Table S1. Service Level Indicator Scoring Criteria

Service	Indicator	Units	Variable	Range	Score
Quality	Faecal Coliforms	MPN/100mL	Ordinal	> 10	1
				3 - 10	2
				1 - 3	3
				0	4
	Geogenic Contaminants	P/A	Binary	Presence	0
				Absence	1
	pH	pH	Binary	Else	0
				6.5 - 8.5	1
	Conductivity	μS/cm	Binary	> 750	0
				< 750	1
	Turbidity	NTU	Binary	> 5	0
				< 5	1
	Residual Chlorine (Presence)	P/A	Binary	Absence	0
				Presence	1
	Residual Chlorine (Concentration)	mg/L	Binary	< 0.2	0
				0.2 - 2	1
Quantity	Liters/person/day	L/pp/day	Ordinal	< 5	1
				5 - 20	2
				20 - 50	3
				50 - 100	4
				> 100	5
	Use of Multiple Water Sources	P/A	Binary	1	0
				> 1	1
	Do you feel you can collect enough water? (Perception)	-	Binary	No	0
				Yes	1
Reliability	Annual Reliability	days/year	Ordinal	< 182	1
				182-237	2
				237-292	3
				292-347	4
				> 347	5
	Daily Availability	hours	Ordinal	0 - 4	1
				4 - 8	2
				8 - 12	3
				12 - 24	4
				24	5
	Functionality	-	Binary	Abandoned	0
				Not Functional	0
				Closed (long-term)	0
				Partially	1
				Functional	1

Table S1. Service Level Indicator Scoring Criteria (cont.)

Service	Indicator	Units	Variable	Range	Score
Accessibility	Time to collect water (round trip)	min	Ordinal	> 60	1
				30 - 60	2
				15 - 30	3
				5 - 15	4
				< 5	5
	Distance to source	m	Ordinal	> 1000	1
				500 - 1000	2
				100 - 500	3
				10 - 100	4
				On plot	5
	How many households in the community collect from this source? (Congestion)	households	Ordinal	Everyone	1
				20 - 40	2
				5 - 20	3
				2 - 5	4
				1 (Private)	5
	Do you feel safe when collecting from this source? (Security)	-	Binary	No	0
				Yes	1
Affordability	Relative Usage	min	Ordinal	Nothing	1
				Drinking	2
				Drinking / Cooking	3
				Domestic Needs	4
				All Needs	5
Acceptability	Water - Taste	Likert	Ordinal	Poor	1
	Water - Odor			Below Average	2
	Water - Appearance			Acceptable	3
	Water - Lather			Good	4
	Water - Affordability			Excellent	5
	Water - Opening Hours				
	Water - Wait Time				
	Vendor - Politeness				
	Vendor - Communication				
	Vendor - Availability				
	Vendor - Helpfulness				
	Vendor - Consider Poor				
	Manager - Professional				
	Manager - Finances				
	Manager - Responsive				
	Manager - Trustworthy				
	Manager - Engagement				

Table S2. Temporal demographics of control and intervention groups (detailed)

