Directions in drainage for the 1990s

Workshop on
Drainage
New Delhi,
India,
October
22-24, 1991

This publication has been written and edited by Peter Kolsky, London School of Hygiene and Tropical Medicine, A. Pierre Hirano, WHO/SEARO and Jens Bjerre, RWSG-SA. This document contains the detailed outcome of the workshop as well as the Strategies and Actions developed at the workshop. The views expressed in the Strategies and Actions are those of the participants and in the text are those of the editors We thank Sunita Vasudeva, RWSG-SA for making this publication a reality.

The workshop was hosted jointly by UNDP/World Bank Water and Sanitation Program, South Asia and WHO/South East Asia Regional Office. The facilitator of the workshop was Peter Kolsky, London School of Hygiene and Tropical Medicine.Some of the background research was funded by British Overseas Development Administration.

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Workshop on Drainage

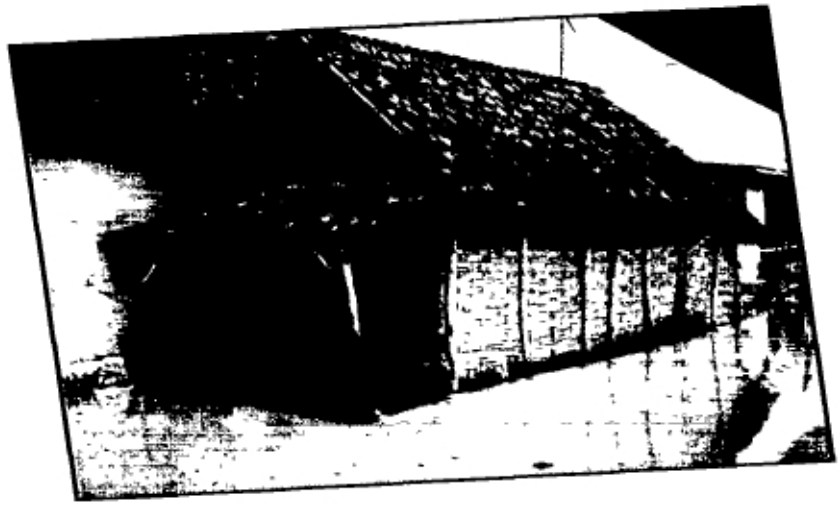
New Delhi, India on October 22-24 1991

UNDP/World Bank Water & Sanitation Program
Regional Water & Sanitation Group

World Health Organization
South-East Asia Regional Office

Imagine yourself
in the rainy season in Chittagong ...

Imagine yourself living in a one room shack with eight other people. The shack is made of straw and bamboo, and is attached to row upon row of other similar shacks, all housing eight to ten people. Imagine the mud. It is everywhere, running in sludgy heaps between the rows of shacks. Men, women, children and animals walk back and forth, churning the mud and squelching through the mess and excreta. Imagine that twice a day the floods from the nearby river rise and pour over the



busti [slum]. Imagine that you have to get up off the ground or floor of your hut and stand to avoid the water that is rushing around your ankles[...] Look at the latrine at the end of a row of *busti* shacks. It is so filthy, the excreta are pouring into the lane. No one bothers with it any more. The open drains running along the edge of the busti are better. But even they are clogged with garbage, excreta, and other filth. There is a mangrove swamp growing on the place that used to be the area drainage system. Imagine that your little brothers and sisters, covered with skin rashes and dripping diarrhoea, are still playing in the drains and sitting in the excreta in the mud[...] Imagine a group of well wishers coming to teach hygiene education.

(Edited from Quarry, 1990)

The Delhi Regional Workshop on Drainage

In October 1991, thirty environmental sanitation experts from ten countries met in New Delhi to discuss the drainage of human settlements. The statement below, "Directions in Drainage for the 1990's",summarizes their conclusions. The rest of this document explains the "Delhi Strategies and Actions for Drainage" developed at the workshop.

