International Relief & Development

Reduction of Drought Vulnerabilities in Southern Swaziland

Final Report | September 2012

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Country SWAZILAND
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Time period covered by this report APRIL 2009 – JUNE 2012
Number of individuals affected in target area 88,605 (SVAC, 2010)
Number of individual beneficiaries targeted 61,370
Number of individual IDP beneficiaries targeted 0

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ACRONYMS

CA	**Conservation Agriculture**
DHS	**Demographic Health Survey**
EOP	**End of Project (endline survey)**
HH	**Household**
IRD	**International Relief and Development**
MT	**Metric Tonne**
OFDA	**Office for Foreign Disaster Assistance**
PTA	**Parent Teacher Association**
UN	**United Nations**
USAID	**US Agency for International Development**
VAC	**Vulnerability Assessment Committee**
WFP	**World Food Programme**

Executive Summary

IRD implemented a three year program (2009-2012) whose goal was "t*o reduce vulnerability to drought of households and communities in the Lowveld Agro-ecological zone of Swaziland*" targeting 61,370 beneficiaries in the Shiselweni and Lubombo areas of the Lowveld region. This region was targeted because it covers 31% of the country and has a semiarid climate with an average annual precipitation between 400mm and 800mm, which makes it very difficult to grow crops without a moisture conservation plan.

This report covers the activities conducted under the umbrella of two primary sectors, which were the focus of the 2009-2012 IRD Swaziland's program areas:

1. **Agriculture and Food Security**
   Objective: to improve agricultural practices under drought conditions;

2. **Water, Sanitation and Hygiene**
   Objective: to improve hygiene practices and expand access to safe water for multiple uses.

Agriculture and Food Security

The program aimed to improve agricultural practices under drought conditions and enhance food security by building farmers' capacity through training in conservation agriculture (CA) and livestock development and minimal farm input support, including drought resistant and soil improving seeds and planting materials. IRD built the capacity of farmers to increase production and income through agricultural production using CA, diversification, and commercialization of vegetables. A total of 4,866 farmers were trained in CA techniques and over 2,687 farmers used conservation agriculture practices to grow maize, sorghum, and cowpeas as their main crops. IRD supported CA activities and expanded from 4 to 12 tinkhundla between 2009 and 2012. IRD also supported 2,551 farmers through the provision of seeds, exceeding program targets by 40%. The farmers' yields increased from 0.2 MT /ha during the baseline year to a program average of 0.55 MT /ha for maize. Results of an end of project survey conducted in May 2012 indicated that the increase in yields also resulted in a rise in the number of months of food self-sufficiency. Results showed a 57% HH cereal consumption rate from the 2010/11 seasonal harvest compared to a 60% consumption rate from the 2011/12 harvest. This indicated an increase in the duration of food availability from individual harvests, especially when compared to the baseline where 8.1% of households had staple cereals available for only 1 month and 11.1% for two months. The average number of months of food self-sufficiency due to distributed agricultural inputs and the application of CA techniques was 5.9 months, an increase of 3.3 months from the baseline which averaged at 2.6 months.

IRD promoted the establishment of 166 keyhole (backyard) gardens in 12 tinkhundla. These gardens served a dual purpose, providing nutritious vegetables for families affected by HIV and AIDS as well as a source of income from the sales at the commercial and local markets. In addition, IRD established 39 community gardens which benefitted over 1,000 households where vegetables, such as spinach, tomatoes, beets, onions, lettuce, cabbages, and carrots, were produced for sale and for home consumption. Of the 39 gardens, 15 engaged in contract farming, with NAMBoard as the main market, while the remaining 24 produced for household consumption and surplus was sold in local villages. Sales from the commercial gardens provided an average seasonal income of E13,000 (USD $1,625) per garden. The most successful garden earned as much as E24,000 (USD3,000) in a season. This increased disposable income for households was mainly used to pay for school fees and other food purchases.

Water Supply, Sanitation & Hygiene

The program also aimed to improve hygiene practices and expand access to safe water for multiple uses. Provision of water supply, promotion of sanitation and hygiene in schools and communities, and establishing and strengthening community-based management of services was an important component of the program. IRD established rainwater harvesting (RWH) systems in 28 schools providing a valuable alternative and supplementary clean water resource to 14,133 school children and teachers. This resulted in significant benefits including decreased school expenditures on water, from an average of E28,000 (USD[1] $3,500) to E5,000 (USD $625) per year; and significant reduction in time and energy to collect water from unprotected or protected sources. Children no longer have to bring water from home to cater to their school's water needs. The installation of the RWH systems was coupled with construction of latrines, provision of hand washing devices, and hygiene education.

IRD replaced broken Afridev hand pumps with much more effective deep well hand pumps (Blue pump). The activity was started by conducting a borehole mapping exercise in 12 tinkhundla where the program was to be implemented. Data was collected and analysed from 430 borehole sites and a water point map was produced. Based on the borehole mapping data, IRD replaced 73 defunct borehole pumps with Blue pumps, which are suitable for deep boreholes and require less maintenance. The traditional Afridev pumps had proven to be ineffective below a depth of 40 meters and required frequent maintenance. The pump replacement has been associated with the construction of cattle troughs within the locality of the water point, to make use of the water being discharged as waste and to keep the animals from contaminating the water source. From the non-functional Afridev pumps, IRD repaired or reassembled 49 pumps and installed them in other shallow boreholes. IRD drilled 41 boreholes for community gardens where hand pumps or electric pumps were installed, depending on garden viability and cost effectiveness. Electrical pumps, pipe networks, and elevated tanks were installed in 15 commercial gardens (CG) while Blue pumps were installed in 24 CGs. Single squat latrines were constructed and hand washing devices were installed to ensure proper hygiene and sanitation practices at garden sites.

IRD helped communities establish and strengthen water supply, sanitation, and hygiene (WASH) committees responsible for managing the operation and maintenance of WASH services. Participatory Hygiene and Sanitation Transformation (PHAST) trainings were conducted for representatives from schools and communities.

[1] Exchange rate is 1$=8 Emalangeni

Summary of Impacts of 'Reduction of Drought Vulnerabilities in Southern Swaziland' 2009-2012 Program

Sector	Program component	Impact	Comment
Agriculture and Food Security	Conservation Agriculture	Maize yield increase from 0.2 MT /ha to 0.66 MT /ha	Due to changes in farmer agronomic practices yields have increased thereby increasing food availability at household level
		Increased adoption of CA due to improved yields	Neighboring farmers have adopted CA after observing improved yields in other farmers fields
	Community garden	Increased income availability	Income increased by USD70 per household per year which is used for other food , health, educations costs
	Keyhole garden	Increased vegetable availability and increased disposable income	Nutritious vegetables now available within the homestead all year round. Farmers able to increase household income to a maximum of USD71per year
WASH	RWH in schools	Reduced water costs	School financial expenditure on water has reduced drastically from USD4,000 to USD700 per year
		Increased water availability and increased demand	Increased water availability for school feeding programs, hand washing, drinking. Due to this there is an increased demand from other neighboring schools which are water challenged
	Blue pump replacement	Reduced maintenance costs	Frequency of breakdown has gone down from 5 times a year to zero thereby reducing borehole maintenance cost to zero
		Increased demand for Afridev replacement	Communities, members of parliament and government are requesting IRD to expand Blue pump replacement program
	Borehole mapping	Improved data availability	Government initiated the National Water and Sanitation point mapping pilot project building on the IRD borehole mapping exercise

Table 1: Major Impacts of 'Reduction of Drought Vulnerabilities in Southern Swaziland' 2009-2012 Program

Introduction

Much of Southern Africa is caught in a cycle of droughts and floods, making it very difficult to grow crops without an irrigation system in place. Swaziland, a small landlocked country sandwiched between South Africa and Mozambique is no exception, and its people often require food aid as a result. Swaziland is ranked as a lower middle-income country and about 80% of the total population lives in rural areas on Swazi Nation Land (SNL) deriving their livelihood from subsistence agricultural production. These farmers face a number of difficulties that prevent them from breaking out of a poverty cycle mainly attributed to the low agricultural productivity, poor road access and market linkages, low and intermittent rainfall and negative impact of HIV and AIDS on the productive power. These conditions are highly exacerbated in the Lowveld region of the country, which has the lowest amounts of rainfall. The region also faces limited access to adequate and clean water supply for rural communities and schools and open defecation practices among households are still common.

It is against this background that IRD was awarded OFDA funding from 2009-2012, to address agriculture and water supply challenges in the Lowveld region of Swaziland. IRD's program entitled: "Reduction of Drought Vulnerabilities in Southern Swaziland", completed activities that turned precarious conditions into an opportunity by expanding low-cost and low-input conservation farming techniques in 12 Tinkhundla. These techniques were combined with diversification of farming to include promotion of drought resistant crops and high nutrition vegetables, while a value chain analysis and intervention for vegetables, legumes and cotton aimed to establish sustainable income generation activities in the region. Agriculture activities were combined with livestock management, water provision, and management interventions. IRD also introduced a proven and more durable pump called Afripump (Blue pump), which is suitable for boreholes deeper than 45m, in order to provide water for small scale irrigation and human and animal consumption. Finally, IRD expanded its successful model of rooftop water harvesting systems at schools and introduced/established water management schemes that aimed to enhance the sustainability of the water supply activities.

With this report, IRD aims to recapitulate completed activities under its three year drought mitigation program, highlighting the overall impact on its beneficiary communities in the Lowveld region of Swaziland.

