

Water Scarcity: Averting A Global Crisis

UNITED NATIONS ASSOCIATION OF GREATER BOSTON Conference on Public Private Sector Collaboration in Addressing the UN Millennium Water and Sanitation Goals

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Arthur Holcombe, President of UNAGB, opened the Conference. He welcomed participants and explained that the Conference topic had been selected in recognition of the UN designation of 2003 as the Year for Fresh Water and because of the importance of the UN Millennium water and sanitation goals. The UN Millennium Summit in 2000 and the UN World Summit on Sustainable Development in Johannesburg in 2002 noted that over 1 billion people lacked access to safe drinking water, and half of the world's population lacked adequate sanitation. The Summit meetings noted that unsafe water and poor sanitary conditions caused as much as 80 percent of all third world diseases, and 5 million deaths each year. The Summit goals called for the halving of the numbers of people without access to clean water and sanitation by 2015.

The purpose of the Conference was to consider how this could best be achieved. Expanding basic water and sanitation services to presently unserved populations would require innovative low cost technologies and practices, strengthened planning and administration of water and sanitation services and very substantial additional financing from international and local sources. These and other issues were discussed by Conference panelists.

Part 1: UNAGB Conference Overview

UNAGB Conference speakers stressed that in the planning and implementation of clean water and sanitation development programs in developing countries, it was important to bear in mind key financial, institutional and technical requisites found through experience for achieving UN Millennium water and sanitation goals. These requisites were seen to be complementary and mutually reinforcing in nature and underlining the importance of more integrated water resource development approaches that incorporate the comparative advantages of both the public and private sectors at the local level.

Financial Requisites

Speakers referred to the broad range of estimates on the amount of financing required annually to achieve the UN Millennium goals of reducing by half the proportion of people without access to safe drinking water and sanitation by 2015. The estimates ranged from a low of about \$12 billion annually estimated by the Water Supply and Sanitation Collaborative Council to a high of \$180 billion annually by the Camdessus

Commission above the current \$15 billion spent annually to achieve the water and sanitation goals. The wide range reflected in part a differing perspective on whether investment should continue to focus on relatively capital intensive, urban schemes targeting largely middle class water and sanitation requirements, or should shift to lower technology, more labor intensive approaches better suited to the needs of relative poor populations living in urban slums and poor rural areas.

Speakers recognized that major international donors would have to continue helping with the large costs of water storage infrastructure in many countries. However, the local public and private sectors would have to cover much of the costs of expanding water and sanitation services to poorer areas and populations. This would require greater encouragement to local banking and other financial institutions such as pension plans and credit unions as well as private enterprises and venture capital companies to mobilize local savings and provide equity financing and credit for investment in relatively small scale water supply and sanitation infrastructure. Experience showed that such small scale schemes tended to be relatively low cost, and thus affordable by relatively large numbers of poor households who fell outside the services of the current relatively capital intensive urban water and sanitation systems catering mainly to middle class families.

Several speakers noted studies which indicated that relatively poor households frequently paid relatively more per unit for their basic water requirements (from private vendors or in terms of labor) than middle income households. Moreover, poor households have demonstrated their ability and willingness to pay for the capital and recurrent costs of water and sanitation schemes designed to accommodate their capacity to pay. For this reason, decentralized, low cost water and sanitation development schemes tend to be as financially sustainable as other larger, more capital intensive schemes targeting higher income groups, especially when local government helps to subsidize the “soft” costs of training and other institutional support arrangements.

Speakers drew reference to a number of innovative water and sanitation financing schemes adapting the types of equity and debt financing institutions and instruments for capital mobilization developed earlier in relatively advanced capitalist countries. Notable in this respect was the success of USAID in providing guarantees to local private financial institutions and other enterprises willing to raise funds and risk providing loans for the financing of local infrastructure, including water and sanitation infrastructure. They estimated that 38 schemes providing guarantees to local private banking and other asset accumulation and management institutions had helped to generate local lending for infrastructure development potentially up to the local currency equivalent of \$600 million.

Apart from the local private sector role in mobilizing capital for investment in water and sanitation infrastructure development, speakers noted measures that local governments were taking to help raise the amount of local financing available for clean water and sanitation development programs. These included the channeling of more aid and national budget resources into the financing of the “soft” costs of strengthening policy and the institutional framework essential for local private sector investment in the “hard”

capital and recurrent budget costs of water and sanitation development. Other techniques employed by the public sector to expand access to clean water and sanitation include the restructuring of public sector budgets away from relatively higher cost urban schemes to relatively lower cost rural schemes, reduction of military budgets and reallocation of funds to water and sanitation development programs, greater “cross-subsidy” of rural water and sanitation capital costs by raising water and sanitation tariffs to higher income urban users for use in extending benefits to lower income areas, and by redesigning water and sanitation schemes targeting low income groups to reduce capital costs by utilizing cheap or free community labor and involvement.

Institutional Requisites

Several speakers noted that local private sector provision of financing and technical services can only be effective when reinforced by a strong public sector institutional framework that provides legitimacy, acceptability and longer term public support and financing for water and sanitation development. This requires the presence of a public sector authority with well-trained staff, a focus on the core water and sanitation responsibilities and the independence to raise funds and otherwise to be enabled to carry out its core mandate effectively on a sustainable basis. Experience showed that focused and enabled public authorities tend to retain public support and an ability to carry out their mandates.

Public sector authorities function in a political environment and come under pressures to carry out mandates and adopt operating procedures that may undermine operating effectiveness and public support. In addition, particularly in developing countries such authorities may require substantial managerial and technical training of staff, and advice on best operating procedures. For these reasons the development of strong, focused and effective public authorities may take a considerable period of time.

Critical also in effective public-private sector collaboration in promoting water and sanitation goals is a framework characterized by good governance, sound economic policies and accountable and transparent public and private sector entities able to retain public support. Several speakers described the importance of local customer awareness and participation in the planning and implementation of water and sanitation services. This can be achieved through establishment of mechanisms for consumer consultation and review, local water associations and other arrangements for ensuring public awareness and support to the work of public and private sector institutions engaged in the provision of water and sanitation services.

Technical Requisites

Providing safe drinking water and sanitation to populations lacking such services is often considered a matter of funding and not of technology. If funds are available, the thinking goes, then existing technology can be implemented to provide the desired services. However, beyond the basic financial issues of conventional water technology are important technical questions. Those presented at the panel can be summarized as asking

whether conventional water and sanitation technology is hydrologically or financially sustainable and whether conventional technology is appropriate for developing countries.