DIRECTIONS IN DRAINAGE FOR THE 1990s

"Drainage of human settlements has assumed considerable significance due to the enormous population growth and the rapid but haphazard urbanization evident in most countries. Failure to provide adequate drainage is directly linked to the resurgence of malaria, the spread of diarrhoeal disease, damage to housing and property, disrupted communications, lost income, and environmental degradation. These costs are not evenly shared across society, but fall most heavily on women and children among the urban and rural poor. Drainage is a cross-sectoral issue, involving such fields as housing, roads, solid waste management, water supply and excreta disposal. The principal social, political, institutional, financial and technical problems include:

- **Neglect of drainage** as a fundamental component of environmental sanitation and protection,
- **Inability of existing policy and institutions** to manage drainage effectively,
- **Inadequate allocation of resources** for drainage of human settlements,
- **Lack of community involvement** in efforts to improve drainage, and
- **Failure of the current technical approach** to meet the challenge.

It is in this context that the workshop has developed the Delhi Strategies and Actions directed towards the following five goals:

- **Increase the awareness** at all levels of the role of drainage in environmental sanitation and protection,
- **Develop new policies and strengthen institutional capacity** to address the problem in a comprehensive manner,
- **Find new resources** to provide and manage drainage facilities,
- **Encourage and develop community participation** in all aspects of drainage, and
- **Develop a more appropriate technology** for community drainage.

The workshop calls upon all those concerned with environmental sanitation and protection to implement the Delhi Strategies and Actions to advance these goals."

The "Delhi Strategies and Actions for Drainage" described on pages six and seven are bold and ambitious. Participants at the workshop have already started their implementation, with a campaign to increase awareness of drainage issues in the region. This report is being distributed to policy-makers and implementors in the countries of the region, and in the bilateral and multilateral External Support Agencies. Workshop participants are discussing this report with professionals and policy-makers in their home country as a step towards increased awareness of the problem.

The workshop has already established an informal network of those interested in drainage and environmental sanitation. The network will serve two purposes; to monitor the success of the first steps to implement the drainage strategy within each country, and to share experience, techniques, and promotional materials between those working in the field. You are welcome to join this network by completing the form on the back of this report.

THE NEED FOR DRAINAGE

Drainage was defined at the Delhi workshop as "the removal of unwanted water from human settlements". Such unwanted water can include runoff and flood waters from seasonal rains, marsh or pond water in low-lying areas, and the used domestic water of the community. All these constituents have a potential impact on health and well-being, from the creation of breeding sites for disease vectors to the spread of faecal-oral diseases.

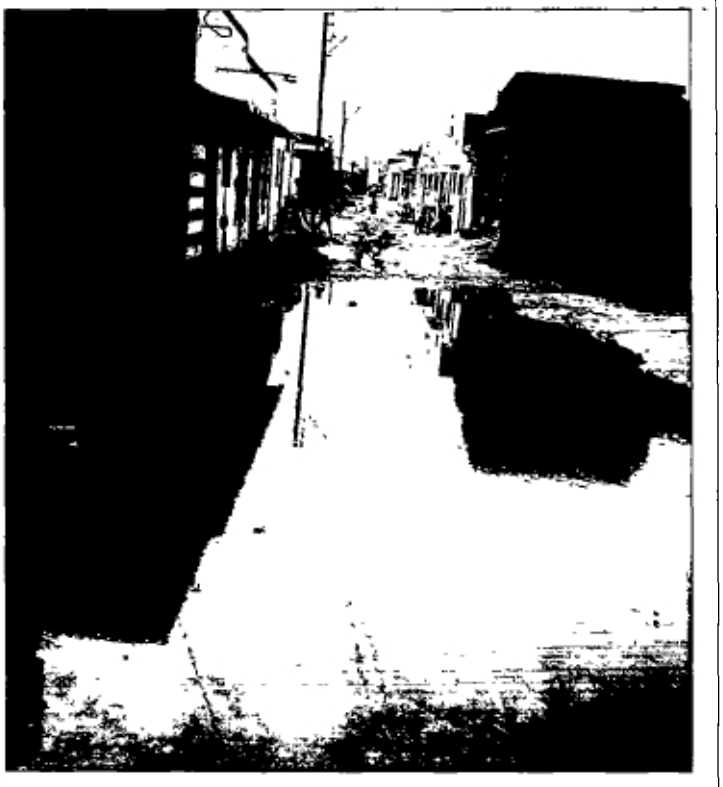
Millions of people across the world suffer from the danger and misery of flooding in their streets and homes. For some, the flood washes away the savings of a lifetime in only a few hours; for others living in low-lying slums, the hazards and nuisance of stagnant ponds are simply the price of being poor. No means of human excreta disposal is safe in areas exposed to frequent flooding, and drainage is essential to control malaria and schistosomiasis.

