Water Sources Inventory for Central - South Somalia

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List of Abbreviations

EC	Electrical Conductivity
FAO	United Nations Food and Agriculture Organization
GPS	Global Positioning System
NGO	Non-Governmental Organization
pH	Concentration of the Hydrogen ion [H+]
SWALIM	Somalia Water and Land Information Management
SWIMS	Somalia Water sources Information Management System
TDS	Total Dissolved Solids
UNICEF	United Nations Children's Fund

Somali Climate Seasons

Gu	April to June rainy season
Hagaa	July to September hot and windy season
Deyr	October to November short rainy season
Jilaal	December to March very dry and cool season

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Acknowledgement

The authors would like to thank the enumerators for their hard work, patience and dedication in carrying out the survey despite many challenges, especially the fragile security conditions in Central - South Somalia. A list of the 18 Somali enumerators that conducted the field survey, and who were mainly from local NGOs is provided in Annex A.1.

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1.0 INTRODUCTION

1.1 Background and Justification

Somalia's surface water resources are concentrated mainly along the two perennial rivers, Juba and Shabelle. The flow in both rivers varies widely across the seasons. During the two rainy seasons, *Deyr* and *Gu*, the rivers often flood from very high flows, whereas in the dry season, flow is very minimal and can barely support irrigation. The riverine areas of the Juba and Shabelle occupy a small percentage of the Somalia's territory. Majority of the country falls under arid and semi arid climatic conditions with very limited surface water resources. Domestic and commercial water needs in such areas are usually met through underground water sources.

SWALIM, as part of its mandate has been recovering data and other information related to water and land resources, which were lost during the close to two decades of civil strife in Somalia. The various approaches employed in the recovery of the lost data include search into various archives and collecting bits of information available; partnership with government and non-government institutions to re-establish data collection networks, which existed before the breakdown of government institutions; and field visits by SWALIM's staff and partners to collect data on the ground. The data recovery and collection is expected to go a long way in building Somali institutions' capacity by providing crucial information on water and land resources for use in national planning and decision-making.

With regard to water sources, SWALIM developed software for the management of point sources data. The software, Somalia Water-sources Information Management System (SWIMS), developed in phase II of SWALIM, was meant for partners working in the water sector in Somalia to collect and manage water sources information. The software allows organizations collecting data in the field to contribute to a national database of water sources. It is designed to store and manage a wide range of data for different types of water sources used in Somalia: boreholes, shallow wells, springs, dams, and berkads.

Data collection using SWIMS started soon after the release of the software in 2006. Most of the data collection was done through partners working in the water sector in Somalia. However, many of the data collected by SWALIM's partners did not have all the essential parameters either due to time and resource limitations during data collection or failure to follow standardized data collection procedures. Some regions were also better spatially covered than others since organizations could only collect data where their projects were based. This necessitated a country wide survey covering the essential parameters of the water sources in all regions.

SWALIM in partnership with UNICEF launched a survey for the strategic sources: boreholes, springs, dams and permanent shallow wells, across the entire country. There are many water sources in the country, but majority of these sources are seasonal, lasting only a few weeks after the rains. These include berkads, small water ponds and some shallow wells, and are used only during the rainy season. When they

dry out the local communities look for alternative sources of water. The limited resources available for the survey could not cover all the water sources in the country. Only the strategic water points were surveyed, as they are the source of water for the local communities when the seasonal sources dry out.

The countrywide survey started in Northern Somalia, and the experience gained was fundamental in planning and carrying out the survey in South – Central Somalia. As a way of capacity building, the survey teams were composed of Somali's, mainly from the NGO sector because in the south we could not get the same support from the government that we received in the north. The enumerators, after receiving hands on training on the survey procedures were able to carry out the exercise with minimal technical support from Nairobi.

1.2 Survey Objectives

The overall objectives of the point water sources survey were to:

- Determine the spatial distribution of the point water sources across the country;
- Document the status of the point water sources concerning their function and use, physical parameters, water quality, demand and supply;
- Improve the national database of the water sources for Somalia; and
- Build national capacity for future inventory surveys of strategic point water sources.

The specific objective of the survey was to establish and document the status of strategic point water sources throughout Somalia in regard to their location, function and use, physical parameters, water quality, demand and supply.

1.3 Expected Outcomes

The water sources inventory aimed at filling gaps on the essential information of existing water sources data and establishing new data on sources not previously visited. This would to a large extent improve on the existing water sources database for Somalia.

For each water source visited, data was collected on the location of the water source, physical parameters, current condition of the source, users, water quality, management etc. Such data is expected to form a base for informed decision making by partners regarding intervention requirements and long term monitoring of the water sources.

Data forms filled in the survey would be archived at SWALIM's Nairobi office and field liaison offices. The data is managed using SWIMS software and used to develop different products such as MS Excel fact sheets, district and region maps, water sources atlas and other user specified products. Such maps would be useful in determining the spatial distribution and functionality of the water sources among other uses.

Information on hydrogeology of Somalia has been missing, leading to difficulties in drilling of boreholes and shallow wells. Results of this survey are expected to be used in subsequent SWALIM phases to develop complete hydro-geological maps for national water use planning and management.

1.4 Purpose of the Report

This report documents the procedure, challenges encountered and achievements of the water sources inventory carried out in the regions of South - Central Somalia highlighted in Figure 1.1. The areas not covered due to security concerns are mentioned in the report. The report has a chapter on the basic analysis carried out on the data, while district maps generated from the data are attached in Annex A.3 at end of the report.

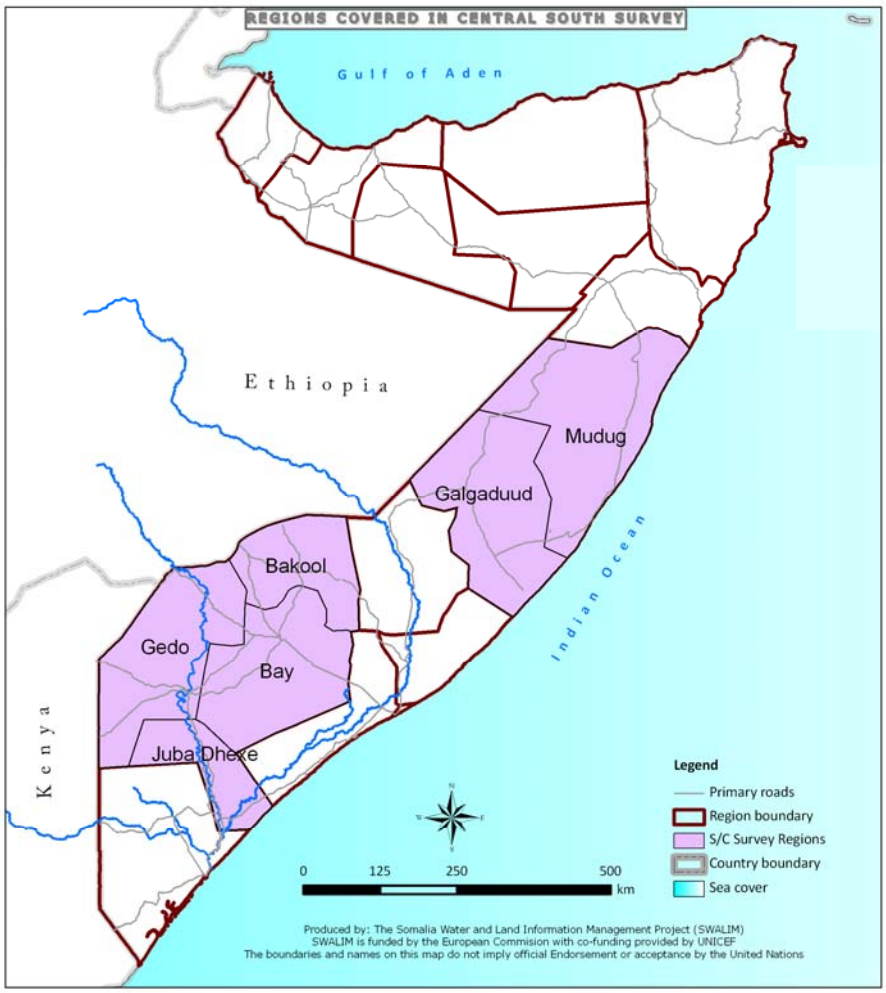


Figure 1.1: Central - South Regions Coverage by the Survey

2.0 SURVEY PLANNING AND PREPARATION

2.1 Pre-Survey Activities

The success of the water sources survey depended largely on how well the teams were prepared before starting the exercise. Two major activities that were done before start of the survey:

- Planning for the survey
- Training of survey teams

2.1.1 Planning for the Survey

Prior to the start of the countrywide survey, planning meetings were held at Nairobi level and on the ground. The Nairobi planning meeting took place in April 2008 with representatives from regional liaison offices, hired consultants and representatives from some partner agencies. In this meeting, Somalia was divided into three regions: Puntland, Somaliland and South/Central Somalia. In each of these regions, a survey was to be carried out by several enumerators headed by a regional coordinator. South/Central Somalia was to be further sub-divided into three sub-regions due to the large area coverage. The initial plan was to carry out the survey in 2008, but only Puntland and Somaliland were completed by the end of 2008. The prevailing security conditions could not allow the survey to be carried out in South-Central Somalia.

The experience gained in northern Somalia survey was crucial in planning for the South-Central survey. However, the approach for the survey in south-central was slightly different from the northern regions. Whereas in the north staff from the line ministries were more involved in the survey as a way of capacity building, in south-central majority of the enumerators were from local NGOs. The choice of working with NGOs was due to lack of staff from the government ministries like in the north. The NGOs have good local knowledge and working relationship with the communities in the survey areas which enabled easy movement across the regions.

Survey in South – Central Somalia was done in two phases. Phase one covered Mudug, Galgadud, Bay and Bakool Regions, while phase two covered Middle Juba and Gedo Regions.

2.1.2 Training of Survey Teams

For each of the two phases of the survey, a week long hands on training was conducted to familiarize the surveyors with the survey equipment and survey procedures. The trainings were conducted by SWALIM staff, and covered technical and logistical aspects of the survey. In the practical sessions, the surveyors visited some water sources in the field and did the actual measurements, data collection and recording in the field data forms. The field training involved:

(i) Use of Global Positioning System (GPS) to identify the X-Y coordinates of a water source as well as tracking paths followed;

(ii) Use of a multi-meter to measure the basic water quality parameters namely pH, Electrical Conductivity (EC), temperature and Total Dissolved Solids (TDS);
(iii) Use of digital cameras to take photos of the water points;
(iv) Use of dip meters to measure the depth of water in shallow wells and boreholes and;
(v) Filling of the standard SWIMS field data collection forms;

The hands-on-training was effective as the surveyors were able to go to the field and carry out the survey with minimum supervision.

2.2 Phase I - Mudug, Galgadud, Bay and Bakool Region's Survey Preparation, Training and Start of Survey

2.2.1 Survey Preparation

Planning and training sessions for the survey team took place in Hargeisa, Somaliland, between 13th and 18th July 2009. The training was carried out in Hargeisa since the security situation in the south – central could not allow such an activity to be carried out in any of the major towns in the region.

The total number of enumerators was nine, grouped into four teams:
Team 1: Mudug Region - two enumerators;
Team 2: Galgadud Region - two enumerators;
Team 3: Bakool Region - two enumerators and;
Team 4: Bay Region - three enumerators;

The composition of the teams was based on experience in the respective regions, either as a result of having worked in the area or coming from the area. Unlike in the north, there were no regional coordinators hired to conduct the survey teams in south – central. Coordination was done directly from Nairobi by SWALIM's field coordinator. Survey routes were established based on knowledge and experience of the survey teams.

Security was a major concern for the survey teams across the regions. Instead of the prior sensitization approach taken in the north, the surveyors opted to carry out the survey quietly, engaging the local authorities only when they got to their area. The use of GPS handsets was also considered risky as the surveyors would be mistaken for spies, therefore risking their lives. Other approaches such as use of mobile phones and humanitarian reference grid[1] had to be used to locate the water sources.

[1] 5 x 5 Km grid maps with a unique alphanumeric code used to locate ones position. They are used where GPS is not available or cannot be used.

The equipments used for the survey were the same ones used in the northern Somalia survey. The only additional purchase was the GPS enabled mobile phones and consumables such as medicine and stationery.

2.2.2 Training of Survey Teams

The survey teams underwent a week long training to equip them with the necessary skills to carry out data collection and recording using the standard SWIMS data collection forms. The training contents were as mentioned in section 2.1.2. Logistics and the theory sessions of the training took place at the FAO offices in Hargeisa. During the practical sessions, shallow wells and boreholes within Hargeisa town were visited, tests done, data collected and filled into SWIMS field data forms. The data collection procedure is outlined in chapter 3 of this document.

2.2.3 Community Sensitization

To avoid raising anxiety and suspicion, community sensitization was not done before the start of the survey. Instead, the surveyors opted to engage the local authorities as they continued with the survey. This would give them an opportunity to evaluate each situation and device the best approach accordingly. This was necessitated by the fragile and unpredictable security situation in most areas of south-central Somalia.

2.2.4 Start of Actual Survey

The first phase of the south-central Somalia inventory survey kicked off on 20th July 2009, soon after the training. The teams were supplied with the necessary equipment which consisted of:

(i) Survey equipment: multi-meter, dip meter, digital camera, field data forms etc.
(ii) Communication equipment: GPS enabled mobile phones, SIM cards and airtime for two main mobile networks.
(iii) Camping materials, generator, first aid kit, stationery etc.

As earlier mentioned, there was no coordinator working with the teams on the ground. Instead, the teams were coordinated from Nairobi through SWALIM's field coordinator. The survey took on average four weeks to finalise.

2.3 Phase II – Middle Juba and Gedo Region's Survey Preparation, Training and Start of Survey

2.3.1 Survey Preparation

Preparations for the survey in Middle Juba and Gedo Regions, both of which are near the border with Kenya, took place in Wajir, in north eastern part of Kenya from 13th to 19th September 2009. About half of the surveyors were Kenyan Somali's working

with Somali NGO's; hence getting them to Kenya for the training was not difficult. Wajir town is also located near the Somali boarder, so it was easy for the teams to travel by road from their respective duty stations to attend the training and go back without having to come to Nairobi.

The number of enumerators for the second phase of the south-central inventory survey was nine, grouped into teams of three. The teams were constituted as follows:

Team I: North Gedo Region - three enumerators;
Team II: South Gedo Region – three enumerators;
Team III: Middle Juba Region - three enumerators.
The teams were selected based on their area of operation. Teams II and III each had one SWALIM gauge reader as one of the enumerators. As in the case of Phase I, there was no regional coordinator hired to coordinate the survey teams. The teams were coordinated from Nairobi by SWALIM's field coordinator.

The same security concerns expressed during phase I of the survey were still valid during this phase. Even though majority of the surveyors were well conversant with the areas they were operating, the security situation remained volatile and not much could be predicted. Use of GPS handsets was particularly considered very risky in almost all areas of the survey. Mobile phones and humanitarian grid maps had to be used as in the case of phase I. The surveyors opted to proceed to the field and deal with the situations as they arose. In the planning of the routes, priority was given to areas covered with clay soils and poor road network as it was expected that the Deyr rains were likely to start in the middle of the survey.

Equipments used for the survey were the same as those used in the northern Somalia survey with only a few additions of stationery and other consumables.

2.3.2 Training of Survey Teams

The surveyors were trained for a week in Wajir, Kenya, to enable them use the survey equipment without difficulties and collect accurate data. Apart from the venue, all other details of the training were as described in section 2.2.2. Theory classes were carried out at Wajir Guesthouse, in Wajir town, while the practical sessions were carried out on shallow wells and boreholes in and around Wajir town. The data collection procedure is outlined in chapter 3 of this document.

2.3.3 Community Sensitization

Due to the same reasons highlighted in section 2.2.3, sensitization of the communities prior to the actual survey was not done. Instead, the teams preferred to carry out the exercise silently, only informing the relevant authorities of what they were doing when they got there. This would allow them assess which areas are secure to visit at a particular time, and avoid risky areas.

2.3.4 Start of Actual Survey

The second phase of the south-central Somalia inventory survey kicked off on 22nd October 2009. At the end of the training, the survey teams went back with the survey equipment so that soon after Ramadhan they would embark on the survey. The same material described in section 2.2.4 was used in the survey.

3.0 SURVEY PROCEDURE

The actual survey in the field involved several activities:

- Visit to the selected strategic water point
- Measurement of water source parameters
- Data entry into standard SWIMS data collection forms

The collected data were transferred into SWIMS and verified, validated and analysed at the end of the survey.

3.1 Selection of Strategic Water Points

There are many water points in Somalia, but the majority are seasonal and do not last long into the dry season. The survey was carried out only on strategic water sources, which the population rely on during drought periods. Although not all the sources considered strategic last the entire dry season, majority sustain water for months after the rains stop. Selection of the strategic water sources was done in consultation with the local communities who are well conversant with the water points.

3.2 Parameters Monitored in the Water Sources

The standard SWIMS data collection forms used in the survey have a wide range of parameters to be monitored. However, the limited time available for the survey could not allow measurement of all the parameters. Emphasis was put on the essential parameters, and other parameters which were easy to determine in the field within the available time and equipment. The parameters monitored include:

- Location details: GPS coordinates, source name, region and district where the source is located.
- Functional status and users of the source.
- Physical parameters: well depth, static water level, etc. of the source.
- Basic water quality: pH, EC, temperature, TDS, colour, smell, etc. of water.
- Water supply and distribution network.
- Ownership and management of the source.

For every source visited, a digital still photo was taken which would help to better visualize the condition of the water source. The photos are linked to the source attributes and archived in SWIMS database alongside the other data collected.

3.3 Steps Followed in Data Collection

Data collection procedure followed a "*Field Data Collection Guide*" prepared to guide the surveyors. The data collection guide is attached in Annex A.2 of this document.

3.4 Coordination and Monitoring of the Survey in the Field and Nairobi

The survey teams composed of two to three enumerators. A local guide was hired when there was need to help identify the strategic water sources and also act as a link to the community. The teams were under the guidance of SWALIM's field coordinator, while the overall activity was coordinated by the Water Coordinator.

Communication with the teams in the field was on daily basis when the teams were within network areas. The teams would report on progress made in the previous day (s) and the plan for the next day(s). The teams also sent weekly updates through email whenever it was possible. In the weekly updates, they would give GPS coordinates of the sources visited, which were plotted on a map to see the spatial coverage of the teams and advice them accordingly.

4.0 RESULTS AND ANALYSIS

4.1 Data Entry

The survey data was collected using standardized data collection forms which are compatible with SWIMS. This allowed easy data entry into the software after the data forms were received from the field. SWIMS is a data management software developed by SWALIM in Phase II to assist agencies working in the water sector in Somalia for the construction and maintenance of point water sources data for the country.

The data entered into the software was generated into MS Excel reports which were used for basic data analysis at region and district levels.

4.2 Data Verification and Validation

The data forms received from the field were checked for any mistakes in filling data, and other types of mistakes. The identified errors were clarified through phone calls to the survey teams. Musse Shaie, SWALIM's feld coordinator was also very resourceful in data verification owing to the great knowledge and high experience he has in the surveyed areas.

The other approach used in data validation was to plot the generated reports and overlay with administrative maps of regions, districts and settlements to check on the location of the water sources. The coordinates of sources found to lay outside the indicated location were re-checked to establish whether the error might have occurred during data entry. Corrections were made where applicable.

