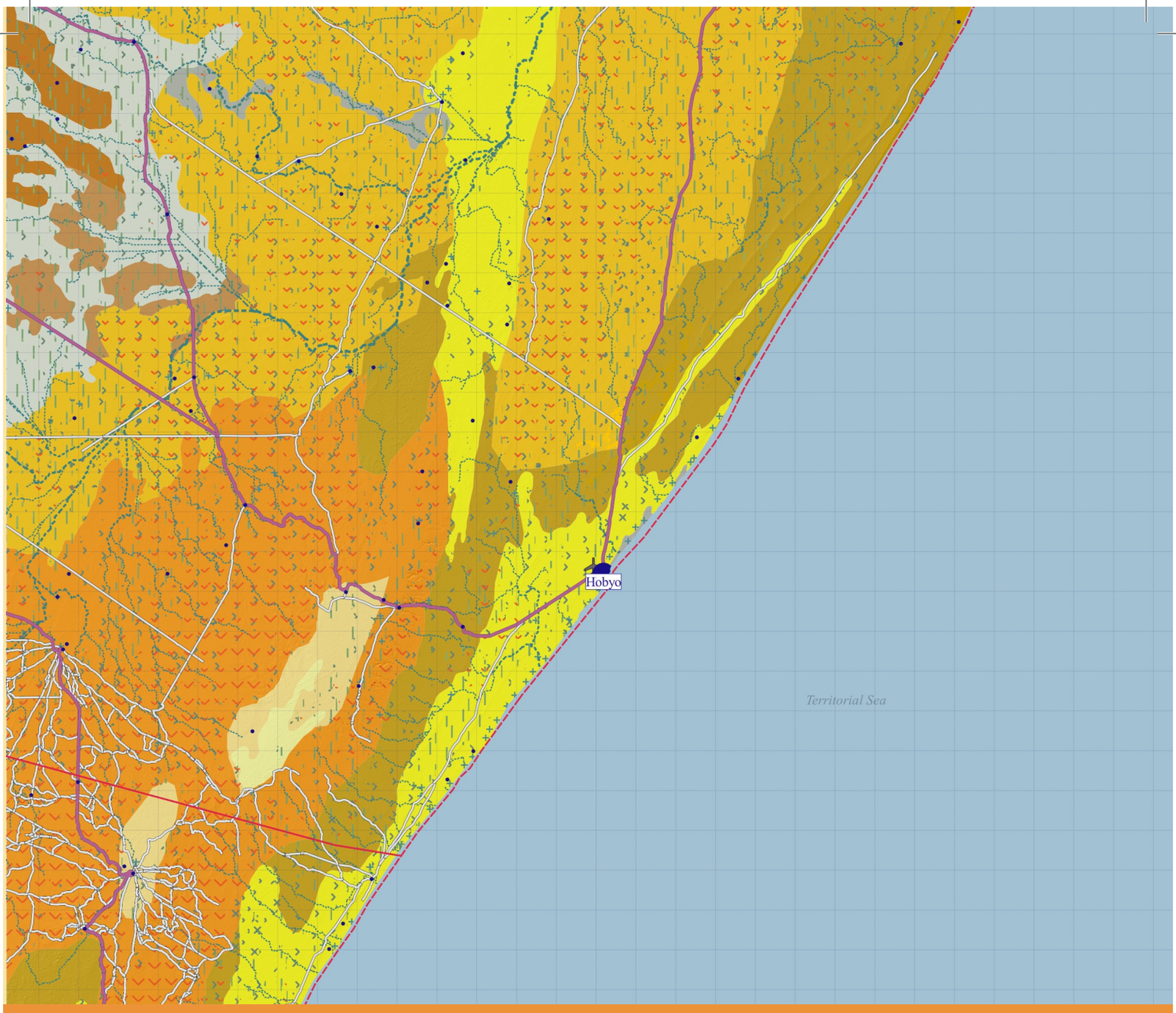

Mapping Somali cities

Training manual

UN HABITAT

UNITED NATIONS HUMAN SETTLEMENTS PROGRAMME
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Index

Introduction

Why this manual?

Maps are not simple representations of the real world on a much smaller scale. They are a tool to organize information. With maps, it become much easier to investigate a place's infrastructure, economy and settlement information, which are all very important facets of population and development situation.
Maps can also easily and concretely show change through time, and allow to understand one place's trend and plan for the future. They help you figure out where you are and how to get where you want to go.
While many data are available across different sectors and key actors, there is no official cartography which represents Somalia as it is now. In this sense, Somalia is, by many ways, an unexplored territory. The limitations in access of many parts of its extension made very difficult to provide updated, reliable and verified information from a spatial prospective.
With concrete improvements in the governance of the country, from the Federal level to the Federal Member States established in the last years, to the administrations at district and municipal level, the chance is to coordinate different level of spatial data and produce an updated cartography. This would contribute in an effective way to develop a shared understanding of the complexity of Somalia territory and support the country's development.

What is the manual about?

The manual is meant to feed into a training course for base mapping in Somalia. It serves as an introduction for local government and other interested stakeholders, guiding through the different scales and themes relevant to the context, the different sources available, and different visualization requirements.

Who is the target for this course?

This course is designed as an introductory training module, which would enable participants to equip themselves with foundation principles, further disseminate the knowledge or train others.
The end-users of the course are intended to be local government staff (ministries, district), as well as other stakeholders (e.g. NGOs and international agencies), particularly those engaged in development activities that deal with infrastructure, agriculture, hydrology, land administration, urban planning, solid waste management, or natural resource management.
The course assumes a basic knowledge of concept of Geographic Information systems (GIS) and the use of QGIS 3 (a free and open-source cross-platform GIS software).
In selecting participants, ensuring geographical and gender distribution, a range of expertise and experience as well as diversity of ethnic and religious backgrounds would augment the mutual learning experience.

By the end of the course participants should be:

- familiar with
- aware of
- able to

Limitations

The manual is structured to work with other material. That is:

- a set of base layers
- QGIS projects and styles

The layers made available are not meant to constitute to only source for the production of the maps, but they are the most updated publicly-available spatial layers sufficient for the elaboration of most of the thematic maps reputed necessary for a basic representation of the territory at district level. The training attendees will be able to collect further data and enrich their maps with ground-level information.

Building up local governments technical capacity

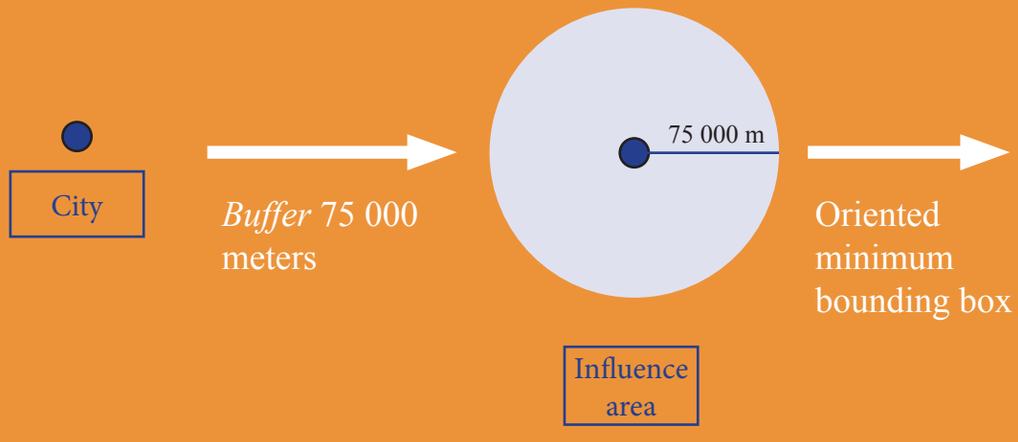
This manual is part of a UN-Habitat strategy for building up capacity of local and state government in Somalia and laying the foundation for the establishment of functional urban development departments able to cope with the tremendous urban development challenges of the country. Mapping is only one of the technical skills at the base of urban planning. Others training developed in coordination with the current one are:

- Rapid urban profiling and land use mapping
- Urban risk mapping and resilience planning
- Roles and responsibilities in urban planning

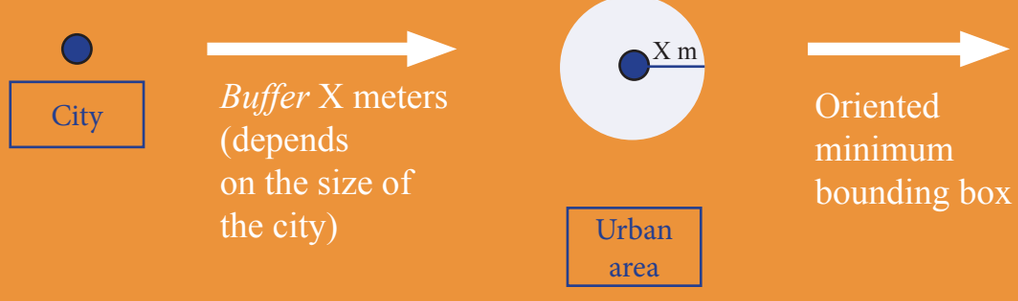
What to map?

Very first step is defining what to represent and at what scale, the drawing limits. Mapping cities through Geographic Information Systems (GIS) makes it possible to identify and work with different city areas of influence.
For this task, it is suggested to work in one of these two scales:
- **Regional scale (RS)**, which integrates the areas, cities and settlements that are less than an hour's drive from the studied city. It is considered that the average speed of a car on a National Road is approximately 70 km/hour. Therefore, an area of 75 km radius is established around the city.
- **Urban Scale (US)**, which focuses on the urban area and its most immediate surroundings.

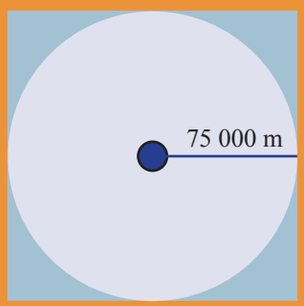
Regional scale



Urban scale



To do this, it is suggested to start from a layer of points that identifies the position of the city, creating a layer that identifies the area of study and simplifies the following steps. These cropping layers/bounding boxes define the boundaries of the site to be reviewed, and they also limit the working area if the data is too heavy to allow for a fluid workflow.
This work is not necessarily a linear process. Scale and limits could be modified based on new finding in the future.

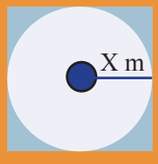


Intersect

Example:
Regional scale
Hobyo 1: 700.000

City clip layer
Regional scale

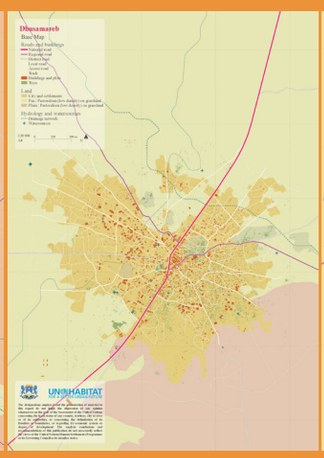
Layers that need manual revision or that are too heavy



Intersect

City clip layer
Urban scale

Example:
Urban scale
Galkayo 1: 50.000



Example:
Urban scale
Dhusamareb 1: 20.000

Example:
Urban scale
Hobyo 1: 15.000

How to map?