Various speakers stressed that if UN Millennium water and sanitation goals are to be achieved, conventional “pipes and concrete” oriented water and sanitation systems will need to be rethought in order to achieve better water efficiency, less capital intensity and reduced overall cost. In large water systems, cracked pipes, illicit connections and unmetered services insure a large fraction of treated water is lost and unaccounted for. In many Asian cities, such as Calcutta, Jakarta, Manila and Hanoi, more than 50% of the supplied water is unaccounted for. In addition, wastewater collection pipes that are in disrepair and have cracks allow groundwater to infiltrate into the pipes from the surrounding soils, in effect draining the surrounding soils of water and needlessly increasing wastewater flows. The capital intensity of implementing centralized water systems also hinders expansion into underserved urban areas, including slums and peri-urban communities. Unfortunately, these areas constitute a large and growing percentage of the population that needs service as urban growth continues to be most vigorous at the urban fringe where infrastructure does not yet exist. As a result, centralized systems requiring capital-intensive delivery networks may not be appropriate as cities continue to grow spatially at rates that match population growth. Implementation of such systems is even more costly in rural areas, where infrastructure is nonexistent and populations are more sparsely distributed.

Fortunately an effective alternative to status quo water infrastructure has been gaining momentum in many countries. So-called “point of use” methods such as the US Centers for Disease Control and Prevention’s Safe Water System offer protection from waterborne disease to communities that do not have access to safe water and sanitation. The Safe Water System consists of small bottles of hypochlorite solution sold to individual consumers by the bottle and 20-liter plastic water vessels with spigots that minimize the risk of contamination by the water handlers. Promotional campaigns communicate the importance of treating and safely storing drinking water before use. The Water Supply and Sanitation Collaborative Council employs a similar approach focusing on water and sanitation “software,” i.e. people’s knowledge of waterborne risk prevention. Called WASH, the community-based program provides education and training in hygiene, safe water handling and water conservation. These alternative approaches do not replace the requirement for effective water supply and sanitation systems. However they do provide stopgap relief from the burden of waterborne disease while awaiting implementation of long term solutions. In particular the U.S. CDCP has found that the Safe Water System consistently reduces the occurrence of diarrhea by 25 – 85% in the countries in which it is applied. Thus, education is an important technical tool to employ while unable to employ technology.

Providing more people with water from the world’s finite supplies will generate competing water demands and apply additional stress to many overdrawn systems. Litigation, market-based initiatives and regulation will all likely play a role in developing mechanisms to administer water to competing uses. In addition, alternative water sources must be sought, such as desalination and conservation. Desalination is a proven

technology that may play an increasingly important role in future water supplies. Cities in the United States such as Tampa, islands such as Trinidad and arid nations such as Kuwait have already chosen desalination for water treatment. Coastal cities with access to affordable energy are likely to rely on desalinated water to augment and replace their dwindling freshwater supplies. Rising costs for water and falling treatment costs figure to make desalination a realistic alternative for many more in the future.

Better management of freshwater resources is another approach for augmenting conventional water supplies. The reigning paradigm for collection and disposal of storm water runoff wastes a valuable source of water and is counterproductive to responsible water resource management. Storm water collection systems can be designed with pervious materials that facilitate recharging groundwater while also preventing puddling. Land use planning can accommodate known recharge zones to prevent the construction of impervious surfaces that block the flow of surface runoff to connecting soils and aquifers. Homes and industries can be designed with dual systems that use gray water for flushing toilets and in production processes that do not require highly treated water. Composting toilets break the nonessential link between human feces and water carriage, conserving water and protecting receiving waters in the process.

Historical lessons teach us that money alone is not sufficient to improve access to clean water and sanitation in meaningful and sustainable ways. The experience and opinions from the public, private and nongovernmental sectors expressed at this conference provide important guidelines for successful implementation of new initiatives to meet the UN Millennium water and sanitation goals. Speakers have cited new financing approaches, better collaboration between governments and the private sector and appropriate, water-efficient technology. A strategy for meeting the Millennium Development Goals for water and sanitation should incorporate these lessons.

Part 2. INDIVIDUAL STATEMENTS

Keynote Statements

Richard Jolly, Chairman of the Water Supply and Sanitation Collaborative Council, noted that a major outcome of the 2002 Johannesburg Summit on Sustainable Development was the priority given to clean water, sanitation and hygiene in the context of country poverty alleviation strategies. There was broad consensus that integrated approaches to water resource development and management should be a priority in helping to achieve the UN Millennium water and sanitation goals, but in the context of making progress with country sustainable development strategies.

Dr. Jolly mentioned that progress to date in achieving the UN millennium water and sanitation goals was mixed-with 10 percent of countries having already achieved the goals, 40 percent being on track to achieve their goals by 2015, 40 percent lagging behind and 10 percent having no data on progress. Priority needs to be given to the 50 percent of countries lagging behind, with particular attention to programs that focus more on the

water, sanitation and hygiene needs of poor households. At present, up to 90 percent of water and sanitation programs in countries focus on the needs of urban elites.

Poverty alleviation oriented water, sanitation and hygiene programs should be bottom up rather than top down in their planning and implementation. They should be small scale, rely on low cost technologies and other inputs, and involve strong local participation, including by women. With respect to hygiene, they can adopt some of the simple low cost measures promoted by WASH, including use of pit latrines, regular hand washing, and use of ash in water.

Dr. Jolly stressed the importance of not being ideological about who pays for water and sanitation services designed for low income populations, but to rely on the abundant experience with such programs and what public and private sector partnerships and financing arrangements work best under local conditions. He referred to the experience in South Africa where clean water was viewed to be a human right for all citizens, and government decided to make the first 180 liters of water free to all, with the expectation that there would be charges placed on all additional water consumed. In this way provision of water and sanitation as human rights were reconciled with the need to ensure adequate cost recovery to ensure financial sustainability.

Dr. Jolly urged that organizations such as the World Bank should refrain from aggressively pushing international and local private sector management of water and sanitation development projects. Rather they should allow local public-private sector arrangements be worked out logically in collaboration with other public, nongovernmental and community based organizations also committed to increased local access to clean water and sanitation.

