SEWERAGE WORKS
PUBLIC INVESTMENT IN SEWERS SAVES LIVES

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Foreword

Using the toilet is something we take for granted in the West. We pay little attention to what happens to the waste when we flush it away and we assume the sanitation services will always be available when we need them.

This is not the case for people living in developing countries, where 2.6 billion people have no access to even the most basic toilet facilities. The situation is worst in sub Saharan Africa where 62% of the population have no access to municipal sanitation services. Thousands suffer waterborne diseases every day, caused in part by improper, or non-existent removal and treatment of human excreta. Many children, especially girls, are unable to attend schools for lack of sanitation facilities. The impact of lack of sanitation services on human health and economic development is staggering.

Public services are essential for sustainable pro-poor development. For many years, public sector solutions to water and sanitation crises for the poorest people have been dismissed as unaffordable and idealistic. This report argues that public sewerage systems will make a significant difference to urban sanitation by saving 326,000 infant deaths every year. Against conventional wisdom, the report finds that the cost of implementing urban public sewerage systems is affordable and can be met through taxation for most countries. For a limited number of low-income countries, only $7.9 billion of aid is needed to meet the shortfall.

The report calls for an end to the demands for full cost recovery as a pre-condition of investment in water and sanitation services. Full cost recovery will never enable countries to tackle the needs of the urban poor. Investment in sewerage must be seen by donors and governments alike as a public good that will benefit many generations to come. This was the justification for municipal sanitation in Western Europe when a similar need for investment existed in the 19th Century. Crucially, the report argues that we must fund the public sector to deliver the necessary sewerage systems because, as the evidence shows, the private sector cannot be relied upon to meet this need. It has failed to deliver any significant investments in sewerage in the last 15 years.

UNISON, the UK's largest public service trade union, and PSI, the global union federation for public sector trade unions, have researched and campaigned for many years on public sector solutions to water and sanitation problems in poor countries. We represent thousands of public service workers who deliver water and sanitation services in the UK and around the world. Their first-hand experience informs our campaigning and policy work.

We hope the report will stimulate debate on the role of public sewerage systems in dealing with sanitation in urban areas. Sewerage works.

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General secretary, UNISON

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1_Summary

This report focuses on a particular aspect of sanitation, the importance of sewerage systems. The introduction of the 'sanitatary system' of household connections to sewers flushed by water has been voted as the greatest medical milestone since 1840. But although this system is universal in the north, developing countries continue to lack urban sewerage systems (Section 2).

The UN estimates that nearly 1.5 billion people need access to improved sanitation by 2015. But the Millennium Development Goals (MDGs) definitions only specify 'improved sanitation', do not require sewerage connections, and emphasise the use of 'lowest-cost' solutions. As a result, they fail to address the needs of city dwellers for sewerage connections and so fail to give proper weight to the enormous public health benefits of sewerage connections (Section 3).

Cholera and diarrhoeal diseases are the major health problems in the absence of sanitation, especially for children. They kill about two million children a year in low and middle-income countries – more than malaria, measles and HIV/Aids combined. With sewers, infant mortality rates are lower. Achieving universal coverage could save 326,000 infant lives per year – the equivalent of eliminating infant deaths from HIV/Aids. Children in homes without sewers are shorter, and their educational achievements lower, than children in households connected to sewers. Toilets and piped water alone do not make up for the lack of sewerage (Section 4.1-4.2).

The problem of ignoring sewers is greatest in urban areas, where world population is growing fastest. Hygienic practices such as hand washing and household toilets help, but the problem of disposal of faeces remains. Cess pits and septic tanks do not provide the same benefits due to leakage and contamination; recycling onto fields is not an option in cities. Universal coverage matters because faeces from unconnected households increases the health risks of all households.

The problem is acute in some major cities, such as Jakarta, Indonesia, with a population of 12 million, but with only 1% of households connected to a sewer. Urban sewers are not a northern invention but a traditional urban technology developed in south Asia 4,000 years ago. The benefits can be delivered by conventional sewerage systems or other systems such as condominial sewerage (Section 4.3).

The MDGs should include a specific target for urban sewerage: "To halve by 2015 the proportion of the urban population without household connections to a sewerage system". This entails connecting a further 1.14 billion people by 2015. Half of this need for urban sewerage connections is concentrated in four countries: China, India, Indonesia and Brazil; and 90% of the global need for urban sewerage connections is in just 24 countries with some combination of high economic growth, high urban populations, or low existing levels of sewerage (Section 4.4).

Donors and international institutions are wrongly emphasising full cost recovery from users and privatisation as a way of developing sanitation systems. They also argue that sewers are unaffordable. This is misleading and unhelpful. Sewerage is a public good, and leaving it to individual spending choices does not deliver the coverage needed for full public benefits. Full cost recovery makes sewerage unaffordable to the poor.
All existing urban sewerage systems in high-income countries – in Europe, North America, and Japan – were developed through taxation and the public sector, not through full cost recovery from user charges by the private sector. Connection was made compulsory as a matter of public policy and not subject to consumer choices to opt in or out. The European Union continues

to provide high levels of subsidies from taxation for countries in eastern Europe to develop water and sanitation systems.

The private sector has failed to deliver any significant investments in sewerage (or other urban infrastructure) in the south in the last 15 years. By contrast, some major developing countries are already achieving significant extensions of sewers in cities through public finance. In China for example, the urban sewerage connection rate rose from 30% in 1990 to 50% in 2002, and is still rising. In Brazil, the connection rate in the city of Salvador (2.5 million) was increased from 26% to 80% in just eight years. These national efforts can be supported by donors, for example Japan provides training support through a series of public-public partnerships. Since public finance is the key mechanism, the issue is not increasing user charges but whether countries are raising sufficient taxation (Section 5).

The costs of meeting the MDGs in full, and extending urban sewerage connections, are affordable. Even using the highest cost estimates from WHO and World Bank officials, the economic and public health benefits of investing in sewers far outweigh the costs, as demonstrated by recent cost-benefit analyses. The actual spending required represents an affordable proportion of gross national income (GNI) in countries with the majority of those needing connection.

Donor arguments that sewers are unaffordable are based on a misleading assumption that they should be financed by personal consumption. If taxation is used, then the question is about the capacity of the national economy. For 14 of the 20 countries with the greatest need, urban sewerage connection targets can be achieved at a cost of less than 1% of GDP per annum. Where the cost is above 1%, countries may need aid. This need is concentrated in a number of low-income countries, especially in Africa, notably Nigeria and the Democratic Republic of Congo. This would require a redistribution of the present pattern of aid, which is too concentrated in countries with relatively low needs are target markets for multinational water companies. The total amount of aid required is also affordable for developed countries. It represents a fraction of the cost of the war in Iraq, for example, and the UK government support for the troubled bank Northern Rock alone would cover half the total global needs for sewers (Section 6).

Developing countries should continue to adopt policies of extending sewerage systems using public finance and concentrate on raising tax revenues to finance them. They should resist advice to raise user charges and introduce the private sector. Donors should stop giving this advice, and instead concentrate on providing aid to those countries most in need of it, along with capacity building and training (Section 7).

2_Sewers and sanitation

"The sewer is the conscience of the city"
Victor Hugo, Les Misérables
from UN World Water Development Report (WWDR), 2006

"Urban poverty is not merely a simple problem brought on by low incomes: it is more of a matter of poor quality of life as characterised by very limited access to clean water and sanitation, health care, education, and economic activities." [1]

This report is about the sewerage systems of cities. It argues that the health benefits of such systems are too great for them to be treated as an optional extra, especially in cities. The view that sewers have to be financed by charges to households, and that the private sector might provide the necessary investment, is shown to be mistaken: public finance needs to be the basis of developing sewerage systems. When the costs of urban sewerage are measured against national economies, the sums are affordable, and some countries are already investing the necessary amounts to deliver these systems. The amount of aid required to support national programmes is also affordable for high income donor countries, and needs to be targeted at countries most in need of assistance; not those where the private sector sees the opportunity for profitable markets.