It is necesary to pre-select and prepare the information before starting to work with it. For this purpose, it is important to sort out the downloaded or received information from work layers into different folders -the information will be used later on the maps. This step provides a more organized arrangement of information and avoids having unused layers in the workspace. The separation of data is also useful in case of data loss or damage.
Once the information is downloaded, it is necessary to do a pre-selection by triage, processing the information. Later we will do an evaluation to decide which layers are needed. These layers will be extracted directly from the chosen source (and named according to the nomenclature defined in page 09), and projected in the chosen CRS.

Downloaded/ Received information

Downloaded / Received information

triage and projection CRS

Preselected base layers are organized in main folders

- **00** Drawing limits *(layers p 06-07)*
- **00** Political Administrative Entities *(layers p 14)*
- **01** Topography and Hydrology *(layers p 15)*
- **02** Land *(layers p 16)*
- **03** Built *(layers p 17-21)*

Triage

Information triage is the selection of relevant information for the mapping. This requires opening each layer in QGIS and looking at both the visible information and the information present in the attribute tables. It is also necessary to download or choose some layers instead of others filtering by the latest update -which appears in the download portal. The most recent ones, or those with higher quality information, will be chosen to make the maps.
The scheme of page 07 shows the sources of the layers that were selected to make the working layers.

Projection in Coordinate Reference System (CRS)

To avoid problems while working, every layer must be projected in CRS **WGS 84/ UTM 38N EPSG: 32638**. If layers are not projected it can be impossible to operate with them. For that it is important to choose in the Properties of QGIS project as Predefined Coordinate Reference System, WGS 84/ UTM 38N EPSG: 32638.

If a layer is correcty located but the CRS is not the chosen one it is necessary to (by right clicking on the layer), “Save as” (QGIS 2.18) or “Export” (QGIS 3.12) modifying the CRS of the layer.
If a layer is not corrrectly located it is necessary to, first, change its CRS (right clicking on the layer on “Properties”) and change CRS; then, it is necessary to (by right clicking on the layer), “Save as” (QGIS 2.18) or “Export” (QGIS 3.12), modifying the CRS.

Data gathering

International organizations

UN OCHA
https://data.humdata.org/

FAO SWALIM
https://spatial.faoswalim.org/layers/?limit=20&offset=0

FAO GEONETWORK
http://www.fao.org/geonetwork/srv/en/main.home
*for Landcover maps

GLOBAL SHELTER CLUSTER
https://cccm-cluster-somalia.github.io/OPSMAP/#moreinfo

Open maps

HOTOSM
https://www.hotosm.org/

OSM
http://download.geofabrik.de/africa.html

Open datasets from satellite images

ALOS PALSAR | ASF Data Search Vertex | DEM 30M
https://search.asf.alaska.edu/
*needs registration

TANDEM-X | DEM 90M
https://download.geoservice.dlr.de/TDM90/
recommended for basin scale hydrologic analysis *needs registration

Tracing / Teledetection from aerial view

Bing aerial
*With OpenLayers plugin

Google satellite
*With OpenLayers plugin
and registration in Google Cloud Platform with Gmail account to set up an API key from "Maps JavaScript API"

Google Earth
https://www.google.com/intl/es/earth/

Other sources
Paper maps etc

Goverment

This manual is for base mapping. The layers made available are not meant to constitute to only source for the production of the maps, but they are the most updated publicly-available spatial layers (UN system, international organization and open sources) sufficient for the elaboration of most of the thematic maps reputed necessary for a basic representation of the territory at district level. The training attendees will be able to collect further data and enrich their maps with ground-level information.

00 Administrative limits and boundaries

- District | polygon
- Region | polygon
- State | polygon
- Country | polygon
- Settlements | point

01 Topography and hydrology

- Digital elevation model -30M | raster 1B | 30x30m
- Hillshade | raster 1B | 30x30m
- Contour lines | line
- Drainage network | line
- Water ponds | polygon
- Salty ground water sources | polygon

02 Land

- Land form and use - RS* | polygon
- Land cover -RS* | polygon
- Geology -RS* | polygon
- Land form and use - US* | point
- Trees -US* | polygon

03 Built

- Built | polygon
- Areas | polygon
- Facilities and infrastructures | point
- Roads | line
- Transport | point
- Water sources | point
- IDP Camps | point
- Historical - US* | polygon

In addition to the sources of data suggested, the layers could be completed with the information that country institutions could have.

How to organize information?

Main folders

00 Drawing limits *(layers p 06-07)*

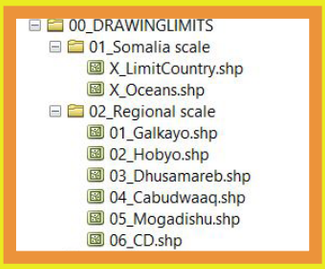
00 Political Administrative Entities *(layers p 14)*

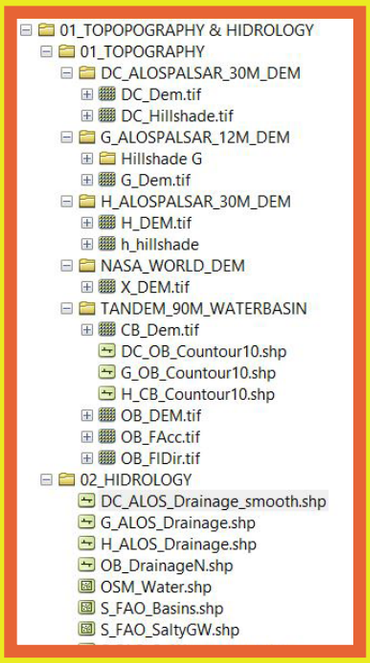
01 Topography and Hydrology *(layers p 15)*

02 Land *(layers p 16)*

03 Built *(layers p 17-21)*

Example of folders organization





* Government should create a database to be upgrated and maintained of ground-level and validated data.

Naming

Inside every main folder the information can be organized by theme, according to the sources, or according to scale. This will vary depending on how the information was produced, on the availability and size of the information, or on the map needs.

However, it is always recommended to maintain the hierarchy in naming the files and folders as described below. This allows to retrace and identify the contents of the layer without opening it.

Scale_Source_Topic (.extension)

Scale

National Scale
> Ø or S or SOM
Example:
FAO_Landcover.shp
SOM_Adm0.shp

Regional or Urban Scale
> Initials of the area
Example:
Ogaden Basin= OB
OB_ALOS_Drainage.shp
Galcayo=G
G_Roads.shp

Source

Only one source
(without intervention in attribute layer)
> Initials of the source
Example:
FAO_Landusystem.shp

Multiple sources
(sources are mentioned in attribute table)
> Ø
Example:
H_Buildings.shp

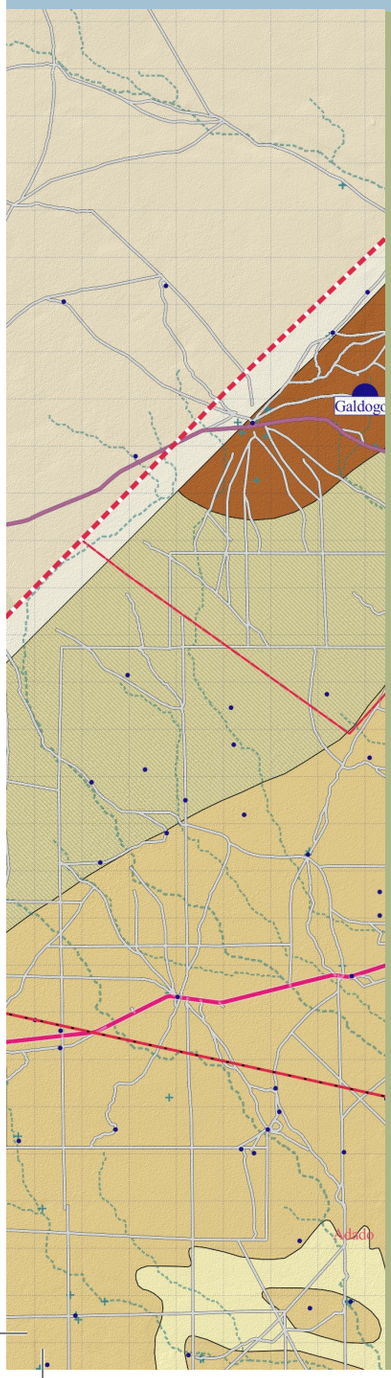
Topic

Different topics are presented in previous page.
Example:
Landusystem.shp
DEM.tif
G_building.shp

00 Political/Administrative Entities

This information is generally well organized, but national and regional boundaries can vary greatly depending on the source and the time of mapping.

In this document the border of Somalia is considered to be demilited by the administrative boundaries as made available by UN OCHA.



UN OCHA
https://data.humdata.org/

AdmN layers | Administrative divisions
https://data.humdata.org/dataset/administrative-regions-of-somalia

- District | polygon | Adm 3
- Region | polygon | Adm 2
- State | polygon | Adm 1
- Country | polygon | Adm 0

UN OCHA
https://data.humdata.org/

Settlements

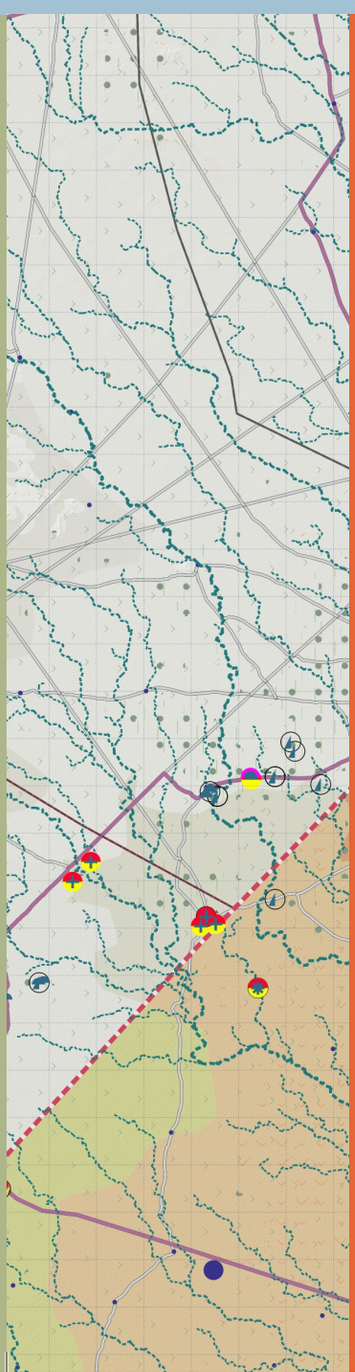
- Settlements | point
  https://data.humdata.org/dataset/somalia-settlements-p-coded-shapefile

01 Topography and hydrology

Hydrology and topography information is extracted from different DEM models. A first hydrological approach is made with TANDEM-X (cell size: 90 x 90 meters) information for the hole Ogaden Basen (and, partially, for the Central Coastal Basin). This information allows to extract countour lines for regional scale. A second and more precise hydrologic analysis to extract local drainage network is made with ALOS PALSAR DEM (cell size: 30 x 30 meters) from 2007 to 2011. The DEM also allows to extract Hillshade. Even if Ogaden Basin information is not represented on the maps, it allows for the study of hydrologicaly connected sites; this information is therefore available in the folders.

