Applications of the WPdx Decision Support Tools

Example: Analyzing wells in Kabarole, Uganda

About the WPdx Decision Support Tools app: The WPdx Decision Support Tools app is an interactive web app to view available water point data from the WPdx+ dataset and the results from our suite of decision-support tools.

Please note that the **WPdx+ dataset is focused on public water points** and does not currently include information on household connections or self-supply. **For these tools, we define 'rural pop with basic access' as populations within 1 km to a public improved functional water point.** The tools include:

- Administrative Region Analysis
- Rehabilitation Priority Analysis
- New Construction Priority Analysis
- Data Staleness Analysis
- Status Prediction Analysis (Beta)

WPdx Decision Support Tools

The mission of the Water Point Data Exchange (WPdx) platform is to unlock the potential of water point data to improve rural water services through evidence-based decision-making.

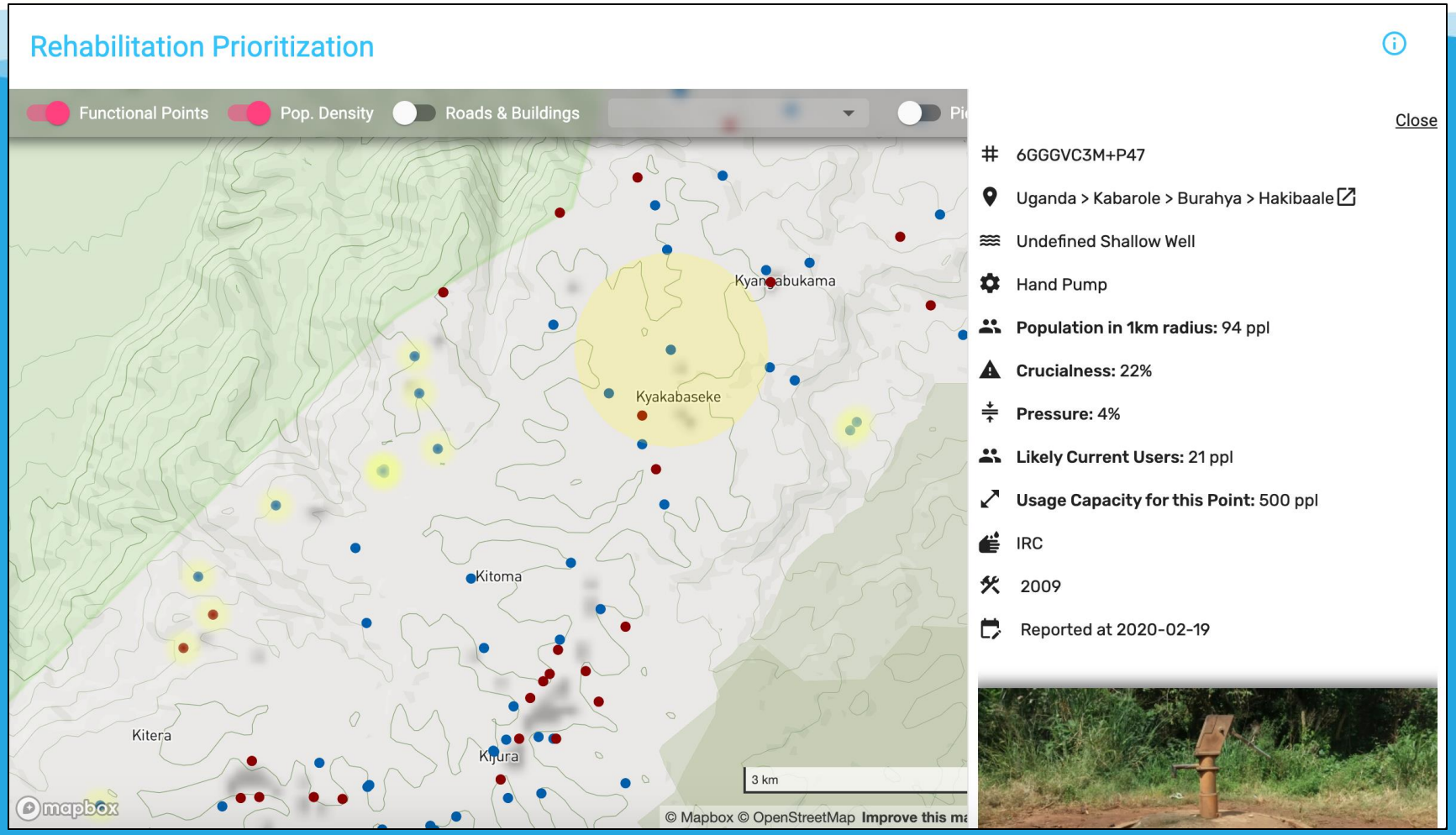
The **WPdx Decision Support Tools** interactive web app provides access to view available water point data from the WPdx+ dataset and the results from our suite of decision-support tools.

The tools include:

- Administrative Region Analysis
- Rehabilitation Priority Analysis
- New Construction Priority Analysis
- Data Staleness Analysis
- Functionality Status Prediction Analysis (expected Q1 2022)

For any of the four tools, click any of the water points on the map to view information about the point, such as the water source type, water technology type, any attached photos, population in 1km radius, installer, install date, and survey report date. Functional water points can be turned on or off to supplement understanding of current water availability. All information is taken from the WPdx+ open data repository and may be incomplete for some water records.

Use case: Explore available water point information



Decision Support Tool: View Water Points

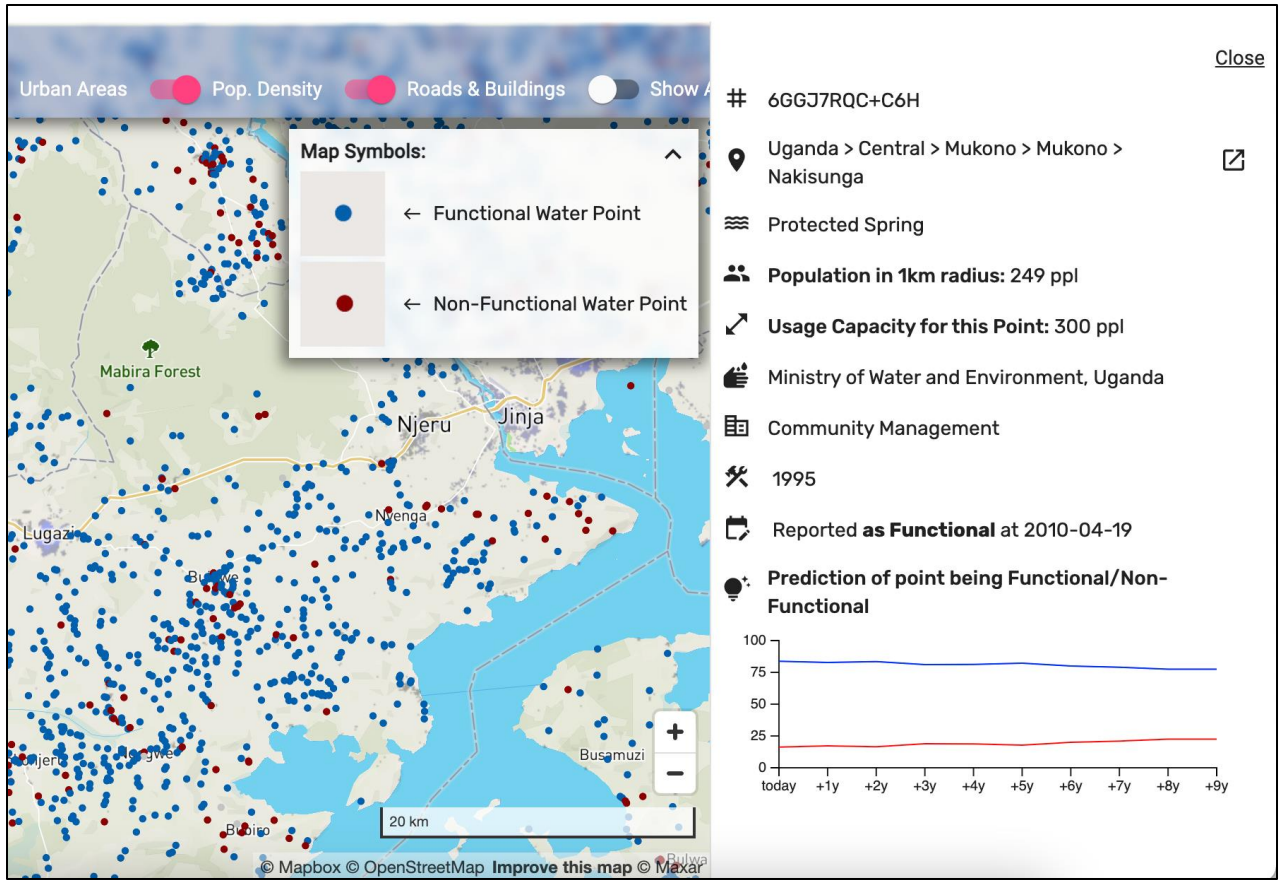
Use case: Explore available water point information

Click any of the water points on the map to view information about the point, such as:

- water source type
- water technology type
- photograph (when available)
- installer
- install date
- survey report date.

Functional water points can be turned on or off to supplement understanding of current water availability.

This feature is available within any of the tools when "Show Water Points" is selected. The current view uses the View Water Points Tool



*Please note that information is taken from the WPdx+ open data repository and may be incomplete for some water records.

Decision Support Tool: Filter By Region

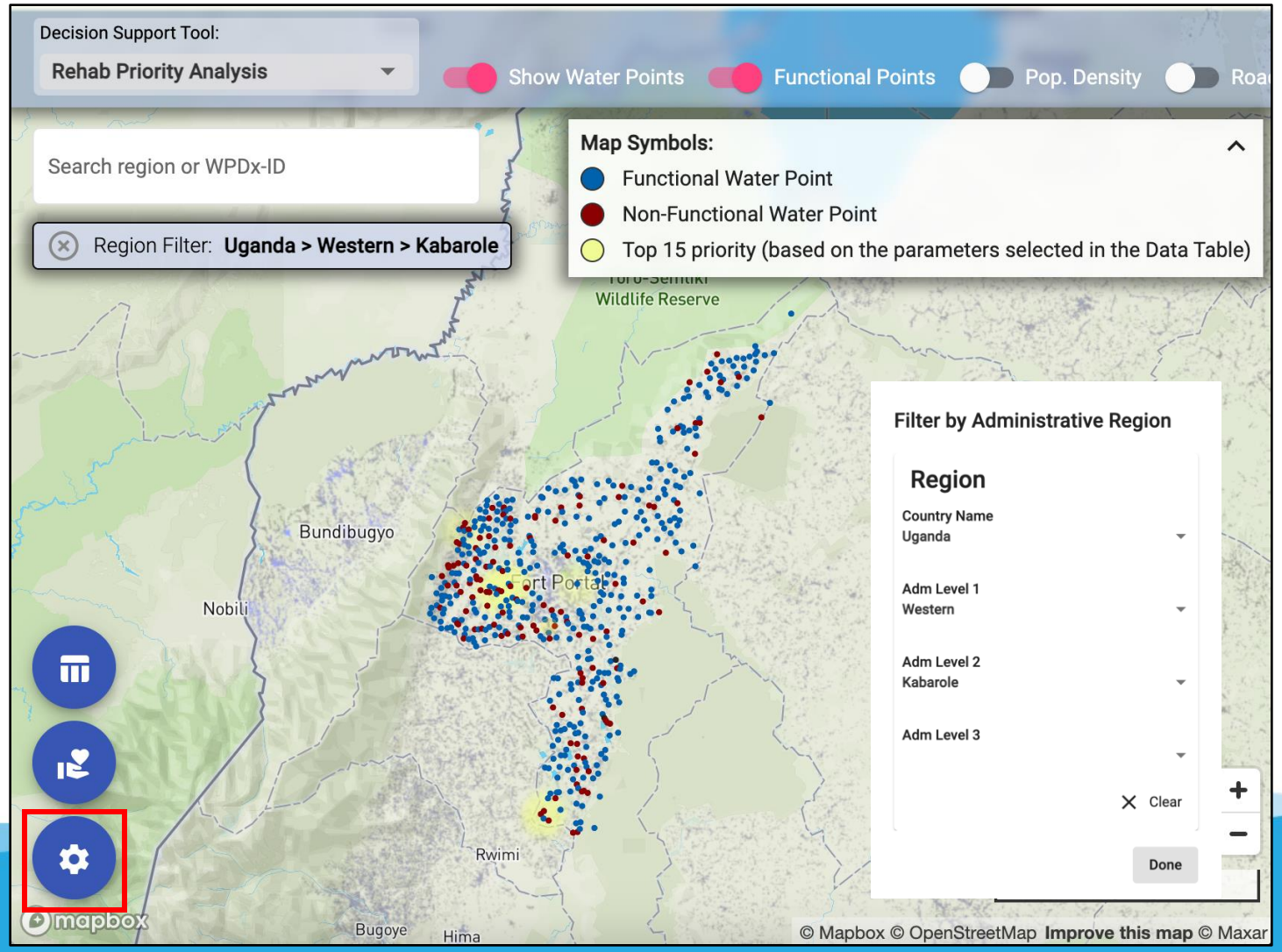
Use case: Filter to area of interest

Click the Filter By Region button using the blue Settings icon in the bottom left corner of the screen. This will open a window with dropdown menus for

- Country Name
- Adm Levels 1-4

For this example, we select:

- Uganda under the Country Name dropdown menu
- Western under the Adm Level 1 menu
- Kabarole under the Adm Level 2 menu to view water points in Kabarole, Uganda.

