Title: Water Access and Sanitation in Africa: A Case Study
Objective: To analyze data, identify patterns and propose informed, data-driven recommendations that governments and stakeholders can implement to effectively improve water access and sanitation in African Communities.

INTRODUCTION

The project was analyzed using structured query language (SQL) in SQL server Management Studio (SSMS).

After creating a database, the dataset was uploaded through the SQL Server import and export wizard.

The queries were written and executed followed by a screenshot of the result.

Some results which are large enough were exported to excel and uploaded to a drive.

The link to the results are provided under each solution.

1. Average water availability (Liters per capita per day) for each country.

QUERY

```
SELECT
    Country,
    AVG ([Water Availability (liters per capita per day)]) AS Avg_Water_Availability
    FROM Water_Supply_Sanitation_Africa
    GROUP BY Country
ORDER BY Avg_Water_Availability DESC;
```

TABLE

Results | Messages

	Country	Avg_Water_Availability
1	Nigeria	58.133004
2	Senegal	57.436842
3	Rwanda	56.228571
4	Uganda	55.716346
5	Tanzania	54.738095
6	Ghana	54.703488
7	Ethiopia	54.552884
8	Kenya	54.313043
9	Malawi	53.951923
10	Zambia	53.162561

Query executed successfully.

EXPLANATION

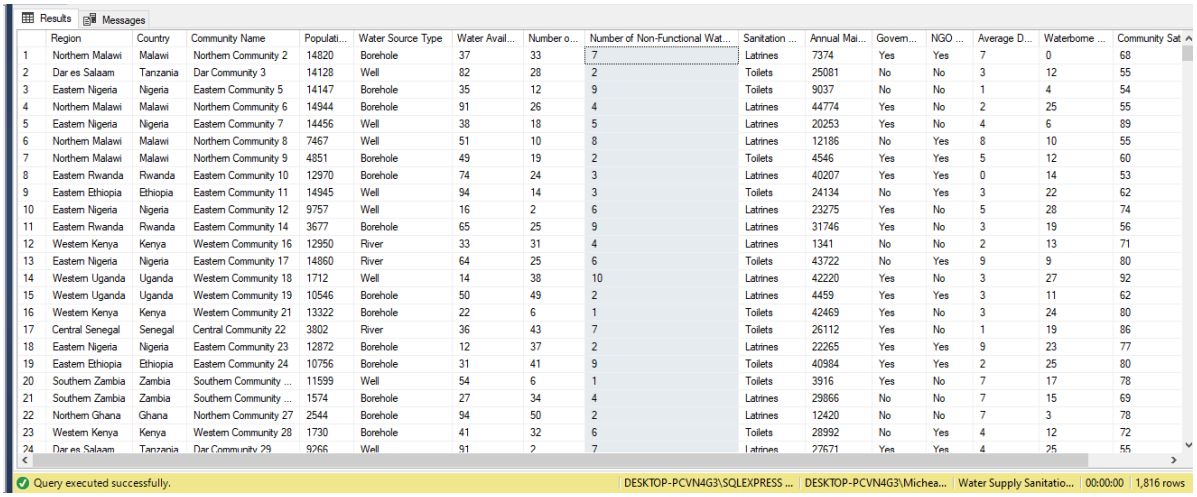
This query calculates the average water availability in liters per capita per day for each country arranged in descending order. The results show that Nigeria has the highest average, while Zambia has the lowest.

2. Details of communities where at least one water point is non-functional

QUERY

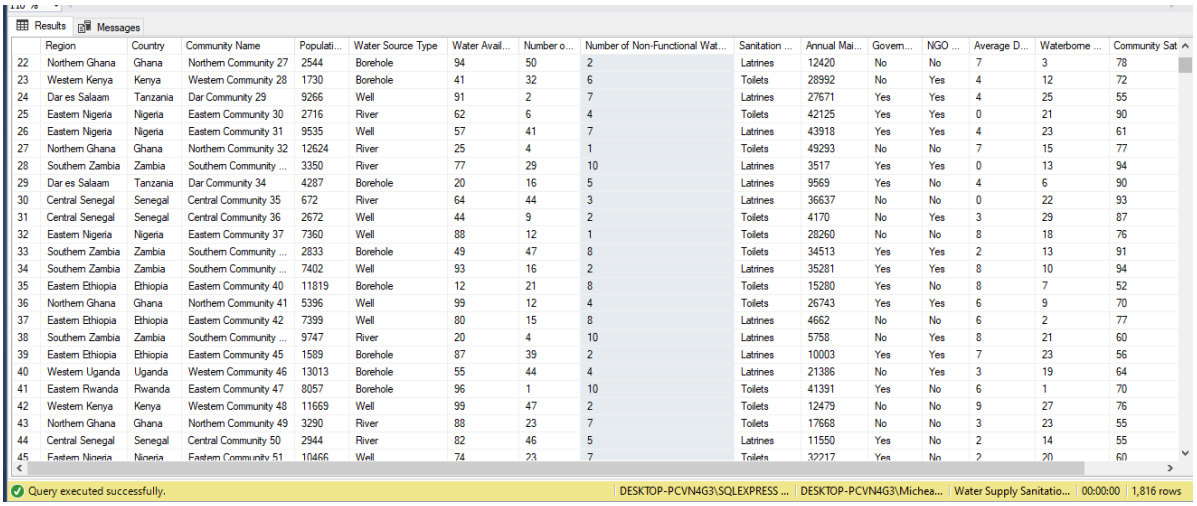
```
SELECT *
FROM Water_Supply_Sanitation_Africa
WHERE [Number of Non-Functional Water Points] >= 1;
```