SECTOR: AGRICULTURE AND FOOD SECURITY

OPERATION SPECIFIC OBJECTIVES
To improve agricultural practices under drought conditions

BENEFICIARY NUMBERS
Households: 1,825; Individuals: 10,950

GEOGRAPHIC AREA
The program targeted the following twelve tinkhundla: Somtongo, Matsanjeni, Sigwe, Lubuli, Mpolonjeni, Hosea, Ngudzeni, Sithobela, Nkilongo, Shiselweni, Hlane and Dvokodvweni

Sub Sector: Seed Systems and Agricultural Inputs

Table 1. Seed systems and agricultural inputs indicators

Indicator	Year 1 target	Year 1 result	Year 2 target*	Year 2 result	Year 3 target	Year 3 result
Number of people benefiting from seed systems/agricultural input activities	6,000	6,720	8,700	9,900	10,950	15,306
Number of households practicing conservation farming techniques and growing drought resistant crops	1,000	1,120	1,450	1,665	1,825	2,551
Number of households growing drought resistant crops at a minimum of 0.25 ha	1,000	1,120	1,450	1,665	1,825	2,551
Number of farmers with 0.25 ha or more farmed with one or more of the 5 CA techniques* introduced by the project	1,000	1,120	1,450	1,665	1,825	2,551

***CA techniques promoted-Minimum tillage, intercropping with legumes, retention of crop residues, natural fencing of fields, use of organic manure**

Expansion of Conservation Agriculture (CA) Techniques
To ensure proper adoption and sustainability of interventions, the project was introduced to communities through various traditional structures–Chief, Bucopo, Indvuna[2], and village meetings. The project was well received by the local authorities and the community. This was because the project was introduced after a period when there were poor harvests and many farmers were frustrated with agriculture activities. Each year beneficiaries were selected based on their interest and motivation to adopt proposed techniques; their willingness to act as peer-to-peer trainers for neighbors and communities not trained by IRD; availability of land between 0.2- 0.5 hectares dedicated to CA; and where possible, availability of similar land area for traditional crop production practices (for control and comparison purposes).

[2] Traditional authorities at constituency level and chiefdom level

Trainings were conducted at community level, as well as through farmer-to-farmer training sessions. Emphasis was placed on farmer-to-farmer training using lead farmers who provided training and practical advice to groups of aspiring CA farmers. All farmer-to-farmer trainings were conducted in demonstrations plots to ensure all aspiring CA farmers gained practical experience. This also allowed farmers to share practical experiences of the advantages and challenges of CA using a common language. A total of 4,866 farmers were trained between 2009 and 2012 (Table 2). The average adoption rate[3] was 60% during the life of the program. The highest adoption rate of 70% was reached in the first year because the concept was new to farmers and they were just coming out of a drought.

Table 2. Summary of CA Beneficiaries

Year	Period	Farmers trained	New farmers who adopted CA	# of new farmers who received seed	% Adoption rate*
1	March 2009-Sep 2010	1,600	1,120	1,120	0.7
2	Sep 2010-Sep 2011	1,396	672	545	0.5
3	Sep 2011 to July 2012	1,870	886	886	0.5
Total		4,866	2,678	2,551	

*** Percentage of farmers who prepared adopted and used CA principles in their fields after receiving training from IRD**
****Percentage of farmers who did not continue to the next season**

Picture 1. Extension to farmer training in Somtongo Inkhundla

Picture 2. Farmer to farmer training in Mpolonjeni Inkhundla

Atotal of 2,678 farmers of 4,866 that were trained adopted CA. Of these, 2,551 (Table 2) were assisted with enough seed to plant an equivalent to the area they prepared under CA. This allowed them to see the effectiveness of CA compared to conventional practices. The remaining 127 farmers used their own traditional seed or seed purchased from the market. A total of 11,921, 4,977 and 8,801 kilograms (Table 3) of maize, sorghum, and cowpea were distributed respectively in the 12 tinkhundla during the project period. The seed varieties provided changed after the first year. Initially, maize and sorghum seeds were hybrids and cowpea seeds were an Open Pollinated Variety (OPV). After the first year, IRD shifted its strategy to promote more OPV seeds due to over-dependence on the market and delays to planting from poor access and availability of hybrid seeds.

[3] Adoption rate is the number of people that adopted CA after receiving training from IRD as a percentage of the total number of farmers trained

Based on results from the post-planting survey and general field observations, IRD found that farmers were interested in making maize the staple crop even though it is more susceptible to drought conditions than smaller grains (sorghum) in the Lowveld. Sweet potatoes and pigeon peas were introduced by IRD as alternative crops to provide a safety net in the event the other crops failed. These were introduced to reduce over reliance on maize and to maximize land usage. In addition, these crops were adaptable to the dry conditions of the Lowveld and had multiple uses, especially pigeon peas. Farmers were trained on the advantages of growing pigeon peas, such as its versatility–the stems could be used as firewood, the leaves as livestock feed, and the roots could be consumed by humans. Also, the biological nitrogen fixation properties are good for improving soil nutrition.

Table 3. Amount and Types of Seed Distributed

	Maize	Seed type	Variety	Sorghum	Seed type	Variety	Cowpea	Variety	Pigeon pea*	Seed type	Sweet potato**	Seed type
Year 1	3,378	Hybrid	SC403	2,056	Hybrid	NS5511	5,880	Glenda	-	-	-	
Year 2	2,177	Hybrid	SC4031	1,131	Hybrid	NS5511	1,131	Glenda	-	-	-	
Year 3	6,366	OPV	ZM 301	1,790	Hybrid	NS5511	1,790	Dr Saunders	672	OPV	336* 50 kg bag	cuttings
Total	11,921			4,977			8,801		672		336* 50 kg bag	

***Pigeon pea variety planted-Maple**
****Sweet potato varieties planted - Kenya white and Gwalagwala**

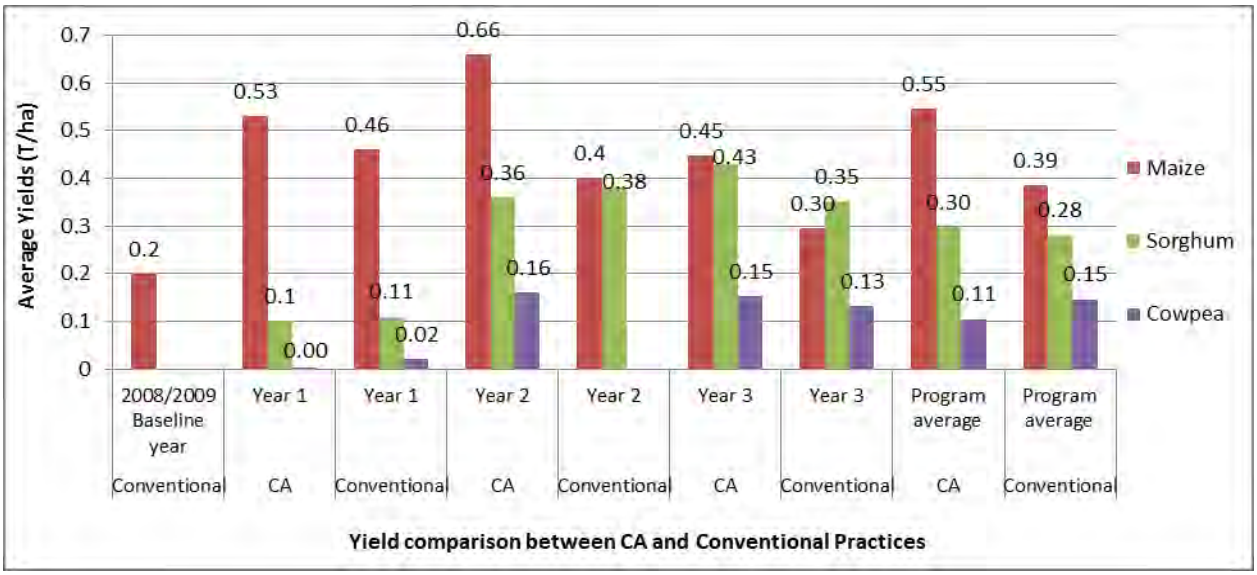


Figure 1. Program yield (T/ha) comparison between conservation agriculture and conventional methods of production

NB-Year 2, cowpea conventional-no data was available from the selected sample

Post-harvest surveys were conducted between April and June every year of the program to determine how cereal and legume yields produced under CA compared to conventional (traditional) practices. The surveys were also used to assess production challenges and establish lessons learned for farmers to draw on the following year. The main challenges experienced during the program were poor rainfall distribution and long dry spells experienced each year between November and January. Weed management was also a problem, due to the change in management from conventional to CA techniques. Farmers were reluctant to change their weed management systems which resulted in crop loss due to

high weed pressure. Despite these challenges, there were significant improvements in yields (Figure 1) from the baseline to the end of the project. The average maize harvested under CA was 0.55 T /ha, an increase of 0.35 T /ha compared to the baseline data. The yield improvements were attributed to both increased amounts of rain over the growing seasons and early planting and land management CA techniques practiced by farmers. A result from the endline survey that corroborates the yield gains showed a 57% HH cereal consumption rate from the 2010/11 seasonal harvest compared to a 60% consumption rate from 2011/12 season harvest. Compared to the baseline, 8.1% had cereals (staple) available for one month and 11.1 % for two months. The average number of months of food self-sufficiency due to distributed agricultural inputs was 5.9, an increase of 3.4 months from the baseline, which averaged 2.6 months. This shows that the program improved food availability at the household level.

Table 4. Seed systems and agricultural inputs indicators

Indicator	Year 1 Target *	Year 1 Result	Year 2 Target*	Year 2 Result	Year 3 Target	Year 3 Result
Number of households benefiting from the establishment of keyhole and trench gardens	42	65	84	95	140	166
Number of households benefiting from community gardens	100	148	400	148	760	975
Number of barriers to cotton and legume production reduced	5*	0	2	2	3	3

***Identified barriers to cotton production-Input availability, cost of production, fencing of fields, cost of capital, cotton disease, poor extension, low yields, lack of Business skills**

Picture 3. Mrs. Ngane Dlamini weeding her keyhole garden in Matsanjeni Inkhundla

Vegetable, Legume and Cotton Production

With the unpredictability of cereal production in the Lowveld, IRD promoted vegetable production at the household and community level. Among households, IRD promoted the construction of keyhole gardens which have proven to be effective for intensive vegetable production in small, dry areas. A total of 166 households constructed keyhole gardens in twelve tinkhundla during the reporting period. The uptake of keyhole gardens in some tinkhundla like Lubuli was slow. This was mainly attributed to a shortage of stones, the main construction material. However, farmers were encouraged to use alternative, locally available materials.These gardens increased the dietary diversity for households and improved food availability all year round. The primary vegetables planted in the backyard gardens included spinach, lettuce, beetroots, and onions. In addition to providing nutritious vegetables, gardens enabled some farmers to increase their household income through vegetable sales to neighboring homesteads. Successful farmers realized up to USD$71 and the majority averaged USD$22 per year. From sales, farmers were able to buy seedlings and purchase food and other household needs.