More information about accuracy of ALOS PALSAR for extracting Drainage network in arid and semi-arid environments:

> https://www.sciencedirect.com/science/article/pii/S221458181830212X



ALOS PALSAR | ASF Data Search Vertex | DEM 30M
https://search.asf.alaska.edu/
*needs registration

↓ Merge raster layers
> https://docs.qgis.org/2.8/en/docs/training_manual/processing/cutting_merging.html)

Digital elevation model -30M | raster 1B | 30x30m

↓ Hillshade from DEM
> https://docs.qgis.org/2.8/en/docs/user_manual/processing_algs/gdalogr/gdal_analysis/hillshade.html

Hillshade | raster 1B | 30x30m

↓ Hydrological analysis
>https://docs.qgis.org/2.2/en/docs/training_manual/processing/hydro.html

Drainage network | line

TANDEM-X | DEM 90M
https://download.geoservice.dlr.de/TDM90/
recommended for basin scale hydrologic analysis *needs registration

↓ Contour from DEM
> Raster menu >> Extraction >> Contour

Contour lines | line

OSM
http://download.geofabrik.de/africa.html

Bing aerial
*With OpenLayers plugin

Google satellite
*With OpenLayers plugin

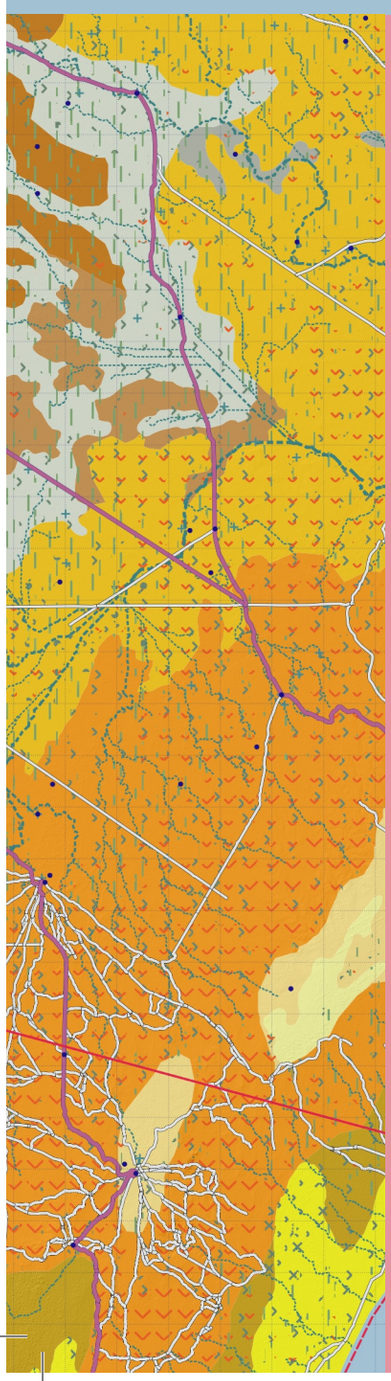
Water ponds and water surfaces | polygon
This layer is not automatically generated, because temporary or stable water surfaces are not numerous nor well documented. Some have been traced from satellite images and some have been compiled from different sources.

FAO SWALIM
https://spatial.faoswalim.org/layers/?limit=20&offset=0

Salty ground water sources | polygon
https://spatial.faoswalim.org/layers/geonode:Salty_Ground_Water_Sources
License: Open Data Commons Open Database License
Publication: December, 6th; 2019 at 10:39

02 Land

Landscape information at regional level is obtained from FAO SWALIM and FAO Geonetwork. This information has a fairly high resolution, so at the closest scales it is necessary to adapt it to the actual scale of representation; either by integrating information sources that have a higher resolution, or tracing from aerial images or -if possible- by taking field data.



FAO SWALIM
https://spatial.faoswalim.org/layers/?limit=20&offset=0

FAO GEONETWORK
http://www.fao.org/geonetwork/srv/en/main.home

Land cover -RS* | polygon
Land cover of Somalia | Globcover Regional (2005)
http://www.fao.org/geonetwork/srv/en/metadata.show?currTab=simple&id=37207
Land cover of Ethiopia | Globcover Regional (2005)
http://www.fao.org/geonetwork/srv/en/main.home?uuid=acdb1530-1840-4a91-a25e-09ee6e4d06e8
Publication: May, 11th; 2009 at 15:49 Resolution: 300 m

Geology -RS* | polygon
Geology Abbate et al. (1993)
https://spatial.faoswalim.org/layers/geonode:Geology_Abbate_et_al_1993#/
License: ?
Publication: December, 11th; 2019 at 17:02

Landuse system | polygon
Somalia Landuse system (2007)
https://spatial.faoswalim.org/layers/geonode:SOM_Landuse_System_FAOSWALIM2007#/
License: Open Data Commons Open Database License
Publication: December, 3th; 2019 at 16:15

Landform | polygon
Somalia Landforms (2008)
https://spatial.faoswalim.org/layers/geonode:SOM_Landforms_FAOSWALIM20080#/
License: Open Data Commons Open Database License
Publication: December, 3th; 2019 at 16:49

↓ Union of both layers and Eliminate sliver polygon tools -for small polygons A<2Ha

Land form and use - RS* | polygon

↓ Adding information by tracing from aerial views combined with previous/other layer information

Cropland- RS* | polygon
Somalia_Cropland_GFSAD_30m_2015
https://spatial.faoswalim.org/layers/geonode:SOM_Cropland_GFSAD_30m_2015#/
Publication: December, 4th; 2019 at 17:28
Credits: GFSAD

Land form and use - US* | polygon

Google satellite
*With OpenLayers plugin

↓ Supervised classification
> https://docs.qgis.org/2.18/en/docs/user_manual/processing_algs/saga/imagery_classification.html#supervised-classification

Trees -US* | polygon

03 Built environment

This folder contains information from different sources; aditionally, documentation is often not as thorough and well-organized. Therefore, it is proposed to not only perform a series of transformation operations, but also to create databases that allow the available information to be updated and represented in a homogeneous way.
To this end, a series of fields have been created which are common to all the tables, and which allow a first approximation to an urban database.

Attribute table common fields

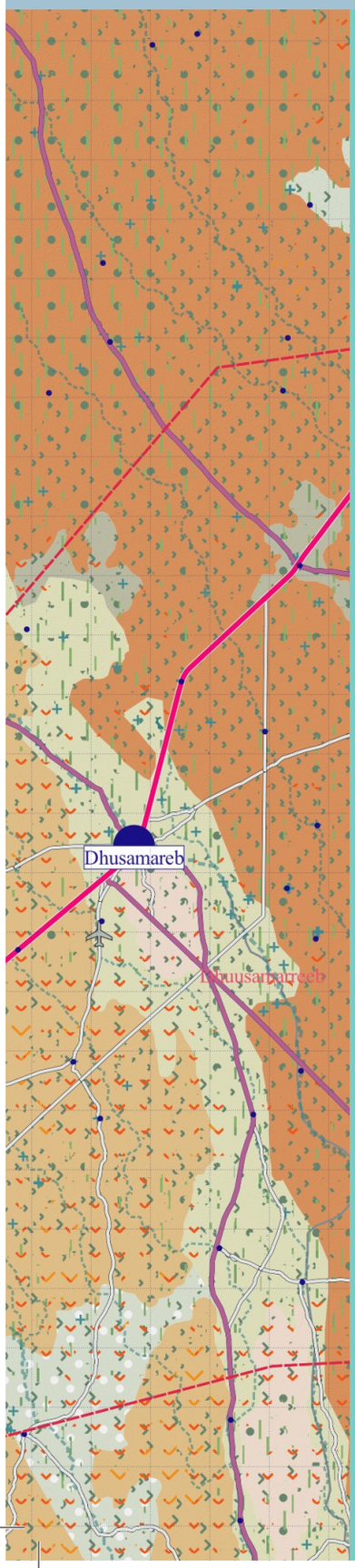
GROUP	TYPE	NAME
Generic object selection	Specific type of object	Official name / Other known names -if relevant-

SOURCE_1	SOURCE_2	DISTRICT
Source that the element was extracted from	Source quoted by the first source from which the element was originally taken from	Name of the district where the element resides

REGION	STATE	CURRENT_ST
Name of the region where the element resides	Name of the state where the element resides	R= Revised / It is most likely to be at this stage NR= Needs revision / It is unlikely to be at this stage

Roads

Road information requires manual prioritization of transport routes. Although a large proportion of roads are found in OSM, there are often many problems with the road hierarchy. This requires consulting other sources - Aerial Bing, Google satellite and Google Earth - and comparing different readings of the road network.



OSM
http://download.geofabrik.de/

OSM Roads | line
http://download.geofabrik.de/africa/somalia.html
License: Attribution-ShareAlike 2.0 Generic (CC BY-SA 2.0)

Bing aerial
*With OpenLayers plugin

Google satellite
*With OpenLayers plugin

Google Earth and Google Maps
https://www.google.com/intl/es/earth/

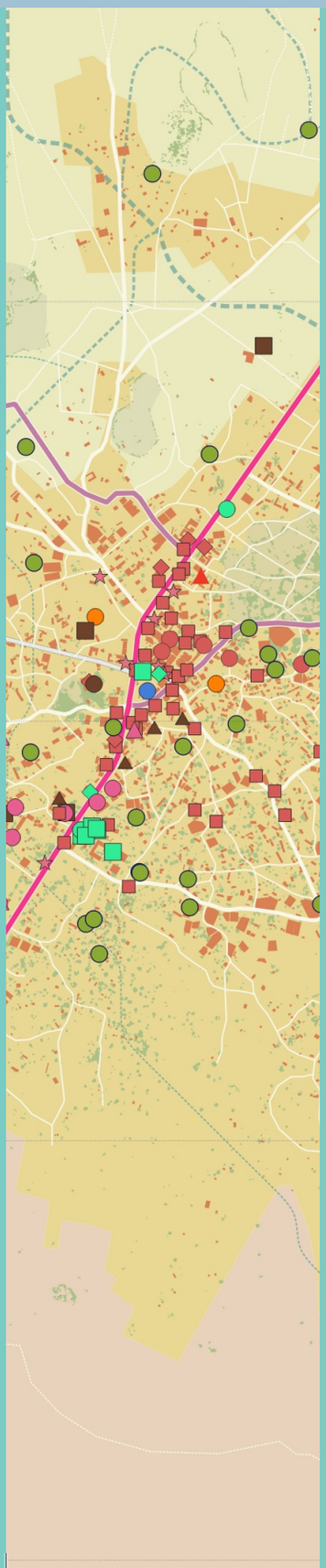
Verify road hierarchy and trace roads if necessary.
Adapt road hierarchy to proposed road hierarchy.

Roads | line
Layer that contains roads

GROUP	TYPE
Trunk road	> National road > Regional road > District road
Urban road	> Local road > Access road > Track road > New development (ND) road

Buildings

Information on buildings and urban spaces is scarce and can be found in many different sources. That is why we propose a 4-layer organization. The work to be done consists of comparing the different databases and integrating the information available in these databases. In some cases the sources repeat information so it is necessary to check the information to avoid duplication.