The photos taken for each water source surveyed were used to further verify the data. Each of the photos had a date and time when it was taken, hence where there was a mix-up of water sources then the photos would be used to clarify the order in which the sources were visited, or estimate the location of the source based on time taken from the previous source.

4.3 Data Analysis and Spatial Presentation of Results

Some basic analyses were done on the parameters collected during the water sources survey. The analyses were done on the following areas:

- Spatial coverage and distribution of water sources
- Utilization of the sources by different users
- Operational status of water sources
- Variation in water characteristics and physical parameters
- Supply and distribution
- Water Source management

For all analysis done, the results were displayed on maps based on the administrative units of regions and districts. The maps are attached in Annex A.3 of this document.

Agencies wishing to do further analyses are advised to use the Excel reports generated from the SWIMS software.

4.3.1 Spatial Coverage of the Survey

The survey for the water sources in South – Central Somalia covered majority of the regions: Mudug, Galgadud, Bay, Bakool, Gedo and Middle Juba. The map in Figure 1.1 above shows the spatial coverage of the water sources.

Few of the districts in the mentioned regions were however not covered, due to insecurity. They include Ceel Buur in Galgaduud Region, Ceel Barde and Yeed in Bakool Region and Buur Hakaba in Bay Region. The entire Hiran, Lower Juba, Middle Shabelle and Lower Shabelle regions were also not surveyed due to security concerns.

4.3.2 Distribution of the Strategic Water Sources by Region

The water sources surveyed are summarized by region in Table 4.1. In total, the surveyors covered 645 strategic water source distributed in six regions as indicated in the table.

Table 4.1: Strategic Water Sources Assessed in South-Central Regions of Somalia

Source Types / Region Names	Dam	Borehole	Dug well	Spring	Total Sources
Mudug		7	66		**73**
Galgadud		44	113		**157**
Bakool	9	16	57	3	**85**
Bay	17	43	32	2	**94**
Gedo	55	9	100	11	**175**
Middle Juba	22	6	32	1	**61**
Total Sources	**103**	**125**	**400**	**17**	**645**

From the summary table, it is clear that shallow wells are the dominant water sources in South Central Somalia. They cover more than 62% of the strategic water points in the region. There are a considerable number of boreholes and dams as well, with their percentages given as 19% and 16% respectively. Springs are the minority, ocupying only about 3% of the total sources.

The general usage of the water sources for each region was analysed and presented in Figure 4.1 below. Majority of the sources are in rural areas, where the usage is either nomadic or for other rural needs, mainly domestic and for livestock. Galgadud region however has a good percentage (about 37%) of the water usage classified as urban.

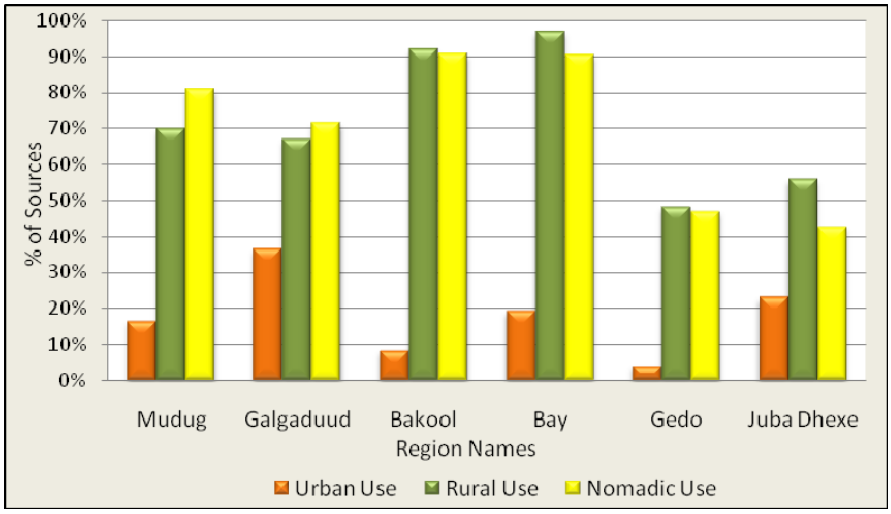


Figure 4.1: Regional Utilization of Sources by Different Users

Looking at different types of water sources (Figure 4.2; Table 4.2), the analysis indicated that dugwells are mainly utilised in the rural areas. The urban populations have a balanced usage of the shallow wells and boreholes. Springs are barely used in urban areas, but the rural people rely on them for their water needs. Some sources are used by multiple users.

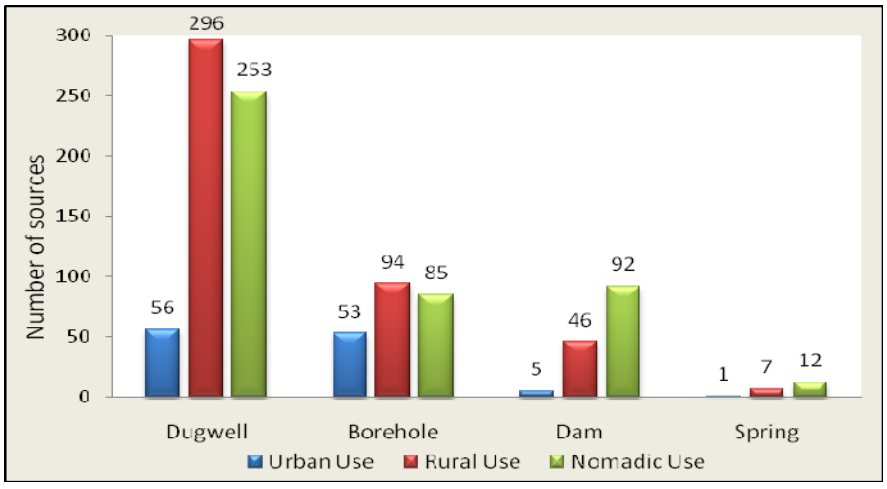


Figure 4.2: Number of Source Types Utilized by Different Users

Table 4.2: Sources utilization by the different users

	Number of Source Types per Users[2]											
Region Names	**Dam**			**Boreholes**			**Dug wells**			**Springs**		
Use Type	**Urb**	**Rur**	**Nom**	**Urb**	**Rur**	**Nom**	**Urb**	**Rur**	**Nom**	**Urb**	**Rur**	**Nom**
Mudug				1	5	5	11	46	54			
Galgaduud				31	30	26	26	75	86			
Bakool		9	9	5	11	10	2	55	55		3	3
Bay	3	17	17	9	41	39	5	31	29	1	2	2
Gedo		6	49	4	5	3	3	71	24		2	6
Juba Dhexe	2	14	18	3	2	2	9	18	5			1
Total Sources	**5**	**46**	**92**	**53**	**94**	**85**	**56**	**296**	**253**	**1**	**7**	**12**
*1)**Urb**- Urban Use 2) **Rur**-Rural use 3) **Nom**-Nomadic Use*												

4.3.3 Operational Status of the Water Sources

For the different types of water sources surveyed, the operational status was anaysed under four categories namely:

- Operational sources
- Non operational sources
- Abandoned sources
- Unknown operational status

Figure 4.3 gives an indication of the number of operational sources. Majority of the sources visted are operational, few are not operational for some reason, and a small number is abandoned. It should however be noted that the survey teams were led by the local people to the strategic water points, hence broken down sources might have been avoided.

[2] Note: A source can be used by different users, e.g. both nomadic and rural population

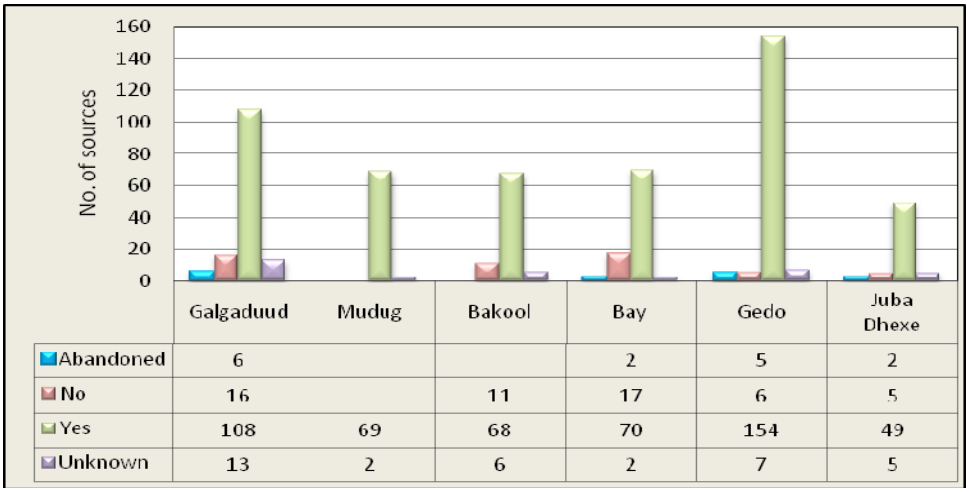


Figure 4.3: Operational Status of Strategic Point Water Sources Assessed

Table 4.3 gives a summary of the operational status of individual sources, as well as a combined status of all sources as a percentage.

Table 4.3: Operational Status per Number of Source Type

	Operational Status			
Source Type	**Yes**	**No**	**Abandoned**	**Unknown**
Borehole	72	19	7	27
Dam	85	8	2	9
Dug well	347	17	6	30
Spring	16			1
% Representation	**80.62%**	**6.82%**	**2.33%**	**10.23%**

4.3.4 Reliability of Water Sources

The reliability of a water source determines how strategic it is to the water users. Even though the survey was carried out for the strategic water sources, there are still some differences in the duration the water source takes before it dries out, if at all it does. Sources with water all year round are much preferred since the consumers do not have to look for water from elsewhere once their sources dry out. Results of this analysis are presented in the Table 4.4.

Table 4.4: Reliability of Water Sources According to the Number of Source Types

	Number of Permanent and Not Permanent water sources											
Source type	**Dam**			**Borehole**			**Dug well**			**Spring**		
Permanent status	**UN**	**NP**	**P**	**UN**	**NP**	**P**	**UN**	**NP**	**P**	**UN**	**NP**	**P**
Number of sources	18	4	82	47	13	65	145	7	248	1		16
***P**-Permanent, **NP**-Not permanent and **UN**-Unknown*												

The majority of the water sources of each type have a big percentage of the sources operational, but as said elsewhere in the report, the teams were guided by the locals to the operational water sources.

4.3.5 Current State of Water Sources

The state of water sources was analyzed based on the surroundings of the source. The parameters analyzed include general[3] conditions; sanitary[4] conditions; environmental[5] conditions and the intervention requirements on the water sources.

A summary of the environmental conditions is presented in Figure 4.4. From the figure, it is clear that 9% of the sources surveyed are in good environmental condition, 35% in poor condition and 56% were not reported on.

The sanitary conditions of the sources surveyed was also not very encouraging, according to the summary presented in Figure 4.5. 4% of the sources are in good condition, 28% in fair state, and 34 % in poor state. The low sanitary conditions can be attributed to the large number of unprotected sources in Somalia. It also increases the risk of water contamination.

Due to the poor state of majority of the water sources, the intervention requirements are many. From Figure 4.6, 4% of the sources require development, 26% require rehabilitation, 14% requires improvement and only 1% of the sources require no intevention at all. To improve on the water supply for the rural and urban areas of Somalia these different types of intevention need toi be implemented alongside establishment of new sources.

[3] The general operation and structural condition of the source based on enumerator's assessment such as the condition of the masonry or concrete elements. The source is classified as poor when the structure is weak, or operates below expected capacity.

[4] Vulnerability of the water source to contamination from surface runoff or seepage; existence of a pit latrine within 20m radius, etc. A source is classified under poor sanitary conditions when it is not protected from possible contaminators.

[5] The condition of the area surrounding the water source as observed by the enumerator, such as drainage condition, overgrazing, etc. The condition is classified as good, fair or poor according to enumerator's assessment of the surrounding.

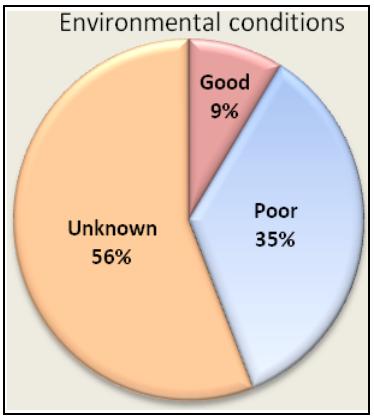


Figure 4.4: Environmental Conditions

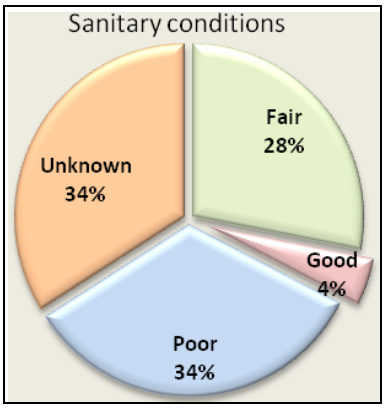


Figure 4.5: Sanitary Conditions

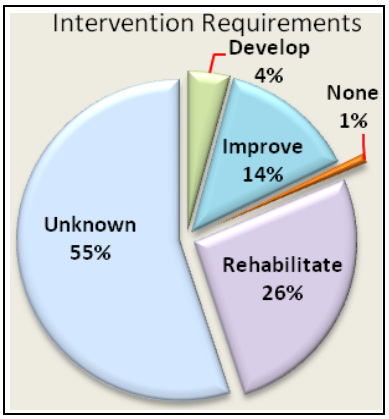


Figure 4.6: Intervention Requirements

4.3.6 Variation in Water Quality Characteristics

The basic water characteristics analyzed were pH, EC, temperature, and turbidity. Table 4.5 gives a summary of the water quality parameters by source type. It is clear from the table that, in some areas people use water with high salinity and acidity, e.g. pH and EC parameters recorded higher values than recommended WHO standards for drinking water. The high EC values are attributed to the geological formations. Due to its scarceness Somalia water availability is considered before its quality.

Table 4.5: Water Quality Parameters of Assessed Water Sources

	Water Quality Parameters					
	Temperature (^{0}C)		pH		EC (µS/cm)	
Source Type	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**
Borehole	22.00	37.40	6.00	9.60	503	8550
Dam	23.50	37.30	6.00	9.30	105	2930
Dug well	21.80	39.00	3.60	13.00	108	9480
Spring	22.00	33.90	6.00	8.60	461	3999

4.3.7 Variation in Physical Parameters

The main physical parameters analysed for the water sources were the well depths and static water level. Figures 4.7 and 4.8 give the varying depths of shallow wells and boreholes respectively. Galgadud area has the deepest shallow wells, but on average majority of the wells are within 20m of depth. In south-central Somalia, boreholes depth range from 30m to over 250m.

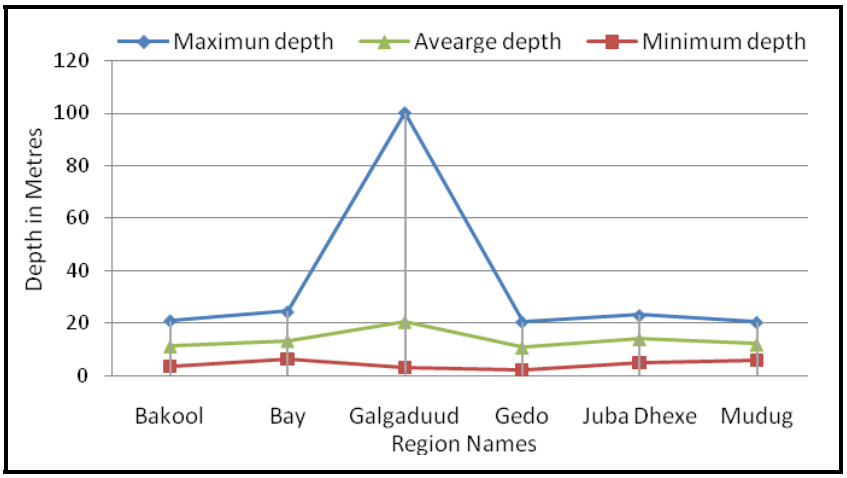


Figure 4.7: Variation in Shallow Well Depths

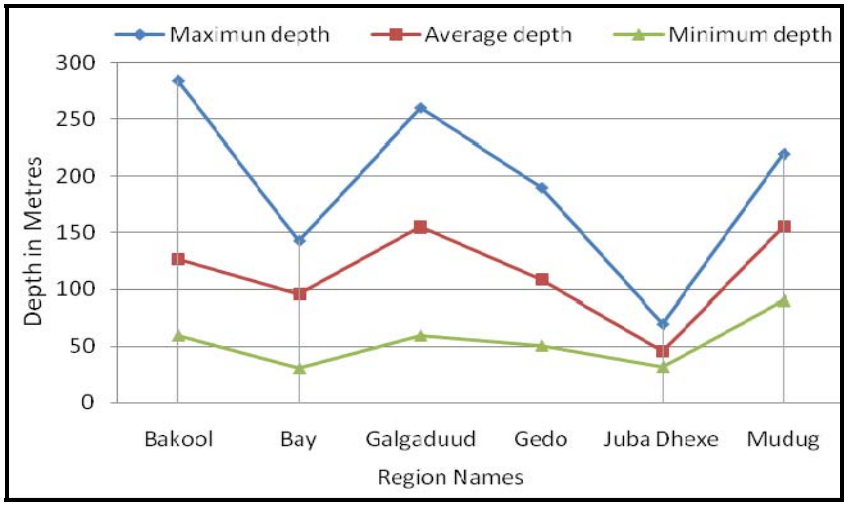


Figure 4.8: Variation in Borehole Depths

Further analyses were done on the supply and distribution, as well as water source management. Maps from these analyses are presented in Annex A.3 of this report.

5.0 SURVEY CHALLENGES

The success of the water sources inventory was as a result of hard work and patience by the survey teams. They were faced with many obstacles but despite all, they managed to overcome them and finish the exercise. Some of the major challenges encountered during the survey are highlighted below:

5.1 Technical Challenges

(i) The prevailing security situation in most areas of south – central Somalia could not allow free movement of the survey teams from one area to another. A lot of time was spent negotiating with the local authorities to allow the teams carry out the exercise at the expense of the actual water sources survey.

(ii) Remoteness of some strategic water sources limited their access by the survey teams, resulting to more time wastage trying to access the sources.

(iii) Some strategic water points could not be reached due to presence of landmines along the roads leading to the sources. Some of the areas reported to have landmines were in Dhusamareeb and Cadaado districts of Galgadud Region. The survey teams were warned by the locals against traveling to the land mine prone areas.

(iv) Tension between clans in some districts occasionally threatened to disrupt the survey. In such cases, the survey teams had to move in the company of local leaders or guides to avoid conflicts.

(v) Use of GPS handset for collecting geographic coordinates of the water sources and tracking of the survey routes was not possible due to the threats such a gadget posed to the surveyors. Mobile phones and humanitarian grids were used instead of the GPS to locate the water sources. However, tracking of the survey routes was not possible with the mobile phones. The tracks collected in Northern Somalia were useful in updating the road network. The use of humanitarian grids on the other hand reduced the accuracy in locating the water sources since the water source could be anywhere within a radius of 2.5km.

(vi) The extremely high parameter values for water quality in some sources posed a challenge to the survey equipment, e.g. the multi meter used by the surveyors had a limitation in measuring EC values above 3999 µS/cm. As it came out during the survey, there are sources with EC values higher than the multi metre maximum reading value. Due to lack of water quality analysis capacity in Somalia, the survey teams had to collect samples of high EC water for further analysis in Kenya. Some sources recorded EC values greater than 9000 µS/cm.