	Variable	Control*		Intervention*		Total*	
		2016	2019	2016	2019	2016	2019
a	Estimated Total Population	23,527		30,503		54,030	
b	Mean Population (Range)	**784**		**1,017**		901	
	Range	60 - 3,874		198 - 6,252		60 - 6,252	
c	Number of Communities	30		30		60	
d	Number of Water Sources	**130**	**145**	**105**	**173**	**233**	**318**
	% Surface Sources	13.1%	11.7%	16.2%	9.8%	13.7%	10.7%
	% Groundwater Sources	**56.2%**	57.2%	**81.9%**	60.7%	68.2%	59.1%
	% Piped Sources	**30.8%**	31.0%	**1.9%**	29.5%	18.0%	30.2%
e	Improved Source Available	96.7%	96.7%	100.0%	100.0%	98.3%	98.3%
f	Sampled Households	560	555	549	597	1108	1152
	Removed	19	11	9	13	28	24
g	Percent females	44.2%	55.2%	31.2%	60.1%	37.0%	57.3%
h	Mean Household Size	5.16	5.4	4.85	5.52	4.99	5.45
i	Mean Workers per Household	2.00	1.74	1.87	1.97	1.93	1.84
j	Median Age Range	40-49	40-49	40-49	40-49	40-49	40-49
k	Respondent Education						
	None	32.3%	37.0%	28.9%	32.2%	30.4%	34.8%
	Primary	9.2%	12.4%	7.4%	16.0%	8.2%	14.0%
	Junior High School	29.6%	32.2%	30.1%	29.8%	29.9%	31.2%
	Senior High School	19.5%	14.2%	20.2%	14.5%	19.8%	14.3%
	Post-Senior High School	9.5%	4.2%	13.5%	7.5%	11.7%	5.7%
l	Job Category						
	Unemployed	12.7%	19.1%	15.8%	15.8%	14.5%	18.8%
	Farming	55.2%	55.8%	62.4%	57.0%	59.2%	56.3%
	Retailer	12.0%	9.4%	6.0%	7.2%	8.7%	8.4%
	Food Service	5.3%	1.3%	0.7%	3.8%	2.7%	2.4%
	Mining	3.4%	1.4%	1.3%	2.4%	2.3%	1.8%
	Salaried	0.1%	4.7%	1.2%	1.3%	70.0%	3.2%
	Other	11.3%	8.4%	12.5%	12.5%	11.9%	9.0%
m	Rural Quintile (Mean)	3.64	3.40	3.67	3.42	3.66	3.41
	Poorest (0-20%)	0.5%	1.2%	0.5%	0.1%	0.5%	0.7%
	Poor (20-40%)	8.6%	14.8%	10.6%	14.0%	9.7%	14.4%
	Average (40-60%)	37.2%	43.4%	30.7%	40.3%	33.7%	42.0%
	Rich (60-80%)	33.5%	24.0%	37.5%	35.6%	35.7%	29.1%
	Richest (80-100%)	20.2%	16.6%	20.7%	10.0%	20.4%	13.8%

*Bolded text denotes p < 0.05

**Table S3.** Multinomial logistic regression of water source performance (detailed)

	Explanatory Variables	n	Functionality* %	Functionality* OR (95% CI)	Annual Reliability > 95%* %	Annual Reliability > 95%* OR (95% CI)	Free from Fecal Coliforms* %	Free from Fecal Coliforms* OR (95% CI)
	System Age	270						
a	< 2 years	72	**82.2%**	**0.38 (0.19-0.75)**	**69.7%**	**0.42 (0.23-0.76)**	**77.8%**	**0.25 (0.12-0.52)**
b	3 - 4 years	37	63.5%	1	49.1%	1	46.8%	1
c	5 - 6 years	20	55.1%	1.42 (0.60-3.36)	30.8%	2.17 (0.59-7.97)	36.9%	1.51 (0.40-5.65)
d	7 - 8 years	32	51.4%	1.65 (0.64-4.23)	41.5%	1.36 (0.57-3.24)	42.0%	1.22 (0.48-3.09)
e	9 - 10 years	31	64.7%	0.95 (0.38-2.42)	27.1%	2.59 (0.97-6.97)	51.9%	0.82 (0.35-1.92)
f	> 10 years	78	68.7%	0.79 (0.39-1.63)	40.9%	1.39 (0.69-2.80)	32.5%	1.82 (0.89-3.73)
	Water Source Type	283						
g	Borehole	104	63.6%	1	37.7%	1	50.9%	1
h	Unprotected Well	44	76.0%	0.55 (0.25-1.20)	54.7%	0.50 (0.25-1.01)	-	-
i	Protected Well	39	57.7%	1.27 (0.63-2.58)	30.9%	1.36 (0.69-2.68)	**7.7%**	**12.45 (4.65-33.40)**
j	Standpipe	48	54.7%	1.45 (0.81-2.59)	38.5%	0.97 (0.45-2.07)	49.4%	1.06 (0.53-2.12)
k	Kiosk	48	**91.7%**	**0.16 (0.08-0.30)**	**85.4%**	**0.10 (0.06-0.18)**	**91.5%**	**0.10 (0.04-0.23)**
	Management Scheme	252						
l	Community	141	61.8%	1	37.3%	1	35.0%	1
m	Access Development	52	**92.3%**	**0.14 (0.07-0.27)**	**86.5%**	**0.09 (0.05-0.16)**	**90.2%**	**0.06 (0.03-0.13)**
n	Religious Institution	8	61.7%	1.00 (0.20-5.17)	51.4%	0.56 (0.13-2.47)	12.9%	3.65 (0.58-22.97)
o	District Assembly	10	50.0%	1.62 (0.70-3.78)	39.1%	0.93 (0.40-2.17)	50.0%	0.54 (0.26-1.14)
p	Individual	24	**88.2%**	**0.22 (0.09-0.51)**	49.1%	0.62 (0.27-1.40)	33.1%	1.09 (0.55-2.16)
q	No Manager	7	52.2%	1.48 (0.29-7.51)	11.9%	4.38 (0.93-20.54)	20.1%	2.14 (0.33-13.92)
r	Public Utility	10	60.0%	1.08 (0.37-3.19)	60.0%	0.40 (0.13-1.19)	50.0%	0.54 (0.20-1.44)
	Payment Method	266						
s	Nothing	88	50.7%	1	30.8%	1	10.1%	1
t	Emergency Funds	15	54.4%	0.86 (0.42-1.77)	38.1%	0.72 (0.26-2.02)	12.7%	0.77 (0.29-2.05)
u	Monthly Tariff	17	**95.2%**	**0.06 (0.01-0.24)**	54.9%	0.36 (0.11-1.22)	**58.5%**	**0.08 (0.04-0.15)**
v	Pay-to-fetch	146	**78.8%**	**0.28 (0.15-0.53)**	**58.9%**	**0.31 (0.16-0.59)**	**68.0%**	**0.05 (0.03-0.10)**

