Impact Evaluation of the MCC-Funded Rural Water Supply Activity (RWSA) in Nampula, Mozambique

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Rural Water Supply Activity (RWSA)

- Installation of 600 handpumps in rural communities across the provinces of Nampula (358) and Cabo Delgado (242)

- Installation of 8 small scale solar systems in Cabo Delgado

The objectives of the RWSA, as stated in the Compact, are to **increase beneficiary productivity and income** through:

- Time savings
- Reducing water-related illnesses (diarrhea, dysentery, etc.)

Impact Evaluation of Rural Water Points Installation Program (RWPIP) in Nampula

Demand Response Approach

Communities submitted an application +
Contributed 2,500 MZN ($86 USD)

The **water committee** received training on:

- Handpump operation and maintenance
- Hygiene and sanitation (PHAST or CLTS)

PHAST = Participatory Hygiene And Sanitation Transformation

CLTS = Community Led Total Sanitation

Research Approach

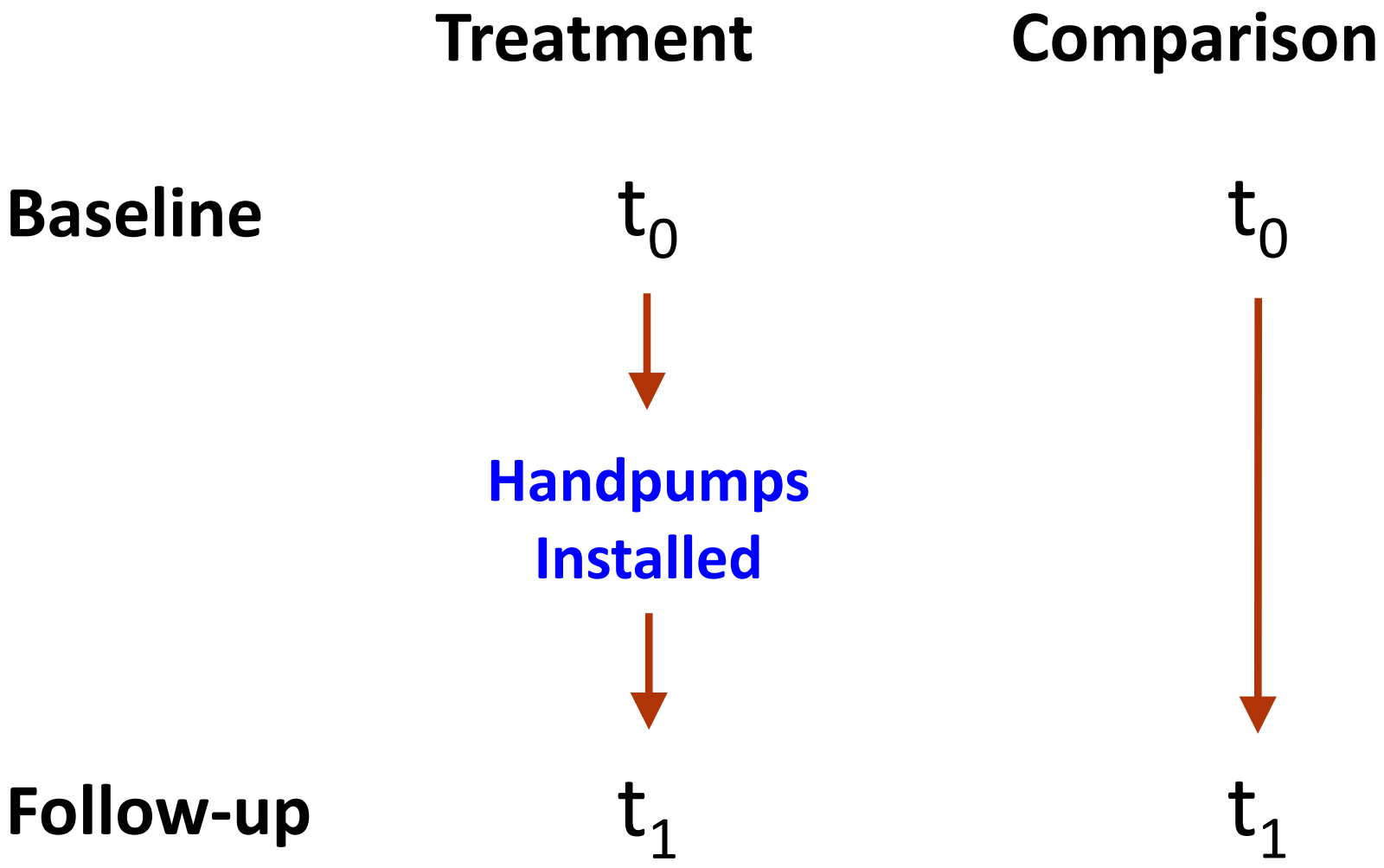
Principle Objective of Impact Evaluation

- Impact evaluations seek to provide confident causal inference about the link between an intervention and outcomes
- Difficulty is determining what would have happened to the individuals/communities of interest in absence of the project
- **Our Task**: Identify the impacts of the installation of handpumps in rural communities in Nampula from all other confounding factors

Research Approach

- **Develop Panel Data**: Compare observed changes in the outcomes for a sample of participants and non-participants
- **Key Assumption**: In the absence of the program, communities selected into the participant and non-participant groups would be changing at the same rate

Research Design for Phase 2 Communities



Selection of Treatment Communities

- Treatment communities were randomly selected from the communities included in Phase 1 and 2 of the Rural Water Points Installation Program (RWPIP) in Nampula
  - Phase 1 Districts: Meconta, Mogovolas, and Nampula-Rapale
  - Phase 2 Districts: Moma, Mogincual, and Murrupula

Selection of Comparison Communities

Visited District Office

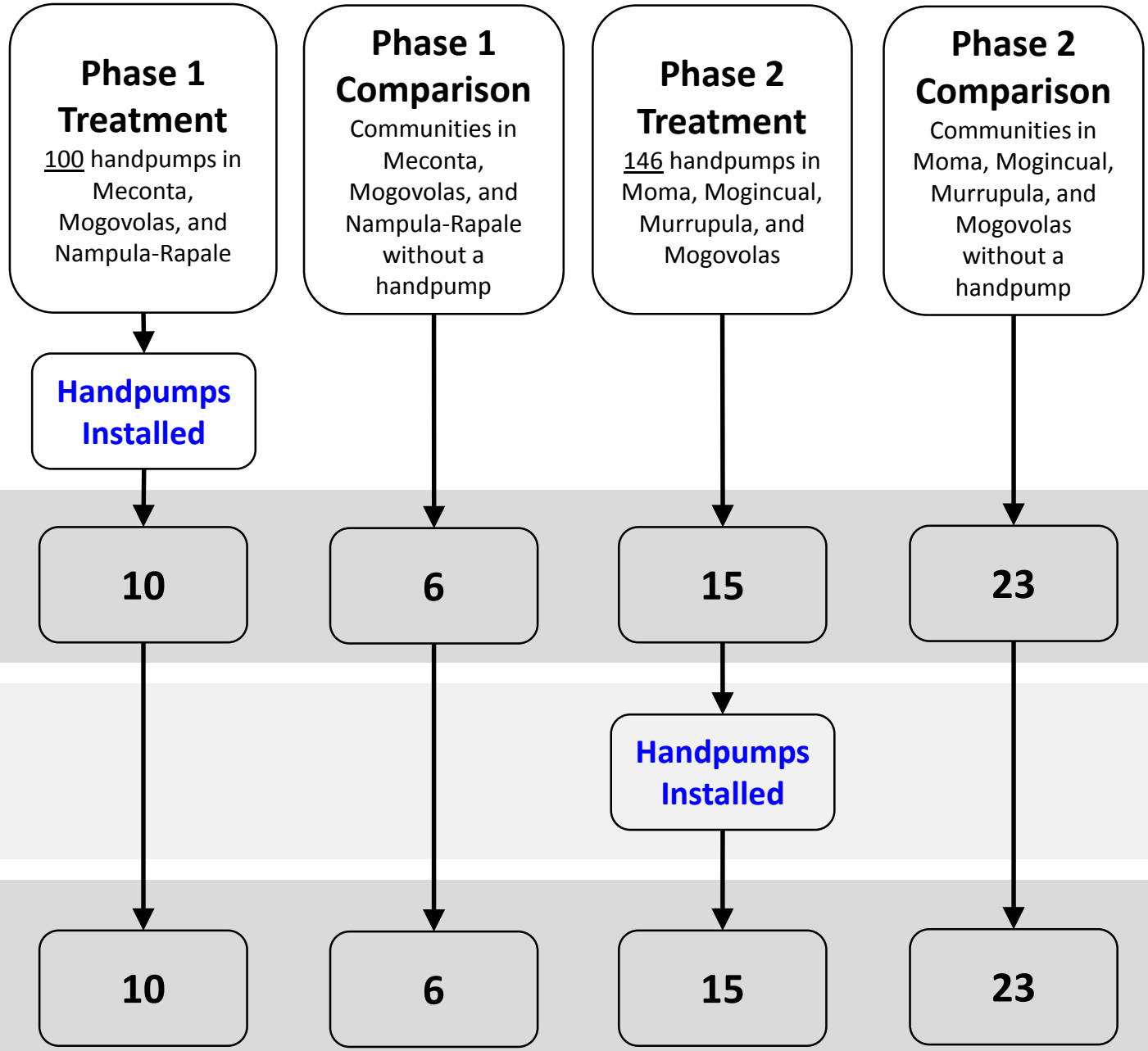
- Informed District Government of impact evaluation study
- Obtained permission to undertake the study