If drainage of human settlements is so important, why don't we have effective solutions yet? "Directions in Drainage for the 1990s" and the Delhi Strategies and Actions identify five distinct problems with the current status of drainage; each is discussed briefly in the following pages, with some of the workshop strategies and actions required to overcome the problem.

OLD PROBLEMS AND NEW DIRECTIONS

Drainage has been neglected as a fundamental component of environmental sanitation and protection.

Within the field of environmental sanitation, attention has generally focused on community water supply and excreta disposal, often at the expense of solid waste management, hygiene education, and surface water drainage. Yet no amount of work on low cost water supply and excreta disposal can eliminate the environmental hazards of stagnant ponds, and no excreta disposal is safe under half a metre of water! Until these problems are understood more widely, drainage will remain neglected.



Strategies

Drainage should not be treated in isolation from hygiene education, solid waste management, excreta disposal and water supply. Instead, we need to develop people's awareness of drainage as an essential component of an integrated program of environmental sanitation.

Awareness of drainage must be increased at *all* levels. National administrative and political leaders must become aware of the importance of drainage in order to establish appropriate policies and strategies. Local officials and technical staff must understand drainage in order to formulate and coordinate various solutions. Lastly, the community must understand the problem, in order to participate effectively in its solution, and to create political demand for the required services.

Research into people's perceptions of drainage and environmental health should be sponsored at all levels, to provide a baseline from which to develop awareness programs. Promotional materials on the role of community drainage in environmental sanitation and protection should also be developed. These could be coordinated with or included in the "Safe Water 2000" and "Health for All 2000" campaigns launched by UN agencies in recent years.

Workshops on investment policy in environmental sanitation are proposed to help put drainage expenditures in perspective; it was recognized that increasing the budget for drainage was important to improve its priority within government. Meaningful implementation of drainage/pollution control regulations is also needed for effective environmental protection.

Existing policies and institutions do not address the problem of drainage of human settlements effectively.

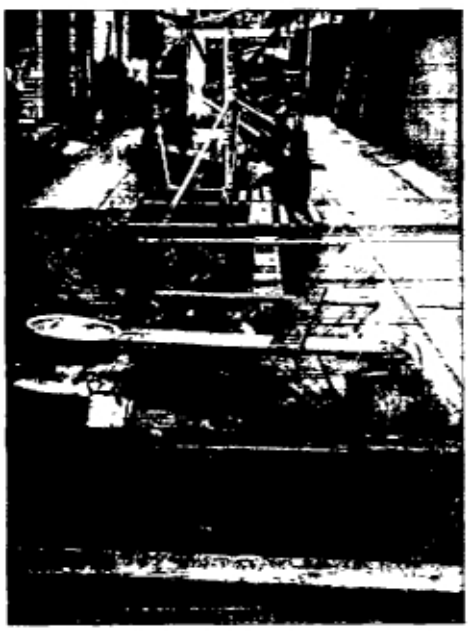
Responsibilities for drainage are poorly defined, and are usually shared between several agencies responsible for other tasks (e.g. roads, water supply, sanitation, and health). As a result, duties overlap in some cases, while in others important responsibilities are ignored. Effective drainage management is dependent upon cooperation with such diverse services as road construction, water supply, solid waste management, sewerage system operation, and land use planning. Unfortunately, such cooperation is rare.

Problems also occur *between* differing levels of the same government body, as when neighbourhood and city drainage systems do not mesh, or construction schedules for different portions of a system conflict. Drainage problems are often passed downstream from one area to another, with nobody looking over the whole. The problems of urban and rural drainage are dramatically different, and require different policies.

