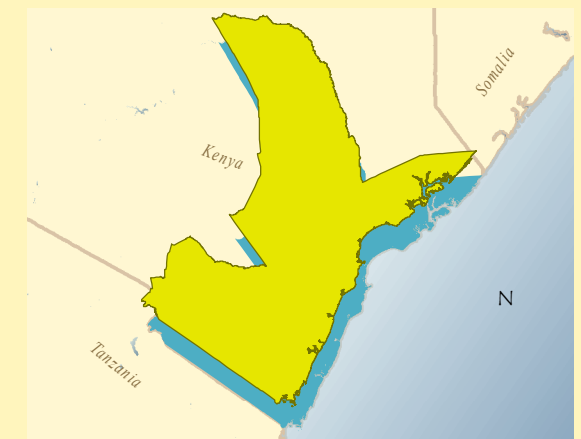
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Map 14

Selected Months
Average Rainfall

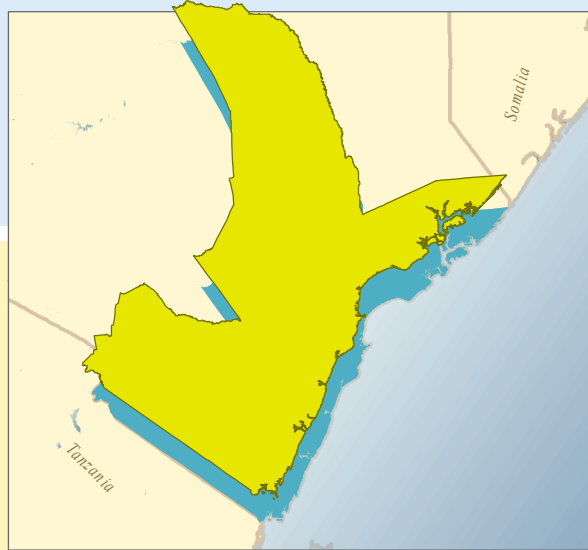
- Population Centres
- County Boundaries
- Monthly Average (mm)





Section II

Water Natural Resources and Current Water Supply Schemes



Natural Water Resources

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- Map 16: Main Rivers Satellite View
- Map 17: Main Springs Satellite View
- Map 18: Main River Intakes Satellite View

Current Water Supply Scheme

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- Map 20: Water Resources & Supply - Current Scheme Mainland
- Map 21: Main Wellfields Satellite View

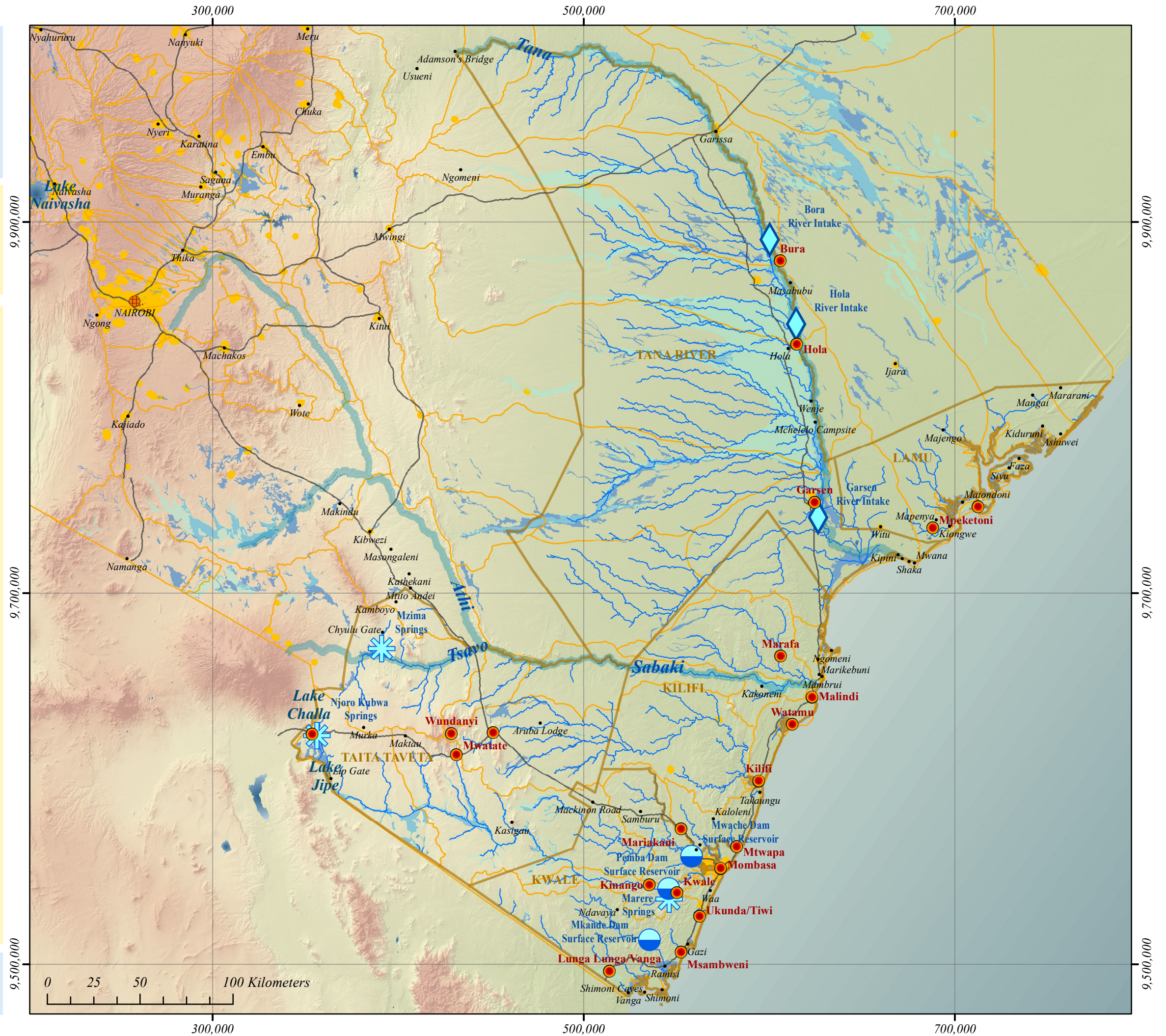
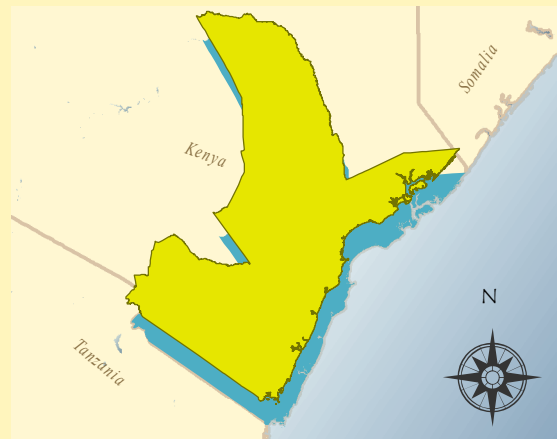


Water Supply Master Plan for Mombasa and Other Towns Within the Coast Province



Map 15 Natural Surface Water

- Population Centres
- County Boundaries
- Existing Surface Water Resources**
- River Intake
- Springs
- Surface reservoir
- Perennial/permanent river
- Non perennial streams
- Lake/pond
- Flood plains
- Wetlands



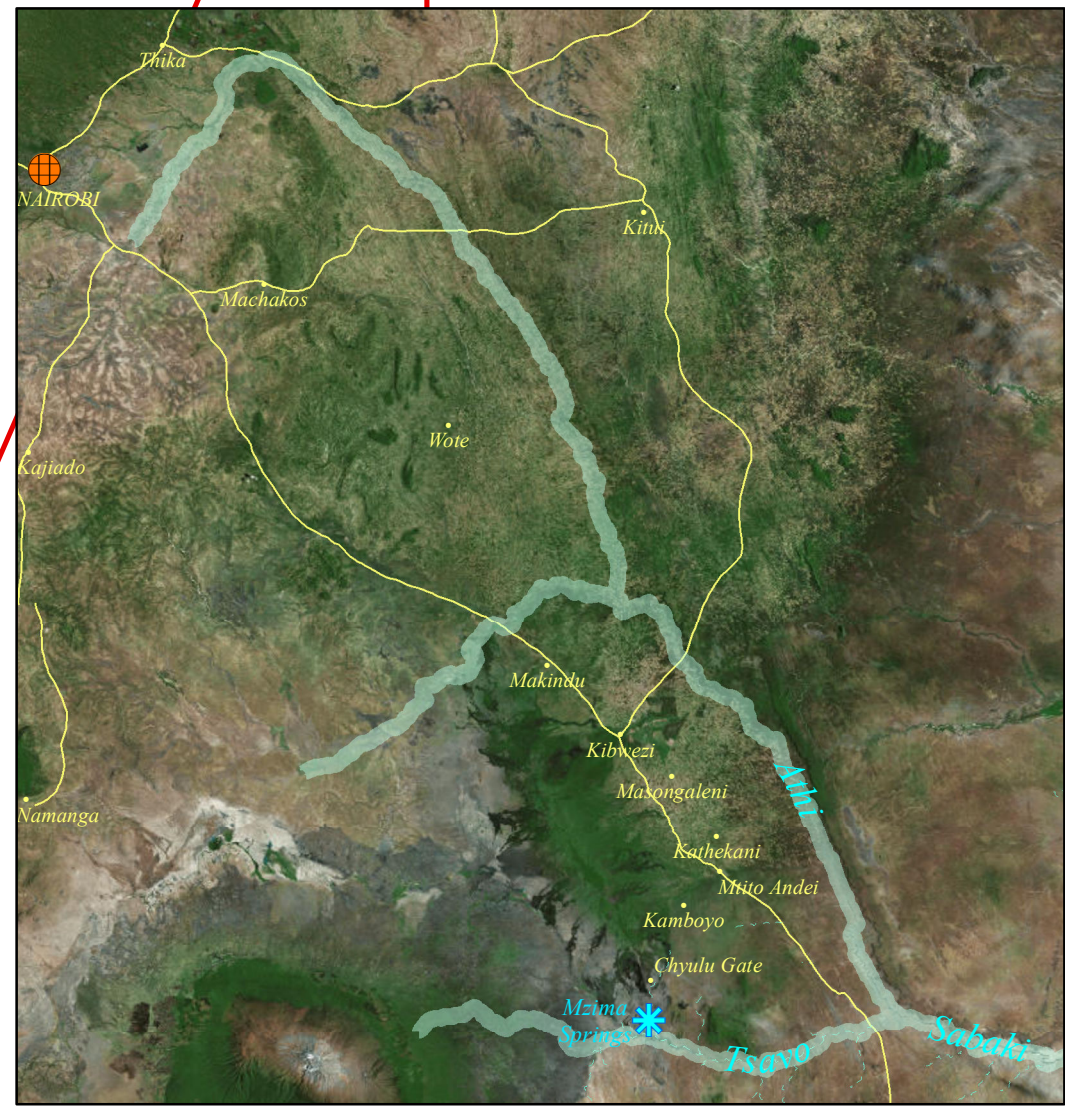
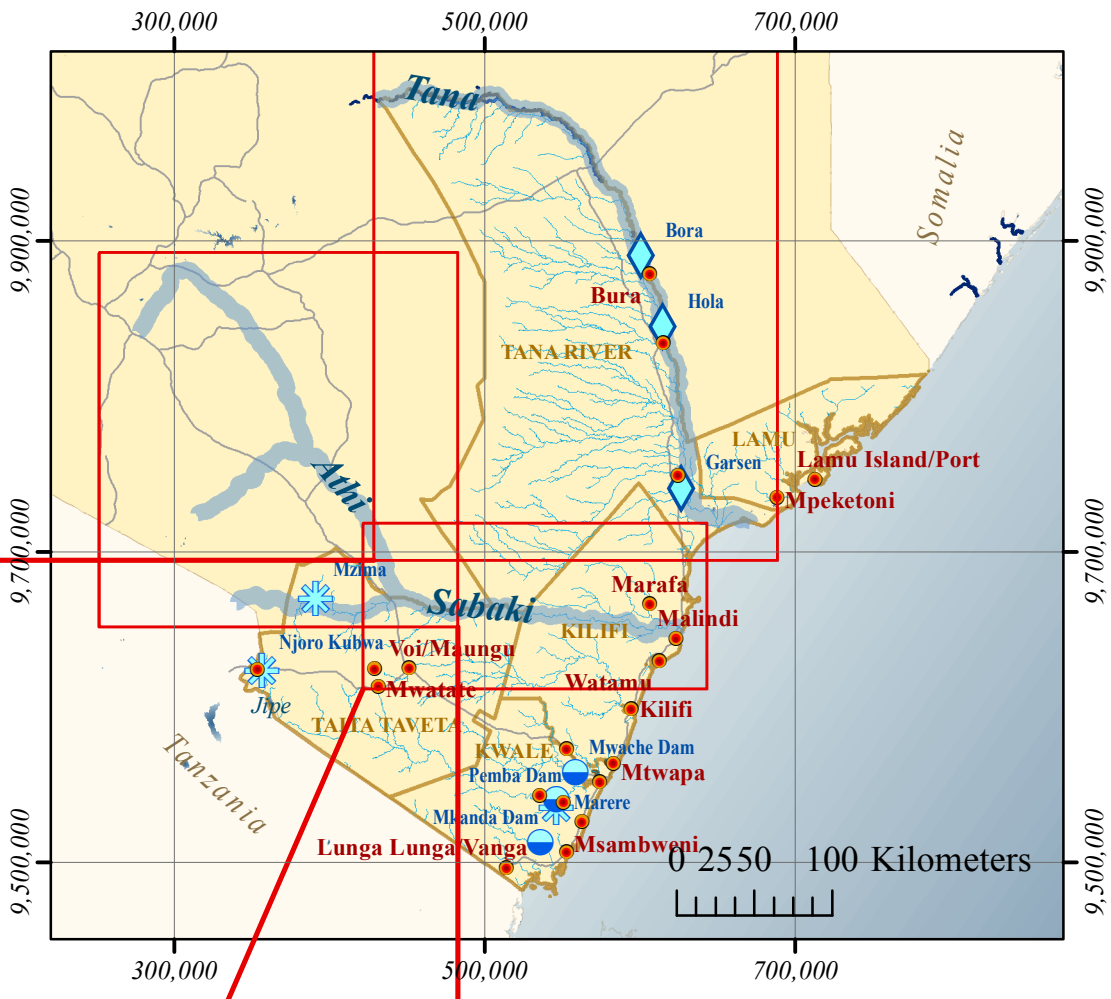
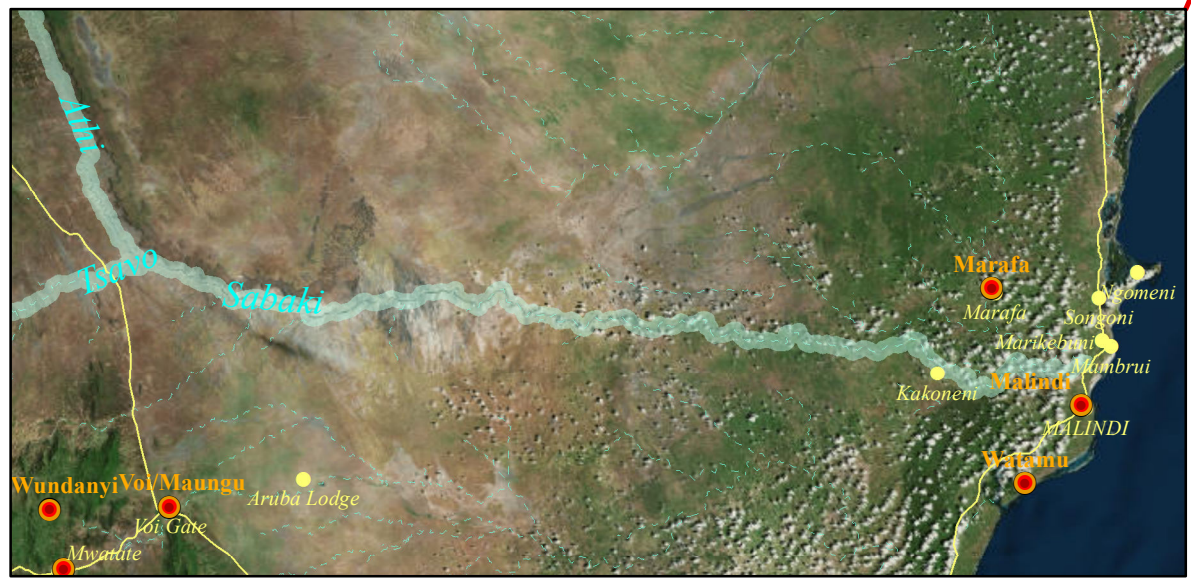
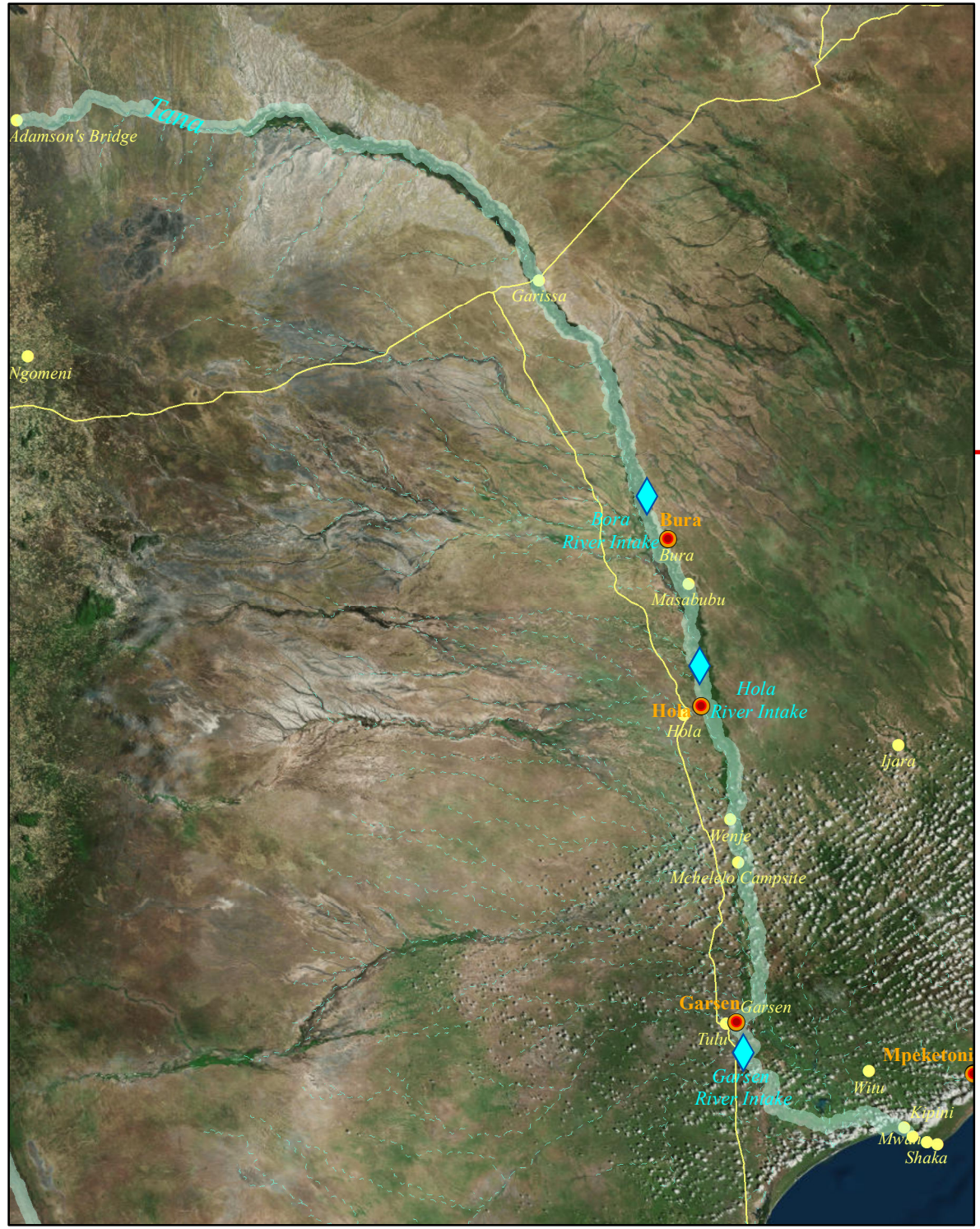
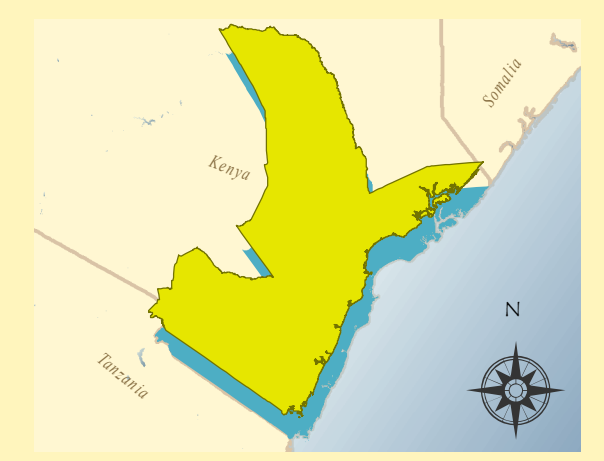
0 25 50 100 Kilometers