2.1_The greatest medical milestone in the last 167 years

In January 2007, over 11,000 readers of the British Medical Journal (BMJ) chose "the sanitary revolution" – connecting people's homes both to clean piped water and to sewers to dispose of their waste – as the most important medical milestone since 1840. They thought it was more important than antibiotics, vaccination or the discovery of the structure of DNA. [2]

The system was first introduced in London in the 19th century to reduce the number of people killed by infectious diseases. The motive was not just humanitarian: the diseases were killing off male breadwinners and pressure was being put on the state to carry the cost of supporting the families. The removal of sewage was crucial to curb the diseases, and the main reason for connecting every house to clean water was to flush away the sewage. All households, rich and poor, were connected to water supply and sewers. The system was financed and run by the public sector.

This solution included four key features:
— the technology to develop a network of sewers throughout the city, flushed by water
— public administrative structures to finance, build and manage these expensive works
— the recognition that sewers were a public environmental measure, rather than an attempt to alter individual behaviour
— a recognition that the sewers were a universal public measure applied to everyone, not selectively targeted. [3]

These same principles have been applied in every high income country in the world. England achieved near-universal coverage before the Second World War, but others, such as France, did not do so until much later in the 20th century. It was very expensive to develop the system (as it is today in developing countries) and it was financed from taxation or massive cross-subsidies. [4]

The same principles were used for the development of sanitation in cities across the USA. Cities, towns and even villages in these countries have piped water and sewerage connections to all houses. In Europe, every village with a population of 2,000 or more must have a sewer system collecting household waste. [5]

The extension of systems to the villages of Europe has taken a long time. But in developing countries, many cities and towns

are still waiting for the sanitary revolution to reach them. They lack the sewerage systems, which protect the northern cities. The rate of death and disease in developing countries continues to reflect this.

Through the Millennium Development Goals (MDGs), the countries of the world are committed to improving sanitation in developing countries. However, the current policy of donors and development banks implementing these goals are often at odds with the key principles of the sanitary revolution. This is because they:

— avoid commitment to the expensive works of building sewers flushed by water
— are failing to support public sector finance and public sector organisations to introduce these systems, preferring to plan on the basis of cost "recovery" from users
— do not prioritise public environmental measures
— prefer "targeted"solutions to a universal approach.

This report addresses these issues and argues that sewerage systems are necessary, achievable and affordable. It consists of the following:

— a critical account of the limitations of the MDGs
— a presentation of the compelling public health case for sewers and their necessity in cities
— an account of the central role of public finance in developing sewerage systems
— the failure of the system to recover costs through user charges
— the risks of relying upon private sector investment
— a review of past and present programmes of public investment which have succeeded in developing urban sewerage systems
— a discussion of the costs of achieving the MDGs and the extra costs of a target for urban sewerage connections
— an assessment of the affordability of these costs by cost-benefit analysis and their affordability for national economies
— the potential requirements for assistance from international aid, and comparison with other expenditure choices
— the conclusion, with recommendations for country and donor policies.

3_The Millennium Development Goals (MDGs) for sanitation

3.1_MDG targets and policies

Improved sanitation was adopted by the United Nations as the seventh Millennium Development Goal (MDG), which addresses environmental sustainability, with a further target (no.10) to "halve by 2015 the proportion of people without sustainable access to safe drinking water and basic sanitation".

The UN Millennium Task Force produced a report on achieving the goals for water and sanitation in 2005 (UN Millennium Project).[6] Progress towards the targets is monitored by the Joint Monitoring Programme (JMP) of the World Health Organization (WHO) and the United Nations Children's Fund (UNICEF)).[7] It is also the subject of reports every three years, which are entitled the World Water Development Reports (WWDR). [8]

Since then, the original estimates of the improvements needed to achieve the MDGs have been updated. The JMP now estimates that nearly 1.5 billion people will need to be given access to improved water and sanitation to meet the targets in 2015.

Table 1:
Millions of people needing access between 2005 and 2015 for MDG targets

Region	Water	Sanitation
Northern Africa	33	33
Sub-Saharan Africa	288	345
Latin America and Caribbean	80	104
East Asia	184	288
South Asia	247	508
South East Asia	98	102
West Asia	48	56
Oceania	4	3
CIS (former Soviet Union)	5	18
All developing regions	**1,002**	**1,463**

Source: JMP 2006 p.40 (see Annex). Note: regional figures do not sum precisely to overall totals in original.

The numbers needing improved sanitation are greatest in rural areas, especially in South and East Asia, and the existing standards are also lower in rural areas: in 2004 only 33% of the rural population of developing countries had access to improved sanitation, compared with 73% of the urban population. [9]

The MDGs have undoubtedly helped attract publicity and policy attention to the need for developing water and sanitation in developing countries, but in respect of sanitation there are a number of serious limitations:
— the targets do not give sufficient weight to the urgent public health reasons for sewerage
— the MDGs do not recognise the very specific importance of sewerage systems in cities
— too much emphasis is given to misleading assumptions about affordability.

The Task Force and the JMP have introduced modifications to the definitions of the MDG. These modifications emphasise that solutions that cost less than sewers are both acceptable and preferable.

3.1.1_What is "improved"?

Although the MDG refers to "safe" drinking water and sanitation, the JMP measures progress, according to the percentage of people using "improved" facilities. The JMP defines "improved" sanitation facilities as those which "are more likely to prevent human contact with human excreta than unimproved facilities", and lists these as including any of: "flush or pour-flush to a piped sewer system, septic tank, or pit latrine; ventilated, improved pit latrine (pit latrine with slab or composting toilet)" but only if these facilities "are not shared or are not public". [10]

This means that urban households can be counted as having "improved'"sanitation, even without a sewer connection. It also means that the health benefits of achieving the MDG on sanitation are much reduced. Even

if the MDGs are met, it has been estimated that 76 million people will die by 2020 of preventable water-related diseases. [11]

3.1.2_What is "sustainable"?

The UN task force has also refined the definition of safe sanitation as follows: "the lowest-cost option for securing sustainable access to safe, hygienic, and convenient facilities and services for excreta and sullage disposal that provide privacy and dignity, while at the same time ensuring a clean and healthful living environment both at home and in the neighbourhood of users." [12]

The most striking feature of this definition is that it introduces "lowest cost" as part of the target itself. Sewers are not ruled out, but they are clearly not the "lowest cost" solution.

It also explains that "sustainable" in this definition, includes the economic sustainability of the service, which is defined as requiring: "credible arrangements to ensure a regular and reliable flow of adequate performance-determining resources – human, financial, institutional, and technical know-how, among others – needed to ensure proper functioning and satisfactory operation and maintenance of service infrastructure." [13]

While this is an important aspiration, it also makes public improvements, such as sewers, look even more costly.

3.1.3_The limitations of the MDG definitions: no sewers necessary

The MDG definition of "improved" sanitation does not require household connection to sewerage. This makes a significant difference to the assessment of the problem, and of the extent to which the MDGs indicate a solution, especially in cities. For example, South East Asia is considered "on track" for meeting the MDG sanitation goal, despite only 9% of urban households having a sewerage connection in 2004 — far lower than any other region. And at a country level, Pakistan is considered "on track" to meet its overall MDG sanitation goals, and to have increased the proportion of its urban population with improved sanitation from around 80% in 1990 to over 90% by 2004. This is despite the fact that over the same period, the urban percentage with sewerage connections actually fell, from around 45% to under 40%.[14]

The following table shows the gap between the MDG definitions and actual sewerage connections for urban populations. In 2004, 73% of the urban population in developing countries had access to improved sanitation, but only 42% had sewerage connections. The gaps were especially wide in Sub-Saharan Africa, South Asia and South East Asia. By contrast, in the developed countries of Western Asia (roughly the Middle East) and the former Soviet Union the level of sewerage connections are over 80%.