Jonathan Margolis, the Director of Policy Coordination and Initiatives of the Bureau of Oceans and International Environmental and Scientific Affairs of the State Department, spoke on current water and sanitation development initiatives within the broader context of UN initiatives to promote sustainable development. He indicated that from the US perspective, the success of the 2002 UN-sponsored Monterrey International Conference on Financing for Development in working out a paradigm for public-private sector collaboration in providing development finance within the framework of good governance, sound economic policies and accountable and transparent economic structures enabled the discussions at the 2002 Johannesburg Summit for Sustainable Development to focus primarily on practical implementation strategies. The same spirit of common understanding prevailed at the more recent meeting of the UN Commission on Sustainable Development which focused on a cluster of priorities for international assistance, namely achievement of the UN Millennium water and sanitation goals and human settlements.

Dr. Margolis stressed that the challenge now was to find practical public and private sector partnerships in countries that can implement water and sanitation programs effectively in working toward achievement of UN water and sanitation goals. In this respect he underlined that the UN was playing an important central role in guiding

international sustainable development, and the US was doing what it could to help empower the UN to influence the achievement of the UN Millennium goals in developing countries throughout the world.

Dr. Margolis went on to state that the US Government had launched several initiatives in the water and sanitation sector that were supportive of the UN Millennium goals. These included a “safe water system” program focused on the development and distribution of technologies for the purification of water at the point of use, and guarantee partnership programs helping to reduce the risk to local private sector partners committed to raising local capital and lending it to support investment in local water and sanitation and other infrastructure. These programs would be described further in later panel sessions. Finally, he indicated that the \$970 million that the US had committed itself to provide in support of UN Millennium water and sanitation goals over three years were available and being spent on target.

Richard Fox, the President of CDM, welcomed conference participants to Cambridge and explained that his company had long experience with the implementation of water and sanitation projects in Massachusetts, the US and in other countries around the world. Out of this positive and negative experience, they had learned many lessons. Three in particular are important to convey to the Conference.

First, in carrying out water and sanitation projects, selecting the appropriate technology is important, but is not enough. It is necessary to ensure that maintenance of infrastructure and its financing are both sustainable. This may require substantial training and build up of local institutions able to ensure adequate levels of water and sanitation services. Mr. Fox referred to earlier CDM experience with simple hand pumps. They regarded hand pump well programs successful when villages were able to arrange for solid maintenance of the hand pumps installed in wells and the financing of maintenance work on a sustainable basis.

Second, Mr. Fox mentioned that private sector participation in water and sanitation projects could help to strengthen their implementation and ability to raise needed finance, but was not enough. Private sector partners need to provide technical services within a public sector framework that can bring legitimacy, acceptability and longer term public support for their contribution to the provision of water and sanitation services.

Third, local public water authorities need a strong public constituency that gives priority and support for the funding of safe water. To help achieve this, water authorities need to focus on carrying out their core responsibilities and competencies well, and avoid taking on too many conflicting agendas that can undermine their effectiveness in delivering core water and sanitation services. Such authorities must remain focused and enabled if they are to provide their core water and sanitation services on a sustainable basis. He mentioned that there were many cases of overburdened public authorities in the US and around the world that were either privatized, with mixed results, or needed to be rebuilt to provide basic water and sanitation services adequately and regain public confidence and support.

Mr. Fox went on to say that at different times in its history, the Boston Metropolitan area experienced all of these difficulties but was ultimately able to put into place some of the highest quality water and sanitation facilities and services in the world. But the road was no superhighway. Boston saw extensive periods when the Metropolitan area lacked an authority with the independence and capacity to manage water resources effectively, when water and sanitation were handled by an organization focused on parks, and when there was zero funding for the maintenance of sewerage facilities.

Financing of Sustainable Water Resources Development and Sanitation

Peter Rogers, Gordon McKay Professor of Environmental Engineering at Harvard University, examined some of the key issues impacting water financing. Professor Rogers explained that water is the most capital-intensive industry per unit of output and therefore conventional approaches to providing water services will require huge infusions of capital over the next 20 years. The choice of technology used in pursuit of the Millennium Development Goals will be critically important.

Professor Rogers stated that there is broad consensus that both public and private utilities should cover costs, although how that will be accomplished is not clear. Most utilities in the United States have difficulty covering the cost of services and many have deferred maintenance due to capital shortages. According to Prof. Rogers, about half of the 55,000 drinking waters systems and 20% of the 30,000 wastewater systems in the U.S are privately owned, most serving populations of less than 10,000. The General Accounting Office (GAO) has estimated that over the next 20 years investments of between \$300 billion and \$1 trillion will be needed to continue providing these services in the U.S. That does not include the costs associated with still evolving stormwater regulations. This sum is far more than the \$7 billion that federal and state resources have provided in the past decade.

The dimension of the problem is much greater in the developing world. Prof. Rogers stated that while the numbers may be suspect, current estimates put the number of people lacking safe drinking water at 1.1 billion and 2.2 billion are without adequate sanitation. Estimates differ on the amount of funding needed to meet the Millennium Development Goals on water and sanitation but the Commission for Water in the 21st Century put the figure at \$50 billion per year for the next 20 years. With current expenditures from all sources estimated at about \$25 billion per year, there is a financing gap on the order of \$25 billion per year. As Prof. Rogers stated, the financing gap is too great for public monies to fill. Then from where will the funding come?

The most popular theory is the private sector. Privatization of water sources could provide the needed infusion of capital and increased efficiency. However the private sector seeks certain conditions before risking investment in water ventures. Prof. Rogers listed these qualities that water companies look for:

- transparency

- strong enforceable contracts
- strong government regulation
- limited liability
- stable governance
- convertibility of earnings

In addition, the driving force for private sector efforts is profit potential. As Prof. Rogers explained, the water sector does offer potential profits in the form of reduced “unaccounted for water,” improved efficiency in operations, improved financial and technical capabilities, bulk purchases of chemicals and energy, the potential for system growth and efficiency gains from economies of scale. Privatization has been implemented in the industrialized world, most notably in Great Britain, where 88% of the population is served by private water companies and in France where 75% get their water from private companies. In the U.S. only 14% of the population is served by private companies.