HOTOSM
https://www.hotosm.org/

OSM
http://download.geofabrik.de/

Google satellite
*With OpenLayers plugin

FAO SWALIM
https://spatial.faoswalim.org/layers/?limit=20&offset=0

Police stations | point
Police stations in Somalia | UNSOS 2018
https://spatial.faoswalim.org/layers/geonode:SOM_Police_Stations_UNSOS2018#/
License: Open Data Commons Open Database
Publication: December, 3th; 2019 at 13:30

Airfield UNSOS | point
Airfields in Somalia | UNSOS 2007
https://spatial.faoswalim.org/layers/geonode:Airfields_UNSOS#/
License: Open Data Commons Open Database
Publication: December, 5th; 2019 at 20:33

OSM Buildings | point
http://download.geofabrik.de/africa/somalia.html
License: Attribution-ShareAlike 2.0 Generic (CC BY-SA 2.0)

OSM Facilities | polygon and points
http://download.geofabrik.de/africa/somalia.html
License: Attribution-ShareAlike 2.0 Generic (CC BY-SA 2.0)

OSM Religious | polygon
http://download.geofabrik.de/africa/somalia.html
License: Attribution-ShareAlike 2.0 Generic (CC BY-SA 2.0)

HOTOSM Interest points | polygons and points
https://data.humdata.org/organization/hot
License: Open Data Commons Open Database

UNSOS Facilties | polygon

Organisation in new layers and information adding through personal knowledge and information available in Google Earth and Google maps

Google satellite
*With OpenLayers plugin

Google Earth
https://www.google.com/intl/es/earth/

Built | polygon
Layer that contains buildings or plots of the city in polygons

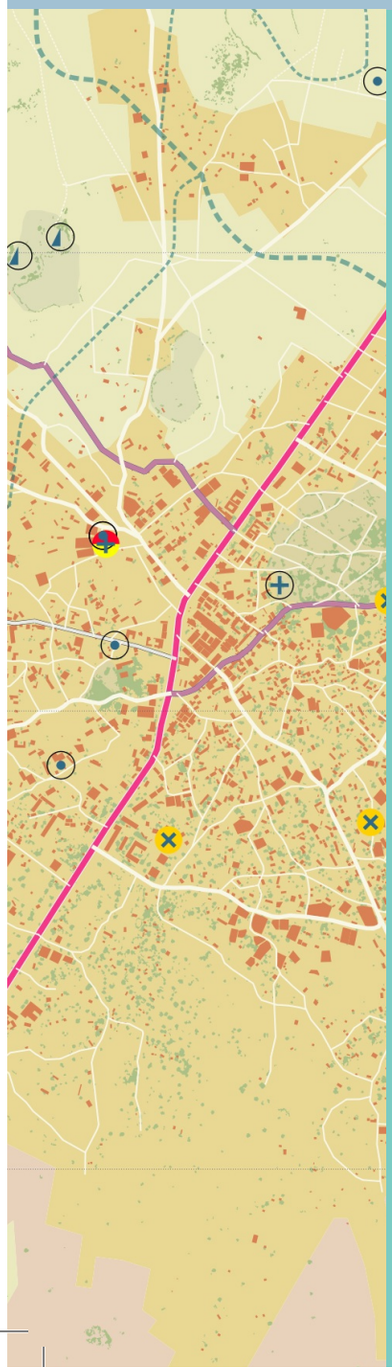
Areas | polygon
Open areas in the city with specific use such as parks, airfields...

Transport | points
Layer that contains points of airports, harbors, and bus stations

Facilities and infrastructures | points
Layer that contains points locating facilities and infrastructures

GROUP	TYPE
Building	
Educational	> School / Community centre /Other
Health	> Hospital / Pharmacy / Health care center / NGO health care cente / Other
Police Station	> Police station / Central police station / Coast guard
Religious	> Muslim / Mosque / Madrassa/ Place of Worship
Social	> Community centre / Feeding centre / Food distribution center / Other
Sports	> Playground / Stadium / Pitch
Government	> Local government centre
Tertiary	> Hotel / Cafe / Market / Store / Money transfer office / Travel Agency / Bank
Infrastructures	> Tower / Communication tower / Mast
NGO	> Office
Other	> Cemetery
Not classified	> Not classified

Others



OSM
http://download.geofabrik.de/

FAO SWALIM
https://spatial.faoswalim.org/layers/?limit=20&offset=0

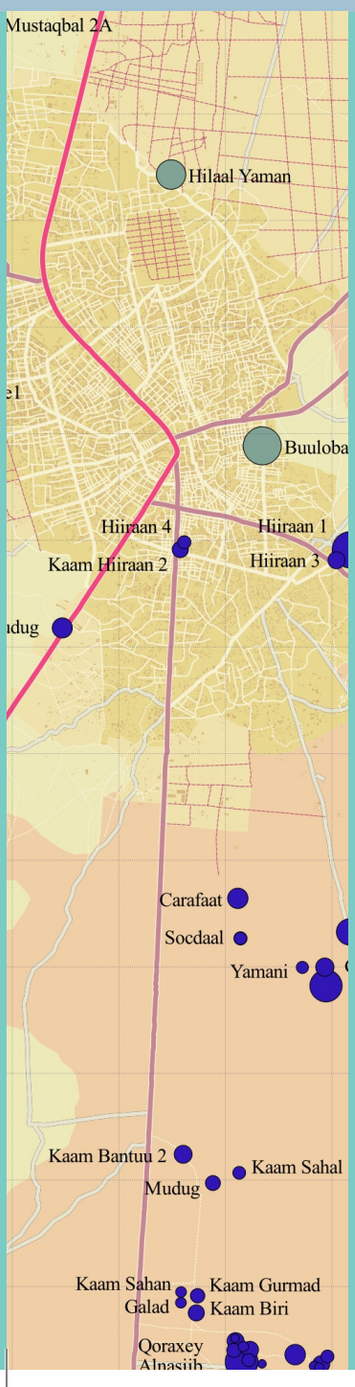
StrategicWater sources | point
Strategic Water sources in Somalia | FAOSWALIM February 2018
https://spatial.faoswalim.org/layers/geonode:SOM_Strategic_Water_Sources_Feb2018#/
License: Open Data Commons Open Database
Publication: September, 26th; 2019 at 13:30

OSM Facilities | line
http://download.geofabrik.de/africa/somalia.html
License: Attribution-ShareAlike 2.0 Generic (CC BY-SA 2.0)

Fusing two layers after verifying that some points do not refer to the same point. If this is the case, only include the point from Strategic water sources. Include as well all the fields present in the Strategic Water Sources map. Points classified by OSM as “Water Well” are classified as “Not classified”.

Water sources | point
Layer that contain water sources and data about its maintenance and quality

GROUP	TYPE
Water source	> Berkad > Borehole > Dam > Dug well > Water tower > Other > Not classified



GLOBAL SHELTER CLUSTER

https://cccm-cluster-somalia.github.io/OPSMAP/#moreinfo

Adaptation of fields present in dowloadable .xls file to used fields
Group: Refugee IDP Camp

IDP Camps | point

Google Earth

https://www.google.com/intl/es/earth/

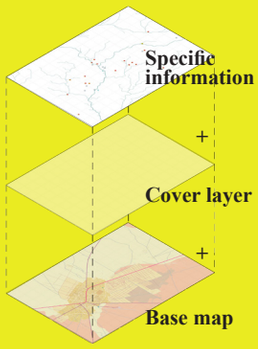
Other sources

Paper maps etc

Drawing an approximation of the city limits evolution though aerial images and old maps
https://support.google.com/earth/answer/148094?hl=en

Historical - US* | polygon

How to represent information?



Plan representation always starts from the Base maps, both on **regional scale (US)** and **urban scale (RS)**. In the rest of the maps, certain layers are included or highlighted to give rise to specific content maps.

Specific information: layers with specific information wishing to be presented in each map (facilities, watersources, IDP Camps, etc).
Cover layer: we can apply the City clip layer used to define the drawing limits (pg 09) with a transparency. Overlapping this cover layer will facilitate reading the specific information above the base map.
Base map: it is recommended to remove the layers of the base map that do not contribute to the reading of each case.

1.0.Base map*US

includes

-from top to down-

AdmN
Area
Buildings
Trees
Transport
Roads *(all)*
Water sources
Water drainage
Landform and use * US

1.1.Facilities

includes

-from top to down-

Facilities and infrastructures
-with different codes for differents groups and selected types-

Regional scale
(Transparency)

Base map*US

1.2.Hidrology

includes

-from top to down-

Water sources
-represented three times , showing both water source type and water quality indicators-

Water drainage

Base map*US
except Water sources and drainage

1.3.IDP Camps

includes

-from top to down-

IDP Camps
-size of the location depending on the population of the camp-

Base map*US

1.4. Urban growth

includes

-from top to down-

Historical

Base map*US

2.0. Base map*RS

includes

-from top to down-

AdmN
Settlements
Transport
Roads *Only truck roads*
Hillshade
Water sources
Water drainage
Landcover
Landform and use * RS

2.1.Hidrology

includes

-from top to down-

Water sources
represented three times , showing both water source type and water quality indicators-

Water drainage

Regional scale
(Transparency)

Base map*RS

except Water sources and drainage

2.2.Topographic

includes

-from top to down-

Base map*RS
instead of Land layers

DEM
represented with a color gradient
-the same for all the maps-

2.3.Geology

includes

-from top to down-

Base map*RS
instead of Land layers

Geology
represented with the same colours and codes than Geology map in SWALIM Atlas of Water and Land

Organising the map

Information on buildings and urban spaces is scarce and can be found in many different sources. That is why we propose a 4-layer organization. The work to be done consists of comparing the different databases and integrating the information available in these databases. In some cases the sources repeat information so it is necessary to check the information to avoid duplication.

Legend

Map content

The symbology stablished for each of the layers (roads, buildings, water sources, etc), can be copy from one project map to another:
- By right clicking Style/Copy Style on the layer that we want to copy and Style/Paste Style on the recipient layer.
- By saving the style as a new template in Layer Properties/ Symbology/Style/Save Style.