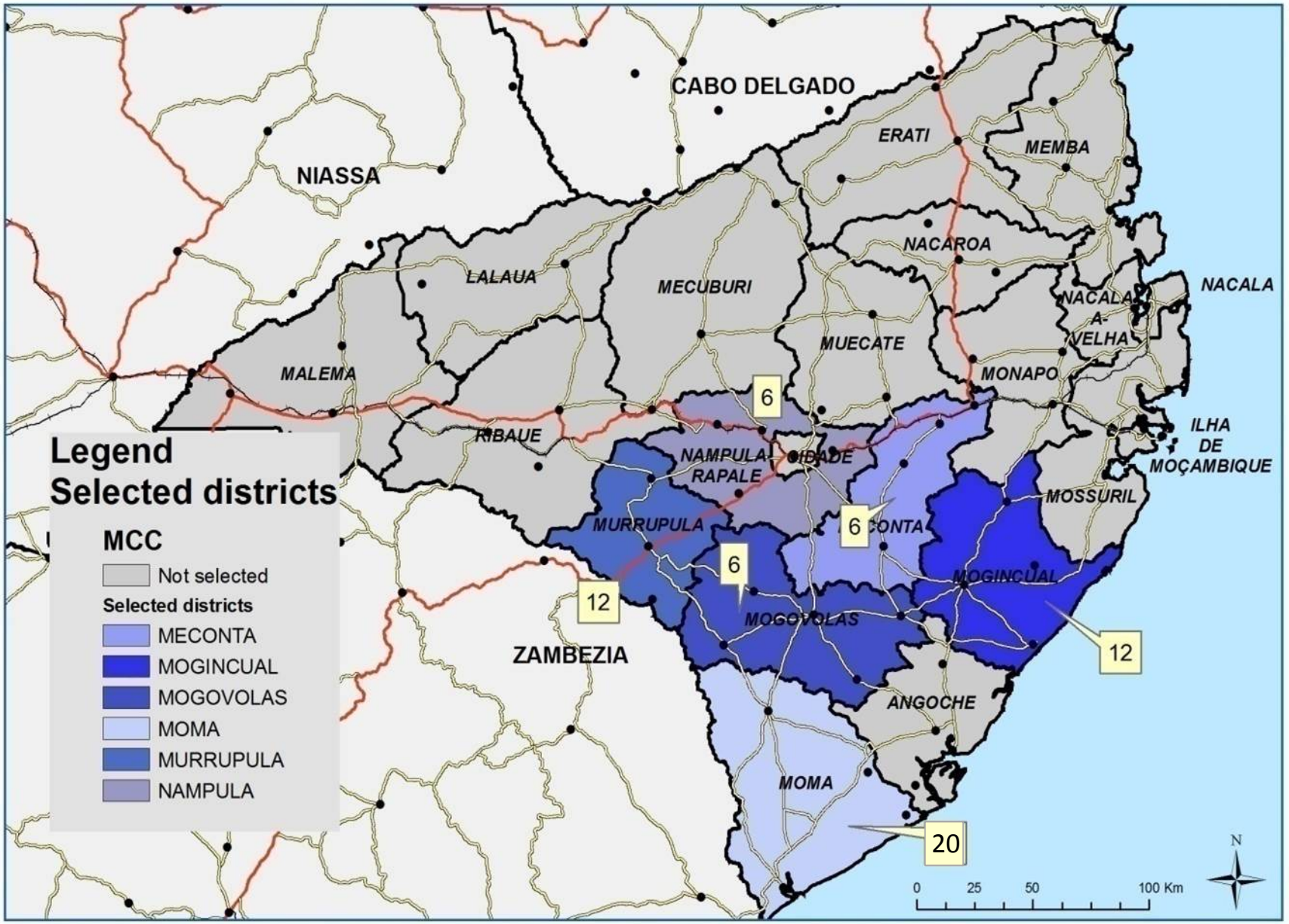
Visited Localidade

- Informed Localidade Authority of impact evaluation study
- Obtained permission to undertake the study
- Developed list of potential comparison communities with the *Chefe de Localidade*
  - Dry communities were excluded
- The *Chefe de Localidade* randomly selected the comparison communities (one for each treatment community in Localidade)


06/07/2011

Sample Frame at Follow-up (2013)




CABO DELGADO
NIASSA
ERATI
MEMBA
NACAROA
LALAUA
MECUBURI
NACALA
NACALA-A-VELHA
MUECATE
MALEMA
MONAPO
6
ILHA DE MOÇAMBIQUE
RIBAUE
NAMPULA
RAPALE
MOSSURIL
MURRUPULA
6
6
12
MOGINCUAL
MOGOVOLAS
12
ZAMBEZIA
ANGOCHE
MOMA
20
Legend
Selected districts
MCC
Not selected
Selected districts
MECONTA
MOGINCUAL
MOGOVOLAS
MOMA
MURRUPULA
NAMPULA
N
0
25
50
100 Km

Final Sample Frame

	Community Classification	Number of Communities in Group	Number of Communities by District
Phase 1	Treatment	10	4 Meconta 3 Mogovolas 3 Rapale
	Comparison	6	2 Meconta 1 Mogovolas 3 Rapale
Phase 2	Treatment	15	8 Mogincual 3 Murrupula 2 Mogovolas 2 Moma
	Comparison	23	4 Mogincual 8 Murrupula 1 Mogovolas 10 Moma

Sample Validity

- Following the baseline study:
  - 9 treatment communities became comparison communities
  - 8 comparison communities became treatment communities
- ANOVA test comparing the overall difference in means between treatment and comparison communities **at baseline** showed that for 13 of 15 key variables, the differences were not statistically significant

Data Collection

Data Collection Activities (RWSA)

Activity	2011 Baseline Study	2013 Follow-up Study
Household Surveys	**1,579** (54 communities: 27 treatment; 27 comparison)	**1,826** (62 communities: 32 treatment; 30 comparison)
Water Committee/ Leader Interviews	**54**	**31**
Water Sampling	**11 communities** (39 community water sources and 259 household containers)	**11 communities** (32 community water sources and 873 household containers; water source variability tested in 4 communities)
Handpump Observations	NA	**17** (17 communities)

73% of the households interviewed during the baseline study were surveyed again in the follow-up study

Fieldwork Preparation

- Household surveyors and water quality testing team members were trained for 2 weeks
- A pilot study was undertaken to test instruments and fieldwork protocols

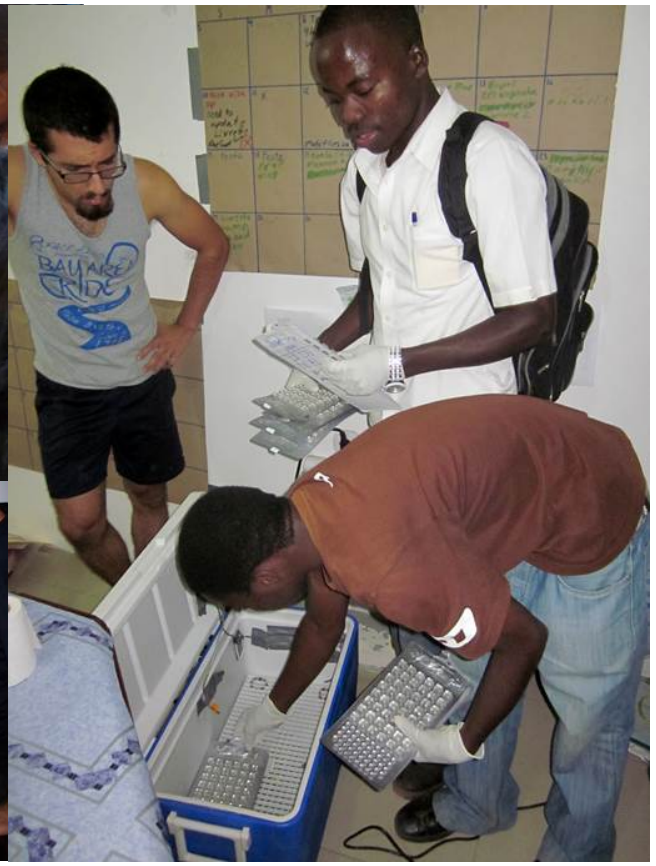
Fieldwork Preparation

- Following pilot – surveyors were retrained and instruments/ protocols were revised
- Three household surveying teams consisted of:
  - 1 team leader
  - 3 household surveyors
  - 1 driver

Fieldwork Preparation

- Stanford-VT-WE Consult team supported the water sampling team (*consisting primarily of Universidade Lúrio students*) in the field and laboratory work