In addition to policy problems, the existing institutional capacity itself is weak. This is true not only for planning and construction, but even more so for system operations, maintenance and repair (OMR). Technical, financial, and managerial capacity needs to be enhanced if the provision of drainage is to be increased.

Strategies

A fresh review of drainage policy and legislation is required in each country to define and assign responsibilities clearly and realistically. It is particularly important to develop policies to facilitate coordination between the various agencies involved in drainage. Governments should consider changing their role from drainage provider to that of drainage promoter, with a corresponding devolution of responsibility to the beneficiaries. Such a strategy recognizes the considerable proven capacity of the non-governmental sector to implement improvements in environmental sanitation. A strategy of human resources development to improve technical, financial, and managerial abilities is also essential to enhance institutional capacity.



Inter-agency task forces should be formed to develop policies and define the roles and responsibilities at different levels, prepare action plans for implementation, and establish a system for regular monitoring, evaluation, reporting and adjustments. A lead national agency should be designated for sector coordination. Baseline surveys should be made to assess the capacity of community bodies and government institutions to implement community based drainage programs.

National master plans for human resources development in drainage should be developed, not only for technical professionals, but also for managers, artisans, and community workers. The syllabi of technical schools should be revised to include the social and health aspects of drainage. In-service training and the development of appropriate manuals and guidelines should take place at all levels.

Allocation of resources for drainage of human settlements is inadequate.

The low priority given to drainage results in inadequate funding. New construction cannot keep pace with rapid urban growth and funds are insufficient to keep even the existing systems working properly. Without good maintenance, existing drains become blocked, and the original investment in them is wasted.

Strategies

Investment in drainage by the government should be allocated as an integral part of the infrastructure development program, i.e. as part of an overall package. But funding from central or local government cannot be the complete answer. Investment costs should be shared between the government, the private sector (commerce and housing developers), and the beneficiaries themselves. Cost recovery strategies from beneficiaries are particularly important to cover the costs of operations, maintenance, and repair (OMR) of existing systems. Improved economic analysis of drainage benefit could also justify greater investment in drainage. Finally, community participation should be explored as a means of reducing costs, and sharing them with beneficiaries.

Existing methods of financing drainage in the region should be surveyed, and compared to the funding approaches used in other public sector activities (e.g. water supply, sanitation, education, and roads.) From this survey, specific approaches should be developed to recover both capital and recurrent costs (e.g. "packaging" with other services to recover the cost of the whole, such as recovery with land taxes, etc.)

Once these approaches are developed, pilot schemes should be tried in each country on a small scale to determine which approaches work best. Methods to ensure that commerce and industry pay their share of drainage costs need to be found, and the accounting and budgetary systems of municipal/local bodies must be tightened to increase efficiency in public works, including drainage.