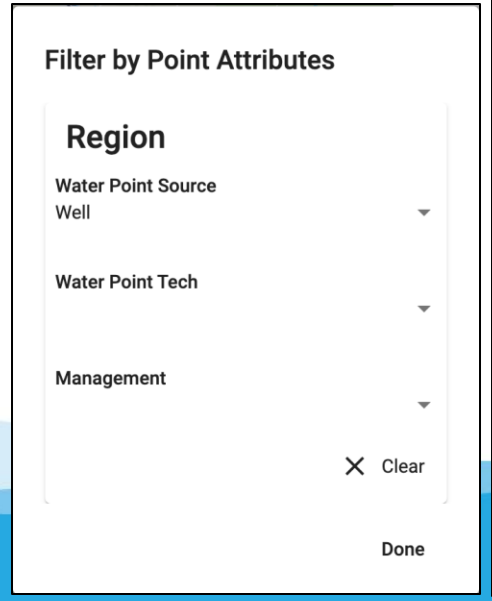


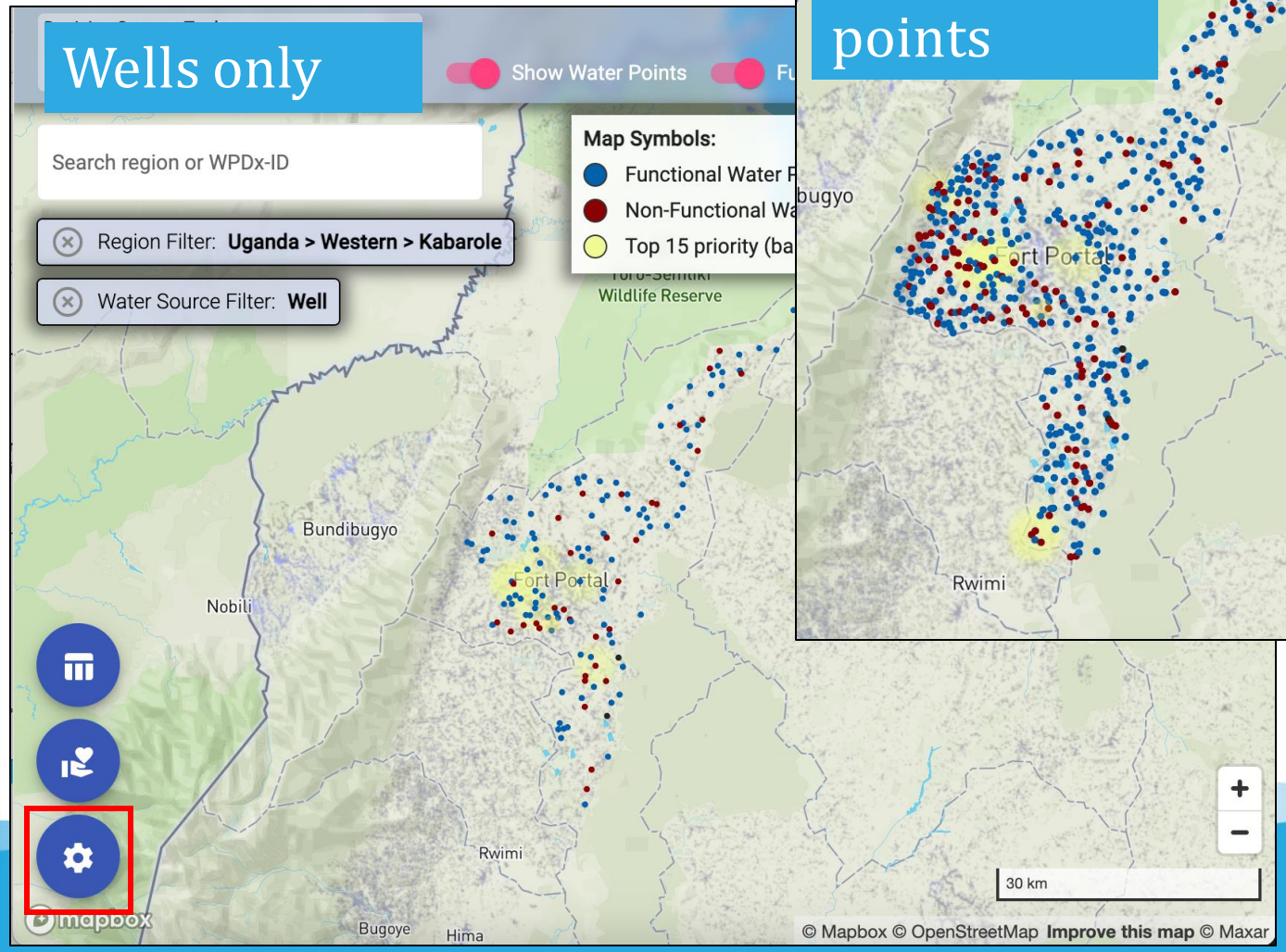
Decision Support Tool: Filter By Water Point Type

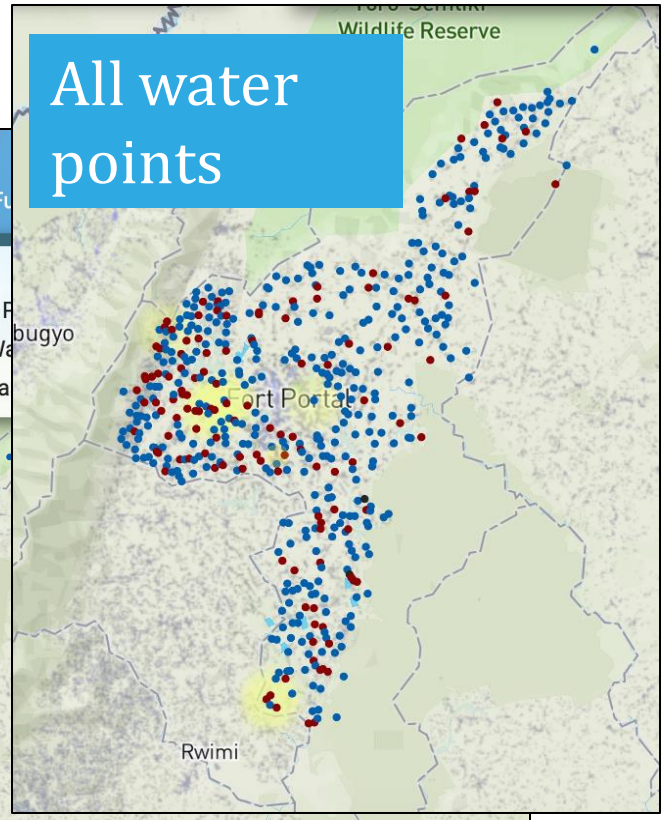
Use case: Filter to specific type of water point

If desired, click on **Filter by Attributes** using the blue Settings icon to select specific water point sources, technologies or management types.

For example, you can view only **wells** in Kabarole, Uganda. See below the wells in Kabarole compared to all water points in Kabarole.





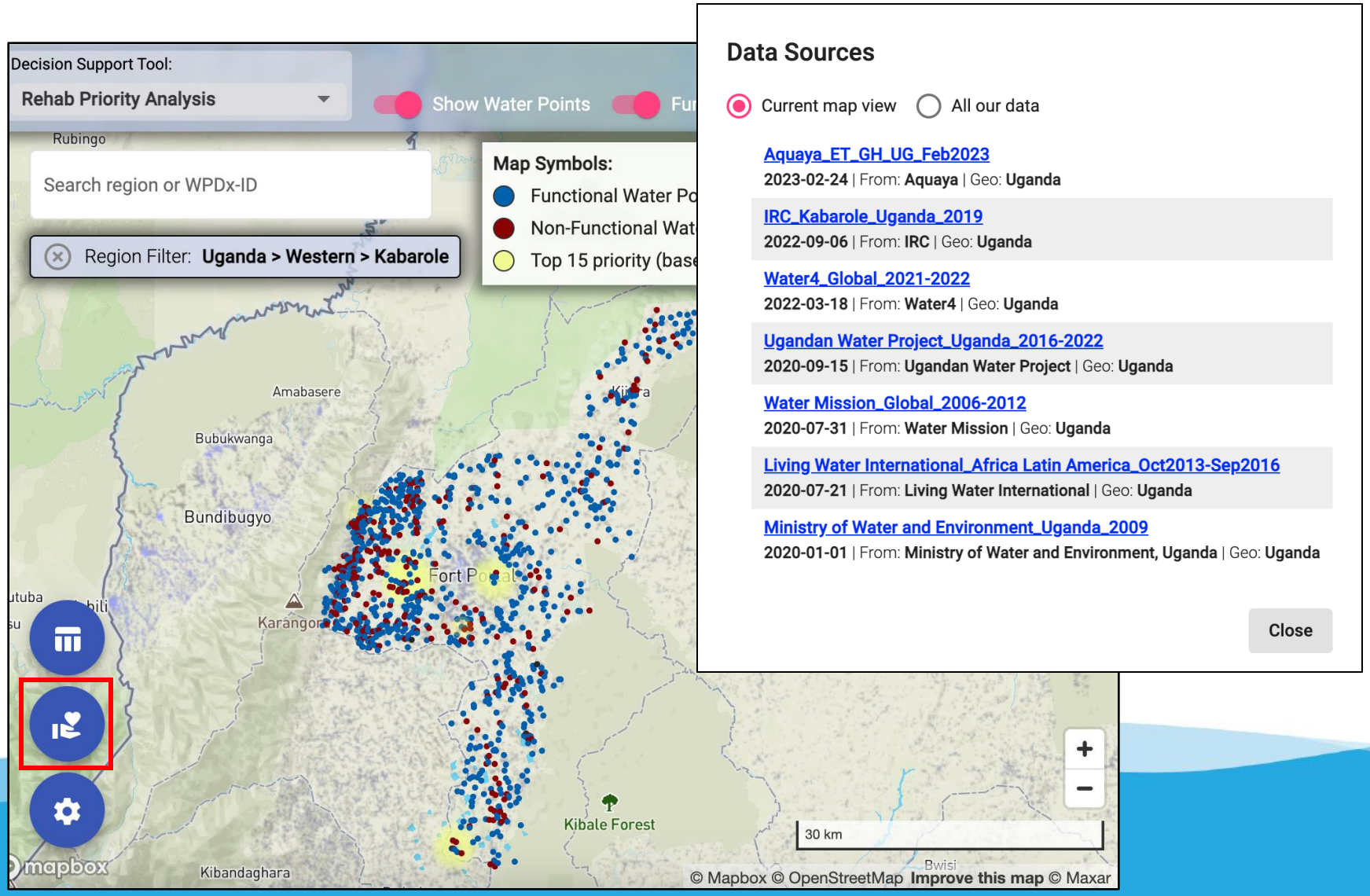


Decision Support Tool: View Data Sources

Use case: View sources of water point data

Click the blue button with a hand icon to view a list of the data sources for all water points in your current map view. Or, if you choose, you can expand the list to view data sources for all data on WPdx.

Use this information to reach out to contributors with questions about specific data sets.



Administrative Region Analysis

Overview

The Administrative Region Analysis Tool provides an overview of the rural population with basic access, without basic access and uncharted for each available administrative level.

- **Rural Population with Basic Access**: Population within 1 km of a functional improved water point
- **Rural Population without Basic Access**: Population within 1 km of a non-functional improved water point (but not within 1 km of a functional water point)
- **Uncharted Rural Population**: Population for which no data on basic water services is available in WPdx. Services may exist, but data has not been shared with WPdx.

Illustrative Uses:

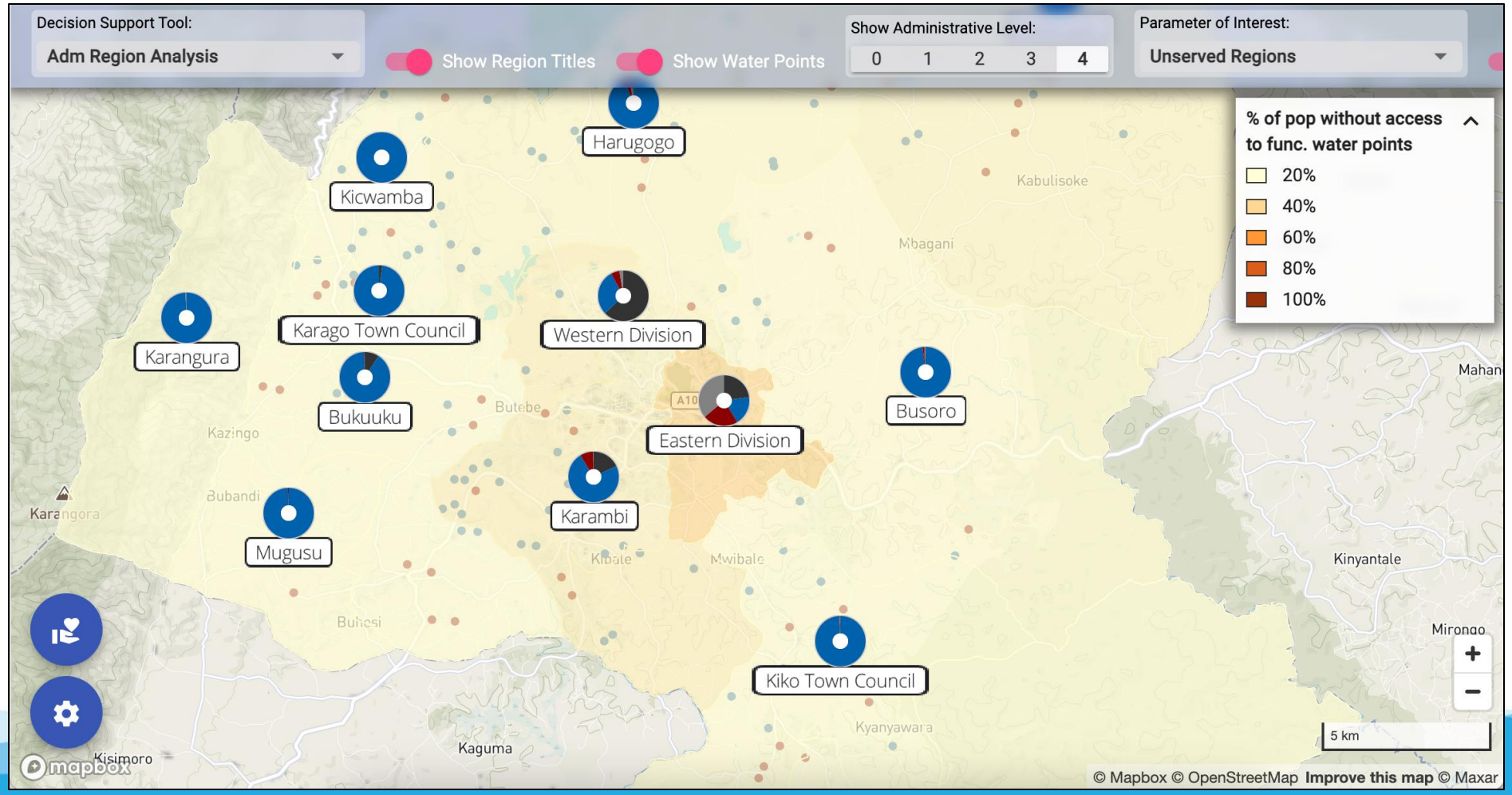
- Prioritizing administrative divisions for budget and resource allocations
- Identifying target administrative divisions for interventions
- Evaluating equity

Decision Support Tool: Administrative Region Analysis

Use case: Analyze water insecurity at each administrative level

Use the Filter By Region menu under the blue Settings icon to select an area of interest. This will reveal **a chloropleth map** of the percentage of the population without access to functional water points.

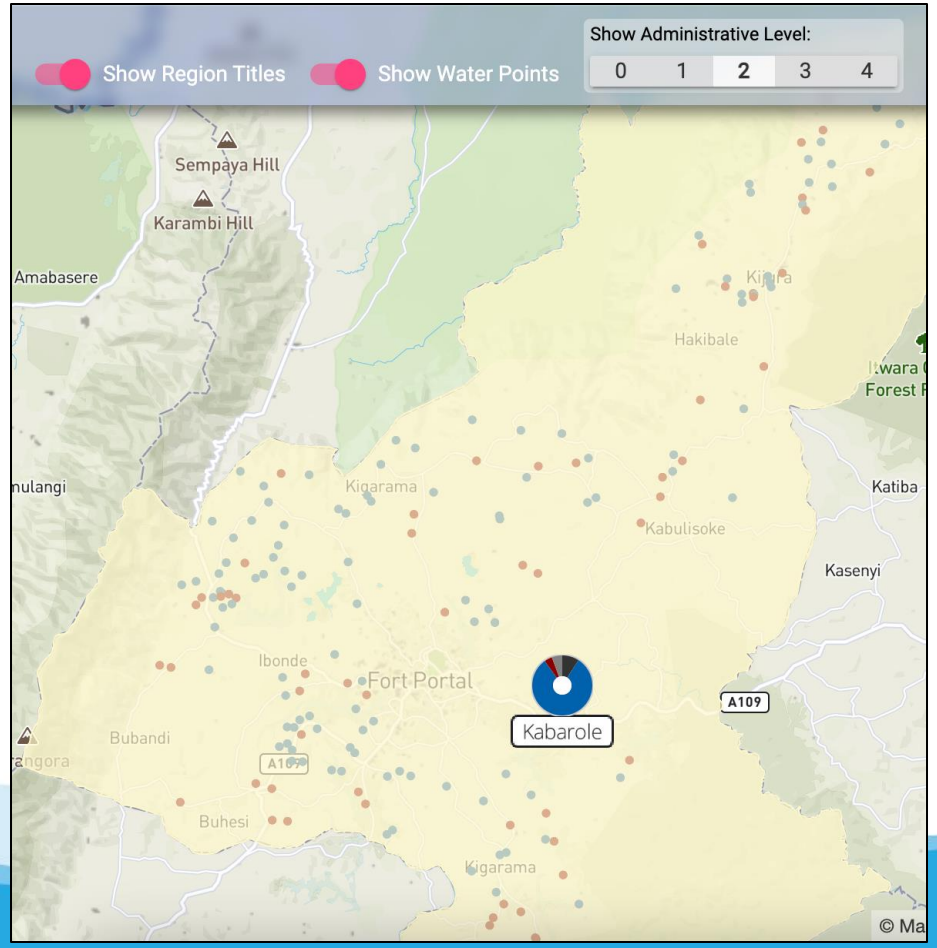
Use this information to reveal which regions have the most significant water insecurity.