Picture 4. Mahlabaneni community garden members in Nkilongo Inkhundla appreciating their harvest

Picture 5. Harvesting of chillies at Mahlabaneni Community

At the community level, IRD promoted the establishment of community gardens (CG). With the provision of minimal inputs during the project period, 39 CGs realized vegetable production after receiving training on production and marketing. These gardens were set up at two levels. One type of garden was irrigated using the hand pump and the produce was mainly utilized for household consumption, with the excess being sold within the neighbouring communities. Of the 39, 26 CGs produced for local sale and household consumption. The other 15 CGs used a micro irrigation scheme supported by an electric pump and produced high quantities of high value vegetables for the local and commercial market. With an average membership of 25 members, the commercial CGs grew onions, beetroot, butternut, green pepper, lettuce and cabbages, which were sold primarily to NAMBoard[4] and also retail outlets such as SPAR and SHOPRITE.

These gardens served a dual purpose, providing nutritious vegetables for families affected by HIV and AIDS as well as generating income for the households. CGs earned an average seasonal income of E13,000 (USD $1,625[5]) per garden, with the most successful garden earning as much as E24,000 (USD$3,000) in a season.

Vegetable sales increased disposable income for household members, with some gardens expanding in plot size to further increase household income. The income earned has been used to pay for school fees and maize. This was a significant improvement, considering the majority of households were unable to harvest adequate maize to last the consumption year. CGs were planted each season after a production quota was agreed upon and contracts with NAMBoard were signed. These ensured farmers would be able to sell their produce following each harvest, so long as they met quantity and quality requirements. Though farmers were guaranteed a market through NAMBoard, challenges such as unreliability and unpredictability of prices affected the motivation of the farmers. Other challenges included pests and diseases.

[4] *The National Agricultural Marketing Board Act (Act No. 13 of 1985) establishes the National Agricultural Marketing Board (NAMBoard). The Board is mandated to facilitate the marketing and improvement of fruits and vegetables and other scheduled agricultural products*

[5] Exchange rate is 1USD=8 Emalangeni

The endline survey revealed that 56% of IRD beneficiaries had gardens or were members of CGs. Of these, 18% had backyard (keyhole and trench) gardens, 14% were members of hand pump community gardens, and 7% were members of commercial designated community gardens. The survey also indicated that 53% of those who sold produce in 2011 collected an average revenue of E101- E500 Emalangeni (USD$13-63), with only 2.6% collecting revenue above E1000 Emalangeni (USD$135) per household per year.

Cotton Production

Picture 6. Cotton production at Mr Mbhamali's field In Somtongo Inkhundla

The main cash crops in the Lowveld region were sugar cane and cotton. According to IRD cotton planting surveys in 2009/10 and 2010/11 agriculture seasons, cotton was being grown by almost 10% of the farmers in the Lowveld. Area under cotton at household level averaged 1.16 ha which was 60% of the total plot size. Seeds were obtained from the Sikhulile Cotton Ginnery which is now owned completely by the government. Seed was obtained at a price of E90 per five kg and quantity obtained on loan varied on the suitability of the candidate as assessed by the ginnery.

Cotton production has decreased over the last five years due to high cost of inputs and low prices. Climatic variability also impacted cotton production as farmers were no longer realizing good yields due to poor rainfall. Despite the fact that the per kilogram price increased during the 2009/10 season, most farmers were still reluctant to plant cotton due to the overall low prices and declining yields. Those that planted did so because they were accustomed to it and want to keep on trying.

The IRD cotton planting surveys and value chain analysis identified the following barriers to production:

- **Input availability** - The tractors or implements for cultivating were difficult to access. Government tried to provide tractors but there were just too many farmers requiring them.
- **Cost of production** - Cotton prodcuction required a lot of labor and inputs. Farmers tried to reduce cost resulting in reduced quality and yields
- **Fencing** - Goats managed to enter through the natural fences which impacted on the harvest.
- **Capital** - Sikhulile cotton ginnery, the main buyer of cotton did not provide micro-credit.
- **Disease** - Diseases were affecting the quality of cotton thereby affecting the cotton grades
- **Extension** - There was a lack of continuous monitoring and expert advice being provided by government extension workers to the farmers
- **Yields** - Yields were on a continuous decline, this was attributed to the changes in weather patterns and lack of inputs
- **Business skills** - Farmers lacked the required business skill

To take advantage of opportunities provided by these challenges, IRD maximized extension services to provide farmers with the necessary information on weather patterns (the length of the rainfall season) to ensure informed decision-making on which crops to plant. Information acquired from trainings by Technoserve and the Sikhulile cotton ginnery on farm business management skills was also disseminated to the farmers through trainings at the household level which helped them determine whether they were making real profits. Results of the cotton production surveys indicated that prior to this, farmers' profit assessments were not fully factoring in production costs as part of the calculations.

Livestock Development

Table 5. Livestock development indicators

Indicator	Year 1	Year 1 achievement	Year 2*	Year 2 achievement	Year 3*	Year 3 achievement
Number of animals benefiting from or affected by livestock activities	225	226	900	882	1,710	1,799
Number of people benefiting from livestock activities	90	108	360	342	684	702
Number of farmers that purchase feed with their own funds and continue use of grazing camps	0	0	36	18	45	33**
Cattle sales from farmer beneficiaries	$16,200	$0	$64,800	$2,880	$113,400	$35,282***
No. of farmers fulfilling IRD MOU agreements	11	0	49	6	75	117****

***Accumulated target**

**** Farmers with cattle grazing from the protected grazing camps, farmers never purchased feed using their own funds**

*****Most sales were to the local butcheries, only 4 HH sold to SMI**

******Farmers that were fulfilling five out of six of the articles in the MOU; the remaining articles that were not fully fulfilled were that of sales, not a single farmer is able to sell a minimum of 60 % of calves in their prime.**

Picture 7. Protected grazing camp-used for rotational grazing

Cattle dominates the country's livestock sector and plays an essential role in the social and economic welfare of farmers in Swaziland. The stocking rate is approximately 1.77 heads per ha, which is among the highest in Africa. This makes livestock production an important sector in Swaziland. To ensure farmers fully benefit from their livestock, IRD provided training on how to better manage livestock, minimize livestock deaths during dry periods, and ensure profits from animal sales. Farmers were also taught about how to manage their pastures (rotational grazing) to prevent livestock deaths during dry periods, and to promote development of pasture in grazing camps. Beneficiaries were provided with monthly supplies of livestock feed (hay) and fencing material for the construction and protection of grazing camps. The main topics of the trainings included:

- Calculating and understanding livestock units per hectare
- Understanding and respecting the stocking rate
- Rotational grazing
- Adding value to pastures
- Value of cattle at different ages and prime periods for selling cattle

A total of 59 ha were put under protected pastures (Picture 7), each farmer contributing a minimum of 0.5 ha. In a livestock survey that was carried out in the 2011/2012 season it was observed that during the 2010 season farmers owned an average of 15 cattle. In the 2011/2012 season, the number increased to 17 cattle. It was also observed that while 69% of livestock sales were conducted among community members, only 12% were sales to the Swaziland meat industries.

Coordination

IRD coordinated the implementation of the agriculture and food security sector with various stakeholders, namely the Ministry of Agriculture and Cooperatives (MOAC), the Food and Agriculture Organization (FAO), the World Food Program (WFP), various NGOs, and the University of Swaziland. IRD was part of the National CA Taskforce that involves the MOAC, Food and Agriculture Organization of the United Nations (FAO) and NGOs working in CA. IRD extension officers coordinated with RDA extension officers to make them aware of what IRD was doing and to get their support in implementation. Information on beneficiaries is shared between MOAC and IRD to ensure that there is no duplication of activities and proper coordination and harmonization of CA programs in Swaziland. MOAC senior extension officers and CA Taskforce representatives participated in the IRD field days and IRD also participated in FAO/ MOAC organized field days in the Shiselweni and Lubombo districts. These field days were organized for the purpose of exchanging and sharing information, experiences, and lessons learned. At the field level, IRD worked with local leaders to get buy in for program

activities as well as establish guarantors for the proper management of infrastructure installed by IRD for the communities.

At the private sector level, IRD coordinated with Swaziland Meat Industries (SMI) for livestock activities and with NAMBoard for vegetable marketing and sales. NAMBoard assigned business advisors to production in IRD supported gardens to ensure quality standards and Good Agricultural Practices (GAP) were followed. These visits helped clarify non-transparent pricing system by NAMBoard and ensured the rapid collection of farmers produce from the farm gate. IRD also coordinated with Sikhulile Cotton Ginnery and Technoserve for the training of cotton farmers that were also beneficiaries of IRD programs. Sikhulile Cotton Ginnery and Technoserve provided training to extension officers on cotton production and farm business management.

Constraints and Challenges

- ***Delays in land preparation*** – New farmers were only able to complete land preparation at the end of September to mid-October in some instances when the rains had already started. The main reason cited for late completion was unavailability of correct tools to use as well as shortage of manpower.

- ***Early rains*** - Light rains in August often resulted in prepared fields being weedy before planting. Farmers were reluctant to weed before planting, as such, in some fields, early growth of crops was compromised by high weed infestation.

- ***Long dry spells*** - No or few rains were received in the month of December and February during the program and as such, crops in the driest Tinkhundla wilted when the maize was at its tasseling stage, resulting in crop stunting for both maize and sorghum plants and small cobs for the maize .

- ***Food for work*** - In most of the operational areas, there were food-for-work programs, where vulnerable families were asked to work in the chiefs' field to prepare land for planting, constructing Neighbourhood Care Points (NCP and repairing of livestock (protection) and community fences), in return for food. This led to more time being spent in public works and less time in their own fields, thereby delaying land preparation (digging of seed basins).

- There were a ***few government extension workers*** available in the Lowveld with a poor farmer-extension worker contact ratio. This led to lower coordination levels, as in some instances there was no government extension officer at all.

Success Stories

Conservation Agriculture – Mr. Madevabovu Dlamini

Mr. Madevabovu Dlamini, 64, is from Mpolonjeni tinkhundla and lives with his wife and five children, four of which are orphans. His only means of income is through farming maize and cotton. He was well-known in his community for his high quality crops and even participated in national maize competitions. Since 2002, Mpolonjeni tinkhundla received very little rainfall which negatively affected Mr. Dlamini's crops. He struggled to support his family and eventually became a beneficiary of food donations from WFP and its partners. During this period he tried alternative means of survival such as backyard gardening, but this failed because there was no water source nearby. He would also fence fields and receive food as compensation, but these employment opportunities were scarce.