*Bolded text denotes $p < 0.05$; surface sources excluded from analysis

Records associated with many of these variables are available within the online dataset, including whether managers were chosen, paid, or under contract, frequencies of inspections and meetings, evidence of training and written records for technical and financial purposes, and sources of external support.

Table S4. Multinomial logistic regression for service level indicators by household group (detailed)

	Parameter	n	Control %	Control vs User* OR (95% CI)	Non-User %	Non-User vs User* OR (95% CI)	User %
Quality							
a	Use Improved Primary Source	1128	70.9%	**3.83 (1.58-9.26)**	71.2%	**3.77 (1.97-7.23)**	90.3%
b	Free from fecal contamination (Prim.)	1079	62.3%	**5.69 (2.61-12.43)**	54.1%	**7.98 (3.66-17.39)**	90.4%
c	Free from fecal contamination (All)	1070	59.7%	**3.41 (1.57-7.39)**	53.1%	**4.46 (2.33-8.57)**	83.5%
d	Free from geogenic contamination	1079	100.0%	1.00 (1.00-1.00)	100.0%	1.00 (1.00-1.00)	0.0%
e	Residual chlorine present	1076	1.5%	**110.1 (26.3-461.6)**	2.4%	**68.2 (12.6-367.4)**	62.9%
f	Residual chlorine above 0.2 ppm	1076	0.4%	**17.1 (1.5-188.5)**	0.0%	-	5.7%
Quantity							
g	Quantity collected above 20 L/p/d	1096	79.6%	0.86 (0.49-1.49)	75.8%	1.07 (0.63-1.80)	76.9%
h	Use of multiple water sources	1128	41.1%	**0.27 (0.14-0.50)**	34.3%	**0.20 (0.12-0.33)**	72.4%
i	Sufficient quantity (perception)	1128	96.9%	**0.26 (0.08-0.87)**	92.6%	0.66 (0.26-1.64)	89.1%
Accessibility							
j	Time per trip < 30 min	1114	94.8%	0.84 (0.35-2.04)	93.4%	1.07 (0.43-2.66)	93.9%
k	Distance to water source < 100 m	992	34.1%	1.85 (0.99-3.47)	27.9%	**2.47 (1.43-4.26)**	48.9%
l	Congestion > 20 households	1039	93.6%	1.72 (0.69-4.25)	97.5%	0.65 (0.19-2.19)	96.2%
m	Security (perception)	1124	94.9%	0.87 (0.27-2.85)	91.3%	1.54 (0.50-4.7)	94.1%
Reliability							
n	Annual reliability > 345 days	963	63.5%	2.20 (0.93-5.20)	48.4%	**4.10 (1.87-9.01)**	79.3%
o	Daily reliability > 12 hrs	1122	83.8%	**0.29 (0.15-0.58)**	85.5%	**0.26 (0.13-0.51)**	60.2%
Affordability							
p	Can afford to pay for domestic needs	1128	77.7%	**0.45 (0.23-0.91)**	86.9%	**0.24 (0.12-0.47)**	61.2%
q	Rural Quintile is above 'Average'	1128	40.6%	1.46 (0.73-2.91)	43.0%	1.32 (0.83-2.11)	50.0%
r	Received 'Excellent' affordability ratings	1106	17.1%	1.07 (0.54-2.13)	17.7%	1.03 (0.60-1.75)	18.1%
Acceptability							
s	Received 'Excellent' taste ratings	1111	22.9%	1.45 (0.87-2.42)	21.5%	1.58 (0.95-2.62)	30.2%
t	Received 'Excellent' odor ratings	1110	15.9%	**2.52 (1.41-4.51)**	14.2%	**2.88 (1.72-4.81)**	32.2%
u	Received 'Excellent' appearance ratings	1106	22.1%	**2.53 (1.46-4.40)**	33.1%	1.45 (0.92-2.29)	41.8%
v	Received 'Excellent' lather ratings	1097	18.8%	1.48 (0.81-2.71)	17.0%	**1.67 (1.01-2.76)**	25.4%
w	Safe to drink (perception)	1034	89.3%	**5.54 (2.12-14.49)**	94.7%	2.61 (0.92-7.40)	97.9%