(vii) The way some of the water sources are constructed hindered collection of some essential information about the sources. Some boreholes for example were completely sealed and could not allow measurement of the static water level, which is an indicator of the water table at the time of the survey.

5.2 Logistical Challenges

The main logistical challenge encountered during the survey was lack of mobile network coverage in many villages, limiting communication between the teams and Nairobi. In case of technical hitches the teams would waste a lot of time trying to reach Nairobi for assistance.

5.3 Other Challenges

- The teams worked under harsh climatic conditions, which is likely to have reduced their efficiency in carrying out the survey. In the first phase (August 2009), the survey was done under very hot and dusty conditions, while in the second phase (October – November 2009) the *Deyr* rains started before the survey was over, making many roads impassable.
- The area covered during the survey was large and many of the feeder roads were in bad state, making movement across the region difficult. The teams were faced with a big challenge of trying to reach all strategic water points within limited time.
- Due to the long distances involved, the surveyors could not operate from their home towns every day. They were forced to camp in some remote areas away from home, therefore affecting their family and social lives in one way or another.

6.0 CONCLUSIONS AND RECOMMENDATIONS

For each of the water sources visited, essential information data was collected which include: location, functional status, use, physical parameters, water characteristics, supply and distribution and ownership of the water sources. Photos were also taken for all sources visited during the survey.

The water sources inventory was done only on the strategic water points, as the resources available could not allow complete coverage of all water sources. There are many seasonal water sources, mainly berkads and some shallow wells across the country. However, these sources do not last long into the dry season, hence the reason why they were not prioritized in trying to make the best use of the available resources for the survey.

Data collected during the water sources inventory went a long way in improving the existing water sources database for Somalia. Prior to the survey, there was very little information on the number of water sources and their status especially in central Somalia. With 645 sources surveyed and data entered into SWIMS, one can now get a clear picture of the coverage of water sources, condition of the water sources, water quality and much more information for south – central Somalia. With such information at their disposal, agencies working in the water sector in the country can make decisions on what kind of interventions they need to undertake in their project areas.

The type of data analysis done by SWALIM was very basic. However, the entire database has been downloaded into MS Excel to enable agencies perform further analysis to meet their specific project needs.

It should be noted though that the characteristics of the water sources presented are only applicable for the time when the survey was conducted. The parameters are expected to vary depending with the season. The water level in shallow wells and boreholes for example would vary from wet to dry season, same with water quality, users and other parameters. It would therefore be highly recommended that continuous monitoring of the water sources be undertaken for a more conclusive analysis of the status of water sources against demand for water in both rural and urban centres in Somalia.

The main purpose of carrying out the inventory was to contribute to a national database of water sources and improve on the existing data. Even though most of the areas were covered, there still remains few areas in south – central Somalia not yet surveyed. Such areas include Hiraan, Lower Juba, Middle Shabelle and Lower Shabelle Regions. Others include Ceel Buur district in Galgaduud Region, Ceel Barde and Yeed districts in Bakool Region and Buur Hakaba district in Bay Region. The maim reason why these areas were not surveyed is insecurity. When security improves, the survey will be extended to these areas so as to complete the inventory for the entire country.

ANNEXES

Annex A.1: Survey Team Members

Team	Surveyors
Phase 1: Mudug, Galgadud, Bakool and Bay Regions	
Team I – Mudug Region	Shukri Hilowle Addawe
	Mohamed Ahmed Kulane
Team II – Galgadud Region	Abdirizak Mohamed Noor
	Abdigargar Ahmed Hashi
Team III - Bakool Region	Sidow Abdi Mireh
	Abdirashid Mohamed Aden
Team IV – Bay Region	Adow Aden Magan
	Hassan Hussein Abkoow
	Yasin Mohamed
Phase II: Gedo and Middle Juba Regions	
Team I – North Gedo Region	Abdi Jama Hussein
	Mohamed Sheikh Hassan
	Mohamed Omar Mohamed
Team II – South Gedo Region	Ahmed Abdi Aden
	Abdidahir Mohamed Mohamud
	Abdulkadir Ahmed Jama
Team III – Middle Juba Region	Ahmed Dubow Keinan
	Osman Siyah Eleh
	Shakir Jama Ibrahim
SWALIM's Field Coordinator	Musse Shaie

Annex A.2: Field Data Collection Guide

Data collection in the water sources inventory survey will follow the standardized SWIMS data collection sheets. The SWIMS data collection sheets contain two categories of information: *Essential* and *Detailed* information. The essential information represents the minimum data required by SWIMS to complete an inventory of the water sources for Somalia, while detailed information provides additional information required to do statistical and spatial analysis of the water sources regarding the water quality, socio-economic parameters, users, management and operation of the source. The essential information is in bold type face in the data sheets, making it easy to differentiate from the detailed information.

The SWIMS data sheets consist of five major water source types in Somalia: boreholes, shallow wells, dams, springs and berkads. Source types that do not fit any of these categories are classified as "other". For each source, the data forms are divided into seven sections: Data Management; Location; Function and Use; Physical Parameters; Water Characteristics; Supply and Distribution; and Source Management. All these sections are the same for the different sources, apart from the physical parameters.

For every water source visited, the following information was collected:

(i) GPS coordinates of the water source. The coordinates (Northings, Eastings and Elevation) should be saved in the GPS handset/mobile phone in addition to recording in the data sheets.
(ii) Physical parameters of the water source: - depth, static water level, protection etc
(iii) Water quality: - pH, EC, smell, colour etc
(iv) Other parameters: - users, supply and distribution, management, cost etc
(v) Photo of the source

The team leader has the responsibility to:

(i) Distribute specific roles to the team members to ensure accurate information is collected and recorded in the shortest time possible.
(ii) Check the filled data form before leaving the source to ensure all information is correctly entered.
(iii) File the filled data sheets in the provided folders before leaving the source
(iv) Ensure the data sheets are kept clean and submitted to the regional coordinator in the best possible condition.

Filling Data Collection Sheets

When filling the field data collection sheets the following should be noted:

i) Use permanent ink such a ball point and not pencil
ii) Writing should be neat and legible, preferably block capitals
iii) Use a tick ✓ when filling in check boxes
iv) Where information is not available leave the field blank
v) Maintain the data sheets as clean as possible

The SWIMS data collection sheets are comprehensive, but due to the time constraints in this survey, not all parameters in the data sheets can be collected. The parameters that are not easy to identify have been shaded, and the survey teams should not spend a lot of time on them. They should instead concentrate more on the remaining parameters to ensure they collect as much information as possible. Below is a brief description of what is required in each field.

Data Management

- Source in SWIMS: Does the source already exists in SWIMS database?
- Date: The date the location was visited and the form filled in.
- Inspected by: The name of the team leader visiting the source.
- Entry Agency: The name of the agency who entered the data on the SWIMS Software – *SWALIM in this case*
- Inspecting Agency: the name of the agency responsible for collecting the data - *SWALIM in this case*

Location Section

- Region: The administrative region that the source is in.
- District: The administrative district that the source is in.
- Source Name: The local name for the source. Where there are a number of sources with the same name in an area, for example a well field, then each individual source should be given a numeral label (e.g. SOURCE1, SOURCE2……..).
- North: The latitude (x) coordinate of the source, reported to a precision of 6 decimal places.
- East: The longitude (y) coordinate of the source, reported to a precision of 6 decimal places.
- Elevation: the elevation of the source in meters above sea level, reported to a maximum precision of 1 m.
- Nearest Settlement Name: the nearest permanent settlement.
- Nearest Settlement Distance: The distance to the nearest permanent settlement.
- Users: The predominant users of the source as Rural, Urban or Nomadic, or all three.

Function and Use Section

- Functioning: The current operational status of the water source.
- Operator: Does the water source have a trained, permanent operator?
- Permanent Use: Is the water source used throughout the year?
- Distance to nearest permanent source: A water source such as a borehole, spring or stream that, in a normal year, provides water at all times throughout the year.
- Description of permanent source: Name or GPS coordinates of the nearest permanent water source if known.
- Settlements served by the source: Number of settlements served by the source.

Water Characteristics

- EC @ 25° C: The electrical conductivity of a sample from the source, corrected to the reference standard of 25° Celcius
- EC Make and Model: The name of the manufacturer of the EC meter and the manufacturer's model number.
- Calibration date: The date that the EC Meter was last calibrated.
- Temperature: The temperature, reported to a maximum precision of 0.5° Celcius, at which the pH measurement was made.
- pH: The pH, reported to a maximum precision of 0.1 pH
- pH meter Make and Model: The name of the manufacturer of the pH meter and the manufacturer's model number.
- Colour: The colour of a water sample from the source
- Smell: The smell of a water sample from the source
- Taste: The taste of a water sample from the source

Supply & Distribution

- Supply system condition: The condition of a distribution network, including animal troughs, if applicable.
- Water lifting technology: The type of water lifting technology at the source (multiple choices are valid).
- Pump Make: The name of the pump manufacturer.
- Pump Model: The pump manufacturers model number.
- Pump serial number: The pump manufacturers serial number.
- Date installed: The date, in ddmmyyyy format, that the pump was installed.
- Head: the delivery head of the pump, reported to a precision of 100 mm (0.1 m), at which the flow rate is achieved.
- Engine Make: The name of the engine manufacturer.
- Engine Model: The engine manufacturer's model number.
- Engine Serial: Number: the engine manufacturer's serial number.
- Date Installed: The date, in ddmmyyyy format, that the engine was installed.
- Engine Output: The engine output, reported to a precision of 1 Watt.
- Generator Make: The name of the generator manufacturer.
- Generator Model: The generator manufacturer's model number.
- Generator Serial Number: The generator manufacturer's serial number.
- Date installed: The date, in *ddmmyyyy* format, that the generator was installed.

Source Management

- Owner: Indicate whether the source is privately owned, community owned or other.

Physical Parameters: Drilled Well

- No. of wells in cluster: How many drilled wells are there in that area?
- Depth: The vertical distance in meters from the surface to the bottom of the drilled well.

- Static water level: The vertical distance in meters from the ground surface to the water surface.
- Pump casing type: What material is the pump casing constructed from?
- Pump casing size: The internal bore, reported to a maximum precision of 1mm of the pump casing
- Well head protected: Does the well have a sanitary seal?

Physical Parameters: Dug Well
- No. of wells in cluster: How many shallow wells are there in that area?
- Depth: The vertical distance in meters from the surface to the bottom of the shallow well.
- Static water level: The vertical distance in meters from the ground surface to the water surface.
- Apron: Does the well have an apron?
- Soak away: Does waste water from the well drain into a soak away pit?
- Infiltration Gallery: Does the well have an infiltration gallery?
- Operating Yield: What is the extraction rate from the well in m3/hr under normal operating conditions.
- Pump level: What is the level of a pump if there is one installed.
- Well head protected; Does the well have a sanitary seal?

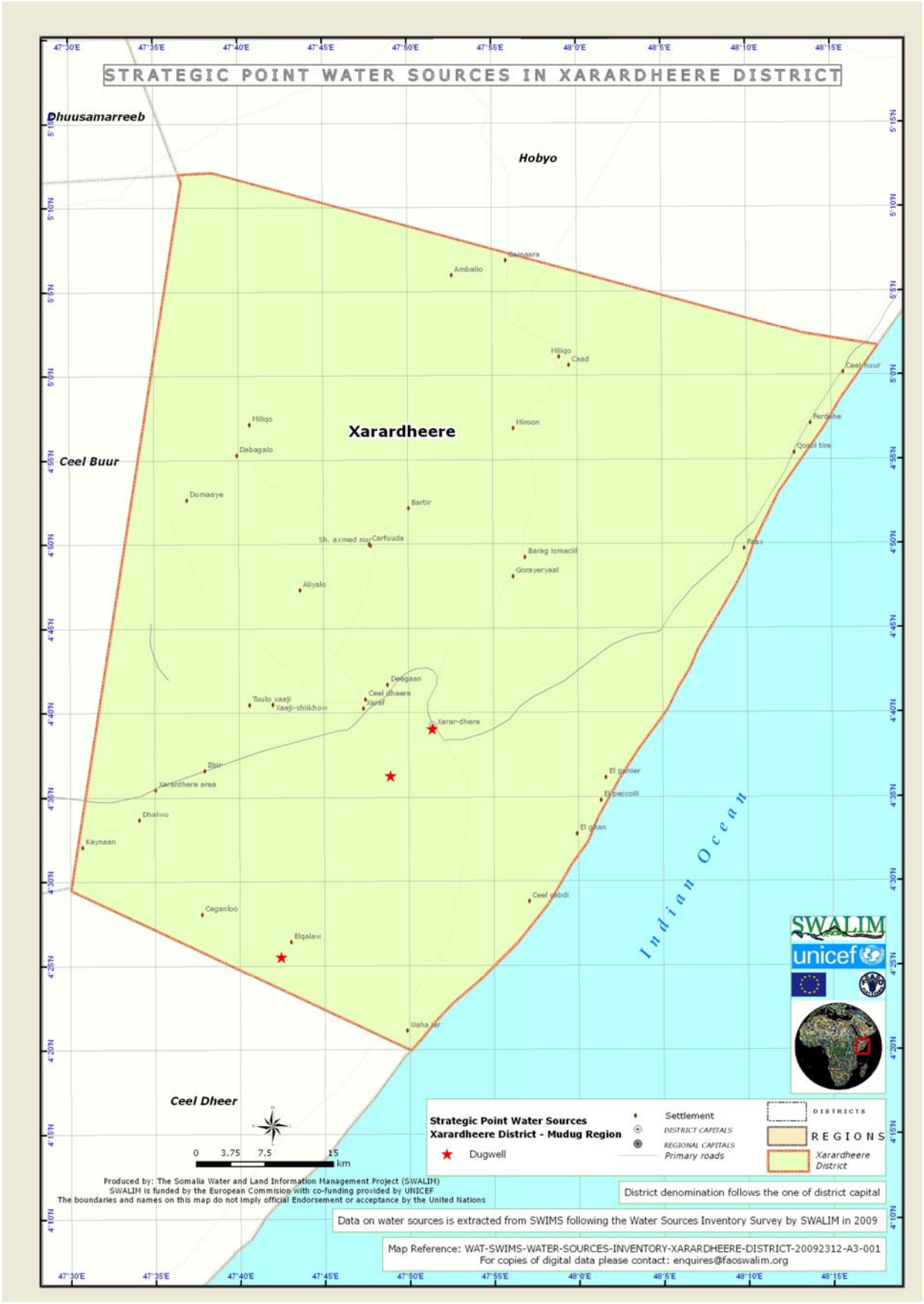
Physical Parameters: Spring
- Seasonal deviation in discharge: The magnitude of fluctuation in the volumetric flow rate of the spring between wet and dry seasons
- Source Protected: Has the source been protected from contamination?

Physical Parameters: Berkad
- No. of Berkad in Cluster: The number of berkads in the same area.
- Reservoir Capacity: The usable volume of the berkad.

Physical Parameters: Dam
- Type of dam: Choose a description for the type of dam.
- Number of dams in cluster: The number of dams in the same area.

Physical Parameters: Other
- Type of Source: Provide a description of the source type.
- Source Protected: Has the source been protected from contamination?

Annex A.3: District maps for water sources


STRATEGIC POINT WATER SOURCES IN XARARDHEERE DISTRICT
Dhuusamarreeb
Hobyo
Ceel Buur
Xarardheere
Ceel Dheer
Indian Ocean
Amballo
Hiiliqo
Caad
Ceel-huur
Hiiliqo
Dabagalo
Hiroon
Perdahe
Qoodi tire
Dumaaye
Bartir
Sh. axmed nur
Carfuuda
Barag ismaciil
Goray eryaal
Faax
Aliyalo
Deegaan
Ceel dheere
Tuulo xaaji
Xaaji-shiikhow
Xarar-dhere
Xarardhere area
Dhalwo
Kaynaan
El ganier
El beccolli
El gaan
Ceel dabdi
Ceganloo
Elqalaw
Uaha ilir
SWALIM
unicef
Strategic Point Water Sources
Xarardheere District - Mudug Region
Dugwell
Settlement
DISTRICT CAPITALS
REGIONAL CAPITALS
Primary roads
DISTRICTS
REGIONS
Xarardheere District
0 3.75 7.5 15 km
Produced by: The Somalia Water and Land Information Management Project (SWALIM)
SWALIM is funded by the European Commision with co-funding provided by UNICEF
The boundaries and names on this map do not imply official Endorsement or acceptance by the United Nations
District denomination follows the one of district capital
Data on water sources is extracted from SWIMS following the Water Sources Inventory Survey by SWALIM in 2009
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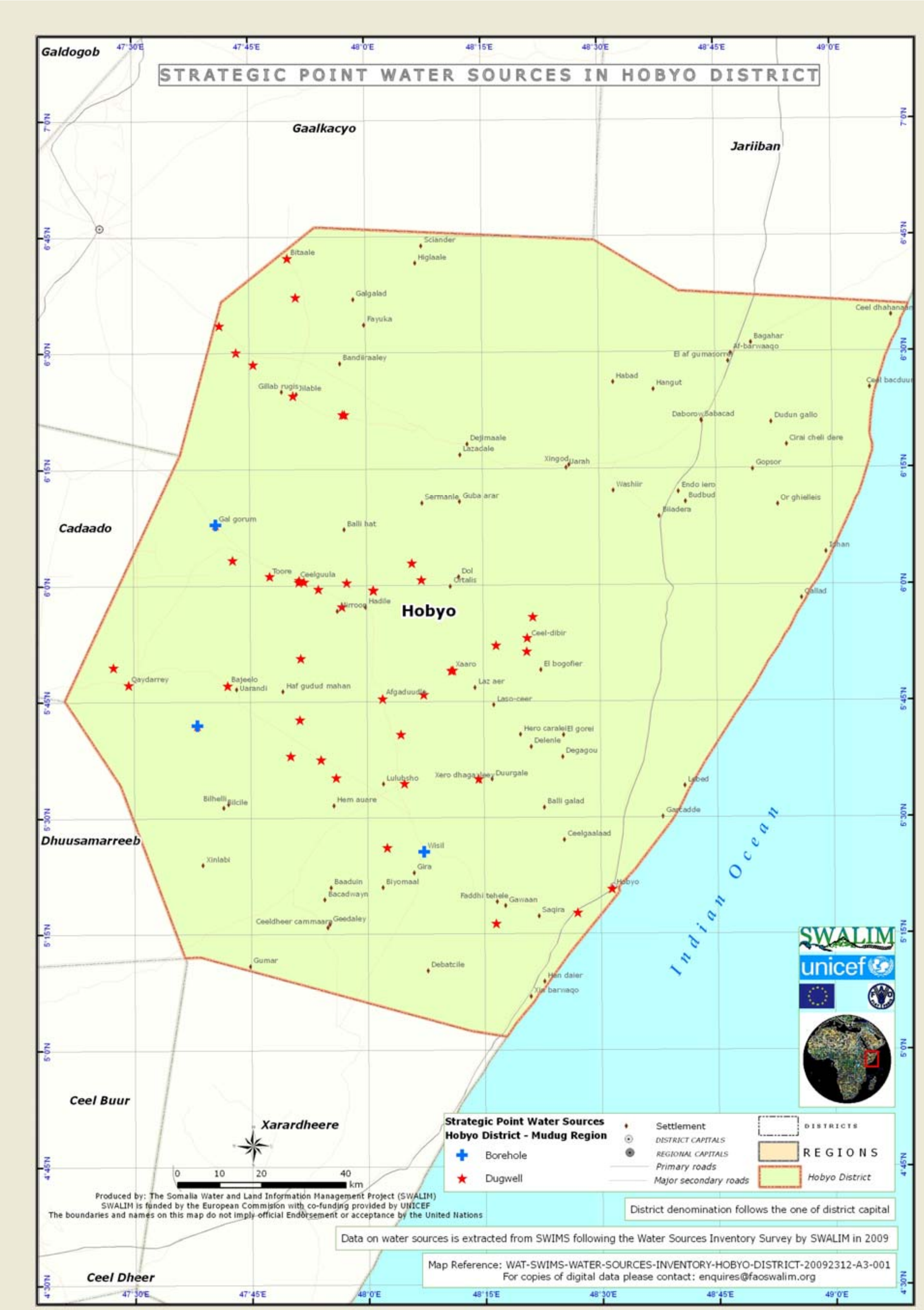
For copies of digital data please contact: enquires@faoswalim.org