Picture 8. Mrs. Madevabovu appreciating her sorghum harvest from her CA field

In 2010 Mr. Dlamini attended training on conservation agriculture conducted by IRD. This was the first time he had been exposed to the concept, and initially, he was sceptical. However, after seeing a successful harvest experienced by a nearby farmer, he decided to give it a try.

"At first I was not convinced with what was being said about planting in basins, but thanks to Mr. Ndamera's field and harvest, I decided to give it a try. Another thing that helped me was the promotion of sorghum. . . sorghum is a crop that we used to grow before and I wanted to try it again."

From what he heard and saw at Mr. Ndamera' s field during a CA exchange visit, he felt there was no other option than to try it. "Digging the basins is difficult, but like everything in life, you have to work for what you want. Now that I am in the second year, my job is just to maintain the basins," said Mr. Ndamera. Under conservation agriculture in 2010 he harvested four shelled 50 kg bags and in 2011 he harvested eight shelled 50 kg bags.

According to Mr. Dlamini he is now able to plant in time and take advantage of the early rains. The following table shows how CA improved the yield of the farmer. When practicing CA techniques, Mr. Dlamini gets almost twice what he gets under conventional farming techniques. "Since I adopted CA I parted ways with hunger. Now I don't buy food as I have it all year round. I also plant sweet potatoes and that helps to save maize," said the farmer. With conservation agriculture Mr. Dlamini is now living with his family happily as they have food. The money he saves is used to pay for his children's school fees and other basic needs like salt and sugar.

Keyhole Garden – Mrs. Tryphina Matsenjwa

Picture 9. Mrs Matsenjwa tending her garden

Mrs. Tryphina Matsenjwa, 62, lives in Gamula in the Lubombo region of Swaziland. Gamula is a very dry community and water is scarce. She lives with a very large family of 13 and struggles to feed everyone. Tryphina survives on informal businesses and elderly grants, which is where she got money to buy vegetables to prepare food for her family.

She constructed a keyhole garden in 2010 after being introduced to it by IRD. When asked on how the garden changed her life she said, *"*I have a very big family, and now I am able to provide food in the winter and in the summer." Before, Tryphina asked her neighbours for food and struggled to buy simple household goods. "Now I can afford those things as I sell vegetables from the garden. After selling and maybe getting E10, I can even pay for the bus fares for my children to go to school," she said.

"The trainer taught me that I don't need more water to have a keyhole garden, even soapy water can be used," said Tryphina. She received initial support from IRD which included training in basic keyhole gardening, seeds, and seedlings. Tryphina is now able to buy her own seedlings from the profit. "The garden looks small but it changed my life. I used to suffer from stress and sometimes I would get sick when I thought about food and where to get it. Now the garden is helping me – I want to build another one."

Community Garden – Gamula Community Garden

The Gamula community garden in Nkilongo Inkhundla was established in 2011 with the assistance of IRD. Most community members were unemployed and survived only on agriculture, which was suffering from poor rains. The high prevalence of HIV and AIDS caused even more hardship, as most community members were on antiretroviral therapy.

Picture 10. Members carrying their produce for local sale

IRD established a community garden and helped mobilize members of the community to grow vegetables for household consumption as well as to earn an income from the sale of surplus vegetables. The Gamula community garden has 41 members, including three males and 38 females. Although gender equity was not intentionally part of the program design, these gardens have increased women's access to livelihood activities and improved their economic and social status in the communities. This is important because in Swazi communities the responsibility of feeding children remains with women.

Picture 11. Members carrying their produce for the formal market

The garden has a total area of 1.2 hectares, and each member is entitled to a plot that is 5 x 58 meters. For the local sales, farmers are mostly growing leafy vegetables such as spinach and lettuce and root vegetables such as onions and beetroot. For the formal market, they grow beetroot and green pepper which usually sell at higher prices. To ensure a reliable market and collection of their produce, farmers sign a contract with NAMBoard[6].

The Gamula community garden has managed to sell a total of E28180.00 ($3522) in two of the three production seasons, amounting to an average of E687.30 ($88[7]) in commercial sales only. Mrs. Agnes Bhembe, 77, is a member of the community garden and lives with seven members of her household. When asked about how the gardens changed her life, she said "In this community we are not lazy, we just don't have water. After IRD supported us with this garden, especially with water, we are no longer hungry, and are able pay school fees and fares to the clinics." From the conversation with Mrs. Bhembe, it was realized that before the garden was established, some farmers even struggled to pay for bus fares to collect medication.

[6] NAMBOARD is the National Agricultural Marketing Board of Swaziland
[7] Exchange rate is 1$=8 Emalangeni

SECTOR – WATER, SANITATION AND HYGIENE (WASH)

OPERATION SPECIFIC OBJECTIVES

To improve hygiene practices and expand access to safe water for multiple use

BENEFICIARY NUMBER

Households: 6,870; Individuals: 50,420; Students: 9,200

GEOGRAPHIC AREA:

The program targeted the following twelve Tinkhundla in Somtongo, Matsanjeni, Sigwe, Lubuli, Mpolonjeni, Hosea, Ngudzeni, Sithobela, Nkilongo, Shiselweni, Hlane and Dvokodvweni.

Sub Sector: Water Supply

Table 6. Water Supply Performance Indicators

INDICATOR	Year 1 Target	Year 1 Achievement	Year 2 Targets (Accumulated)	Year 2 Achievement (Accumulated)	Year 3 Targets (Accumulated)	Year 3 achievement (Accumulated)
No. and percentage of household water supplies with 0 coli forms bacteria per 100ml	1125 75%	0%	3200 80%	80%	6183(90%)	80%
No. and percent of water points with measurable chlorine residual exceeding 0.2mg/l	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)
No. of people with access to rehabilitated/ established water wells	9000	7008	24000	17432	41,220	47,920
No. of students with access to RWH systems	0	0	4,000	5267	9,200	14,133
No. of schools upgraded with water access /RWH	0	0	10	9	23	28

Provision of access to clean water, sanitation and hygiene was made through the installation of roof top water harvesting systems and the construction of latrines at schools as well as the replacement of broken pumps with reliable deep well Blue pumps. Multi-use Boreholes were also drilled at CGs. IRD began the pump replacement and repair activity in 2009 by conducting an assessment on all of the existing boreholes in 12 tinkhundla located in the drought affected areas of Lubombo and Shiselweni districts and produced a detailed map of the existing protected water sources (Annex 1). The objective of the mapping exercise was to lay a foundation for the creation of a national database and to locate non-functioning water wells that would be replaced by deep well pumps through this program. The mapping exercise prompted the MNRE to embark on a national water point mapping program in 2011, of which IRD is a national committee member.

Result and Analysis of the Borehole Mapping

Out of the 416 boreholes identified through the borehole mapping exercise, 34.9% were non-operational and 12% were partially operational (Figure 2). Major reasons for the failure of borehole pumps included:

- Decline of the water table due to lack of ground water recharge which resulted in the suspension of water pumps above the static water level (SWL).
- Improper pump selection: Afridev pumps were found to be ineffective below a depth of 40m. The survey results indicated that 76% of the pumps installed were Afridev pumps while only 7% were deep well pumps (Indian Mark II).
- Poor management of services: the survey highlighted that 15% of community water points did not have a management structure. It was also noted that a significant number of the existing water committees were not proactive. There was a real need for strengthening community-based management systems.
- Poor drilling site selection/completion: some organizations or their unsupervised contractors installed or are installing casings and water pumps while there is not enough water to be pumped. There were some boreholes, which should have been abandoned during drilling. There was a need not only for proper drilling site selection but also to have conducted a pumping test in order to understand the aquifer and select or recommend the appropriate pump and pump installation depth.
- Poor repair and maintenance: The capacity of the Rural Water Supply branch of the Ministry of Natural Resources and Energy (MNRE), Department of Water Affairs (DWA), to provide repair and maintenance services was very limited. The financial sustainability of the beneficiary communities was vital in order to ensure sustainability of services.

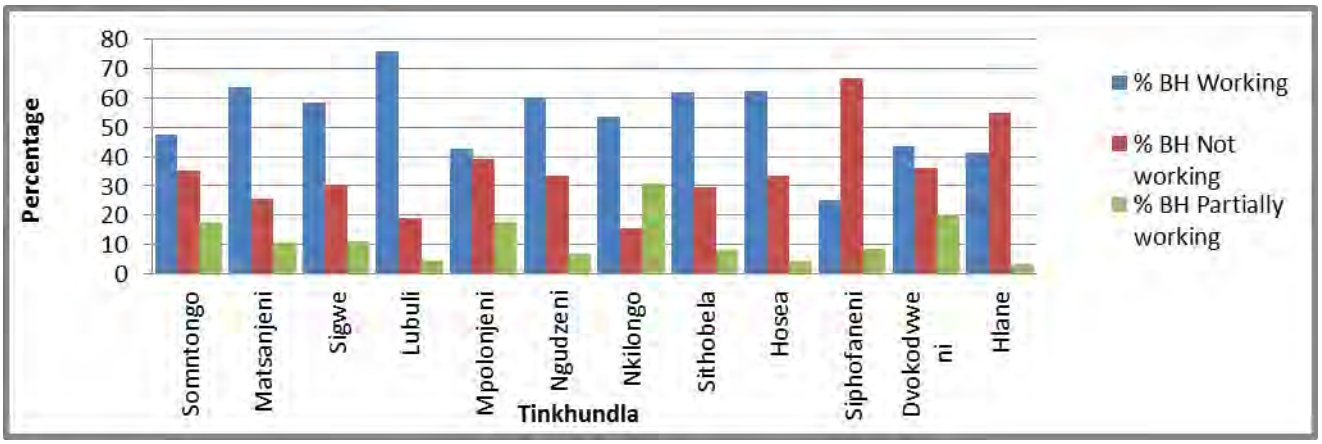


Figure 2. Borehole Condition in 12 Tinkhundla

Replacement of Broken pumps by Blue pumps

Picture 12. Gabazi water point - before and after IRD's intervention

The borehole mapping exercise identified improper pump selection as one of the major challenges to sustainability of hand pump based community water supplies in rural Swaziland. To tackle this specific challenge, IRD proposed and successfully outsourced the most reliable deep well hand pump in the market – the Blue pump.

