

Bill and Melinda Gates Foundation

Multiple Use Water Services for the Poor: Assessing the State of Knowledge

Final report

December 2007

Winrock International

IRC Water and Sanitation Centre

International Water Management Institute



Research Team and Acknowledgements*



Research Team. This study was led by Winrock International in partnership with the International Water and Sanitation Centre and the International Water Management Institute under the overall leadership of Mary Renwick, Winrock International.

Winrock International

- Mary Renwick
- Deepa Joshi
- Margie Huang
- Shing Kong
- Silvia Petrova
- Gelsey Bennett
- Racey Bingham

International Water and Sanitation Centre team:

- Catarina Fonseca
- Patrick Moriarty
- Stef Smits
- John Butterworth

International Water Management Institute team:

- Eline Boelee
- Gayathree Jayasinghe

Acknowledgements. The research team would like to thank the following individuals for their contributions to this report:

Belinda Calaguas, Action Aid UK
 Sarah Carriger, Waterwrites
 Luke Colavito, Winrock Nepal
 Jenna Davis, Stanford University
 Sanjaya Darshan, Winrock SIMI
 John DeBoer, Winrock senior associate
 Richard Franceys, Cranfield University
 Rakesh Kothari, Winrock SIMI
 Douglas Merrey, Food, Agriculture and Natural Resources
 Policy Analysis Network, South Africa
 Ruth Meizen-Dick, International Food Policy Research Institute
 Alan Nicol, Overseas Development Institute
 Stacey Noel, Stockholm Environmental Institute
 Corey O'Hara, Winrock SIMI
 David Seckler, formerly Director General, International Water
 Management Institute
 Kailash Sharma, IDE SIMI
 Ratna Shrestha, Winrock SIMI
 Narayan Singh Khawas, IDE SIMI
 John Soussan, Stockholm Environmental Institute
 Mark Svendsen, independent irrigation consultant
 Barbara Van Koppen, International Water Management
 Institute, South Africa
 Bob Yoder, IDE International



WINROCK
INTERNATIONAL
Putting Ideas to Work



* To cite this report, please use the following: **Renwick, et. al, 2007, "Multiple Use Water Services for the Poor: Assessing the State of Knowledge," Winrock International: Arlington, VA.**

Multiple-use services

Poor populations need water for a variety of essential uses ranging from drinking, hygiene and sanitation to food production and income generation. Existing approaches to water service delivery typically entail systems that are designed, managed and financed for a single use—for example, drinking or irrigation. But the poor often rely on such single-use systems to meet multiple water needs—needs not considered in the planning or management of the system. An alternative model for water service provision—known as multiple-use approaches to water service delivery—is a consumer-oriented approach that takes people’s multiple water needs as a starting point and involves planning, finance and management of integrated water services for multiple domestic and productive uses.

Purpose

The purpose of this study is to guide prospective investments in the water sector by

- assessing the relative costs, benefits and poverty impacts of multiple-use approaches over single-use approaches
- evaluating the potential market for multiple-use approaches focusing on South Asia and sub-Saharan Africa

Executive Summary

1. Background

2. Findings: Costs and benefits

3. Findings: Poverty Impacts

4. Findings: Market Mapping

5. Opportunity Action Areas

6. Strategic considerations for implementation

The study findings suggest that while multiple-use services cost more than single-use services, they do offer significant advantages in that they have greater potential to:

- **Generate more income and benefits** (health, nutrition, time savings, food security and social empowerment) for a wider range of poor people (including women and the landless) than most single-use services.
- **Decrease vulnerability** by allowing more diversified livelihood strategies.
- **More effectively reduce poverty** by simultaneously addressing multiple dimensions of poverty.
- **Increase sustainability** of services—multiple use services generate enough income to cover on-going operation, maintenance and replacement costs, and, because they better meet the water needs of communities, conflict over water and damage to infrastructure caused by “illegal” or unplanned uses is decreased and community investment is increased.

Potential beneficiaries from multiple use investments: over 1 billion people

Where: in rural South Asia and sub-Saharan Africa, where there are high concentrations of rural poor with inadequate access to water for domestic and productive purposes

How: Through provision of new multiple services to those currently “unserved” and upgrading service levels within existing domestic and irrigation systems. A number of opportunity areas have been identified where we consistently found widespread income generation activities and poverty impacts with incremental benefits sufficient to cover incremental investment costs, frequently in 6-36 months.