*Bolded text denotes p < 0.05
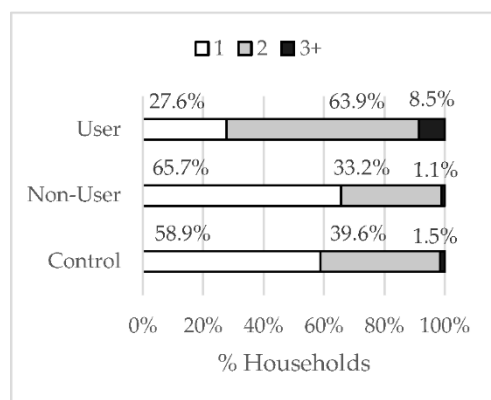
Figure S1. Proportion of households using multiple water sources
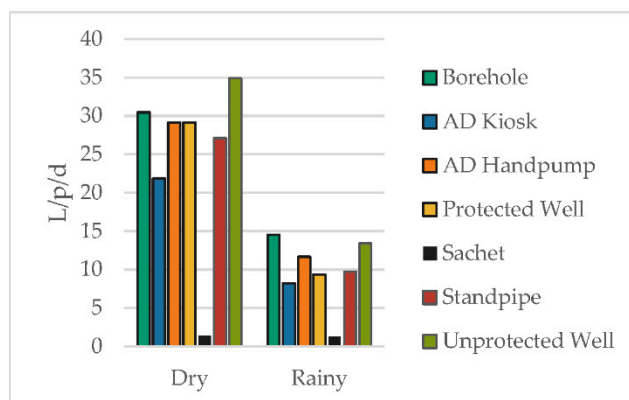
Figure S2. Quantity of water collected per person per day in the dry and rainy seasons
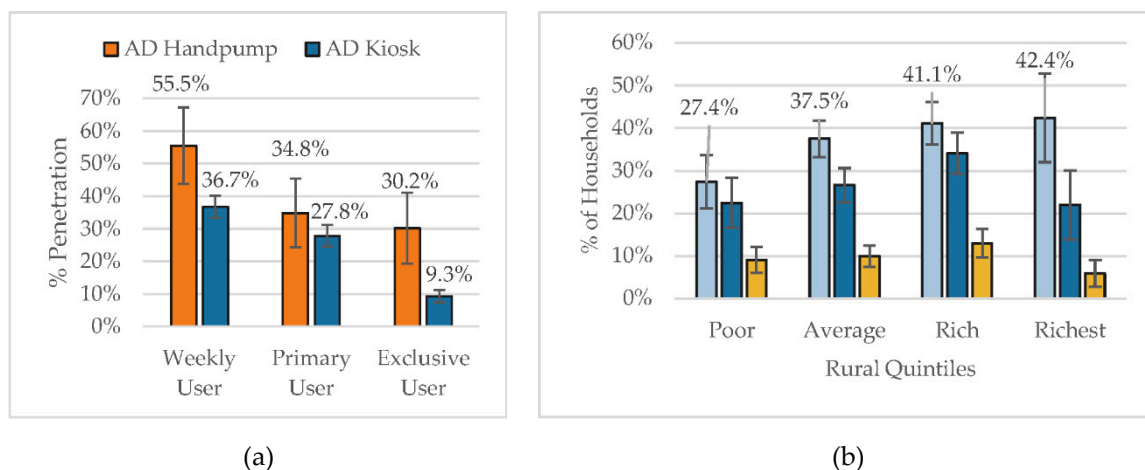
(a)   (b)