Despite the improved efficiency that the private sector can bring to water systems, Prof. Rogers reckons that it will be impossible to meet all financing requirements in developing countries from public or private sources using conventional technologies. He recommended several actions needed to redirect conventional efforts to meet the Millennium Development Goals:

- Change technologies
- Phase in environmental standards
- Adopt dual systems using bottled water for drinking and lower quality water for all other uses
- Promote ecological engineering solutions to escape the “wastewater treadmill”

Russell de Lucia, President of the Small–Scale Sustainable Infrastructure Development Fund, stressed the importance of mobilizing capital in local financial markets to meet the needs of poor urban and rural populations not able to access clean water and sanitation services. At present, the large international financing institutions are backing away from the financing of major water and sanitation infrastructure, while failing to focus on encouraging local capital markets essential for the financing of “pro poor” water and sanitation development schemes. Major financial institution investment in water and sanitation infrastructure such as dams and sewerage treatment was seen to be essential as local governments generally lacked the resources, and the private sector often found such investments too risky. However, achievement of millennium water and sanitation goals could only be achieved through the development of local private financial institutions and mechanisms able to mobilize local equity financing and credit for investment in relatively small scale, low cost community water and sanitation development activities.

Dr. de Lucia stressed that such decentralized investment in local water supply and sanitation schemes by local enterprises and business minded non-governmental organizations and community based organizations would tend to be relatively low cost. Such schemes would have relatively low capital interest costs, simple technology and local materials, low labor costs and service pricing tailored to community capacity to pay. Also, the bundling of infrastructure services such as water supply and electricity

provision have been found to reduce costs. Experience has shown that the customers for such low cost services can generally cover the “hard” costs of services (capital and related operational costs), while some “soft” costs such as training and government regulation might be partially or fully subsidized. For these reasons, decentralized water and sanitation development schemes tend to be as financially sustainable as other larger scale more capital intensive schemes oriented toward higher income groups.

Dr. de Lucia concluded by noting that experience around the world demonstrates that there are a broad range or menu of financing options. These include equity financing with financial resource mobilization from various institutional, supplier, community and individual sources, and debt financing from government, commercial bank, cooperative and other sources.

John Wasielewski, the Director of the Office of Development Credit, USAID, described the evolution in thinking regarding credit within USAID over the last 35 years way from direct loans to countries for investment in infrastructure to support to local private sector enterprises in their efforts to raise capital locally through guarantees provided by the Housing Guarantee Program. In the last five years or so, USAID has been experimenting with a new model involving the provision of guarantees to banks, pension funds, bond and equity market organizations and other sources to savings mobilization willing to take greater risks in lending for poverty alleviation, including water and sanitation development. He mentioned that USAID had “gone into business” to date with 38 local banks and other asset accumulation and management institutions providing guarantees for local lending potentially up to about \$600 million equivalent in local currency. Among the projects was one providing guarantees for loans to poor communities for small water and sanitation schemes under a \$20 million clean water revolving fund in Johannesburg Municipality.

Mr. Wasielewski mentioned USAID satisfaction that the model for promoting local capital mobilization and lending based on guarantees was more financially sustainable than the earlier USAID approach based on direct country lending. They were convinced that poor households were prepared to pay for basic water and sanitation services. In this connection, they would continue to build up their guarantee program support to local entrepreneurs willing to lend and take a risk in the water sector.

Richard Jolly mentioned that there were high and low estimates on the amount of capital needed to achieve the UN Millennium water and sanitation goals by 2015. The high figure of \$180 billion annually through 2015 was found in the Camdessus Report presented to the recent Kyoto Water Conference. The figure was in addition to the \$75 billion being spent annually on water and sanitation projects, and was oriented toward the needs of middle urban class populations in developing countries. A much smaller estimate of financial needs for the achievement of UN Millennium goals is contained in a report of the Water Supply and Sanitation Collaborative Council. It had estimated that an additional \$10 billion was needed annually to achieve the water goal and \$2 billion annually to meet the sanitation goal by 2015. Taking into account the \$17 billion presently being provided for measures to increase access to clean water and sanitation, a

total of about \$30 billion annually was required. He stressed that both estimates underestimated the contribution that people can make at little or no cost to attain increased access to clean water and sanitation.

Dr. Jolly indicated that there were at least six ways to help raise the funds needed to achieve the UN Millennium water and sanitation goals. They included:

1. Blending of aid with local financial market investments. This would include mixing of external assistance on concession terms covering training and other external costs in a program approach with local private enterprises, financial institutions and other local government and non-government and community based organizations able to raise capital and provide basic water and sanitation services.
2. Restructure local government budgets for water and sanitation. This would require adjustment of investment priorities for water and sanitation away from large, higher cost urban schemes targeting the middle classes to lower cost rural schemes targeting populations not presently receiving water and sanitation services.
3. Cut the military budget and reallocate savings to rural water and sanitation schemes. He mentioned that a study determined that over 100 countries had been able to reduce their military budgets in the last decade, and that there was more potential for substantial savings being reallocated to rural water and sanitation development needs in this way.
4. Introduce cross subsidy of rural water and sanitation capital costs. This can be achieved by restructuring of water and sanitation charges so that middle class groups underpaying for water and sanitation services pay more and help to subsidize the capital costs for extension of basic water and sanitation services to relatively poor populations in rural areas.
5. Reduce the unit costs of new rural water and sanitation services to underserved areas. This can be done by designing such services with relatively low cost technologies and with subsidies made possible with cheap or free community labor and other involvement.
6. Introduce a broad program approach to financing that stimulates the local economy and helps facilitate local mobilization of capital needed for rural water and sanitation services development. This approach calls for international-local partnerships that can address the root causes of stagnant local economic conditions, including debt relief, declining local commodity prices in international trade and counterproductive aid conditionality. This approach can help to bring about dynamic and democratic local conditions that are conducive to local capital mobilization for water, sanitation and other infrastructure on a sustainable basis.

Experiences and Future Roles of Governments, Nongovernmental Organizations and Private Institutions

Alan Hurdus is the Water Team Leader at the US Agency for International Development. He presented his perspective on meeting the Millennium Development Goals in water and sanitation and the approach engaged by USAID. Mr. Hurdus noted that the global

consumption of water doubles every 20 years which is twice the rate at which population is growing. Currently the number of people without sanitation is approximately equal to half the population of the developing world. These and other figures make it clear that there is an important role for the US to provide assistance to avert a growing water crisis.

Mr. Hurdus presented Integrated Water Resources Management as the conceptual framework for the USAID approach. This involves an effort to move water policy toward broader, better-coordinated responses to challenges in multi-sector water management. Integral to this approach is the recognition of the linkages between upstream and downstream users, terrestrial and aquatic ecosystems and surface and underground water sources. The approach will operate on specific principles such as “user pays” and “polluter pays,” full cost pricing for agriculture and industry to encourage conservation and a regulatory framework to prevent the destructive practices of polluters.