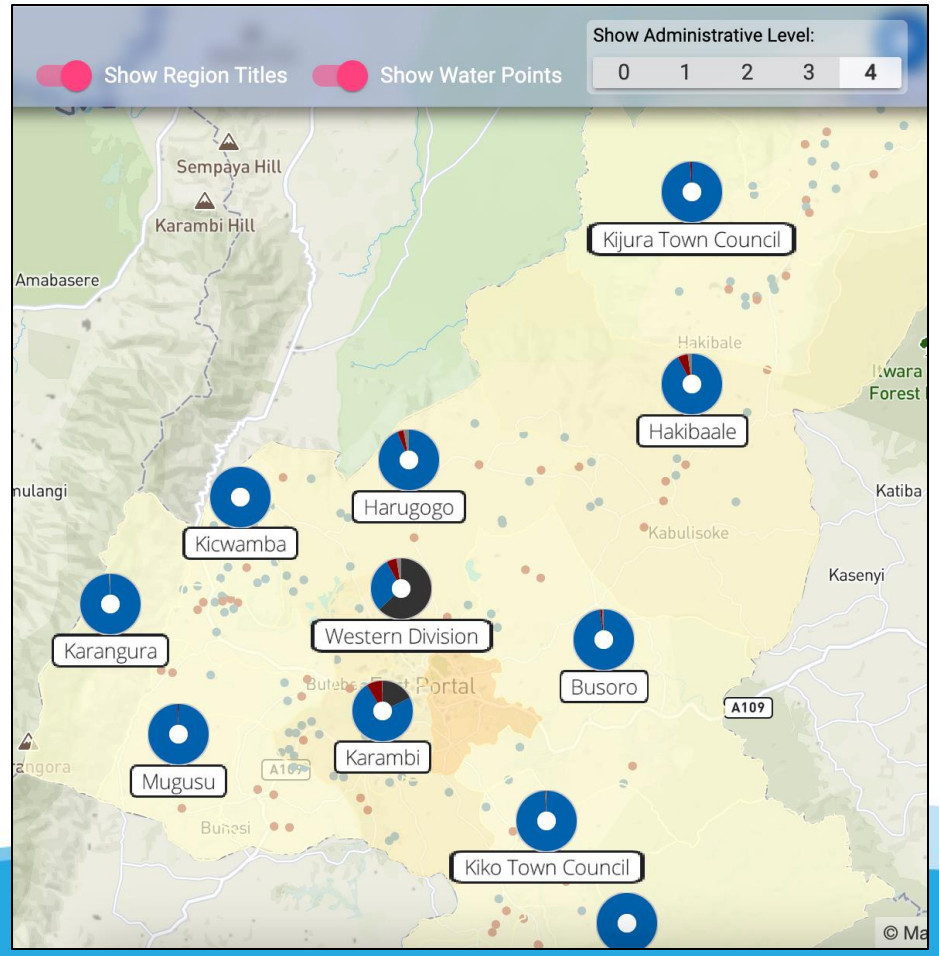


Decision Support Tool: Administrative Region Analysis

Use case: Analyze water insecurity at each administrative level

Filter by Administrative Level using the scale along the top bar to view data staleness at different regional levels. Use this feature to understand where and at what level water access issues are most severe. The images below show data staleness at adm2 versus adm4 for Kabarole, Uganda.

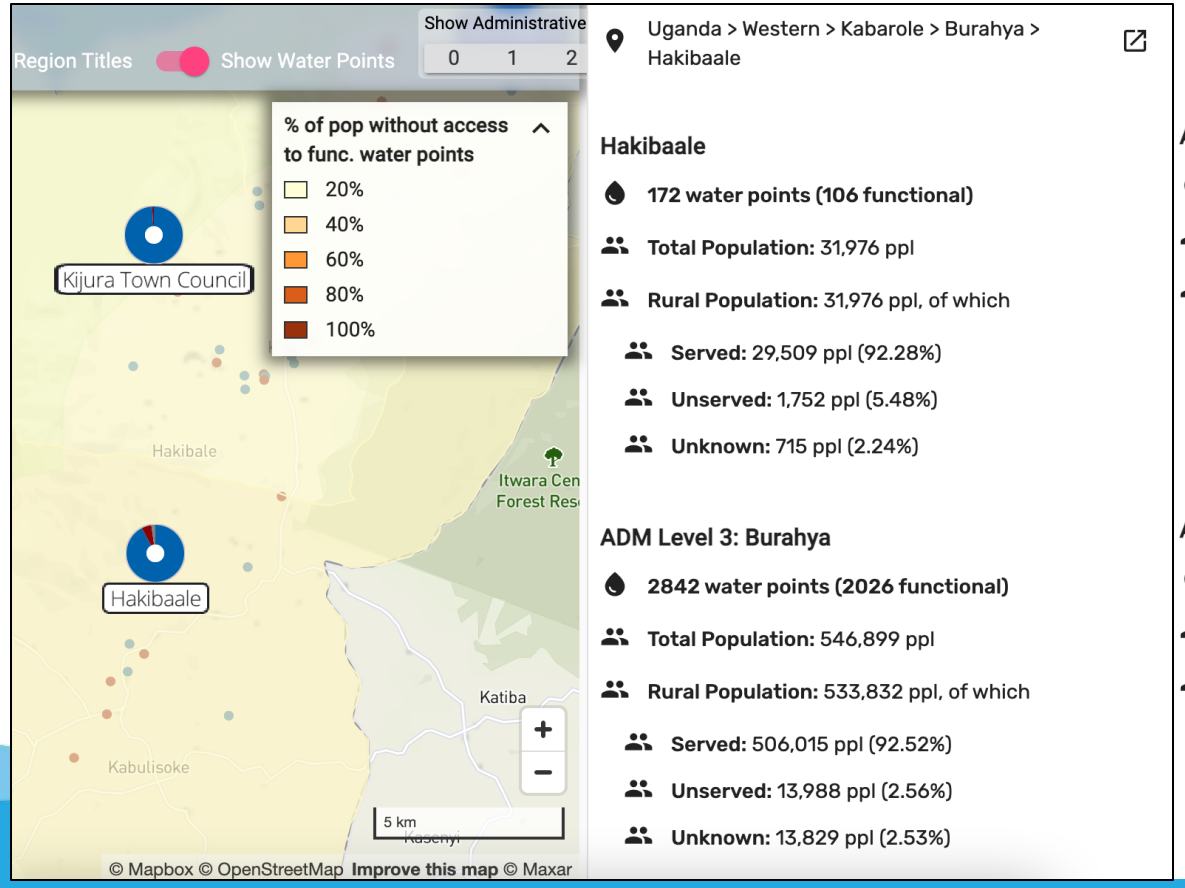




Decision Support Tool: Administrative Region Analysis

Use case: Analyze water insecurity at each administrative level

Click on an **administrative area** or **Coverage Summary pie chart** to open a pop-up box which includes an overview of the total urban population, and then rural population with basic access (served), without basic access (unserved) and which is uncharted (unknown) and the total functional and non-functional water points for **each nested administrative division.**



Uganda > Western > Kabarole > Burahya > Hakibaale

Hakibaale

- **172 water points (106 functional)**
- **Total Population:** 31,976 ppl
- **Rural Population:** 31,976 ppl, of which
  - **Served:** 29,509 ppl (92.28%)
  - **Unserved:** 1,752 ppl (5.48%)
  - **Unknown:** 715 ppl (2.24%)

ADM Level 3: Burahya

- **2842 water points (2026 functional)**
- **Total Population:** 546,899 ppl
- **Rural Population:** 533,832 ppl, of which
  - **Served:** 506,015 ppl (92.52%)
  - **Unserved:** 13,988 ppl (2.56%)
  - **Unknown:** 13,829 ppl (2.53%)

ADM Level 2: Kabarole

- **4296 water points (3063 functional)**
- **Total Population:** 1,004,270 ppl
- **Rural Population:** 913,038 ppl, of which
  - **Served:** 813,797 ppl (81.03%)
  - **Unserved:** 42,672 ppl (4.25%)
  - **Unknown:** 56,570 ppl (5.63%)

ADM Level 1: Western

- **113732 water points (93044 functional)**
- **Total Population:** 39,575,636 ppl
- **Rural Population:** 38,658,854 ppl, of which
  - **Served:** 22,743,680 ppl (57.47%)
  - **Unserved:** 2,383,356 ppl (6.02%)
  - **Unknown:** 13,531,818 ppl (34.19%)

Decision Support Tool: Administrative Region Analysis

This analysis is based on the latest available data from the WPdx+ dataset, population estimates from the Facebook High Resolution Population Datasets and administrative boundaries from GADM or HDX (Eswatini, Ghana and Uganda).

If your organization has additional or more recent data, please consider sharing it with the WPdx platform. For more information, please visit the **Share Data** page on the WPdx website.

Questions and Feedback: We greatly value your feedback! If you have any questions or suggestions on the tool, please provide your input here. If you have any general questions, please contact us here.

Rehabilitation Priority Analysis

How to transform the WPdx Rehabilitation Priority Tool into action

Overview

The **Rehabilitation Priority Tool** provides recommendations for which non-functional water points should be considered for priority rehabilitation and repair. This guide provides an overview of how to use the WPdx Rehabilitation Priority analysis and apply the analysis for action.

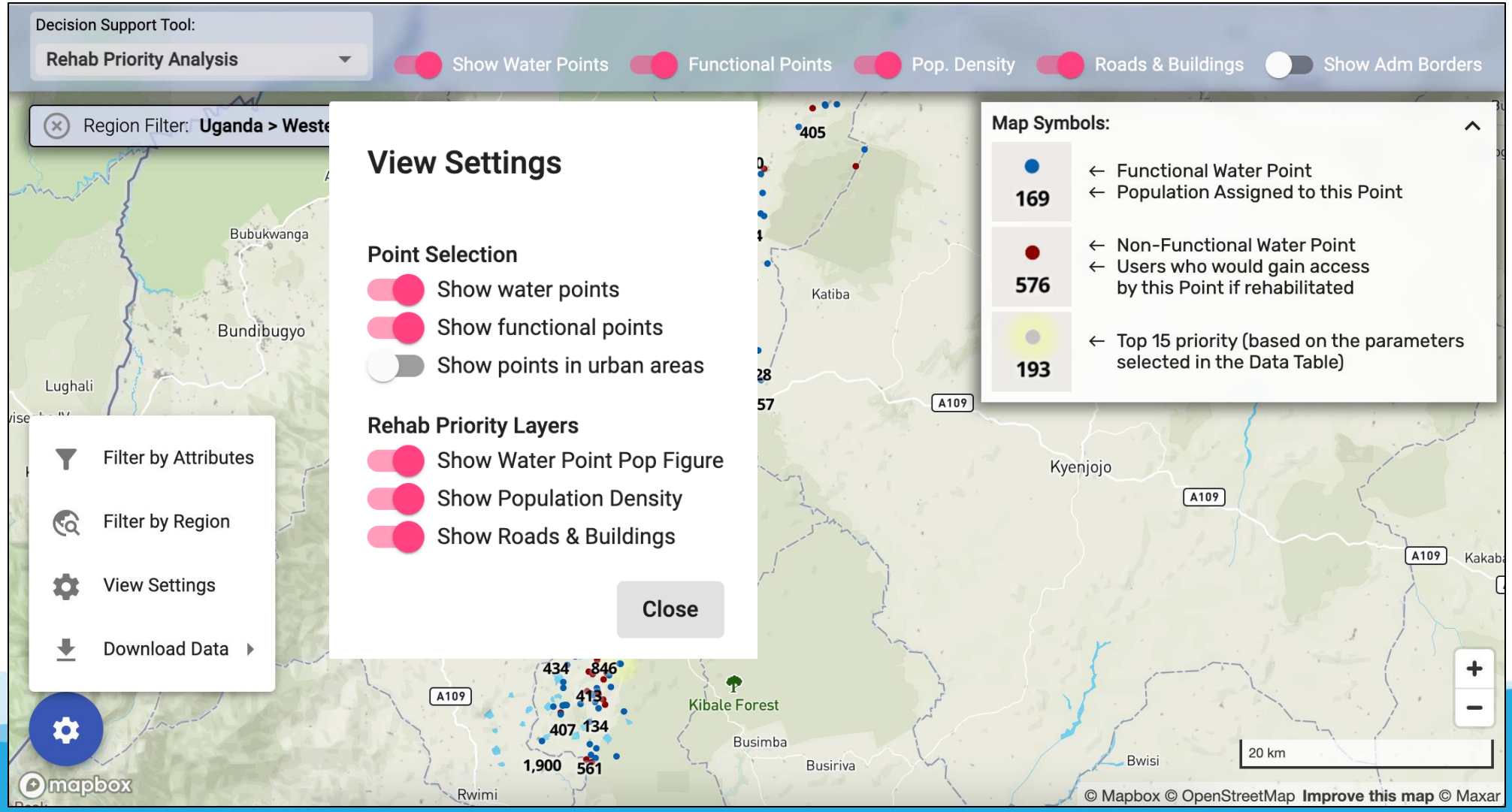
Illustrative Uses:

- Prioritizing which water points to rehabilitate
- Highlighting areas where there are limited alternative water points available
- Understanding which water points are over- or under-utilized
- Benchmarking rehabilitation needs to inform district budgets and workplans

Decision Support Tool: Rehabilitation Priority Analysis

Use case: Customize what type of data you see

Click on **View Settings** to customize the results and visualizations. The "Top Water Points" table will update according to the settings that you select. Users can change some of these settings using the top menu bar.



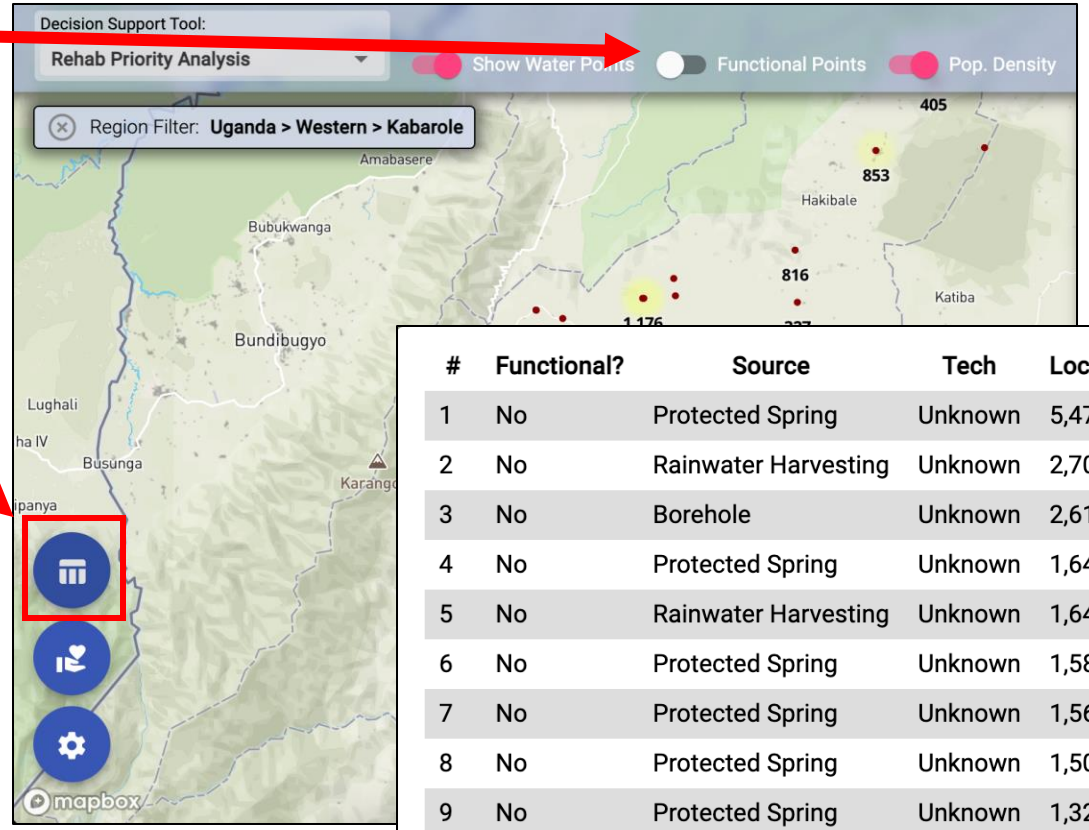
Decision Support Tool: Rehabilitation Priority Analysis

Use case: View recommended rehabilitations for non-functional water points

Turn off the functional water points on the header bar.