STRATEGIC POINT WATER SOURCES IN HOBYO DISTRICT
Galdogob
Gaalkacyo
Jariiban
Cadaado
Hobyo
Dhuusamarreeb
Ceel Buur
Xarardheere
Ceel Dheer
Indian Ocean
SWALIM
unicef
Strategic Point Water Sources
Hobyo District - Mudug Region
Borehole
Dugwell
Settlement
DISTRICT CAPITALS
REGIONAL CAPITALS
Primary roads
Major secondary roads
DISTRICTS
REGIONS
Hobyo District
0 10 20 40 km
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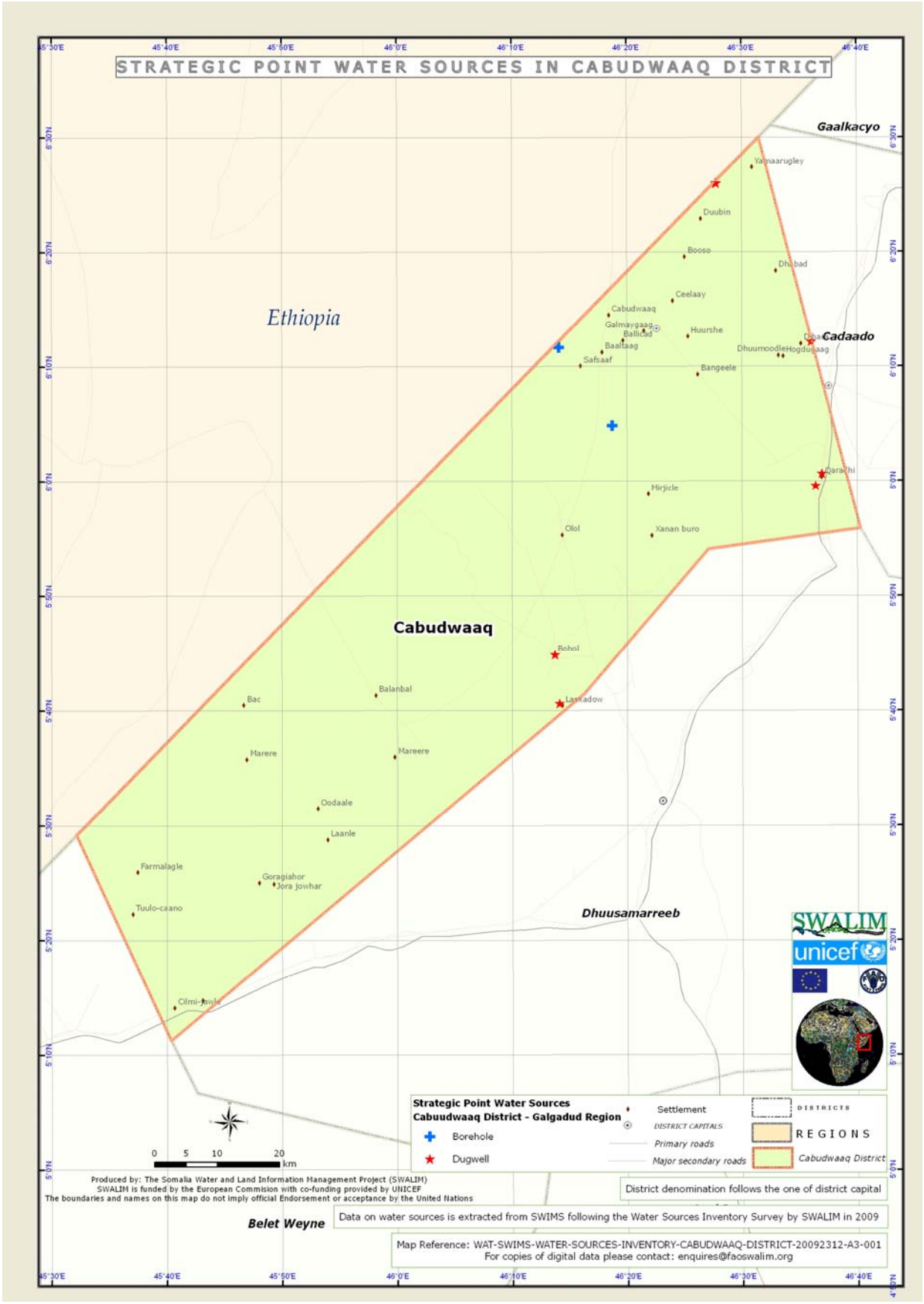
STRATEGIC POINT WATER SOURCES IN CABUDWAAQ DISTRICT
Gaalkacyo
Yaqnaarugley
Duubin
Booso
Dhilbad
Ceelaay
Cabudwaaq
Galmaygaag
Ballidad
Huurshe
Baaltaag
Safsaaf
Bangeele
Dhuumoodle
Hogdugaag
Cadaado
Ethiopia
Qaradhi
Mirjicle
Ololl
Xanan buro
Cabudwaaq
Bohol
Balanbal
Bac
Laasadow
Marere
Mareere
Oodaale
Laanle
Farmalagle
Goragiahor
Jora jowhar
Tuulo-caano
Dhuusamarreeb
Cilmi-awyle
Belet Weyne
SWALIM
unicef
Strategic Point Water Sources
Cabuudwaaq District - Galgadud Region
Borehole
Dugwell
Settlement
DISTRICT CAPITALS
Primary roads
Major secondary roads
DISTRICTS
REGIONS
Cabudwaaq District
0 5 10 20
km
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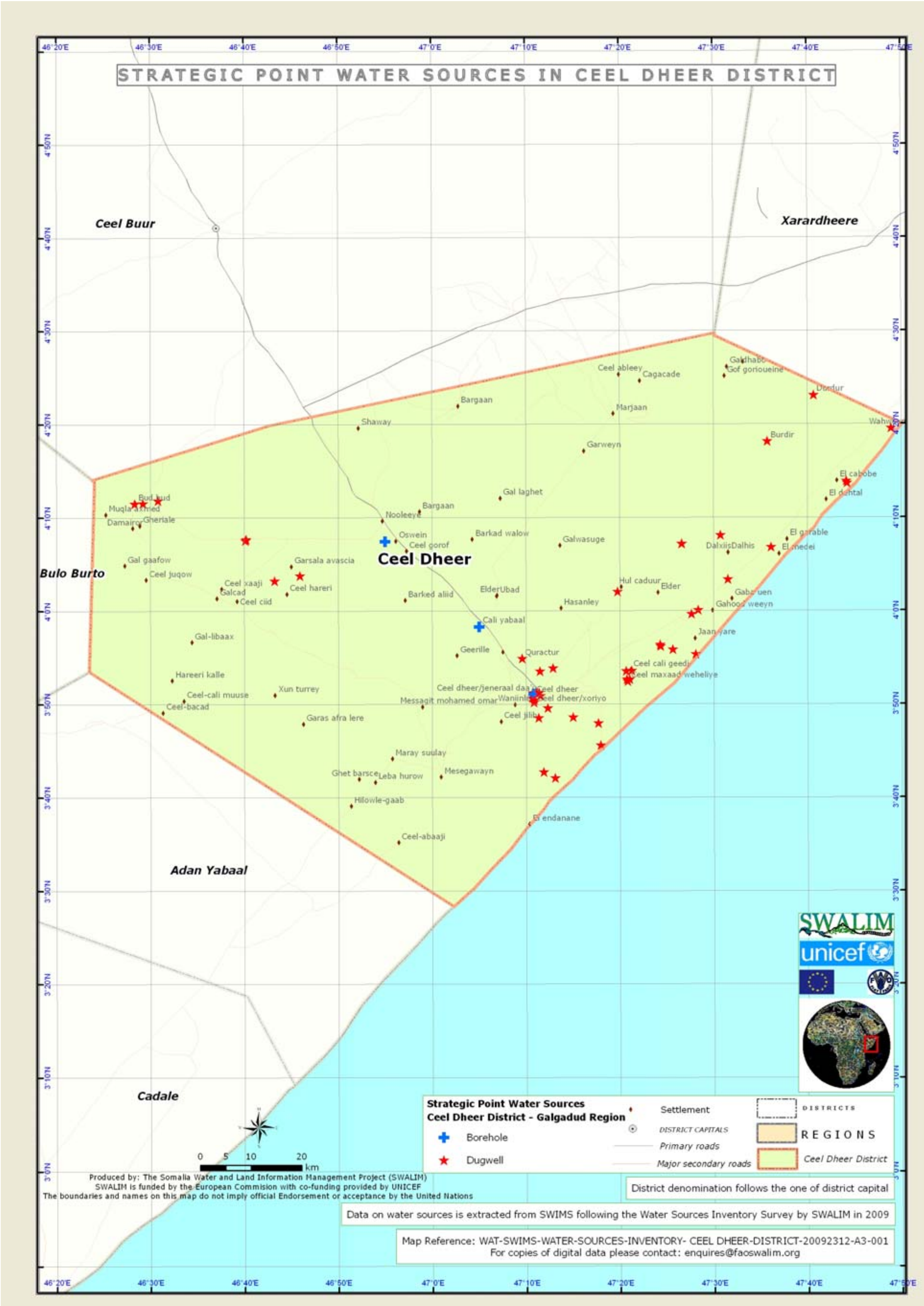
STRATEGIC POINT WATER SOURCES IN CEEL DHEER DISTRICT
Ceel Buur
Xarardheere
Bulo Burto
Adan Yabaal
Cadale
Ceel Dheer
Strategic Point Water Sources
Ceel Dheer District - Galgadud Region
Borehole
Dugwell
Settlement
DISTRICT CAPITALS
Primary roads
Major secondary roads
DISTRICTS
REGIONS
Ceel Dheer District
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SWALIM is funded by the European Commision with co-funding provided by UNICEF
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Data on water sources is extracted from SWIMS following the Water Sources Inventory Survey by SWALIM in 2009
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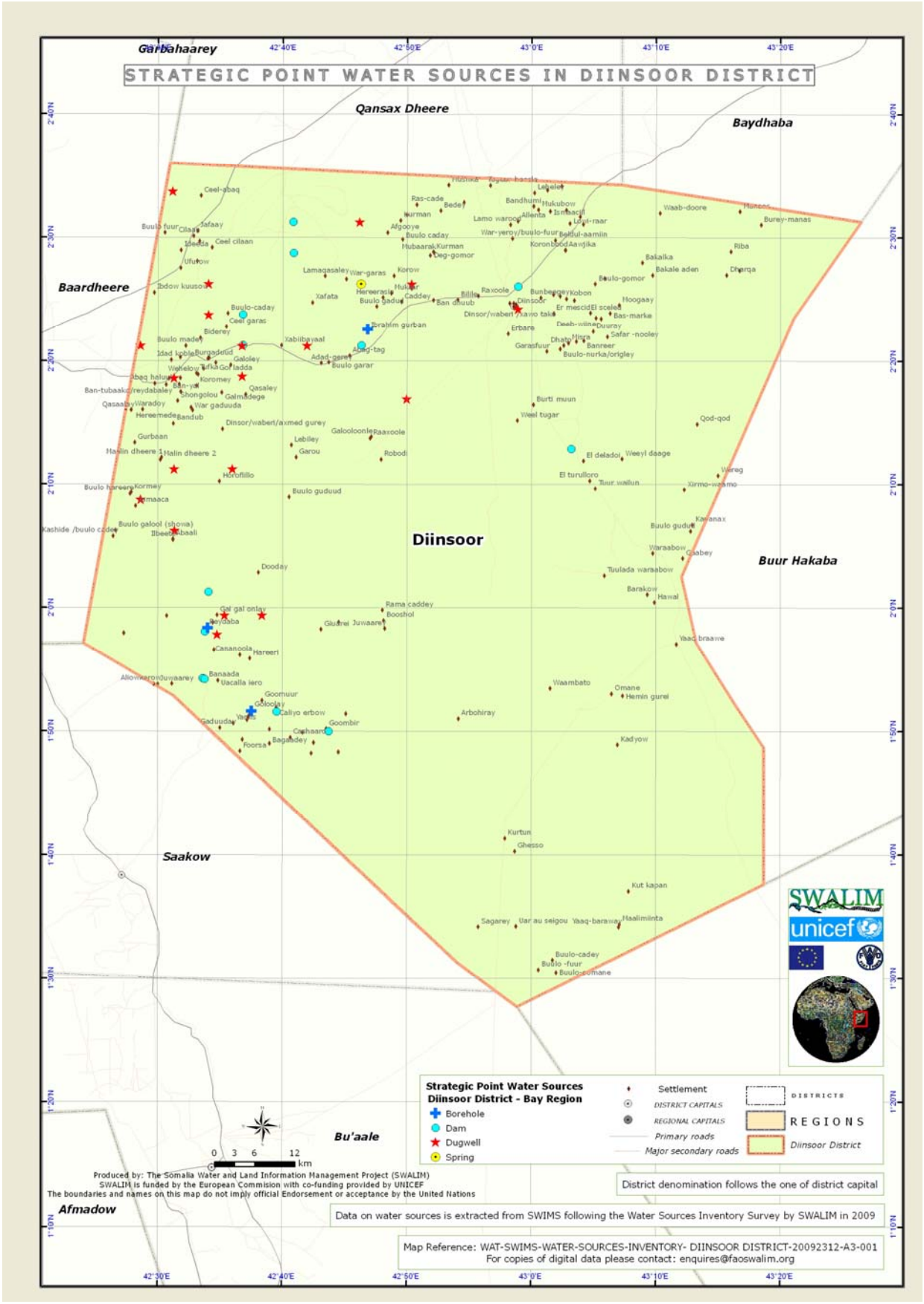
SWALIM
unicef


STRATEGIC POINT WATER SOURCES IN DIINSOOR DISTRICT
Garbahaarey
Qansax Dheere
Baydhaba
Baardheere
Diinsoor
Buur Hakaba
Saakow
Bu'aale
Afmadow
Strategic Point Water Sources
Diinsoor District - Bay Region
Borehole
Dam
Dugwell
Spring
Settlement
DISTRICT CAPITALS
REGIONAL CAPITALS
Primary roads
Major secondary roads
DISTRICTS
REGIONS
Diinsoor District
0 3 6 12 km
Produced by: The Somalia Water and Land Information Management Project (SWALIM)
SWALIM is funded by the European Commision with co-funding provided by UNICEF
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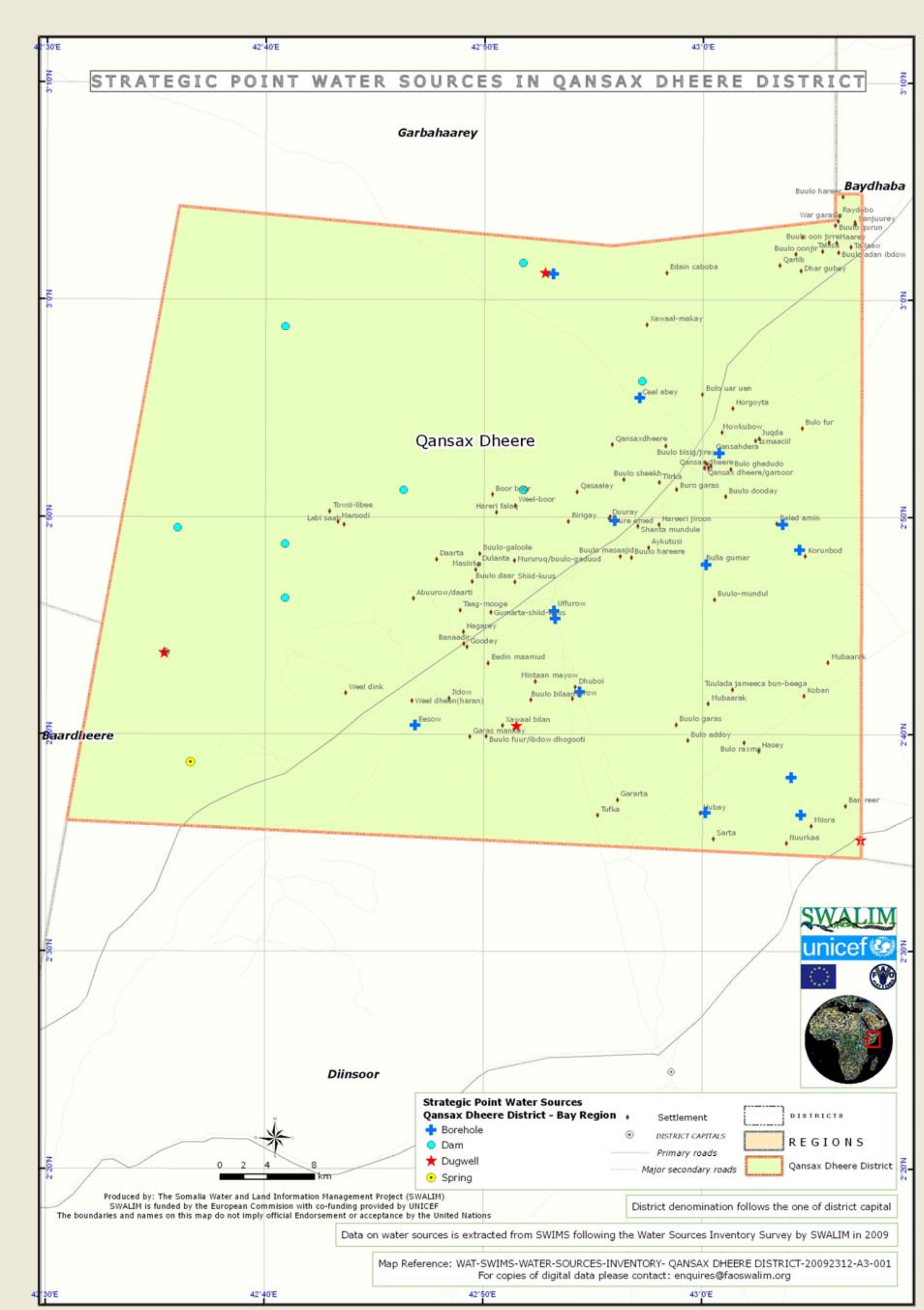
For copies of digital data please contact: enquires@faoswalim.org