The USAID water efforts are divided into four categories: Water Supply, Sanitation and Wastewater Management (WSSWM), Natural Resources Management, Economic Development/Food Security and Disaster Preparedness. WSSWM represents the bulk of the budget, which was \$461 million in FY 2003. Geographically, the majority of resources are devoted to the Middle East, with Egypt, Jordan and the West Bank/Gaza receiving 50% of the assistance. Over the next 3 years funding is expected to increase to \$970 million, with another \$630 million in leveraged financing. US funding, while substantial, can not bring water and sanitation to all those who need it. Mr. Hurdus described the supply of water and sanitation services as a function of several factors, including investment in the sector, the ability to recover costs, public participation, privatization and the resulting backlash, competition for water, and sustainability and energy issues. He also noted that water for nature to preserve ecosystems must be part of the debate. Given these realities, he identified avenues for progress, which included improving the enabling environment for private sector investment, innovative financing mechanisms such as revolving funds and partial guarantees, cost recovery, better water-use efficiency, reuse of treated wastewater, new technology and desalination, and intersectoral collaboration. In the future, governments will be shifting from water service provision to facilitating provision by others. Mr. Hurdus closed by stating that governments at all levels have important roles as facilitators to mobilize financial and human resources, enforce regulations and establish procedures for broad public participation.

Malcolm Morris is a member of the board of Living Water International, a faith-based group that focuses on facilitating the drilling of wells in impoverished communities. This nonprofit began work in Kenya by converting abandoned oil drilling equipment for use in drilling drinking water wells. Mr. Morris described how they quickly learned that they needed the buy-in of the local people for their operations to be successful. The program has been a major success in Kenya, with all of their employees and 90% of their support coming from within the country. They supply equipment, train local people to drill the wells and maintain a database of the wells. With their services they also attempt to spread the Christian faith. They currently have on-going projects in 16 countries around

the world. Mr. Morris pointed out some remarkable successes, including a school that derives 40% of their budget from selling water. Ultimately, all people deserve humane living conditions. As Mr. Morris suggested, the lack of clean water and sanitation leads to frustration and anger, fomenting violence and terrorism that affects us all.

Kazi Jalal, Visiting Scholar at Harvard University and former Chief of the Environment Division at the Asian Development Bank, shared the Asian experience in water management. He first described the context in which water management takes place. Specifically, Dr. Jalal described water as a unitary and location specific sector, diversified in terms of supply and demand, with multi-dimensional institutional frameworks. Water is an economic good and must be treated as such but there must also be recognition of its cultural, religious and political dimensions. He then presented some statistics that outlined the size of the challenge that providing water for all will be. Asia has some of the lowest freshwater resources per capita, approximately 3000 m³, in comparison to a world average of 8240 m³ and 12,800 m³ in Europe. With the additional population growth expected, per capita resources will only continue to decrease. Much of Asia draws over 40% of their available water resources which represents the rule of thumb indicator for a water-stressed country. By far the greatest use of water in Asia is agriculture, which represents up to 90% of freshwater withdrawals. Projections show that the amount of land devoted to irrigated agriculture is expected to increase, tugging on already scarce supplies.

Dr. Jalal noted that in urban areas demand for water is dominated by domestic uses, although huge quantities of water are unaccounted for, more than 50% in many cities. He also presented statistics that underlie the difficult situation the poor face in gaining access to water. In many Asian cities, the poor do not have access to municipally supplied water and so rely on informal water vendors who charge many times more than what is charged for municipal water. In Delhi, India, for example, the water charge from a house connection is US\$ 0.01/m³, while vendors charge an average of US\$ 4.89/m³. Thus in many Asian cities the poor pay much more for water than those who can afford a house connection. Dr. Jalal cited other projections for Asia that painted a grim picture for meeting water demands in the world's most populous continent. In the face of these challenges, he described some key elements needed in a water policy, such as fostering efficient use and conservation, increasing mutually beneficial use of shared water resources, facilitating stakeholder consultation, participation and partnerships and improving governance through capacity building, monitoring and evaluation.

Dr. Jalal also briefly described the challenges of international river basins in Asia. There is no ruling doctrine for sharing water resources among nations although there are several precedents and proposed guidelines. The most commonly used approaches are:

- Absolute sovereignty
- Riparian rights
- Prior Appropriation
- Optimum basin development
- Reasonable share and equitable use

Those that promote reasonable share and equitable use or optimum basin development are least likely to cause conflict. History shows that water disputes are unlikely to lead to war but can contribute to instability, and so it is best to establish basin commissions before tensions rise. In Asia there is a long history of shared river basins, and the Mekong basin stands as the strongest example of cooperation.

Eirah Gorre-Dale, the Communications and External Relations Manager for the Water Supply and Sanitation Collaborative Council, presented their project, WASH – Water, Sanitation and Hygiene for all. The objective of this program is to achieve “poverty eradication and sustainable development through improved hygiene, sanitation and affordable, safe water.” Their working premise is that poverty is inescapably linked with water and sanitation. Access to clean water and sanitation engenders poverty reduction through less disease, improved nutrition, better education, and improving productivity through reallocation of time to income-generating activities. As Ms. Gorre-Dale explained, water, sanitation and hygiene save lives and serve as an entry point for poverty alleviation and sustainable development. Operationally, the effort concentrates on mobilizing communities, building partnerships across sectors, collecting data, working with the media and promoting people-centered approaches. Capacity building and behavioral change in hygiene, water management and sanitation practices are the expected outcomes. The WASH effort envisions children as the agents of change and so school programs are an integral part of their approach. They also foster private-public partnerships, matching the skills and management ability of the private sector with their own ability to work with the very poor and to understand poverty.

Ms. Gorre-Dale described some specific examples of WASH programs. WASH Manila organized women groups in Tondo slum, establishing soap making for community hygiene and income generation and also promoting rainwater harvesting. WASH South Africa was active in realigning the bureaucratic structure of the sanitation sector of government and also employed a social marketing campaign to influence behavior for safe water handling. They also orchestrated the “cholera road show” which brought the WASH message to schools. Within schools WASH also works to promote gender parity through removing barriers to girls’ education, for example by encouraging separate sanitation facilities for girls and boys in primary schools. Through the efforts of the WSSCC and the WASH program, awareness and advocacy for hygiene and sanitation is maximized to achieve the greatest possible returns for poverty alleviation and sustainable development.