Click the blue circle with a table icon to view **Top Water Points,** a table which shows the top fifteen water points to prioritize for rehabilitation.

You can choose to sort this table by four parameters: total local population within 1km of water point, population assigned to a specific water point, crucialness or pressure.*



#	Functional?	Source	Tech	Local Pop.	Water Point Pop.	Crucialness	Pressure
1	No	Protected Spring	Unknown	5,477	5,477	100%	1,825.7%
2	No	Rainwater Harvesting	Unknown	2,709	1,685	62.2%	1,685%
3	No	Borehole	Unknown	2,614	1,276	48.8%	255.2%
4	No	Protected Spring	Unknown	1,646	1,486	90.3%	495.3%
5	No	Rainwater Harvesting	Unknown	1,645	853	51.9%	853%
6	No	Protected Spring	Unknown	1,585	1,358	85.7%	452.7%
7	No	Protected Spring	Unknown	1,569	550	35.1%	183.3%
8	No	Protected Spring	Unknown	1,504	1,077	71.6%	359%
9	No	Protected Spring	Unknown	1,324	1,186	89.6%	395.3%
10	No	Rainwater Harvesting	Unknown	1,310	1,183	90.3%	1,183%
11	No	Rainwater Harvesting	Unknown	1,292	1,176	91%	1,176%
12	No	Protected Spring	Unknown	1,226	784	63.9%	261.3%
13	No	Protected Spring	Unknown	1,156	750	64.9%	250%
14	No	Borehole	Unknown	1,111	240	21.6%	48%
15	No	Protected Spring	Unknown	1,100	306	27.8%	102%

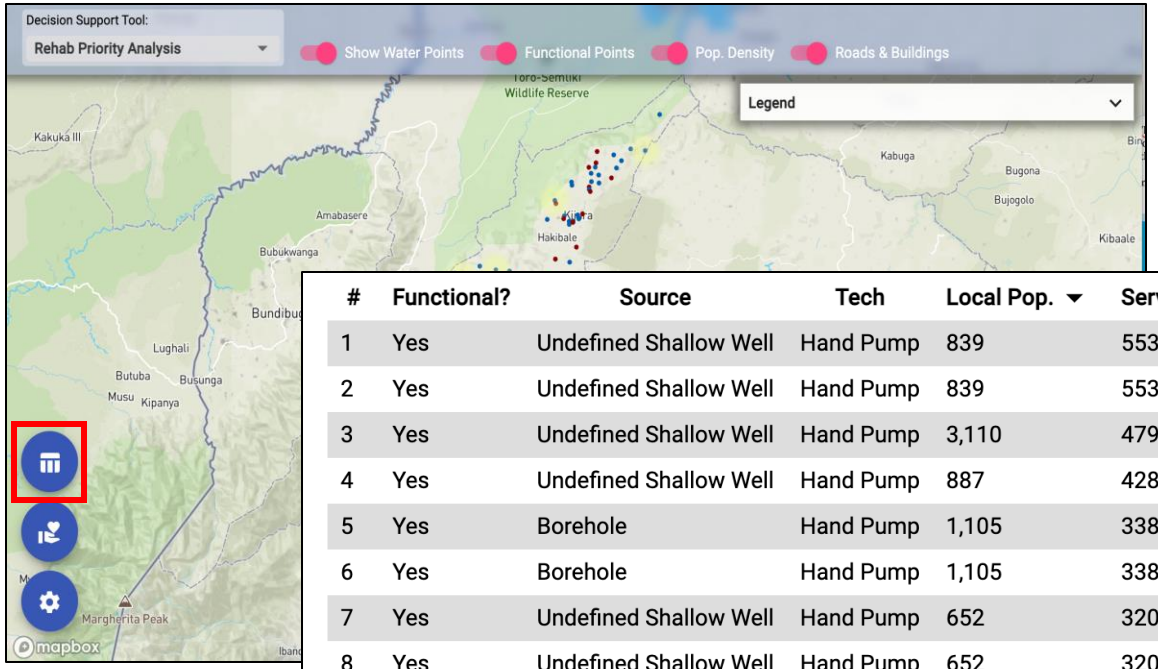
Decision Support Tool: Rehabilitation Priority Analysis

Use case: View recommended rehabilitations for all water points

If all water points are shown, results show which functional and non-functional points may be being overutilized and/or are critical to the local populations. Water points that are overutilized or critical to local populations may require more frequent maintenance and visits. Users may be able to anticipate which functioning water points are more likely to break.

Click the blue circle with a table icon to view **Top Water Points,** a table which shows the top fifteen water points to prioritize for rehabilitation.

You can choose to sort this table by four parameters: total local population within 1km of water point, population assigned to a specific water point, crucialness or pressure.*



#	Functional?	Source	Tech	Local Pop.	Served Pop.	Crucialness	Pressure
1	Yes	Undefined Shallow Well	Hand Pump	839	553	65.9%	110.6%
2	Yes	Undefined Shallow Well	Hand Pump	839	553	65.9%	110.6%
3	Yes	Undefined Shallow Well	Hand Pump	3,110	479	15.4%	95.8%
4	Yes	Undefined Shallow Well	Hand Pump	887	428	48.3%	85.6%
5	Yes	Borehole	Hand Pump	1,105	338	30.6%	67.6%
6	Yes	Borehole	Hand Pump	1,105	338	30.6%	67.6%
7	Yes	Undefined Shallow Well	Hand Pump	652	320	49.1%	64%
8	Yes	Undefined Shallow Well	Hand Pump	652	320	49.1%	64%
9	Yes	Undefined Shallow Well	Hand Pump	560	312	55.7%	62.4%
10	Yes	Undefined Shallow Well	Hand Pump	875	269	30.7%	53.8%
11	Yes	Undefined Shallow Well	Hand Pump	875	269	30.7%	53.8%
12	No	Undefined Shallow Well	Hand Pump	755	266	35.2%	53.2%
13	No	Undefined Shallow Well	Hand Pump	755	266	35.2%	53.2%
14	Yes	Undefined Shallow Well	Hand Pump	369	256	69.4%	51.2%
15	Yes	Undefined Shallow Well	Hand Pump	369	256	69.4%	51.2%

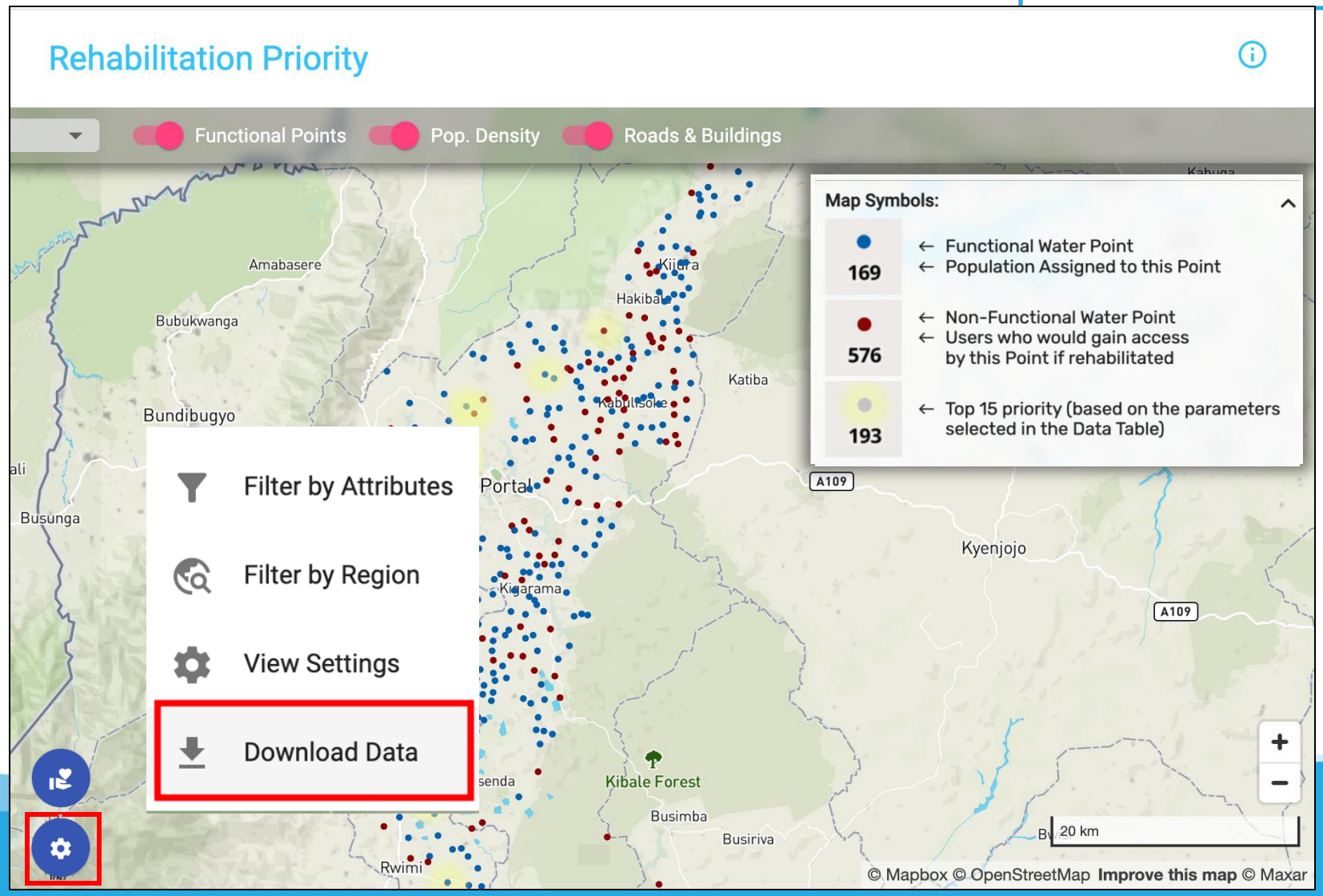
Decision Support Tool: Rehabilitation Priority Analysis

Use case: Download results for further analysis

The **Download Data** button will provide a CSV of the complete WPdx dataset amended with the Rehab Priority tool results.

If you have filtered to a specific geography of interest **and/or** zoomed into a smaller area, only those points will be included in the download file.

Here, I am downloading records and rehabilitation priority information for all wells in Kabarole, Uganda.



Decision Support Tool: Rehabilitation Priority Analysis

Use case: Download data for analysis

Here is a **sample of the csv file** for all wells in Kabarole, Uganda. The downloaded data contains information about each water point pulled from WPdx+, plus three additional parameters: criticality, pressure, and usage_cap

report_dat	wpdx_id	lat_deg	lon_deg	status_id	source	criticality	pressure	usage_cap
40290	6GGG95PX	0.385838	30.19929	Yes	Ministry of Water and Environment, Uganda	0.807774	3.782	500
43880	6GGGM7F6	0.672493	30.26206	No	IRC	0.741183	2.606	500
40463	6GGGC6XG	0.448669	30.22501	No	Ministry of Water and Environment, Uganda	0.809365	1.452	500
43880	6GGGC796	0.417862	30.26019	Yes	IRC	0.389741	1.322	500
40321	6GGGF6MH	0.484989	30.22999	Yes	Ministry of Water and Environment, Uganda	0.57971	1.28	500
40291	6GGGC6MI	0.432532	30.23271	No	Ministry of Water and Environment, Uganda	0.799197	1.194	500
41836	6GGGM7M	0.682738	30.26026	Yes	Ministry of Water and Environment, Uganda	0.208097	1.172	500

Decision Support Tool: Rehabilitation Priority Analysis

Use case: Download data for analysis

Crucialness (% scale): The crucialness score is the ratio of 'served population' (likely current users or users who would gain access) to the total local population within a 1km radius of the water point. Crucialness provides a measure of water system redundancy. For example, if there is only 1 water point within a 1km radius, the water point crucialness score is 100%, meaning that there are no nearby alternatives. If there are two functional water points within 1km, the crucialness score for each point will be ~50% indicating there is some redundancy in the system, so if one water point is broken down, users have an alternative water point available. For non-functional water points, the crucialness score shows how important the water point would be if it were to be rehabilitated

Pressure (% scale): Calculated based on the ratio of the likely current users assigned to that water point over the theoretical maximum population which can be served based on the technology. If a point is serving less than the recommended maximum, the pressure score will be less than 100% (i.e., 250/500 = 0.5). If a point is serving more than the recommended maximum, the pressure score will be over 100% (i.e., 750/500 = 150%).

criticality	pressure	usage_cap
0.807774	3.782	500
0.741183	2.606	500
0.809365	1.452	500
0.389741	1.322	500
0.57971	1.28	500
0.799197	1.194	500
0.208097	1.172	500

Decision Support Tool: Rehabilitation Priority Analysis

Use case: Use crucialness (% scale) to inform district budgets and workplans

The criticality and pressure scales can inform district budgets and workplans. The 'Top Water Points' table can be ordered by Crucialness and Pressure scores to give users a perspective beyond rehabilitation priority

Crucialness:
Users can interpret the crucialness scale as a measure of redundancy in the water point system. A lower crucialness score means there is more redundancy in the water points available to a population. For example,

- A crucialness score of **100%** indicates that the water point is the only one available to its served population
- A crucialness score of **50%** indicates that there are an estimated **two** available water points for its served population
- A crucialness score of **33%** would indicate that there are an estimated **three** available water points.

Users can prioritize water point construction and rehabilitation in areas with **highly crucial water points.** If a water point with a high crucialness score breaks, its served population does not have as many alternative water sources.

Decision Support Tool: Rehabilitation Priority Analysis

Use case: Use pressure (% scale) to inform district budgets and workplans

The criticality and pressure scales can inform district budgets and workplans. The 'Top Water Points' table can be ordered by Crucialness and Pressure scores to give users a perspective beyond rehabilitation priority

Pressure:
Users can interpret the crucialness scale as a ratio of the number of people currently served over the theoretical maximum for the water point. For example,

- A pressure score of **150%** indicates that the water point serves an estimated 1.5 times the recommended number of people. This water point is **overutilized** and another point should be constructed nearby.
- A pressure score of **100%** indicates that the water point serves the maximum number of people recommended. This water point is **appropriately utilized.**
- A pressure score of **50%** indicates that the water point serves half of the population that it could. This water point is **underutilized** and water point construction is lower priority in this area.