Table 2:
Urban population with
(a) access to "improved" sanitation
(b) sewer connections 2004

Region	Urban population (billions)	% with improved sanitation	% with sewer connection
Sub-Saharan Africa	0.27	53	19
East Asia	0.58	69	50
South Asia	0.46	63	24
South East Asia	0.24	81	9
Latin America and Caribbean	0.43	86	62
Oceania	0.02	81	32
Northern Africa	0.08	91	73
Western Asia	0.13	96	83
CIS (former Soviet Union)	0.18	92	82
Developed countries	0.76	100	93
World total	**3.11**	**80**	**56**

Source: JMP online data (see Annex)

These modifications and policies fail to give sufficient weight to the enormous public health benefits of sewerage connections, especially in cities.

4_Death, sewers and cities

"The obvious benefits to poor people of increased provision of sewerage facilities should serve as the mandate for greater investment by all levels of government and civil society in tackling one of the greatest scourges to communities in developing countries — infectious diarrhoea due to poor sanitation."
David Durrheim, writing in the Lancet, 10 November 2007. [15]

4.1_Cholera and diarrhoea

Cholera and diarrhoeal diseases, both transmitted through contaminated food and water, are the major health problems in the absence of sanitation. Outbreaks of cholera are most likely in countries with high infant mortality rates which, in turn, are strongly linked to diarrhoeal diseases. The common factor is the absence of adequate sanitation systems.[16]

Cholera epidemics in the 19th century led to the creation of sewerage systems in London and New York, and subsequently the rest of Europe and north America. Cholera epidemics no longer affect London and New York, but they continue to be major killers in developing countries. In 2006 the World Health Organization (WHO) recorded 236,896 cases of cholera with 6,311 deaths in 52 countries. This was a 79% increase in cases since 2005, and was a return to the levels of the 1990s.[17]

The sanitary revolution brought about through sewerage systems could curb cholera in the south as it has in north. According to a global medical review: "The longterm prevention of cholera will require improved water and sanitation facilities, but these improvements are not happening rapidly in most regions where cholera is prevalent."[18]

Diarrhoeal diseases, including dysentery, continue to kill around two million children a year in low and middle income countries. The incidence of diarrhoeal diseases has not decreased significantly in recent decades. [19 20]

There have been great advances and efforts made to reduce child deaths from diarrhoea by improved healthcare, but their impact has been much lower than hoped for. In the 1980s it was estimated that two thirds of deaths from diarrhoea could be avoided if all children suffering from diarrhoeal diseases were treated with water containing a sugar/ salt solution – known as oral rehydration therapy (ORT). The WHO and the UN Childrens' Fund (UNICEF) led a major programme of training and the production of suitable kits. However by 2003, still only about 40% of children were being treated with ORT. [21]

This emphasises the importance of public health measures. A recent WHO editorial estimated that over 9% of the global disease burden could be prevented by improved water supply, sanitation and hygiene, with the greatest impact coming from reductions in diarrhoeal disease. "The slow progress in extending basic services leaves a billion people waiting in line for services to reach them."[22]

4.2_The impact on children

4.2.1_Infant mortality and sewers

The greatest impact of inadequate sanitation and sewerage is on children. More than 10 million children under the age of five years die each year, most from preventable causes. Three hundred and sixteen out of every 1,000 children die before they are five. Almost all these deaths are in poor countries: three quarters of them are in Sub-Saharan Africa and South Asia. Diarrhoea and pneumonia are the biggest two killers, each responsible for over two million deaths each year.

Table 3:
Causes of death of children under five, globally

	Millions of child deaths, annually
Neonatal	3.9
Pneumonia	2.0
Diarrhoea	1.9
Malaria	0.8
Measles	0.4
HIV/Aids	0.3
Injuries	0.3
Other	1.0
Total	10.6

Source: Bryce et al. 2005 [23]

The risk of dying from these diseases is strongly increased by the absence of water and sanitation: "Unhygienic and unsafe environments place children at risk of death." [24] Simply because of its effectiveness in curbing diarrhoeal diseases, universal water and sanitation provision could save 326,000 infant lives per year. This is the equivalent of eliminating all infant deaths from AIDS.[25]

Table 4:
Under fives' deaths that could be prevented by universal coverage of most effective preventative interventions

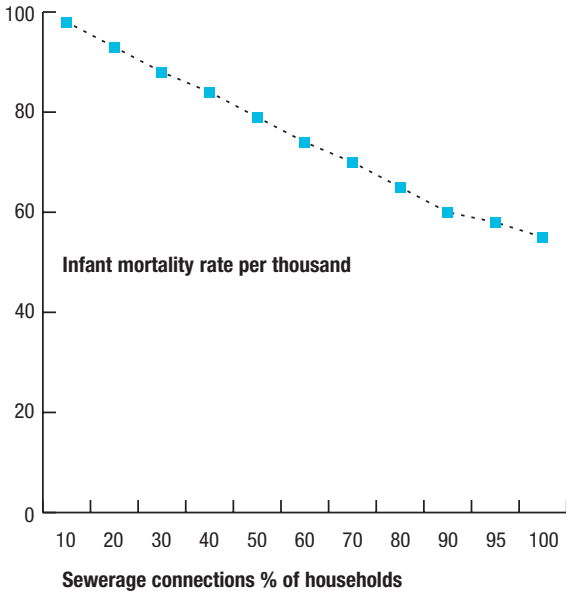
	Number of under fives' deaths preventable
Breast-feeding	1,301,000
Insecticide-treated materials	691,000
Complementary feeding	587,000
Zinc	459,000
Clean delivery	411,000
Hib vaccine	403,000
Water, sanitation, hygiene	326,000

Source: Jones et al. 2003 [26]

A World Bank study of 92 major cities demonstrated the clear relationship between sewerage connections and child mortality holding other factors, such as income, constant.[27] As the household sewerage connection increases, the infant mortality rate drops. If the level of sewerage connection is as low as 15%, (this is the average for most African countries), then infant mortality is 95 per 1,000. If sewerage connections rise to 80%, infant mortality falls to 65 per 1,000.

These massive health gains from sewers in cities have been demonstrated in the city of Salvador, Brazil, where diarrhoeal diseases fell by over 20% as a result of installing sewers (see Section 5.5.2).

Chart A:
Infant mortality and sewerage connections



Source: Shi 2000 Table 4. [28]

4.2.2_Children's growth and education

A lack of sewers not only leads to more infant deaths through higher rates of diarrhoeal disease. The higher rates of disease also cause long term damage to the physical growth and the educational progress of children who survive. Children in homes without sewerage and water connections have more episodes of diarrhoea. This damage to their health stunts their growth. Diarrhoea in childhood is also clearly linked to lower scores in non-verbal intelligence tests and worse performance at school.

A study in Peru [29] demonstrated these remorseless links between sewerage systems, disease and disability. Children in households without sewers had a 54% higher rate of diarrhoeal disease. Children in households without a sewage connection were 0·9 cm shorter at two years of age than children from households with sewerage connections.

Toilets alone, without sewerage connections, made much less difference: by the age of two, the children in these households had the same rate of diarrhoeal diseases as those with no latrine/toilet at all, and were not significantly taller.