Water Supply Master Plan for Mombasa and Other Towns Within the Coast Province



Map 16
Main Rivers
Satellite View

- Population Centres
- Existing Surface water Resources**
- ◆ River Intake
- ❄ Springs
- Surface Reservoir
- Major Rivers**
- Perennial/permanent
- Non perennial streams




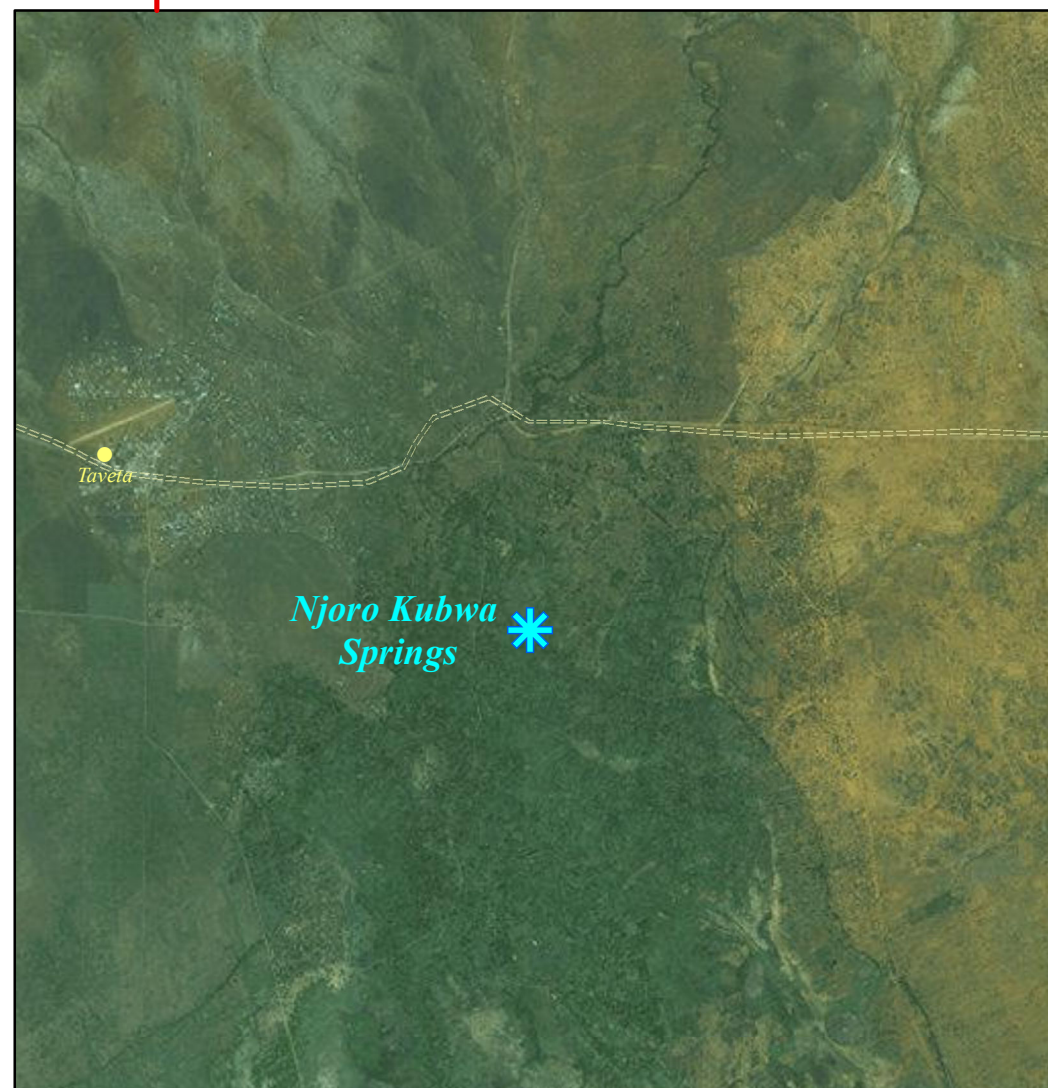
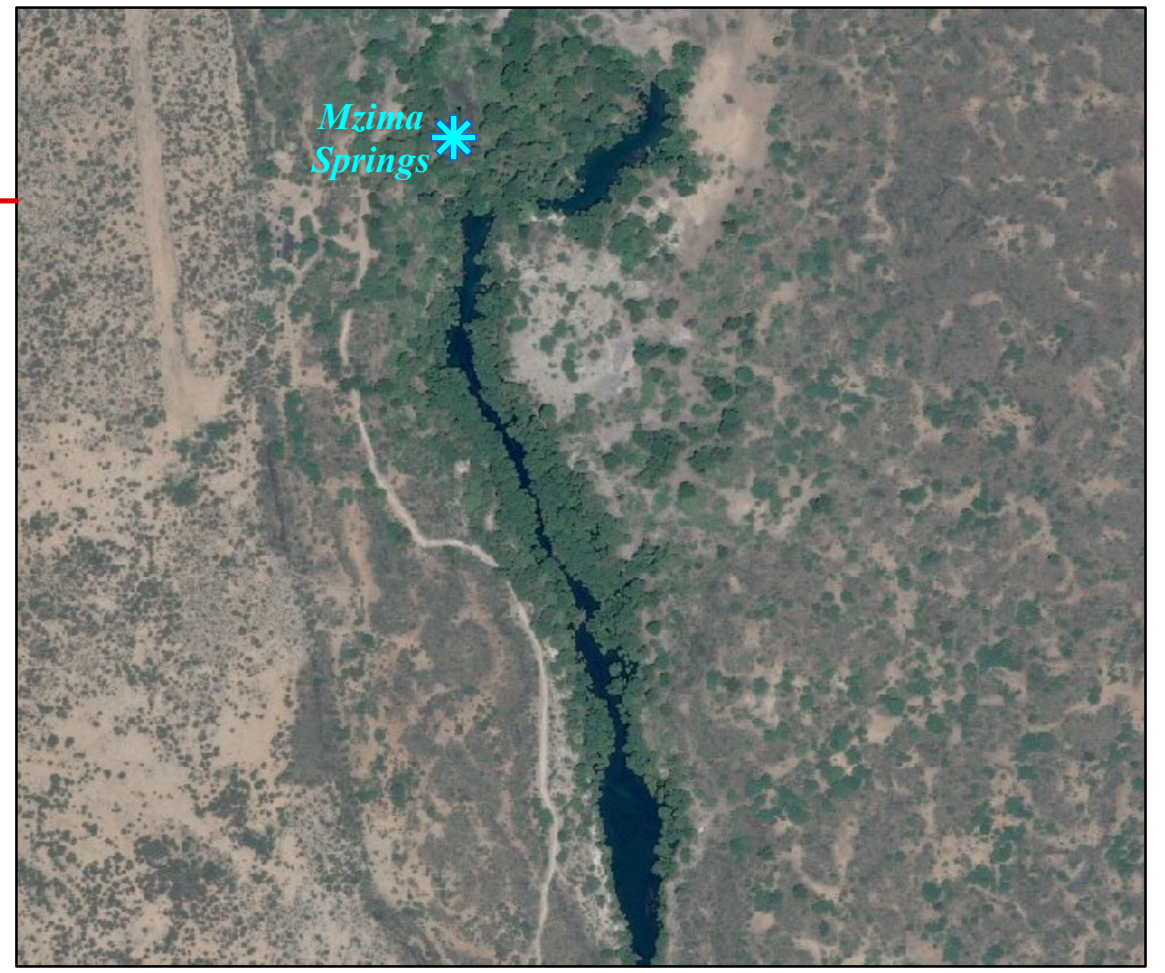
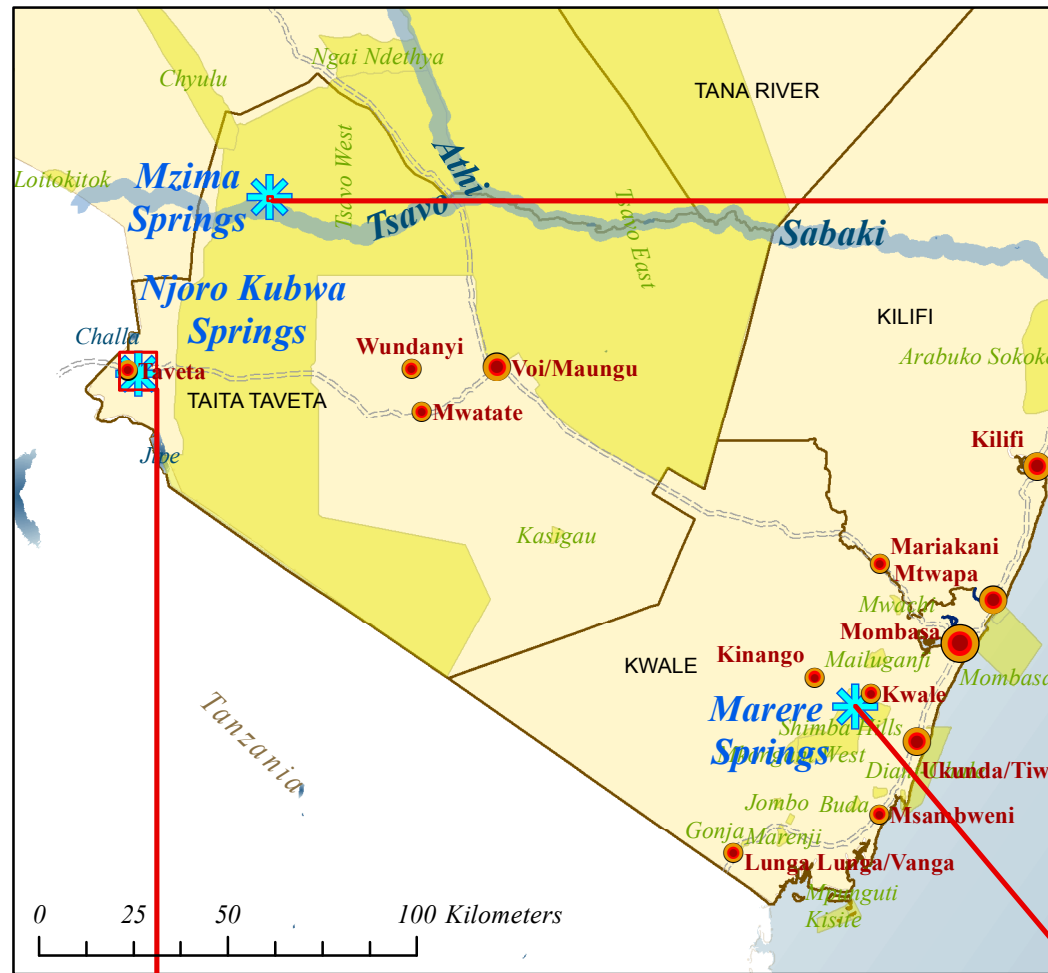
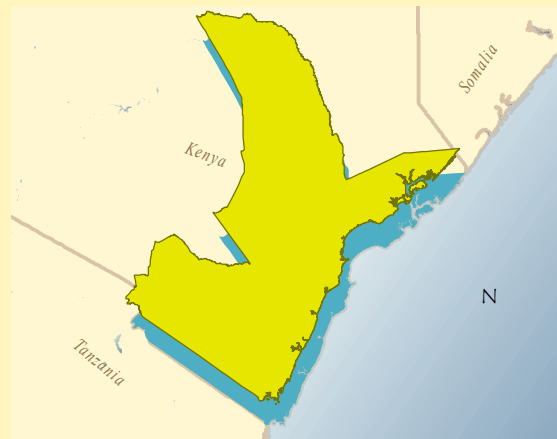
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Map 17