Picture 13. Cattle Trough in Nsalitje, Matsanjeni Inkhundla

Since IRD started installation of Blue pumps in November 2009, no breakdowns have been reported. IRD replaced 73 broken Afridev hand pumps (target was 37) with Blue pumps which were suitable for deep boreholes and required less maintenance than the traditional Afridev pumps, which proved to be ineffective below a depth of 40 meters (Annex 2). Forty-five cattle troughs each with a dimension of 4m x 1m x 0.5m were also constructed at the vicinity of the water sources in order to keep animals from contaminating the water sources and provided them with a water source during the dry seasons. All the existing well heads at these replacement sites were rehabilitated/reconstructed.

Repair and Re-installation of Existing Afridev Pumps

Experience has shown that Afridev pumps performed better in shallow boreholes than in deeper ones. IRD repaired the broken Afridev pumps and reassembled and installed them in shallow boreholes. Of the 73 broken Afridev pumps that were replaced with Blue pumps, IRD repaired and reassembled 50. These pumps were re-installed in 49 selected non-operational borehole pump sites (Annex 3) which have a relatively shallow water table (Afridev pumps are less effective below 40 meter depth). On-the-job training was provided to the local technicians at each of these pump repair sites. Repair tool kits were also provided to them.

Installation of Multi-Use Water Points at CGs

The rapid needs assessment carried out on existing CGs in 2009 identified access to water as the major limiting factor to increasing vegetable production. With the objective of supporting the establishment of vegetable gardens at homesteads and strengthening existing community gardens, IRD Agriculture and WASH experts have jointly conducted a re-assessment of the existing CGs located in 12 Tinkhundla, where the current program area is located, in order to select CGs for borehole drilling.

Picture 14. Blue pump in operation at Ematje Community Garden, Somtongo Inkhundla

The selection criteria included suitability of the garden for ground water development, availability of enough land for vegetable gardening, and willingness of the beneficiaries to work in vegetable gardens.

Borehole drilling was carried out through a contract agreement between IRD and the Ministry of Natural Resources - Department of Water Affairs (DWA). A total of 41 boreholes were drilled from 2009 to 2011 and all are productive. Out of the 41 productive boreholes drilled during the program period, electric power and submersible electrical pumps were installed in 15 selected CGs (Annex 4) in order to increase vegetable production and transform the CGs to commercial gardens. The selection criteria to transform a CG to a commercial garden included borehole yield, proximity of the garden to the electric grid, availability of enough irrigable land area (average two ha), and motivation of the beneficiaries. Elevated tanks with 10,000 to 20,000 litre capacity, galvanized pipe network, pump houses and latrines were installed at each of these commercial gardens. Blue pumps were installed at 26 CGs (Annex 4). Single squat latrines and cattle troughs were also constructed in these gardens.

Picture 15. Upgraded RWH system at Phumelela Primary School Matsanjeni Tinkhundla

PROVISION OF CLEAN WATER AT SCHOOLS

Upgrading Rooftop Rainwater Harvesting (RWH) Systems in Schools

An assessment was made on the 14 schools where IRD installed RWH systems in 2008, in order to identify requirements to upgrade the systems. The assessment exercise identified the following areas for improvement which were not considered due to budget limitations during the RWH installation in 2008.

- The installed galvanized gutters were not wide enough to collect much if not all of the rain water.
- The roofs of the smaller classrooms and the staff quarters were not used to harvest rain water
- Efflorescence (salt contamination) was observed in some of the concrete cisterns caused by the use of water sources which were a bit salty. These were salty borehole waters and river waters which were extensively used for sugarcane irrigation.

The following improvement works were carried out on each of the 14 schools in order to upgrade the existing RWH systems:

- The old galvanized gutters (75mmx50mmx0.3mm) were replaced with new gutters which were wider and stronger (125mmx100mmx0.5mm). The old gutters were reinstalled in the smaller classrooms and staff quarters
- The storage capacity was increased by at least 10,000 litre through the installation of plastic tanks
- All the concrete cisterns were coated with water proofing in order to avoid contact of the stored water with the concrete
- A separate maintenance fund (Water Maintenance and Security fund) was established in each school. Each student contributes between E30 and E70 per year together with tuition fees to raise maintenance funds.

Picture 16. 75m³ RC tank in Ngcina/Lasi High school, Mpolonjeni Inkhundla

Installation of Rooftop Rainwater Harvest Systems for Schools

Water harvesting systems at schools can provide a reliable solution for areas with low water tables, which is usually the case for schools built at the top of hills in rural Swaziland. IRD conducted an assessment to identify schools with little or no access to water, sanitation and hygiene. The criteria used for school selection included factors such as: number of students and teachers, available roofing area for water collection, access to potable drinking water, distance to the nearest potable water source, existing sanitation and hygiene condition of the schools.

IRD has completed the construction of cisterns and the installation of gutters in 28 schools (Annex 5). All the cisterns were rectangular in shape, made from reinforced concrete, constructed over the surface with a storage capacity of 75 m3. All the installed gutter systems were galvanized types (125mm x100mm x 0.5mm) to ensure higher volume capacity and a longer lifespan and resistance.

Most of the main blocks of classrooms were connected to the newly constructed cisterns while the small size classrooms were connected to the new and existing plastic tanks in order to maximize the harvest area. For each of the installed plastic tanks, concrete seats were constructed to support them. All the installed plastic tanks were anchored by strong

wires at four angles in order to withstand frequent winds. Plastic tanks and gutters were also installed for teachers' quarters in each of the schools in order to avoid competition for water among children and teachers.

Sub Sector – Sanitation and Hygiene

INDICATOR	Yr1 Target	Yr1 Achievement	Yr2 Targets (Accumulated)	Yr2 Achievement (Accumulated)	Yr3 Targets (Accumulated)	Yr3 Achievement (Accumulated)
No. of local technicians trained and equipped with water point maintenance kit	18	19	58	58(100%)	92(100%)	116(126%)
No. and percent of clean water points functioning three months after completion	18 (100%)	19 (105.5%)	58 (100%)	58(100%)	92(100%)	165(179%)
No. and percent of clean water points functioning	18(100%)	19(105.5%)	57(98%)	58(101.75%)	88(96%)	165(188%)
Percent of target population demonstrating good hand washing practices	n/a	n/a	n/a	n/a	20% increase(based on year 1)	35% increase
Percent of target population demonstrating correct water usage and storage	n/a	n/a	n/a	n/a	20% increase(based on year 1)	n/a*
No. of farmers who have received target HIV health education messages	1000	0	1450	1460	1825	2551
No. of students who have received target HIV health education messages	0	0	4,000	3056	9200	14,133
No. of extension workers trained in HIV awareness	9	9	9	9	12	12

Picture 17. Single squat latrine at Sitanani Community Garden

Sanitation and Hygiene – Community Gardens

In order to reduce the open defecation practices and promote hygiene/hand washing practices among the CG beneficiaries, IRD took the initiative to construct latrines and provide hand washing buckets though it was not budgeted for. Subsequently, 15 single squat latrines were constructed at each of the commercial gardens and 78 hand washing devices – two for each CG –were provided. IRD community mobilizer held a number of meetings with the CG beneficiaries before, during and after the WASH systems were installed in order to sensitize them on hygiene practices and latrine use and establish a community based management system.

Picture 18.Latrines Constructed in Hluti Central

Sanitation and Hygiene – Schools

An assessment was carried out in 28 schools where IRD has installed RWH systems, in order to evaluate the existing condition of the latrines and hand washing practices. The latrines in 20 schools were not in good conditions. IRD constructed two blocks of latrines, each with three rooms, in each of these 20 schools where the existing latrines were not in good condition. Five hand washing devices were installed at each of the 28 schools in order to promote hand washing practices. The hand washing units were placed in kitchens and latrines. Children were taught about hand washing practices, latrine use and tippy-tap production.

Latrine Construction by CA Farmers

Data collected during the survey conducted on CA farmers in 2009 assessed the following components: levels of awareness, willingness to construct latrines, and ability to afford materials by the beneficiaries among others, IRD prepared an intervention plan in order to improve the existing hygiene and sanitation situation. Farmers were taught about the importance of hygiene and sanitation and encouraged to construct their own latrines. IRD also made a provision for those farmers who cannot make it on their own to be assisted with a minimum provision of incentives such as roofing material, cement for floor slab, vent pipe and hand washing bucket. A total of 44 farmers constructed their latrines on their own and a total of 150 farmers completed their latrines with IRD's minimal assistance.

COMMUNITY MANAGEMENT OF WASH SERVICES

The primary reason for high failure rates of hand pump equipped boreholes in rural Africa, and hence low sustainability, is insufficient attention to operation and maintenance of the pump (Harvey and Reed, 2004). IRD recognizes the importance of a well-established and functioning community management for the sustainability of WASH services in rural communities. Through the assistance of IRD's community mobilization officer, user communities established a water supply, sanitation and hygiene (WASH) committees, also called water committees, which are responsible for managing operation and maintenance of their hand pumps. These committees normally have five members, a chairman, a deputy chairman, a treasurer and two members. They were elected by community members and are responsible for collection of maintenance funds, monitoring of pump performance and organization of repairs and replacements.

Community based management structures were established/strengthened in 42 schools and 107 pump replacement and repair sites. IRD's community mobilization officer helped communities to draft their constitution. The constitutions were signed by WASH committees and the local administration. Participatory Hygiene and Sanitation Transformation (PHAST) trainings were conducted for representatives from schools, community water points and community gardens. The trainings were provided through the facilitators from the Ministry of Health and Ministry of Natural resources and Energy. Two representatives from each of the 68 community water points, 41 community gardens and 42 schools attended the training. The objectives of the training include:

- To raise awareness on waterborne and water related diseases.
- To assist communities to manage their water and sanitation projects (sustainability).

- To impart knowledge on water, sanitation and hygiene with the aim of behaviour and practices change.
- To ensure that committee members know all development projects in their respective communities.
- To sensitize on issues of safe water in relation to handling, storage, usage and collection
- To identify the best options and practices on water and sanitation an hygiene using the PHAST initiative

Trainings were also conducted by IRD's community mobilizer on HIV/AIDS awareness, sanitation and hygiene during community meetings.