STRATEGIC POINT WATER SOURCES IN QANSAX DHEERE DISTRICT
Garbahaarey
Baydhaba
Qansax Dheere
Baardheere
Diinsoor
Strategic Point Water Sources
Qansax Dheere District - Bay Region
Borehole
Dam
Dugwell
Spring
Settlement
DISTRICT CAPITALS
Primary roads
Major secondary roads
DISTRICTS
REGIONS
Qansax Dheere District
0 2 4 8 km
Produced by: The Somalia Water and Land Information Management Project (SWALIM)
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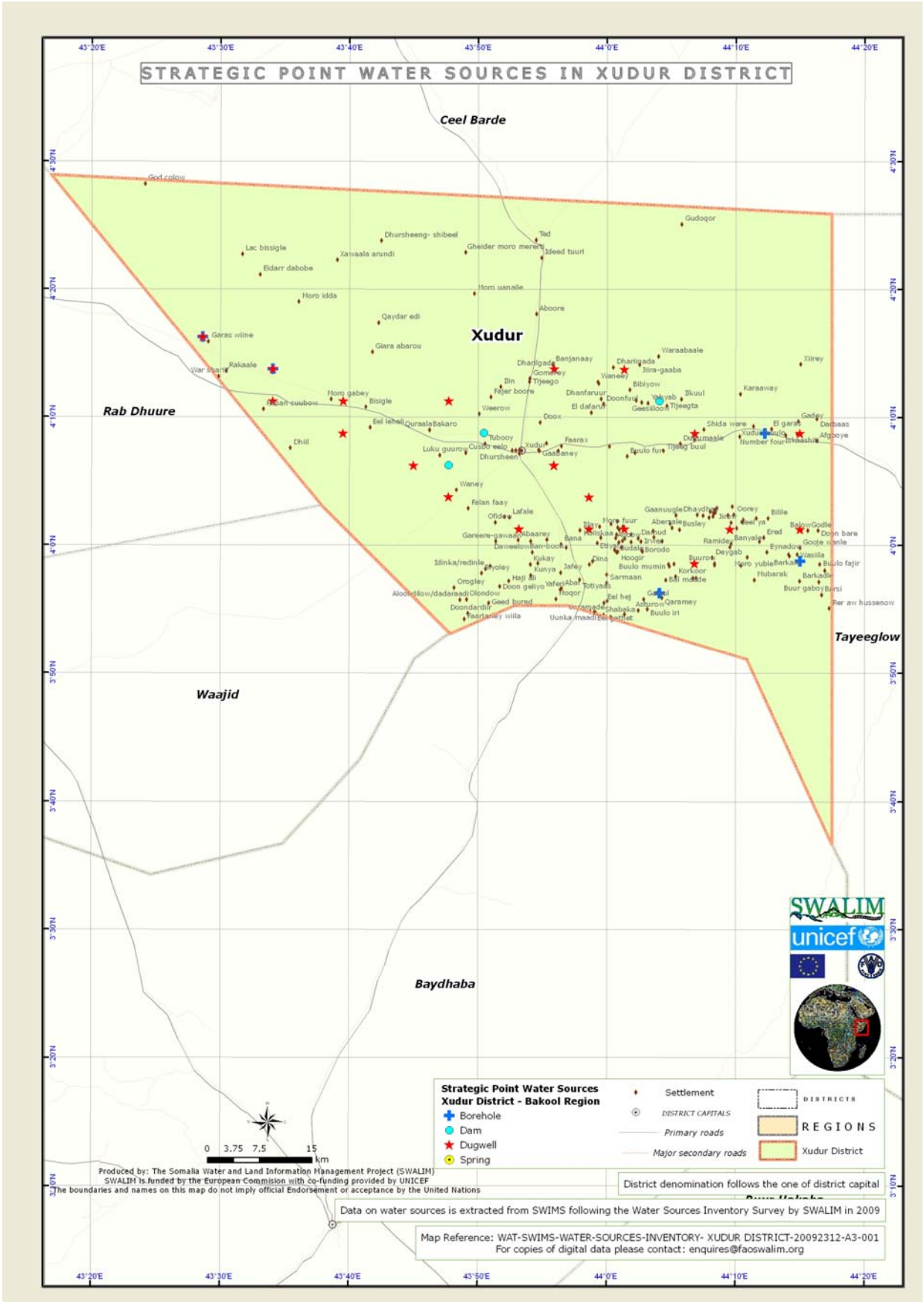
For copies of digital data please contact: enquires@faoswalim.org
SWALIM
unicef
42°30'E
42°40'E
42°50'E
43°0'E
3°10'N
3°0'N
2°50'N
2°40'N
2°30'N
2°20'N


STRATEGIC POINT WATER SOURCES IN XUDUR DISTRICT
Ceel Barde
Xudur
Rab Dhuure
Waajid
Baydhaba
Tayeeglow
Strategic Point Water Sources
Xudur District - Bakool Region
Borehole
Dam
Dugwell
Spring
Settlement
DISTRICT CAPITALS
Primary roads
Major secondary roads
DISTRICTS
REGIONS
Xudur District
SWALIM
unicef
0 3.75 7.5 15
km
Produced by: The Somalia Water and Land Information Management Project (SWALIM)
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District denomination follows the one of district capital
Data on water sources is extracted from SWIMS following the Water Sources Inventory Survey by SWALIM in 2009
Map Reference: WAT-SWIMS-WATER-SOURCES-INVENTORY- XUDUR DISTRICT-20092312-A3-001
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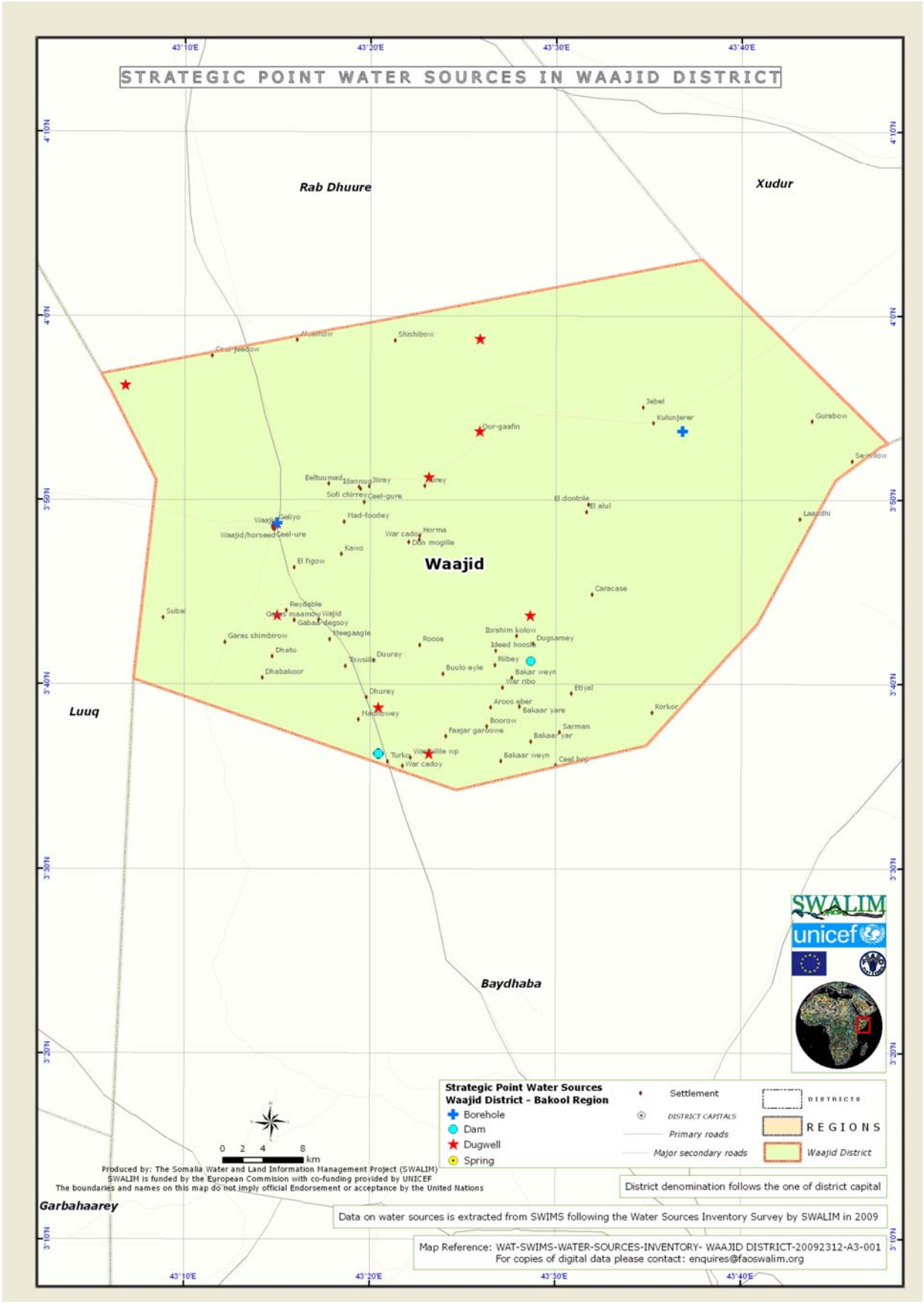
STRATEGIC POINT WATER SOURCES IN WAAJID DISTRICT
Rab Dhuure
Xudur
Waajid
Luuq
Baydhaba
Garbahaarey
Shishibow
Jebel
Kulunjerer
Gurabow
Oor-gaafin
Eeltuumad
Idannug
Hiray
Sofi chirrey
Ceel-gure
El dontole
El alul
Laasidhi
Waajid/horseed
Ceel-ure
Mad-foodey
War cadoy
Horma
Dan mogille
Kawro
El figow
Caracase
Subai
Reydable
Gaas maamow
Wajid
Gabaa-degsoy
Meegaagle
Garas shimbirow
Roose
Ibrahim kolow
Dugsamey
Ideed hoosh
Dhato
Duuray
Towsile
Dhabakoor
Buulo eyle
Ribey
Bakar weyn
War ribo
Dhurey
Etiyal
Aroos eber
Bakaar yare
Korkor
Madhowey
Boorow
Sarman
Bakaar yar
Raajar garoowe
Turko
War cadoy
Bakaar weyn
Ceel hoyo
SWALIM
unicef
Strategic Point Water Sources
Waajid District - Bakool Region
Borehole
Dam
Dugwell
Spring
Settlement
DISTRICT CAPITALS
Primary roads
Major secondary roads
DISTRICTS
REGIONS
Waajid District
0 2 4 8
km
Produced by: The Somalia Water and Land Information Management Project (SWALIM)
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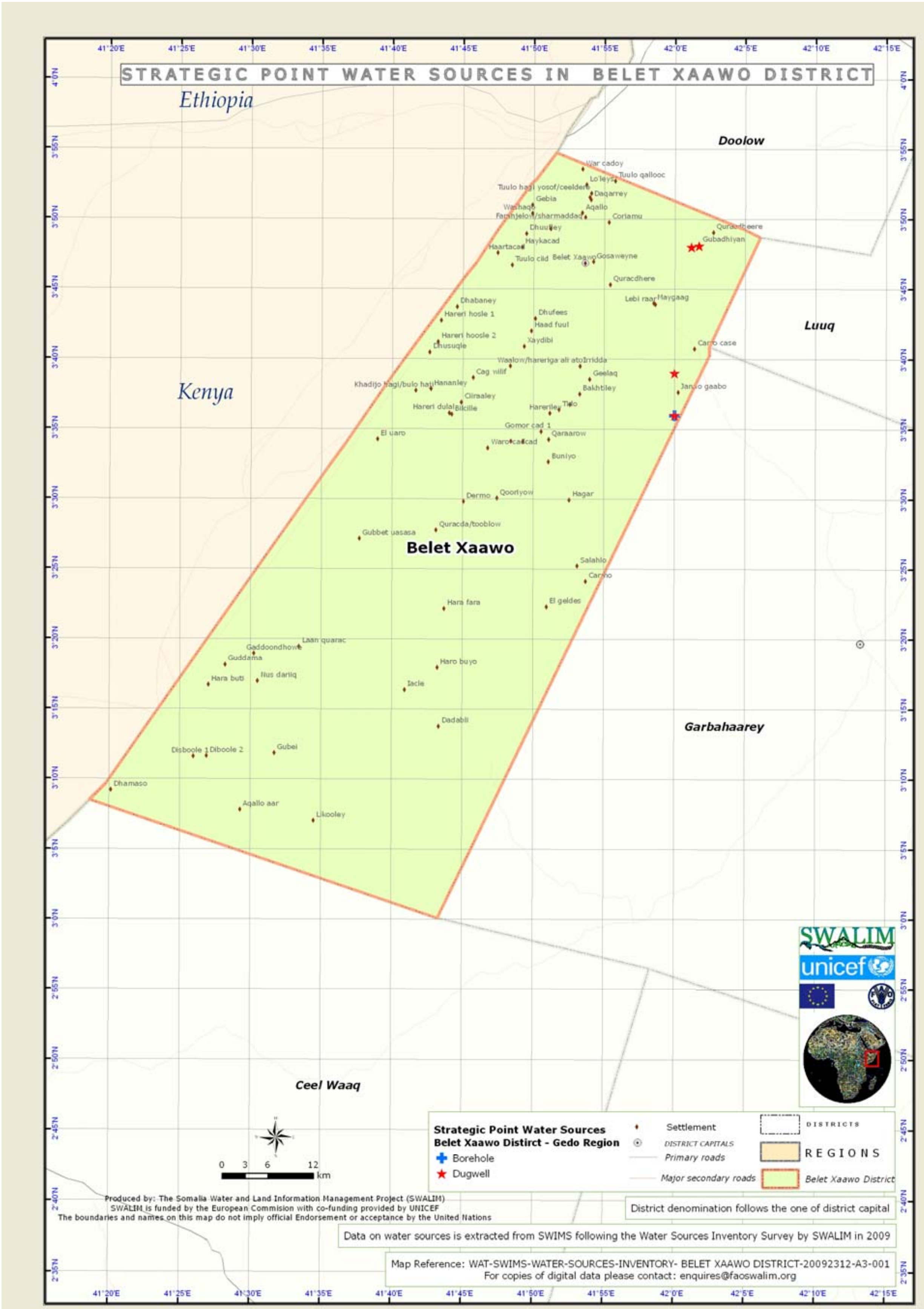
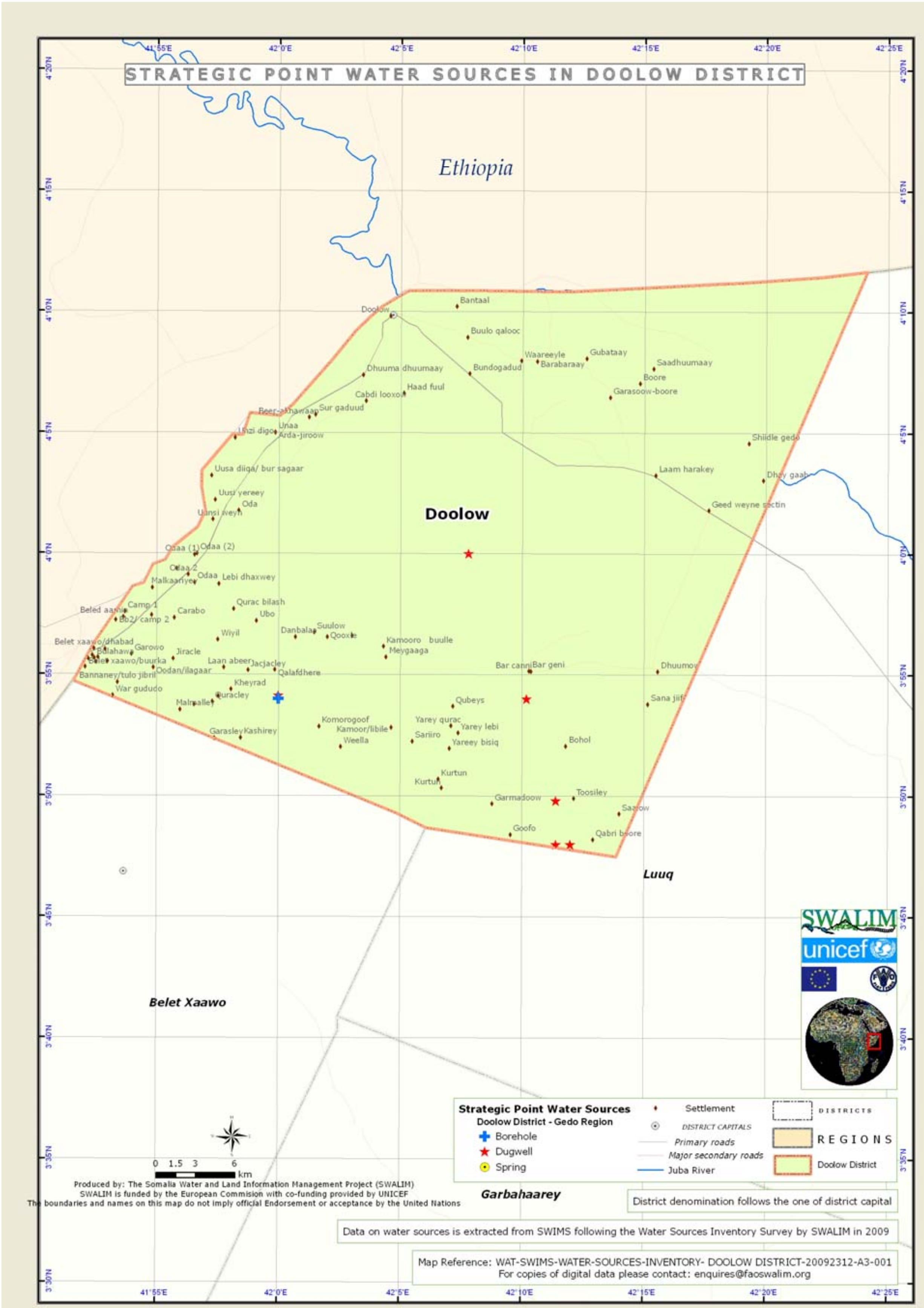
Data on water sources is extracted from SWIMS following the Water Sources Inventory Survey by SWALIM in 2009
Map Reference: WAT-SWIMS-WATER-SOURCES-INVENTORY- WAAJID DISTRICT-20092312-A3-001
For copies of digital data please contact: enquires@faoswalim.org
43°10'E
43°20'E
43°30'E
43°40'E
4°10'N
4°0'N
3°50'N
3°40'N
3°30'N
3°20'N
3°10'N


STRATEGIC POINT WATER SOURCES IN BELET XAAWO DISTRICT
Ethiopia
Kenya
Doolow
Luuq
Garbahaarey
Ceel Waaq
Belet Xaawo
SWALIM
unicef
Strategic Point Water Sources
Belet Xaawo Distirct - Gedo Region
Borehole
Dugwell
Settlement
DISTRICT CAPITALS
Primary roads
Major secondary roads
DISTRICTS
REGIONS
Belet Xaawo District
0 3 6 12 km
Produced by: The Somalia Water and Land Information Management Project (SWALIM)
SWALIM is funded by the European Commision with co-funding provided by UNICEF
The boundaries and names on this map do not imply official Endorsement or acceptance by the United Nations
District denomination follows the one of district capital
Data on water sources is extracted from SWIMS following the Water Sources Inventory Survey by SWALIM in 2009
Map Reference: WAT-SWIMS-WATER-SOURCES-INVENTORY- BELET XAAWO DISTRICT-20092312-A3-001
For copies of digital data please contact: enquires@faoswalim.org