Household Survey Teams (in field)

Household Survey

- Household surveys undertaken using PDAs
- Data were cleaned during fieldwork
  - Enumerators were provided with feedback on their data entry errors and outliers were checked
  - Feedback dramatically reduced the number of recurring errors
- Summary data were sent to the MCA/MCC every two weeks during fieldwork

Respondent/ Household Characteristics

	Baseline		Follow-up	
	Mean	Median	Mean	Median
Age of survey respondent	39.6	38	39.7	37
% female	38%	–	44%	–
% literate	32%	–	32%	–
Number in household	4.2	4	4.2	4
Number of children < 5	0.7	1	0.7	1

Water Sources Used by Households

78% of the households surveyed in the **treatment communities** reported using a handpump

Phase 2 Treatment – Percent of Households Using Source and Percent of Total Water Collected from Source

	% of HHs Using Source	
	Baseline	Follow-Up
Handpump	**9%**	**78%**
Unprotected Well	**85%**	**21%**
River/Lake	16%	9%

The water sources used by households in the **comparison communities** remained relatively unchanged from the baseline to follow-up study

Phase 2 Comparison – Percent of Households Using Source and Percent of Total Water Collected from Source

	% of HHs Using Source	
	Baseline	Follow-Up
Handpump	10%	2%
Unprotected Well	**78%**	**65%**
River/Lake	15%	35%

Handpump Use

Water Committee Estimate (n=28)	Value
Median number of people using the handpump in the dry season (Aug-Nov)	391
Median number of people using the handpump in the wet season	176

Handpump Observation (n=17)	Value
Average number of water collectors per hour	6
Average number of water collectors per day (8 hours)	48
Average number of trips per household	2.3
Estimated number of people served by the handpump	88

Water Consumption

All Sources and Improved Sources

The installation of the MCA handpumps are associated with an insignificant **2.5 LPCD** increase in **median water consumption** (from all sources) (p<0.1)

Phase 2 Median Total Liters per Capita per Day (LPCD) (All Sources)

	Number of Communities	Baseline	Follow-Up	Difference
		Mean of Median LPCD	Mean of Median LPCD	LPCD
Treatment	15	17.2	19.5	2.3.
Comparison	23	18.5	18.3	-0.2
			Difference in Differences	2.5.

Significance codes: *** p<0.001 ** 0.001>p<0.01 * 0.01>p<0.05 . 0.05>p<0.10

p < 0.001 = very strong evidence that there is a difference between treatment and comparison

0.001 < p < 0.01 = strong evidence that there is a difference …

0.01 < p < 0.05 = evidence that there is a difference …

0.05 < p < 0.1 = indication that there is a difference …

The installation of the MCA handpumps are associated with an **15.1 LPCD** increase in **median water consumption** (from **improved sources**) (p<0.001)

Phase 2 Median Total Liters per Capita per Day (LPCD) from *Improved Sources*

	Number of Communities	Baseline	Follow-Up	Difference
		Mean of Median LPCD	Mean of Median LPCD	LPCD
Treatment	15	0.0	15.1	15.1***
Comparison	23	1.8	0.2	-1.6
			Difference in Differences	16.7***

Significance codes: *** p<0.001 ** 0.001>p<0.01 * 0.01>p<0.05 . 0.05>p<0.10

In treatment communities, 3 out of every 4 buckets of water collected are from an improved source

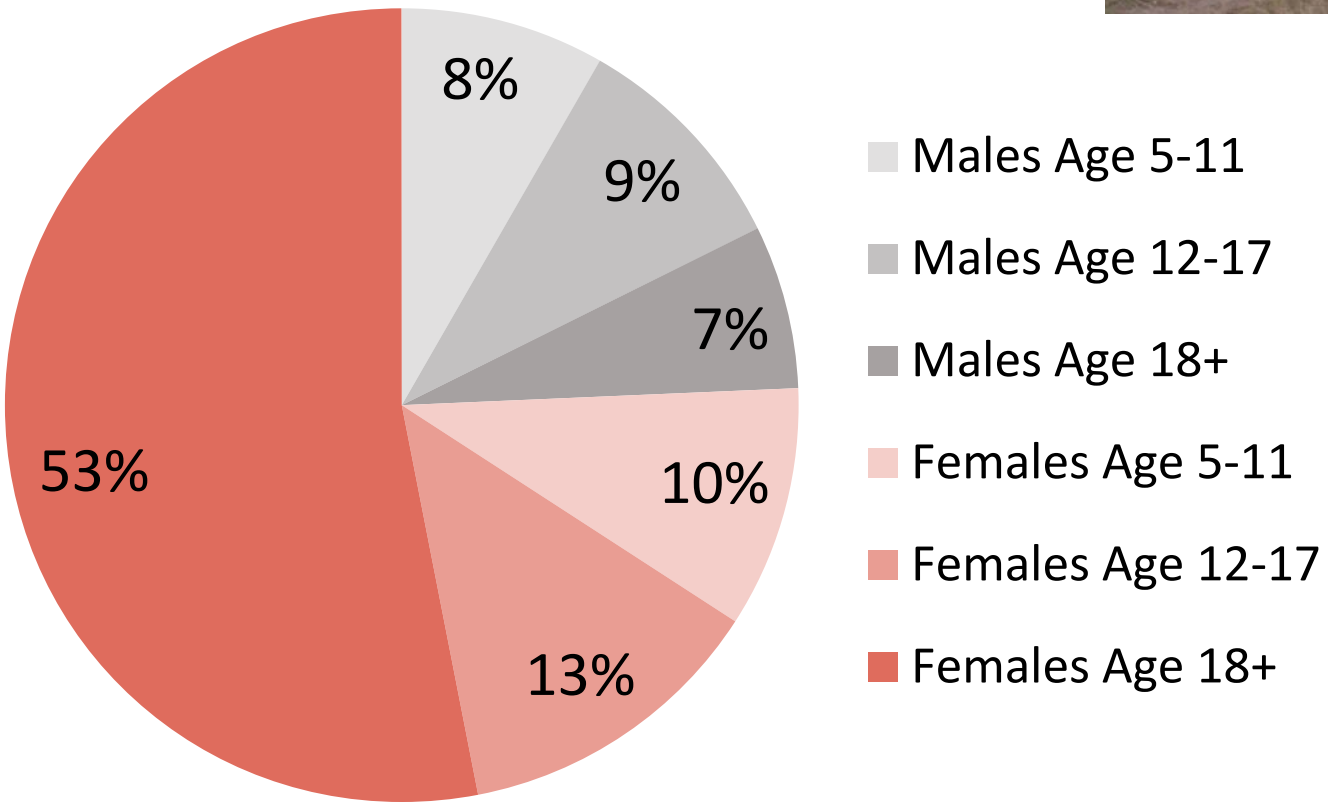
Phase 2 Median Total Liters per Households per Day (LPD)

		Baseline	Follow-Up	Difference
Phase/ Community	Number of Communities	Mean of Median LPD	Mean of Median LPD	LPD
Treatment (all sources)	15	65.4	76.5	11.1*
Treatment (improved)	15	0.0	58.0	58.0***
Comparison (all sources)	23	75.6	68.5	-7.1
Comparison (improved)	23	7.5	1.3	-6.2

Significance codes: *** p<0.001 ** 0.001>p<0.01 * 0.01>p<0.05 . 0.05>p<0.10

Time Spent Collecting Water

Females account for three quarters (76%) of the total time spent collecting water



Following the installation of the MCA handpumps there was an **88-minute decline** in the time households spent collecting water from all sources, but this decline was **statistically insignificant**

But…

The installation of the MCA handpumps can be associated with a 62-minute reduction in the median roundtrip time to the **'primary' source** (p<0.05)

Phase 2 Median Roundtrip Time to *Primary Source*

	Number of Communities	Baseline	Follow-Up	Difference
		Mean of Median Time (Minutes)	Mean of Median Time (Minutes)	Minutes
Treatment	15	161	76	-85**
Comparison	23	137	114	-23
			Difference in Differences	-62*

Significance codes: *** p<0.001 ** 0.001>p<0.01 * 0.01>p<0.05 . 0.05>p<0.10

The wait time at the primary source in treatment communities **declined by 41 minutes** relative to comparison communities ($p<0.05$)

No statistically significant change was found in the one-way walk times to the primary source

The installation of the MCA handpump can be associated with a 30% reduction in the total median time females (aged 12 and above) spend collecting water each day

There was no overall reduction in the time males spent collecting water

By comparing the **time** and **water volume** data by demographic groups, the installation of the MCA handpump can be associated with …

an *increase* in the quantity of water collected by girls and boys aged 12-17 and women aged 18 and above, …

but a *decline* in the time these groups spend collecting water

The installation of the MCA handpumps can be associated with a 55-minute reduction in the median **time to collect 20 liters of water** (p<0.001)