Goal and Questions

Study Goal : The goal of this study is to help inform prospective investments in the water sector by assessing the potential of multiple-use water services to sustainably meet the water needs of the poor.

Research Question One: What are the incremental costs and benefits of multiple-use approaches over single-use approaches?

Research Question Two: Where do multiple-use approaches apply and who are the main beneficiaries?

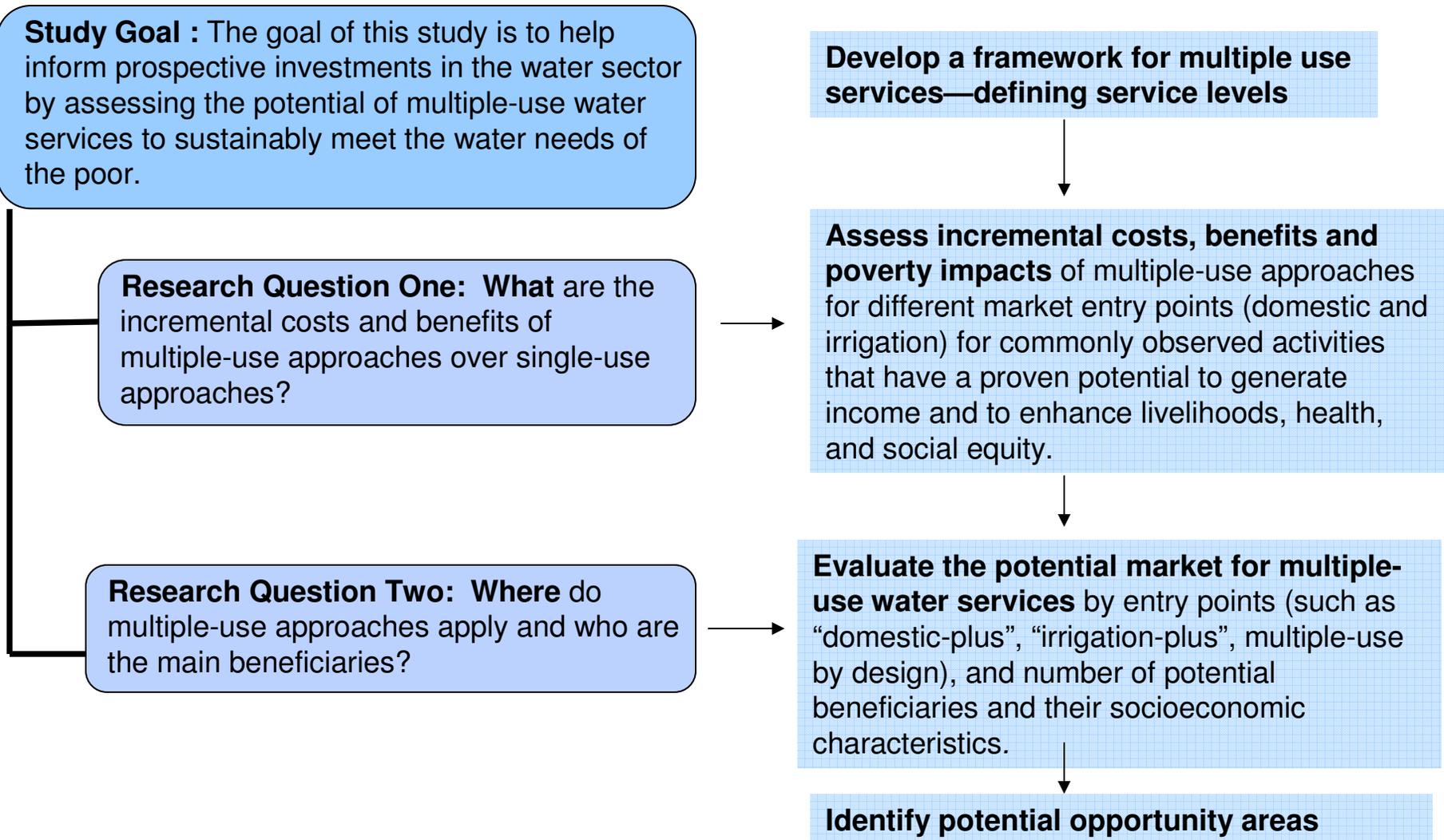
Methods

Develop a framework for multiple use services—defining service levels

Assess incremental costs, benefits and poverty impacts of multiple-use approaches for different market entry points (domestic and irrigation) for commonly observed activities that have a proven potential to generate income and to enhance livelihoods, health, and social equity.