Marcio Amazonas, Water Technologies Manager at the Coca-Cola Company, presented the role that water management plays within the company. As producers of a beverage that is mostly water, they have a keen interest in water resources. Coca-Cola is most notable in the attention they devote to the efficient use of water. Mr. Amazonas provided an overview of the treatment process used on the source water that entails watershed protection and advanced filtration. In addition, every stage of the production process is evaluated to minimize the unnecessary use of water. As a result, Coca-Cola uses only 3.17 liters of water for every liter of coke produced, far outpacing standard practice in many industries. This close examination of the complete production process pays off

economically as avoided costs, which Mr. Amazonas described as the 53rd week of sales. Finally, as Mr. Amazonas stated, US corporations, especially retailers, can not do business in failing societies. Therefore they have a vested interest in helping the societies that they are in. Accordingly, Coca-Cola has distributed water and provided relief worldwide in the wake of many disasters such as hurricanes and earthquakes, promotes an annual river clean-up in the Philippines and participates in many other conservation projects.

Dyanne Hayes, vice president for programs at the Conrad N. Hilton Foundation, shared the Foundation's experiences in collaborative efforts to bring water and sanitation to rural areas of Mali, Niger and Ghana. Known as the West Africa Water Initiative, the effort involves two foundations, nine non-governmental organizations, a corporate donor plus USAID. Utilizing a cross-sectoral approach, WAWI combines bore hole drilling and latrine construction with health and hygiene education and capacity building to increase access to safe water and to reduce water-related disease (primarily guinea worm, trachoma and diarrhea).

Based on lessons learned from the Foundation's 13 year rural water project in Ghana and WAWI activities to date, Ms. Hayes outlined six components essential for successful partnerships:

- Local involvement – community-based, community-driven and community-managed
- Integrated approach – skills development, education and training, environmental and economic awareness
- Appropriate technology – affordable, manageable and repairable
- Monitoring of water quality – periodic testing to ensure water meets WHO standards
- Involvement of women – emphasis on inclusion of women in all facets of water planning and operations
- Software – education on the links between water, sanitation, hygiene and health to maximize the benefits of safe water

Ms. Hayes spoke further of some operating principles for building partnerships. She mentioned that initiatives must ultimately be sustained by the villagers themselves, that there must be a shared geographic and programmatic focus and institutions must be prepared to lay aside institutional pride and facilitate joint decision making. Finally, Ms. Hayes stated that their Water Initiative is difficult to generate support for because donors consider the issue too overwhelming, expensive and risky. However, as she stated, water is a fundamental condition of human development and a human right. There is no justification for not responding.

Jim Shine, Assistant Professor at the Harvard School of Public Health, presented his view of how academia can assist efforts to bring water and sanitation to those who lack it. Universities have strengths that are particularly suited for the intersectoral issues that

riddle water and wastewater management. The typical university hosts experts in engineering, economics, hydrology, chemistry, health, policy and more fields that all overlap in the water arena. Universities also yield a surplus of idealistic energy and creativity in the form of students poised to pursue new solutions to development challenges. In addition, many schools have developed distance learning structures that may prove useful for outreach and training programs. Despite the presence of these powerful resources, there exist institutional and philosophical impediments that deny their full utilization. One of the most important is the reward structure, which emphasizes crisp, publishable results over the messy reality of most water initiatives. In addition, funding sources prefer research proposals that tackle fundamental questions of science, not the mundane details of providing water to the poor. Finally, those within universities are often trapped by departmental physical barriers as well as the philosophical barrier of the discounted status of interdisciplinary research projects.

At Harvard, Prof. Shine is working to remove these obstacles. He has revived the Water and Health Program to promote interdisciplinary research and to focus on student training. The goal is to balance research and application by partnering with ongoing projects and existing NGO's to augment their efforts with the strengths of academia. Susan Murcott of MIT joined the podium to speak of her efforts within the Master of Engineering program at MIT. There, students are working on projects based in Haiti, Brazil, Nepal and the Dominican Republic on point of use water treatment applications. These Harvard and MIT efforts are a plausible model for universities to augment efforts to achieve the Millennium Development Goals for water and sanitation.

Technical Challenges and Solutions to Clean Water and Sanitation

David Marks, Goulder Professor of Civil and Environmental Engineering and Engineering Systems at the Massachusetts Institute of Technology, developed several themes relating to the technical context of water issues. He began by stating that the social, economic and institutional issues outweigh the technical issues. Answering the questions of where the water will come from and to whom will the water go will require tackling the issue of reallocation between sectors. Reallocation of water resources from agriculture and to industry and domestic uses appears inevitable. However, it will not be a pretty process as powerful water bureaucracies are likely to resist any changes to current allocations.

Prof. Marks noted that technology might provide part of the solution through increased efficiency in irrigated agriculture. In fact, he stated that the water technology of the future might be more about from where the water is derived than cleaning it. In the future water supplies will commonly draw from impaired sources such as saline, brackish and treated wastewaters. In addition, water treatment and distribution will be largely dependent on the pattern of human settlement. Water management in the emerging megacities of the developing world will, to a large extent, determine the fate of efforts to meet the Millennium Development Goals in water and sanitation. Prof. Marks cited figures from the UN Development Program that predict 60% of the world's population

and 70% of the developing world's population will live in urban areas by the year 2030. In addition, urban areas are becoming less dense as they grow in population. The prospect of low-density growth on urban fringes where infrastructure does not yet exist is a major challenge to long term sustainability of water systems. Prof. Marks deduced that decentralized water systems would be required to meet this challenge. This follows the lead of the electrical power industry in turning to decentralized systems to meet distributed demands while minimizing costs.

Paul Barlow of the U.S. Geological Survey presented issues and evolving management approaches related to groundwater sustainability. He first described some of the manifestations of groundwater development. These include water-level decline and reduction in groundwater storage capacity, reduction in streamflow, impacted ecosystems, land subsidence, water quality changes and saltwater intrusion. In the High Plains aquifer of the central U.S., groundwater levels have been dropping precipitously as water stores are exploited for irrigated agriculture. In parts of Texas, Oklahoma and Kansas, water levels have declined more than 100 ft from before ground-water development began through 1997. In Massachusetts, the Ipswich River runs dry in summer as groundwater withdrawals deplete streamflow. Groundwater pumping for drinking water supply has caused saltwater intrusion in Cape May City, New Jersey, forcing the closure of several affected wells.