The pressure score uses the following recommended maximum values:

•100 people per rainwater catchment system
•250 people per tap [tapstand, kiosk]
•300 people per protected spring
•400 people per hand pump [most hand pumps]
•1000 people per mechanized (powered) well

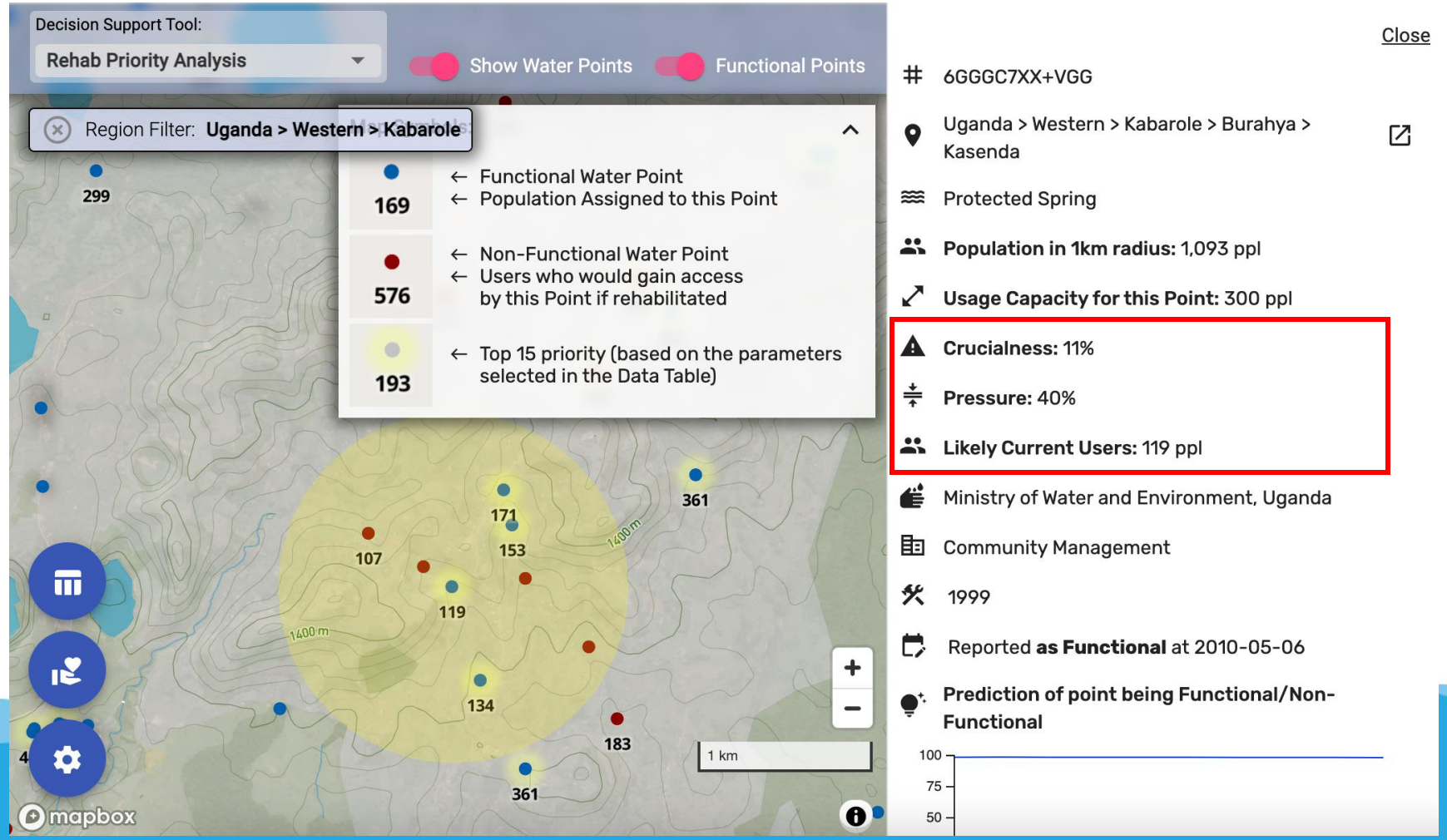
Decision Support Tool: Rehabilitation Priority Analysis

Use case: Use pressure (% scale) to inform district budgets and workplans

Example:

In this example, the selected water point has **11% crucialness and 40% pressure.**

These figures mean that the water point is about **one of ten available** to its served population, and it serves **40%** of its theoretical maximum capacity. In this case, the water point is a protected spring with a maximum capacity of 300 people, so it serves an estimated ~119 people, as indicated by the **Likely Current Users.**

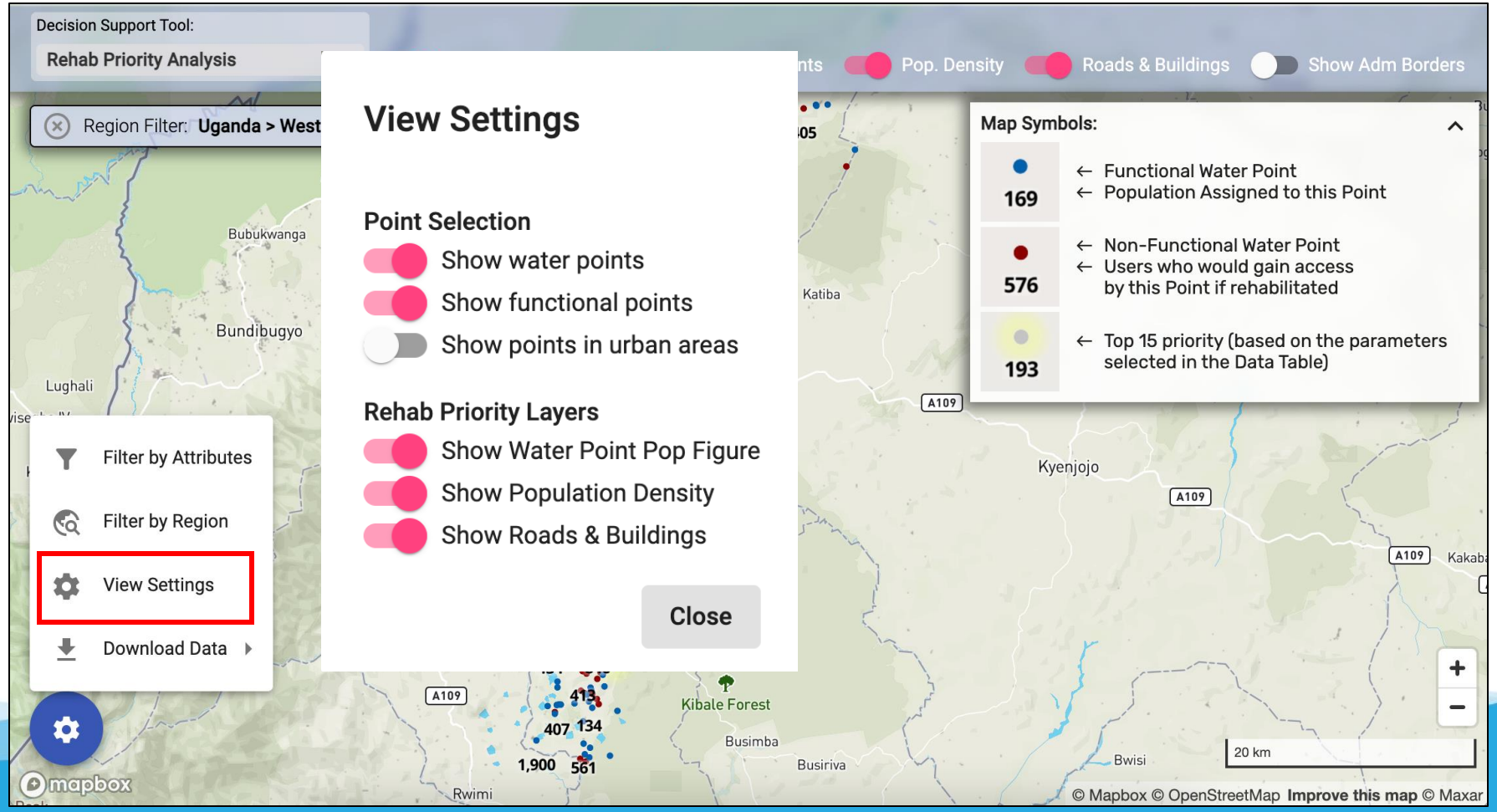


Decision Support Tool: Rehabilitation Priority Analysis

Use case: Customize what type of data you see

There are several other settings that users can customize using the **View Settings** menu. Click on **View Settings** to customize the results and visualizations.

The "Top Water Points" table will update according to the settings that you select. Users can change some of these settings using the top menu bar.

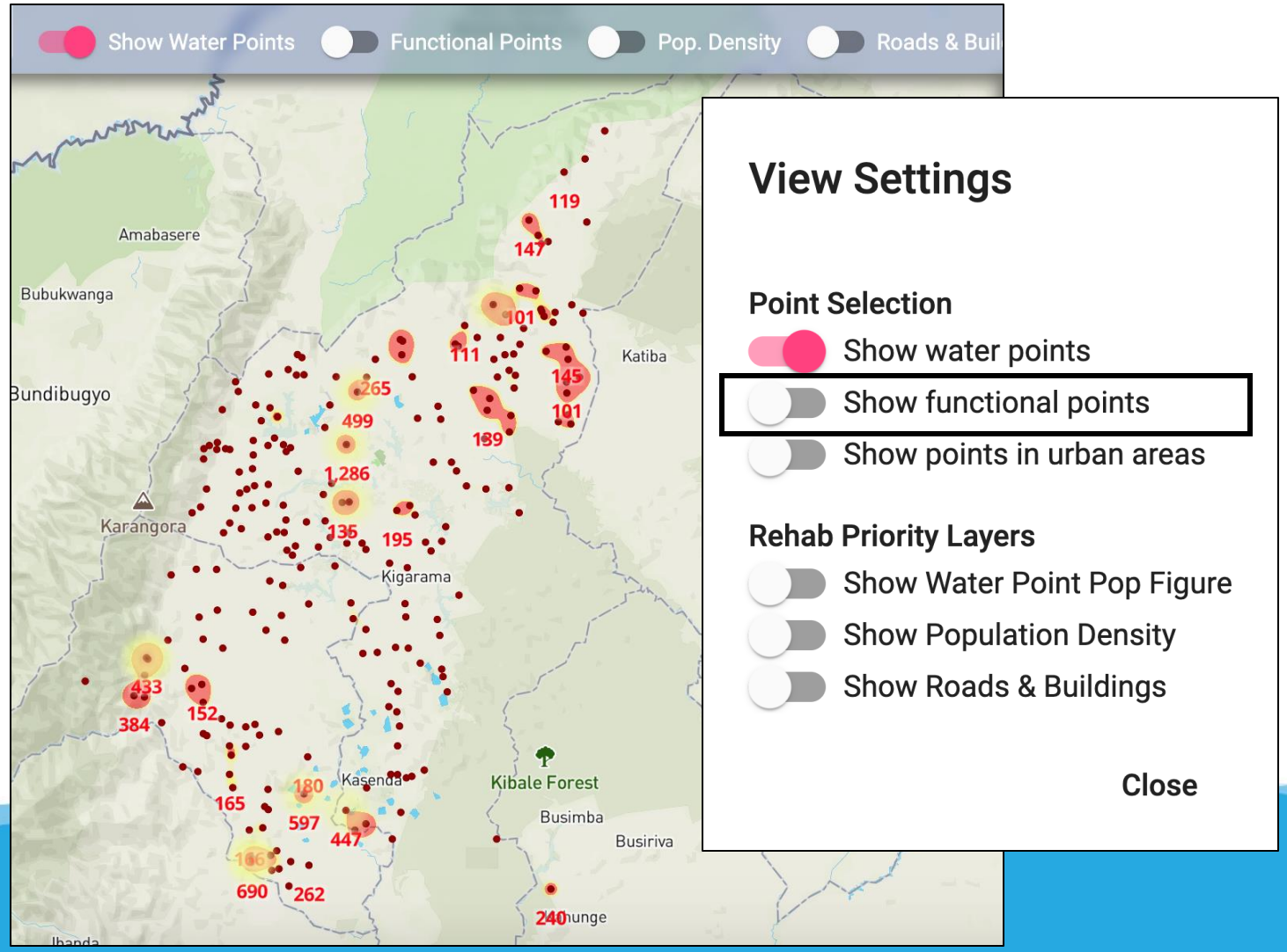


Decision Support Tool: Rehabilitation Priority Analysis

Use case: Choose to focus on non-functional points only

Toggle **Show functional points**: If selected, both functional and non-functional points will appear on the map and be included in the *Top Water Points* table.

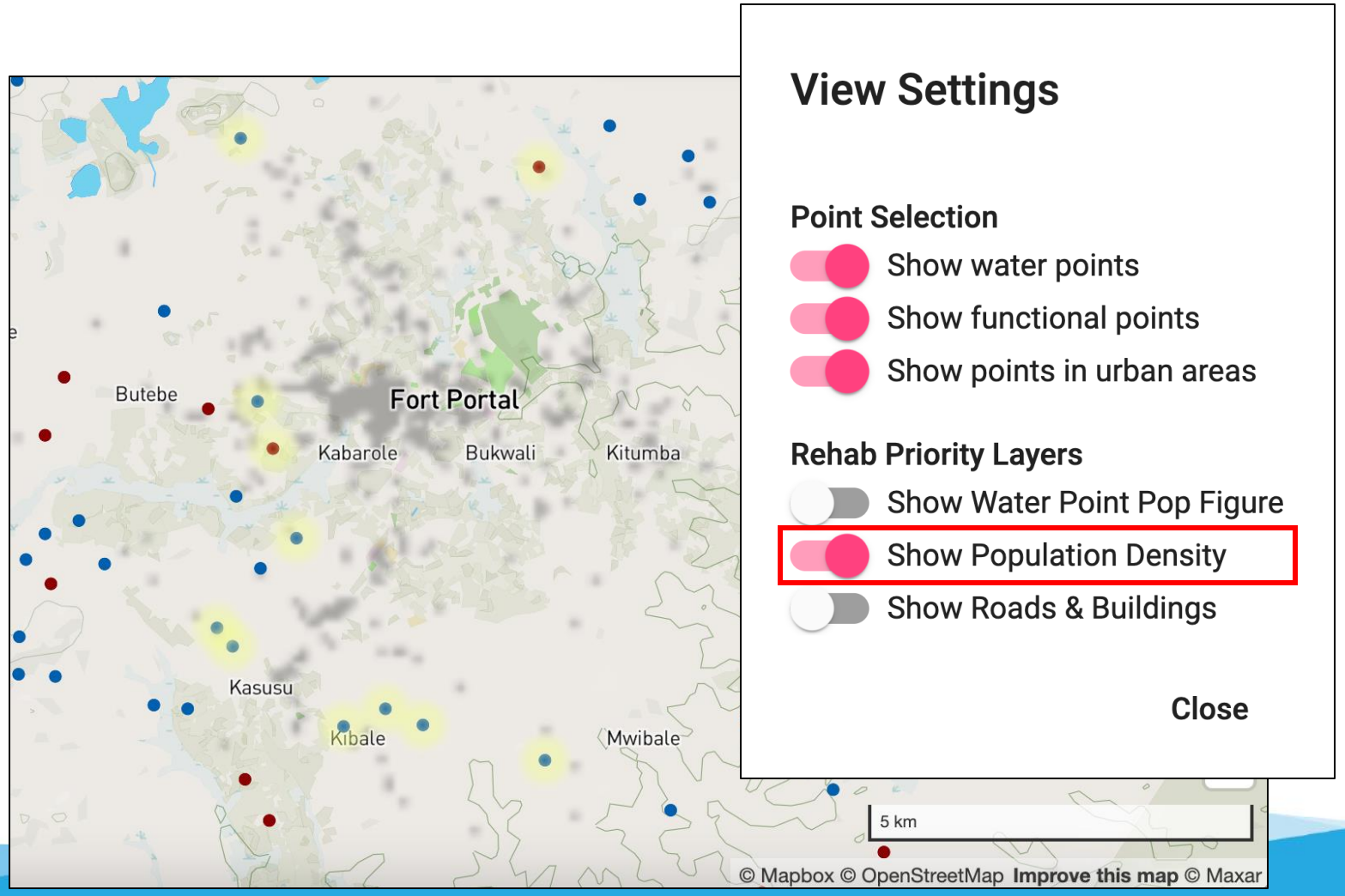
In this example, **Show functional points** is toggled off and we see only the non-functional points.