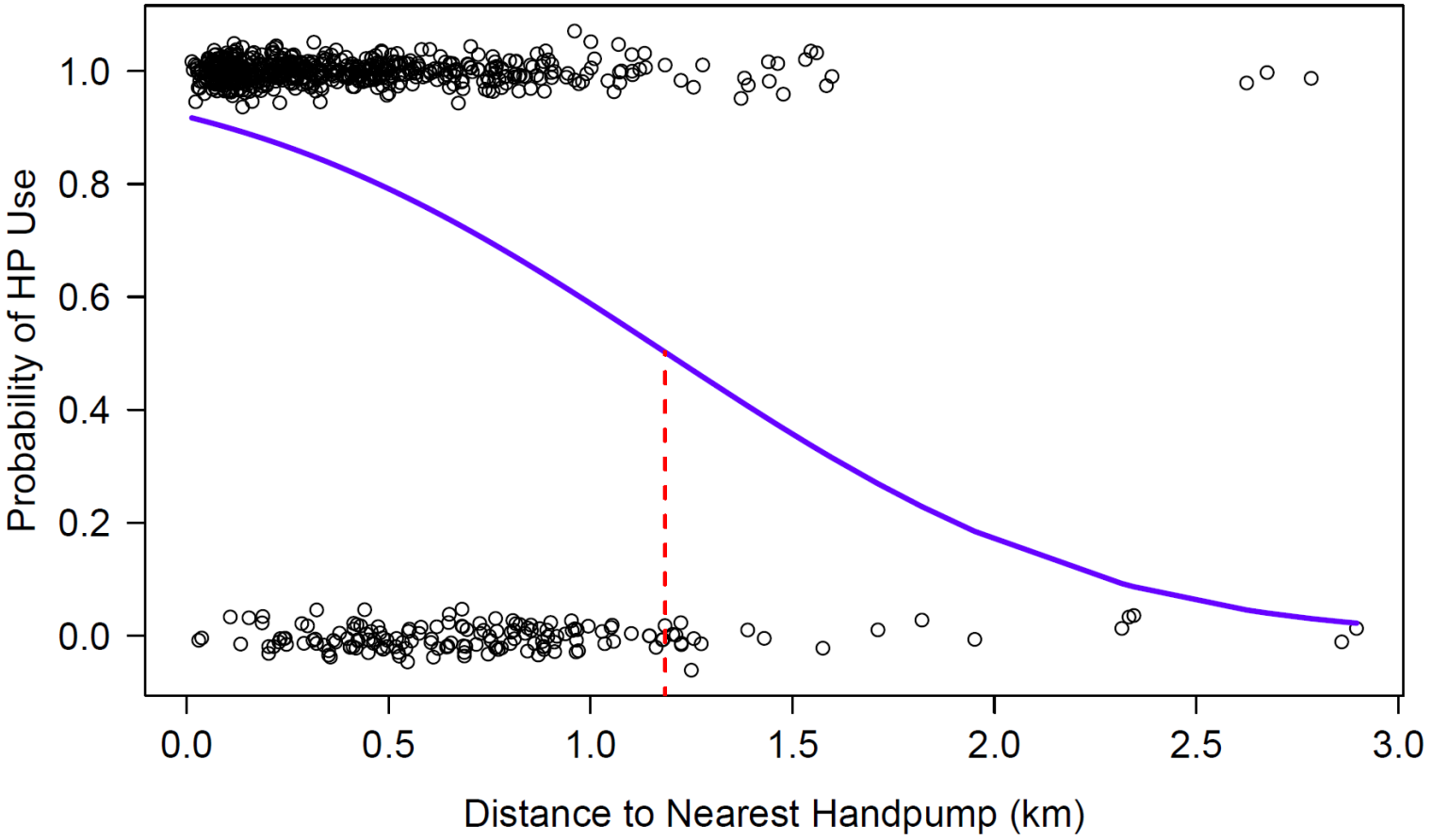
Phase 2 Median Time to Collect 20 Liters of Water

	Number of Communities	Baseline	Follow-Up	Difference
		Mean of Median Time (Minutes)	Mean of Median Time (Minutes)	Minutes
Treatment	15	104	62	-42*
Comparison	23	86	99	13
			Difference in Differences	-55***

Significance codes: *** p<0.001 ** 0.001>p<0.01 * 0.01>p<0.05 . 0.05>p<0.10

Probability of Using the Installed Handpumps

As distance to the nearest handpump increases, the probability that a household will use the handpump decreases. The distance at which the probability of using a handpump drops below 0.5 is 1.2 km.



Reasons for Not Using a Handpump

- 22% of households in the treatment communities do not use the handpump

Reason for Not Using Handpump	Percent of Households (n=170)
Distance	64.7%
Too expensive	28.8%
Don’t like taste	14.1%
Closed or broken	7.1%
Too crowded	6.5%
Not permitted to use	5.9%
Conflicts	1.2%

Impact on Schooling

MCA handpumps are associated with a 17.5% reduction in the mean percentage of households stating that water fetching negatively affects the school attendance of their children (p<0.01)

Phase 2 Mean Percentage of Households (HHs) Stating that Water Fetching Affects School Attendance

	Number of Communities	Baseline	Follow-Up	Difference
		Mean % HHs Stating that Water Fetching Affects School Attendance	Mean % HHs Stating that Water Fetching Affects School Attendance	Change in Percentage
Treatment	15	26.7%	7.1%	-19.6%**
Comparison	23	16.8%	14.7%	-2.1%
			Difference in Differences	-17.5%**

Significance codes: *** p<0.001 ** 0.001>p<0.01 * 0.01>p<0.05 . 0.05>p<0.10

Satisfaction with Water Supply

MCA handpumps are associated with a 63% increase in respondent satisfaction with their water supply relative to comparison communities (p<0.001)

Phase 2 Percentage of HH Indicating Satisfaction with Water Supply Situation

	Number of Communities	Baseline	Follow-Up	Difference
		Mean Percent of HH Satisfied	Mean Percent of HH Satisfied	Change in Percentage
Treatment	15	22%	79%	57%***
Comparison	23	31%	26%	-6%
			Difference in Differences	63%***

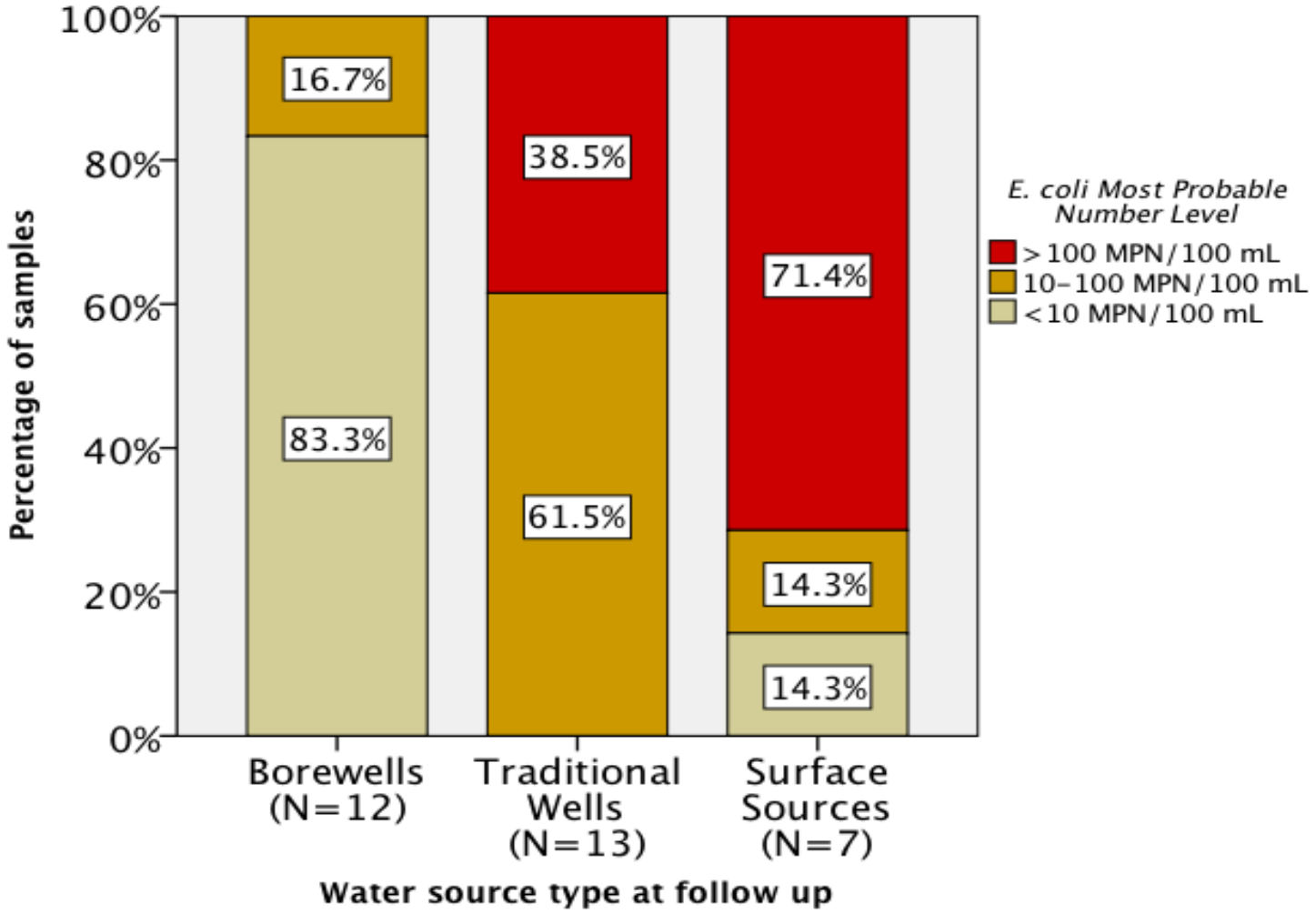
Significance codes: *** p<0.001 ** 0.001>p<0.01 * 0.01>p<0.05 . 0.05>p<0.10