Page Format

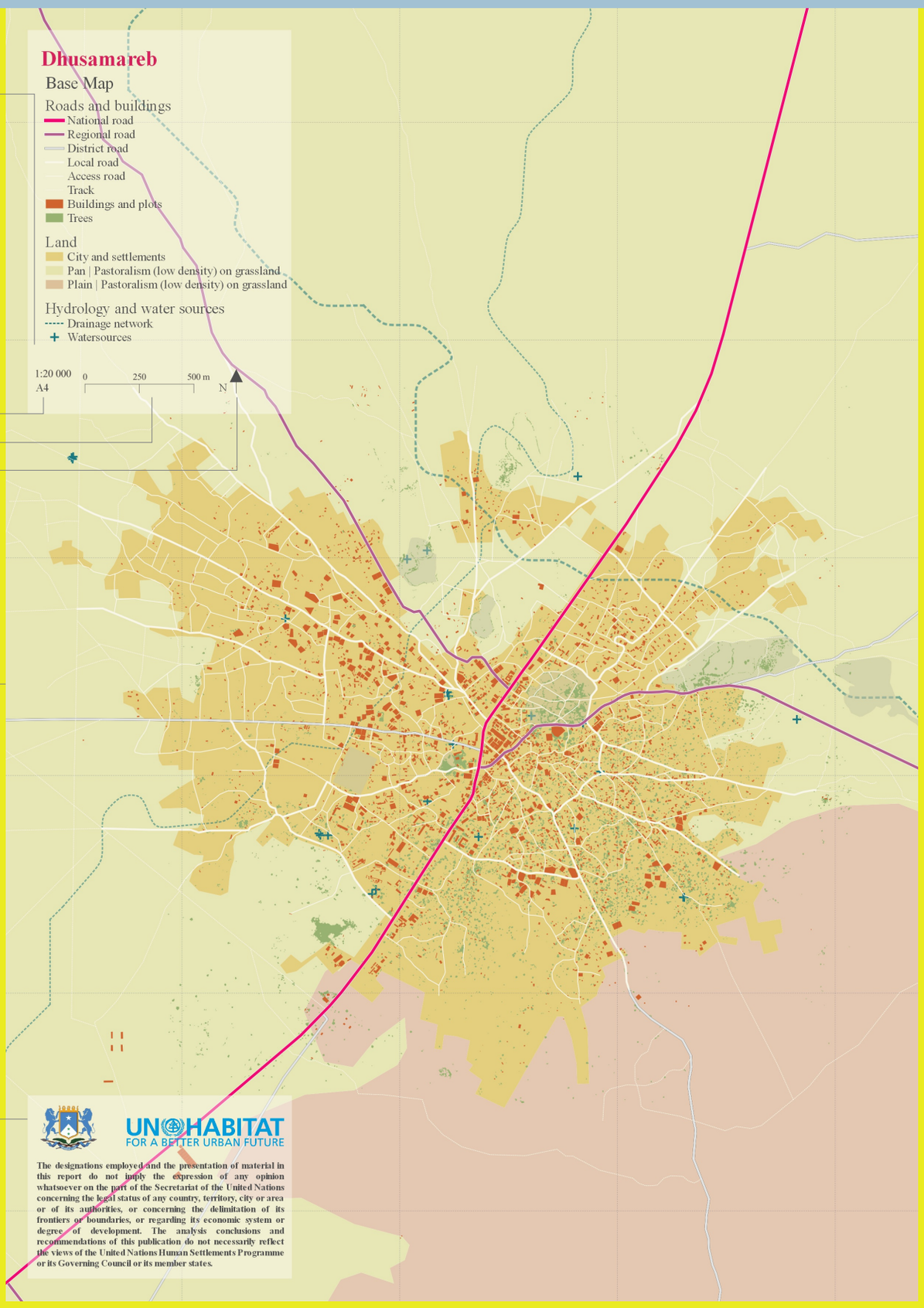
Scale

North

Map

Additional information

Logos, crédits, sources, disclaimer, authors, etc).



Examples of representation

URBAN SCALE

1.0 Base map
1.1 Facilities
1.2 Hydrology
1.3 IDPCamps
1.4 UrbanGrowth

REGIONAL SCALE

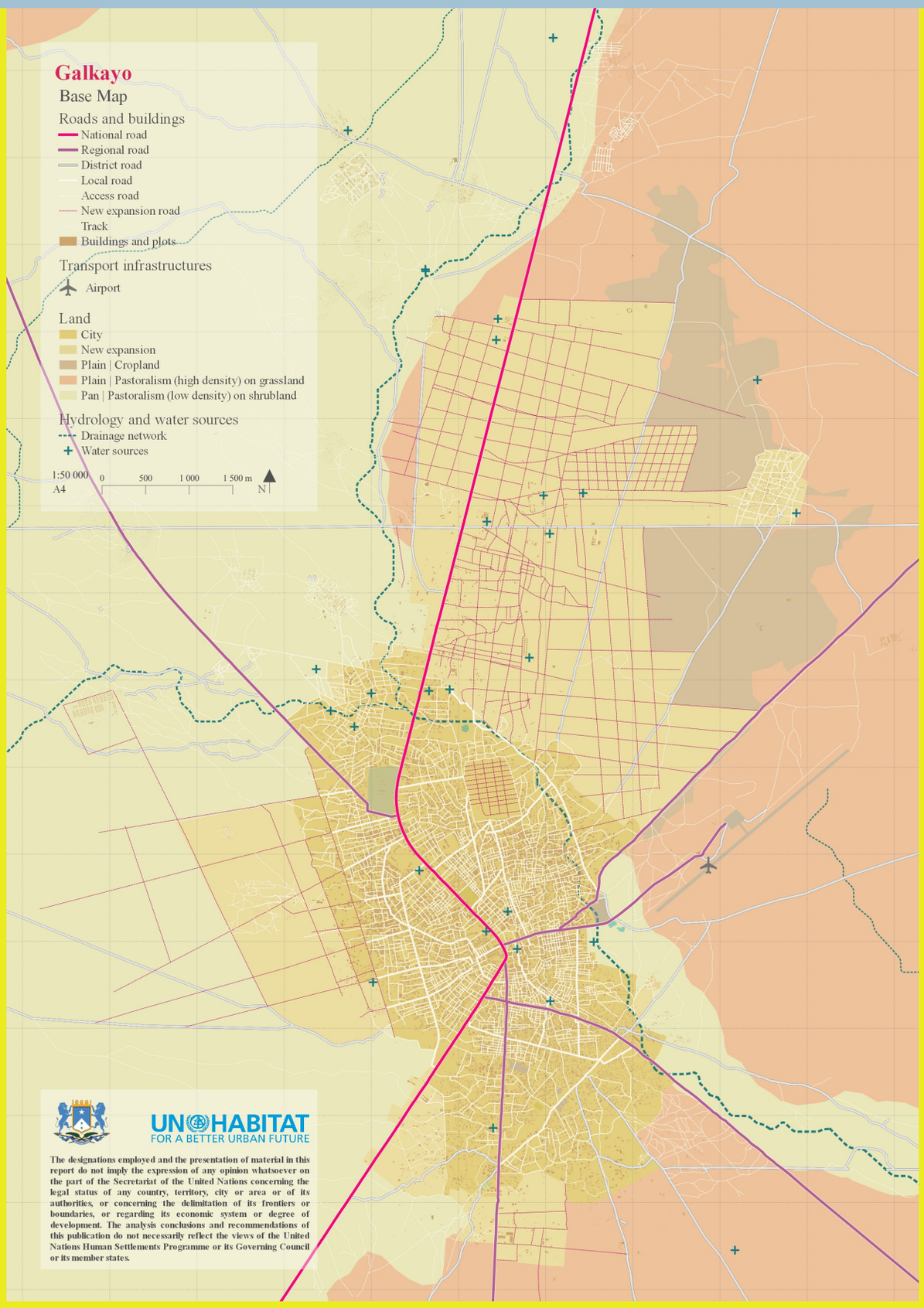
2.0 Base map
2.1 Hydrology
2.2 Topographic
2.3 Geology

Urban scale
1.0 Base Map

Layers used

-from top to down-

AdmN
Transport
Water sources
Roads *(all)*
Buildings
Area
Trees
Water drainage
Landform and use * US



Urban scale
1.1 Facilities

Layers used

-from top to down-

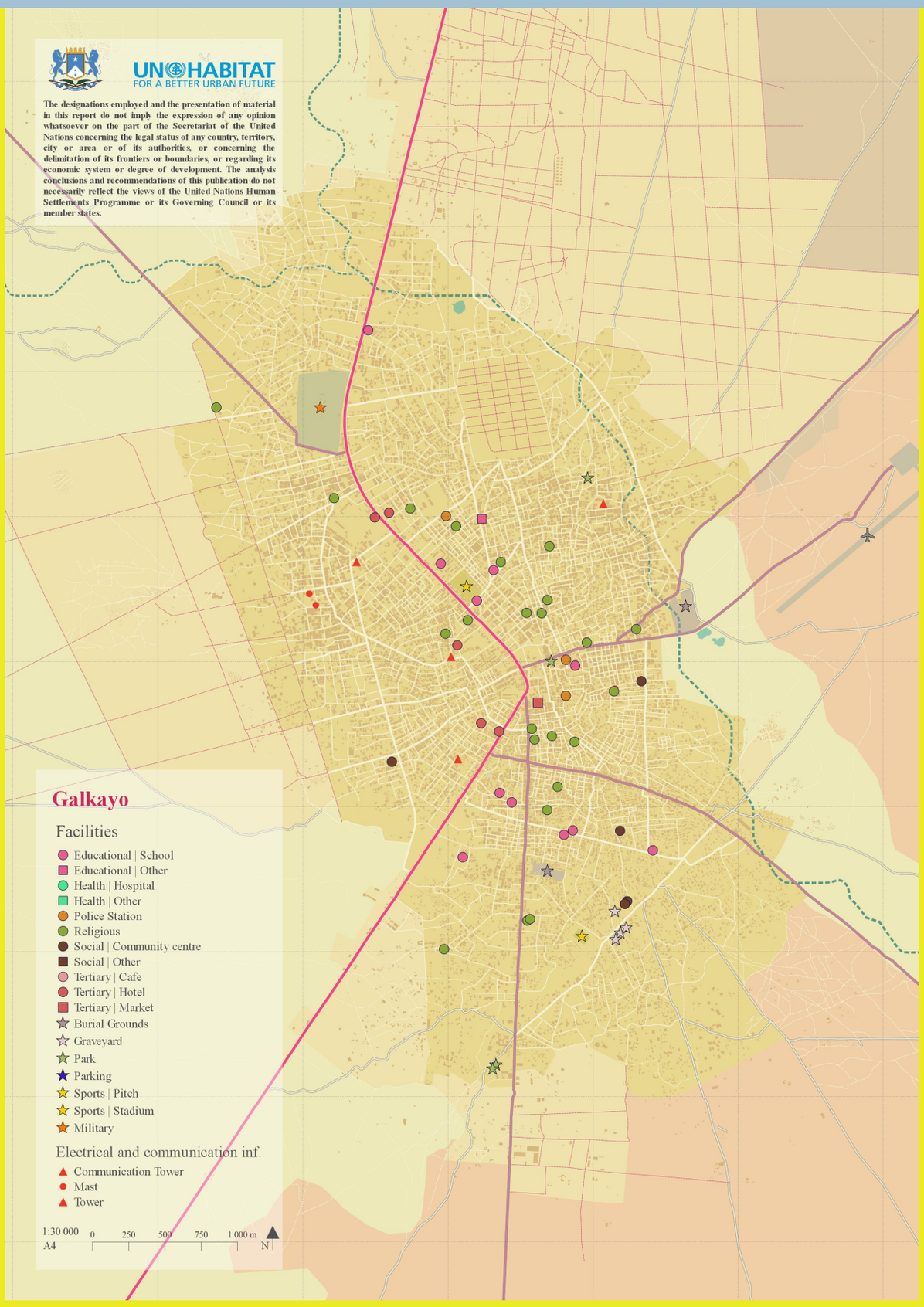
Facilities and infrastructures

-with different codes for differents groups and selected types-

Regional scale

(Transparency)