STRATEGIC POINT WATER SOURCES IN DOOLOW DISTRICT
Ethiopia
Doolow
Luuq
Belet Xaawo
Garbahaarey
Strategic Point Water Sources
Doolow District - Gedo Region
Borehole
Dugwell
Spring
Settlement
DISTRICT CAPITALS
Primary roads
Major secondary roads
Juba River
DISTRICTS
REGIONS
Doolow District
0 1.5 3 6 km
Produced by: The Somalia Water and Land Information Management Project (SWALIM)
SWALIM is funded by the European Commision with co-funding provided by UNICEF
The boundaries and names on this map do not imply official Endorsement or acceptance by the United Nations
District denomination follows the one of district capital
Data on water sources is extracted from SWIMS following the Water Sources Inventory Survey by SWALIM in 2009
Map Reference: WAT-SWIMS-WATER-SOURCES-INVENTORY- DOOLOW DISTRICT-20092312-A3-001
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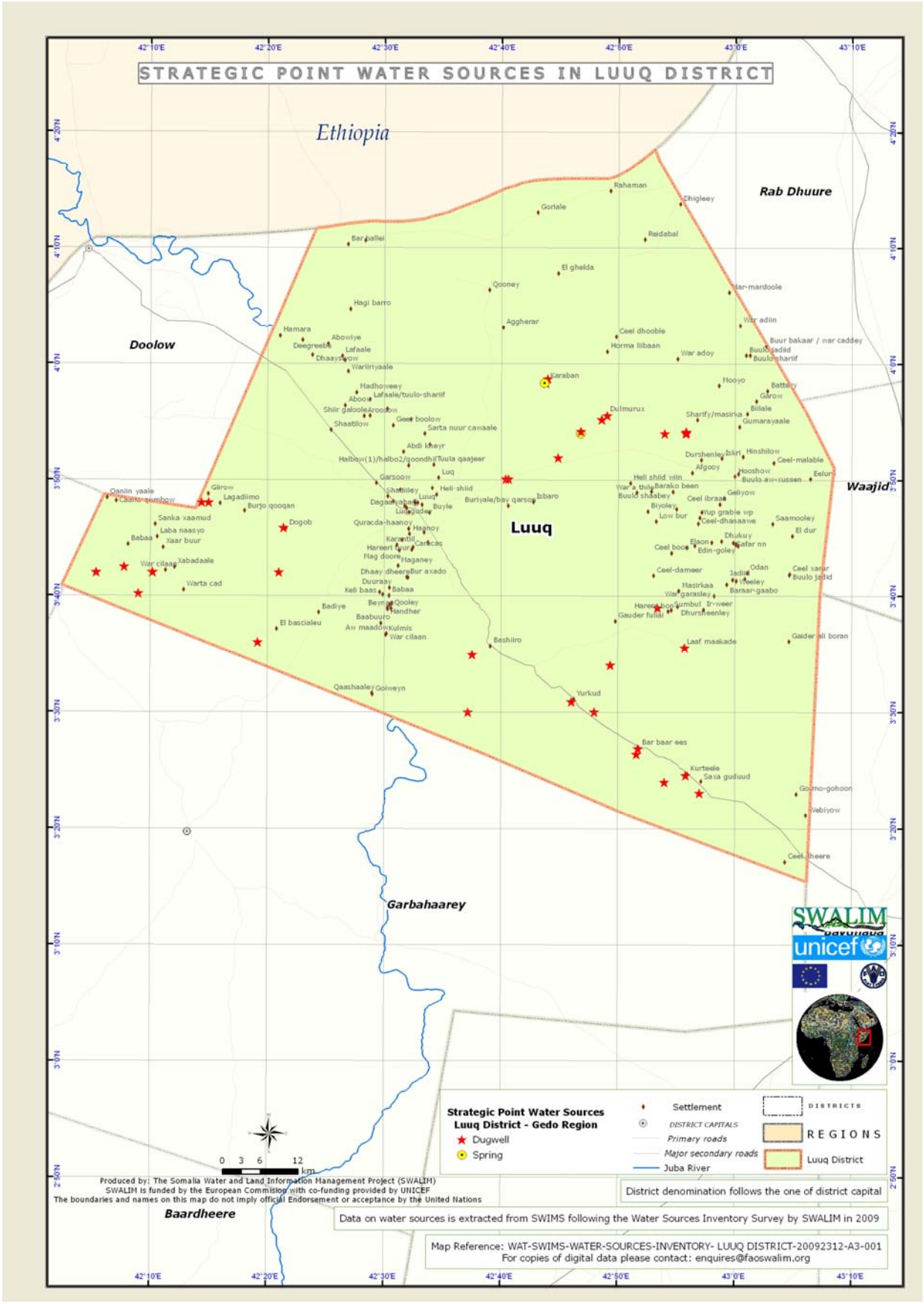
SWALIM
unicef


STRATEGIC POINT WATER SOURCES IN LUUQ DISTRICT
Ethiopia
Rab Dhuure
Doolow
Waajid
Luuq
Garbahaarey
Baardheere
Strategic Point Water Sources
Luuq District - Gedo Region
Dugwell
Spring
Settlement
DISTRICT CAPITALS
Primary roads
Major secondary roads
Juba River
DISTRICTS
REGIONS
Luuq District
0 3 6 12 km
Produced by: The Somalia Water and Land Information Management Project (SWALIM)
SWALIM is funded by the European Commission with co-funding provided by UNICEF
The boundaries and names on this map do not imply official Endorsement or acceptance by the United Nations
District denomination follows the one of district capital
Data on water sources is extracted from SWIMS following the Water Sources Inventory Survey by SWALIM in 2009
Map Reference: WAT-SWIMS-WATER-SOURCES-INVENTORY- LUUQ DISTRICT-20092312-A3-001
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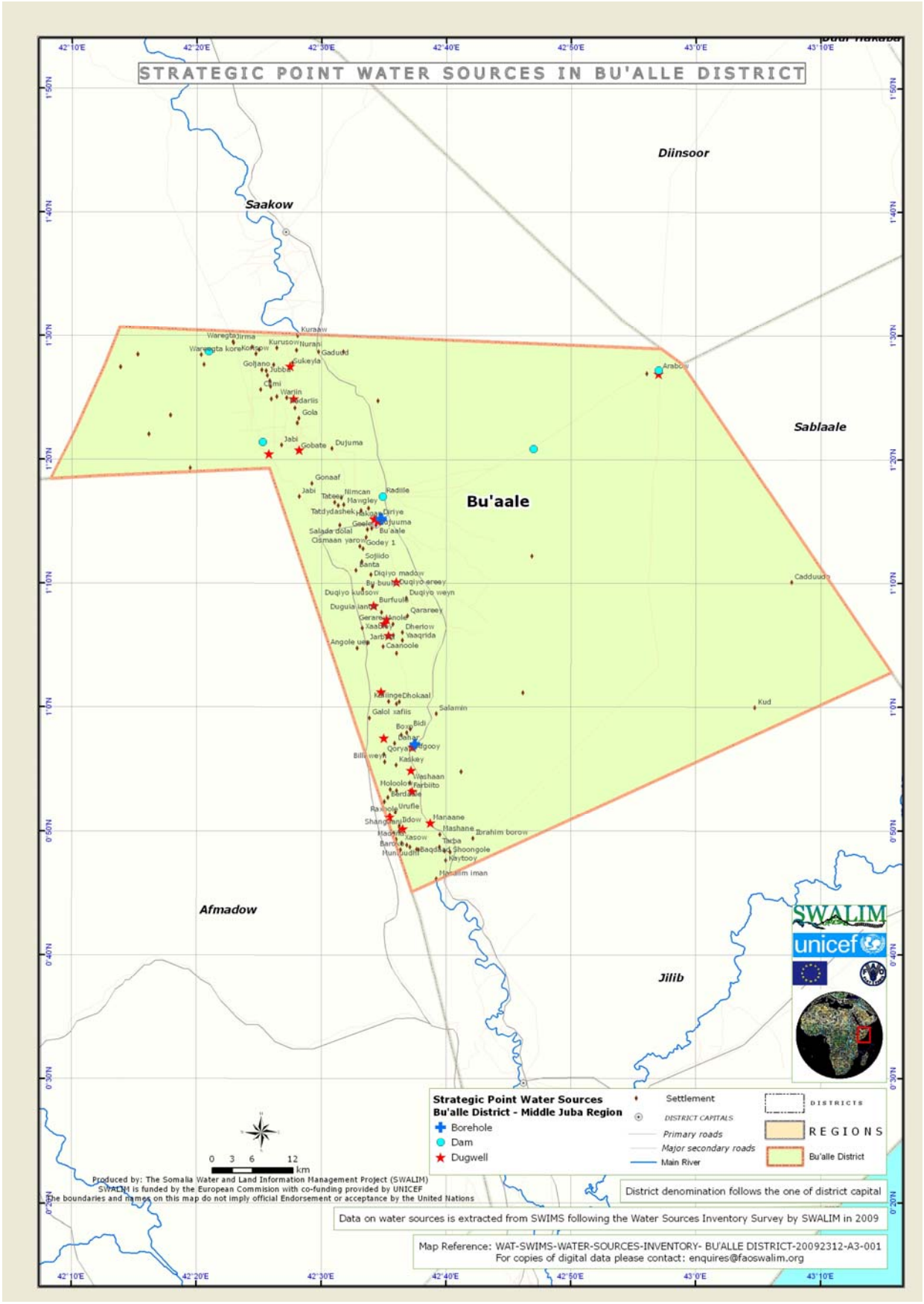
STRATEGIC POINT WATER SOURCES IN BU'ALLE DISTRICT
Diinsoor
Saakow
Sablaale
Bu'aale
Afmadow
Jilib
Strategic Point Water Sources
Bu'alle District - Middle Juba Region
Borehole
Dam
Dugwell
Settlement
DISTRICT CAPITALS
Primary roads
Major secondary roads
Main River
DISTRICTS
REGIONS
Bu'alle District
0 3 6 12
km
Produced by: The Somalia Water and Land Information Management Project (SWALIM)
SWALIM is funded by the European Commision with co-funding provided by UNICEF
The boundaries and names on this map do not imply official Endorsement or acceptance by the United Nations
District denomination follows the one of district capital
Data on water sources is extracted from SWIMS following the Water Sources Inventory Survey by SWALIM in 2009
Map Reference: WAT-SWIMS-WATER-SOURCES-INVENTORY- BU'ALLE DISTRICT-20092312-A3-001
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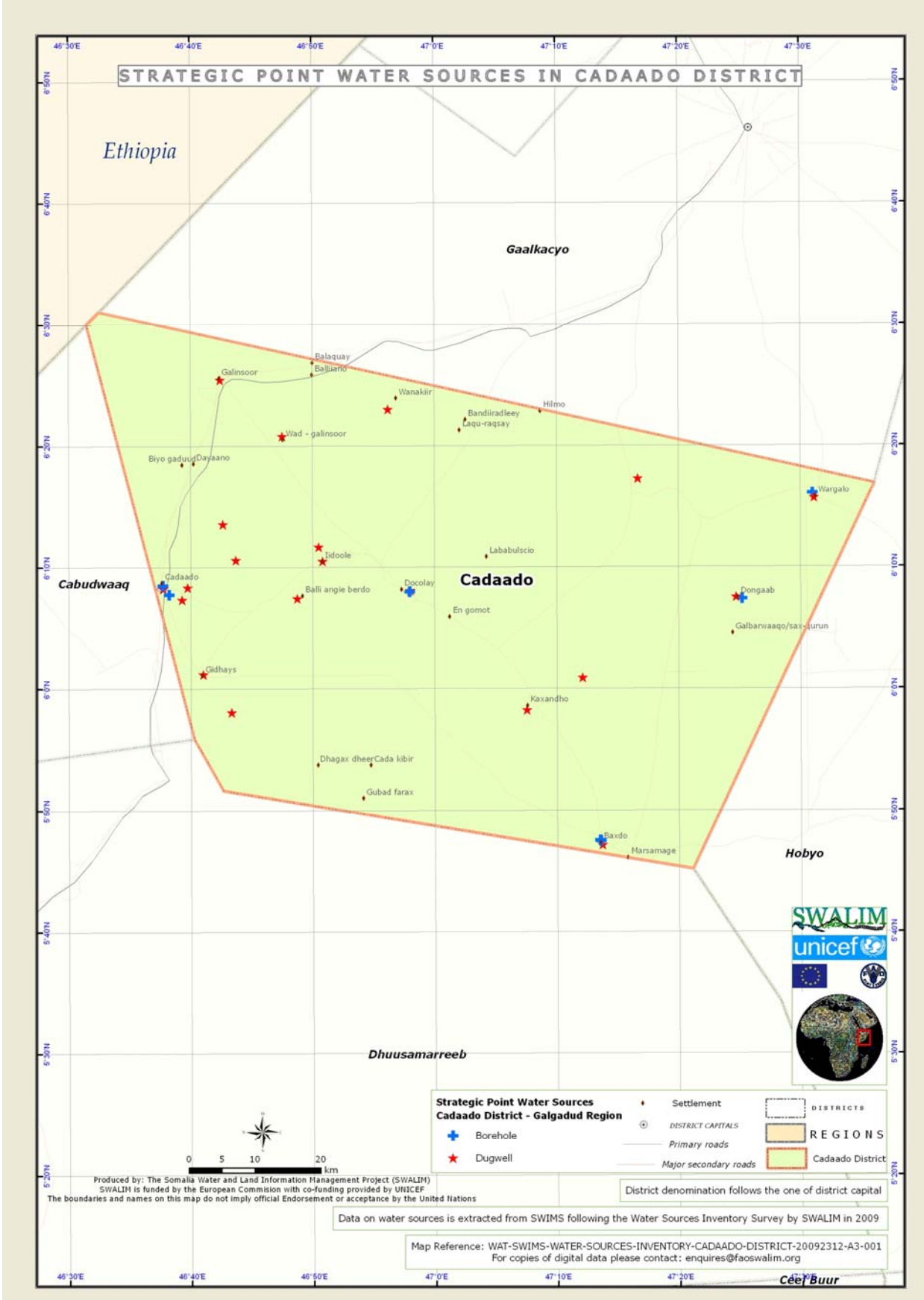
SWALIM
unicef


STRATEGIC POINT WATER SOURCES IN CADAADO DISTRICT
Ethiopia
Gaalkacyo
Cabudwaaq
Cadaado
Hobyo
Dhuusamarreeb
Cee' Buur
Balaquay
Balliano
Galinsoor
Wanaklir
Hilmo
Bandiiradleey
Laqu-raqsay
Wad - galinsoor
Biyo gaduud
Dayaano
Wargalo
Tidoole
Lababulscio
Cadaado
Balli angie berdo
Docolay
Dongaab
En gomot
Galbarwaaqo/sax-turun
Gidhays
Kaxandho
Dhagax dheerCada kibir
Gubad farax
Baxdo
Marsamage
46°30'E
46°40'E
46°50'E
47°0'E
47°10'E
47°20'E
47°30'E
6°50'N
6°40'N
6°30'N
6°20'N
6°10'N
6°0'N
5°50'N
5°40'N
5°30'N
5°20'N
Strategic Point Water Sources
Cadaado District - Galgadud Region
Borehole
Dugwell
Settlement
DISTRICT CAPITALS
Primary roads
Major secondary roads
DISTRICTS
REGIONS
Cadaado District
0 5 10 20
km
Produced by: The Somalia Water and Land Information Management Project (SWALIM)
SWALIM is funded by the European Commision with co-funding provided by UNICEF
The boundaries and names on this map do not imply official Endorsement or acceptance by the United Nations
District denomination follows the one of district capital
Data on water sources is extracted from SWIMS following the Water Sources Inventory Survey by SWALIM in 2009
Map Reference: WAT-SWIMS-WATER-SOURCES-INVENTORY-CADAADO-DISTRICT-20092312-A3-001
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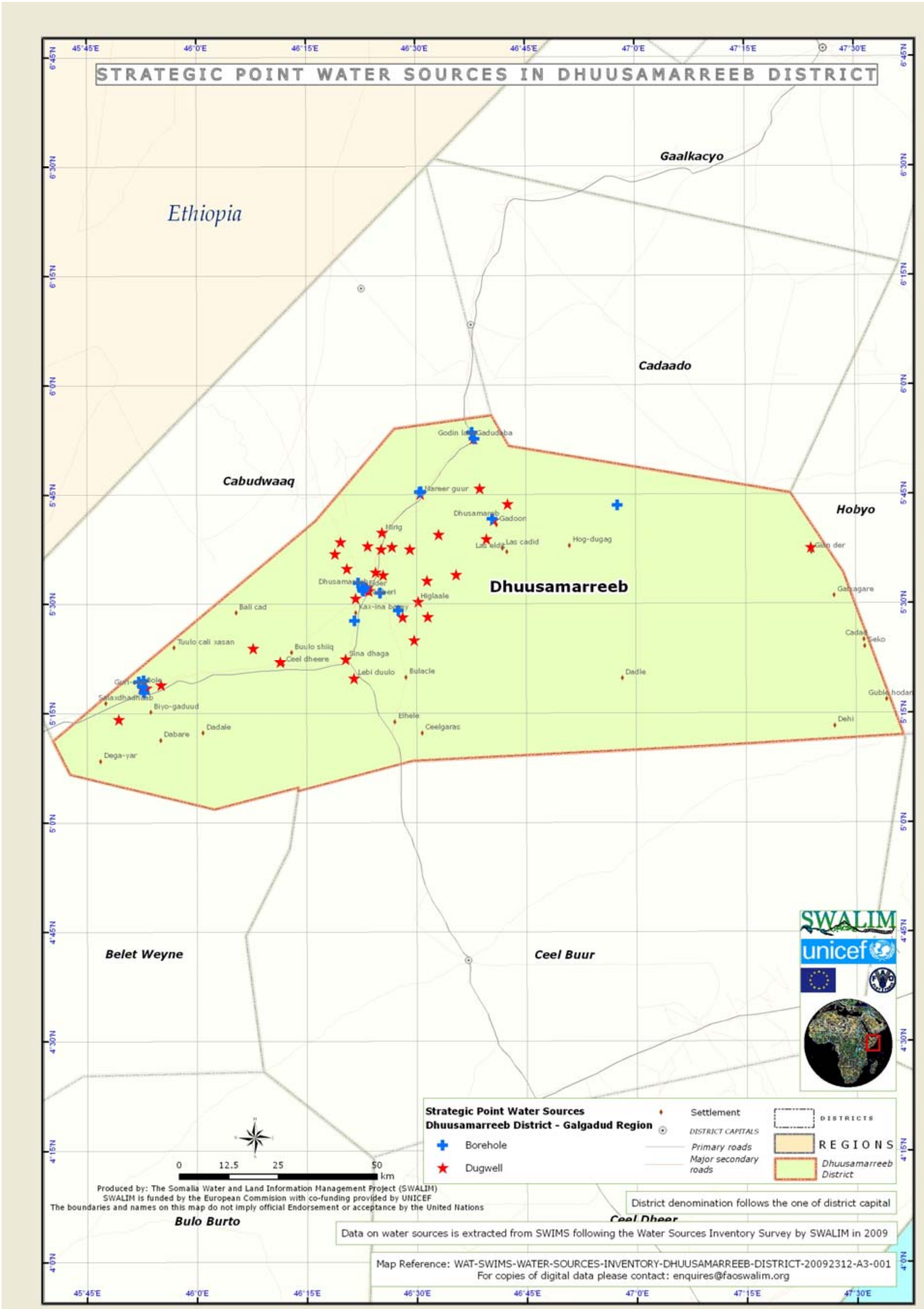
unicef