Figure S3. AD penetration rates by usage frequency vs (a) water source type or (b) rural wealth quintile

Table S5. Chemical measurement summary of improved water sources

Variable	Units	Median	Range		Criteria
pH	-	5.95	3.91	7.75	6.5 - 8.5 [a]
Conductivity	µS/cm	215.33	51.57	1255.40	< 750 [b]
Turbidity	NTU	0.00	0.00	52.67	<= 5 [a]
Arsenic	mg/L	0.00	0.00	0.00	< 0.01 [a]
Fluoride	mg/L	0.20	0.00	0.96	< 1.5 [a]
Free Chlorine	mg/L	0.00	0.00	0.20	0.2 – 2 [a]
Total Chlorine	P/A	17.9%	-	-	Presence

[a](WHO, 2017a); [b](EPA, 2019)
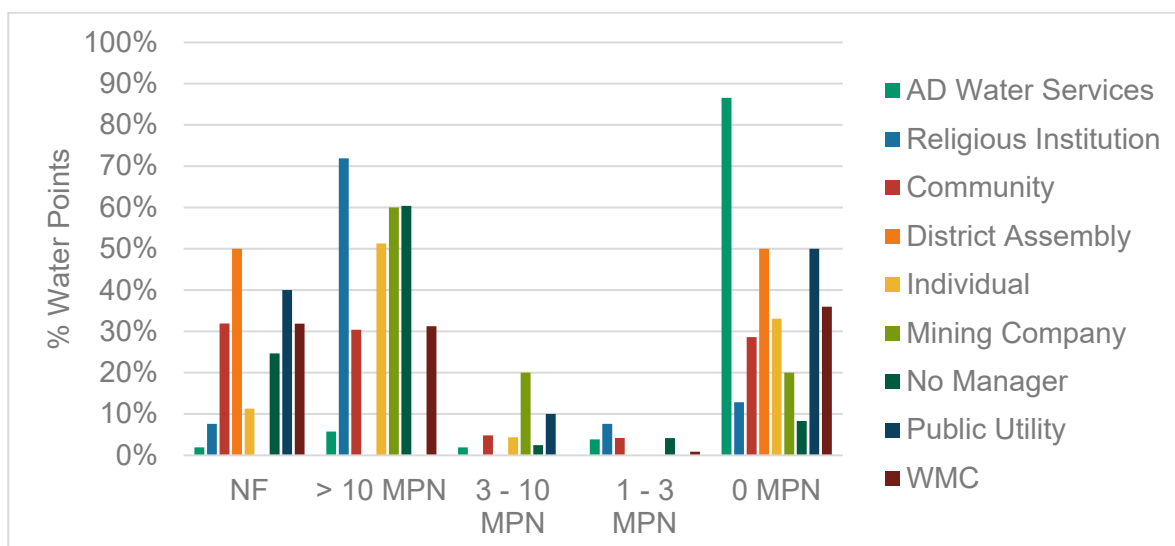
Figure S4. E. coli measurements vs management entity
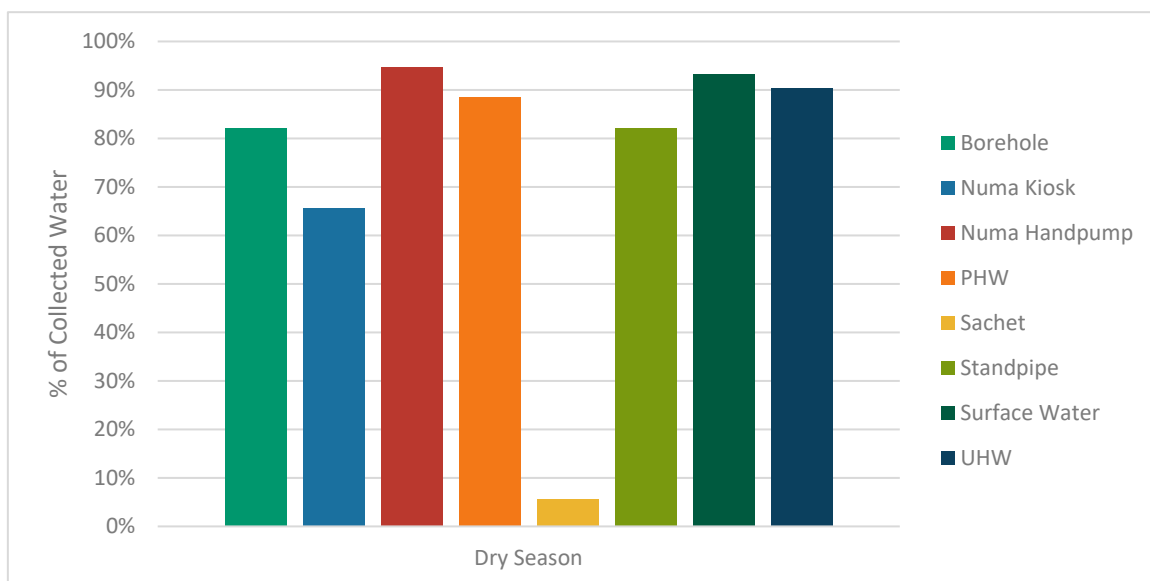
Figure S5. Mean proportion of total water collected by a household for a given primary source
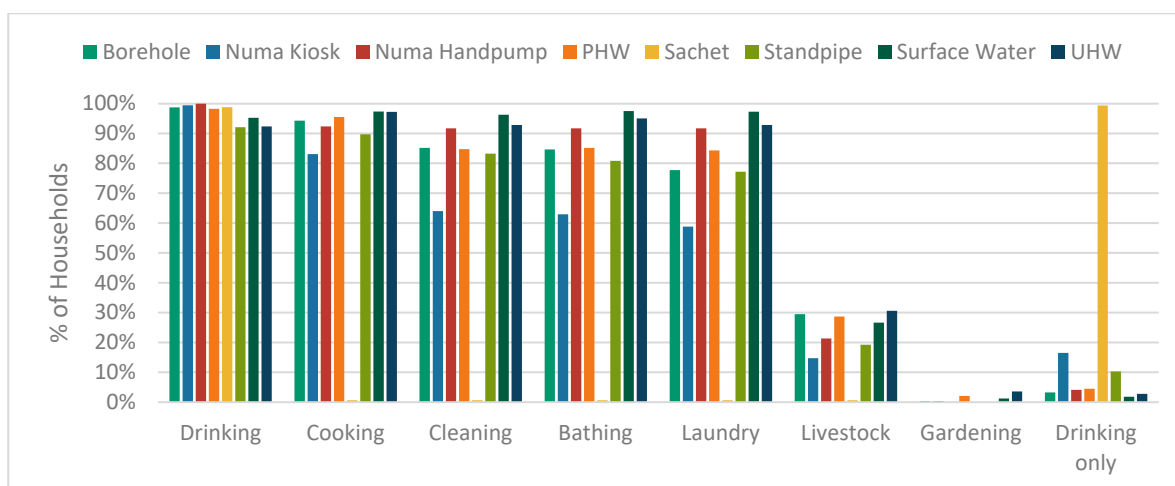