Sewerage connections also make a greater difference than a piped water connection alone. Children in houses with piped water, but no sewerage connection, were shorter than those in households with sewerage connection as well as piped water. [30]

4.3_The need for sewers in cities

There is a need for sanitation in all areas, rural and urban and the benefits of sewerage systems apply in all human settlements, even at village level. The needs of rural populations must be met by public policies, supported by aid, as much as the needs of urban populations. However it is urban populations who suffer most without sewerage systems. There are three features which make urban sewerage systems of particular importance:

— urban populations are growing fast
— a significant proportion of urban dwellings are in slums, where the health problems of diarrhoeal diseases are most acute
— the safe collection and disposal of human faeces is much harder in densely populated areas which do not have easy access to countryside.

Programmes to improve sanitation in developing countries include a range of initiatives. Many are concerned with the creation of toilet facilities, which are an integral part of a comprehensive sanitation system. The disposal of faeces also has to be addressed, and in a rural context this may involve various forms of septic tank, for example. Hygienic practices are also necessary in order to obtain the health benefits of improved sanitation, for example hand-washing after defecation. All of these initiatives are important and valuable.

But in an urban context, the benefits of toilets and hygienic practices are much more limited without a sewerage system to ensure safe disposal of excreta.[31] Attempting to dispose of human waste without sewers, through the use of soak-pits or septic tanks, does not remove the waste from the urban environment. These solutions do not provide the same health benefits as sewers. A survey in Pakistan found that infants in households with soak-pits were 60% more likely to die than those with toilets connected to sewers.[32] Household toilets without a sewerage connection may actually increase the contamination of the neighbourhood, and thus endanger other households. [33] In rural areas it may be feasible to recycle excreta as a fertiliser on fields, but this becomes uneconomic as cities grow and absorb farming land and it is common for water borne diseases, such as typhoid, to become more prevalent in these conditions.[34] However

a household with a sewerage connection still has a higher risk of disease if the streets are contaminated with sewage from other households which are not connected. [35] Even the disposal of wastewater from household activities such as washing and laundry – known as "grey water" – "is a major problem in low income settlements without sewerage and represents a significant health and environmental threat". [36]

As the UN's World Water Development Report (WWDR) 2006 states:

"While household solutions may be sufficient in a rural environment or in a dispersed settlement, they would be woefully inadequate in an urban area, especially in urban slum areas or in congested urban areas and megacities. For such situations, we would need to go beyond access at the household level to provide proper collection systems, such as an appropriate form of sewerage, together with facilities for treatment and disposal of the collected sewage." [37]

4.3.1_Case study – Indonesia

The need for sewers in cities is well illustrated by the example of Indonesia. [38]

The great majority of people in Indonesian cities live without a sewerage connection. In the capital city, Jakarta, which has a population of 12 million people, only 1% of houses are connected to a sewer.

Around 12% of the urban population have no access to latrines, so they defecate outdoors. Some of the houses with latrines empty their contents directly into streams or rivers. The majority, around 65% of houses in urban areas, use septic tanks. In Jakarta alone, there are more than one million septic tanks.

More than 60% of homes have septic tanks that are less than 10 metres apart from their wells and they are often too close to their neighbour's well. Many tanks leak too. Some are more like pits, because the base of the tank is not sealed and some have walls made of ordinary bricks or are too small. Some have inlet pipes that are not functioning properly.

The contents of these septic tanks are often dumped by sewage trucks straight into rivers.

Many urban people still use river water for washing and bathing and, collectively, these millions of septic tanks have polluted 70% of the groundwater in cities with bacteria. Yet half of city dwellers use this groundwater for their daily needs.

4.3.2_The ancient South Asian tradition of urban sewers

Some argue that sewers and wastewater treatment plants are an inappropriate northern technology, at odds with the environment and traditional wisdom. A paper published by the German aid agency GTZ in 2006, for example, argued that end-of-pipe sanitation systems are "expensive to build, operate and maintain, and out of step with traditional wastewater management philosophy", which was based on the principle of re-use and recycling of human waste. [39]

It is important to respect and use local traditions and knowledge in all countries, but this is not a reason for avoiding the development of sewerage systems. In urban environments, sewers are the traditional technology – a technology that was first developed in the ancient cities of South Asia 4,000 years ago. The first urban sewerage systems were built around 2,000 BC by the inhabitants of the great cities of the Indus Valley civilisation at Mohenjo-Daro (now in Pakistan).

They installed universal systems: almost every house was connected. "Wastewater was conveyed in baked clay conduits to covered gutters, then through canals dug under the streets and covered with bricks,

and finally to larger collectors. Settling tanks existed in this network to prevent clogging". The main sewer was 1.5 metres deep.[40]

Other ancient urban civilisations also used sewers. In Ancient Rome, there was even a shrine to a goddess of sewers, Cloacina. [41]

4.3.3_Sewers, slums and condominial sewerage

A large part of the urban population in developing countries lives in informal settlements in slum areas. Here, the health benefits of sewerage may be twice as high as in other urban settlements, because of the combination of living conditions and poverty. [42]

Therefore, some major initiatives have focused upon improving conditions for slum dwellers. Here are some examples:

In the slums of Indore City, India, a sewerage network was constructed in the roads and side paths of city slums, paving the streets and redeveloping the riversides. This was funded by the public authorities, and supported by aid from the UK. Residents were given official long-term land leases by the public authorities, effectively legalising their tenure. [43]

The Orangi pilot project (OPP), in Karachi, Pakistan, was created by a community organisation who planned and developed a sewerage network throughout the area. It was constructed by paving the lanes over sewers, following natural drainage channels. It was built using local labour and micro finance. The municipal authority built large mains sewers in the settlements to support the development. The same principles have been applied in other towns and cities in Pakistan, with investments financed by the Government and development banks. The project has successfully campaigned for the principles of this approach to be adopted by the Karachi Water and Sewerage Board, as the basis for developing sewers throughout the city, including the slums: "OPP's proposal for sewage disposal for Karachi is now the KWSB's [Karachi Water and Sewerage Board] plan for the city costing Rs.8.85 billion (about US$121 million). The plan has been approved by the provincial and federal government for its financing." [44]

Public authorities in Brazil developed "condominial" sewerage systems as a cheaper method for providing sewerage, using narrower pipes installed at shallower depths under back alleys or pavements, rather than under streets. Condominial systems, or simplified sewerage, are not an alternative to sewers – they are sewers, built using cheaper construction techniques. The system has been adopted by some public authorities as a standard. For example, the sewerage board of Brasilia, the capital city, use condominial systems throughout the city, not just for poor areas. However the installation of condominial sewers requires skilled workers and a "lack of trained engineers is a major constraint to the implementation of condominial sewerage.".[45]

4.4_A new target for urban sewer connections

Because of the above factors, the MDGs should be revised so that the target for urban sanitation, at least, is specifically for household sewerage connections – not merely "improved" sanitation. It would then read:

"To halve by 2015 the proportion of the urban population without household connections to a sewerage system."

The following table illustrates the number of people in cities in developing countries needing household connections to sewers, in order to achieve this goal. It is based on JMP data for urban sewerage connections, and the UN urban population forecasts for 2015. The JMP data on household connections to sewers

is not certain enough for exact conclusions, but the results can be used to indicate the differences between the existing and proposed goals.

The total figure is higher than the comparable number in the existing MDG target for urban improved sanitation. The regional distribution also differs from the MDG targets for "improved" sanitation, with a much higher concentration of needs in East, South and South East Asia. North Africa and West Asia are already close to the level of high income countries.

The target would require the levels of urban household sewerage connections in these regions to rise from an average of 41% in 2004 to an average of 71% in 2015. Based upon World Bank estimates measuring the relation between sewerage connections and infant mortality (see Table 4), this could be expected to reduce infant mortality in relevant urban areas from about 84 children per thousand to about 70 per thousand. Moreover, the needs are highly concentrated in relatively few countries.

This target is quite feasible. For all regions, including South East Asia, which requires the greatest leap, it is less demanding than the achievement in Salvador, Brazil, which moved sewerage connections from 26% to 80% in eight years.