Decision Support Tool: Rehabilitation Priority Analysis

Use case: Choose to focus on rural water points only

Toggle **Show points in urban areas**: If selected, both rural and urban points will appear on the map and be included in the *Top Water Points* table. Urban areas are as defined by [the EU Global Human Settlement Database](). Urban water points are not included in the analyses due to population density and likelihood of other sources of drinking water.

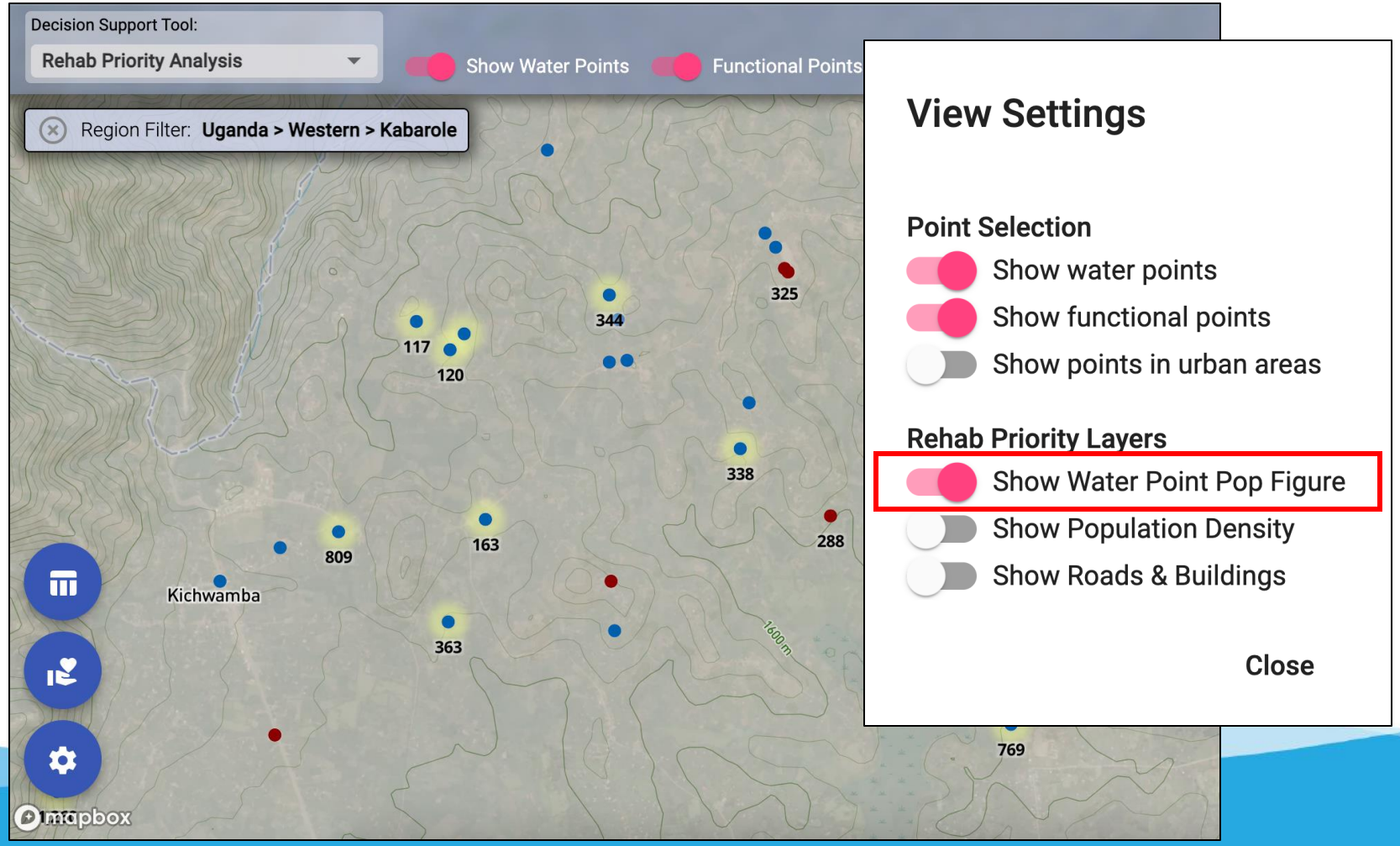


Decision Support Tool: Rehabilitation Priority Analysis

Use case: Show users who could gain access to functional and non-functional points

Toggle **Show Water Point Pop Figure** for an estimate of the served population for each water point (i.e. how many users are assigned to the water point). For non-functional water points, this number estimates how many people would use the water point if it were functioning. The tool will also highlight the top 15 points for rehabilitation.

Use this map to identify patterns in over- and under-utilized water points across the selected region. These figures are also available when you select a certain point to view.

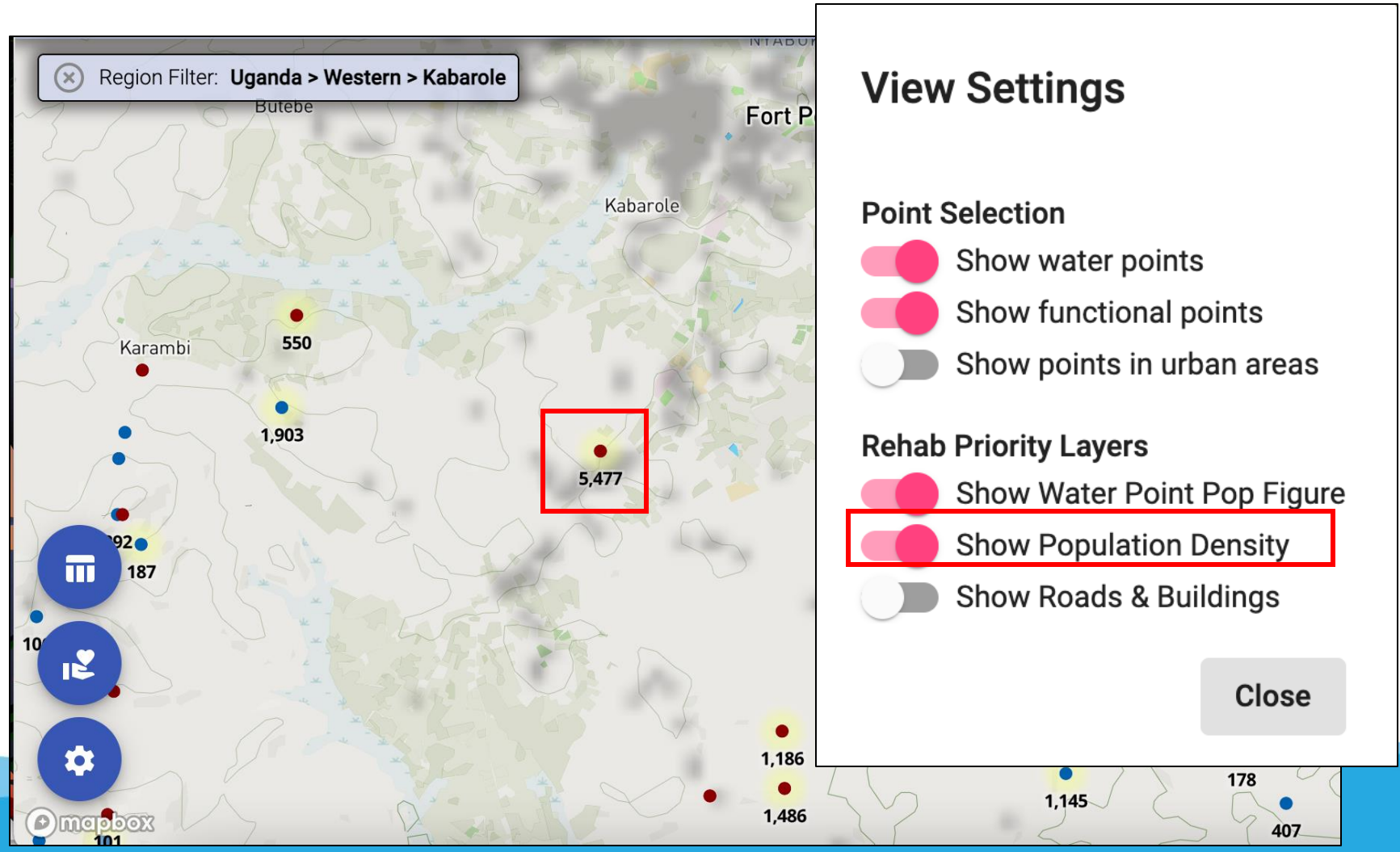


Decision Support Tool: Rehabilitation Priority Analysis

Use case: Compare population density with water point locations

Toggle **Show Population Density** to overlay population density in shades of gray. The densest population center in Kabarole is in the city of Fort Portal. The WPdx open data repository primarily contains records for rural water points, and therefore there are few water points in the most population dense, urban areas. Use this map to compare rural water point locations with population density.

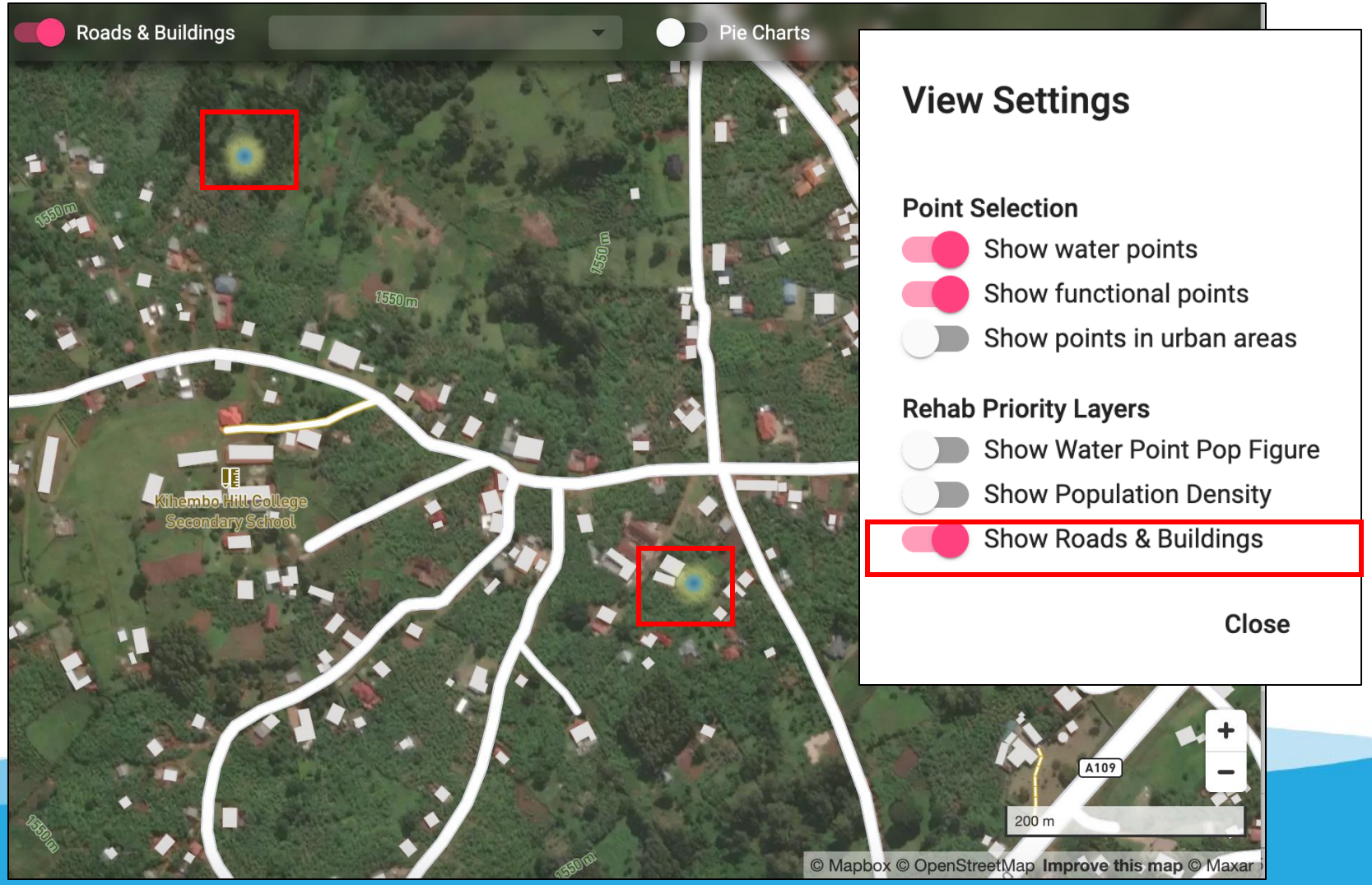
The water point boxed in red is near a population cluster with a water point population of 5,477.



Decision Support Tool: Rehabilitation Priority Analysis

Use case: View water points relative to infrastructure

Toggle **Show Roads & Buildings** and zoom in to view a layer of roads and buildings. Use this map to see where water points are located relative to roads and buildings in the population center.



New Construction Priority Analysis

Overview

The **New Construction Priority Analysis Tool** evaluates all possible locations that a water point could be constructed in a given district and evaluates how many people that are not near an existing water point (regardless of functionality) could gain access if a water point was constructed in that location.

For each administrative region, we inspect the 'uncharted' areas to find concentrations of population. Uncharted areas are those in which the population is outside of a 1km radius of an existing (functional or non-functional) water point in the WPdx+ dataset.