Main Springs
Satellite View

 Springs General Location

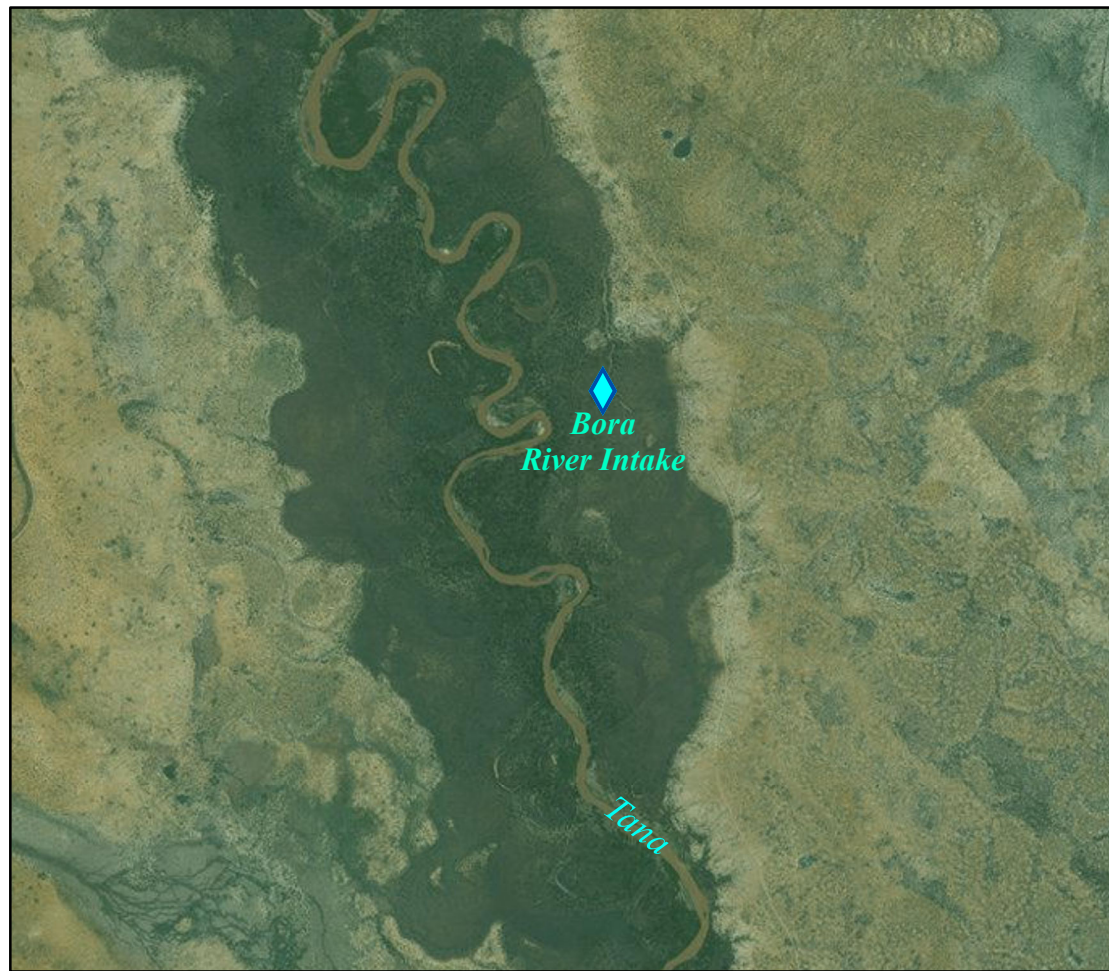
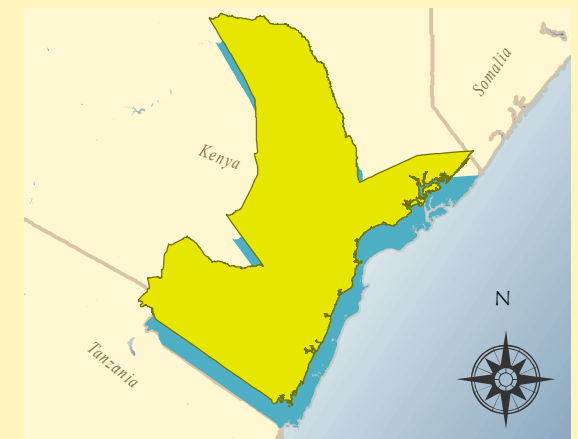




Map 18

Main River Intakes
SatelliteView

◆ River Intake General Location



Water Supply Master Plan for
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Map 19

Water Resources & Supply
Current Scheme

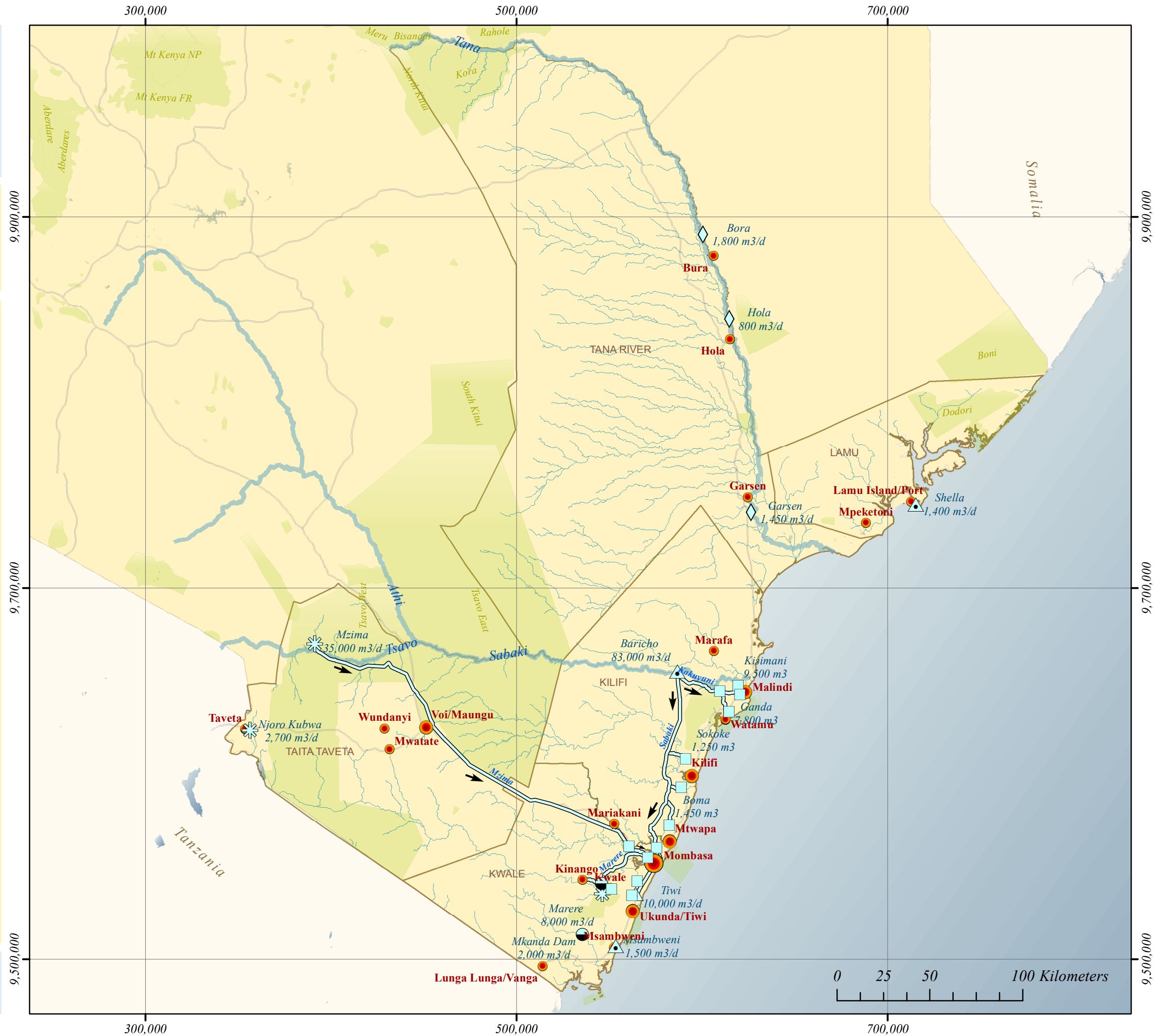
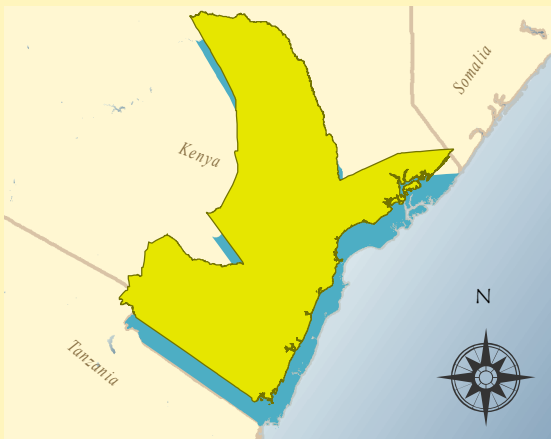
Population Demand Centres (2012)

- 750 - 5,000 (m³/d)
- 5,000 - 50,000 (m³/d)
- 50,000 - 150,000 (m³/d)

Main Pipeline

Existing Water Resources

- Boreholes
- River Intake
- Springs
- Surface Reservoir
- Water Tank





Water Supply Master Plan for Mombasa and Other Towns Within the Coast Province



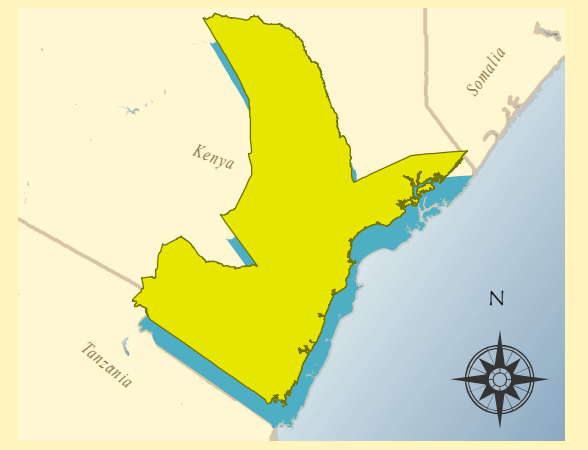
Map 20
Water Resources & Supply
Current Scheme -
Mainland

Population Demand Centres (2012)

- 750 - 5,000 (m³/d)
- 5,000 - 50,000 (m³/d)
- 50,000 - 150,000 (m³/d)
- Main Pipeline