DELHI STRATEGIES AND ACTIONS FOR DRAINAGE

Strategies	Actions
Social 1. Create awareness of drainage problems and solutions at community level, including individual responsibility towards society 2. Develop appropriate community participation methods for drainage improvement 3. Revise/develop implementation framework for community participation 4 Package with other services, to increase community support. 5. Generate incentives/motivation for political support 6. Focus on the poor and on women's involvement	**Social** 1 Conduct programs for increasing awareness on drainage problems at the community level (e.g health, economic, etc) and solutions, (e.g. land use planning) among the following groups· • Government • Politicians • Community • ESAs • NGOs • Industrial and commercial establishments • Educational institutions including primary and secondary schools *by* (a) Identifying the knowledge base for each target group (b) Identifying probable action they could take if they were better informed (c) Determining the content of messages for actions (d) Designing the delivery system for messages to different groups (mass campaigns and educational materials including videos, slide-sound shows, mass media to promote demand - i e social marketing - competition among municipal/local bodies for "Best Environmental Sanitation" award, demonstration projects, workshops, etc.) The research and design should be carried out by professionals *[National/State or Provincial Lead Agency]* 2 Identify existing expertise in the community (people, experience, models, etc) and adapt for drainage movement *[National/State or Provincial Lead Agency]* 3 Assess the capacity of community bodies and government institutions to implement community based drainage programs *[National/State or Provincial Lead Agency]*
Technical 1. Increase technical know-how and education for all levels 2 Promote and encourage TCDC on drainage 3 Improve and provide effective solid waste management in human settlements including waste disposal sites 4 Develop, test and promote appropriate community-based drainage technologies 5. Initiate research programs on drainage impact 6. Increase attention to health aspects in design and implementation	**Technical** 1. Initiate appropriate research in – Cost/benefit – Evaluation of existing projects – Social impact – Health impact – OMR (e g cleaning, solid waste, etc.) – Technology (e.g on-site sullage disposal) *[Collaborative effort of ESAs (including academic institutions) National and Provincial Governments, National Academic Institutions]* 2. Develop appropriate guidelines, manuals, codes of practice for professionals, artisans, volunteer NGOs, and community – Design – Construction – O M R *[Regional Level Guidelines by. ESAs]* *[National & Local Guidelines by. National Sector Lead Agency]* 3. Follow-up research with pilot projects. Evaluate and disseminate results of pilot projects as research *[Collaborative effort of ESAs (including academic institutions) National and Provincial Governments, National Academic Institutions.]* 4 Execute demonstration projects to enhance effective implementation *[Sector Agency, NGOs, ESAs]* 5. Develop regional TCDC programs on drainage *[National Government with ESAs support and local level involvement]* 6 Develop master plan for training in drainage for professional, sub-professional managers, decision makers, communities, etc. *[Sector Agency, Academic/Training Institutions]* 7 Modify syllabus of educational institutions to include health and social aspects *[Sector Agency, Academic/Training Institutions]* 8 Promote in-service training *[Sector Agency, Academic/Training Institutions]* 9 Establish training for management trainers, particularly for OMR *[National Government, Sector Agency, with ESAs support and local level involvement]* 10 Develop training programs and materials for field level staff and community workers *[National Government, Sector Agency with ESAs support and local level involvement]*

DELHI STRATEGIES AND ACTIONS FOR DRAINAGE

Strategies	Actions
Institutional 1. Elicit Government's support on drainage policy 2 Revise the role of Government from facilitator to promoter and involve both private sector and the community 3. Strengthen community based action-plan for environment and sanitation 4 Define roles and responsibilities of different agencies 5 Establish a mechanism to improve coordination among various agencies for an appropriate mix of Government and non-Government organizations 6. Strengthen institutional capacities (e.g HRD, manuals)	**Institutional** 1. Organize awareness programs for policy/decision makers, executives, professionals, social organizations and community on the need for drainage *[Government and ESAs]* 2 Review and strengthen, as needed, existing legislation to check appropriateness for drainage or introduce specific legislation on drainage *[Government]* 3. Designate lead national agency for sector coordination and encourage the inclusion of drainage in infrastructural/national economic development plans and programs *[Government]* 4 Formation of inter-agency task force to develop policies and define the roles and responsibilities at different levels, prepare action plans for implementation and establish a system for regular monitoring, evaluation, reporting and adjustments *[Government]* 5 Document and widely disseminate appropriate case studies on drainage in the region *[ESAs, NGOs, Government]*
Policy 1. Increase priority for drainage (both in project and international fora) 2. Modify existing laws to facilitate implementation of drainage programs 3. Integrate drainage into water supply and environmental sanitation 4 Increase budget allocation for drainage 5. Promote involvement of community and NGOs 6. Define roles and responsibilities 7. Rural drainage should be community based and managed 8. Rural and urban drainage policy should be separately defined	**Policy** 1 Use national task forces for water supply and environmental sanitation to promote drainage *[National Level]* 2 Conduct sector study to establish baseline situation on drainage *[National/State or Provincial level]* 3 Make drainage promotional materials similar to those used for "Safe Water 2000" and "Health for All 2000", campaigns *[ESAs]* 4 Support the development of action for social awareness *[National Government, State and Local Levels with support from ESAs]* 5 Conduct national workshops on investment policy as a part of water supply and environmental sanitation *[National Sector Lead Agency]* 6 Develop competitions among municipal/local bodies for "Best Environmental Sanitation" Award. Recognize and reward winners by financial and social incentives *[Regional and Local levels]* 7 Ensure the inclusion and implementation of drainage/pollution control regulations to increase environmental protection effectiveness *[National Level]*
Financial 1 Allocate adequate funds for capital investment in drainage as an integral part of the infrastructure development program, e.g. by packaging with other services 2 Explore financial models from other sub-sectors (e.g schools, WS&S) 3. Share costs among Government, private sector and community 4. Allocate funds for proper OMR of the system and ensure cost recovery 5. Analyse economic impact of the costs of urban flooding/ poor drainage	**Financial** 1 Survey existing methods for financing drainage Compare funding approaches used in other public sectors *[Regional and National Agencies]* 2 Develop and supply cost-benefit analysis to justify greater investment, including the economic implications of poor drainage *[ESAs, National/State/Provincial Governments, Academic Institutions]* 3 Develop approaches for funding drainage (e g by packaging with other services, cost-recovery from beneficiaries for capital investment and OMR) *[Regional and National Level Agencies]* 5. Develop methods to encourage industries and housing developers to invest in drainage *[Government/Industries/Developers]* 6. Implement/improve municipal/local body accounting and budgetary system for drainage *[National/State or Provincial/Local Government]*