In response to the concerns caused by falling groundwater levels, Dr. Barlow described some of the evolving management approaches that the USGS supports. These include:

- artificial recharge
- aquifer storage and recovery
- use of recycled or reclaimed water
- desalination of brackish water
- conjunctive use of groundwater and surface water resources
- control or regulation of groundwater withdrawals
- conservation

He described an example of such an approach, an artificial recharge demonstration project in Wichita, Kansas, where treated river water is discharged to recharge basins that facilitate infiltration to underground aquifers. In Cape May City, New Jersey, they are employing desalination to treat the brackish well water caused by saltwater intrusion. And in South Florida they are storing excess surface water in underground aquifers for use in augmenting surface water flows in dryer times. In conclusion, Dr. Barlow described water systems as complex and dynamic, interconnecting hydrologic, environmental and human forces. Effective management requires a long-term perspective and adapted approaches demonstrated in the presentation.

Arthur Goldstein is the Chairman of Ionics, Inc. a leading company in the field of desalination and membrane separation technology. As Mr. Goldstein cited, we do not have the quantity or the quality of water in the places where it is needed. Therefore to provide the required water to meet demand there are three basic options: 1) transport water by pipe, 2) clean up and use what water is present or 3) develop new local sources.

The cost of pipelines is very high and maintenance is typically underfunded. In the US the costs of pipeline upgrades are expected to cost \$200 – 400 billion. For these reasons Mr. Goldstein expects most cities in the world will use desalinated water in the future.

Currently desalinated water costs about \$0.50/m³ making it a competitive source of water. Ionics has been involved in over 4,000 desal plants, including the largest plant in the western hemisphere in Trinidad, the largest US surface water plant in Minneapolis, and the largest wastewater reuse plant in Kuwait City. For psychological reasons most customers will not reuse wastewater for drinking water, but will use it for irrigation, which is what is done in Kuwait.

Mr. Goldstein also described general challenges to private industry's involvement in the water sector. He notes that there is often a lack of political will to pay for the upgrade and repair of water and wastewater treatment plants. Often a crisis is required to cause action and at times these actions are rescinded when the crisis passes. Communities turn to privatization to remedy the lack of public money available for water infrastructure. However, privatization will not be any more successful if there is a lack of appreciation for the benefits that it provides. Therefore, according to Mr. Goldstein, one of the greatest challenges to providing water services is establishing the communication and coordination necessary to teach the benefits of clean water, motivate public activism and establish a rationale for funding water projects.

Eric Mintz, Chief of Diarrheal Diseases Epidemiology at the US Centers for Disease Control and Prevention, presented the Safe Water System, a point of use water treatment system that has shown great promise for preventing waterborne illnesses. Dr. Mintz began by detailing the sources of contamination for users who do not have access to piped water. First he noted that many improved water sources are not safe water sources. Even if all sources were safe, post-source contamination remains a major threat. Water is often transported in containers with uncovered mouths, in contact with the water bearer's hands and water is drawn by cup with more hand contact. During a cholera epidemic in Peru it was found that most people did not comply with boiled water orders, open storage containers still posed risk of contamination, and piped water was still many years from becoming reality. Point of use measures emerged as a logical approach to mitigate waterborne disease.

The Safe Water System consists of a two-pronged approach: treatment and storage containers for the home ("hardware") and education and training ("software"). The hardware are small bottles of hypochlorite solution and 20-liter plastic water storage vessels with small mouths and spigots. The software is promoted with social marketing through publicity and implementation partners. The materials are inexpensive, vessels are \$2-5 and the cost for solution amounts to about \$0.15/month per family. The program has resulted in reduction in the occurrence of diarrhea of 25 – 65% where it has been implemented, making it the most cost effective water intervention worldwide. A key to its success is the program relies on the existing commercial structure instead of the expensive and nonexistent concrete and steel water infrastructure. The system is also potentially economically self-sustaining. Emergency disaster responses are another

example of where the Safe Water System can provide relief. The growth in users is exponential since 1990, now reaching 5 million with great potential for expansion.

Charles Harvey, the Doherty Associate Professor of Civil and Environmental Engineering at MIT, presented a case study of the arsenic crisis in Bangladesh. In doing so, Prof. Harvey painted a picture of the complications that arise in water management due to the interconnections of dynamic hydrologic systems. In Bangladesh, widespread surface water contamination, mostly due to lack of sanitation, effectively made groundwater the only safe source of water. People there became extremely adept at digging wells and are able to complete a well in 4 to 5 hours for US\$50. As a result, massive groundwater withdrawal for drinking and irrigation water is ongoing, at a rate that will exchange all the groundwater down to 50 m over a few decades.

Unfortunately, as Prof. Harvey described, arsenic was present in the water and the country now suffers from an epidemic of arsenic poisoning. However, as Prof. Harvey explained, the arsenic crisis is not a simple case of an element occurring naturally in an aquifer. Arsenic levels are not especially high there. Instead, this is likely a case of the perturbation of a dynamic, complex system yielding unexpected results. The surface water in Bangladesh remains highly polluted with organics due to agricultural and human waste. Groundwater pumping for irrigation draws the water with high organic concentrations into the aquifer. There the organics are oxidized which triggers the dissolution of arsenic from soil compounds. Thus the arsenic contamination in Bangladesh is less a matter of unfortunate geology and more a matter of water management. The solution being pursued is a shift to deeper wells. But as Prof. Harvey noted, there's some risk the contamination could happen again, or perhaps elsewhere in Asia.

Bob Zimmerman, executive director of the Charles River Watershed Association, discussed approaches to better managing water resources at the local level. He was specifically concerned with the mismanagement of storm water that is characteristic of American communities. In the state of Massachusetts approximately 45 inches of rain fall each year, yet there are permanent water restrictions in many communities. He explained that the fundamental problem is that city water system designs treat storm water as rubbish, to be collected and disposed, instead of recognizing it to be a critical water resource. Ultimately it is rainwater that replenishes the underground aquifers that provide drinking water and augment streamflows. However, as more land becomes developed, impervious surfaces prevent infiltration, and instead rainfall is diverted to sewers and rivers that are already at their highest at these times. This water is then lost to the community; without recharge, their water tables will fall. In addition, Mr. Zimmerman explained how leaky sewer pipes drain groundwater. The cracks in the old sewer pipes that lie under most communities allow groundwater to seep in. These perforated pipes thus act as drains, dewatering the surrounding aquifers and transporting a clean water resource to wastewater treatment plants. In eastern Massachusetts, these systems carry enough groundwater to the \$4 billion Deer Island facility that it constitutes 60 – 65% of 390 million gallons per day (MGD) flow during wet weather. The effluent

from Deer Island is pumped to Massachusetts Bay; the whole process represents a massive short-circuiting of the natural hydrologic system.