STRATEGIC POINT WATER SOURCES IN DHUUSAMARREEB DISTRICT
Ethiopia
Gaalkacyo
Cadaado
Cabudwaaq
Hobyo
Dhuusamarreeb
Belet Weyne
Ceel Buur
Bulo Burto
Ceel Dheer
Strategic Point Water Sources
Dhuusamarreeb District - Galgadud Region
Borehole
Dugwell
Settlement
DISTRICT CAPITALS
Primary roads
Major secondary roads
DISTRICTS
REGIONS
Dhuusamarreeb District
0 12.5 25 50 km
Produced by: The Somalia Water and Land Information Management Project (SWALIM)
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District denomination follows the one of district capital
Data on water sources is extracted from SWIMS following the Water Sources Inventory Survey by SWALIM in 2009
Map Reference: WAT-SWIMS-WATER-SOURCES-INVENTORY-DHUUSAMARREEB-DISTRICT-20092312-A3-001
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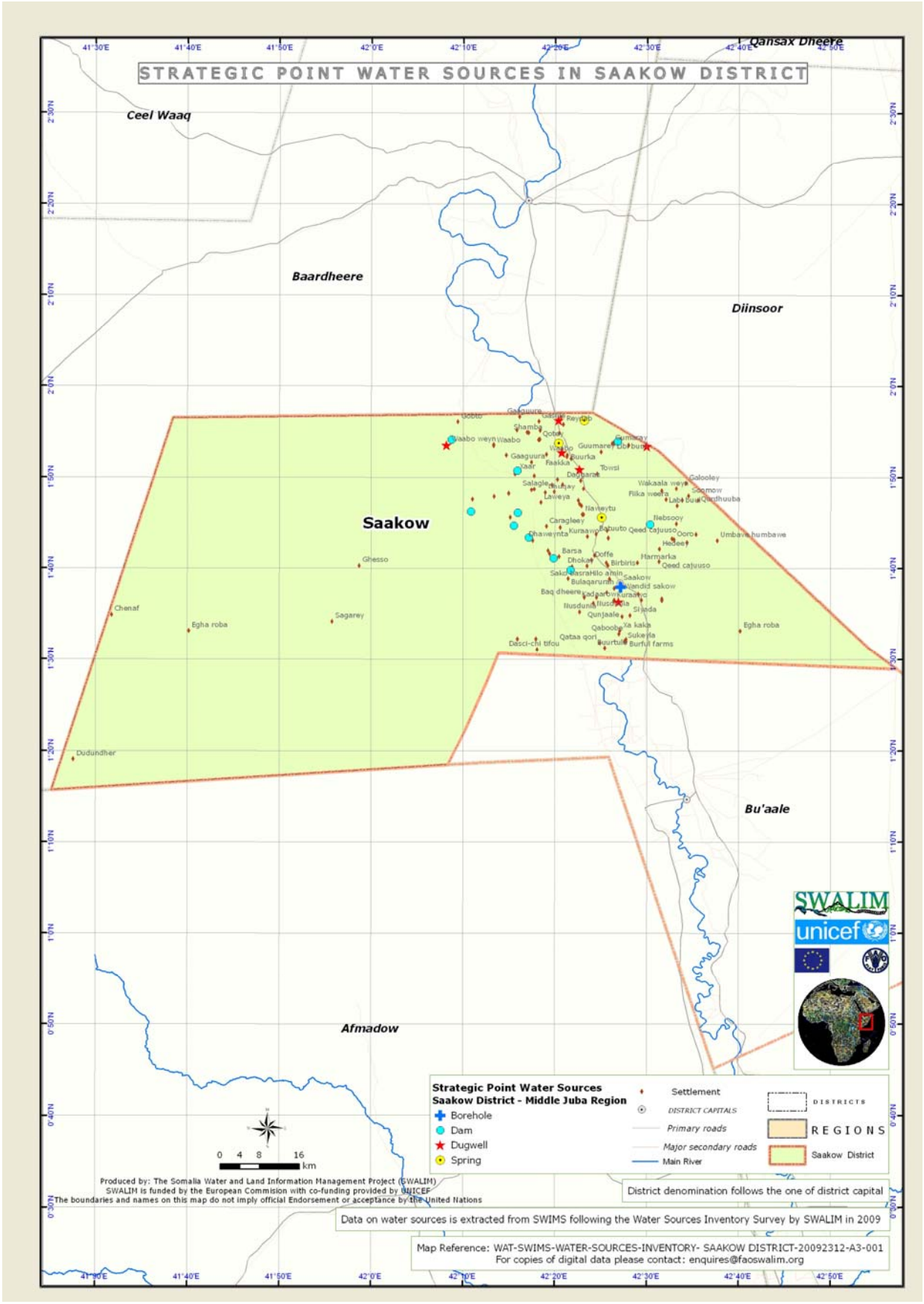
STRATEGIC POINT WATER SOURCES IN SAAKOW DISTRICT
Ceel Waaq
Qansax Dheere
Baardheere
Diinsoor
Saakow
Bu'aale
Afmadow
Ghesso
Chenaf
Egha roba
Sagarey
Dudundher
Strategic Point Water Sources
Saakow District - Middle Juba Region
Borehole
Dam
Dugwell
Spring
Settlement
DISTRICT CAPITALS
Primary roads
Major secondary roads
Main River
DISTRICTS
REGIONS
Saakow District
0 4 8 16
km
Produced by: The Somalia Water and Land Information Management Project (SWALIM)
SWALIM is funded by the European Commision with co-funding provided by UNICEF
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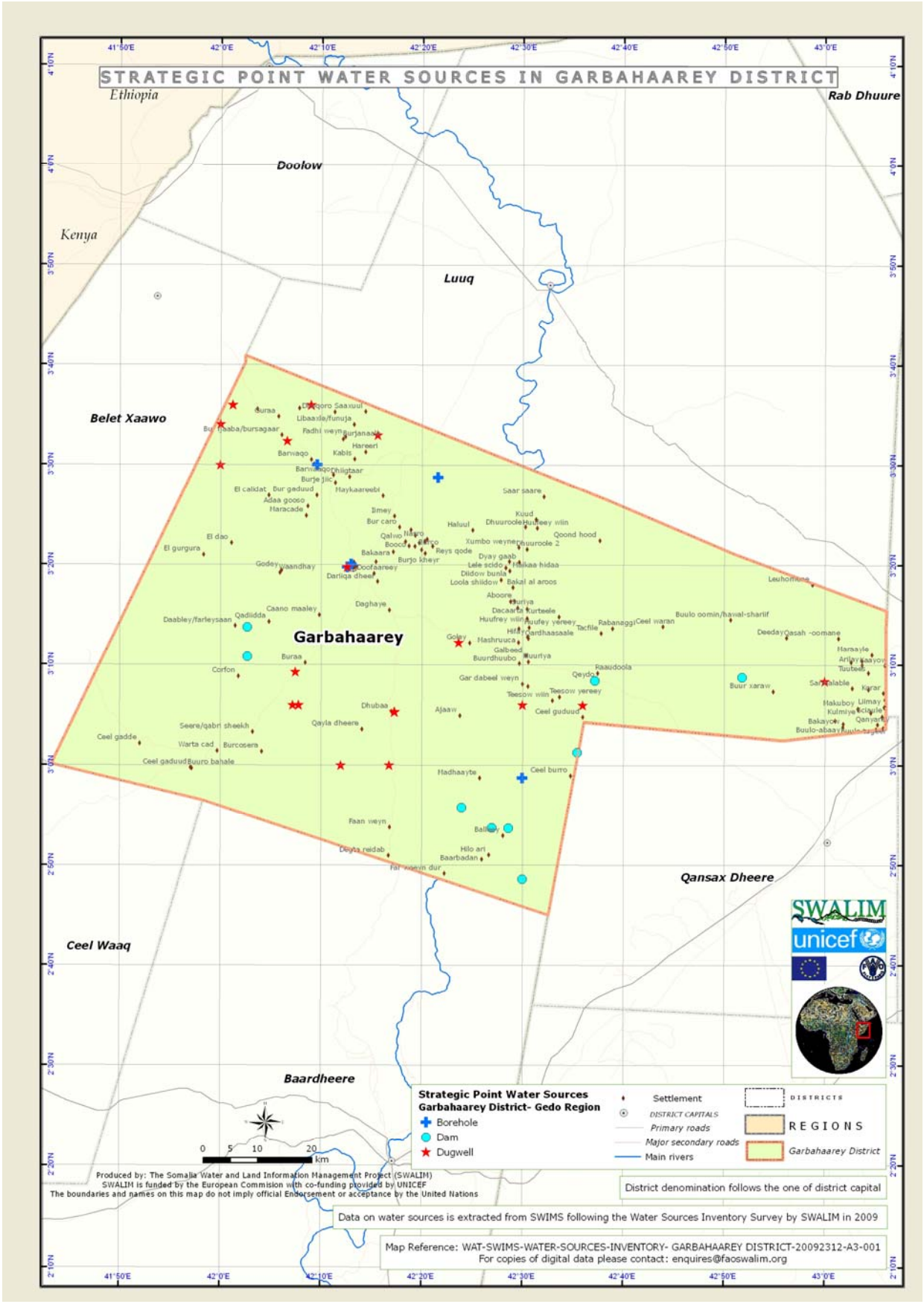
District denomination follows the one of district capital
Data on water sources is extracted from SWIMS following the Water Sources Inventory Survey by SWALIM in 2009
Map Reference: WAT-SWIMS-WATER-SOURCES-INVENTORY- SAAKOW DISTRICT-20092312-A3-001
For copies of digital data please contact: enquires@faoswalim.org
SWALIM
unicef


STRATEGIC POINT WATER SOURCES IN GARBAHAAREY DISTRICT
Ethiopia
Kenya
Rab Dhuure
Doolow
Luuq
Belet Xaawo
Garbahaarey
Qansax Dheere
Ceel Waaq
Baardheere
Strategic Point Water Sources
Garbahaarey District- Gedo Region
Borehole
Dam
Dugwell
Settlement
DISTRICT CAPITALS
Primary roads
Major secondary roads
Main rivers
DISTRICTS
REGIONS
Garbahaarey District
0 5 10 20
km
Produced by: The Somalia Water and Land Information Management Project (SWALIM)
SWALIM is funded by the European Commision with co-funding provided by UNICEF
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District denomination follows the one of district capital
Data on water sources is extracted from SWIMS following the Water Sources Inventory Survey by SWALIM in 2009
Map Reference: WAT-SWIMS-WATER-SOURCES-INVENTORY- GARBAHAAREY DISTRICT-20092312-A3-001
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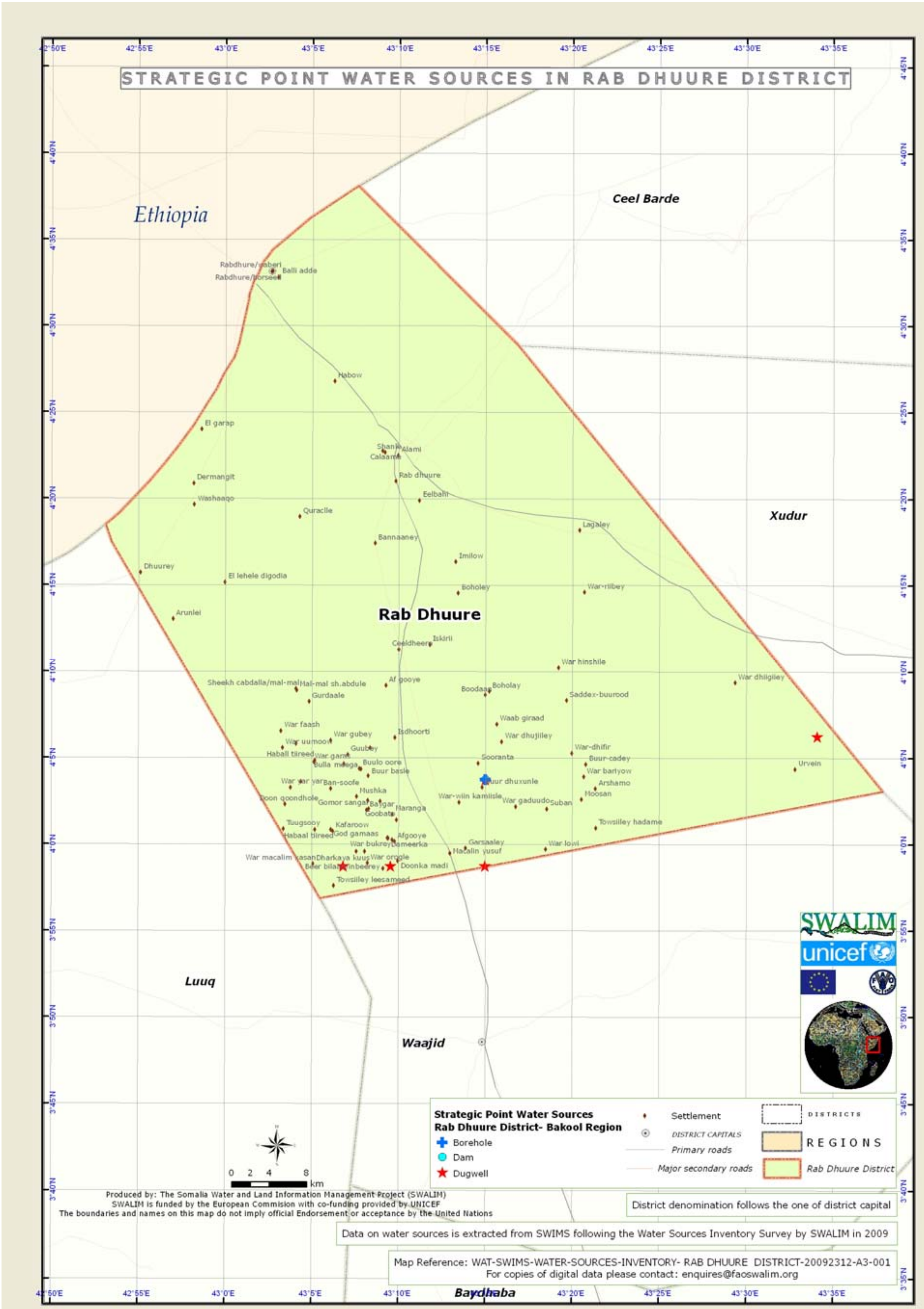
STRATEGIC POINT WATER SOURCES IN RAB DHUURE DISTRICT
Ethiopia
Ceel Barde
Xudur
Rab Dhuure
Luuq
Waajid
Baydhaba
Strategic Point Water Sources
Rab Dhuure District- Bakool Region
Borehole
Dam
Dugwell
Settlement
DISTRICT CAPITALS
Primary roads
Major secondary roads
DISTRICTS
REGIONS
Rab Dhuure District
0 2 4 8 km
Produced by: The Somalia Water and Land Information Management Project (SWALIM)
SWALIM is funded by the European Commision with co-funding provided by UNICEF
The boundaries and names on this map do not imply official Endorsement or acceptance by the United Nations
District denomination follows the one of district capital
Data on water sources is extracted from SWIMS following the Water Sources Inventory Survey by SWALIM in 2009
Map Reference: WAT-SWIMS-WATER-SOURCES-INVENTORY- RAB DHUURE DISTRICT-20092312-A3-001
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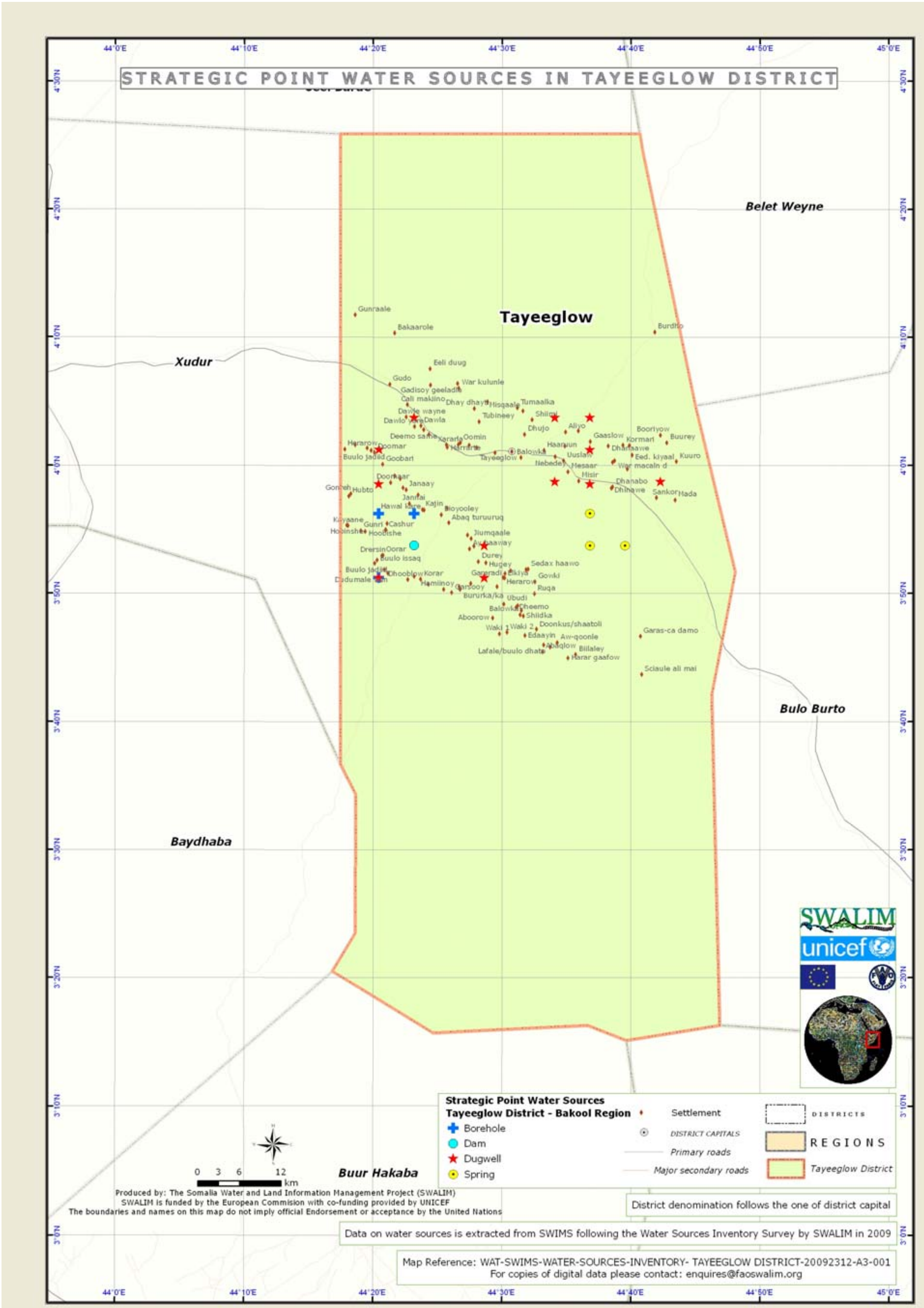
STRATEGIC POINT WATER SOURCES IN TAYEEGLOW DISTRICT
Tayeeglow
Xudur
Belet Weyne
Bulo Burto
Baydhaba
Buur Hakaba
SWALIM
unicef
Strategic Point Water Sources
Tayeeglow District - Bakool Region
Borehole
Dam
Dugwell
Spring
Settlement
DISTRICT CAPITALS
Primary roads
Major secondary roads
DISTRICTS
REGIONS
Tayeeglow District
0 3 6 12 km
Produced by: The Somalia Water and Land Information Management Project (SWALIM)
SWALIM is funded by the European Commision with co-funding provided by UNICEF
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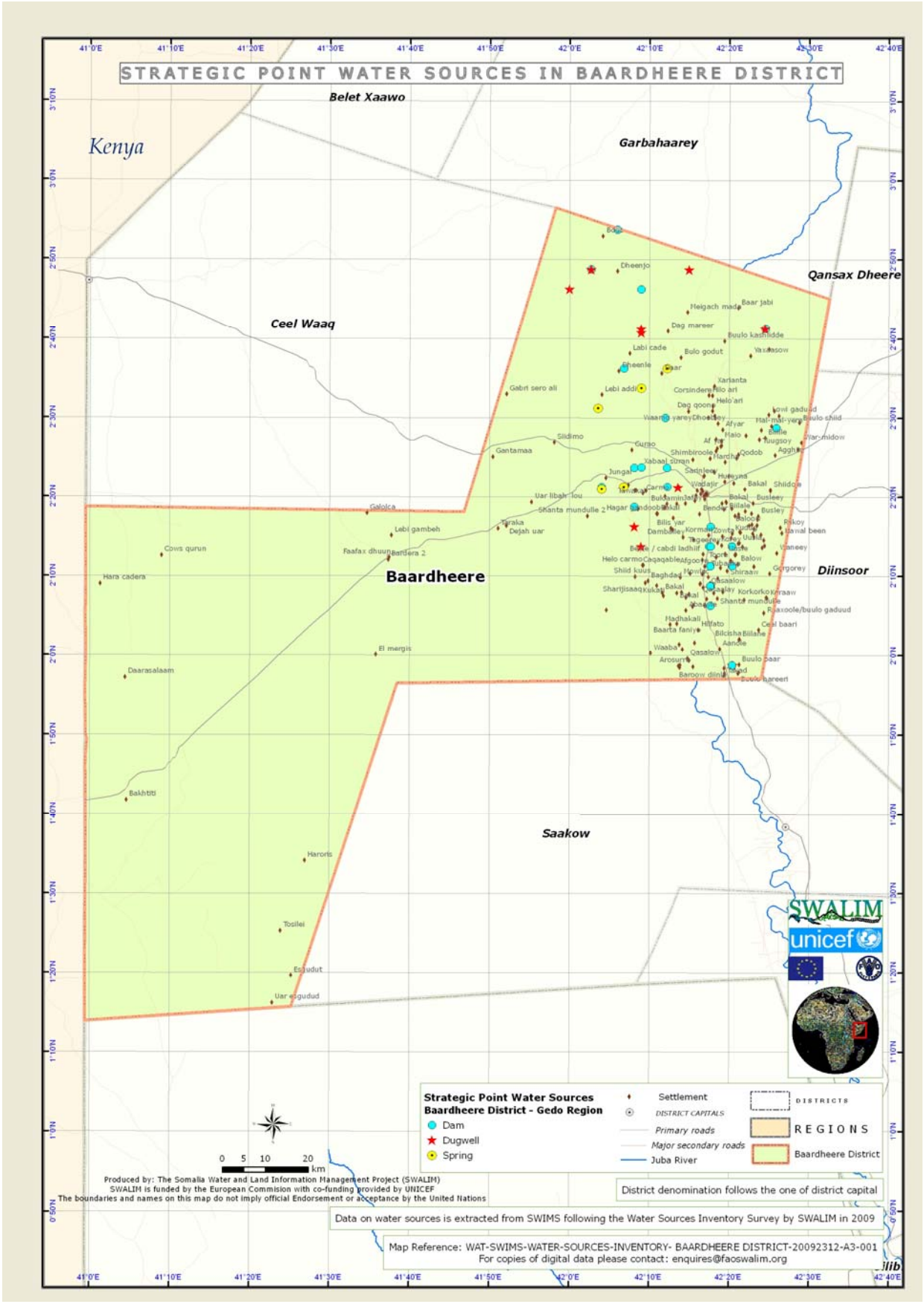
District denomination follows the one of district capital
Data on water sources is extracted from SWIMS following the Water Sources Inventory Survey by SWALIM in 2009
Map Reference: WAT-SWIMS-WATER-SOURCES-INVENTORY- TAYEEGLOW DISTRICT-20092312-A3-001
For copies of digital data please contact: enquires@faoswalim.org