THE ORANGI PILOT PROJECT IN LOW-COST SEWERAGE

The Orangi Pilot Project (OPP) is an NGO that has been operating in Pakistan since April 1980. Orangi, situated in the periphery of Karachi, is a large *Katchi Abadi* (unplanned slum) with a population of 800,000, spread over 8,000 acres. The OPP has undertaken a number of development and housing projects, but it is most famous for its model of low-cost sewerage which is "self-financed, self-managed and self-maintained by the house owners".

The OPP defines two levels of sewerage development: internal and external. *Internal development* consists of building sanitary latrines in the houses, individual lane sewers, and collector sewers downstream of the lanes. The OPP has demonstrated that the people of Orangi can implement and maintain this work without government assistance. At present, 70% of the lanes in Orangi have

underground sewers built under this program, and 345 collector sewers have also been built. This represents low-cost sewerage for nearly 70,000 homes in ten years.

External development consists of building large drains and collectors along main roads, main trunk sewers downstream of collectors, and treatment works. The OPP believes that this is the responsibility of the government, which local people cannot undertake. Integration of internal and external development is critical, and the OPP and the Karachi Municipal Corporation have just signed a contract to work together on this integration in the future. While there has been some debate and criticism on the technical aspects of OPP's work, few observers question the dramatic impact that OPP has had on improving the immediate environment of slum-dwellers in Orangi, at only a quarter of the cost of conventional government-run programs.

Adapted from OPP/RTI (1991).

Community involvement in drainage is lacking.

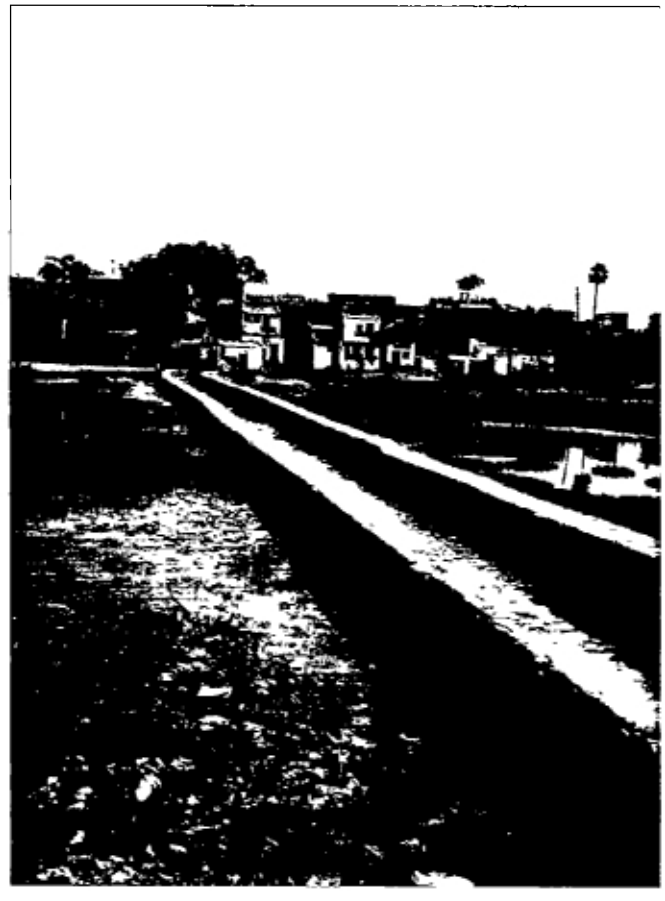
At present, drainage is viewed largely as a government function with little or no community involvement. Yet when government funds are inadequate to finance construction, people are forced to endure flooding and health hazards while waiting for a response. In some cases, the resources to solve these problems may lie within the community; because the tradition of government control of drainage is so strong, such resources are rarely tapped.