Existing Water Resources

- ▲ Boreholes
- ◆ River Intake
- ✻ Springs
- Surface Reservoir
- Water Tank

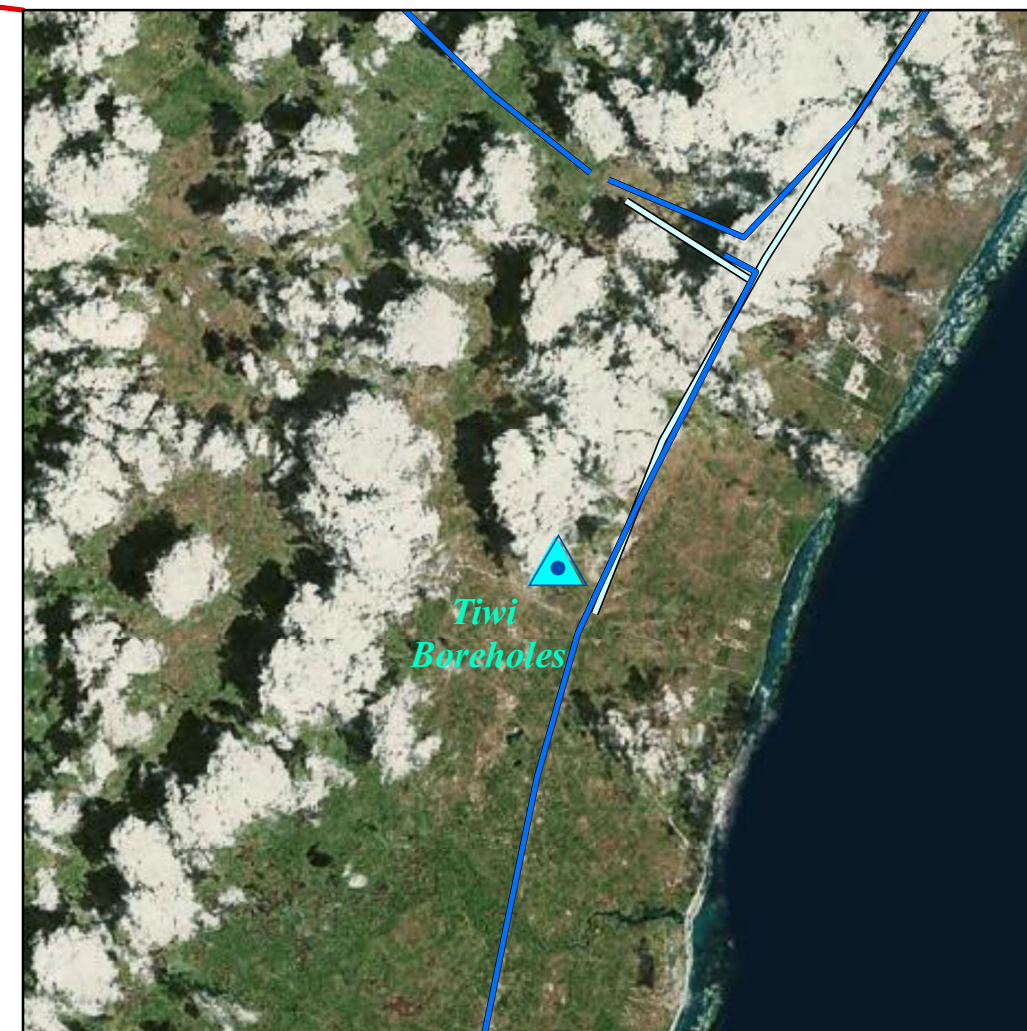
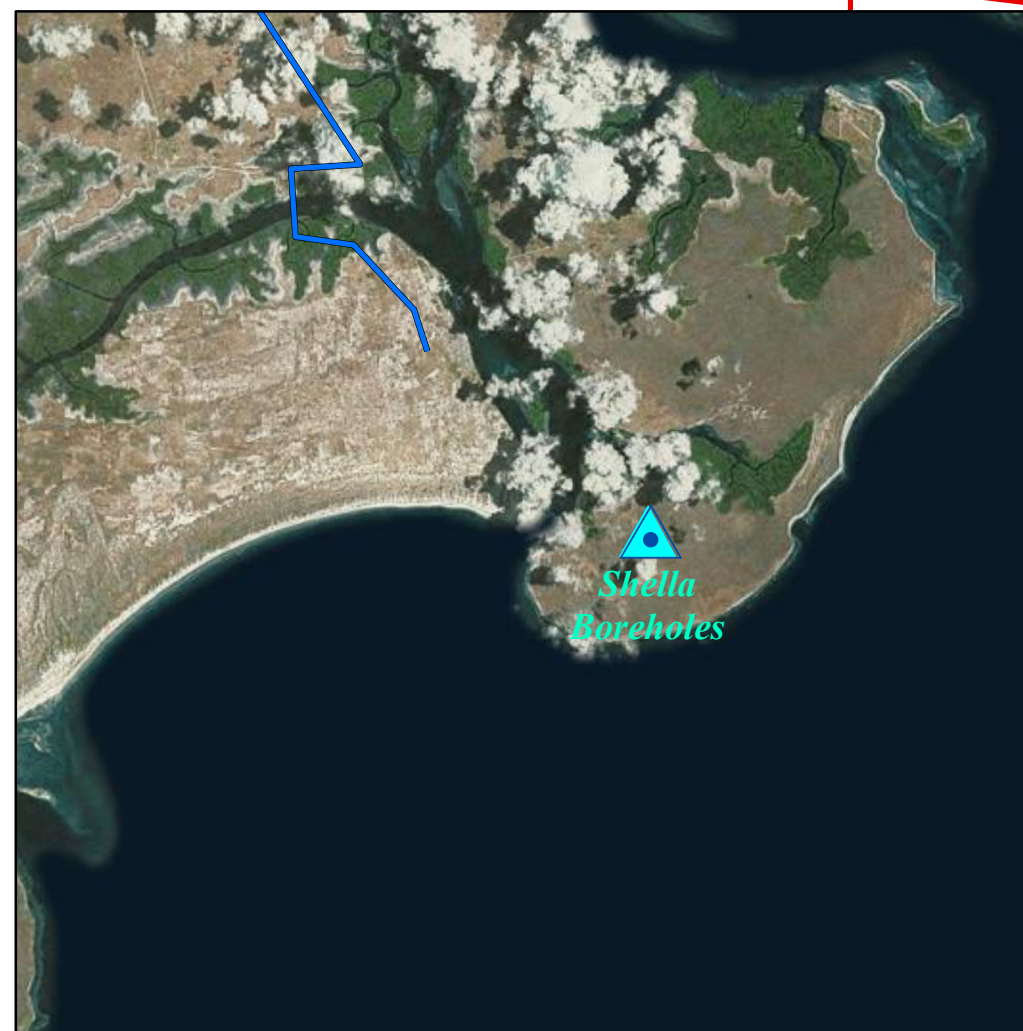
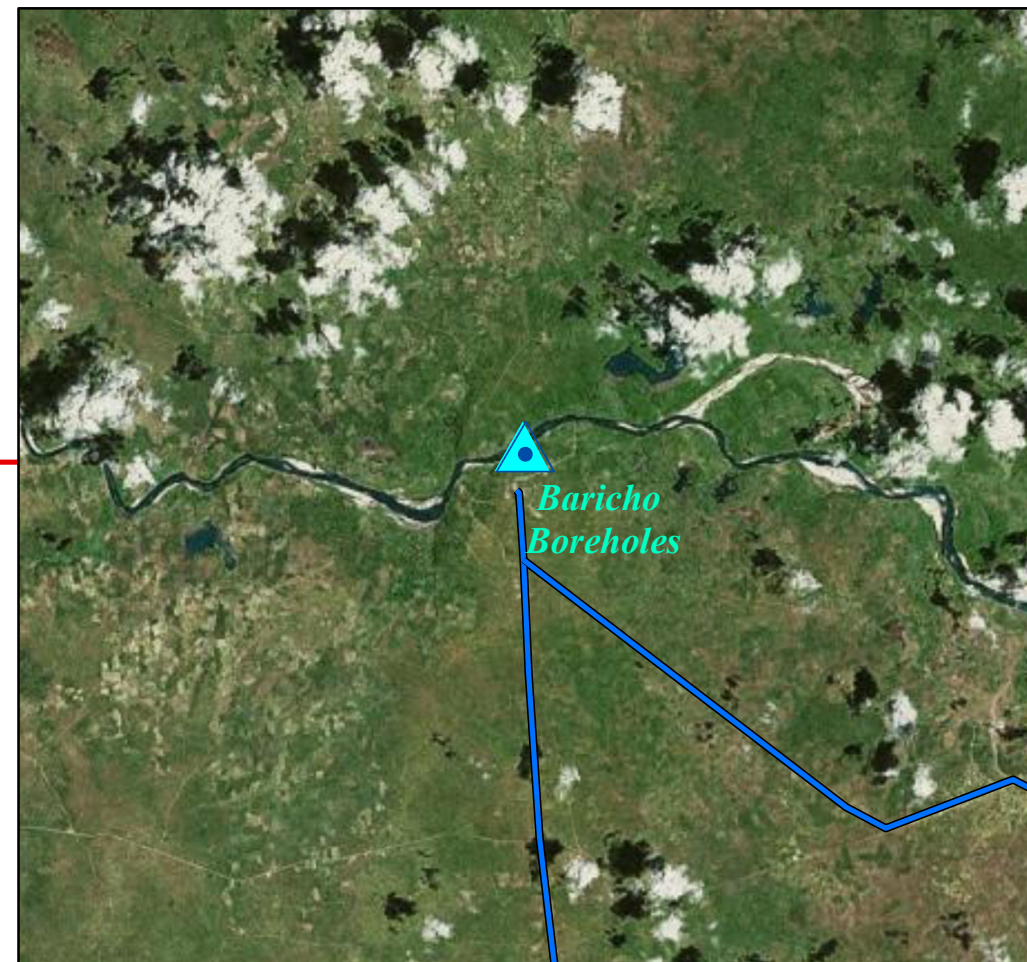
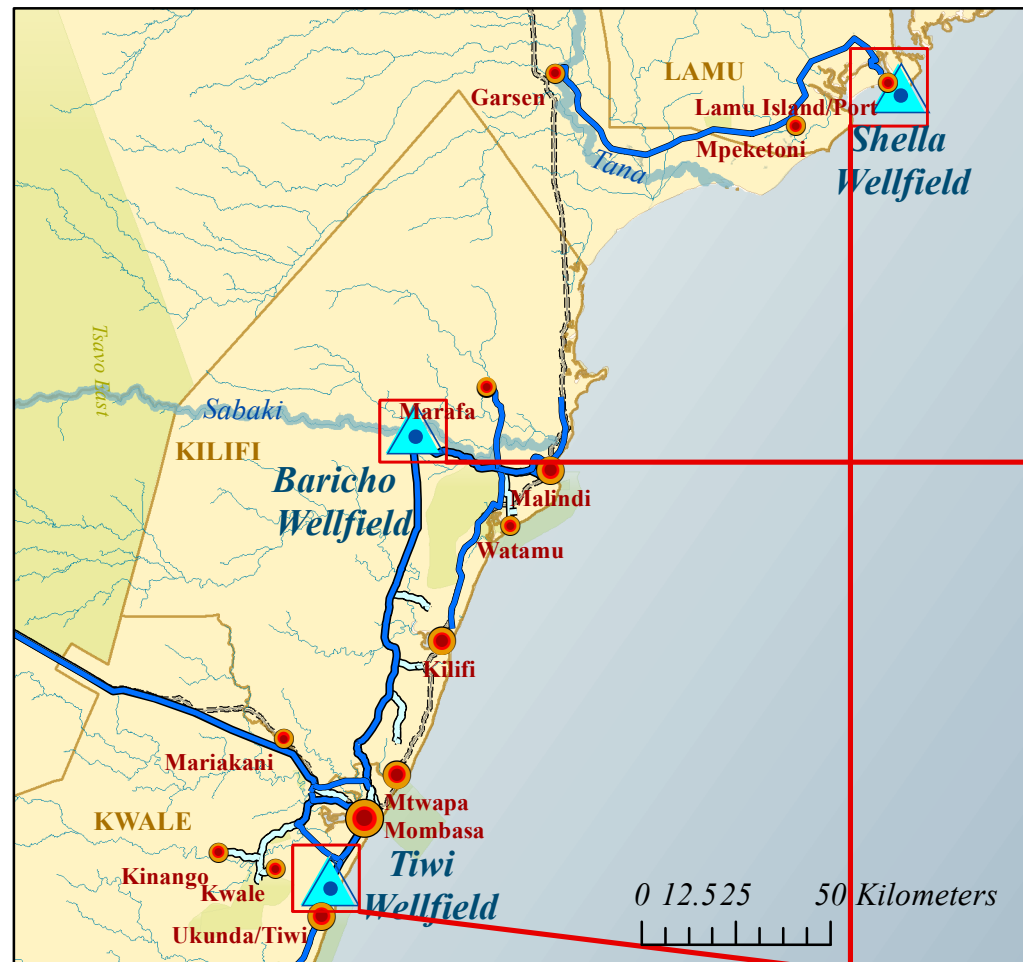
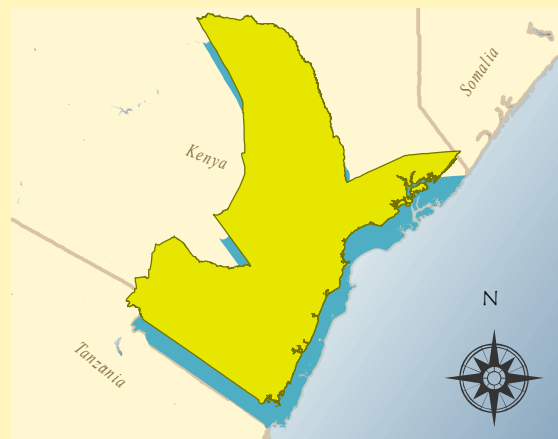


Water Supply Master Plan for
Mombasa and Other Towns
Within the Coast Province



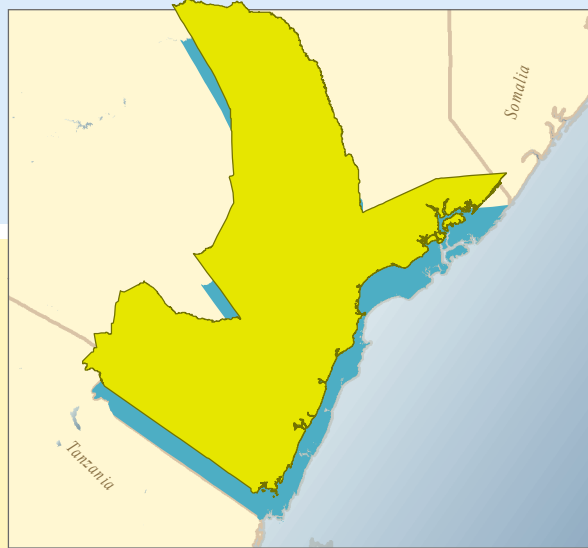
Map 21
Main Wellfields
Satellite View

Wellfield General Location





Section III Water Resources Development Plan



Full Development 2035

Map 22: Full Development Plan (2035)

Map 23: Full Development Plan (2035) - Mainland

Immediate Phase

Map 24: Development Plan - Immediate Phase

Map 25: Development Plan - Immediate Phase - Mainland

Phase I

Map 26: Development Plan - Phase I

Map 27: Development Plan - Phase I – Mainland

Phase II

Map 28: Development Plan - Phase II

Map 29: Development Plan - Phase II – Mainland

Phase III

Map 30: Development Plan - Phase III

Map 31: Development Plan - Phase III – Mainland

Full Development by County

Map 32: Full Development Tana River

Map 33: Full Development Lamu

Map 34: Full Development Kilifi

Map 35: Full Development Taita Taveta

Map 36: Full Development Kwale



Water Supply Master Plan for Mombasa and Other Towns Within the Coast Province



Map 22

CWSB Water Supply Master Plan Full Development (2035)