STRATEGIC POINT WATER SOURCES IN BAARDHEERE DISTRICT
Belet Xaawo
Kenya
Garbahaarey
Qansax Dheere
Ceel Waaq
Baardheere
Diinsoor
Saakow
Strategic Point Water Sources
Baardheere District - Gedo Region
Dam
Dugwell
Spring
Settlement
DISTRICT CAPITALS
Primary roads
Major secondary roads
Juba River
DISTRICTS
REGIONS
Baardheere District
0 5 10 20
km
Produced by: The Somalia Water and Land Information Management Project (SWALIM)
SWALIM is funded by the European Commision with co-funding provided by UNICEF
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District denomination follows the one of district capital
Data on water sources is extracted from SWIMS following the Water Sources Inventory Survey by SWALIM in 2009
Map Reference: WAT-SWIMS-WATER-SOURCES-INVENTORY- BAARDHEERE DISTRICT-20092312-A3-001
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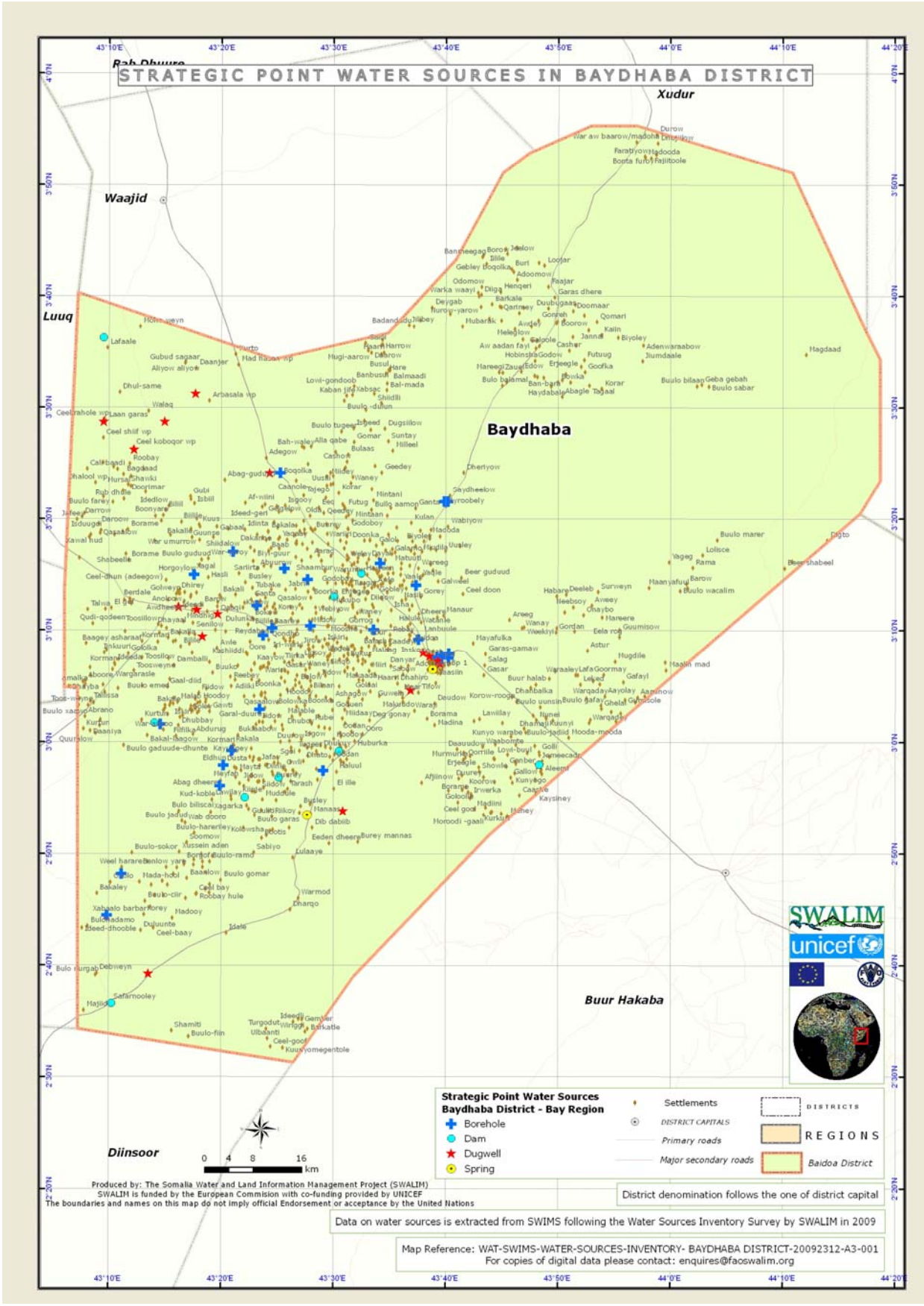
STRATEGIC POINT WATER SOURCES IN BAYDHABA DISTRICT
Xudur
Waajid
Luuq
Baydhaba
Buur Hakaba
Diinsoor
Strategic Point Water Sources
Baydhaba District - Bay Region
Borehole
Dam
Dugwell
Spring
Settlements
DISTRICT CAPITALS
Primary roads
Major secondary roads
DISTRICTS
REGIONS
Baidoa District
0 4 8 16
km
Produced by: The Somalia Water and Land Information Management Project (SWALIM)
SWALIM is funded by the European Commision with co-funding provided by UNICEF
The boundaries and names on this map do not imply official Endorsement or acceptance by the United Nations
District denomination follows the one of district capital
Data on water sources is extracted from SWIMS following the Water Sources Inventory Survey by SWALIM in 2009
Map Reference: WAT-SWIMS-WATER-SOURCES-INVENTORY- BAYDHABA DISTRICT-20092312-A3-001
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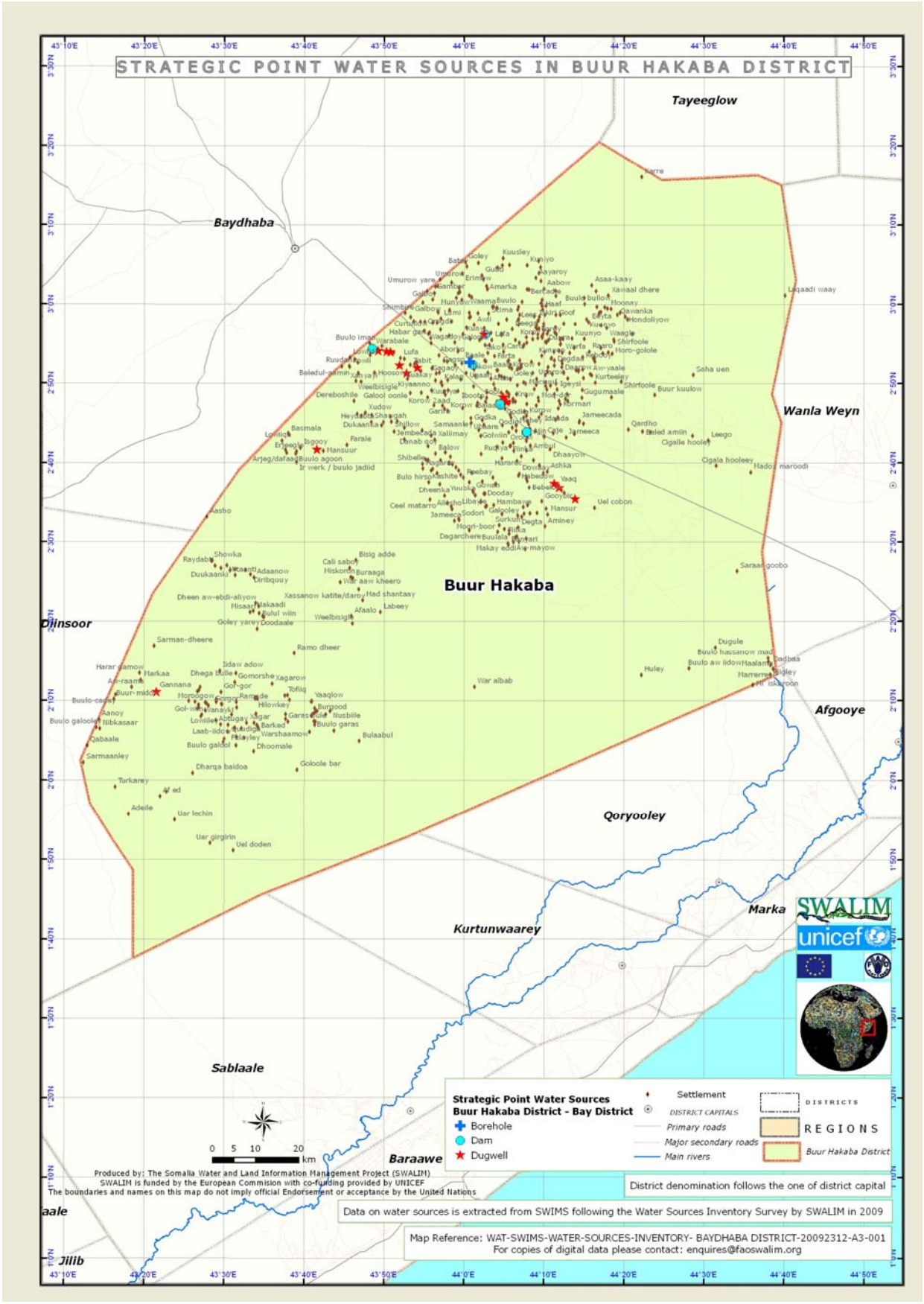
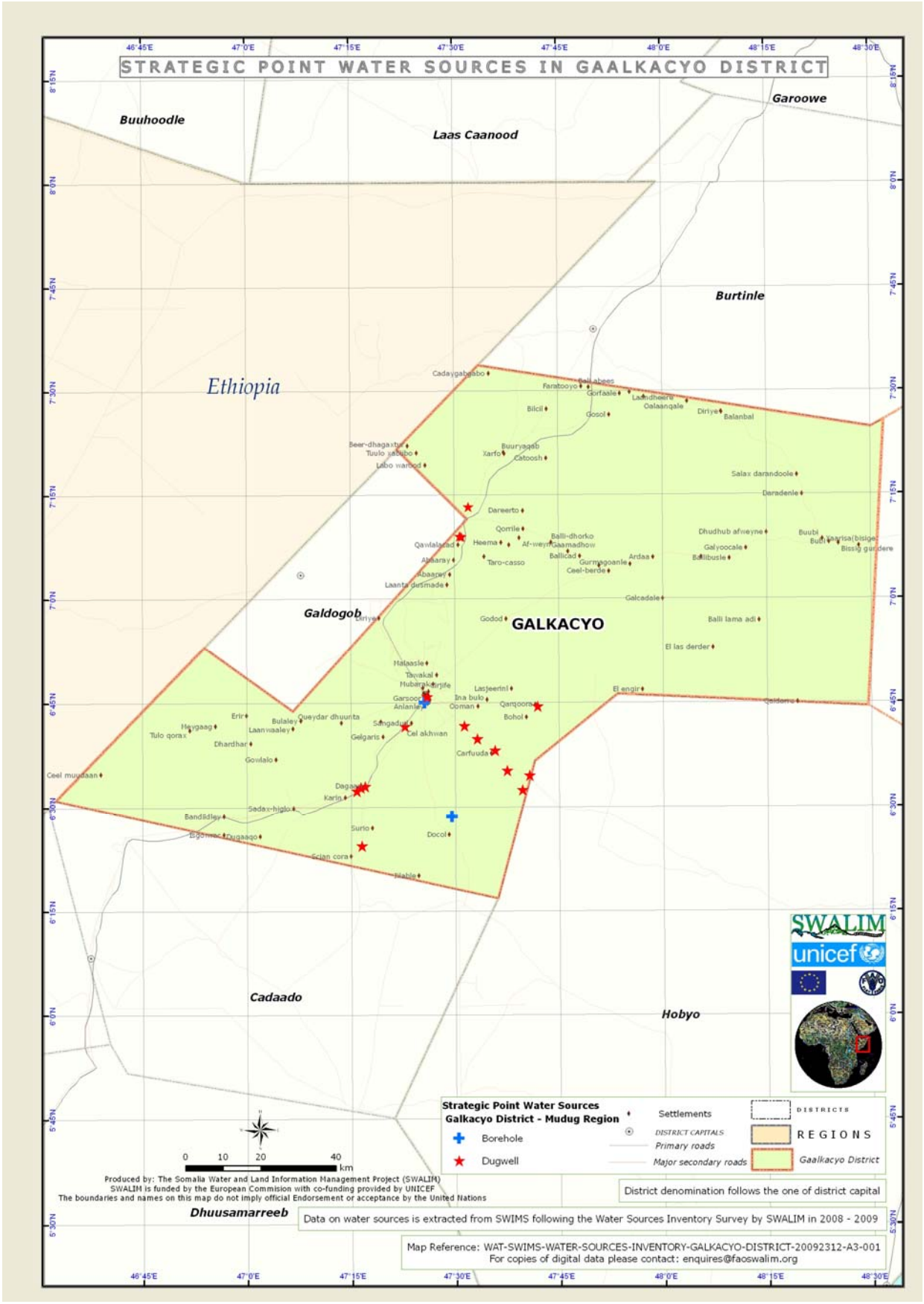
SWALIM
unicef


STRATEGIC POINT WATER SOURCES IN BUUR HAKABA DISTRICT
Tayeeglow
Baydhaba
Wanla Weyn
Buur Hakaba
Diinsoor
Afgooye
Qoryooley
Marka
Kurtunwaarey
Sablaale
Baraawe
Jilib
Strategic Point Water Sources
Buur Hakaba District - Bay District
Borehole
Dam
Dugwell
Settlement
DISTRICT CAPITALS
Primary roads
Major secondary roads
Main rivers
DISTRICTS
REGIONS
Buur Hakaba District
0 5 10 20 km
Produced by: The Somalia Water and Land Information Management Project (SWALIM)
SWALIM is funded by the European Commision with co-funding provided by UNICEF
The boundaries and names on this map do not imply official Endorsement or acceptance by the United Nations
District denomination follows the one of district capital
Data on water sources is extracted from SWIMS following the Water Sources Inventory Survey by SWALIM in 2009
Map Reference: WAT-SWIMS-WATER-SOURCES-INVENTORY- BAYDHABA DISTRICT-20092312-A3-001
For copies of digital data please contact: enquires@faoswalim.org
SWALIM
unicef


STRATEGIC POINT WATER SOURCES IN GAALKACYO DISTRICT
Buuhoodle
Laas Caanood
Garoowe
Burtinle
Ethiopia
Galdogob
GALKACYO
Cadaado
Hobyo
Dhuusamarreeb
Strategic Point Water Sources
Galkacyo District - Mudug Region
Borehole
Dugwell
Settlements
DISTRICT CAPITALS
Primary roads
Major secondary roads
DISTRICTS
REGIONS
Gaalkacyo District
0 10 20 40
km
Produced by: The Somalia Water and Land Information Management Project (SWALIM)
SWALIM is funded by the European Commision with co-funding provided by UNICEF
The boundaries and names on this map do not imply official Endorsement or acceptance by the United Nations
District denomination follows the one of district capital
Data on water sources is extracted from SWIMS following the Water Sources Inventory Survey by SWALIM in 2008 - 2009
Map Reference: WAT-SWIMS-WATER-SOURCES-INVENTORY-GALKACYO-DISTRICT-20092312-A3-001
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