Evaluate the potential market for multiple-use water services by entry points (such as “domestic-plus”, “irrigation-plus”, multiple-use by design), and number of potential beneficiaries and their socioeconomic characteristics.

Identify potential opportunity areas



Executive Summary: Research Description—Defining a Water Service Level Framework



The research team developed a framework of service levels for analyzing the incremental benefits and costs of different water service approaches.

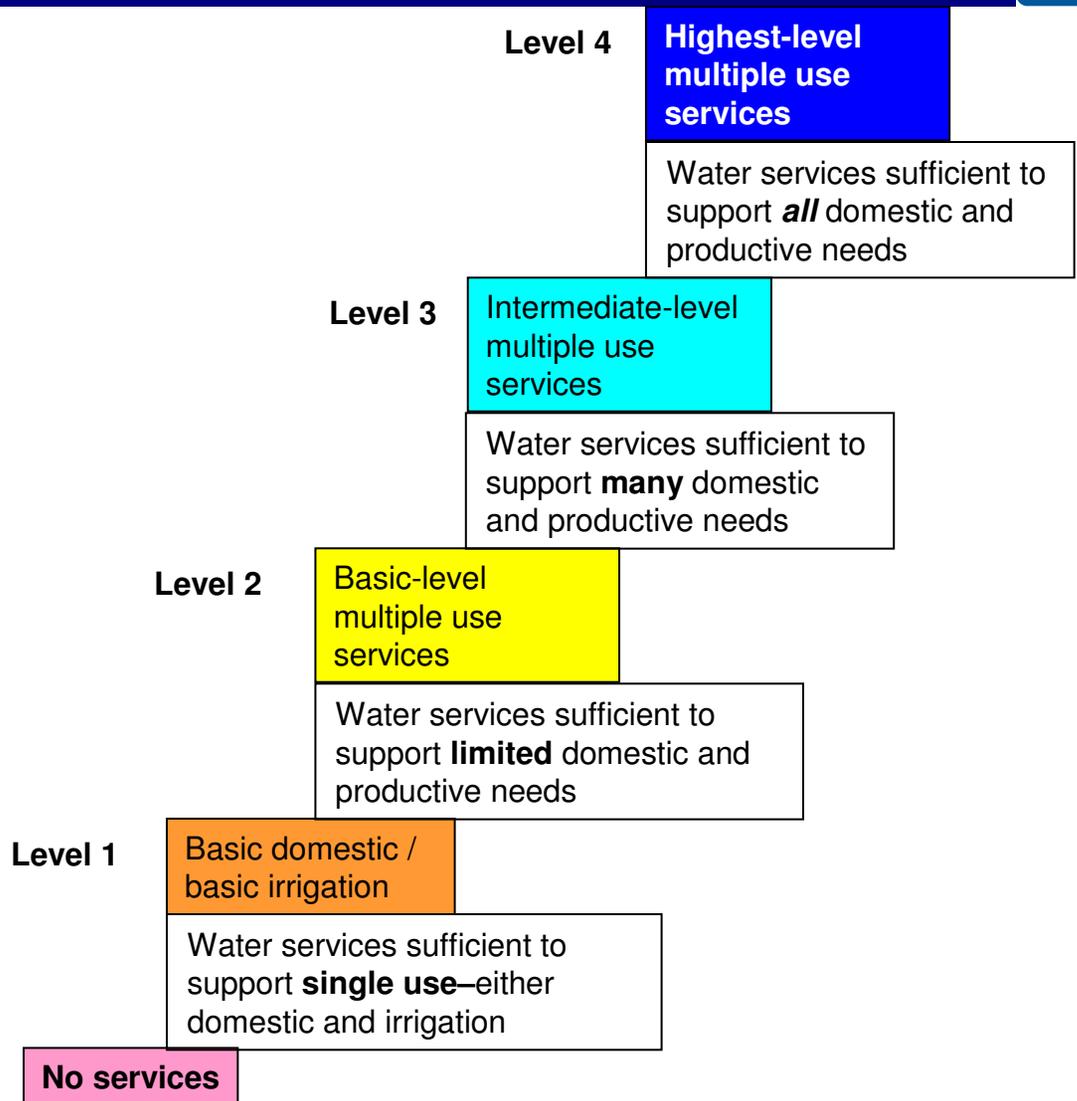
Building on the definitions of “no service” and single-use “basic domestic” and “basic irrigation” services, the research team defined three additional levels of water services required to support varying levels of both domestic and productive uses.