Secondly, the absence of participation means that the community feels little responsibility for upkeep of the system; it is the job of "someone else" to keep drainage systems free of solid waste and debris. While it may be unreasonable to expect residents to operate an entire drainage network, the community can play a valuable role in managing solid waste and keeping inlets clear.

Principles

A variety of methods to develop community participation in water supply and excreta disposal already exist, and these should be adapted for drainage. Increased community support may be obtained by treating drainage as part of a larger package of water supply, excreta disposal, street improvements, and slum upgrading. Efforts to increase community participation should be focused upon women and the poor; the leadership role of women in other water and sanitation activities has been clearly established over the past decade.

Existing expertise in the community (people, experience, models, etc.) should be identified and adapted for drainage. The capacity of existing community bodies for grassroots action in environmental sanitation, including drainage, should be assessed. Mass education and awareness programs need to be developed, based on research into the existing level of understanding about environmental sanitation Specific actions to be undertaken by the target groups within the community should be determined from such research, and these should define the objectives of the awareness campaign.



AMMAN NAGAR AND YOUSSEF BI

Amman Nagar (B) is a low-income community living in the bottom of an abandoned water reservoir in Hyderabad, India. The Municipal Corporation of Hyderabad, with some assistance from the British Overseas Development Administration, has funded some slum upgrading work in Amman Nagar (B). Because of the area's inherent drainage problems, the work included the construction of some large open drains, although it did not include sewers for each street. Nevertheless, a number of streets have sewers, funded by the residents themselves, which lead to the open drains. In one of the lanes, the prime mover for such construction was a woman named Youssef Bi.

Several years ago, her family built a *Sulabh* twin-pit sanitation system, which she claims the municipality was supposed to clean out periodically. The municipality did not do so, but Youssef Bi did not complain: as her family has no title to the land on which they live and are "illegal" squatters, they did not wish to attract attention to themselves. As a result, the *Sulabh* toilet failed, and the system overflowed into the lane. The other houses in the area had similar problems, with the result that the area was soon flooded with sewage. Nine months ago, Youssef Bi went to the local slum improvement committee (composed entirely of men) and asked them to consider building a sewer to connect to the open drain. For whatever reason, they were more concerned with other problems.

Undeterred, Youssef Bi talked to the women in the other twelve houses of her lane, and succeeded in obtaining a contribution of Rs 500 (U S $ 20) from each to build a sewer. Youssef Bi contributed a little bit more, and then hired a contractor to build the sewer; the job was done in two days. After their success, the lane on the opposite side of the open drain followed suit, and now four lanes have built their own sewers. They have had no blockages in eight months, but anticipate collecting Rs 5 per household to cover the cost of unblocking the sewer. An inspection of the sewer built by Youssef Bi and her neighbours reveals some basic technical problems that might have been avoided with some technical assistance. Nevertheless, the environment has been much improved by their efforts in comparison with the other unsewered lanes.

Why do some lanes build sewers, and other lanes not?

According to Youssef Bi, there are two main reasons: (i) some people have a lower consciousness about hygiene and its importance, and (ii) some are waiting for the government to do the job – there is no point in paying for the sewer yourself if you can wait and get it free from the government.