Illustrative Uses:

- Identify locations to construct new water points
- Evaluate the relative benefit of building new water points compared to rehabilitating existing water points
- Providing insights on potential data gaps which could be filled by uploading data to WPdx

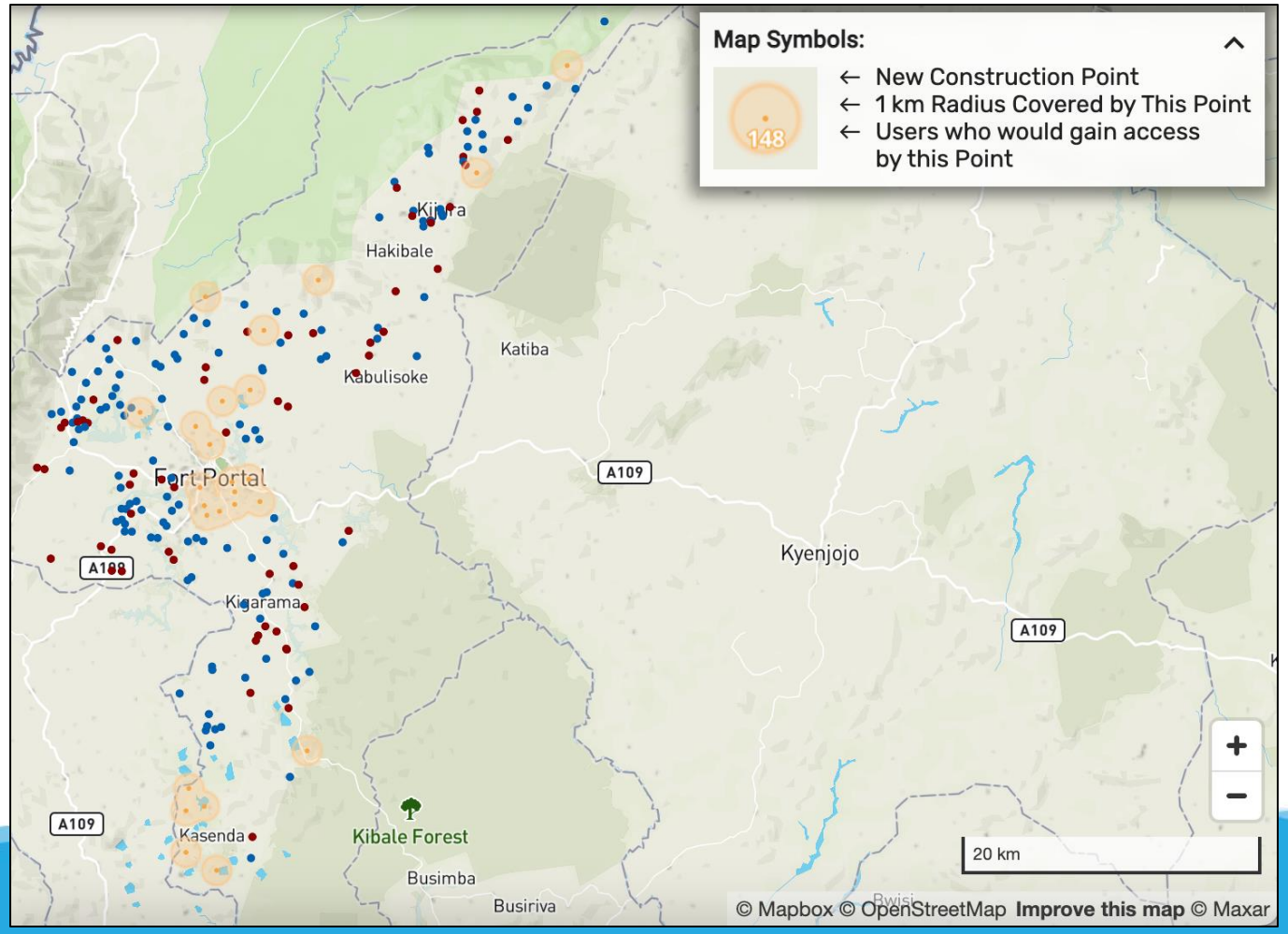
Decision Support Tool: New Construction Priority Analysis

Use case: Decide where to construct new water points to maximize impact

Methodology:

For each administrative region, we inspect the 'uncharted' areas to find concentrations of population. Uncharted areas are those in which the population is outside of a 1km radius of an existing (functional or non-functional) water point in the WPdx+ dataset.

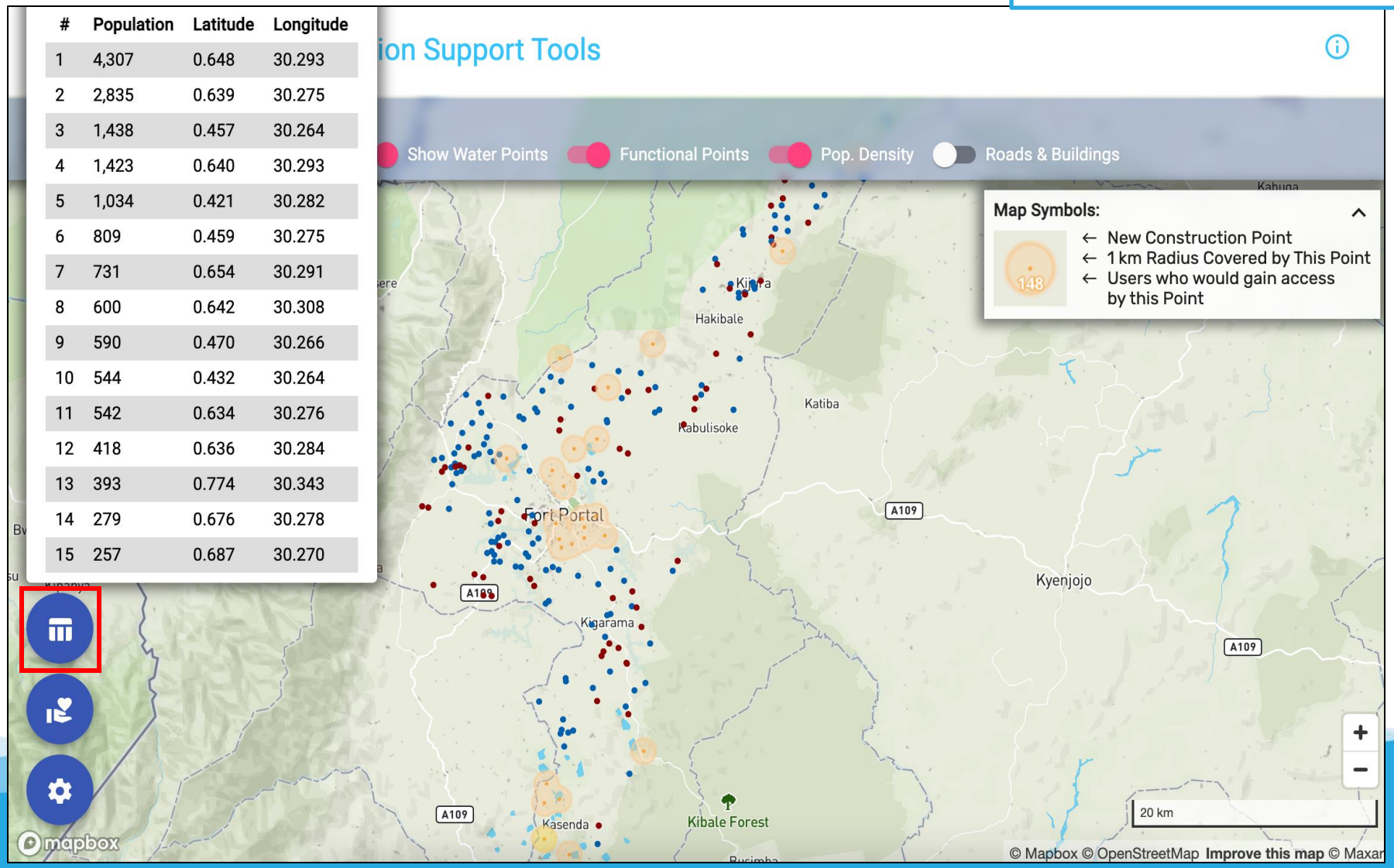
- First, we find the point location that has the most uncharted population in a 1km radius and save its coordinates and population size.
- Then we repeat the process, while ignoring population that was already "found" in previous iterations.
- We end the process when we can't find any point in the administrative region that has more than 100 people in less than 1km distance from it.



Decision Support Tool: New Construction Priority Analysis

Use case: Decide where to construct new water points to maximize impact

Click on the table icon in the lower left corner to view the **Top Water Points** table which shows the GPS coordinates and local population within 1km for the top fifteen proposed points for new construction based on potential population reached.



#	Population	Latitude	Longitude
1	4,307	0.648	30.293
2	2,835	0.639	30.275
3	1,438	0.457	30.264
4	1,423	0.640	30.293
5	1,034	0.421	30.282
6	809	0.459	30.275
7	731	0.654	30.291
8	600	0.642	30.308
9	590	0.470	30.266
10	544	0.432	30.264
11	542	0.634	30.276
12	418	0.636	30.284
13	393	0.774	30.343
14	279	0.676	30.278
15	257	0.687	30.270

Data Quality Score

Overview

The **Data Quality Score** provides an overview of the average age of data available from the WPdx dataset. For each point, we calculate a 'staleness' score which depends solely on its report date. The score represents the depreciation of the point's relevance - older updates are less valuable than fresh data. The main parameter that controls this score is the 'target value' - for example, in the current state we define that a 20 year-old report is worth only 10% in comparison to a 'day-old' report. These values give a rough, qualitative estimate of data 'freshness.'

Illustrative Uses:

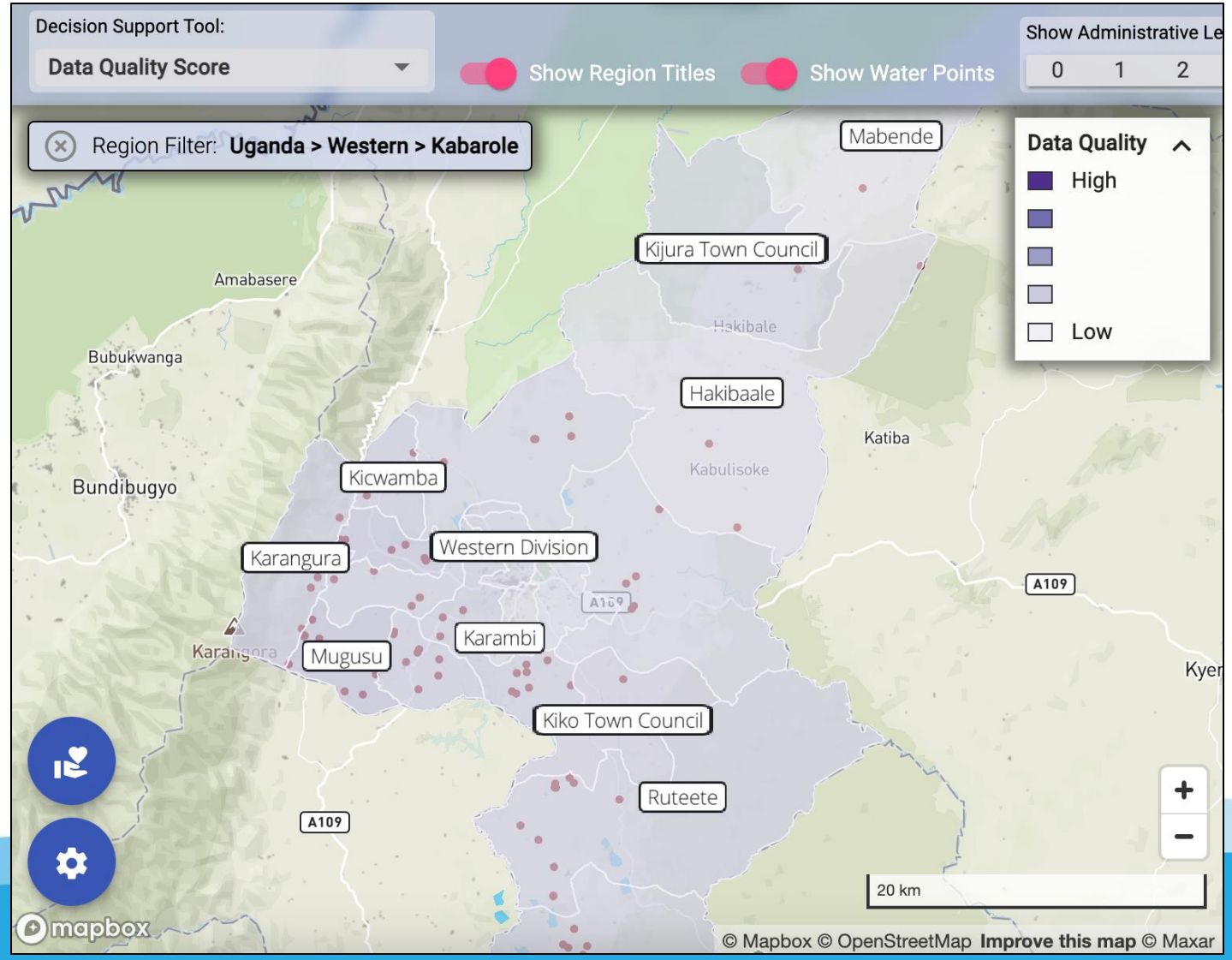
- Identifying areas for targeted data sharing outreach
- Selecting areas for focused data collection
- Ensuring a clear understanding of the age of data available for other analyses

Decision Support Tool: Data Quality Score

Use case: Understand relative age of available data

This is a view of Data Staleness in Kabarole, Uganda. Lighter colors indicate that the data is older, while darker colors indicate that the data is newer.

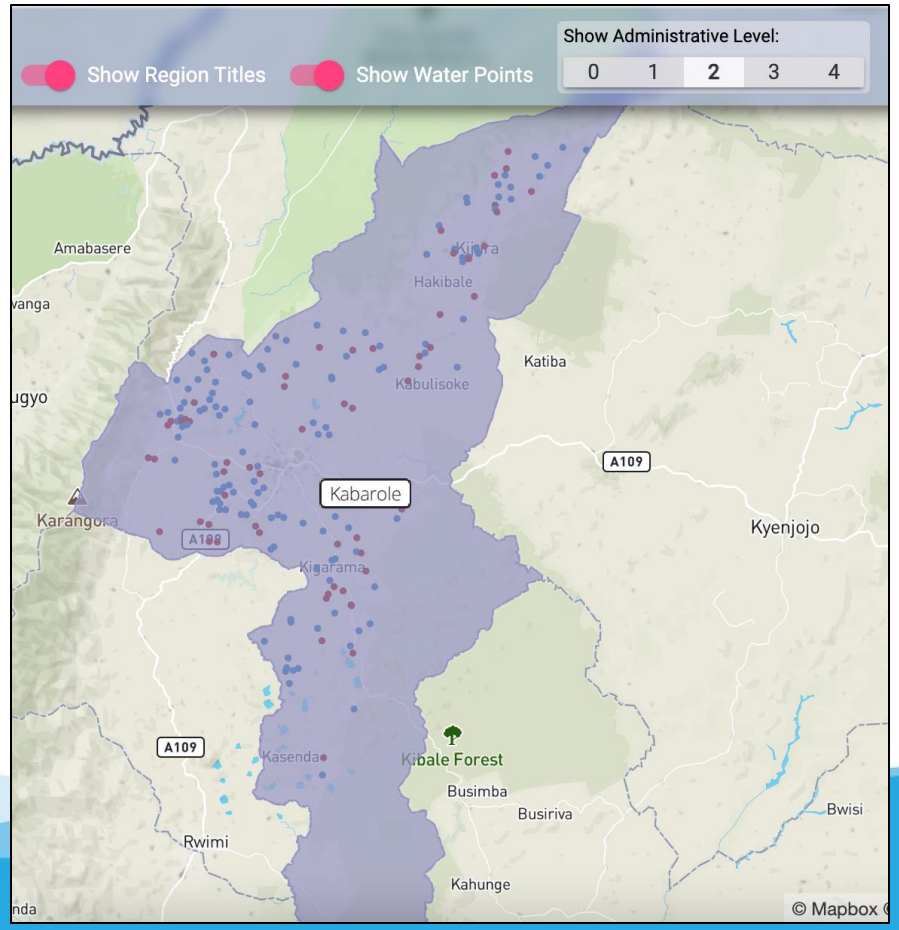
Newer data allows for analysis that most accurately reflects the current status of water points.