Base map*US



Urban scale
1.2 Hydrology

Layers used

-from top to down-

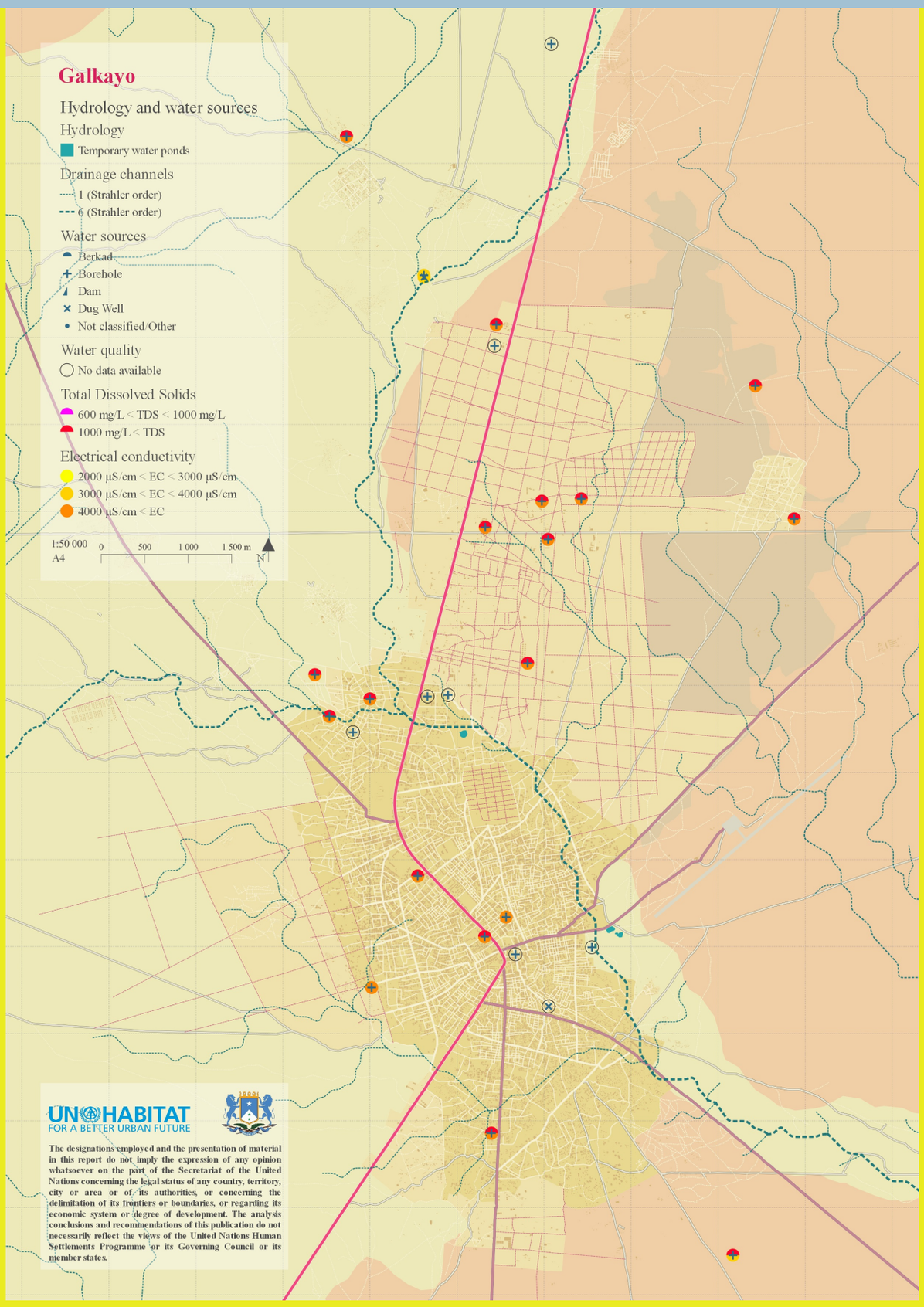
Water sources

-represented three times , showing both water source type and water quality indicators-

Water drainage

Base map*US

except Water sources and drainage



Urban scale
1.3 IDP Camps

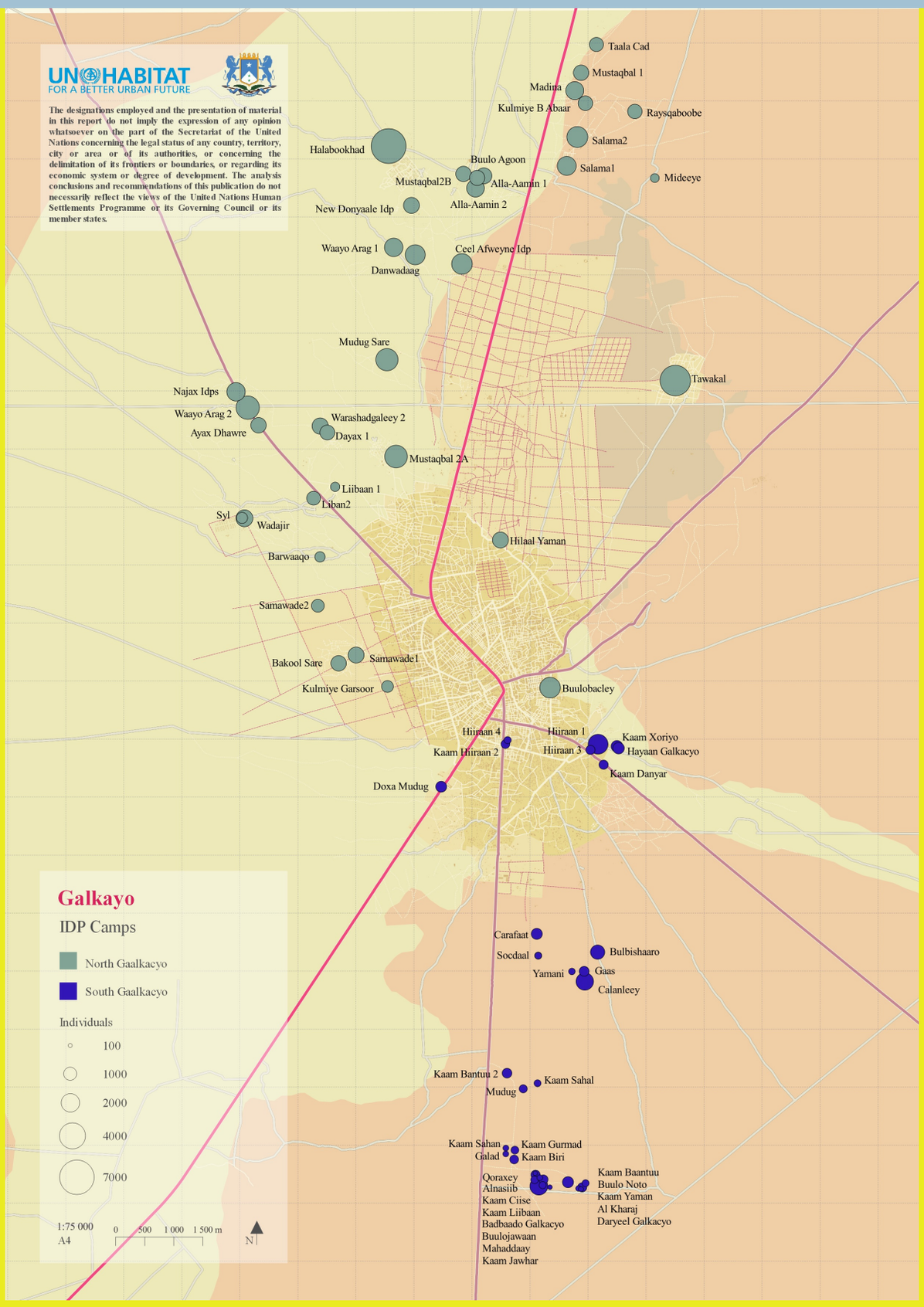
Layers used

-from top to down-

IDP Camps

-size of the location depending on the population of the camp-

Base map*US



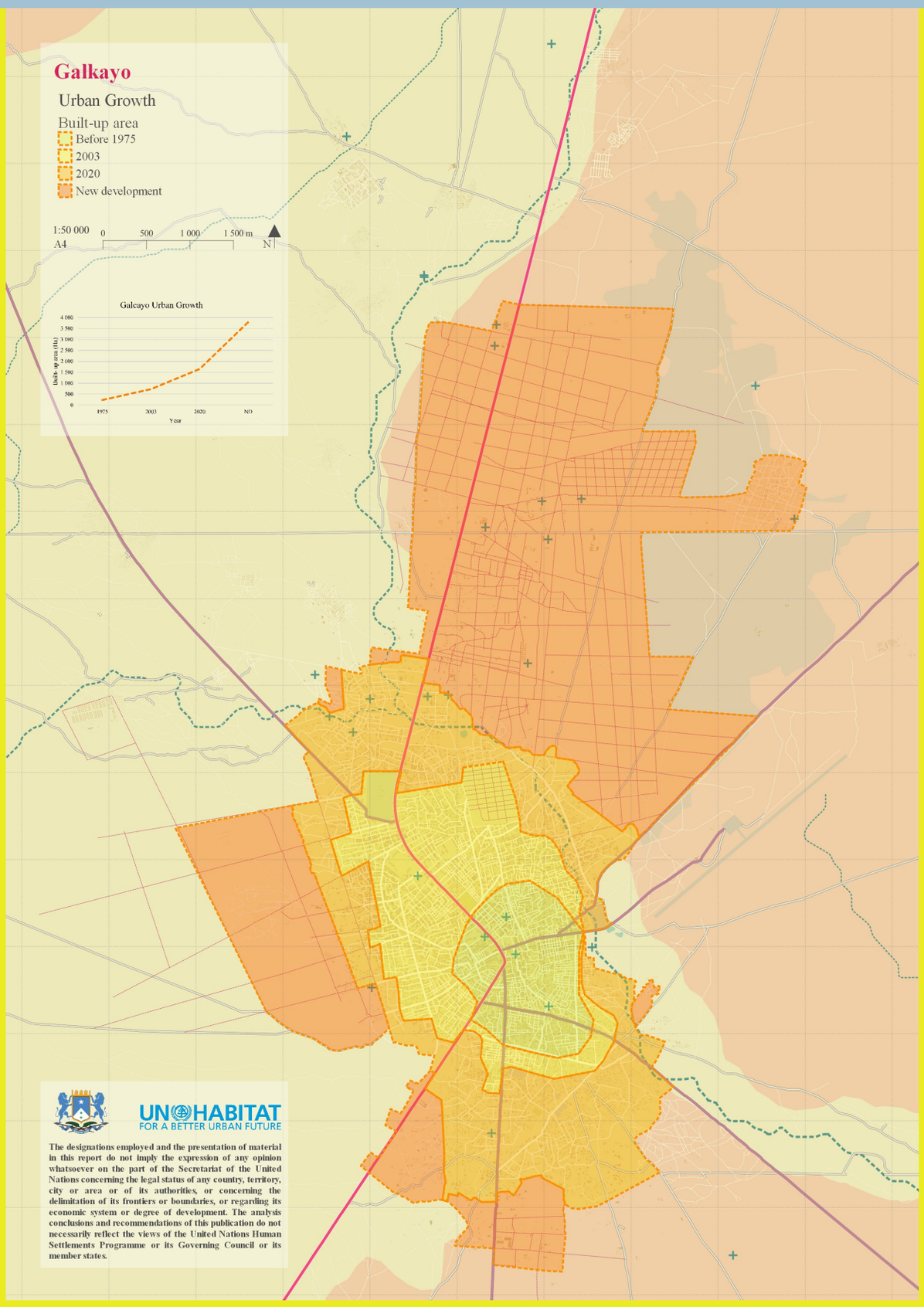
Urban scale
1.4 Urban growth

Layers used

-from top to down-

Historical

Base map*US



Regional scale
2.0 Base map

Layers used

-from top to down-

AdmN
Settlements
Transport
Roads *Only truck roads*
Hillshade
Water sources
Water drainage
Landcover
Landform and use * RS