Other achievements in the community based management area include:

- IRD successfully negotiated with Standard bank to help communities with the opening of "pure save accounts" which has a zero bank charge. The opening of this account is significant not only for its zero service charge but also because it removes the requirement of the communities to get permission from the local chief which costs them about $30 per community for opening an account. It also encourages the communities to regularly raise their monthly contribution by providing a security for their money. It was reported that some members of the communities are reluctant to raise their monthly contribution due to suspicion of fund embezzlements as the maintenance funds were used to be kept with elected treasurers. IRD community mobilization officer and IRD extension officers are assisting communities in the opening of accounts in the three nearest branches in the program area (Big Bend, Nhlangano and Simunye).
- School children contribute between E30 and E70.00 each per year, which is reserved for water management and maintenance of infrastructure such as locks, repair of gutter, purchase of soap for hand washing and replacement of taps. There is a security personnel assigned to each school and students are expected to pay E5.00 a term for security services. All the fees that students pay is included in the school tuition fees.
- In order to regularly monitor the status of the community management systems, services, and the monthly contribution for maintenance/replacement fund, templates were prepared and provided to the extension officers. Information collected by the EOs on a monthly basis is being analysed, documented and reported by the community mobilizer.

COORDINATION

IRD has coordinated its activities with the relevant government and non-government organizations both at the central government and the local site level. A close relationship has been established with the Ministry of Natural Resources and Energy, Water Affairs Department, Ministry of Education, Ministry of Health and World Vision.

IRD has continued its active participation and coordination with partners who are engaged in WASH activities through the WASH Stakeholders Forum.

CONSTRAINTS AND CHALLENGES

- There was a lack of consistency by water point user communities in raising maintenance funds - some community members were reluctant to raise their share of contribution. With IRD's assistance, the community reassessed their contribution rules and regulations by requesting other members to increase their usual contributions. The community also resorted to having the person who is unable to make payments contribute through other means such as securing the water point or maintaining the sanitation of the area.

- Some WASH committees were reluctant to open bank accounts as it was not their custom to save money in that manner. IRD sensitized the communities so that they appreciate the value of saving their contributions in a bank, alerting them of the risks associated with having individuals in charge of keeping the entire amount in cash.
- There were delays in drilling of boreholes and supply of pumps
- Community labour contribution for latrine construction in schools caused some delays.
- Some schools were using the water from RWH for school construction projects causing shortage of water for drinking and cooking. IRD approached the situation by sensitizing school staff on the importance of preserving the water from RWH solely for human consumption, and to find other means to carry out construction and other activities.

Success Stories

Rain Water Harvesting

Picture 19. Ngcina Primary School is one of the many schools, which benefited from IRD's intervention in the provision of potable water through the installation of rain water harvesting system

Ngcina Primary School, with its 470 student population used to experience chronic water shortages, putting a hamper on everyday activities. Oftentimes, the situation was so dire that courses in Agriculture and Home Economics were no longer active as there was never enough water to enable students to cook and water their plants in the school garden. Students and teachers alike would be forced to bring their own water to school so as to cover their basic water needs.

Ngcina Primary School was one of many schools that relied on the Ministry of Education's coupon program to procure its water supplies. This government service, however could not cope with the high demand with its one tanker to service the whole region. With a tanker that often experienced breakdowns and long queues, it was never a reliable source for clean water. According to Mr. Thulani Dlamini, the chairperson of the parent teacher association, the school had to resort buying its water from co-operations or from local tankers, which provided unsanitary water drawn from rivers just to make ends meet. Mr. Dlamini noted that the unsanitary water in the school contributed to incidences of diarrheal diseases, which were already present amongst the student population.

IRD's intervention installed a 75 000 L concrete tank and five 5000L plastic tanks, along with two block pit latrines, a significant improvement from its previous possession of just one 5000L tank to service the entire school. The intervention has not only provided the school with enough water supply to meet its everyday needs, it has also been a cost-saving venture which has cut the students contribution towards water needs by a third.

Efficient water management training by IRD staff has also enabled the school to manage it wisely and in a sustainable fashion. A committee comprised of staff and parents' teacher association (PTA) has been established to oversee the proper management and maintenance of the resources. Locks have been purchased to tightly monitor the usage of water and sufficient funds have been set aside for regular maintenance. Ngcina Primary School is now the proud custodian of a clean and reliable water source and a well-informed community, which utilizes and manages water in a responsible manner.

Multi-Use Blue Pump Replacement

Picture 20. Mrs. Selina Matse collecting water from the Blue pump

Picture 21. Mrs Selina Matse working on one of her vegetable plots

Mhlabeni water point was installed in 2005 by a Japanese funded organization and has been the main source of the community's household water needs. Selina Matse is a 61-year-old mother looking after four children, three of which were abandoned by their parents. She has been part of the community for the past 26 years and has witnessed the frequent breakdown of the hand pump. Two years ago, the pump suffered a major breakdown and could no longer be repaired. This precarious situation forced Mrs. Matse and her community members to travel for an hour or more to the river to fetch water.

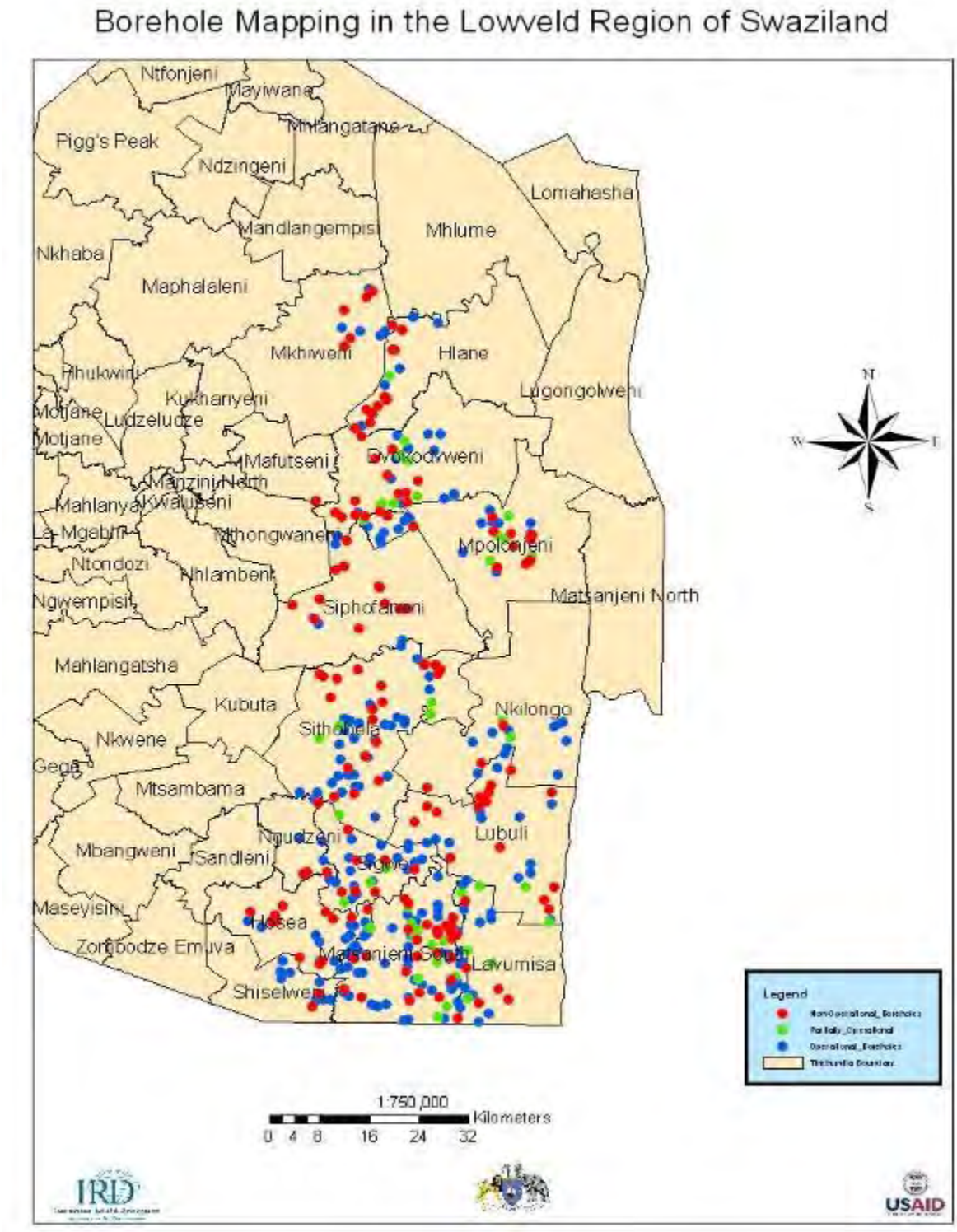
Even after traveling the long distance, the community was only able to get muddy river water which caused many to suffer from diarrheal diseases, as the source also shared by livestock. In order to disinfect the water, Mrs. Matse had to do the painstaking task of boiling the water using Jik, which can be toxic if not used in the correct amount. In 2011, IRD replaced the pump and installed the more effective and sturdier Blue pump. The community has found the new pump to be user-friendly as the water comes out at the first stroke that even the elderly were using it effortlessly. Moreover, due to the reliability of the water, the community decided to establish a garden closer to the water site where everyone interested is allowed to have a plot. The garden has also incorporated pupils from the nearby school where they plant their own plots for agricultural studies.

In the garden, Mrs. Matse owns seven small plots of 2m * 2m where she is growing various vegetables such as beetroot, onions, spinach, lettuce and tomatoes. She highlighted that despite that distance of almost 20 metres from the garden, she is able to collect from the hand pump, at most 7*25 litres containers twice a day, which she uses one per each plot. The pump is soft and easy to use thereby requiring less labour on her part. From 2011 after the pump was installed her production has increased as there is constant water available.

Upon being questioned on what other benefits have accrued after the pump was installed, she said that though the plots are small, she managed to get the highest number of plots because she is more needy and does not have a man to support her, "*through the garden I get my household vegetable needs, which I complement with the cereals I purchase from the elderly grant support I receive from the government. I manage to sell at least E20 ($2.5) worth of vegetables every week, though the money is small, but its money that I cannot pick from the streets. It still helps me with the needs of my family as well as for purchasing seedlings for the garden*".