Each different service level represents changes in two or more of four variables: quantity, quality, distance and reliability.

To reflect fundamental differences in water service provision, our typology includes separate service level definitions for “domestic-plus” and “irrigation-plus” approaches. In general, domestic+ approaches involve increasing the quantity and reducing distance between source and homestead. Irrigation+ approaches involve reducing distance between source and homestead and improving quality.

See sections 1.3.3 and 1.3.4 for service level definitions.

Level 0



The study identified and quantified the incremental costs and benefits associated with different water service levels. Benefits were estimated for commonly observed productive uses such as home gardens, livestock and water-dependent small-scale enterprises. Different levels of single-use to multiple-use services were compared to identify optimal service levels. The analysis included benefits and costs for both new domestic+ multiple-use services and upgrades to existing domestic and irrigation services. All benefits and costs are stated in 2004 International Purchasing Power Parity U.S. dollars (PPP I \$US). Given the macro-scope of the study, estimates should be considered as “indicative” rather than “universal”.

Key Findings

- **Multiple-use services cost more than single-use services but generate greater income and poverty impacts.**
- **For domestic+, the intermediate multiple-use service level optimizes benefits** (including non-financial poverty benefits) relative to costs for new services and most upgrades. Once basic domestic needs are met (approximately 20 liters per capita per day), each additional liter per capita per day (lpcd) generates an estimated \$.5-\$1 per year of income. Improving water services from 20 lpcd to 100 lpcd has the potential to generate \$40-\$80 per capita per year (e.g. for a family of five this would mean an additional \$200-\$400 per year).
- **For irrigation+, upgrading from the basic irrigation to the basic multiple-use service level optimizes financial benefits relative to costs**, but upgrading to the intermediate multiple-use service level optimizes poverty impacts, including substantial health benefits in areas without domestic water services.
- **Income generated by multiple-use services can enable repayment of initial and ongoing costs for most service levels and technology options**, making multiple-use services more likely to be sustained.



Per capita annual income benefits by service level for domestic+ are:

Highest level multiple uses: \$71/capita
 Intermediate level multiple uses: \$61/capita
 Basic level multiple uses: \$25/capita

Finding: The largest incremental gains in income are achieved at the intermediate service level.

Average incremental income benefit: \$10

Average incremental income benefit: \$36

Average incremental income benefit: \$25

Highest level MUS				
	Home gardens	Livestock	Small-scale enterprises	Total
Average	\$64	\$87	\$19	\$71
Range	\$4-50	\$36-138	\$4-35	\$4-138

Intermediate level MUS				
	Home gardens	Livestock	Small-scale enterprises	Total
Average	\$23	\$67	\$17	\$61
Range	\$2-43	\$14-120	\$4-30	\$2-120

Basic level MUS				
	Home gardens	Livestock	Small-scale enterprises	Total
Average	11	27	17	25
Range	\$1-22	\$4-50	\$4-30	\$1-50

Basic Domestic

No Service

Although basic domestic services generate a range of economic benefits related especially to health and time savings, any income generated is through unplanned and often illegal water use, making sustainability uncertain.

Summary of Costs and Benefits for New Domestic+ Multiple-use Services

Recommendations:

- Based on the findings, investments in new domestic+ multiple-use services for those currently unserved should focus on the intermediate multiple-use service level, where incremental benefits are sufficient to cover capital investment and annual recurrent cost within 3 years.
- A particularly promising option is low-cost piped, gravity-fed spring systems.

Per capita costs and benefits, repayment periods and benefit-cost ratios of new domestic+ services

Water Service Level	Technology	Capital investment costs (hardware plus software)	Annual income net of recurrent costs	Repayment period (months)	Benefit-cost ratio (10% discount rate)
Level 1: Basic domestic	Range	\$63-\$91	(\$9-\$13)		(negative)
	Piped systems, dispersed standpipes	\$70	(\$12)		
	Shallow wells w/ hand pumps	\$63	(\$9)		
	Boreholes w/ hand pumps	\$91	(\$13)		
Level 2: Basic multiple uses	Range	\$98-\$116	\$8-\$9	147-155	.66-69
	Piped systems, some standpipes	\$98	\$8	147	.69
	Boreholes w/ hand pumps & add-ons	\$116	\$9	155	.66
Level 3: Intermediate multiple use	Range	\$56-\$105	\$42-\$51	13-30	3.4-7.8
	Piped systems, frequent standpipes	\$105	\$42	30	3.4
	Piped gravity-fed spring systems	\$56	\$51	13	7.8
	Hand-dug household wells: protecting & adding improved lifting devices	\$102	\$47	24	3.4
Level 4: Highest multiple uses	Piped schemes, household connections	\$140	\$21	80	1.28