Galkayo

Base Map | Regional scale

Borders and limits
- National border
- Regional limit
- District limit

Settlements
- Regional Capital
- District Capital
- Settlement

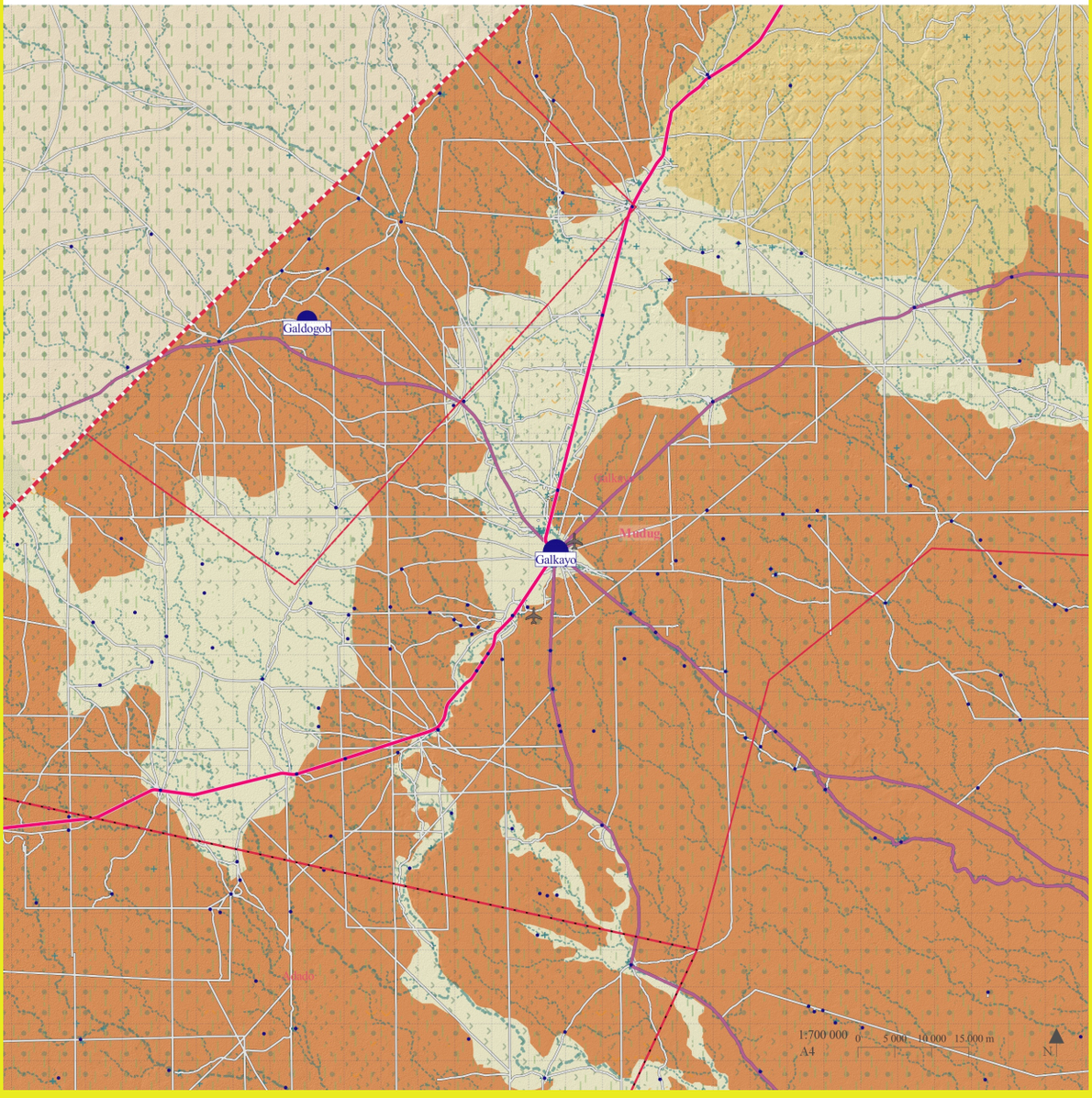
Roads
- National road
- Regional road
- District road
- Airports

Drainage network and water sources
- Channels
- Water sources

Land cover
- Mosaic forest or shrubland/grassland
- Open grassland
- Closed to open herbaceous vegetation (or lichen and mosses)
- Sparse vegetation
- Mosaic vegetation / cropland
- Rainfed cropland

Land form and land use
- Plain | Pastoralism (high density)
- Plain | Pastoralism (high density) with scattered oasis farming
- Pan | Pastoralism (low density) with scattered oasis farming in a gypsiferous surface

UN-HABITAT
FOR A BETTER URBAN FUTURE



Regional scale
2.1 Hydrology

Layers used

-from top to down-

Water sources

represented three times , showing both water source type and water quality indicators-

Water drainage

Regional scale

(Transparency)

Base map*RS

except Water sources and drainage

Galkayo

Hydrology and water sources | Regional scale

Drainage network -Strahler order-

- 3
- 4
- 5
- 6
- 7

Water sources

- Berkad
- Borehole
- Dam
- Dug Well
- Not classified/other

Water quality

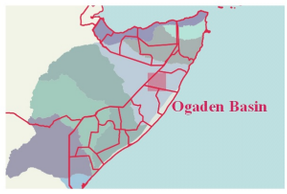
- No data available

Total Dissolved Solids (TDS)

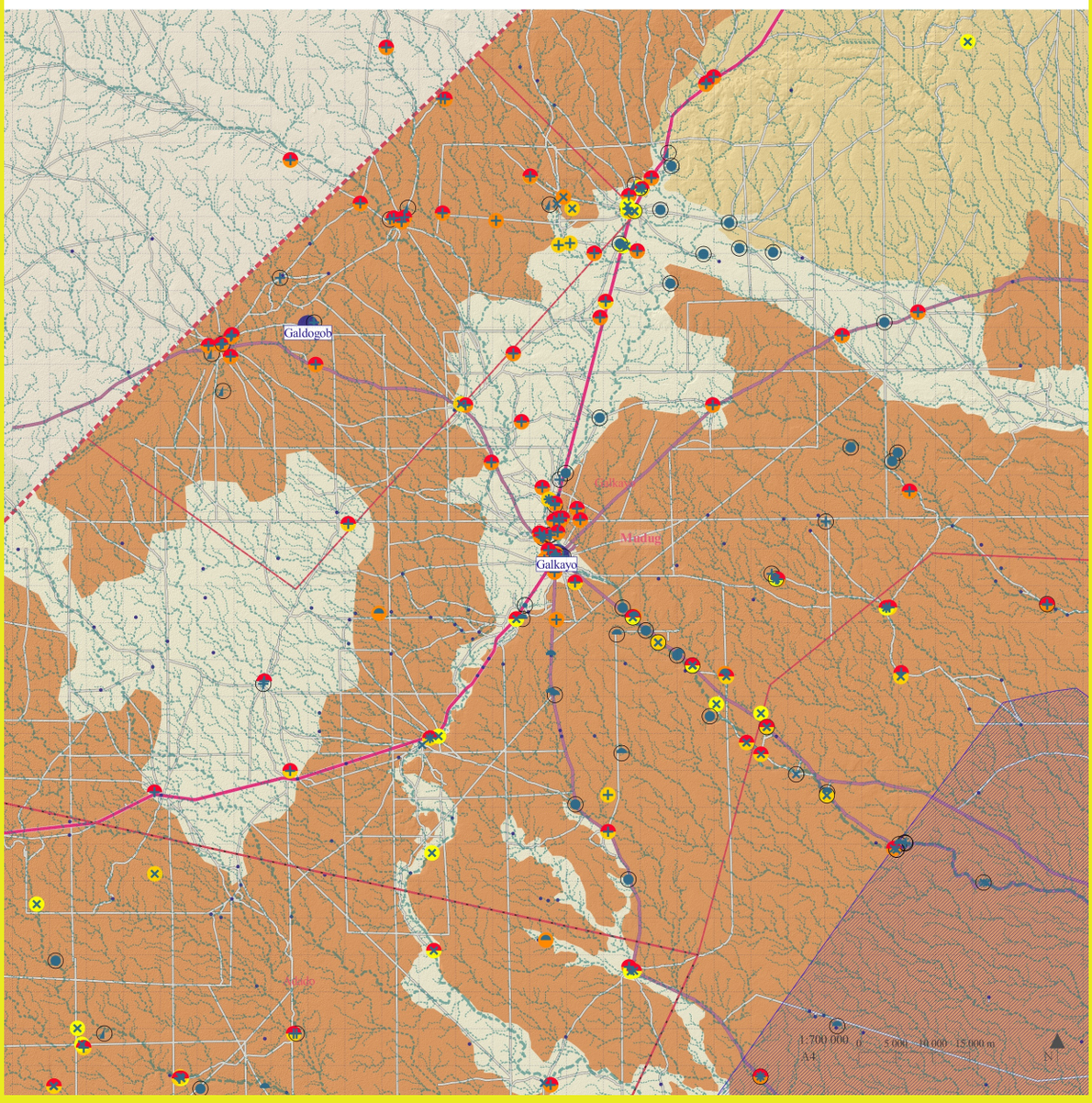
- 600 mg/L < TDS < 1000 mg/L
- 1000 mg/L < TDS

Electrical conductivity

- 2000 µS/cm < EC < 3000 µS/cm
- 3000 µS/cm < EC < 4000 µS/cm
- 4000 µS/cm < EC
- Salty Ground Water Sources