Population Demand Centres (2012)

- 750 - 5,000 (m³/d)
- 5,000 - 50,000 (m³/d)
- 50,000 - 150,000 (m³/d)

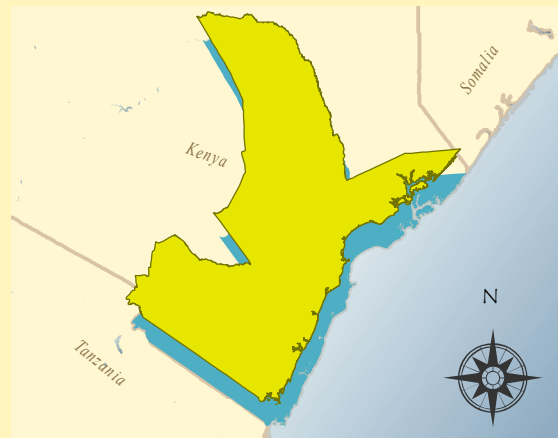
- Existing Main Pipeline
- Proposed Pipeline Full Development

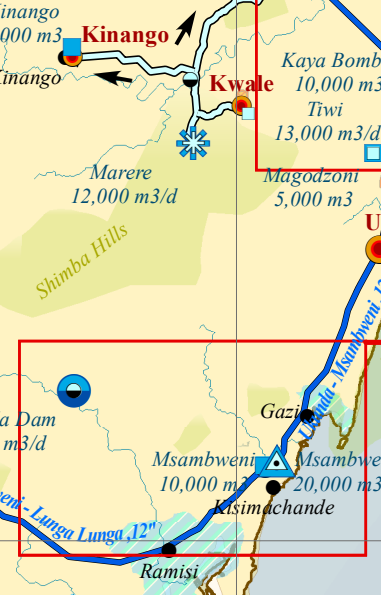
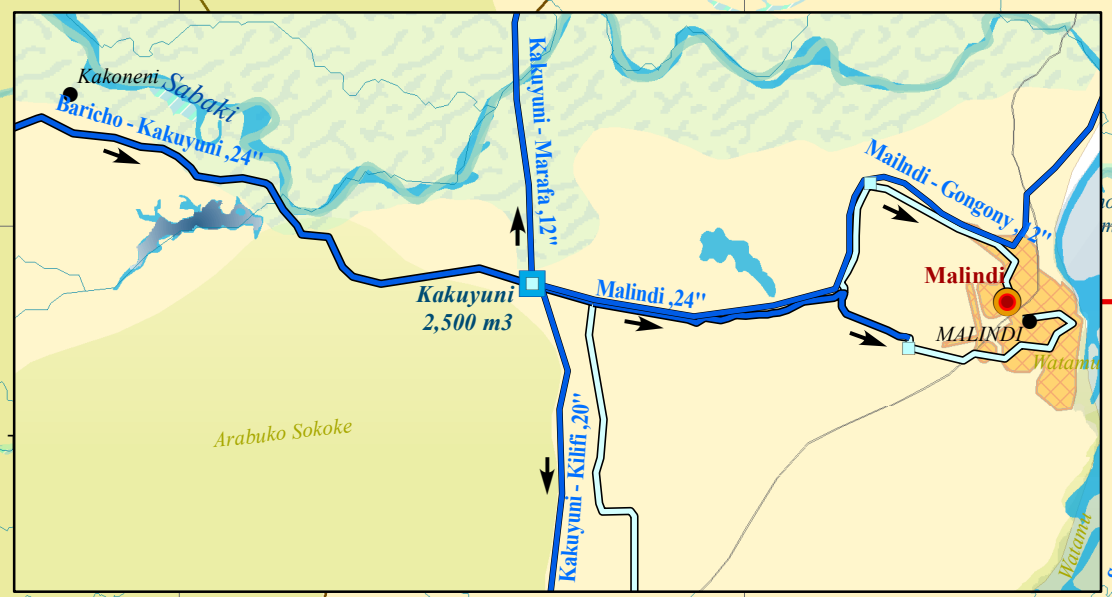
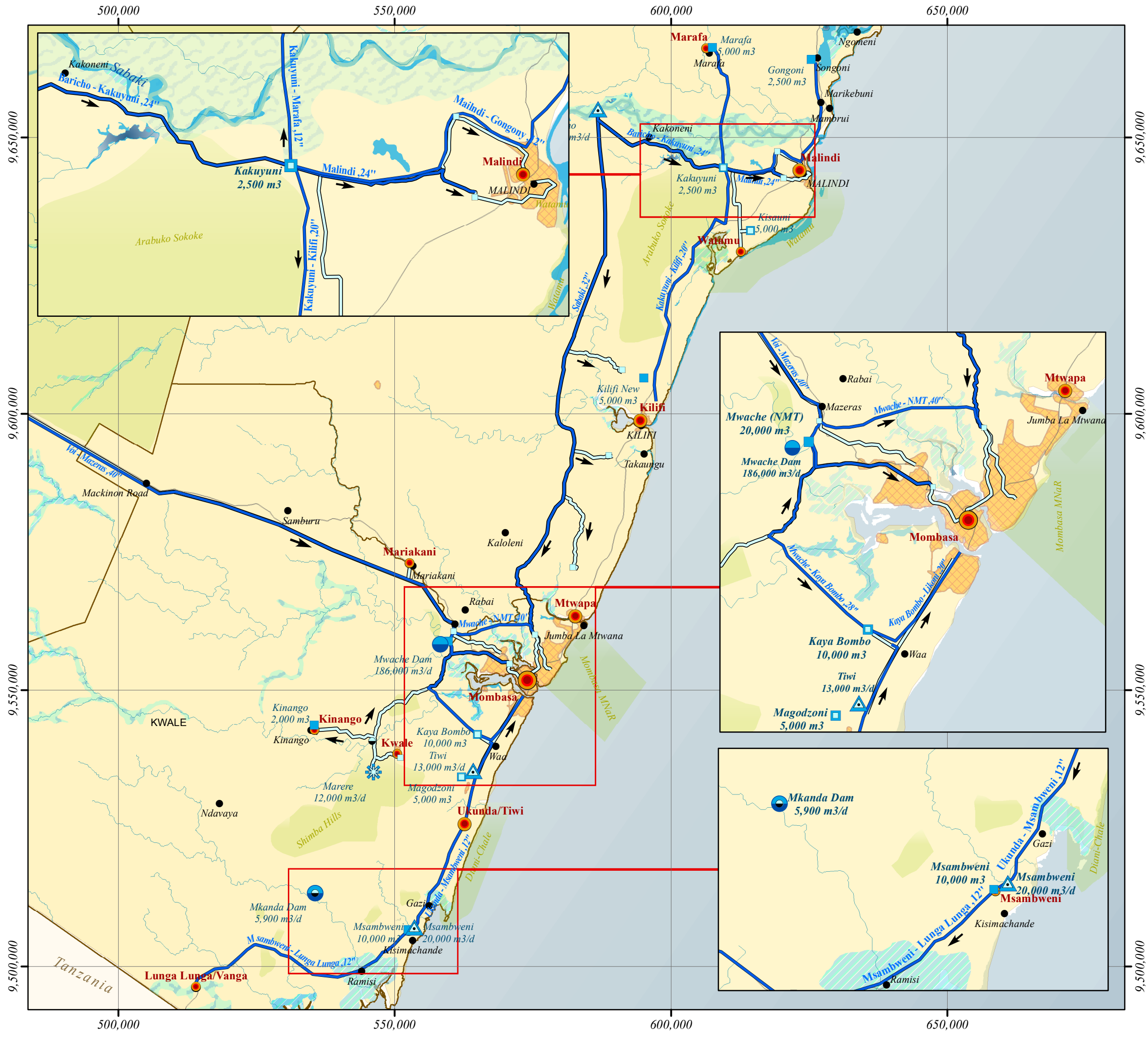
Existing Water Resources

- Boreholes
- River Intake
- ✱ Springs
- Surface Reservoir
- Water Tank

Proposed Water Resources - Full Dev.

- Boreholes
- River Intake
- ✱ Springs
- Surface Reservoir
- Water Tank





Map 23
CWSB Water Supply Master Plan Full Development (2035)
Mainland

Population Demand Centres (2012)

- 750 - 5,000 (m³/d)
- 5,000 - 50,000 (m³/d)
- 50,000 - 150,000 (m³/d)

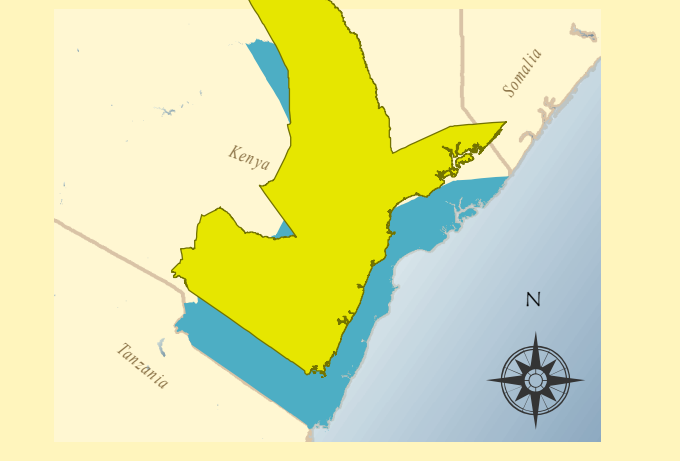
Existing Main Pipeline
Proposed Pipeline Development

Existing Water Resources

- Boreholes
- River Intake
- Springs
- Surface Reservoir
- Water Tank

Proposed Water Resources - Full Dev.

- Boreholes
- River Intake
- Springs
- Surface Reservoir
- Water Tank



Water Supply Master Plan for Mombasa and Other Towns Within the Coast Province



Map 24

Development Plan - Immediate Phase

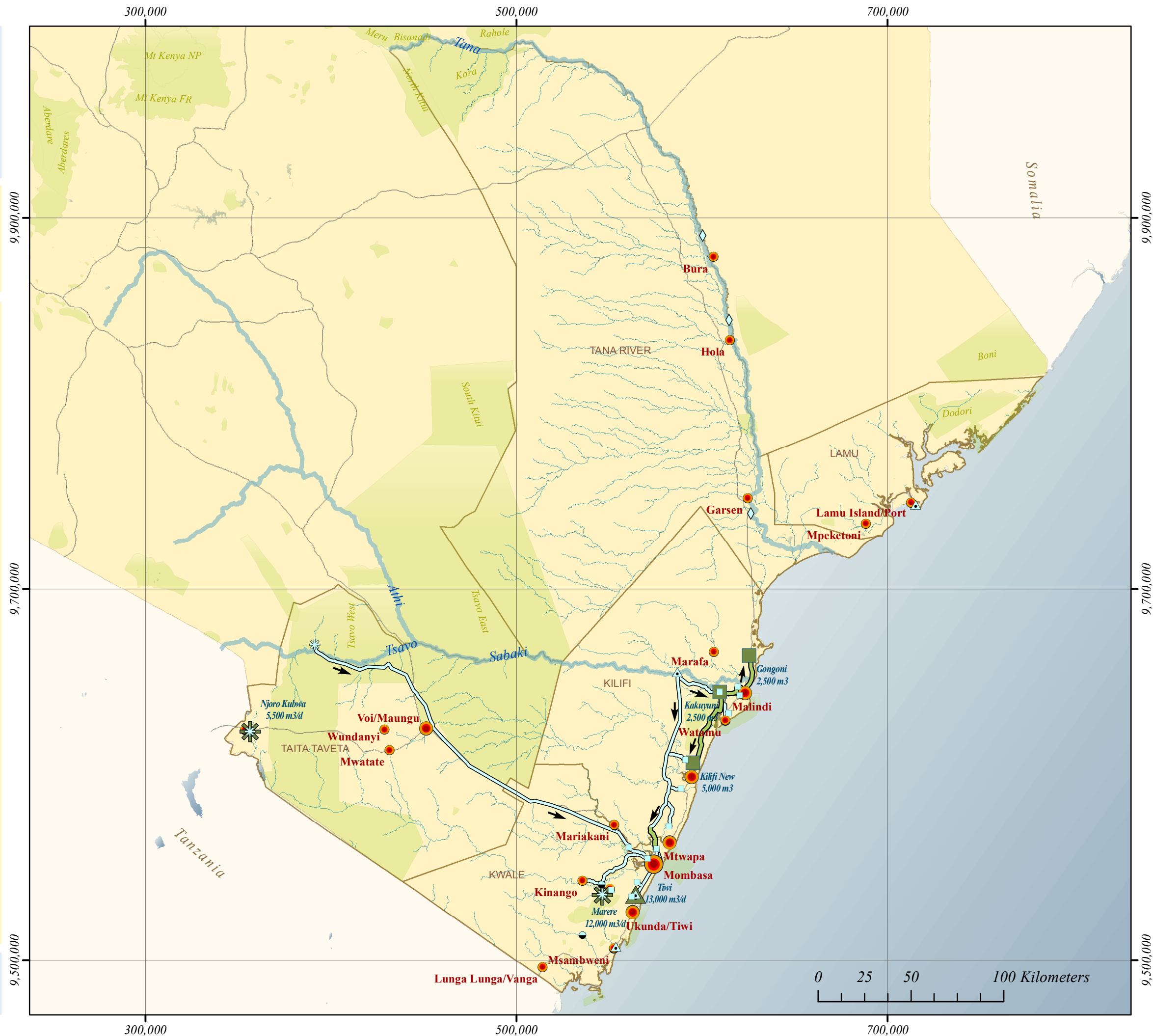
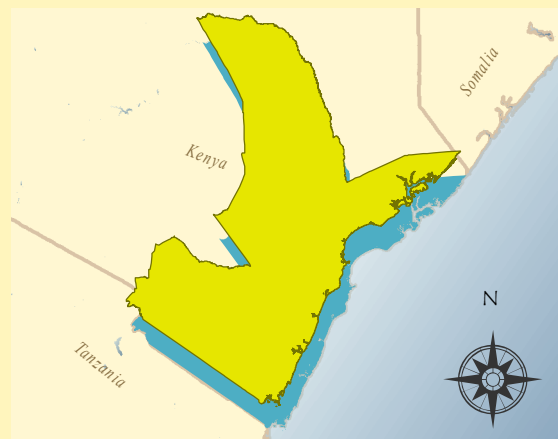
Population Demand Centres (2012)

- 750 - 5,000 (m³/d)
- 5,000 - 50,000 (m³/d)
- 50,000 - 150,000 (m³/d)