TABLE



	Region	Country	Community Name	Populati...	Water Source Type	Water Avail...	Number o...	Number of Non-Functional Wat...	Sanitation ...	Annual Mai...	Govern...	NGO ...	Average D...	Waterborne ...	Community Sat
1	Northern Malawi	Malawi	Northern Community 2	14820	Borehole	37	33	7	Latrines	7374	Yes	Yes	7	0	68
2	Dar es Salaam	Tanzania	Dar Community 3	14128	Well	82	28	2	Toilets	25081	No	No	3	12	55
3	Eastern Nigeria	Nigeria	Eastern Community 5	14147	Borehole	35	12	9	Toilets	9037	No	No	1	4	54
4	Northern Malawi	Malawi	Northern Community 6	14944	Borehole	91	26	4	Latrines	44774	Yes	No	2	25	55
5	Eastern Nigeria	Nigeria	Eastern Community 7	14456	Well	38	18	5	Latrines	20253	Yes	No	4	6	89
6	Northern Malawi	Malawi	Northern Community 8	7467	Well	51	10	8	Latrines	12186	No	Yes	8	10	55
7	Northern Malawi	Malawi	Northern Community 9	4851	Borehole	49	19	2	Toilets	4546	Yes	Yes	5	12	60
8	Eastern Rwanda	Rwanda	Eastern Community 10	12970	Borehole	74	24	3	Latrines	40207	Yes	Yes	0	14	53
9	Eastern Ethiopia	Ethiopia	Eastern Community 11	14945	Well	94	14	3	Toilets	24134	No	Yes	3	22	62
10	Eastern Nigeria	Nigeria	Eastern Community 12	9757	Well	16	2	6	Latrines	23275	Yes	No	5	28	74
11	Eastern Rwanda	Rwanda	Eastern Community 14	3677	Borehole	65	25	9	Latrines	31746	Yes	No	3	19	56
12	Western Kenya	Kenya	Western Community 16	12950	River	33	31	4	Latrines	1341	No	No	2	13	71
13	Eastern Nigeria	Nigeria	Eastern Community 17	14860	River	64	25	6	Toilets	43722	No	Yes	9	9	80
14	Western Uganda	Uganda	Western Community 18	1712	Well	14	38	10	Latrines	42220	Yes	No	3	27	92
15	Western Uganda	Uganda	Western Community 19	10546	Borehole	50	49	2	Latrines	4459	Yes	Yes	3	11	62
16	Western Kenya	Kenya	Western Community 21	13322	Borehole	22	6	1	Toilets	42469	Yes	No	3	24	80
17	Central Senegal	Senegal	Central Community 22	3802	River	36	43	7	Toilets	26112	Yes	No	1	19	86
18	Eastern Nigeria	Nigeria	Eastern Community 23	12872	Borehole	12	37	2	Latrines	22265	Yes	Yes	9	23	77
19	Eastern Ethiopia	Ethiopia	Eastern Community 24	10756	Borehole	31	41	9	Toilets	40984	Yes	Yes	2	25	80
20	Southern Zambia	Zambia	Southern Community ...	11599	Well	54	6	1	Toilets	3916	Yes	No	7	17	78
21	Southern Zambia	Zambia	Southern Community ...	1574	Borehole	27	34	4	Latrines	29866	No	No	7	15	69
22	Northern Ghana	Ghana	Northern Community 27	2544	Borehole	94	50	2	Latrines	12420	No	No	7	3	78
23	Western Kenya	Kenya	Western Community 28	1730	Borehole	41	32	6	Toilets	28992	No	Yes	4	12	72
24	Dar es Salaam	Tanzania	Dar Community 29	9266	Well	91	2	7	Latrines	27671	Yes	Yes	4	25	55

Query executed successfully. DESKTOP-PCVN4G3\SQLEXPRESS ... DESKTOP-PCVN4G3\Michea... Water Supply Sanitatio... 00:00:00 1,816 rows