UN-HABITAT
FOR A BETTER URBAN FUTURE



Regional scale
2.2 Topographic

Layers used

-from top to down-

Base map*RS

instead of Land layers

DEM

represented with a color gradient

-the same for all the maps

Galkayo

Topographic map | Regional scale

Countour lines

10 meters

50 meters

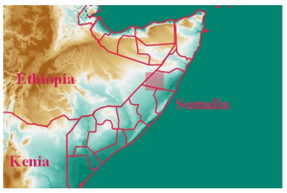
Elevation

200 meters

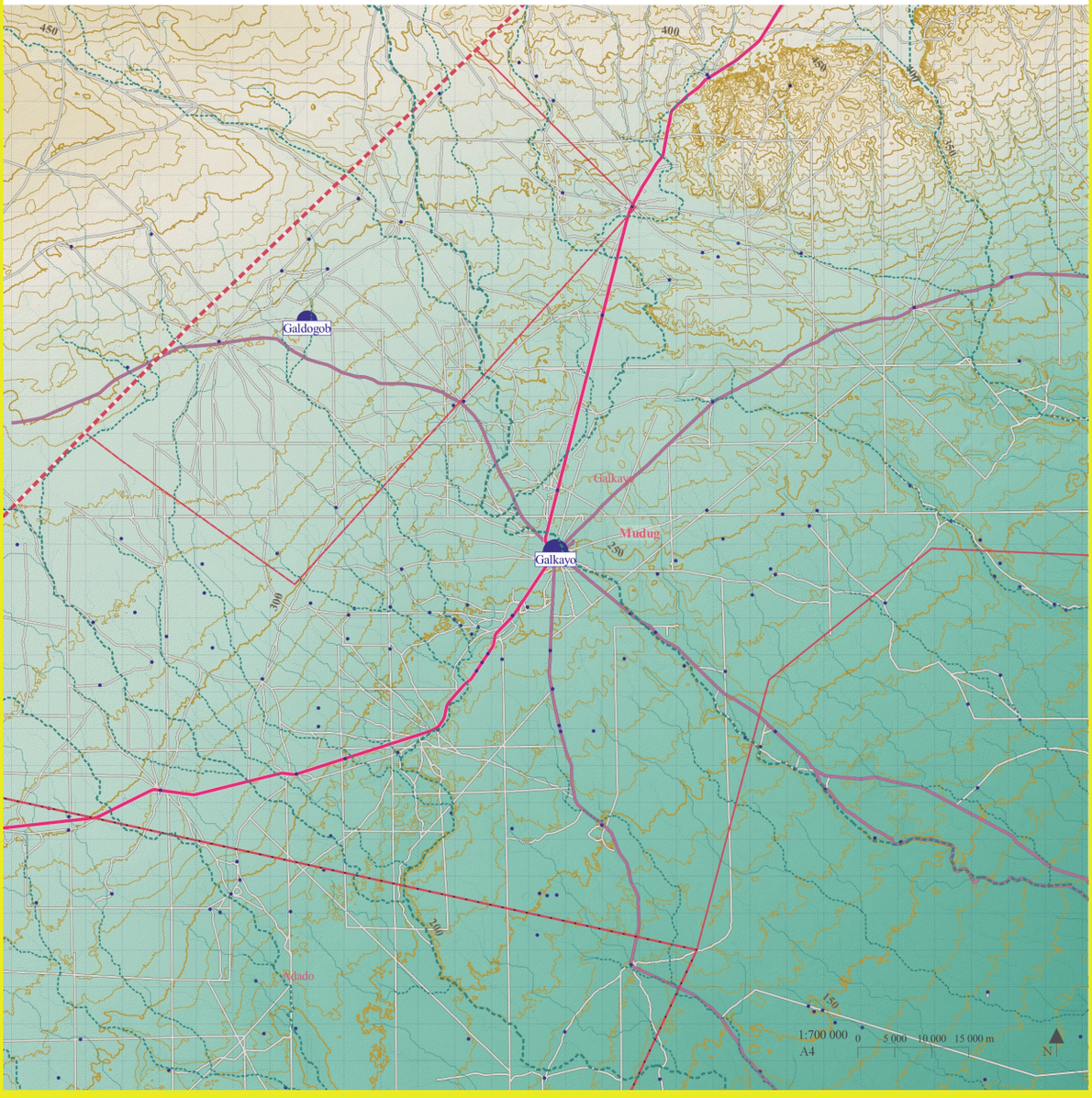
300 meters

400 meters

500 meters



UN HABITAT
FOR A BETTER URBAN FUTURE



Regional scale
2.3 Geology

Layers used

-from top to down-

Base map*RS
instead of Land layers

Geology
represented with the same colours and codes than Geology map in SWALIM Atlas of Water and Land

Galkayo

Geological Map | Regional scale

Pleistocene to Present
Qa | Sands and gravels filling main ephermal streams

Central and Southern Somalia Sedimentary Cover and associated volcanic rocks

Late Neocene to Present
Qqy | Gypsiferous crust deposits alternating with fluviolacustrine clays, sometimes with sepiolites (Ceel Buur) and calcretes with carnolite (Dhuusa Marreeb)

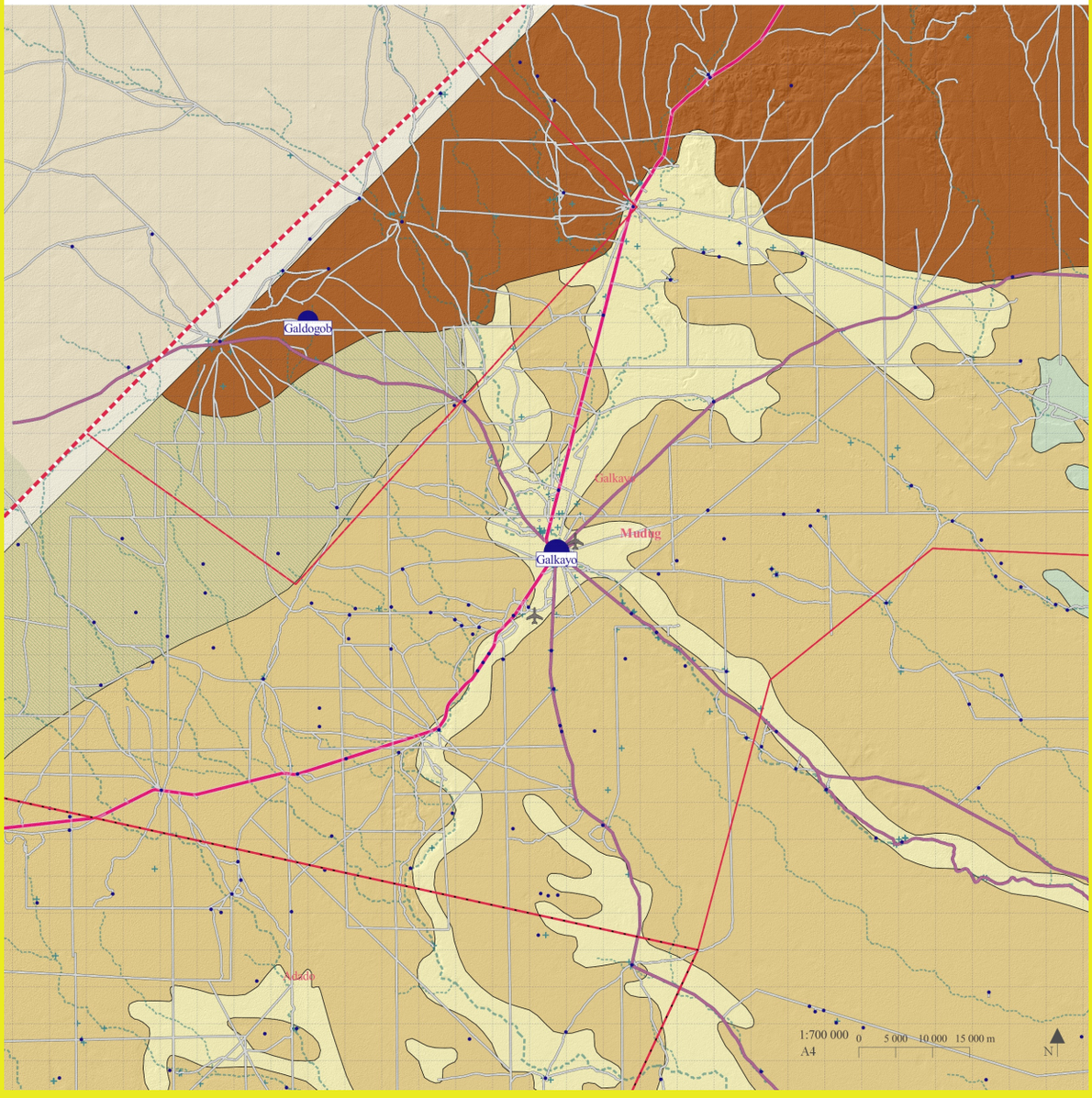
Mudug Succession

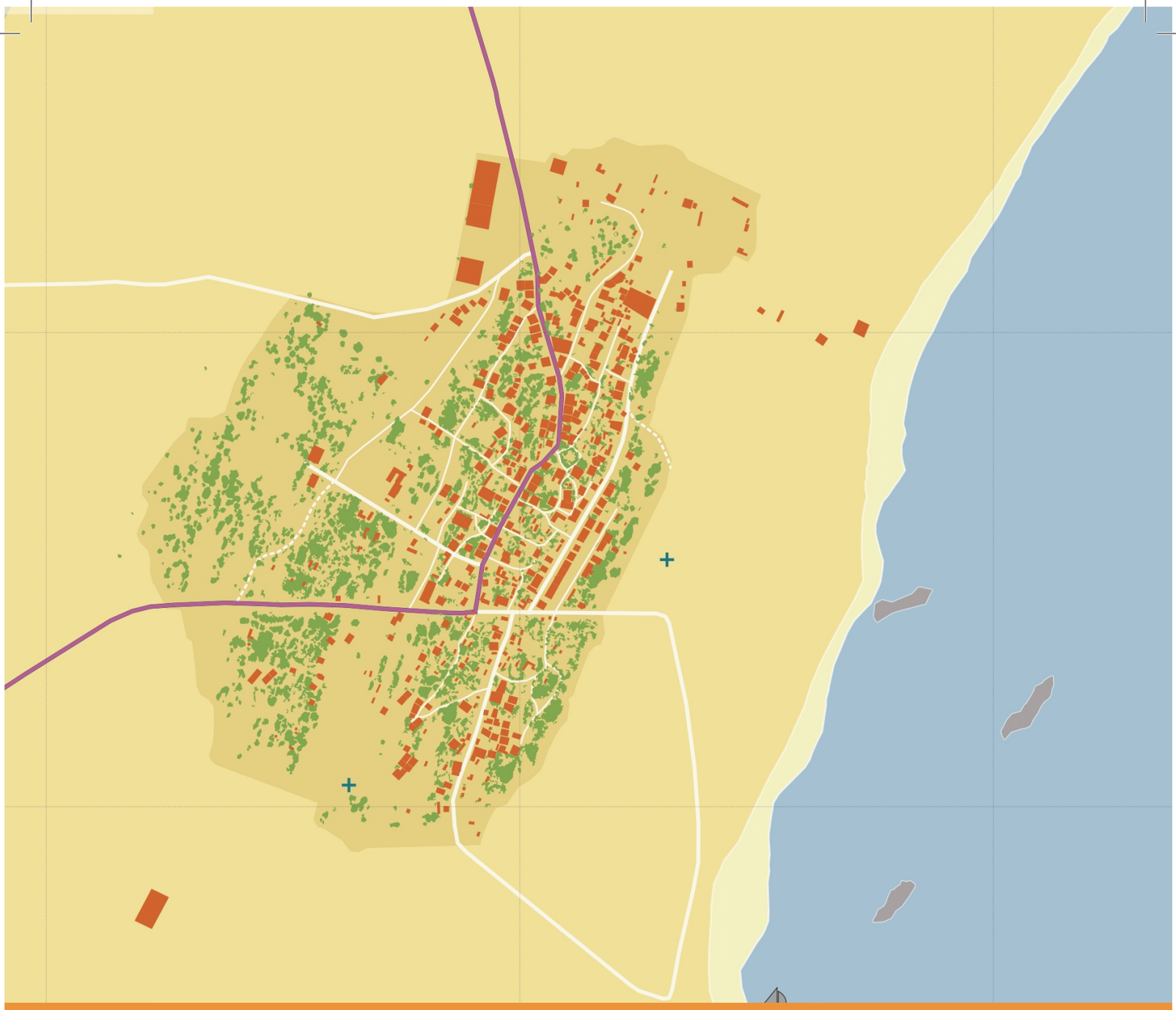
Oligocene to early Miocene
OMmb | Gypsiferous sands and sandy clays, limestones, basalts found in wells (continental "Mudug Beds")

OMbi | Limestones often karstified, marly limestones, and marls ('Basal Limestone')

Webi Shabeli (Webi Shabeelle) Succession

Maastrichtian to Early Miocene
Ea | Auradu Limestone: shelf limestones, often nodular, with corals, pelecypods and foraminifera, and intercalations of marls and cherts





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