Water Quality Testing

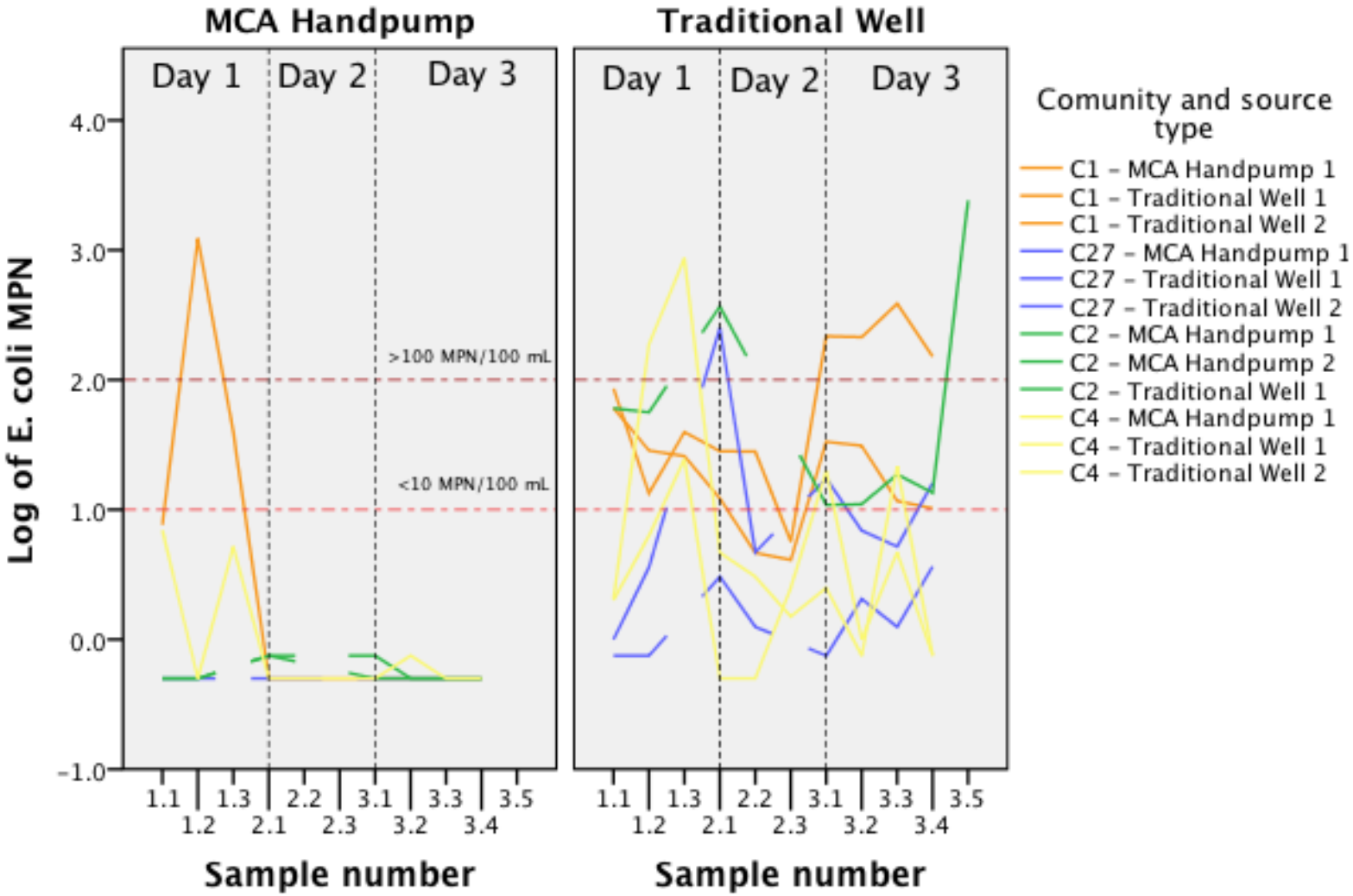
Water Sampling Methodology

- Source and household stored water sampled in 11 communities during baseline and follow-up studies
- Source water quality variability study undertaken in 4 communities (follow-up study only)
- All samples processed tested for fecal indicator bacteria (*E. coli* results presented here)
- IDEXX protocol used to determine most probable number (MPN) of colony forming units (CFU) of *E. coli* in each sample
  - Results presented in terms of 0-10, 11-100, and >100 CFU/100mL (MPN) as per older WHO guidelines and current custom among WASH researchers