	Region	Country	Community Name	Populati...	Water Source Type	Water Avail...	Number o...	Number of Non-Functional Wat...	Sanitation ...	Annual Mai...	Govern...	NGO ...	Average D...	Waterborne ...	Community Sat
22	Northern Ghana	Ghana	Northern Community 27	2544	Borehole	94	50	2	Latrines	12420	No	No	7	3	78
23	Western Kenya	Kenya	Western Community 28	1730	Borehole	41	32	6	Toilets	28992	No	Yes	4	12	72
24	Dar es Salaam	Tanzania	Dar Community 29	9266	Well	91	2	7	Latrines	27671	Yes	Yes	4	25	55
25	Eastern Nigeria	Nigeria	Eastern Community 30	2716	River	62	6	4	Toilets	42125	Yes	Yes	0	21	90
26	Eastern Nigeria	Nigeria	Eastern Community 31	9535	Well	57	41	7	Latrines	43918	Yes	Yes	4	23	61
27	Northern Ghana	Ghana	Northern Community 32	12624	River	25	4	1	Toilets	49293	No	No	7	15	77
28	Southern Zambia	Zambia	Southern Community ...	3350	River	77	29	10	Latrines	3517	Yes	Yes	0	13	94
29	Dar es Salaam	Tanzania	Dar Community 34	4287	Borehole	20	16	5	Latrines	9569	Yes	No	4	6	90
30	Central Senegal	Senegal	Central Community 35	672	River	64	44	3	Latrines	36637	No	No	0	22	93
31	Central Senegal	Senegal	Central Community 36	2672	Well	44	9	2	Toilets	4170	No	Yes	3	29	87
32	Eastern Nigeria	Nigeria	Eastern Community 37	7360	Well	88	12	1	Toilets	28260	No	No	8	18	76
33	Southern Zambia	Zambia	Southern Community ...	2833	Borehole	49	47	8	Toilets	34513	Yes	Yes	2	13	91
34	Southern Zambia	Zambia	Southern Community ...	7402	Well	93	16	2	Latrines	35281	Yes	Yes	8	10	94
35	Eastern Ethiopia	Ethiopia	Eastern Community 40	11819	Borehole	12	21	8	Toilets	15280	Yes	No	8	7	52
36	Northern Ghana	Ghana	Northern Community 41	5396	Well	99	12	4	Toilets	26743	Yes	Yes	6	9	70
37	Eastern Ethiopia	Ethiopia	Eastern Community 42	7399	Well	80	15	8	Latrines	4662	No	No	6	2	77
38	Southern Zambia	Zambia	Southern Community ...	9747	River	20	4	10	Latrines	5758	No	Yes	8	21	60
39	Eastern Ethiopia	Ethiopia	Eastern Community 45	1589	Borehole	87	39	2	Latrines	10003	Yes	Yes	7	23	56
40	Western Uganda	Uganda	Western Community 46	13013	Borehole	55	44	4	Latrines	21386	No	Yes	3	19	64
41	Eastern Rwanda	Rwanda	Eastern Community 47	8057	Borehole	96	1	10	Toilets	41391	Yes	No	6	1	70
42	Western Kenya	Kenya	Western Community 48	11669	Well	99	47	2	Toilets	12479	No	No	9	27	76
43	Northern Ghana	Ghana	Northern Community 49	3290	River	88	23	7	Toilets	17668	No	No	3	23	55
44	Central Senegal	Senegal	Central Community 50	2944	River	82	46	5	Latrines	11550	Yes	No	2	14	55

Query executed successfully. DESKTOP-PCVN4G3\SQLEXPRESS ... DESKTOP-PCVN4G3\Michea... Water Supply Sanitatio... 00:00:00 1,816 rows

EXPLANATION

The query above filters the dataset to display only locations where at least one water point is non-functional.

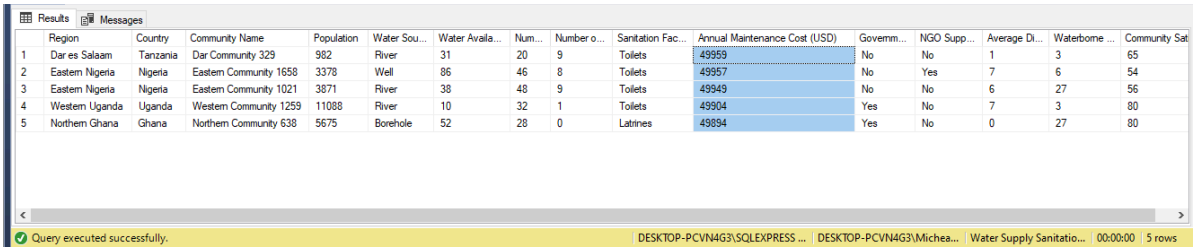
The output consists of 1,816 records. The tables above only display a sample of the data. Please, find attached the link to the complete data in spreadsheet (Excel) format: Communities where at least one water point is non-functional

3. Top five communities with the highest annual sanitation maintenance costs.

QUERY

```
SELECT TOP 5 *
FROM Water_Supply_Sanitation_Africa
ORDER BY [Annual Maintenance Cost (USD)] DESC;
```

TABLE



Results | Messages

	Region	Country	Community Name	Population	Water Sou...	Water Availa...	Num...	Number o...	Sanitation Fac...	Annual Maintenance Cost (USD)	Governm...	NGO Supp...	Average Di...	Waterborne ...	Community Sat
1	Dar es Salaam	Tanzania	Dar Community 329	982	River	31	20	9	Toilets	49959	No	No	1	3	65
2	Eastern Nigeria	Nigeria	Eastern Community 1658	3378	Well	86	46	8	Toilets	49957	No	Yes	7	6	54
3	Eastern Nigeria	Nigeria	Eastern Community 1021	3871	River	38	48	9	Toilets	49949	No	No	6	27	56
4	Western Uganda	Uganda	Western Community 1259	11088	River	10	32	1	Toilets	49904	Yes	No	7	3	80
5	Northern Ghana	Ghana	Northern Community 638	5675	Borehole	52	28	0	Latrines	49894	Yes	No	0	27	80

Query executed successfully. | DESKTOP-PCVN4G3\SQLEXPRESS ... | DESKTOP-PCVN4G3\Michea... | Water Supply Sanitatio... | 00:00:00 | 5 rows