The Charles River Watershed Association promotes several methods to realign the handling of storm water with the essential flows of the environment. Zoning can be used as a tool to protect vital recharge areas and to limit the growth of impervious surfaces. Parking lots can be designed with lattice-like support structures that facilitate infiltration. They have also developed a rainwater collection system, based on centuries-old rainfall harvesting, that funnels stormwater from roofs to storage tanks. As Mr. Zimmerman stated, all these methods ultimately keep water in our streams.

Valerie Nelson, director of the Coalition for Alternative Waste Water Treatment, proposed a need to rethink the assumptions that dominate wastewater planning and design. Dr. Nelson described integrated water resource management as an important paradigm for water planning, echoing the discussion of Alan Hurdus of USAID. Planning for wastewater, drinking water, stormwater, development, flood control and habitat protection must each be conducted within the context of all others. By her estimation, decentralized approaches are particularly suitable, as they typically offer less impact on natural processes and can have better assimilative and treatment ability. Dr. Nelson prescribed these “soft path” technologies as appropriate alternatives for rural, suburban or urban areas. Emphasis is on implementation at or near the point of use. Examples include on-site and cluster wastewater systems, which are a thriving technology for subdivision development, low impact development designs, stream buffers, land conservation, demand management and reuse options.

The advantages of soft path technologies become apparent when one investigates the shortcomings of conventional wastewater treatment. Centralized wastewater treatment systems require large investments in infrastructure and invoke the burden of repair and maintenance costs on future generations. As described earlier by Bob Zimmerman, older systems drain away groundwater resources. Also there is growing evidence that conventional treatment is less effective against newly recognized pollutants, including endocrine disruptors, hormones and other pharmaceuticals. Decentralized alternatives offer cost savings by avoiding the need for widely distributed collection systems, which can account for 70% of sewage system costs. Because they can be constructed incrementally, integration with other municipal projects, such as roads, is possible and also investments can be spread over time. These smaller scale approaches increase flexibility and can be targeted for specific sites and situations. Dr. Nelson closed by citing the obstacles that impede the progress of soft path approaches. Among the most critical are the regulatory framework and engineering standards that entrench conventional technology. She suggested that new models are needed for “smart infrastructure” that integrate planning and regulations with technology development.

Closing Remarks

The final panel consisted of a brief summary and closing thoughts from Peter Rogers, David Marks and Sir Richard Jolly. Prof. Rogers commented that although the statistics are daunting, we generally do have the tools necessary to solve the issues that challenge us. The term “crisis” should be used carefully because it conjures up fear that is not necessarily productive. Prof. Marks reiterated that there are underlying principles of economics and ecology that we don’t fully understand. As a result, we can’t plan for everything or expect all plans to work perfectly. Adaptability will be a key quality needed for achieving the goals. In addition, he stated that water issues impact security issues that affect us all. Richard Jolly remarked that new technologies and appropriate technologies must be identified for implementation in the unique context of the developing world. He also noted the great discrepancy between the stringent conditions and requirements that accompany aid provided to developing countries with the history of dialogue, debate and the arduous pace of reform and management that takes place in the donor countries. He recommended that assistance not be used to force privatization or other contentious measures that defy the true meaning of partnership. He closed by reminding all that the Millennium Development Goals address much more than water and sanitation. Discussions relevant to this goal must be considered in the context of the greater effort.

Annexes: UNAGB Leadership Awards

Charles River Watershed Association

The United Nations Association of Greater Boston is presenting its Leadership Award to the Charles River Watershed Association. The Charles River Watershed Association was established in 1965 in response to widespread concern about deteriorating water quality in the Charles River Watershed. The Association has evolved into an organization successful in working with local government agencies, private entities and citizen groups in some 35 watershed towns. It has been highly successful in promoting scientific assessment of local watershed and resource conditions, stimulating community involvement in the planning and management of water resources and initiating social mobilization in clean-up efforts. Today the Charles River Watershed Association provides highly competent technical and scientific services to local communities and private entities requiring solutions to water and sanitation problems impacting on the Charles River Watershed.

Of particular note is a current CRWA initiative in two township areas to help reverse the present declining watershed aquifer water reserves due to rainwater run-off through sewerage systems to the river and the ocean. Working with a local power company, township agencies and local communities, it has devised a comprehensive water resource management strategy involving:

- Storm water retention through cleaning and recharging of the groundwater aquifer;
- retrofitting of municipal buildings and schools with lower volume water fixtures;
- public education and community outreach about water conservation and low-flow remediation;
- leak detection and remediation programs;
- modeling of groundwater reserves and identification of best practices to manage them; and
- septic system repair.

Water Supply and Sanitation Collaborative Council

UNAGB is presenting its Leadership Award to the Water Supply and Sanitation Collaborative Council. The WSSCC (or now WASH) has been instrumental in promoting

greater political will within developing countries, but also at the international level, for supporting more integrated water and sanitation services that benefit relatively underserved populations in both rural and urban areas. These efforts have included preparation and publication of reports, convening of international meetings and other advocacy activities intended to focus on the UN Millennium water and sanitation goals of halving the number of people without access to safe water and sanitation by 2015. WASH advocacy efforts focus on the need to increase the share of international and national resources going to water services in urban slums and shanty towns and in poor rural areas.

In the last several years, these efforts have increasingly included promotion of country based pilot demonstration activities to bring about more receptive attitudes towards basic hygiene, and more innovative water and sanitation service systems that can directly benefit relatively poor, disadvantaged populations. These initiatives focus on empowerment of low income citizen groups, including women, to become actively engaged in the planning and management of water, sanitation and hygiene development schemes that address their requirements. In these initiatives, poor households and communities collaborate directly with other stakeholders, including local government units, the private sector and other non governmental organizations and associations. These activities incorporate low cost technologies, inclusion of capital cost recovery considerations, attention to environmental sustainability, and facilitate government and international donor support. Since 2001, community centered water, sanitation and hygiene development schemes have been introduced in about 30 countries, including Brazil, India, South Africa, Madagascar and the Philippines through the WASH campaign.