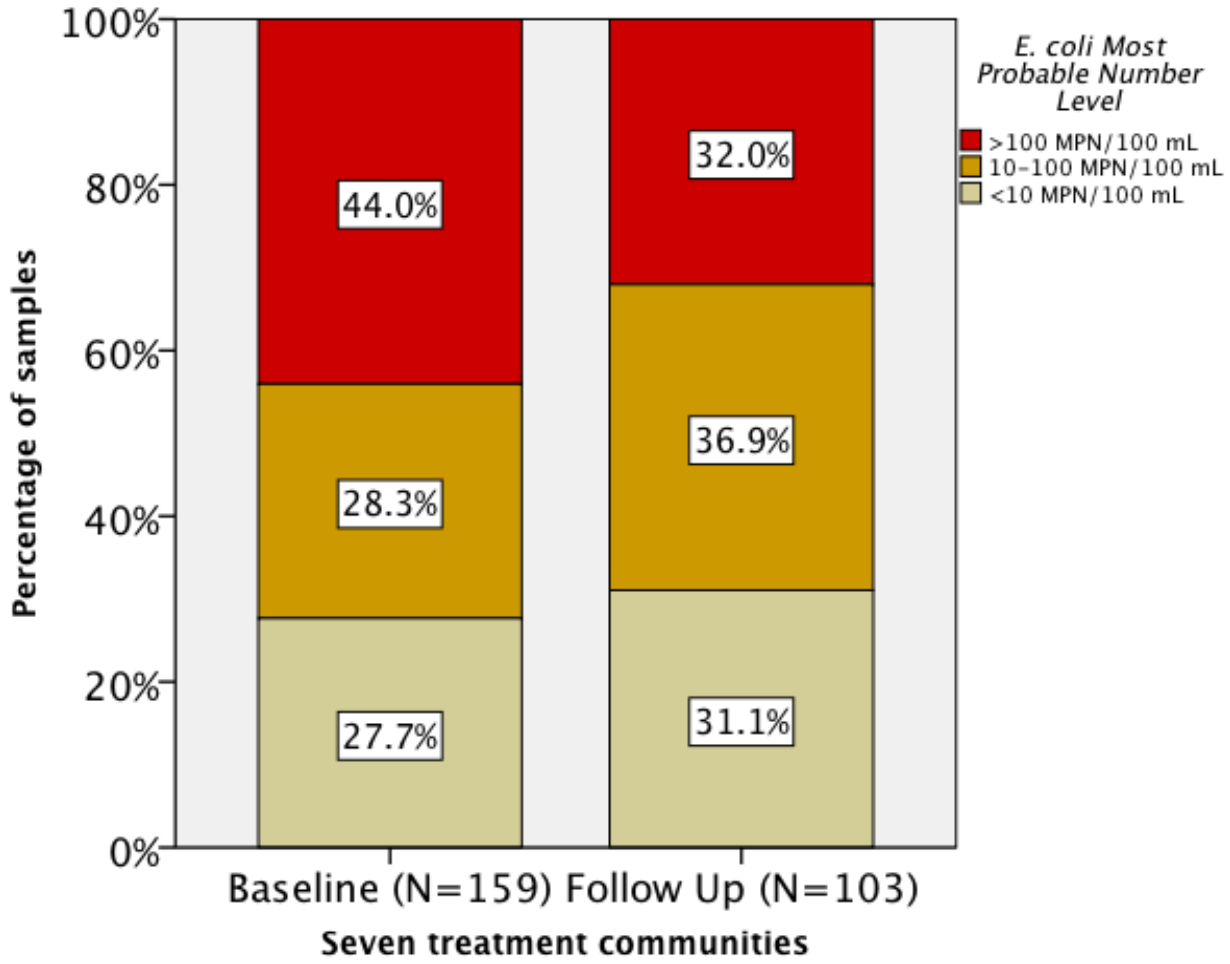
Water Quality at Point of Collection



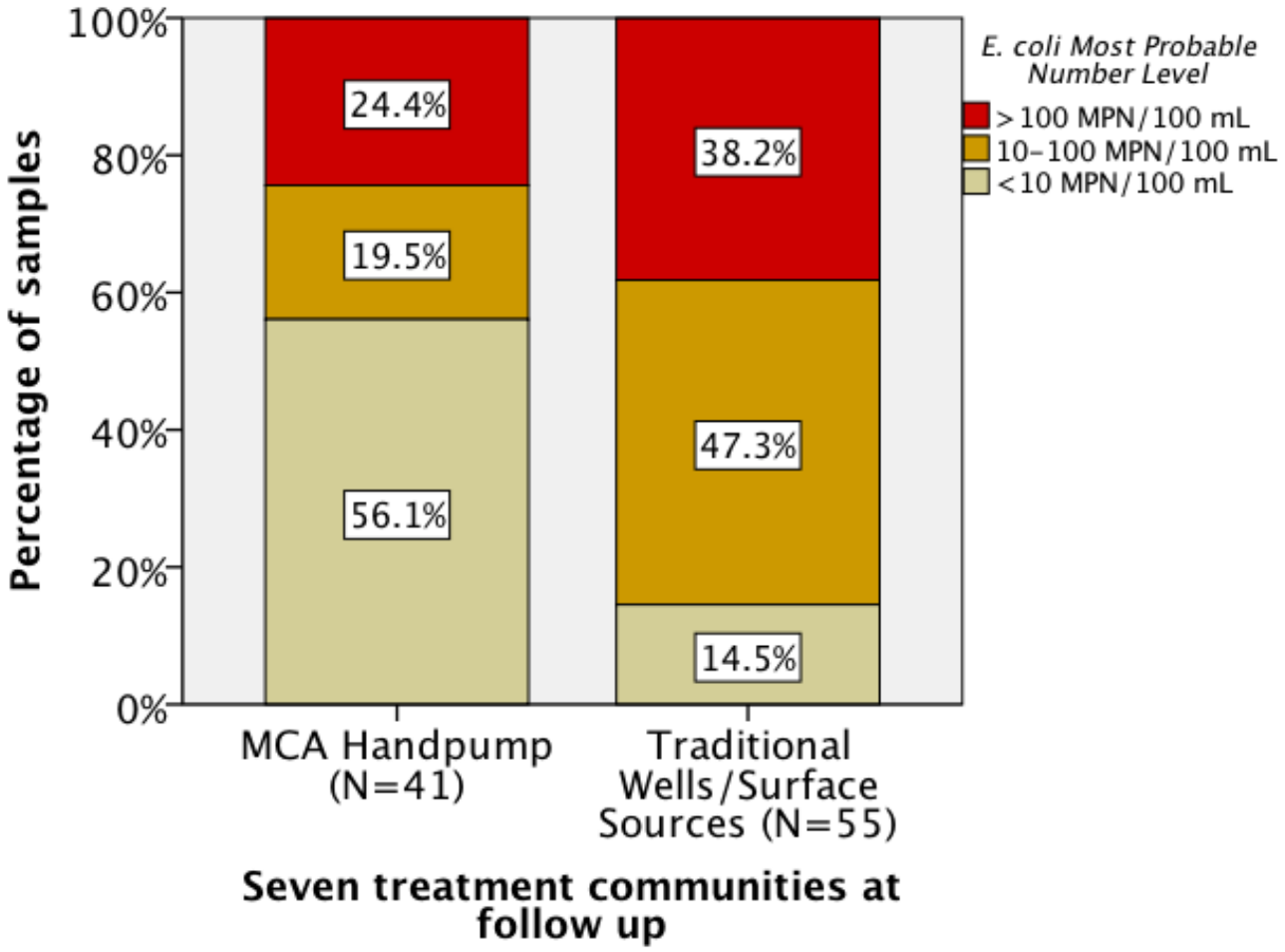
Variability of Water Quality at Source



Quality of Stored Household Water by Study Phase: Pooled data from 7 treatment communities



Quality of Stored Household Water at Follow-up: Source-stratified data from 7 treatment communities



Health, Hygiene, and Wealth

The Installation of the MCA Handpump was *not* associated with significant changes in:

Health

- Percentage of children with reported symptoms of gastrointestinal or respiratory illness in week prior to interview

Sanitation and Hygiene

- Self-reported handwashing practices, latrine use, or satisfaction with household's sanitation situation

Wealth

- Household income and expenditure

However, the percentage of households using a **latrine** did increase by 10% in the treatment communities (p<0.01)

Phase 2 Percentage of Households Using Latrines

	Number of Communities	Baseline	Follow-Up	Difference
		% HHs Using Latrine	% HHs Using Latrine	Change in Percentage
Treatment	15	23%	33%	10%**
Comparison	23	16%	18%	2%
			Difference in Differences	8%.

Significance codes: *** p<0.001 ** 0.001>p<0.01 * 0.01>p<0.05 . 0.05>p<0.10

Incomes and expenditures increased in both treatment and comparison communities along with household engagement in agriculture and consumption of meat and fish, pointing to a **general trend of economic development in Nampula** (or a productive farming season)

Are the Impacts Sustained?

An analysis of Phase 1 treatment and comparison communities revealed no significant changes in the key variable of interest

This suggests that the various impacts observed due to the installation of the MCA handpumps have been sustained for at least two years

It also indicates that there has been no significant *increase* in benefits over time

Policy Implications from RWSA

Policy Implications

- “Distance” was the number one reason households did not use the handpumps
- It may be necessary to consider alternative approaches to selecting sites for handpump installation, as well as criteria for installing multiple water points or small piped systems
- Future demand responsive programs should include a broader range of water technologies and management models
- Consider alternative approaches to sanitation and hygiene promotion that result in broader reach and better uptake of key messages

Policy Implications

- Local governments may require additional financial support to cover major system repairs
- Follow-up trainings with the water committee may be required in the areas of financial management, and operation and maintenance
- A small stipend or incentive may also be necessary to ensure that the water committees continue to function at a high level over the life of the handpump
- Explore the use of new handpump maintenance models

Small Scale Solar Systems (SSSS)

Cabo Delgado

June 18-July 3, 2013

Andy Ismali Buanando and
Valdimira Caetano

Research Questions

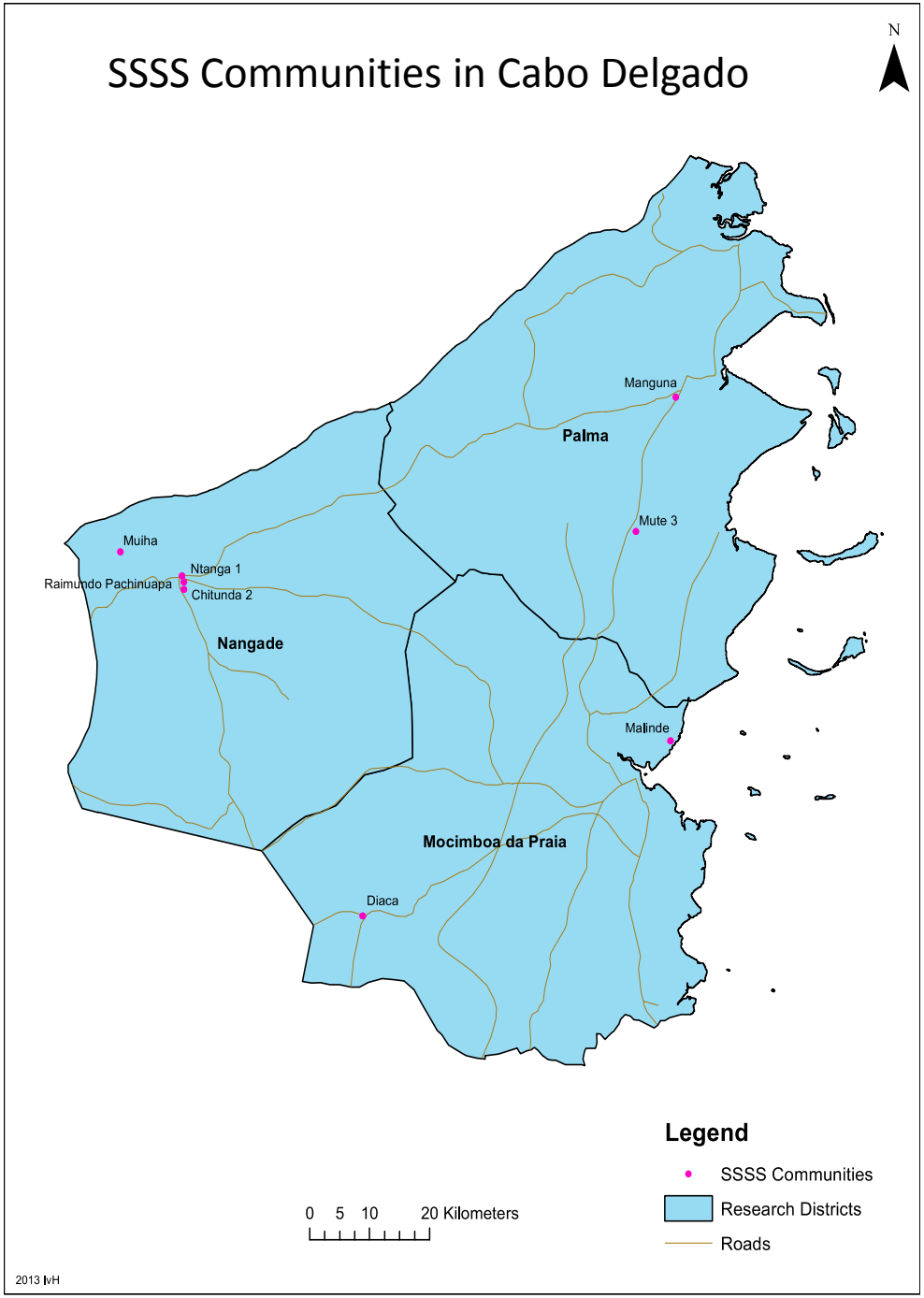
1. How are the water systems functioning from a financial, technical, and managerial perspective?
2. To what extent do the water systems satisfy the water users' needs and preferences?
3. What are the prospects for the long-term sustainability of the water systems in Cabo Delgado?