EXPLANATION

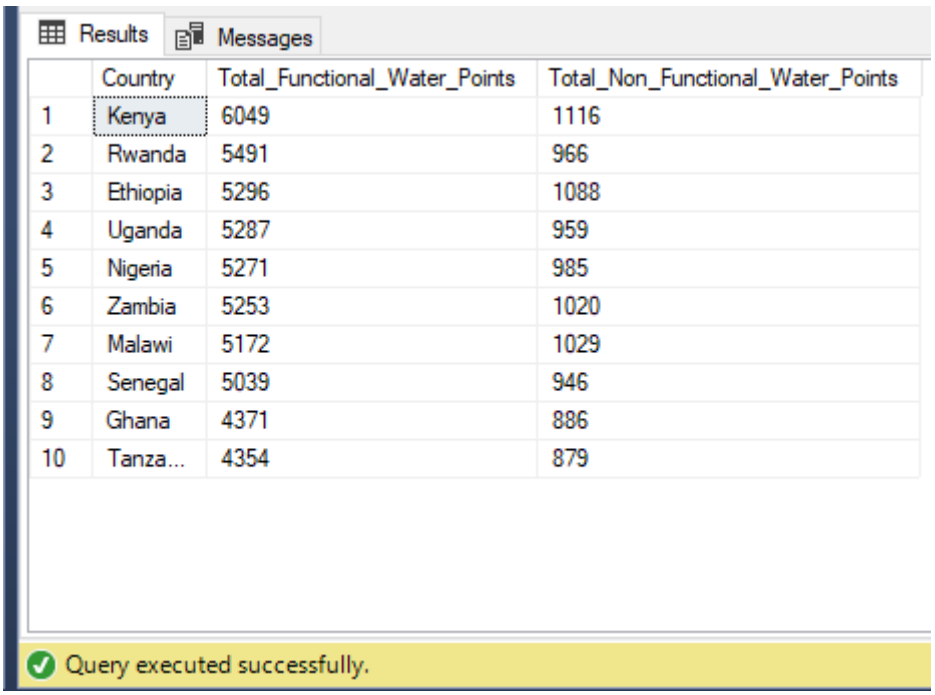
This query retrieves the top five communities with the highest annual sanitation maintenance costs. The results show that Dar Community 329 (Tanzania) has the highest cost at $49,959, followed closely by two communities in Eastern Nigeria.

4. Total numbers of functional and non-functional water points per country

QUERY

```
SELECT
    Country,
    SUM([Number of Functional Water Points]) AS Total_Functional_Water_Points,
    SUM([Number of Non-Functional Water Points]) AS Total_Non_Functional_Water_Points
FROM Water_Supply_Sanitation_Africa
GROUP BY Country
ORDER BY Total_Functional_Water_Points DESC;
```

TABLE



Results | Messages

	Country	Total_Functional_Water_Points	Total_Non_Functional_Water_Points
1	Kenya	6049	1116
2	Rwanda	5491	966
3	Ethiopia	5296	1088
4	Uganda	5287	959
5	Nigeria	5271	985
6	Zambia	5253	1020
7	Malawi	5172	1029
8	Senegal	5039	946
9	Ghana	4371	886
10	Tanza...	4354	879

Query executed successfully.

EXPLANATION

This query provides an analysis of the total number of functional and non-functional water points in each country. The results reveal that:

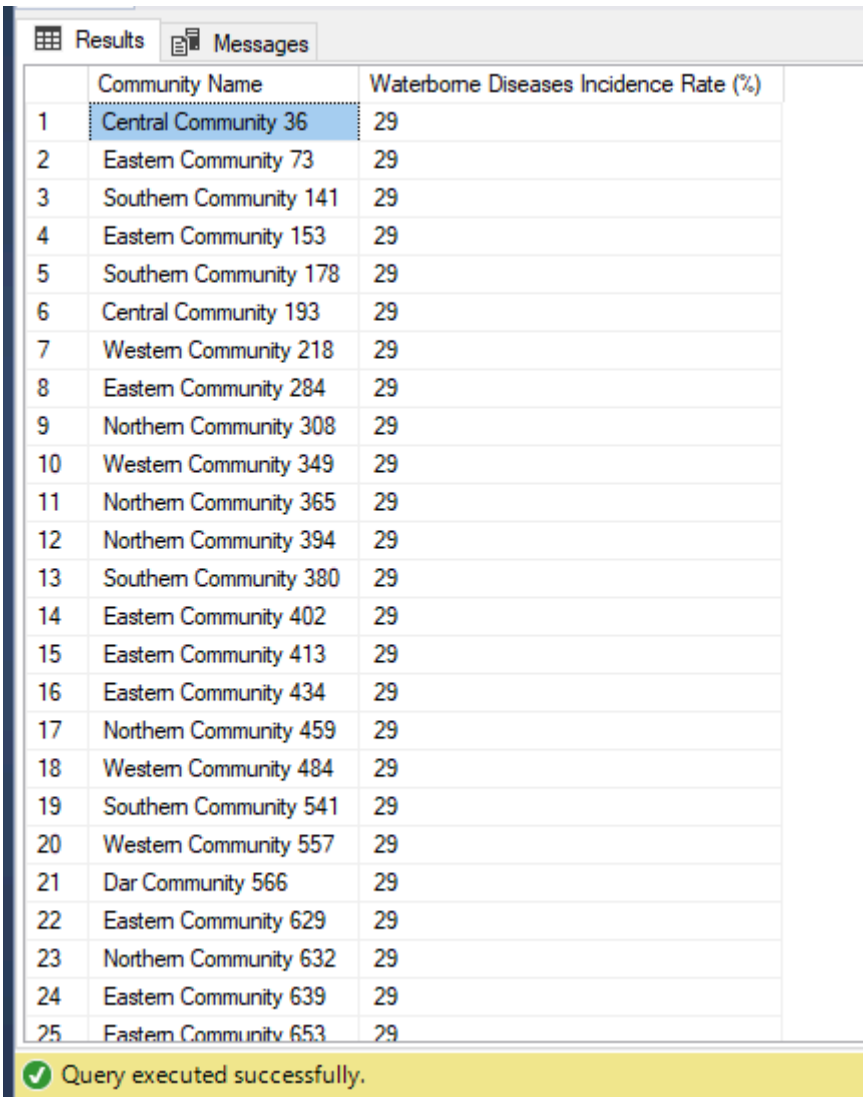
- Kenya has the highest number of functional water points (6,049), followed by Rwanda (5,491) and Ethiopia (5,296).
- Tanzania has the lowest number of functional water points (4,354) among the listed countries.
- Non-functional water points are also highest in Kenya (1,116), followed by Ethiopia (1,088).