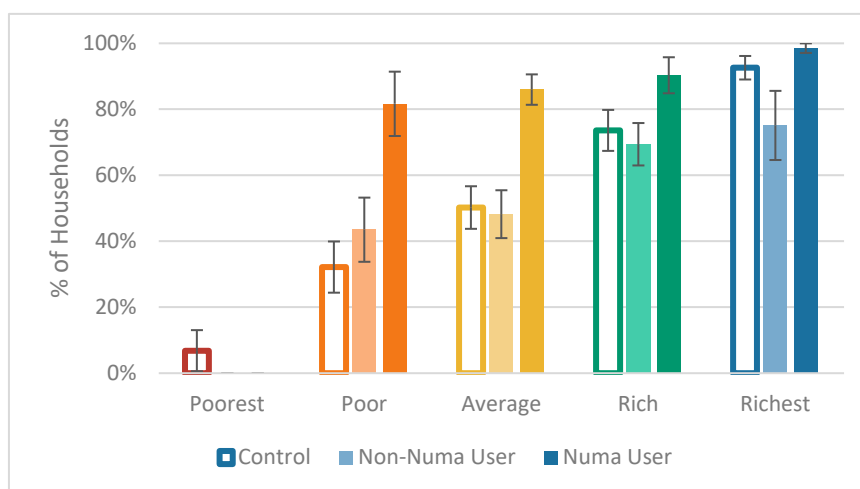**Figure S6.** Proportion of households that use their primary source for each category