With the help of IRD's community mobilizer, the existing but weekly organized water committee was strengthened with 23 households actively contributing E5.00 per household. The fund totalling at E1070.00 raised thusfar has been deposited safely in the newly opened bank account with Standard Bank. It is a new dawn for Mrs. Matse and her community members who now can rely on a single water pump to meet their daily needs and can tend to their vegetables to feed their family healthy and nutritious meals.

Annex 1 Borehole mapping - 2009



Annex 2 Blue pump replacement sites

Year 1

No.	BH designation	SITE NAME	INKHUNDLA	# of HSs	Coordinates		BH depth (m)	SWL (m)	Pump position(m)
					X	y			
1	A53	Hluti/Sbovini	Hosea	75	271515	313414	71	35	65
2	A1	Lulakeni	Sigwe	35	3000627	63754	50	23.7	40
3	A7	Moises	Sigwe	55	3002190	61961	72	29	66
4	A9	Gabazi 1	Sigwe	30	2995157	73879	80	10	70
5	A13	Mpakeni	Sigwe	43	27 10 13	31 37 45	67	15	61
6	A15	Dlezani	Sigwe	30	2989833	62150	100	12	90
7	A17	Gukuka I	Lubuli	42	2965448	73192	86	32	75
8	A27	Mpopoza	Matsanjeni	25	3012446	73752	60	7	55
9	A34	Matjemnyana	Matsanjeni	45	3013990	64775	84	28	78
10	A35	Nsalidje III	Matsanjeni	30	3019086	68439	100	36	90
11	A49	Nsubani 3	Somatongo	30	3003177	94743	110	42	100
12	A50	Mdlakundze	Somtongo	33	2999454	95714	90	12	85

Year 2

No.	BH design ation	SITE NAME	INKHUNDLA	# of HSs	Coordinates		BH depth (m)	SWL (m)	Pump position (m)
					X	Y			
1	A60	Phongolo	Hosea	35	3002691	51915	79	26	73
2	A61	Siyalusabomake	Hosea	44	3012442	58773	76	16	70
3	A62	Enyokeni	Lubuli	27	2984928	84718	81	35	75
4	A63	Kasthole/Dlakadla	Lubuli	43	2983288	85151	96	40	90
5	A65	Emahangeni	Lubuli	56	2987730	83857	69	20	63
6	A66	Mcathuvane	Lubuli	39	2986703	76774	89	38	80
7	A67	Egoli	Matsanjeni	55	3016957	76003	102	12	96
8	A68	Gudla	Matsanjeni	25	3005760	75235	70	26	64
9	A69	Eyihosheni	Matsanjeni	23	3019783	56712	62	19	56
10	A70	Lusotini	Mpolonjeni	208	2939505	88705	99	26	93
11	A71	Gwaba	Sigwe	15	3000132	63745	82	27	76
12	A72	Kabhunu	Sithobela	37	2968011	67951	75	24	69
13	A73	Lomahubehube	Somtongo	36	3006102	78123	100	45	91
14	A74	Kamhlongo	Somtongo	22	3008611	77844	68	24	62

Year 3

No.	BH designation	SITE NAME	INKHUNDLA	# of HSs	Coordinates		BH depth (m)	SWL (m)	Pump position(m)
					X	Y			
1	A88	Skhuphe No1	Hlane	27	2912636	69122	89	40	85
2	A89	Mnjoli	Hlane	41	2900318	64127	95	27	72
3	A90	Mbadlane	Hlane	42	2907200	68120	115	45	100
4	A91	Mnjoli kaShabangu	Hlane	35	2913010	65887	68	28	60
5	A92	Mdumezulu	Dvokodweni	37	2919654	78109	100	29	94
6	A93	Malindza	Dvokodweni	35	2971420	73616	86	24	80
7	A94	Enjabulweni	Dvokodweni	31	2923286	80311	78	32	72
8	A95	Mchinsweni	Shiselweni 1	34	3014428	51452	67	24	60
9	A96	Sivule	Shiselweni 1	45	3020021	50054	94	29	90
10	A97	Qomintaba/ kaSimelane	Matsanjeni	45	3020021	50054	88	35	82
11	A98	Gudla	Matsanjeni	45	2716355	317337	92	30	80
12	A99	Bambitje	Matsanjeni	39	2725478	3158124	106	46	96
13	A100	Mahhashini	Matsanjeni	53	2725478	3158124	100	38	90
14	A101	Mahangeni	Lubuli	43	2724169	315945	94	35	80
15	A102	Bekezela/Mbutfu	Lubuli	33	2710629	319190	102	40	90
16	A103	Mhlabeni 1	Lubuli	40	2702316	319180	82	28	76

No	Site Designation	Site	Inkhundla	HH	Coordinates		BHD (m)	Pump (m)	SWL (m)
					X	Y			
1	A104	Mvubu	Somtongo	21	3006916	76776	81	76	28
2	A105	Siphombosini	Mpolonjeni	29	2944069	86379	120	106	40
3	A106	Mahonca	Hosea	25	3011782	45734	72	69	24
4	A107	Mantjolini	Mpolonjeni	31	2941606	88984	110	100	26
5	A108	Etjeni	Mpolonjeni	27	2937615	87903	116	98	35
6	A109	Nkisa	Hosea	44	3012782	58720	84	78	23
7	A110	mamisa2	Sthobelweni	25	2972416	69145	96	88	39
8	A111	Gucuka	Sthobelweni	32	2967918	67891	108	92	34
9	A112	Nenekazi	Mtsenjeni	29	3009191	68336	80	76	27
10	A113	Mpandesene ps	Mtsenjeni	330	3012740	68336	88	78	34
11	A114	Phumelela/mbamali	Mtsenjeni	35	3022205	72745	76	70	24
12	A115	Moyeni	Mpolonjeni	42	3010836	78518	91	80	39
13	A116	Mshinini/mphakatsi	Hosea	25	3005003	50826	78	74	19
14	A117	Mzisheni/shongweni	Hosea	27	3004474	50899	102	90	36
15	A118	Nzuleni	Dvokodvweni	29	2932173	78575	106	96	39
16	A119	Mampempeni	Dvokodvweni	23	2934070	71906	114	100	41
17	A120	Mpaka	Dvokodvweni	37	2922618	77394	99	93	32
18	A121	Madabulwa2	Lubuli		2982263	87419	75	70	24
19	A122	Sihlahleni	Lubuli	26	2986413	75328	87	84	21
20	A123	Makhava primary	Sigwe	370	2985815	75149	75	70	19
21	A124	2Mabantaneni/mphakatsini	Lubuli	39	2986787	91063	69	66	17
22	A125	Ntandweni 1.	Hlane	33	2916167	68473	104	99	40
23	A126	Ntandweni 2./sikhonyaneni	Hlene	39	2917829	67196	116	100	35
24	A127	A1 Kraal	Sigwe	27	3006406	66078	82	76	15
25	A128	Mahlabaneni ps	Nkilongo		2972178	95589	85	79	30
26	A129	Mndobandoba2/mtfuntini	Nkilongo	29	2721653	87563	75	72	33
27	A130	Kakufa	Mpolonjeni	33	2934482	84533	103	97	39
28	A131	MNCITSINI	Mpolonjeni	31	2933594	85335	110	102	40
29	A132	Shoba	Mpolonjeni	40	2946034	86302	99	90	27
30	A133	Emakhalatsini/Mnconcwane	Lubuli	25	2985815	75149	70	63	20
31	A134	Lusotini 2	Mpolonjeni	23	293295	87683	104	98	45

Annex 3. Afridev repair

Year 1

No.	Site designation	Site name	Inkhundla	District	No. of HS	Coordinates		*BH depth (m)*	SWL (m)
						X	Y		
1	A51	Bambitje	Matsanjeni	Shiselweni	13	27 16 50	31 43 24	*59*	21
2	A52	Mabasa	Matsanjeni	Shiselweni	25	3017293	61512	61	24
3	A54	Nsalitje I	Matsanjeni	Shiselweni	22	27 17 19	31 37 54	59	23
4	A55	Egoli	Somtongo	Shiselweni	55	27 16 53	31 47 29	58	24
5	A56	Gabazi II	Sigwe	Shiselweni	27	27 02 21	31 45 13	64	28
6	A57	Chovane 2	Somtongo	Shiselweni	16	27 13 16	31 49 02	35	15
7	A58	Zomane 1	Somtongo	Shiselweni	28	27 12 31	31 48 51	59	28
8	A59	Mahangeni	Somtongo	Shiselweni	14	27 10 41	31 50 42	60	28

Year 2

No.	Site designation	Site Name	Inkhundla	District	No. of HH	Coordinates		BH depth (m)	SWL (m)
						X	Y		
1	A5	Total	Sigwe	Shiselweni	52	299615	66118	83	25
2	A75	Nyatsini	Sigwe	Shiselweni	34	2997751	57533	76	19
3	A76	Nsingizini	Hosea	Shiselweni	38	3009863	58858	75	26
4	A78	Ntuntwakazi	Somtongo	Shiselweni	46	2996828	82761	78	29
5	A79	Zibovini	Matsanjeni	Shiselweni	29	3015175	79609	86	30
6	A80	Victoria	Lubuli	Lubombo	35	2988433	86765	88	25
7	A81	Mahangeni-	Somtongo	Shiselweni	20	3005223	86336	70	26
8	A82	Maplotini	Somtongo -	Shiselweni	45	3013518	86757	86	22
9	A83	Lugaganeni	Hosea	Shiselweni	24	059810	3011987	60	21
10	A84	Nhlongamanzi	Matsanjeni	Shiselweni	80	063517	301320	83	22
11	A85	Magengesane	Matsanjeni	Shiselweni	56	072276	3003613	86	31
12	A86	Nsingizini	Hosea	Shiselweni	29	057399	3007672	67	18
13	A87	Sidzakeni	Matsanjeni	Shiselweni	31	3012373	75825	80	24