5. Communities with a high incidence of waterborne disease (>20%)

QUERY

```
SELECT
   [Community Name],
   [Waterborne Diseases Incidence Rate (%)]
FROM  Water_Supply_Sanitation_Africa
WHERE [Waterborne Diseases Incidence Rate (%)] > 20
ORDER BY [Waterborne Diseases Incidence Rate (%)] DESC;
```

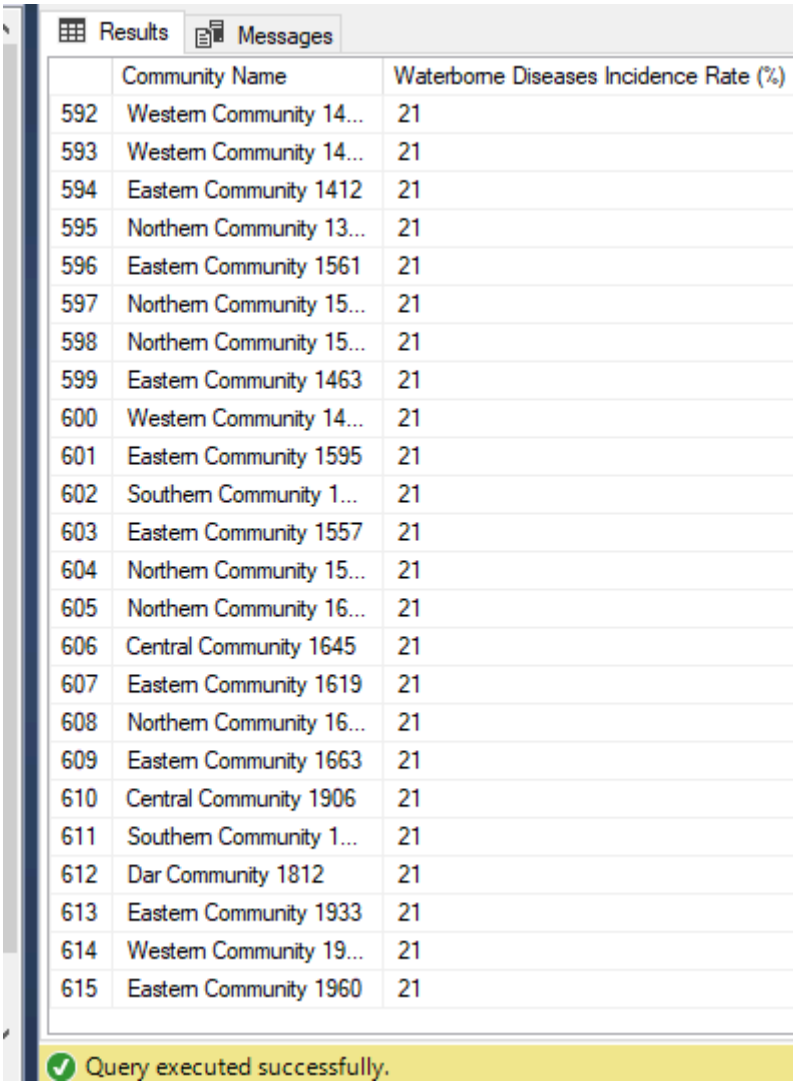
TABLE



Results | Messages

	Community Name	Waterborne Diseases Incidence Rate (%)
1	Central Community 36	29
2	Eastern Community 73	29
3	Southern Community 141	29
4	Eastern Community 153	29
5	Southern Community 178	29
6	Central Community 193	29
7	Western Community 218	29
8	Eastern Community 284	29
9	Northern Community 308	29
10	Western Community 349	29
11	Northern Community 365	29
12	Northern Community 394	29
13	Southern Community 380	29
14	Eastern Community 402	29
15	Eastern Community 413	29
16	Eastern Community 434	29
17	Northern Community 459	29
18	Western Community 484	29
19	Southern Community 541	29
20	Western Community 557	29
21	Dar Community 566	29
22	Eastern Community 629	29
23	Northern Community 632	29
24	Eastern Community 639	29
25	Eastern Community 653	29

Query executed successfully.



Results | Messages

	Community Name	Waterborne Diseases Incidence Rate (%)
592	Western Community 14...	21
593	Western Community 14...	21
594	Eastern Community 1412	21
595	Northern Community 13...	21
596	Eastern Community 1561	21
597	Northern Community 15...	21
598	Northern Community 15...	21
599	Eastern Community 1463	21
600	Western Community 14...	21
601	Eastern Community 1595	21
602	Southern Community 1...	21
603	Eastern Community 1557	21
604	Northern Community 15...	21
605	Northern Community 16...	21
606	Central Community 1645	21
607	Eastern Community 1619	21
608	Northern Community 16...	21
609	Eastern Community 1663	21
610	Central Community 1906	21
611	Southern Community 1...	21
612	Dar Community 1812	21
613	Eastern Community 1933	21
614	Western Community 19...	21
615	Eastern Community 1960	21

Query executed successfully.

EXPLANATION

The query filters communities where the waterborne disease incidence rate is above 20%.