- Existing Main Pipeline
- Proposed Pipeline Dev. - Imm. Phase

Proposed Water Resources - Imm. Phase

- ▲ Boreholes
- ✱ Springs
- Water Tank



Water Supply Master Plan for
Mombasa and Other Towns
Within the Coast Province



Map 25

Development Plan -
Immediate Phase
Mainland

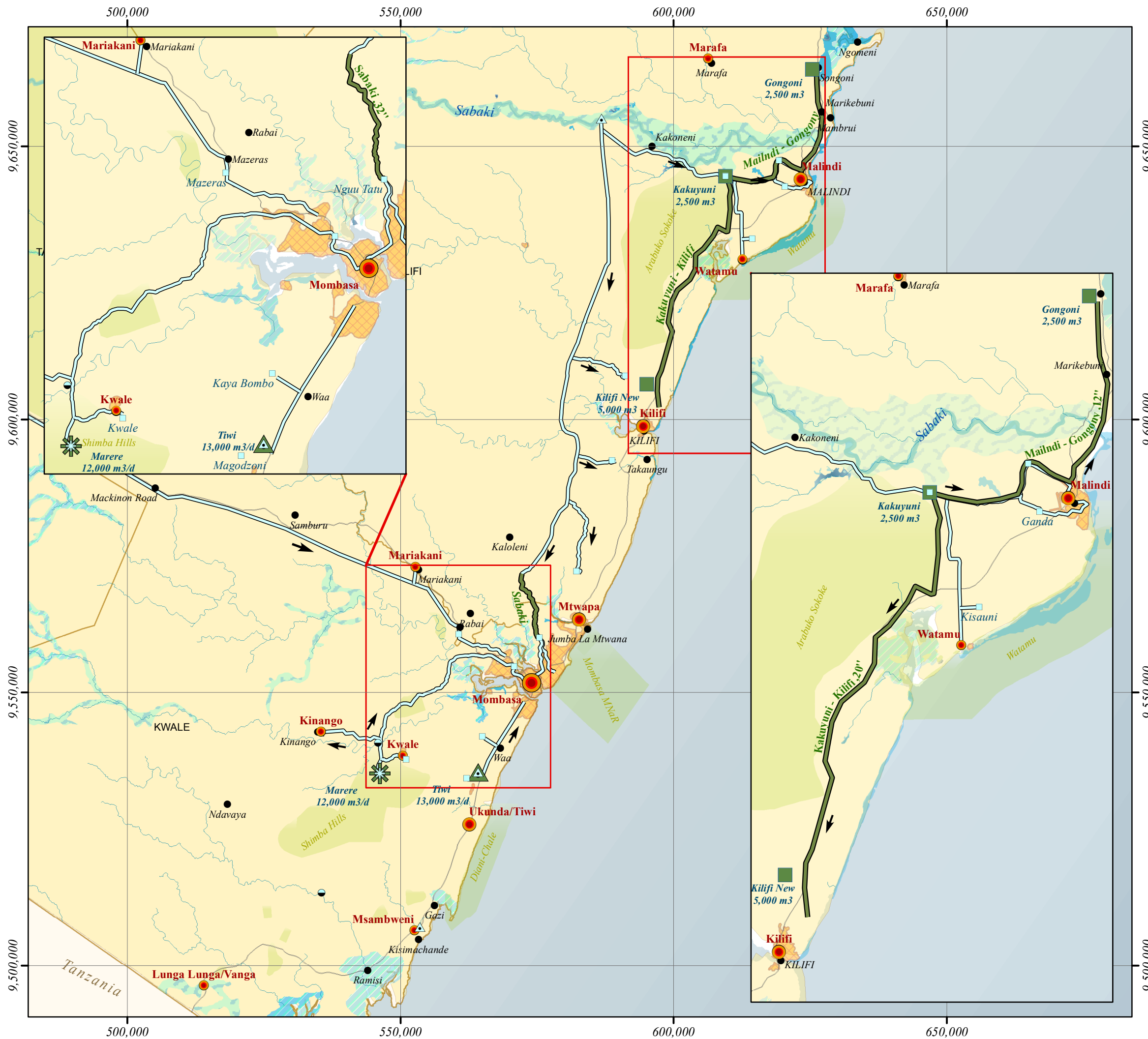
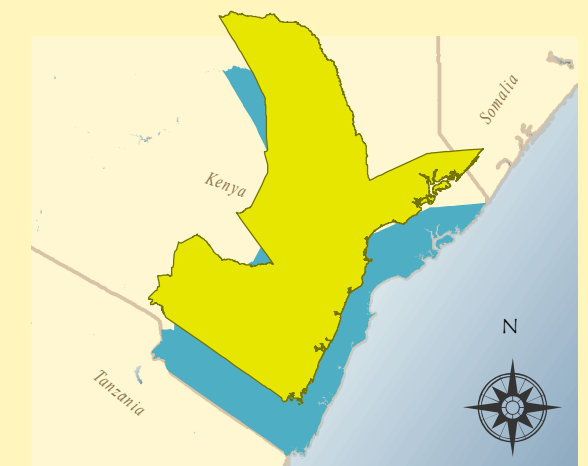
Population Demand Centres (2012)

- 750 - 5,000 (m3/d)
- 5,000 - 50,000 (m3/d)
- 50,000 - 150,000 (m3/d)

- Exist Main Pipeline
- Proposed Pipeline Dev. - Imm. Phase

Proposed Water Resources - Imm. Phase

- Boreholes
- Springs
- Water Tank



Water Supply Master Plan for Mombasa and Other Towns Within the Coast Province



Map 26

Development Plan - Phase I

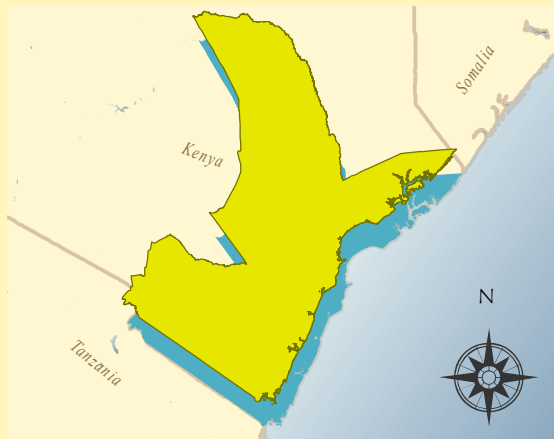
Population Demand Centres (2012)

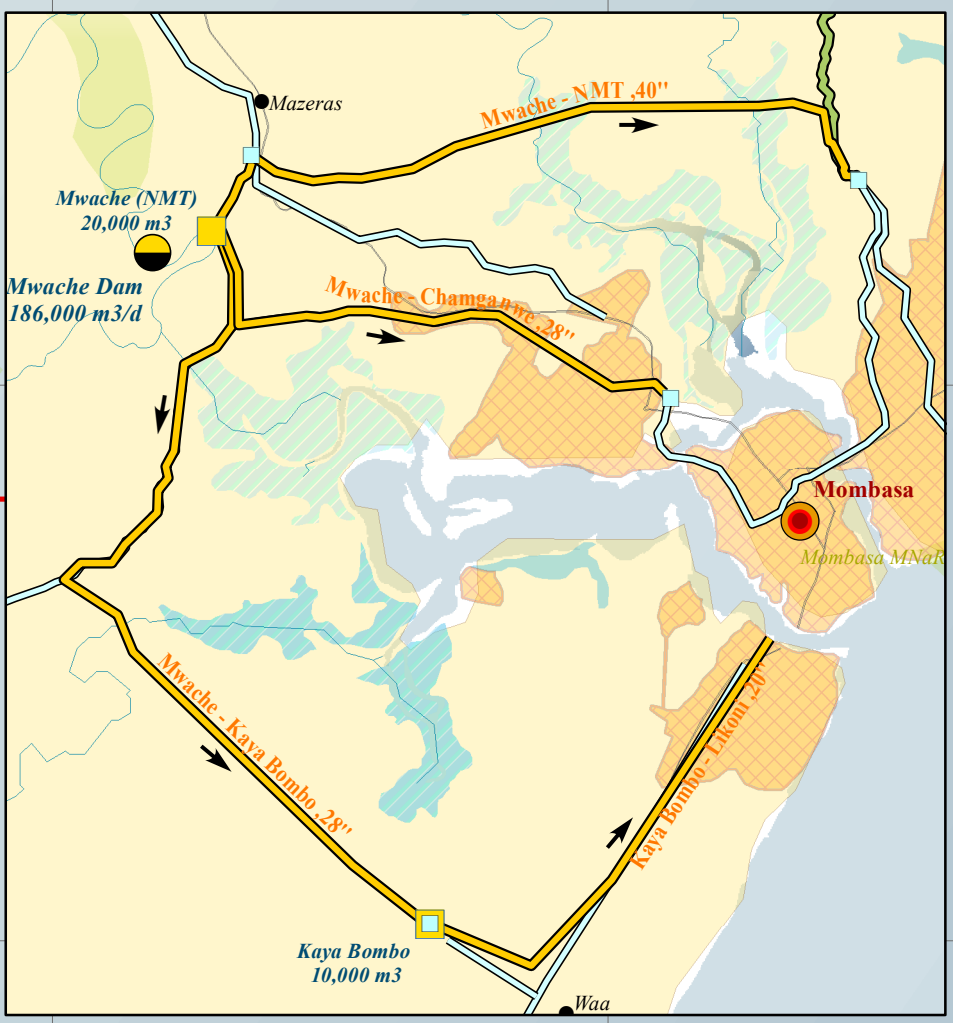
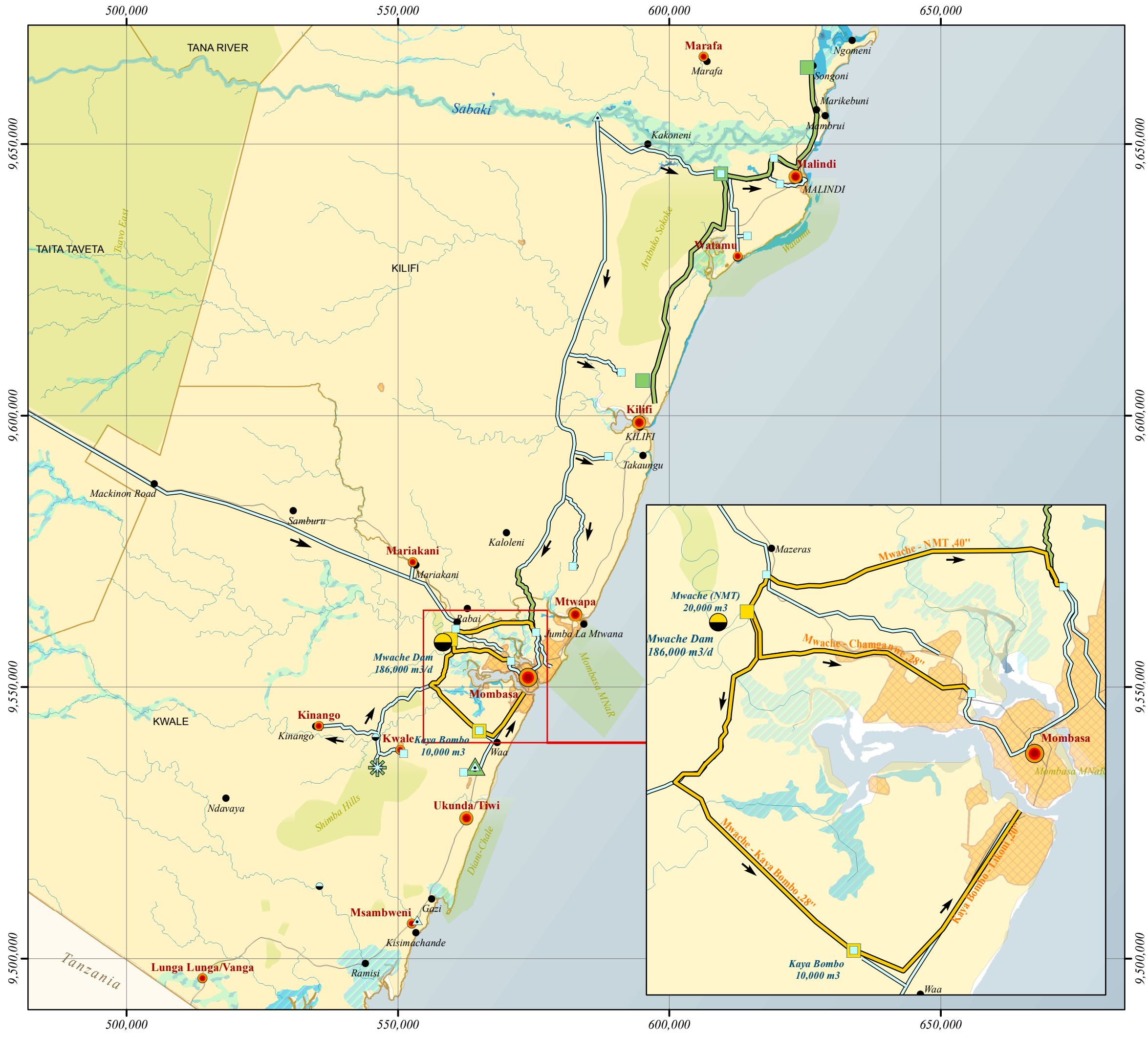
- 750 - 5,000 (m3/d)
- 5,000 - 50,000 (m3/d)
- 50,000 - 150,000 (m3/d)

- Existing Main Pipeline
- Proposed Pipeline Dev. - Imm. Phase
- Proposed Pipeline Dev. - Phase I

Proposed Water Resources Dev.- Phase I

- Surface Reservoir
- Water Tank





Map 27
Development Plan - Phase I
Mainland

Population Demand Centres (2012)

- 750 - 5,000 (m3/d)
- 5,000 - 50,000 (m3/d)
- 50,000 - 150,000 (m3/d)

— Existing Main Pipeline
— Proposed Pipeline Dev. - Imm. Phase
— Proposed Pipeline Dev. - Phase I

Proposed Water Resources - Phase I

- Surface Reservoir
- Water Tank



Water Supply Master Plan for Mombasa and Other Towns Within the Coast Province



Map 28

Development Plan - Phase II

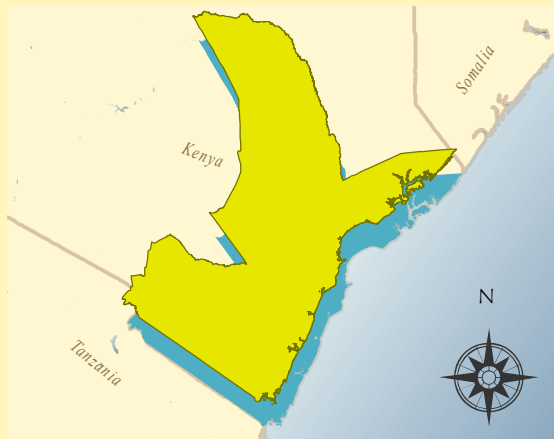
Population Demand Centres (2012)