Recommendations:

- **Based on the findings, investments in upgrading to domestic+ multiple-use services should focus on the intermediate multiple-use service level for piped systems and hand-dug wells, where incremental benefits are sufficient to cover incremental capital investment and annual recurrent cost within 7-22 months.**
- **For boreholes fitted with hand pumps, an attractive option involves upgrading to the basic multiple-use service level through in situ add-ons* for domestic and productive activities, with repayment period of 1 year.**

Incremental costs and benefits, repayment periods and benefit-cost ratios of upgrading domestic services

Water Service Level Upgrade	Technology	Capital Investment costs (hardware plus software)	Annual income net of recurrent costs	Repayment period (months)	Benefit-cost ratio (10% discount rate)
		per capita			
Level 1 to Level 2: basic domestic to basic multiple uses	Boreholes w/ hand pumps: in-situ add-ons to support livestock, bathing and community gardens	\$25	\$22	12	5.4
Level 1 to Level 3: basic domestic to intermediate multiple uses	Range	\$32-\$84	\$46-\$58	7-22	4.7-8.6
	Piped systems: increasing quantity and density of standpipes, adding some yard taps	\$84	\$46	22	4.7
	Hand-dug protected household wells: add improved lifting devices to increase quantity - treadle pump	\$32	\$58	7	8.6
	- rope pump	\$56	\$54	13	6.1
Level 2 to Level 3: basic multiple uses to intermediate multiple uses	Piped systems, increasing quantity and adding standpipes & yard taps to expand productive activities	\$56	\$26	25	3.9

* Livestock troughs, bathing facilities and community gardens added at the source.

Executive Summary: Per Capita Annual Income Benefits by Service Level for Irrigation+



Per capita annual income benefits by service level are:

Highest level multiple uses: \$71/capita
 Intermediate level multiple uses: \$61/capita
 Basic level multiple uses: \$52/capita

The greatest incremental income benefits are achieved at the basic multiple-use service level.

Average incremental income benefit: \$10

Average incremental income benefit: \$9

Average incremental income benefit: \$52

Highest level MUS

	Home gardens	Livestock	Small-scale enterprises	Total
Midpoint	\$64	\$87	\$19	\$71
Range	\$4-124	\$36-138	\$4-35	\$4-138

Intermediate level MUS

	Home gardens	Livestock	Small-scale enterprises	Total
Midpoint	\$23	\$67	\$17	\$61
Range	\$2-43	\$14-120	\$4-30	\$2-120

Basic MUS

	Home gardens	Livestock	Small-scale enterprises	Total
Midpoint	-	\$52	\$17	\$52
Range	-	\$4-100	\$4-30	\$4-100

Basic Irrigation

Basic irrigation services generate a range of income and poverty impacts, which are well documented. Given the focus on incremental benefits associated with multiple-use services, these benefits have not been estimated.

Recommendation:

- **Upgrading services from basic irrigation to basic multiple use is the most financially attractive investment option, but higher levels of service are also financially viable and generate more significant poverty impacts including health, time savings and social equity benefits.**

Incremental costs and benefits, repayment periods and benefit-cost ratios of upgrading irrigation services

Water Service Level Upgrade	Technology	Capital investment costs (hardware plus software)	Annual income net of recurrent costs	Repayment period (months)	Benefit-cost ratio (10% discount rate)
		per capita			
Level 1 to Level 2: Basic Irrigation to Basic Multiple Uses	In situ add-ons to support livestock (drinking troughs and livestock crossings)	\$10	\$50	3	27
Level 1 to Level 2: Basic Irrigation to Intermediate Multiple Uses	Community water storage (including home water treatment and hygiene education) and in situ add-ons for livestock and domestic uses (bathing and laundry)	\$50-\$110	\$51-\$57	12-24	2.9 - 6.8
Level 1 to Level 3: Basic Irrigation to Highest Multiple Uses	Household water storage (including home water treatment and hygiene education) and in situ add-ons for livestock and domestic uses (bathing and laundry)	\$98-\$165	\$58-\$63	19-34	2.2 - 3.9

In addition to evaluating the financial costs and benefits, the study also looked at the non-financial benefits derived from multiple-use services and evaluated the potential of multiple-use services to address the multidimensional aspects of poverty.