Table 5:
Millions needing connections to halve proportion of urban population without sewerage connection by 2015

	Millions		%
	Numbers of people needing connection to achieve target	2004 % urban household sewerage connection	2015 % urban household sewerage connection after achieving target
Northern Africa	46	73	87
Sub-Saharan Africa	179	19	60
Latin America and Caribbean	146	62	81
East Asia	273	50	75
South Asia	277	24	62
South East Asia	157	9	55
West Asia	50	83	92
Oceania	1	32	66
Total above	**1,141**	**41**	**71**

Source: calculated from JMP data and UN ESA population data [46]
(see Annex for more details)

The next table shows that half of all the new sewerage connections needed to meet this target are in just four countries: India, China, Indonesia, and Brazil. Three-quarters of all the connections needed are in just 20 countries.

This concentration helps make the discussions of needs and affordability concrete, instead of an abstract debate about billions of people in unspecified places, and the billions of dollars involved. Some of the countries at the top of the list are there because of their size and rapid growth and urbanisation (China, India). Some are included mainly because of an existing large urban population (eg Brazil). Some are included mainly because of a very low level of sewerage connection (eg Indonesia and the Philippines); and some because of very high levels of forecast urban population growth coupled with low levels of sewerage connection (eg Nigeria, Bangladesh).

Table 6:
The 20 countries needing most urban sewerage connections

	Millions	%	%
	Numbers of people needing connection to achieve target (millions)	2004 % urban household sewerage connection	2015 % urban household sewerage connection after achieving target
China	251	50	75
India	184	25	63
Indonesia	73	2	51
Brazil	60	53	77
Nigeria	43	23	62
Philippines	34	7	54
Pakistan	32	40	70
Bangladesh	27	7	54
Iran	25	19	60
Democratic Republic of Congo	15	4	52
Vietnam	14	14	57
Argentina	13	48	74
Thailand	12	0	50
Sudan	11	1	51
Egypt	11	68	84
Venezuela	10	61	81
Ethiopia	10	2	51
Malaysia	10	41	71
Myanmar	9	10	55
Korea Rep	9	65	83
Total of top 4 (China, India, Indonesia, Brazil)	**568**		
Total of 20 countries with greatest needs	**851**		
Total connections needed in all developing countries*	**1,141**		

*from Table 5

Source: calculated from JMP data and UN ESA population data [47]

(see Annex for more details)

5_The need for public finance

5.1_Cost recovery and the private sector

There are many who still believe that the necessary investment in water and sanitation should come through the private sector investing in commercially viable operations. For most of the 1990s, and up to 2003, this was the mainstream view of the major donors and development banks. The World Bank in particular promoted the private sector as the key to delivering water and sanitation.

The main policy advice of donors and development banks emphasised three key policy positions:
— the insistence on the need to finance developments through cost recovery from users
— the preference for a central role for the private sector
— the assumption that sewer systems were too expensive and so unaffordable.

For example, the UN World Water Development Report (WWDR) 2006 report states:
"Population growth and burgeoning water demand have convinced most policymakers that the cost of water system development will increasingly have to be met by users, especially if the Millennium Development Goals are to be achieved. Meeting the financial challenge of water supply means the involvement of all stakeholders, with funds from governments, financial markets, international aid and users. However, with private sector participation – ranging from small water vendors to large private utilities – projected to increase in the next decades, the issue of pricing is critical, not only to improve access and quality of service and discourage theft and wasteful use, but to ensure affordability and fairness to all customers." [48]

The UNWP Task Force report even suggests that by choosing to use the private sector, as the most fundamental choice, this then determines whether sewers are appropriate:

"The use of self-provision, informal provision, public provision, or private-sector provision determines, in part, the scale of service. This, in turn, determines what type of infrastructure or technological option would be appropriate. Thus, sewerage is not a technology of choice for private provision." [49]

The Organisation for Economic Co-operation and Development (OECD) is currently contributing to the process by conducting three large studies on water and sanitation finance. One study is on pricing and cost recovery; one focuses upon the role of the private sector; and the third is researching financial strategies to incorporate the other two pillars. Angel Gurria, its general secretary, told an OECD forum in 2007 that, although there may be a temporary need for some use of public finance:

"The first requirement is to make better use of market mechanisms, both to ensure the most efficient use of water supplies and to help finance water infrastructure to encourage greater supply. This means pricing water so that there is full cost recovery and capacity for reinvestment. … True pricing of water also provides an incentive for the development of new technologies and for greater participation by private investors in helping to build and operate water supply systems." [50]

The same ideology and the same approach recur in many other policy documents. One example is the African Development Bank's (AfDB) current strategy document for Nigeria, whose cities have the greatest need in Africa for sewerage connections. Previous attempts at water privatisation were rejected by companies as insufficiently profitable. Nevertheless, the AfDB repeatedly refers to the need to develop policies which attract the private sector. It:

"foresees the implementation of interventions that will contribute to a more conducive environment for private sector activity through improved water supply and sanitation,

power supply and enhanced road transport and mobility..... Priority will be given to projects that will attract public and private participation and lead to immediate capital investments. ..... Support activities will focus on preparatory activities to make a project attractive (short term studies, execution studies, Public Private Partnership, tender documents, etc.). ...Private sector participation (PSP) in the water sector has great potential in several areas of African Water Facility (AWF) interventions. The AWF would provide the necessary support to attract private sector participation, whenever possible, in line with the Country policy and regulatory framework."[51]

The problem extends beyond the operation of water supply and sewerage. Donors have encouraged the development of public toilets by local groups on a private enterprise basis. But these commercial ventures create similar problems of affordability and service delivery. The Wateraid representative in India has stated that: "Public toilets are being viewed as profitable sub contracted works and are being increasingly contracted out resulting in both unaffordable and badly maintained infrastructure for the urban poor. .... The trend to privatise and contract out public infrastructure in slums and even in mixed areas (commercial and slums), needs to be curtailed.".[52] In Ghana, the policy of contracting out the management of public toilets to "community businesses" led to local political elites creating "front" businesses to run these lucrative contracts, as a prime source of funding which they would not easily give up – thus creating an obstacle to developing better services.[53]

This emphasis on the private sector and cost recovery is contrary to the experience of high income countries, all of which developed sewerage systems using public finance. It ignores the failure of privatisation in the south to deliver any significant investment; and the fact that successful extensions of sewerage systems in the south also use public finance. The current policy advice is in itself an obstacle to the development of sewerage and sanitation in the south, because it directs aid and government efforts into developing schemes which will not deliver the investment needed for sanitation.

5.2_The problems of cost recovery

Insisting on full cost recovery means that sanitation programmes are only worth doing if people are willing and able to pay the full cost themselves. There are two flaws in this approach.

Firstly, the benefits of sewerage connections are public. The improvements in health and the environment are benefits to the community as a whole, not just the households connected, and so should be financed collectively. The UN task force report notes that many households are reluctant to pay for the health benefits of sanitation: "among the reasons that people invest in improved [sanitation] services, health does not figure particularly prominently". But, as they also note, this was exactly the same in the countries of the north in the 19th century: the citizens of Boston, Massachusetts, in 1850 were also: "unable or unwilling to take on personal responsibility to conduct their lives in accord with recommended sanitary principles". [54]

The second problem with user charges is affordability. The poorest, who usually are in greatest need of connections, will be least likely to afford them. An insistence on cost recovery from users of the system becomes an obstacle to achieving improvements in sanitation: "If international donors wish to pursue a policy of universal access, they should acknowledge that the costs of improved services are far beyond the reach of many households."[55] Even low levels of connection charges act as deterrents for poor households, who suffer most from the disease

consequences of poor sanitation, because of unequal resources. The death rate within the same city varies according to the income of residents: a study found that infant mortality rates in seven different areas of Karachi varied from 33 to 209 per 1000 live births.[56]

5.3_The solution of public finance

The core reasons are listed above as to why, in all developed countries, the idea of financing sanitation through cost recovery from users was abandoned. The sewerage systems in Europe, the USA and Japan were not developed through full cost recovery from users – they were paid for by distributing the costs amongst the public, using taxation and cross-subsidy. Connection was not a matter of individual choice, but required as a matter of public policy: "Public financing of sanitation infrastructure was seen as the only option for ensuring investment adequate to protect public health." [57]

The example of Toronto (see 5.3.1) shows how little progress was made in extending sewerage connections in the 19th century by waiting for private demand from individual householders. The system only grew significantly when the cost of connections was publicly financed and the sewer connections were made compulsory.