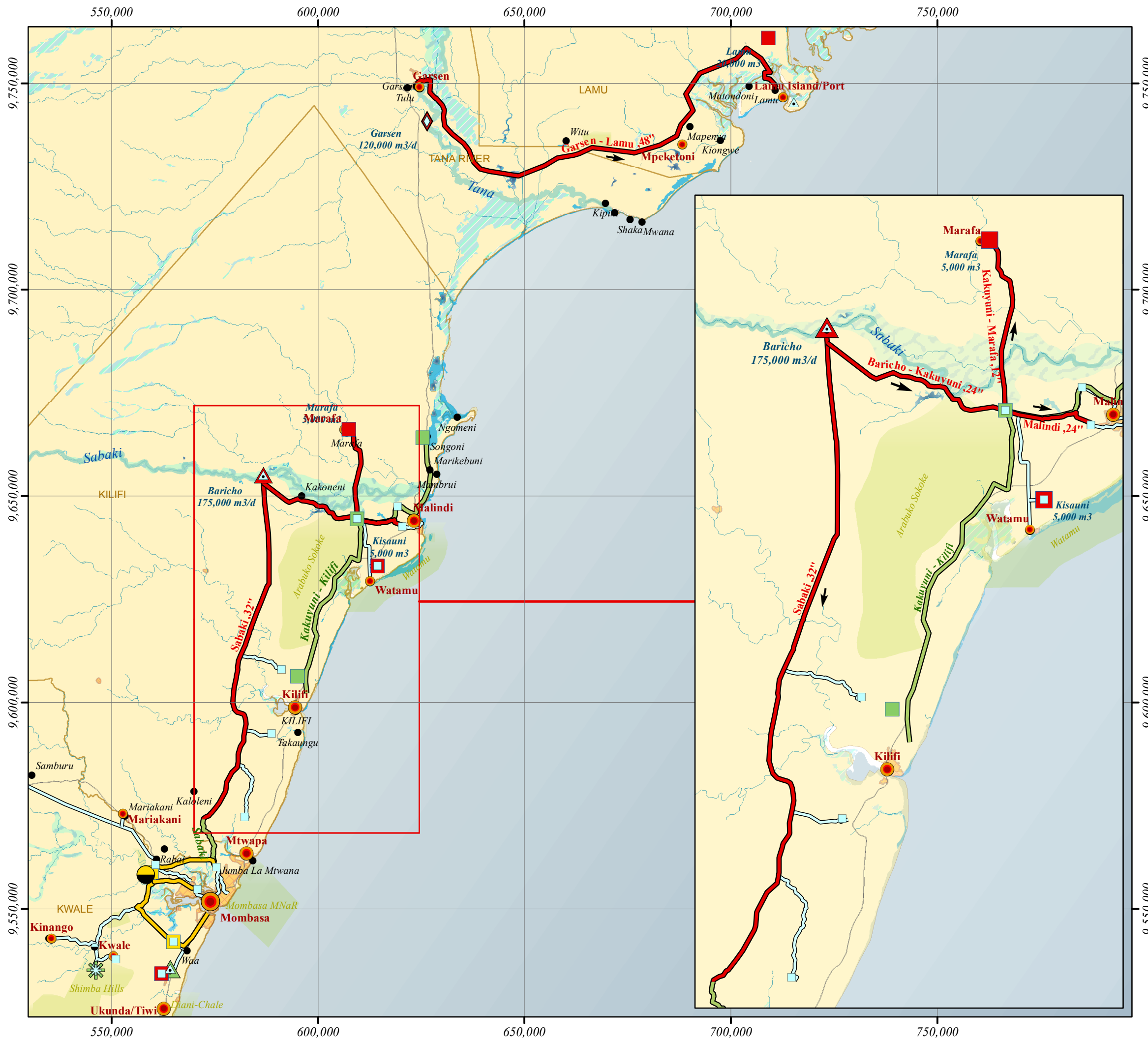
- 750 - 5,000 (m³/d)
- 5,000 - 50,000 (m³/d)
- 50,000 - 150,000 (m³/d)

- Existing Main Pipeline
- Proposed Pipeline Dev. - Imm. Phase
- Proposed Pipeline Dev. - Phase I
- Proposed Pipeline Dev. - Phase II

Proposed Water Resources Dev.- Phase II

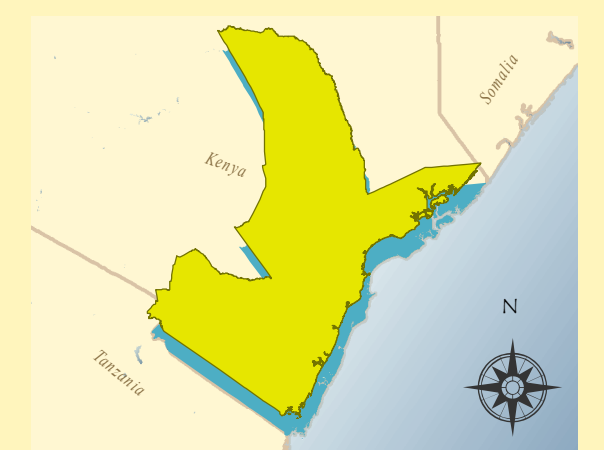
- ▲ Boreholes
- ◆ River Intake
- Water Tank





Map 29
Development Plan - Phase II Mainland

- Population Demand Centres (2012)**
- 750 - 5,000 (m3/d)
 - 5,000 - 50,000 (m3/d)
 - 50,000 - 150,000 (m3/d)
- Existing Main Pipeline
- Proposed Pipeline Dev. - Imm. Phase
- Proposed Pipeline Dev. - Phase I
- Proposed Pipeline Dev. - Phase II
- Proposed Water Resources Dev.- Phase II**
- Boreholes
 - River Intake
 - Water Tank



Water Supply Master Plan for Mombasa and Other Towns Within the Coast Province



Map 30
Development Plan - Phase III

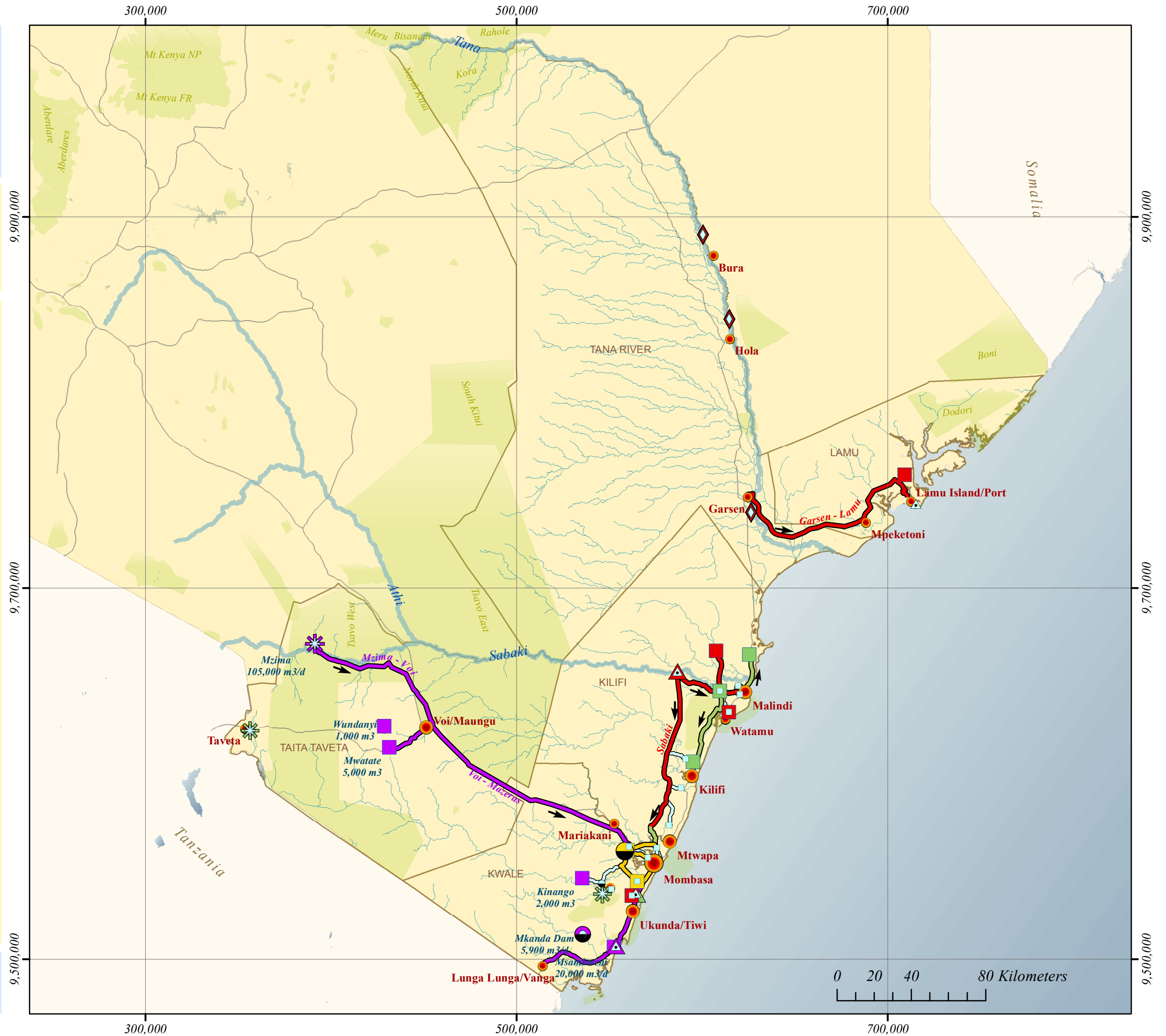
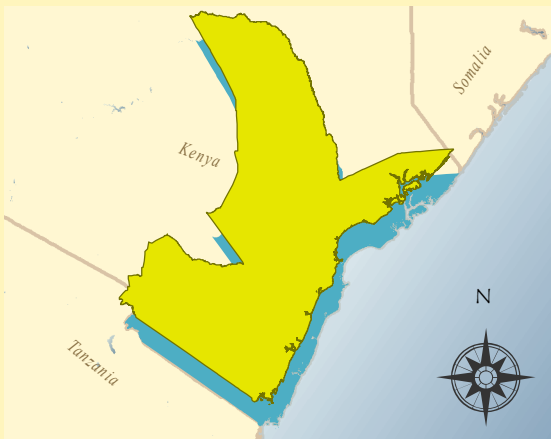
Population Demand Centres (2012)

- 750 - 5,000 (m³/d)
- 5,000 - 50,000 (m³/d)
- 50,000 - 150,000 (m³/d)

- Existing Main Pipeline
- Proposed Pipeline Dev. - Imm. Phase
- Proposed Pipeline Dev. - Phase I
- Proposed Pipeline Dev. - Phase II
- Proposed Pipeline Dev. - Phase III

Proposed Water Resources Dev.- Phase III

- ▲ Boreholes
- ✱ Springs
- Surface Reservoir
- Water Tank



Water Supply Master Plan for Mombasa and Other Towns Within the Coast Province



Map31

Development Plan - Phase III Mainland

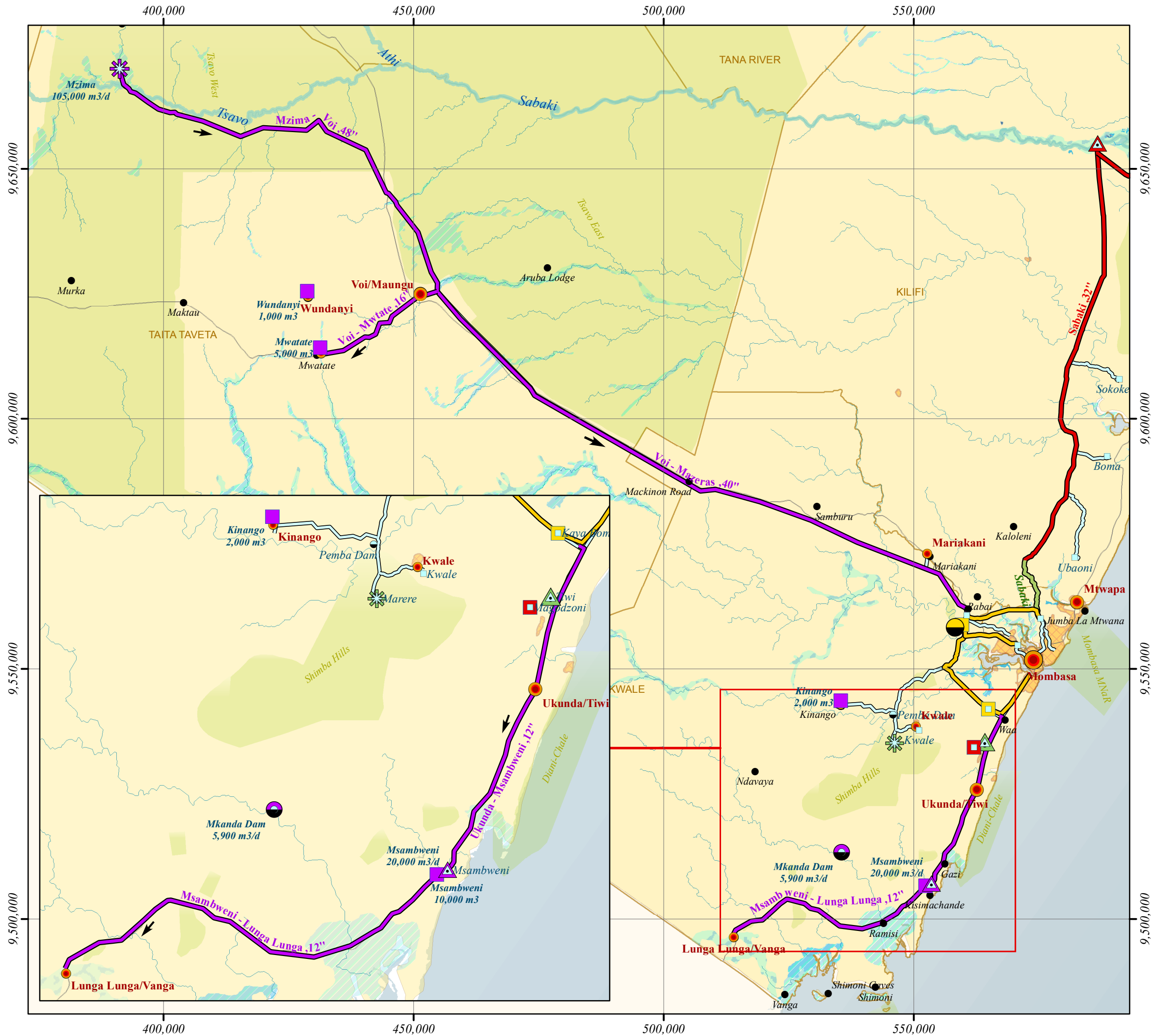
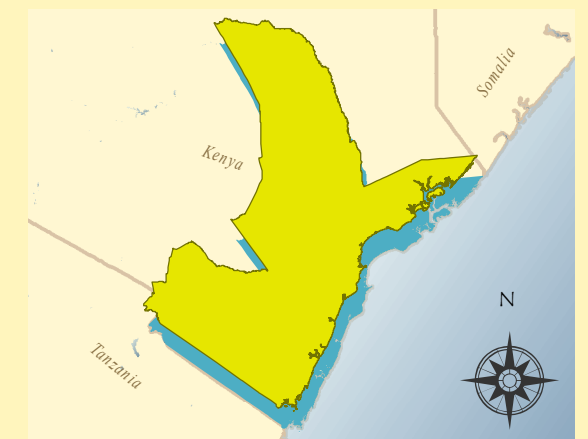
Population Demand Centres (2012)

- 750 - 5,000 (m3/d)
- 5,000 - 50,000 (m3/d)
- 50,000 - 150,000 (m3/d)

- Existing Main Pipeline
- Proposed Pipeline Dev. - Imm. Phase
- Proposed Pipeline Dev. - Phase I
- Proposed Pipeline Dev. - Phase II
- Proposed Pipeline Dev. - Phase III

Proposed Water Resources Dev.- Phase III

- Boreholes
- Springs
- Surface Reservoir
- Water Tank



Water Supply Master Plan for
Mombasa and Other Towns
Within the Coast Province



Map 32

CWSB Water Supply Master Plan
Tana River - Full Dev. (2035)

Population Demand Centres (2012)

● 750 - 5,000 (m³/d)

— Existing Main Pipeline

— Proposed Pipeline Full Development

Existing Water Resources

▲ Boreholes

◇ River Intake

✱ Springs

Proposed Water Resources - Full Dev.