Year 3

No.	Site designation	Site name	Inkundla	District	HH	Coordinates		BHD (m)	SWL (m)
						X	Y		
1		Mndobondobo	Nkilongo	Lubombo	23	87563	2975163	67	26
2		Mukhulusihlengi	Nkilongo	Lubombo	27	87362	2971204	51	17
3		Lomvovo	Ngudzeni	Shiselweni	61	65478	2990839	59	23
4		Phobone	Ngudzeni	Shiselweni	22	62356	2992181	70	19
5		Nokwone	Ngudzeni	Shiselweni	43	60992	2987131	64	25
6		Mdubukelwu	Ngundzeni	Shiselweni	24	86966	2980062	66	20
7		Mncumini	Lubuli	Lubombo	19	81136	2980062	59	16
8		Mebenteneni	Lubuli	Lubombo	15	90095	2987587	42	9
9		Mshoshozi	Sigwe	Shiselweni	24	62256	2993271	69	21
10		Oivo	Sigwe	Shiselweni	15	66253	3019307	65	24
11		Chophotini	Sigwe	Shiselweni	27	61659	2992037	55	14
12		Luhlekweni	Somtongo	Shiselweni	28	77576	3005334	62	19
13		Matjeni	Somtongo	Shiselweni	11	80370	3009252	65	48
14		Etjeni ekuhlaba	Somtongo	Shiselweni	25	80271	3010359	71	45
15		Ntintini	Matsanjeni	Shiselweni	28	72937	3015153	69	45
16		Makhava 2	Matsanjeni	Shiselweni	26	64316	3005917	92	48
17		Sdzakeni	Matsanjeni	Shiselweni	24	71792	3005917	70	45
18		Gaddafi/ Nyamazane	Somtongo	Shiselweni	15	91094	3002240	77	28
19		Mhlabeni junction	Lubuli	Lubombo	23	91130	2999431	92	31
20		Gamula 2	Nkilongo	Lubombo	29	95944	2979865	85	29
21		Holy Ghost	Mpolonjeni	Lubombo	26	91673	2944118	78	33
22		Mpabayi 1	Mpolonjeni	Lubombo	21	91813	294405	90	30
23		Munyani	Mpolonjeni	Lubombo	25	86298	2946033	62	13
24		Mncitsini 1	Mpolonjeni	Lubombo	23	82945	2934149	69	24
25		Mkhutjane	Mpolonjeni	Lubombo	27	87475	2932787	86	23
26		Nkonka 2	Matsanjeni	Shiselweni	31	73355	3013229	79	19
27		Msuzaneni	Somtongo	Shiselweni	28	80328	3015684	59	12
28		Lunkuntu/ Makhasane	Nkilongo	Lubombo	17	88101	2975833	78	21

Annex 4. BHs drilled for CGs

Year 1

No.	Site design ation	Site name	Inkhundla	# of HSs	Coordinates		BH depth (m)	SWL (m)	Type of Pump installed
					X	Y			
1	CG1	Khaniysani	Matsanjeni	18	3011935	72764	56	17	Electrical pump
2	CG2	Phakamani	Lubuli	34	2982591	91729	43	7	Afri pump
3	CG3	Sidokoza	Sigwe	36	2999279	62739	53	1	Afri pump
4	CG4	Sitanani Bomake	Sigwe	17	3016374	81971	48	8	Electrical pump
5	CG5	Ematje/	Somtongo	22	3011483	81505	48	2.5	Electrical pump
6	CG6	Mbutfu	Lubuli	*21*	2995840	91470	44	5	Electrical pump

Year 2

No.	Site design ation	CG name	Inkhundla	# of HSs	Coordinates		BH depth (m)	SWL (m)	Type of pump installed
					X	Y			
1	CG7	Mahlabaneni	Nkilongo	36	2971457	096324	30.5	3.42	Electrical pump
2	CG8	Gamula	Nkilongo	35	2977764	095696	67.1	18.43	Electrical pump
3	CG9	Lubuli	Lubuli	26	2999406	93157	61	7.84	Afri pump
4	CG10	Mcathuvane	Lubuli	29	2987327	089929	73	8.59	Afri pump
5	CG11	Coshindla	Sithobela	45	2972945	061109	73	1.5	Afri pump
6	CG12	Lutsini	Ngudzeni	45	2991242	057061	36.6	1.58	Afri pump
7	CG13	Emphini	Ngudzeni	24	2996625	056828	42.7	12.31	Electrical pump
8	CG14	Intamakuphila	Hosea	18	3007441	057535	42.7	5.24	Electrical pump
9	CG15	Embondweni	Sigwe		2991242	070765	73	31.45	Afri pump
10	CG16	Phaphamani Lombiwako	Matsanjeni	23	3012018	060192	36.6	1.26	Afri pump
11	CG17	Phaphamani Bomake	Somtongo	28	3018910	079428	54.90	27.58	Afri pump
12	CG18	Madwala	Somtongo	27	3017410	079428	36.6	12.08	Electrical pump

Year 3

No.	Site design ation	CG name	Inkhundla	# of HSs	Coordinates		BH depth (m)	SWL (m)	Type of pump installed
					X	Y			
1	C19	Magidza/Mvundle Hosea		26	3005104	62774	73.20	14.18	Afri pump
2	C20	Bambanani Bomake	Matsanjeni	15	3017101	62167	61.00	10.36	Afri pump
3	C21	Phumelela Farmers	Matsanjeni	18	3019652	72240	73.20	8.01	Afri pump
4	C22	Enyatsini (Sigwe)	Sigwe	28	2998717	61142	42.70	4.35	Electrical pump
5	C23	Phophotha Lulakeni	Sigwe	33	2996610	62623	73.20	17.76	Afri pump
6	C24	Nzomane	Somntongo	30	3002609	80406	73.20	15.88	Afri pump
7	C25	Timiseleni Bomake	Sithobela	13	2981277	63164	52.30	5.36	Electrical pump
8	C26	Phophonyane	Sithobela	12	2982473	63617	60.50	7.93	Afri pump
9	C27	Phangweni	Somntongo	14	3010616	80252	79.30	13.43	Afri pump
10	C28	Sihlahla Sendoda	Lubuli	17	2984250	74623	68.70	48.88	Afri pump
11	C29	Sinyamantulu	Lubuli	24	2981418	81477	73.20	3.35	Afri pump
12	C30	Gamula	Nkilongo	46	2980011	95163	67.10	9.00	Electrical pump
14	C32	Magwayane	Nkilongo	18	2943866	96222	85.40	13.31	Afri pump
15	C33	Phobane	Ngudzeni	42	2992353	61622	72.80	22.14	Afri pump
16	C34	Imphumelelo Magomba (Etjeni)	Mpolonjeni	28	2939400	81607	61.00	7.79	Electrical pump
17	C35	Kwetsembeni	Dvokodvweni	50	2928138	68984	56.40	6.94	Electrical pump
18	C36	Ngcayizivele	Dvokodvweni	22	2928001	76130	73.20	8.75	Afri pump
19	C37	Ben	Hlane	21	2904296	68248	60.50	7.50	Electrical pump
20	C38	Zikhotheni	Shiselweni 1	21	3013515	40440	48.80	9.03	Elec. Pump
21	C39	Zanani	Matsanjeni	60	3004191	73019	18	8.47	Afri pump
22	C40	Lawila	Dvokodvweni	42	3001294	71028	52.3	19	Afri pump
23	C42	Siphambaweni	Hlane	34	2903261	68193	64.6	23	Afri pump

Annex 5. School RWH systems

Year 2

No.	School name	Inkhundla	District	Coordinates		No. of Students	Harvest area	Storage capacity
				X	Y			
1	Mgampondo Primary	Somtongo	Shiselweni	3018643	82450	722	985m²	95m³
2	Hluti Central primary	Hosea	Shiselweni	3012157	58262	502	1640m²	107m³
3	Decapole Primary	Sigwe	Shiselweni	2995974	72432	400	1020m²	107m³
4	Hluti Central High school	Hosea	Shiselweni	2977977	880542	409	1000	115m³
5	Sinceni Primary	Sithobela	Lubombo	2976841	71408	401	892	110m³
6	Dlakadla Primary	Lubuli	Lubombo	2975630	69409	622	1420	130m³
7	Ndzangu Primary	Mpolonjeni	Lubombo	2939101	086455	790	1200m²	105m³
8	Ndzevane Primary	Nkilongo	Lubombo	2977761	095690	1010	1390m²	115m³
9	Mzila Primary	Sigwe	Shiselweni	2999757	070759	512	900m²	105m³

Year 3

No.	School name	Inkhundla	District	Coordinates		No. of Students	Harvest area	Storage capacity
				X	Y			
1	Mlindazwe Primary	Somtongo	**Shiselweni**	**3010226**	79212	400	840m²	105m^3
2	Nsingizini Primary	Hosea	Shiselweni	3007671	57398	435	780m²	120m^3
3	Matsanjeni Secondary	Matsanjeni	Shiselweni	3015375	73035	398	890 m²	115m^3
4	Ngcina Primary Primary	Mpolonjeni	Lubombo	2939799	92134	670	1120m²	120m^3
5	Mantambe Primary	Shiselweni	Shiselweni	3015170	42764	660	1300m²	125m^3
6	Mhlabeni primary	Lubuli	Lubombo	2999460	91432	410	790 m²	105m^3
7	Ngcina high school	Mpolonjeni	Lubombo	2939799	92134	490	1040m²	110m3
8	Mantambe high school	Shiselweni	Shiselweni	3015170	42764	530	1100m²	115m3
9	Enjabulweni primary	Dvodvweni	Lubombo	2939503	88709	370	850 m²	105m3
10	Mnjoli Primary	Hlane	Shiselweni	2900318	64003	413	990 m²	140m3
11	Mndumezulu primary	Dvodvweni	Shiselweni	2919654	78324	491	1055 m²	125m3
12	Maja 1 primary	Lubuli	Lubombo	2694705	31919	397	795 m²	110 m3
13	Nkonjwa High School	Sithobela	Lubombo	2979975	62310	401	1200m²	140 m3
14	Nkonjwa Primary School	Sithobela	Lubombo	2979813	62241	465	1400m²	165 m3
15	Bekezela high school	Lubuli	Lubombo	2997035	91744	294	640m²	90m3
16	Maloma primary	Ingudzeni	Shiselweni	2987870	64901	510	1040	140m3
17	Holly Ghost primary	Mpolonjeni	Lubombo	2943930	911624	490	980	125m3
18	Ikwezi primary	Lubuli	Lubombo	2988637	86447	541	1018	140m3
19	Ikwezi High	Lubuli	Lubombo	2988630	86437	470	1022	120