JUN CABREZA AND RUBBISH IN MANILA

Jun Cabreza is a baker on Taft Avenue in Ermita, Manila. He knows solid waste is important because nobody will buy bread and cakes from a shop surrounded by rubbish. Although, in principle, the Metropolitan Manila Authority is responsible for rubbish collection, in practice everyone recognizes that it is unable to collect all of it. Many of the drivers of municipal rubbish trucks collect mostly from hotels and large restaurants that pay substantial "tips" to the drivers, and leave the public collection points untouched.

Jun talked to other businessmen in his neighbourhood and they organized Samahang Balikatan, ("Let's shoulder the problem"), a non-governmental organization to deal with local rubbish collection. Members pay 50 pesos a month (about US$2) for overheads (e.g. an organizational secretary) and the organization receives contributions from various sources.

Samahang Balikatan has about 40 small pushcarts, which can easily cover streets not accessible to the large municipal trucks. It hires unemployed women and men from the slums and pays them 55 pesos for four hours work of street sweeping, recycling, and rubbish collection. The idea was to collect the rubbish to a transfer point, from which the municipality trucks would collect it.

Samahang Balikatan succeeded in improving solid waste collection dramatically in its area. Jun attributes their success to three factors: their use of pushcarts rather than trucks; their ability to discharge people who don't perform, and their use of anonymous inspectors to see whether the streets are swept.

The story is not a complete success, however. Rubbish was not collected by the municipality from the transfer point, and there were complaints by neighbours as the rubbish piled up. Jun successfully sought funds to buy a truck so that Samahang Balikatan could do their own hauling to the dump site. Jun then asked for permission to unload at the city dump. The city agreed but only if the trucks were controlled by municipal staff. Fearing that the truck would be used for other ends, Samahang Balikatan understandably refused.

The problem is difficult because Metro Manila cannot find a suitable final disposal point. As in drainage, there is an urgent need for municipal cooperation with, and coordination of, such private initiatives. Local initiative can bring the unwanted water or solid waste to a collection point; from that point on, however, the balance of the responsibility must rest with the municipal authority. The challenge lies in striking the right balance.

The existing technical approach is inappropriate.

Existing drainage systems often fail because of poor design and operation. Drainage design criteria were developed in the industrialized countries, with little or no modification to reflect the very different conditions present in Southern Asia. Design methods are often too complicated, produce expensive systems, and ignore the realities of crooked, narrow and unpaved streets, and poor solid waste management. In addition, engineers responsible for drainage are rarely prepared to deal with the non-technical issues that determine whether or not the network will succeed or fail.

Strategies

Technical know-how and education for all involved in drainage should be increased. One approach is through the promotion of Technical Cooperation between Developing Countries, to share the experience and solutions of common problems. Support should be given to improved solid waste management, not only for its own contribution to environmental sanitation, but because without it rubbish and debris would rapidly block the drains. Appropriate existing knowledge and experience should be more widely disseminated. Research must be undertaken into new low-cost technologies for community drainage implementation and management, and should be followed up with field testing and demonstration projects.

Appropriate guidelines, manuals and codes for design, construction, and Operation, Maintenance and Repair should be developed to respond more effectively to the drainage problems of Southern Asia. Appropriate research should be initiated into a variety of technical and related questions, including cost-benefit analysis, the evaluation of existing projects, methods of maintaining drainage systems, and health aspects of drainage.

A master plan for technical training in drainage should be drawn up at the country level, and the target groups should include professional, technical and managerial staff, artisans, sub-professional managers, and community development workers. Training of trainers for management of OMR is particularly important, as is the expansion of in-service training. The syllabus for technical professionals needs to be modified to reflect not only revised, simplified and practical design methods, but also the social, financial, and community development aspects of drainage implementation and management.

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Informal Drainage Network

The workshop participants decided to establish an informal network of those interested in drainage and environmental sanitation. If you want to join the network, you are welcome to do so, by filling in the form below and returning it to RWSG-SA, attn. Jens Bjerre.

Name : .....

Designation : .....

Organization : .....

Mailing address : .....

.....

.....

Main field of activity : .....

Signature : ..... **Date :** .....

Send to : UNDP/World Bank and Sanitation Program
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World Health Organization/United Nations Environment Program *Surface Water Drainage for Low-Income Communities*, Geneva, 1991

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