France was no exception, even though private water companies have continued to operate there since the 19th century. The development of sewers was financed through local taxation, subsidies from central government taxation, and cross-subsidies through special taxes at regional river basin level. Sewerage was a matter of public health policy and so:

"Connection to a main sewer was compulsory for households, and therefore it was covered by local taxes (as in Germany) … It required an intense effort, supported by government subsidies, to catch up with the rapid urbanisation and industrialisation process that took place after 1945 … investment in sewage treatment led to the creation of the Agences de l'Eau … levying water pollution and abstraction charges from water bills at river basin level, through a mutualisation of investment needs." [58]

Japan expanded sewerage coverage from 8% in 1965 to 69% in 2006 using public finance, public operations and domestic public-public partnerships (PUPs), mainly technical and financial assistance provided by a central governmental agency to local authorities. Sewerage coverage is projected to reach 72% in 2007.[59]

The problems of affordability and people's reluctance to pay are addressed when a redistribution through taxation is adopted. This redistribution is key, as individuals contribute what they can afford with the wealthy contributing the most. By contrast, policies based on full cost recovery from users are more likely to favour the rich. The same principle is applied in Europe at a transnational level. The EU raises taxes across all the countries of Europe to support the cost of water and sanitation improvements in the poorer countries. This cost is the equivalent of €20 per person per year. [60]

However, the key donor publications avoid mentioning public finance. The UN Task Force report, for example, explained clearly that households cannot be expected to pay for sanitation, but urged public authorities to "broaden their focus toward an emphasis on influencing citizen/consumer behaviour, as well as toward engaging community-level institutions in planning appropriate interventions". [61]

5.3.1 Case study – Toronto

Before the 1870s, the city of Toronto was mainly dependent on private contractors for water supply. Sewers were not automatically laid in new streets. Instead, householders had to petition the local council for connections, and then pay the cost themselves. Neither water nor sewerage connections grew fast enough and deaths from water-borne diseases, especially typhoid, were common.

In 1872 the *Toronto Globe* newspaper wrote:

"We have neither the quantity nor the quality [of water] necessary to secure the health and comfort of the citizens, and we are equally destitute of what is indispensable for the safety of our houses from fire; the flushing of our common sewer; and the watering and cleaning of our streets. No city of the size and pretensions of Toronto can be mentioned where the sanitary arrangements are so inadequate, and where consequently preventable disease is so common." [62]

Over the next five years, despite an economic recession, the city council not only municipalised the water service, it authorised the city engineer to install new sewers for public health reasons, whether householders asked for it or not, financed by the municipality. The benefits were immense:

"This unprecedented power…led to tremendous sewer development in the 1880s…..The effects of the typhoid fever epidemic were greatly reduced by the presence of a complete, clean sewage system. At the beginning of the 20th century, most of the streets in the city had been serviced and the operational costs were met through direct taxation." [63]

The same approach was taken up across the province of Ontario, where public water systems were growing rapidly by the turn of the century. The Public Health Act 1912 enshrined the Toronto principles of public finance and compulsory connection, by giving the provincial board of health the right not only to decide when a water or sewerage system was necessary "in the interest of the public health", but also to require local councils to finance it. [64]

The water and sanitation system of Toronto has continued to be publicly run and financed. As a proportion of the household incomes of Toronto, there is a long-term downward trend. [65]

Chart B: The cost of water and sanitation in Toronto (1935-95)

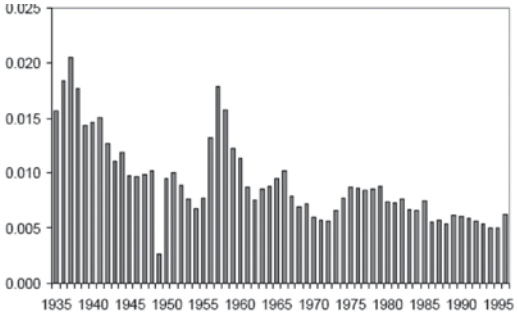


Figure 9. Ratio of total water and sewer expenditures (capital and operating) to total income
Source: Pharasi and Kennedy 2002[66]

5.4_The illusion of private sector investment

The idea that the private sector can or will invest significant money in developing sanitation or sewerage systems is equally misleading. It is contradicted by the evidence on investment in sanitation in developed countries; by the evidence of private sector failure to invest in infrastructure in general in developing countries; and by the evidence of the lack of private investment in sanitation in developing countries.

In developed countries, the private sector played almost no role in financing the sanitation systems. The constant donor advice to involve the private sector is thus contrary to all the experience of successful development of sanitation and sewerage.

In developing countries, despite all the encouragement and support from donors and development banks, the private sector has contributed only a trivial amount to investment in urban infrastructure in the last 20 years. A key problem has been that the private sector has to make profits that cover the cost of its capital and the associated risks. It is therefore selective about the countries it chooses to operate in and only one third of developing countries have received any kind of private investment in water and sanitation. Therefore governments have frequently had to revise contracts and provide guarantees, creating fiscal risks for governments in the shape of unexpected liabilities. As a result, private companies have been unable to get the necessary rate of return, due at least in part to public resistance to paying the prices required to deliver this rate of return. Therefore governments have retreated, even from those areas where they have invested. Even in middle income countries where the private sector presence has been greater, the private sector investment is very small in comparison to investment by the state. In South Africa, for example, total private investment in urban infrastructure over the entire 20 year period "has been quite insignificant … much less than 1% of one year's local government spending." [67]

A World Bank research paper in 2006, reviewing actual private investment in a 22 year period from 1983 to 2004, concluded bluntly that: "PPI [private participation in infrastructure] has disappointed – playing a far less significant role in financing infrastructure in cities than was hoped for, and which might be expected given the attention it has received and continues to receive in strategies to mobilize financing for infrastructure…

"...PPI is inherently limited in scope for financing urban infrastructure for the wide array of non-commercial infrastructure services cities need. Even for commercial services like water supply, subsidies are prevalent all over the world…Local governments need good sources of public finance to fund those services, and some form of government borrowing is needed for major investments in these areas to avoid inter-generational inequities."

This failure is confirmed by reviewing the actual cases of private sector involvement in

sanitation in developing countries. The record of the private sector in water was described in the earlier World Development Movement's report called Pipe Dreams." [68] This section does not repeat the material in that report, but supplements it with details specific to sewerage connections and sanitation policies.

5.4.1_Asia

In Asia, there have been few attempts to use the private sector to finance investment in water supply and sanitation. Asia needs about one billion sewerage connections to achieve 80% urban coverage, but the great majority of cities have received no sewerage extensions from the international or local private sector. There have been private water concessions in the capital cities of Indonesia and the Philippines; Malaysia set up a private concession for developing sewerage; and a project in Tamil Nadu, India, used a private company as a construction contractor in building a sewerage system. In China, as of 2002, there were a number of private Bank of Thailand (BOT) concessions for waste water treatment plants, but no private concessions for extending sewerage connections.[69]

This includes only two cases where the private sector actually invested in sewerage coverage (Malaysia and Philippines). However, one example was later nationalised and the other has delivered very little.