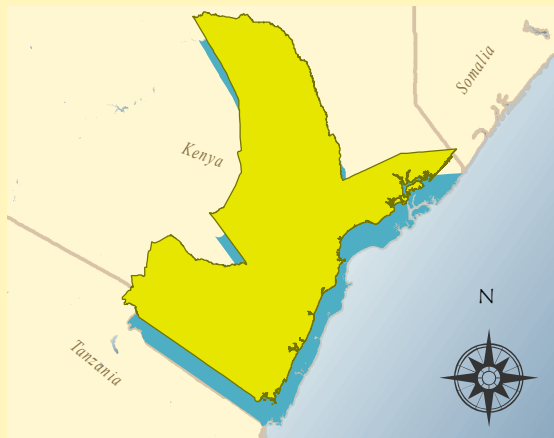
▲ Boreholes

◇ River Intake

✱ Springs

✱ Springs

■ Water Tank



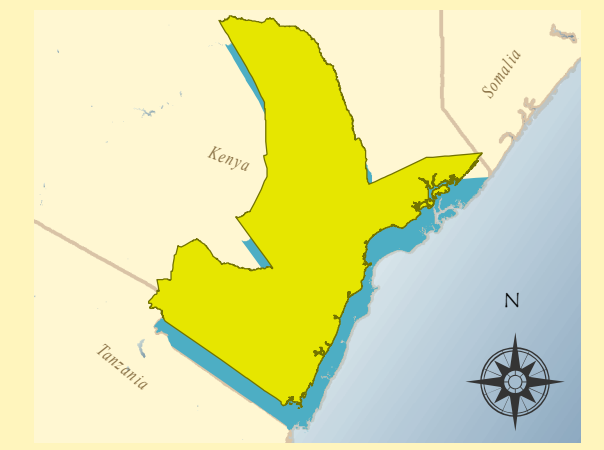
Water Supply Master Plan for
Mombasa and Other Towns
Within the Coast Province



Map 33

CWSB Water Supply Master Plan
Lamu - Full Dev. (2035)

- Population Demand Centres (2012)**
- 750 - 5,000 (m³/d)
- Existing Water Resources**
- Existing Main Pipeline
 - Proposed Pipeline Full Development
 - ▲ Boreholes
 - ◇ River Intake
- Proposed Water Resources - Full Dev.**
- ◆ River Intake
 - Water Tank



Water Supply Master Plan for
Mombasa and Other Towns
Within the Coast Province



Map 34

CWSB Water Supply Master Plan
Kilifi - Full Dev. (2035)

Population Demand Centres (2012)

- 750 - 5,000 (m3/d)
- 5,000 - 50,000 (m3/d)
- 50,000 - 150,000 (m3/d)

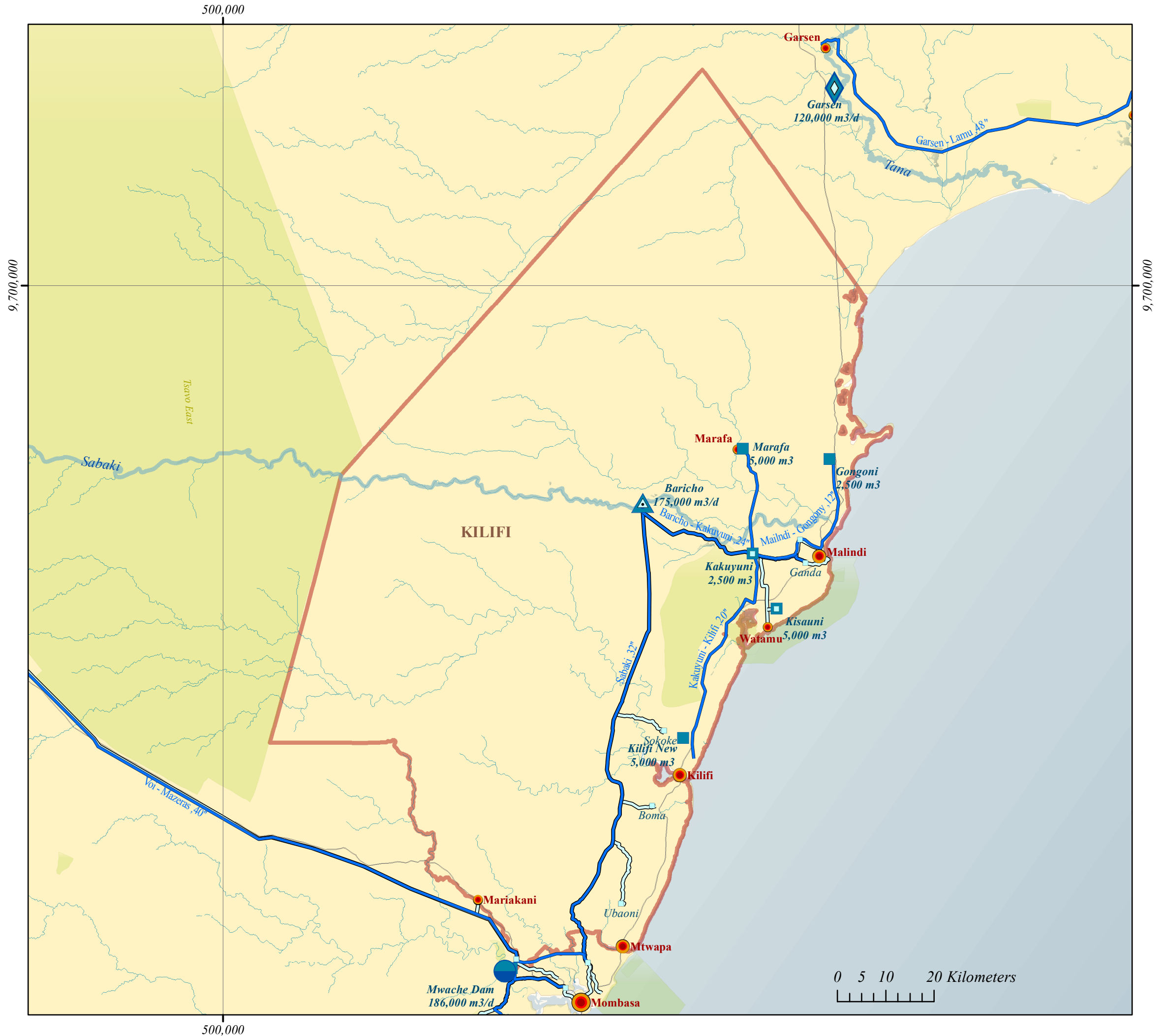
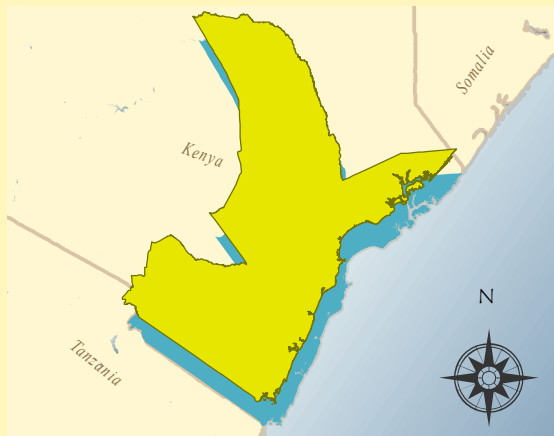
- Existing Main Pipeline
- Proposed Pipeline Full Development

Existing Water Resources

- Boreholes
- River Intake
- Water Tank

Proposed Water Resources - Full Dev.

- Boreholes
- River Intake
- Surface Reservoir
- Water Tank



Water Supply Master Plan for
Mombasa and Other Towns
Within the Coast Province



Map 35

CWSB Water Supply Master Plan
Taita Taveta - Full Dev.(2035)

Population Demand Centres (2012)

- 750 - 5,000 (m3/d)
- 5,000 - 50,000 (m3/d)

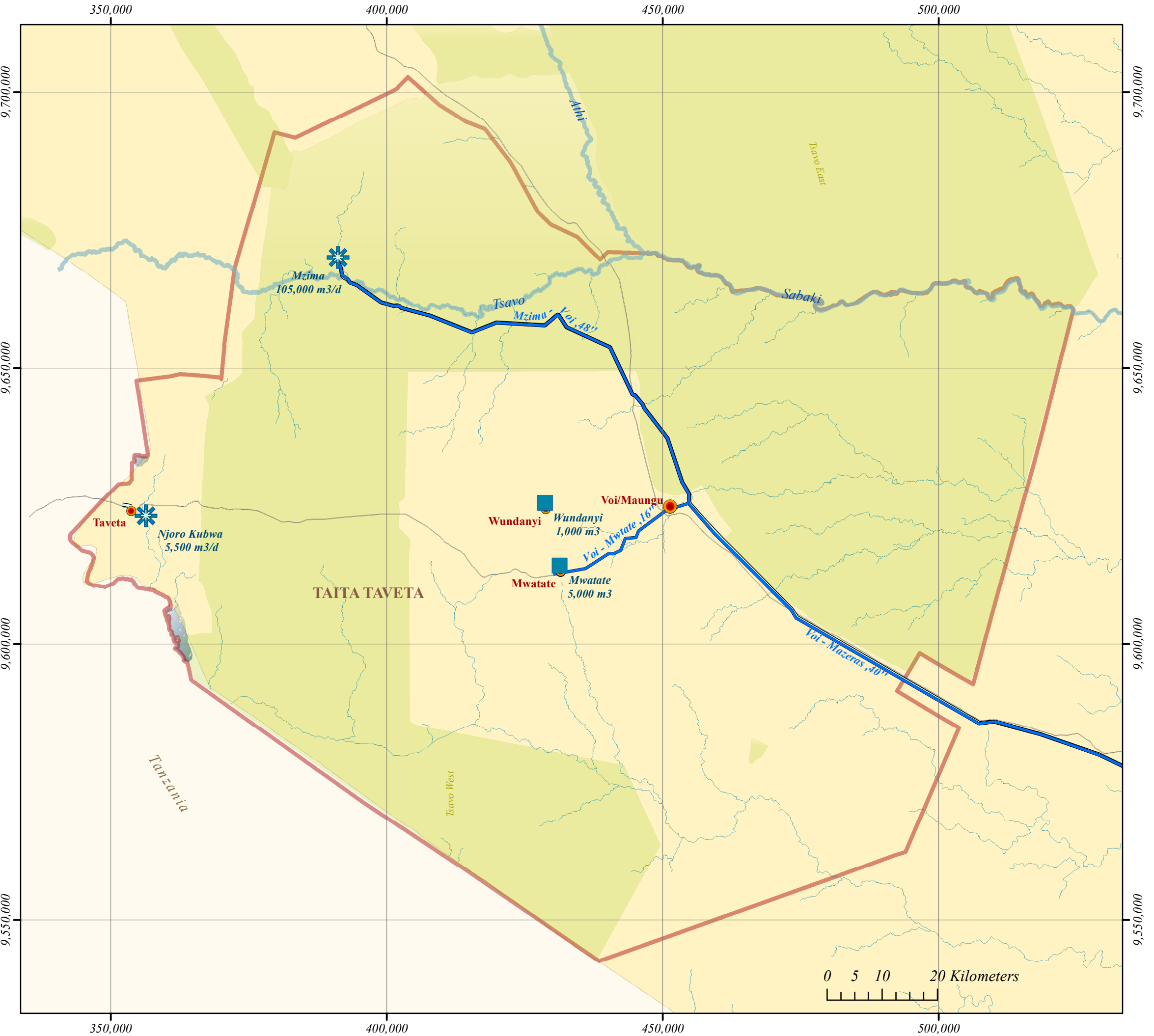
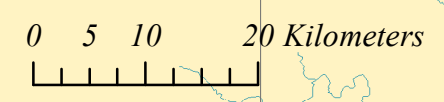
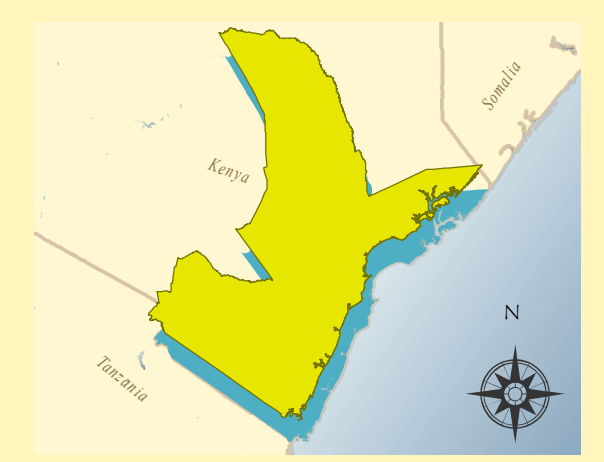
- Existing Main Pipeline
- Proposed Pipeline Full Development

Existing Water Resources

- ✱ Springs

Proposed Water Resources - Full Dev.

- ✱ Springs
- Water Tank



Water Supply Master Plan for
Mombasa and Other Towns
Within the Coast Province



Map 36

CWSB Water Supply Master Plan
Kwale- Full Dev. (2035)

Population Demand Centres (2012)

- 750 - 5,000 (m³/d)
- 5,000 - 50,000 (m³/d)
- 50,000 - 150,000 (m³/d)

- Existing Main Pipeline
- Proposed Pipeline Full Development

Existing Water Resources

- ▲ Boreholes
- ✱ Springs
- Surface Reservoir
- Water Tank

Proposed Water Resources - Full Dev.

- ▲ Boreholes
- ✱ Springs
- Surface Reservoir
- Water Tank