- The fields included are the community name and waterborne disease incidence (%).
- Results are ordered in descending order to highlight the most affected communities.
- There are 615 records but the photo depicts a sample of the record.

Please find attached the link to the complete table in spreadsheet (excel) format: Communities with high incidence of waterborne disease (>20%)

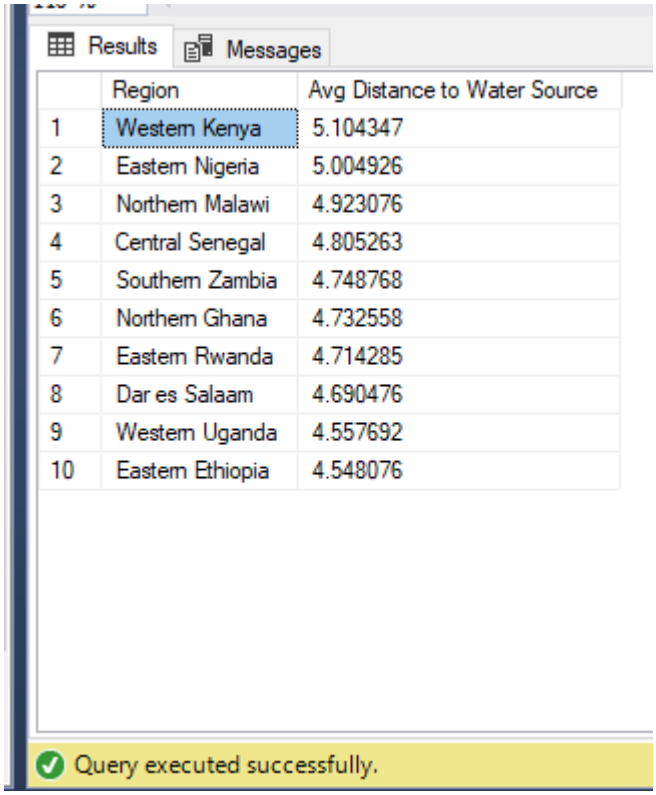
6. Average distance to the water source for each region

QUERY

```
SELECT
    [Region],
    AVG ([Average Distance to Water Source (km)]) as "Avg Distance to Water Source (km)"
FROM Water_Supply_Sanitation_Africa
```

```
GROUP BY  [Region]
ORDER BY [Avg Distance to Water Source] DESC;
```

TABLE



Results | Messages

	Region	Avg Distance to Water Source
1	Western Kenya	5.104347
2	Eastern Nigeria	5.004926
3	Northern Malawi	4.923076
4	Central Senegal	4.805263
5	Southern Zambia	4.748768
6	Northern Ghana	4.732558
7	Eastern Rwanda	4.714285
8	Dar es Salaam	4.690476
9	Western Uganda	4.557692
10	Eastern Ethiopia	4.548076

Query executed successfully.

EXPLANATION

The query returns the average distance to the water source for each region. It also assigns the name "Avg Distance to Water Source" to the new field.

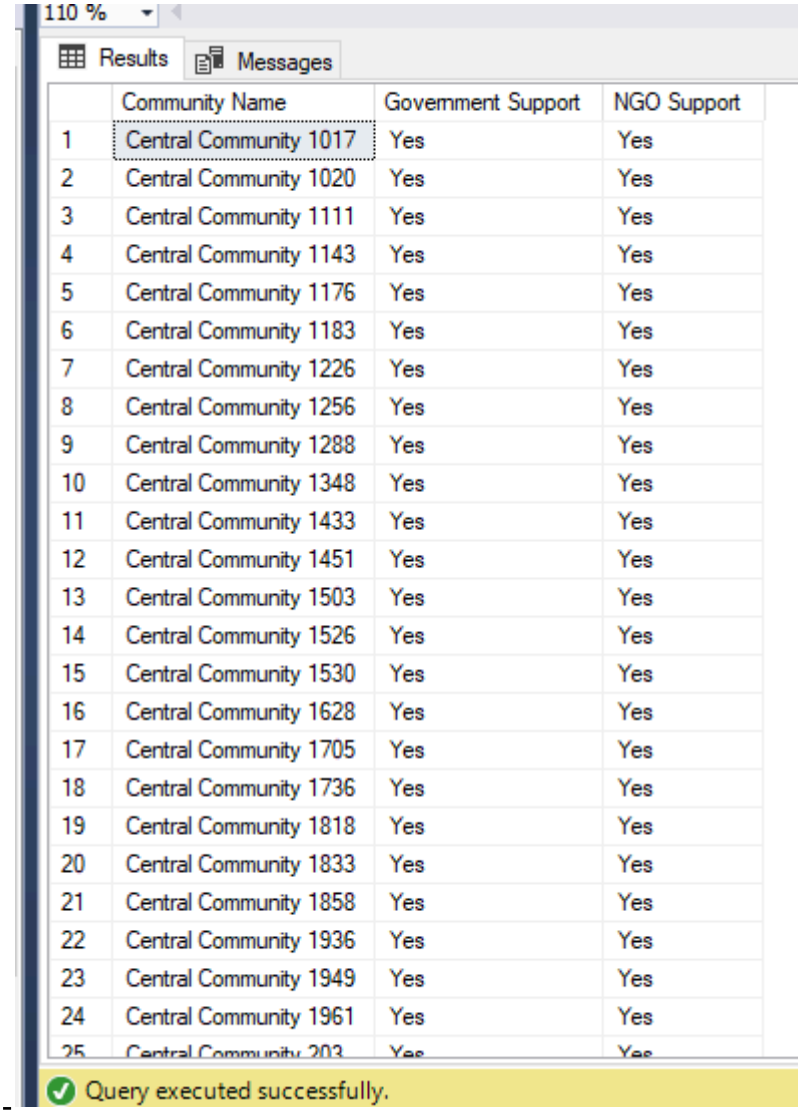
- The result is ordered by the average distance arranged in descending order to show the highest distance as the first.
- Western kenya has the highest distance of 5.104347km, followed by Eastern Nigeria with a distance of approximately 5.004926km.