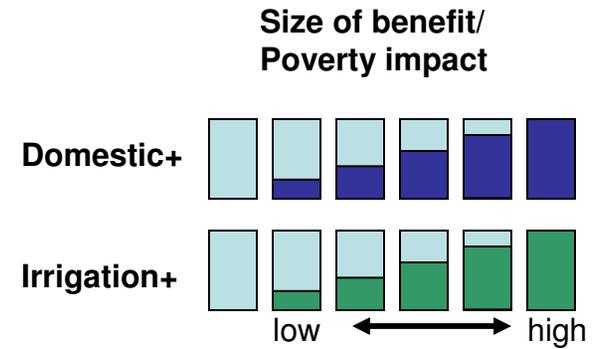
Key Findings

- **Most rural poor have assets necessary to benefit to some extent from multiple-use services.** An estimated 60-70% of the rural poor rear livestock, have access to small cultivable plots (often around their homesteads) and engage in water-dependent small enterprises. Study results suggest that multiple-use services can ‘unlock’ the productivity of these assets.
- **Improved water services enhance the productivity of these assets**, achieving multiple poverty impacts—income, food security/nutrition, health, reduced vulnerability and livelihoods diversification, and social equity and empowerment (well supported).¹
- **Communities with high water service levels have more home gardens, higher numbers of livestock, greater numbers of small-scale enterprises and more diversified livelihood activities** therefore reduced vulnerability to shocks (partially supported).²

Executive Summary: Illustrative staging of benefits by service level



Domestic+ and Irrigation+ services progressively and synergistically broaden benefits of single-use services and more comprehensively address the multi-dimensional aspects of poverty.



	health	time savings	income	improved food security/ nutrition	diversification of livelihoods; reduced vulnerability	equity and empowerment
Highest-level multiple-use services						
Intermediate-level multiple-use services						
Basic-level multiple-use services						
Basic Domestic/ Basic Irrigation*						

* Assumes no unplanned uses as they cannot assure sustainable generation of benefits.

Executive Summary: Opportunity Action Areas

The study identified 5 high-potential areas for action based on evaluation of: financial sustainability; impact on well-being, health, and social empowerment; scalability; opportunities for leverage, testing and learning.

Opportunity Action Area	Potential Market & Pilot Locations	Capital investment costs per capita hardware & software	Annual income net of recurrent costs (per capita)	Benefit-cost ratio (10% discount rate)
Opportunity 1. New piped multiple-use services for currently unserved at the intermediate service level	137 million (South Asia: 56 m SS Africa: 81 m) Pilot: Nepal	\$56-\$105	\$41-\$50	3.4-7.8
Opportunity 2. Upgrading existing domestic piped systems to intermediate multiple-uses service level	185 million (South Asia: 144 m SS Africa: 41 m) Pilot: South Africa	\$84	\$45	4.7
Opportunity 3. Boreholes with hand pumps: upgrading services to basic multiple-use service level through communal add-ons to support multiple uses	280 million (South Asia: 263m SS Africa: 17m) Pilots: India and Burkina Faso	\$25	\$22	5.4
Opportunity 4. Upgrading existing household hand-dug wells to the intermediate multiple-use service level through well protection and improved lifting devices	74 million (South Asia: 43m SS Africa: 31m) Pilots: Zimbabwe and Mali	\$39 - \$102	\$47-\$55	3.4-8.6
Opportunity 5. Upgrading existing irrigation systems to basic and intermediate service levels through communal add-ons, domestic storage and water treatment	447 million (South Asia: 443m SS Africa: 4m) Pilot: Sri Lanka	\$10 - \$110	\$50-\$57	2.9 - 27

Criteria for successful implementation of multiple-use services:

- 1. Water availability.** Sufficient water must be available to support multiple-use services.
- 2. Water allocation rules and regulations.** Multiple-use services require enforceable formal and informal rules to allocate water among competing uses and users. Regulations must address scarcity, impacts on quality and quantity, and equitable access.
- 3. Management capabilities.** Implementing and maintaining multiple-use services requires sufficient technical, financial, and environmental management capacity. The larger the desired scale of impact, the greater is the need for capacity at intermediate and national levels.
- 4. Financing.** Financial resources and supporting credit institutions must provide adequate credit for system construction and productive activities.
- 5. Sector and policy coordination.** Local actors must work effectively across sectors and stakeholders—both horizontally and vertically— to support to multiple-use activities. The policy and institutional environment must at least be neutral towards multiple-use approaches.