SSSS Technology

- 7.5m tower
- Tank 10 cubic meter
- 3 standpipes, each with 2 taps and water meter
- 6-10, 250 W solar panels
- 72 to 96 V DC 96mm submersible pumps
- Designed to serve 1,500 people

Selection Criteria

- Population greater than 2,000 people
- Borehole yield greater than 3,000 L/h
- Low water coverage rate and unmet demand



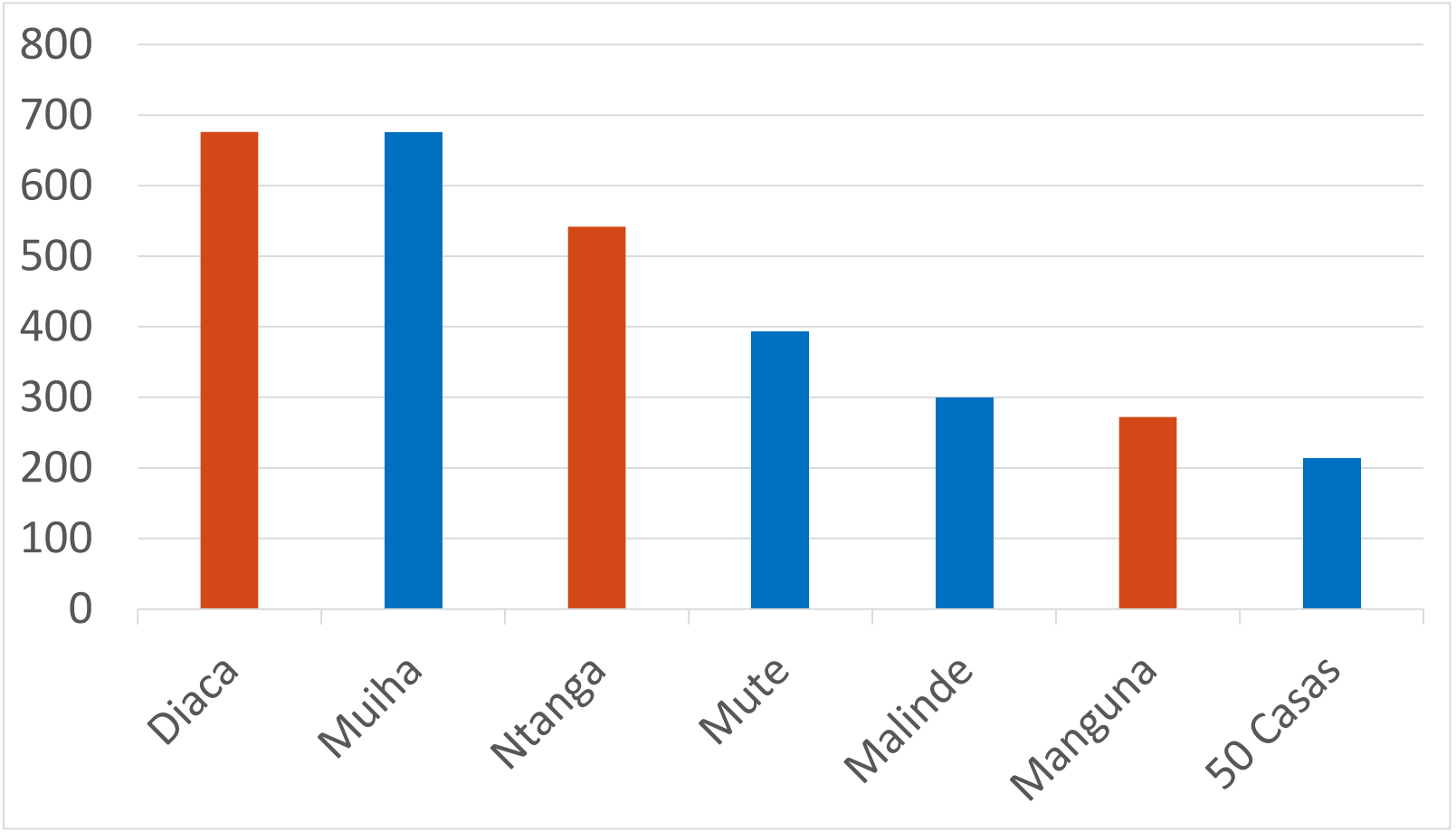
Research Methods

- Interviews with SDPI directors
- Interviews with Cowater animators
- Interviews with water committees
- Interviews with operators
- Focus groups with water users
- Interviews with community leaders
- One day of observation at the SSSS or records of water use

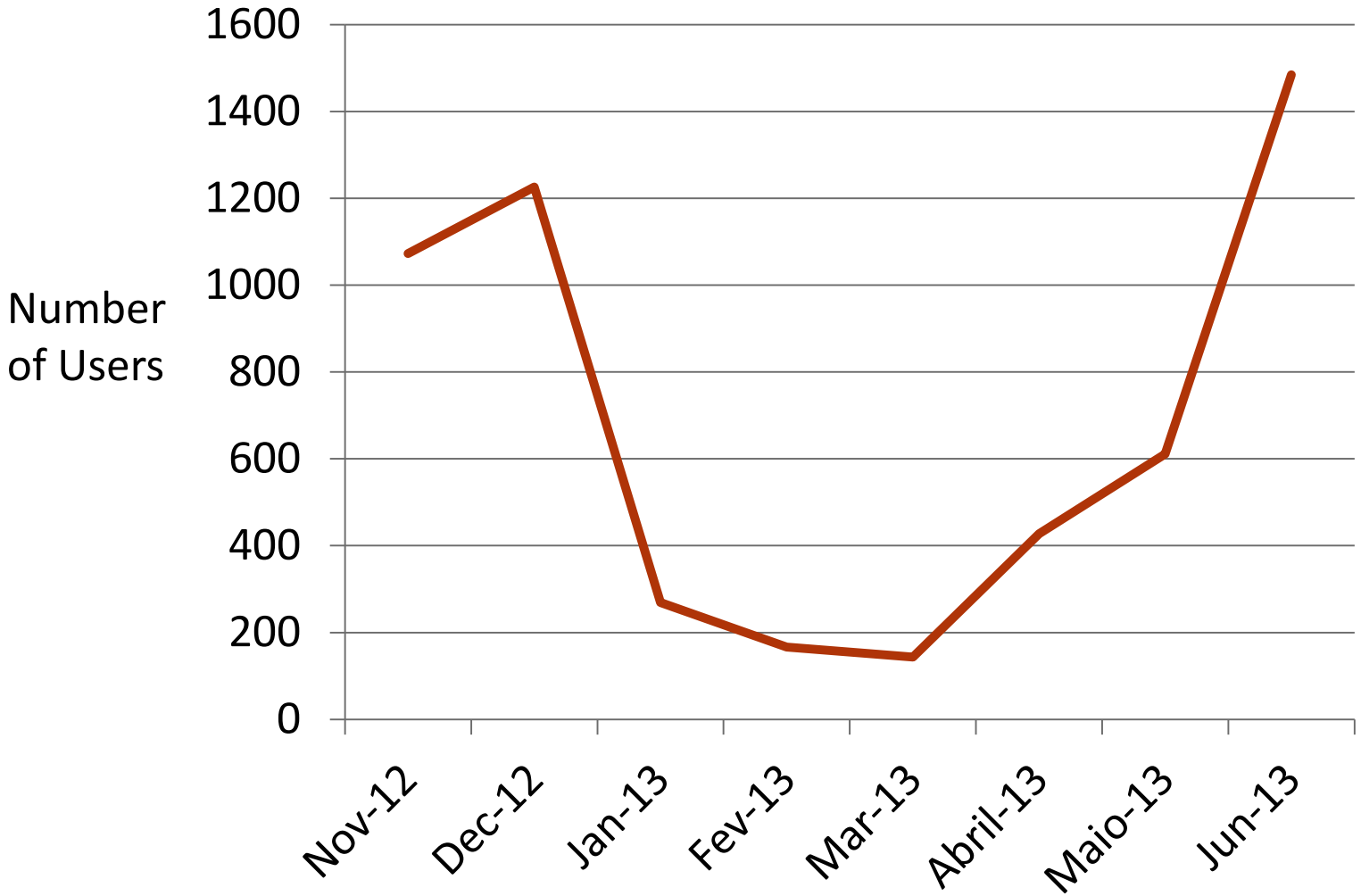
Water Use

- Water used mostly for domestic purposes (some brick making and food preparation)
- Wide variation of water use between systems (213-676 users/day and 2-22 cubic meters/day)
- Highly seasonal usage (highest demand Sept-December)