7. Communities receiving both government and NGO support

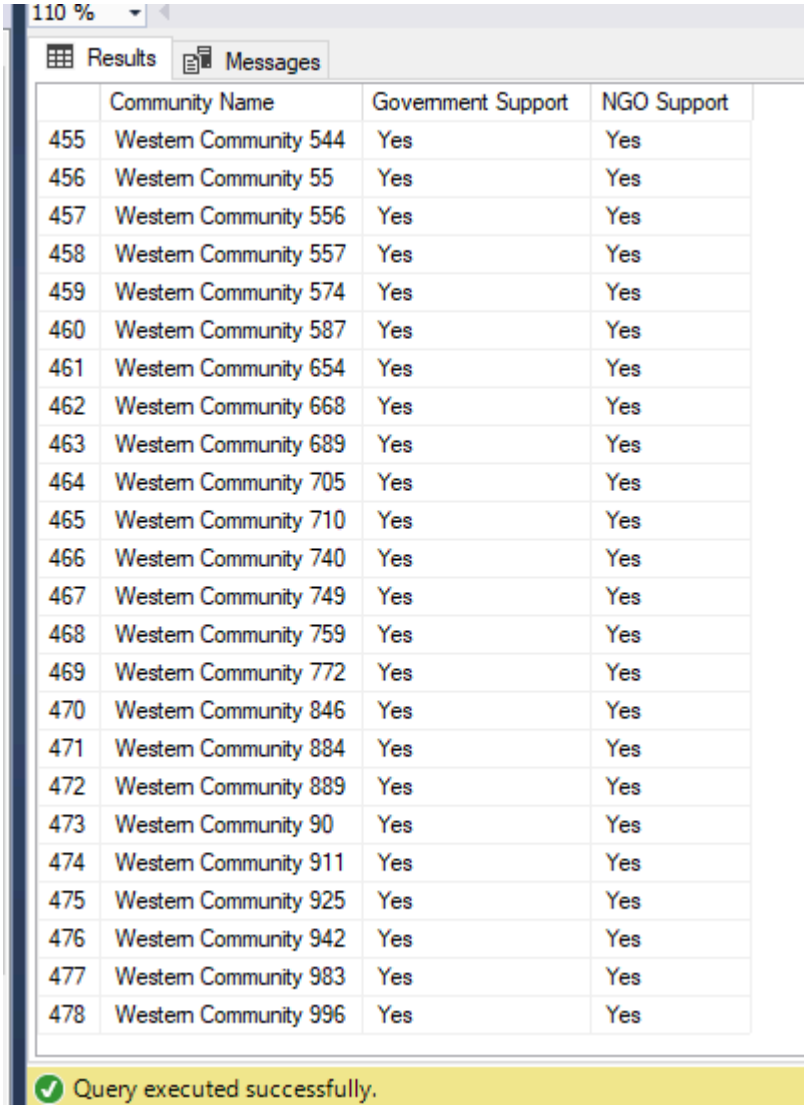
QUERY

```
SELECT
  [Community Name],
  [Government Support],
  [NGO Support]
FROM Water_Supply_Sanitation_Africa
WHERE [Government Support] = 'Yes'
AND [NGO Support] = 'Yes'
ORDER BY [Community Name] ASC;
```

TABLE



	Community Name	Government Support	NGO Support
1	Central Community 1017	Yes	Yes
2	Central Community 1020	Yes	Yes
3	Central Community 1111	Yes	Yes
4	Central Community 1143	Yes	Yes
5	Central Community 1176	Yes	Yes
6	Central Community 1183	Yes	Yes
7	Central Community 1226	Yes	Yes
8	Central Community 1256	Yes	Yes
9	Central Community 1288	Yes	Yes
10	Central Community 1348	Yes	Yes
11	Central Community 1433	Yes	Yes
12	Central Community 1451	Yes	Yes
13	Central Community 1503	Yes	Yes
14	Central Community 1526	Yes	Yes
15	Central Community 1530	Yes	Yes
16	Central Community 1628	Yes	Yes
17	Central Community 1705	Yes	Yes
18	Central Community 1736	Yes	Yes
19	Central Community 1818	Yes	Yes
20	Central Community 1833	Yes	Yes
21	Central Community 1858	Yes	Yes
22	Central Community 1936	Yes	Yes
23	Central Community 1949	Yes	Yes
24	Central Community 1961	Yes	Yes
25	Central Community 203	Yes	Yes



110 %

Results | Messages

	Community Name	Government Support	NGO Support
455	Western Community 544	Yes	Yes
456	Western Community 55	Yes	Yes
457	Western Community 556	Yes	Yes
458	Western Community 557	Yes	Yes
459	Western Community 574	Yes	Yes
460	Western Community 587	Yes	Yes
461	Western Community 654	Yes	Yes
462	Western Community 668	Yes	Yes
463	Western Community 689	Yes	Yes
464	Western Community 705	Yes	Yes
465	Western Community 710	Yes	Yes
466	Western Community 740	Yes	Yes
467	Western Community 749	Yes	Yes
468	Western Community 759	Yes	Yes
469	Western Community 772	Yes	Yes
470	Western Community 846	Yes	Yes
471	Western Community 884	Yes	Yes
472	Western Community 889	Yes	Yes
473	Western Community 90	Yes	Yes
474	Western Community 911	Yes	Yes
475	Western Community 925	Yes	Yes
476	Western Community 942	Yes	Yes
477	Western Community 983	Yes	Yes
478	Western Community 996	Yes	Yes

Query executed successfully.