In Jakarta, where only 1% of the population is connected to a sewer, the concessions do not cover sanitation at all. They have thus contributed nothing to improved sanitation.

In Manila, both water supply and sanitation were privatised in January 1997 to two private groupings: a Lyonnaise des Eaux-led consortium to operate Maynilad, involving the multinational Suez group, in the western zone of the city; and Manila Water, led by the British company United Utilities in the eastern zone. Both concessions included responsibility for water and sanitation, including targets for new sanitation concessions. The regulator, the Manila Water Company (MWSS-RO), assessed that Maynilad increased sewerage coverage from pre-privatisation levels of 7% to 11% in 2001 (compared to a target of 16% for the same year) and 10% in 2002. Manila Water achieved coverage of 3% in 2001 (meeting its target of 3% for the same year) and 3% in 2002, from pre-privatisation levels of 7%. [70] A Maynilad executive admitted that the company had fallen short in achieving sewerage and sanitation targets. [71]

According to an Asian Development Bank (ADB) report in 2007, less than 4% of Manila's total population is connected to the sewer network: "It is estimated that there are more than one million septic tanks in Manila. However, sludge treatment and disposal facilities are rare, resulting in indiscriminate disposal of untreated or poorly treated effluent into the Pasig River. Some 10 million people discharge untreated waste into the Pasig, which, combined with the 35 tons of solid waste also deposited in it annually by squatters living in makeshift shelters on the river bank, makes it one of the world's most polluted rivers, with human waste accounting for 70% of the pollution load." The limits of the Millennium Development Goal definitions are also highlighted by the fact that the Philippines is regarded as on-track to meet its target for urban sanitation: in 2004, 80% of the urban population were assessed as having "improved" sanitation facilities, although only 7% had sewerage connections. [72]

In Malaysia, a concession for developing sewerage and sanitation throughout the company was awarded to a private company Indah Water Konsortium, in 1993. The concession was based on the principle of financing investment through consumer charges. However, consumers objected to the tariffs, so its structure was revised, and then

investment needs were found to be higher than anticipated. As a result, the Government had to provide substantial financial support in the form of long term soft loans. In 2000, the Malaysian Government nationalised Indah, thus ending the experiment with private sewerage. [73]

In India, a sewerage project was set up in 2001 to build a sewerage network for the city of Alandur, Tamil Nadu, with a population of 145,000 in 2001. The construction contract was issued to an Indian construction company. However operation was not included, and the company made no contribution to the financing of the project. The project was financed by the public authorities through grants and loans, with advanced consumer contributions expected to provide 20-25% as a kind of equity investment. The household tariff was reduced following consumer complaints, and the Tamil Nadu state government increased its contribution. Despite the fact that Alandur residents were relatively well off, the chair of the municipality commented that: "In Alandur, we were able to raise a substantial amount from the beneficiaries because of their paying capacity. In other areas, this may not work, given the economic conditions of the people. So, the state government has to support such schemes by giving grants". [74]

The works were delayed, and there was confusion over whether the company or the municipality was responsible for maintaining and operating the pumping station element of the project, and there were problems with sewage flooding due to design problems with the pumping station.[75] By 2005, nearly 8,350 of the 23,000 households that had paid for the service in advance were connected, including 500 of the 7,000 slum households, 43% of whom opted for individual sewerage connections. For the poor households that could not afford to pay for the sewerage service, public toilets were provided as an alternative, but families were expected to join a membership register and pay a monthly fee: "when located relatively close to the sewerage network, the toilets are connected to it, otherwise septic tanks are used."[76] There is also a BOT contract for a wastewater treatment plant, which will be financed through a combination of user charges and tax revenues of public authorities.[77]

Table 7:
Asia: private concession contracts covering sanitation

Country	City	Private sector involvement	Sewerage aspect	Results
Philippines	Manila	Concession contracts	Yes, targets	Coverage only 4% after 10 years
Malaysia	National	Concession contract	Sewerage extension	Nationalised in 2000

5.4.2_Africa

The contribution of the private sector to investment in urban sewerage in Africa is limited to five concessions or lease contracts which covered sanitation as well as water.

The two contracts in South Africa, at Nelspruit and Dolphin Coast, were concessions requiring investment in new extensions. In Nelspruit, the company laid 35 kilometres of sewer mains and most residents gained access to waterborne sanitation.[78] The company reported 5,000 new household connections, but no precise figures for sewerage connections. As with water, therefore, despite various problems with finances and public resistance, these are the only two cities in Africa where some new household sewerage connections may have been made by private investment.

It is worth examining the situation of sanitation in three other countries, one where a lease did not cover sanitation; one where it did; and one where the private sector decided that neither water nor sanitation was an attractive commercial proposition.

In Senegal, water distribution was privatised, following World Bank pressure, under a lease contract. Therefore the private company had no responsibility for new investments, which were all made by the state and the World Bank.[79] But responsibility for urban sanitation and sewerage was excluded from the privatisation, and was given to a new government agency, the Office National d'Assainissement (ONAS). According to a World Bank report, the reason was as follows: "It was decided that including the sanitation sector in the responsibilities of the private operator would be too burdensome, given its poor state. However, ONAS was not completely ignored…" [80]

Unrelated to the water privatisation, between 1998 and 2007 the World Bank helped finance new sewerage connections for 212,250 additional people in Senegal. However the current World Bank country assistance strategy for Senegal ignores ONAS completely and forgets that it was not privatised. It refers to the success of privatisation "in water and sanitation".[81] Health problems remain: in 2005 a cholera epidemic killed 1,295 people of 76,881 cases in West Africa, according to the World Health Organization (WHO), more than a third of them in Senegal. In the first 10 months of 2007, there were 12 deaths and 2,231 cases of cholera in the country. [82]

In Cote d'Ivoire, the nationwide water privatisation, which covers sewerage, as well as water, is also a lease contract not a concession. The private company, Les Actionnaires de la Société de Distribution d'Eau de la Côte d'Ivoire (SODECI), owned by the French multinational construction company Bouygues, is thus responsible only for maintenance and renewal, not for new extensions. The concession was awarded without competition in 1960, and renewed in 1987 for a further 20 years: "In these renegotiations, [Bouygues] was not prepared to take on responsibility for investment because the company did not want to take the risk that future revenue would cover debt service requirements." [83] Abidjan, the capital, has a higher level of sewerage connections than most other African cities, but these were financed, not by the multinational company involved (Bouygues), but by World Bank loans and other public finance. The slum areas, such as Yopougon, do not have sewerage connections: "Plans for further large investments to improve the sanitation of Abidjan, including Yopougon, exist but have not yet been implemented."[84] At the end of February 2008, there were problems with the performance of the private company: "A third of Abidjan's inhabitants have had no drinking water for over a month". [85]

Nigeria has the second highest number of under fives' deaths in the world (834,000). The infant mortality rate is 184/1000, worse than Ethiopia (174) or Haiti (125). Two thirds of childhood disease is attributable to inadequate access to safe drinking water. [86] Less than 1% of the population of Lagos, the largest city, with a population of over 11 million, is connected to a sewerage system. [87] Lagos has suffered from a lack of sewerage and the associated health problems for a long time. In the 1920s, colonial administrators decided that modern sewers could not be afforded, even after a series of outbreaks of bubonic plague.. A further proposal to build sewers was later dropped in 1956, because of a lack of capital and opposition from politicians who were benefiting from private waste-removal contractors. [88] After independence, Nigeria's own plan for a sewerage system was also frustrated: "The extraordinary Lagos master plan of 1980… envisaged that within the space of two decades all households would be connected to a water supply and sewerage system…but the programme of works was curtailed by a combination of economic crises, externally imposed structural adjustment policies and the return of military rule"[89]