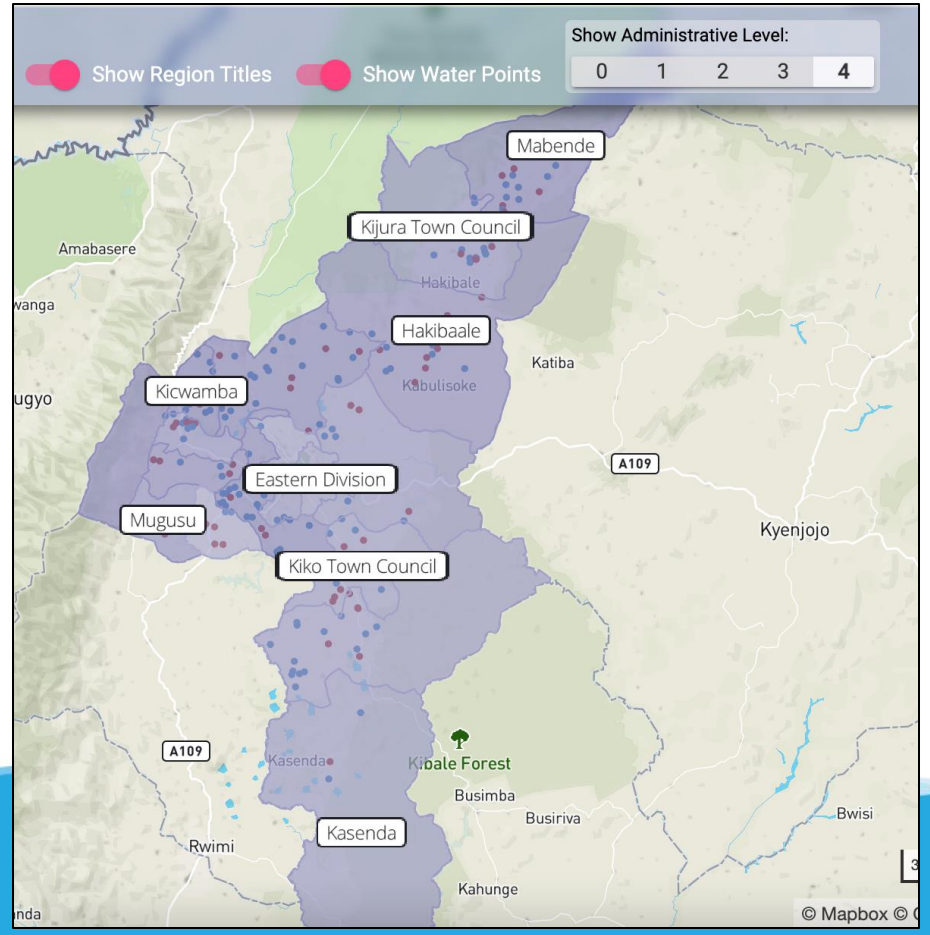


Decision Support Tool: Data Quality Score

Use case: Decide where to collect new water point data

Filter by Administrative Level using the scale along the top bar to view data staleness at different regional levels. Use this feature to understand where and at what level new data collection is most crucial. The images below show data staleness at adm2 versus adm4 for Kabarole, Uganda.





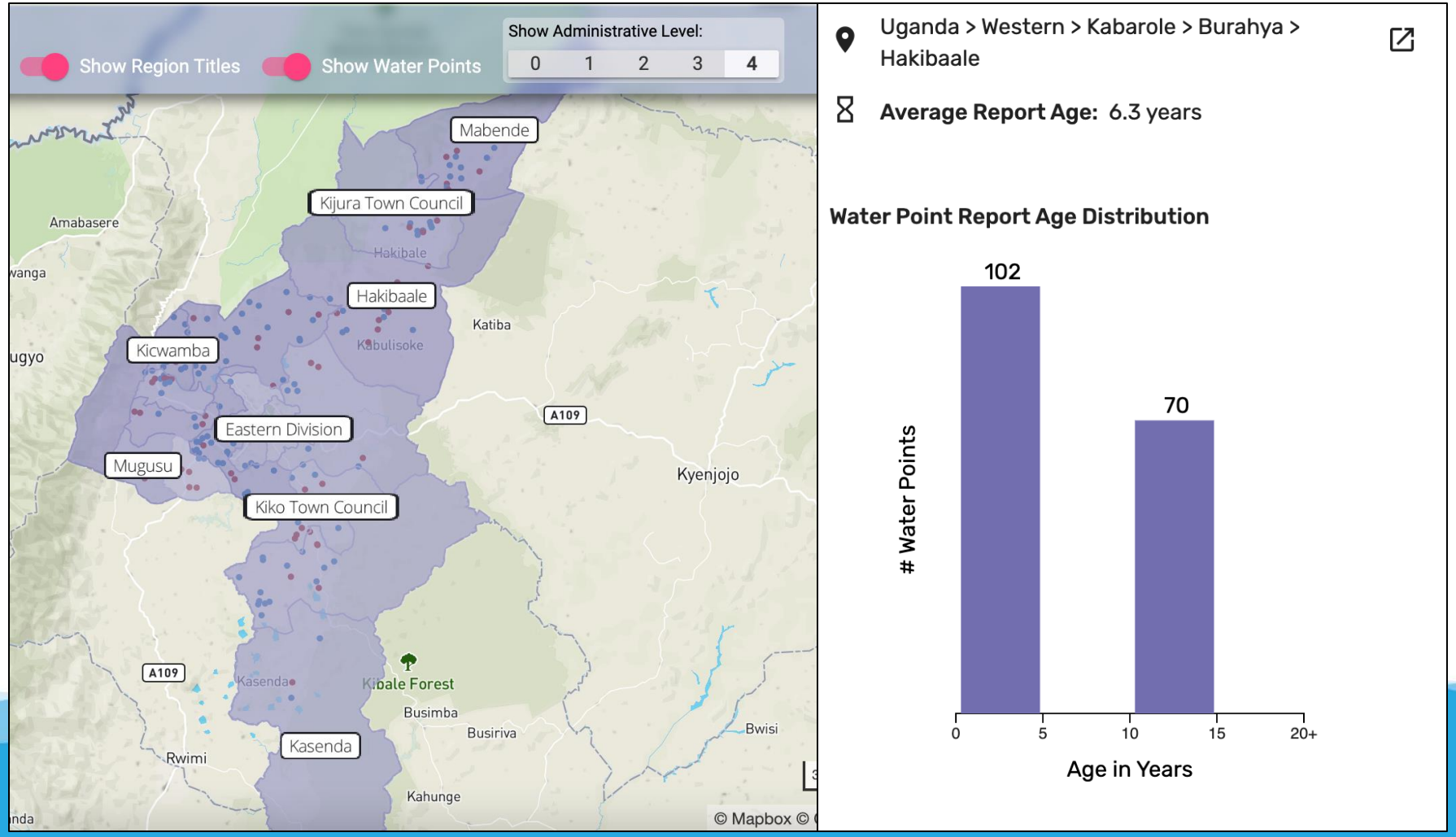
Decision Support Tool: Data Quality Score

Use case: Decide where to collect new water point data

Clicking any point on the map reveals a side panel gives an **overview of data quality** at that district and administrative level.

The panel includes the average age of data points in the region and the distribution of water points in a certain age range.

In this example, Hakibaale, Uganda (adm4) has 102 water points that were surveyed less than 5 years old, and 70 water points that were surveyed between 10 and 15 years ago. The average report date for a water point in this region is 6.3 years.



Status Prediction Analysis (Beta)

Overview

The **Status Prediction Analysis (Beta)** provides a predicted water point status for each record in the WPdx+ dataset. For each point, the tool determines if a water point is newly functional, functional, requires maintenance, non-functional, or newly non-functional since the last time data for that water point was uploaded to WPdx. The tool also provides a Predicted Risk Index for each ADM Region on a scale of Stable to High Risk of water point failure.

Illustrative Uses:

- Identifying areas for targeted water point maintenance and construction
- Understanding which regions to target for national and sub-national water access policies
- Understanding how water point functionality changes over time to draft proactive water policy

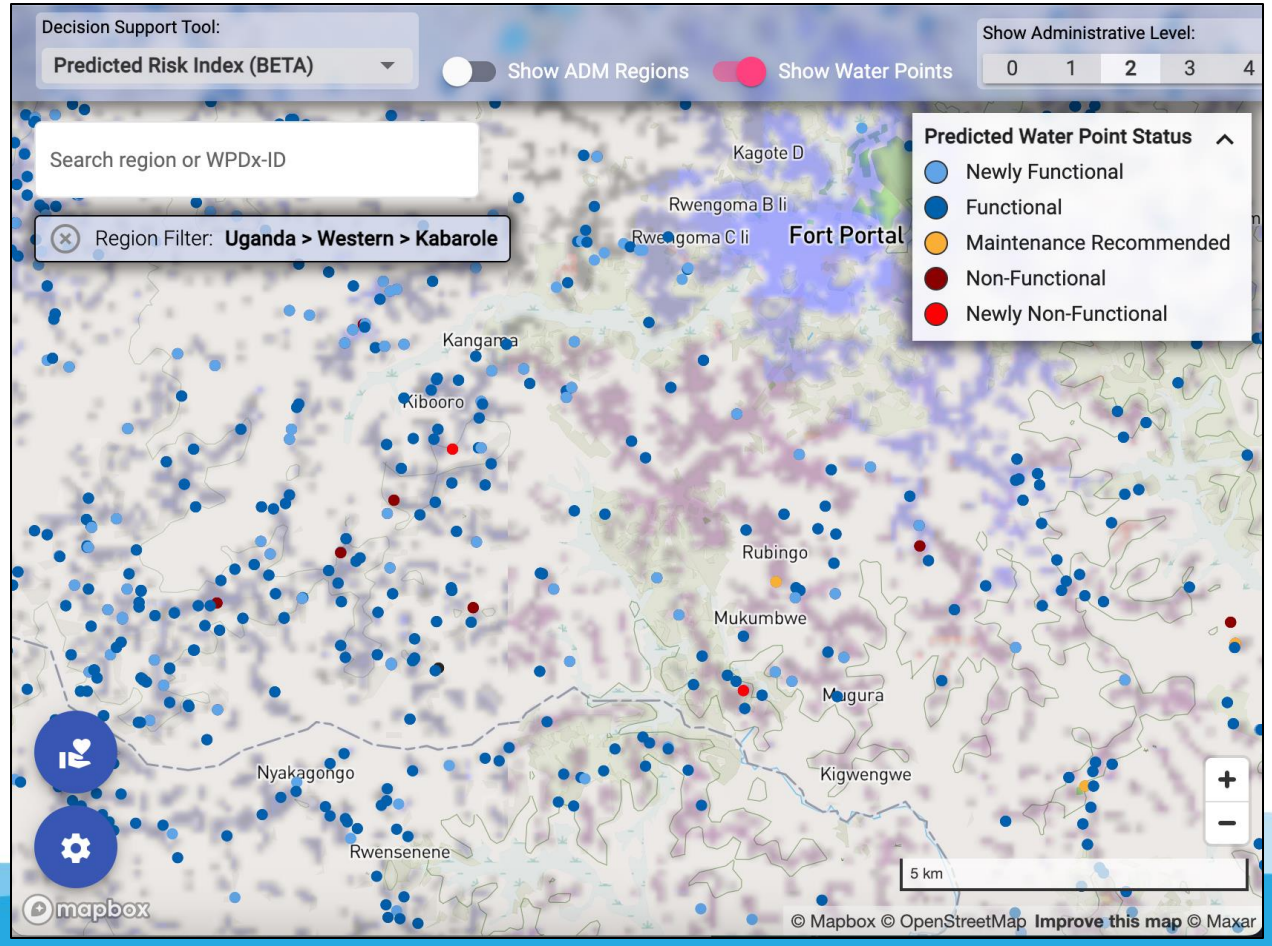
Decision Support Tool: Status Prediction Analysis (Beta)

The Status Prediction Analysis is in the beta testing stage. The prediction models are not finalized. WPdx is working to make predictions accurate.

Use case: Understand how water point functionality changes over time

This is a view of Status Prediction Analysis (Beta) in Kabarole, Uganda. Many of the water points are light blue and dark blue, indicating that they are newly functional or functional.

Bright red colors indicate that the water point is newly non-functional, while dark red points indicate that the water point has been non-functional. Yellow points suggest maintenance is needed.



Decision Support Tool: Status Prediction Analysis (Beta)

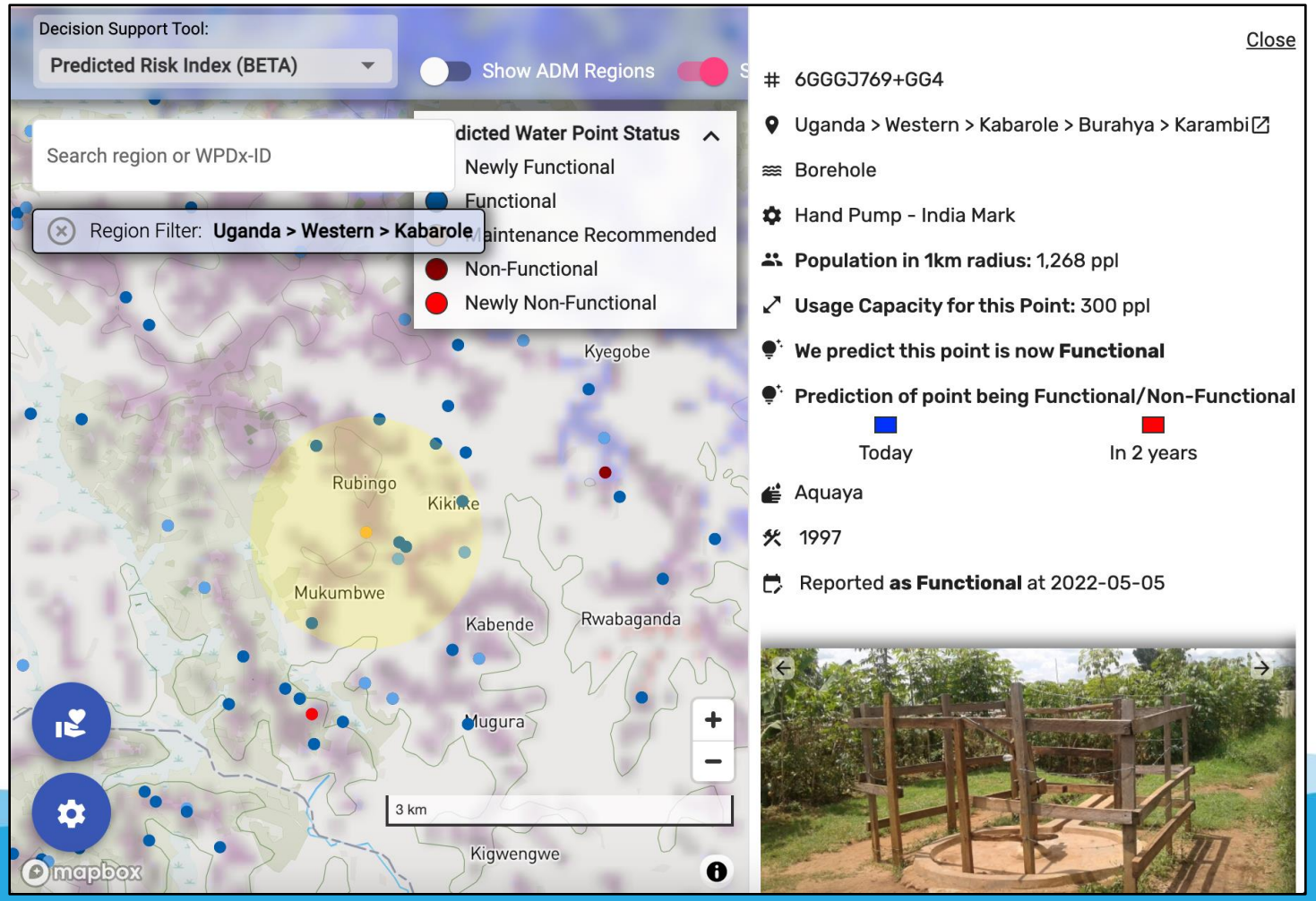
The Status Prediction Analysis is in the beta testing stage. The prediction models are not finalized. WPdx is working to make predictions accurate.

Use case: Understand how water point functionality changes over time

Clicking any of the points on the map reveals information about the location, water source, water technology, and population served.

The Status Prediction Analysis (Beta) provides a prediction of the water point status today and the water point status in 2 years.

In this example, the water point is predicted to be functional today, but will be non-functional in two years. This indicates that the water point needs maintenance to maintain service.



Decision Support Tool: Status Prediction Analysis (Beta)

Use case: Understand how water point functionality changes over time

The Status Prediction Analysis is in the beta testing stage. The prediction models are not finalized. WPdx is continuously working to make predictions more accurate.

The Status Prediction Analysis also provides a Risk Index for each administrative region. Administrative regions are labeled on a scale of stable to high risk.

Users can choose which administrative level they would like to view using the "Show Administrative Level" slider at the top of the screen. In this example, we are looking at ADM2 in Uganda. Kabarole is white, indicating that the region is stable.