Figure S7. Proportion of households that pay for their primary source vs classification and wealth index
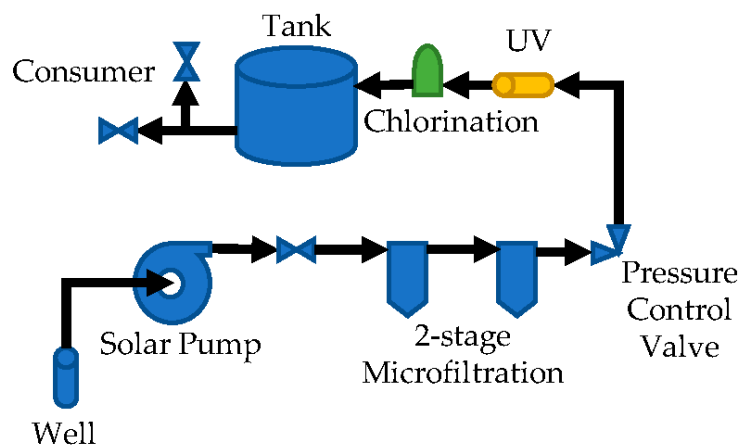
Figure S8. Simple water treatment process flow diagram. Other valves or treatment (iron removal) may also be present.
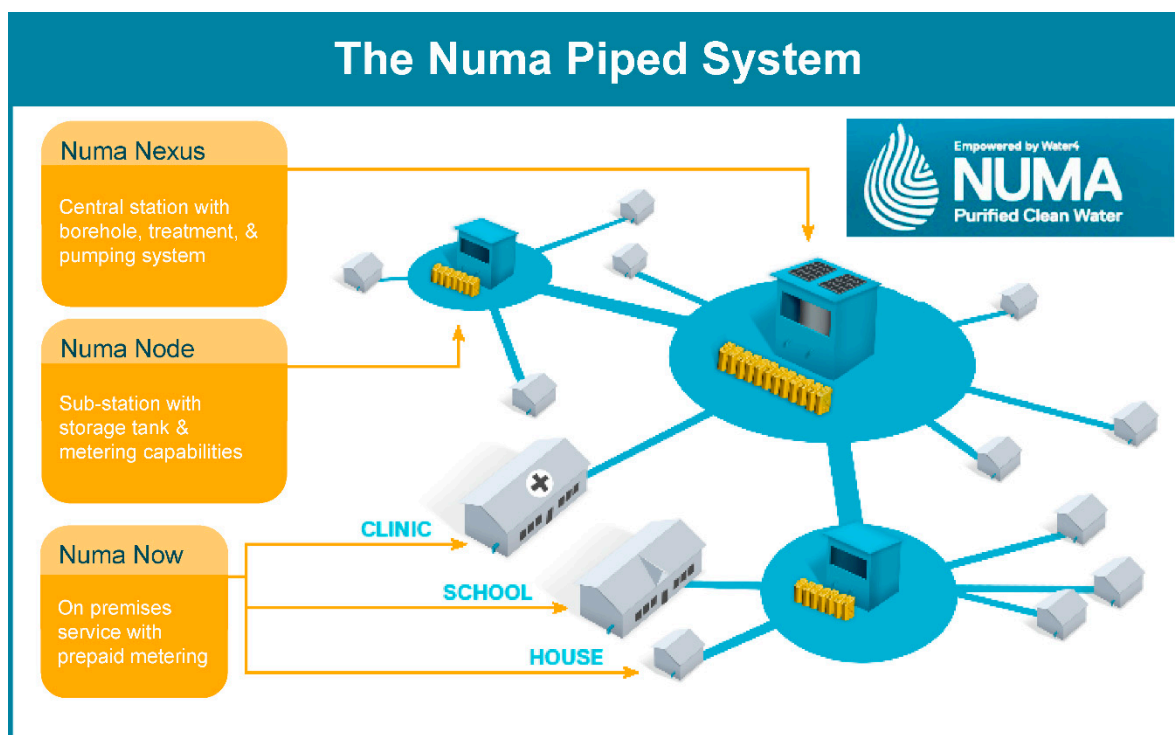

Figure S9. Modular technology design of Access Development, where Numa is the brand name