EXPLANATION

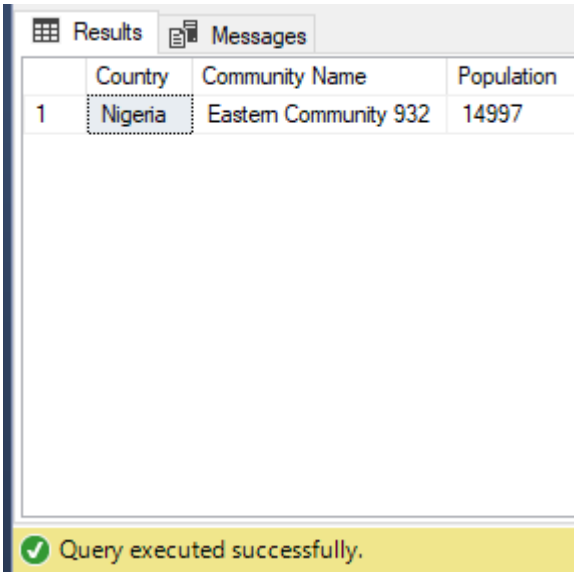
The query returns all the communities receiving both government and NGO support.
There are 478 records but the table above shows a sample of the data returned, displaying the first 25 records and the last 24 records in ascending order by the Community name.
Please, find attached the link to the complete dataset in spreadsheet (excel) format;
Communities receiving both Government and NGO Support.

8. Community with the highest population per country

QUERY

```
SELECT TOP 1
   Country,
   [Community Name],
   Population
FROM Water_Supply_Sanitation_Africa
ORDER BY Population DESC;
```

TABLE



EXPLANATION

The query above returned the community with the highest population per country.
From the syntax, the data was ordered in descending manner with the highest on top, then the first record was selected to be displayed as top 1.
The table shows that Eastern Community 932 of Nigeria has the highest population of 14,997.

INSIGHTS AND RECOMMENDATIONS

1. Improve Water Availability in Low-Supply Countries

Insight:

Nigeria has the highest average water availability, while Zambia has the lowest.

Recommendations:

- Prioritize the construction of new water supply systems in Zambia and other low-availability regions.
- Invest in efficient water management techniques, such as rainwater harvesting and improved water storage solutions.
- Introduce water conservation policies to reduce wastage, such as fixing leaks and improving irrigation methods.

2. Restore Non-Functional Water Points

Insight:

Several communities have at least one non-functional water point, with significant numbers in certain regions.

Recommendations:

- Implement a water infrastructure rehabilitation program in high-failure areas, including regular maintenance and repair funding.
- Train local maintenance teams to ensure water points remain functional.
- Encourage public-private partnerships for long-term sustainability and management of water points.

3. Reduce the High Cost of Water Sanitation Maintenance

Insight:

The top 5 highest maintenance cost communities are in Tanzania and Nigeria (up to $49,959 per year).

Recommendations:

- Conduct a cost audit to understand why these costs are high and explore ways to reduce inefficiencies.
- Encourage use of local materials and labor for sanitation projects to lower costs.
- Seek alternative funding through NGOs and micro-financing to assist communities in sustaining sanitation infrastructure.

4. Reduce Non-Functional Water Points

Insight:

Some countries have a high number of non-functional water points, with Kenya, Ethiopia, and Tanzania being the worst affected.

Recommendations:

- Establish a routine inspection and maintenance program to detect and repair faulty water points before complete failure.
- Create government and community maintenance funds for sustainable repairs.
- Invest in more durable infrastructure, particularly in Tanzania, which has the lowest number of functional water points.

5. Health Interventions for Communities with High Waterborne Disease Rates

Insight:

615 communities have a waterborne disease incidence rate above 20%.

Recommendations:

- Implement immediate clean water initiatives in affected communities.
- Provide free or subsidized chlorine tablets and filtration kits to at-risk populations.
- Run regular health awareness campaigns on proper sanitation, hygiene, and waterborne disease prevention.

6. Reduce Distance to Water Sources

Insight:

Western Kenya (5.10 km) and Eastern Nigeria (highest distance: 5+ km) have the longest distances to water sources.

Recommendations:

- Construct local water access points to reduce long travel distances, prioritizing the worst-affected regions.
- Expand piped water systems to provide easier access in remote and rural areas.
- Improve water transportation solutions, such as community-managed water delivery services for households far from main water points.

7. Expand Government and NGO Support

Insight:

Only 478 communities receive both government and NGO support, leaving many without adequate resources.

Recommendations:

- Increase collaboration between government agencies and NGOs to reach more underserved communities.

- Develop a data-driven funding system that prioritizes the most water-insecure areas for new projects.
- Establish community-led committees to advocate for additional support and improve fund allocation transparency.

8. Address High Water Demand in Densely Populated Communities

Insight:

The largest communities in each country face the highest water demand.

Recommendations:

- Build additional water reservoirs and treatment plants in high-density communities.
- Encourage the use of water-efficient technology in urban areas to reduce water waste.
- Implement water rationing policies in high-demand areas to prevent shortages.