Average Number of People Served per Day by System



Number of Daily SSSS Users in Muiha

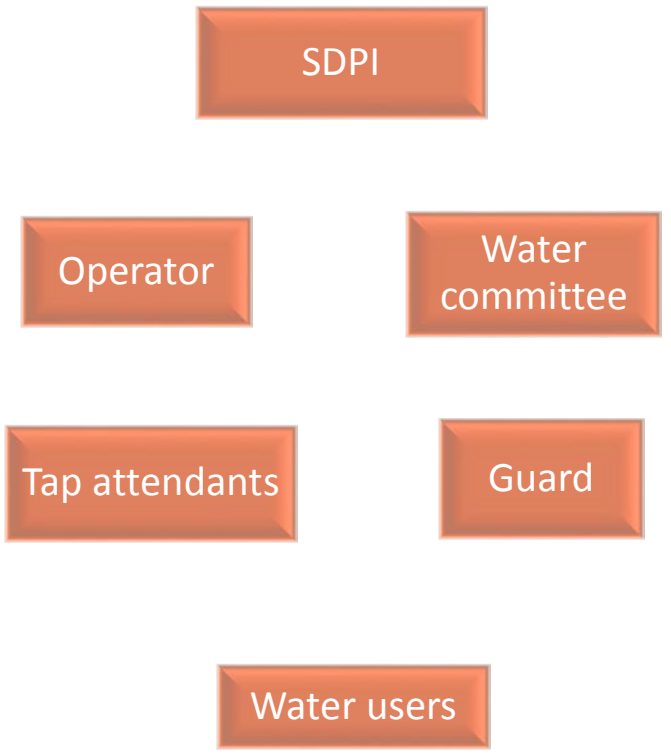


Finances

- All communities have positive account balances
- Savings vary between systems (300-55,000 Mt.)
- Average monthly expenses: 3,600 Mt.
- Revenue highly seasonal (example: 900-14,458 in 50 Casas)

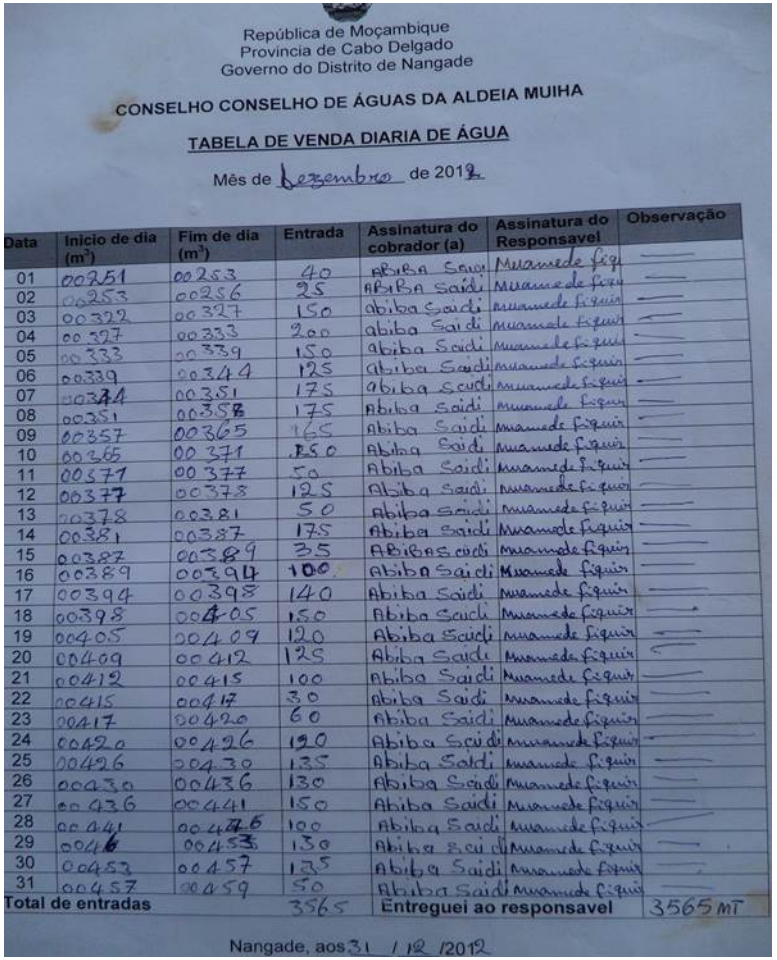
Community-Led Management

District	Comm. name	Type of mngt. model
Nagade	Chitunda	WC and OP
Nagade	Muiha	WC and OP
Nagade	Ntanga	WC and OP
Nagade	50 Casas	WC and OP
Palma	Manguna	WC only
Palma	Mute 3	WC and OP
Mocimboa de Praia	Diaca	WC and OP*
Mocimba de Praia	Malinde	WC only



Management Challenges

- No supervision of the operator
- Lack of financial transparency
- Poor communication between the users, operator, and SDPI
- Water users are not well informed
- Lack of technical competence



República de Moçambique
Provincia de Cabo Delgado
Governo do Distrito de Nangade

CONSELHO CONSELHO DE ÁGUAS DA ALDEIA MUIHA

TABELA DE VENDA DIARIA DE ÁGUA

Mês de Dezembro de 2012

Data	Inicio de dia (m^3)	Fim de dia (m^3)	Entrada	Assinatura do cobrador (a)	Assinatura do Responsavel	Observação
01	00251	00253	40	ABIBA Saidi	Muamede fig	
02	00253	00256	25	ABIBA Saidi	Muamede fig	
03	00322	00327	150	abiba Saidi	muamede fiquir	
04	00327	00333	200	abiba Saidi	muamede fiquir	
05	00333	00339	150	abiba Saidi	muamede fiquir	
06	00339	00344	125	abiba Saidi	muamede fiquir	
07	00344	00351	175	abiba Saidi	muamede fiquir	
08	00351	00358	175	Abiba Saidi	muamede fiquir	
09	00357	00365	165	Abiba Saidi	muamede fiquir	
10	00365	00371	150	Abiba Saidi	muamede fiquir	
11	00371	00377	50	Abiba Saidi	muamede fiquir	
12	00377	00378	125	Abiba Saidi	muamede fiquir	
13	00378	00381	50	Abiba Saidi	muamede fiquir	
14	00381	00387	175	Abiba Saidi	muamede fiquir	
15	00387	00389	35	ABIBA Saidi	muamede fiquir	
16	00389	00394	100	ABIBA Saidi	Muamede fiquir	
17	00394	00398	140	Abiba Saidi	muamede fiquir	
18	00398	00405	150	Abiba Saidi	Muamede fiquir	
19	00405	00409	120	Abiba Saidi	muamede fiquir	
20	00409	00412	125	Abiba Saidi	Muamede fiquir	
21	00412	00415	100	Abiba Saidi	Muamede fiquir	
22	00415	00417	30	Abiba Saidi	muamede fiquir	
23	00417	00420	60	Abiba Saidi	Muamede fiquir	
24	00420	00426	120	Abiba Saidi	muamede fiquir	
25	00426	00430	135	Abiba Saidi	muamede fiquir	
26	00430	00436	130	Abiba Saidi	Muamede fiquir	
27	00436	00441	150	Abiba Saidi	Muamede fiquir	
28	00441	00446	100	Abiba Saidi	muamede fiquir	
29	00446	00453	130	Abiba Saidi	Muamede fiquir	
30	00453	00457	135	Abiba Saidi	muamede fiquir	
31	00457	00459	50	Abiba Saidi	Muamede fiquir	
Total de entradas			3565	Entreguei ao responsavel		3565 MT

Nangade, aos 31 / 12 /2012

Technical Performance

- System supplies enough water to meet water demand
- All systems functioning well, except Chitunda and Muiha
- At least one breakdown in 6 of 8 systems
- Technical problems mostly related to electrical issues
- Long duration of breakdowns (45-90 days)
- Two solar panel robberies
- All breakdowns repaired by Cowater / GM Todd Irrigation

User Satisfaction

	Satisfied	Somewhat satisfied	Not satisfied
Type of technology	100%		
Location of taps	87.5%	12.5%	
Water quality	87.5%	12.5%	
Hours system is open	75%	12.5%	12.5%
Price of water	63%	37%	
Reliability	25%	62.5%	12.5%
Management	25%	37.5%	37.5%

Major Sustainability Challenges

- The majority of the communities will have difficulty fixing major technical problems
- Lack of financial transparency
- Lack of communication among management groups
- No supervision of operator

Questions?

Impact Evaluation Team

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