In 1999 the International Finance Corporation (IFC) made privatisation a condition of a loan for water in Lagos, claiming that investment of $1billion was needed, and that this should be: "largely financed by tariffs generated by the expanded

system." This plan failed when the multinational companies refused to consider investing money. The current plan of the Lagos State Water Company envisages outsourcing of operations, but there is no coherent plan for financing investment.[90] However, another World Bank project for development and governance of Lagos metropolitan area is encouraging higher property taxes, through higher rates and better collection, to support infrastructure: "In most cities, property taxes are a substantial part of general revenues. In Lagos, however, property tax rates have been historically very low." Increasing the yield from this source of revenue, therefore, is critical for Lagos State Government (LASG) to sustain benefits from investments in drainage and solid waste." [91]

Table 8:
Private concession and lease contracts covering sanitation in Africa

Country	Location	Company	MNC involved	Type
Cote d'Ivoire	National	SODECI	Saur	Lease
South Africa	Dolphin Coast	Siza Water	Biwater	Concession
South Africa	Nelspruit	GNUC	Biwater	Concession
Tanzania	Dar es Salaam	City Water	Biwater	Lease (terminated)

5.4.3_Latin America

Privatisation has been most extensive in Latin America, with a significant number of concessions and leases being issued which have included targets for the extension of sewers. Very few achieved these targets. In some cities the levels of sewerage connections are high, but this is due to public investment, not to the private concessions.

In Argentina, the flagship concession in Buenos Aires managed to increase a pre-existing connection level of 58% to only 63% in nine years – around one million connections short of the original target. In the other concessions in Buenos Aires province, the connection rates did not improve. The Salta concession did achieve a significant increase in connection rates, but this was largely due to public finance rather than private investment.

Brazil illustrates the illusions of private sector investment. In the affluent suburb of Limeira, sewerage connection levels reached 80% under public control, even before privatisation. Since then, private companies have claimed to increase this coverage to 100%, but the figures are not credible. In the city of Manaus, sewerage connection was at just 3% when the concession started: by 2005, the company had increased this to just 12%, compared with a target of 31%. This compares badly with the progress in the comparable city of Salvador, which in almost the same time period, under the public sector, increased connection levels to 80%.

In Chile, the high levels of coverage were achieved under public ownership before privatisation took place. In the three cases noted below, the private operators inherited levels of sewerage connection of 86%, 87%, and 97% – more typical of European and North American cities. The coverage in Chile is therefore another tribute to the use of public finance for developing sewers.

In Colombia, there have been significant sewerage extensions in Cartagena, where official levels of coverage are 95%. Once again, however, these extensions have been overwhelmingly financed by public finance from the World Bank and the Government, with the private company contributing little. Also, the damaging impact of connection charges can be seen here too. Around 40,000 homes in a poor neighbourhood remained unconnected to the sewerage network in 2006, which was partly due to the level of connection charges.

The concessions in Bolivia, Ecuador and Peru also fell short of targets by varying amounts.

Table 9:
Water privatisations and sewerage extensions in Latin America

Country	Concession	Company	Performance on sewerage – other issues (and sources)
Argentina	Aguas Argentinas (Buenos Aires)	Suez	In the nine years from 1993 to December 2001 – prior to the breakout of the Argentine crisis – Aguas Argentinas expanded sewerage service coverage from 58% to 63%, compared with the original contractual target of 72%. Aguas Argentinas' failure to reach the original contractual goals meant that by December 2001 more than one million Buenos Aires dwellers had not been connected to the sewerage network.
Argentina	OSBA (Buenos Aires province)	Azurix	In 1999 – when privatisation took place – 47% of the urban population had access to sanitation. By 2005, only 45% of households were connected.
Argentina	AGBA (Buenos Aires province)	Aguas de Bilbao; Urbaser	In July 2006 the contract with AGBA was terminated, claiming that the concessionaire had failed to achieve its targets in terms of investments and expansion of services. Of the 1.8 million inhabitants covered by the AGBA concession, 80% were not connected to sewerage.
Argentina	Aguas de Salta	Latinaguas	Sewerage connections under the Salta concession increased from 54% to 84%, partly thanks to public subsidies directly subsidising low-income consumers.
Bolivia	AISA (La Paz/El Alto)	Suez	AISA increased sewerage connections, but these fell 33% short of its contractual target.
Brazil	Aguas de Limeira	Suez	Sewerage coverage was 80% at the start of the contracts. The company claimed to have reached 100% connections by 2005, but a 2003 report stated that "There was also a small improvement in services expansion, whose rates were already high, and a broad investment in sewage treatment … On the other hand, there are strong suspicions … of manipulation on data about the investments made and the contract goals."
Brazil	Aguas do Amazonas	Agbar	The concession contract emphasised sewerage and sanitation, with 65% of investment expected to be concentrated in this area. From an initial level of 3% in 1999, the company was expected to increase connections to 31% by 2005 and 90% by 2029. However, actual coverage for sewerage in 2005 was only 12%.
Brazil	Aguas de Guariroba	Agbar	Awarded in July 2000, the concession aimed at achieving 50% coverage for sewerage in 10 years and 70% coverage in 30 years (from an initial level of 22%). In 2005, sewerage coverage was 32%. [92]
Brazil	Sanepar	Veolia (minority stake, 1998-2007)	In 1998 SANEPAR achieved 32.67% coverage in sewerage, and in 2005 coverage reached 42.02% (50.95% in urban areas). However in November 2007, urban coverage was said to be only 48.7%. Sanepar president Stênio Jacob wanted to achieve 60% coverage in urban areas by 2010, and said that the only way to meet this target was through state control of the company: "It is important that the state control the company because aggressively trying to make profits would not leave room for making water and sewage access universal, serving small communities or keeping the social and environmental commitment of the company." [93]
Chile	ESSBIO	Thames Water	Under public ownership, Chilean water supply and sanitation company ESSBIO increased sewerage coverage from 69.2% in 1990 to 86.1% in 2000. Thames Water took control of ESSBIO in September 2000, after which ESSBIO increased sewerage coverage by 2.1% in five years, from 86.1% in 2000 to 89% in 2005: ESSBIO failed to meet targets, including targets on expanding the sewerage network. [94]

Country	Concession	Company	Performance on sewerage – other issues (and sources)
Chile	ESVAL	Anglian Water	Under public ownership, Chilean water supply and sanitation company ESVAL increased sewerage coverage from 81.0% in 1990 to 87.4% in 1998. Overall, under private operations, coverage for sewerage increased from 87.4% in 1998 to 91.2% in 2005.
Chile	EMOS/Aguas Andinas	Suez/Agbar	Under public ownership, in 1980 EMOS provided sewerage to 90% of the urban population with the exclusion of informal settlements. Coverage reached 97% in the early 1990s, including poor peri-urban areas. In June 1999, a Suez/Agbar consortium took control of EMOS (then renamed Aguas Andinas): according to Ducci (2007: 142), Aguas Andinas has achieved 98.3% coverage in sewerage.
Colombia	ACUACAR	Agbar	The World Bank (2006) estimates that by 2005 ACUACAR had extended access to sewerage to 95% of the population, 56% in 1994 (ARD, 2005: 63). However, ACUACAR's claimed achievements in terms of extending sanitation coverage from 1995 to 1999, at a growth rate of 5 to 8%, are not remarkable given the scale of external investment ($157.7m). In June 2006, 40,000 buildings in the La Boquilla neighbourhood were not connected yet to the sewerage network. A number of families referred to the high connection costs as the impediment to accessing the service. [95]
Colombia	Monteria	Proactiva/Veolia	In May 2003, Proactiva was criticised for low investment levels and failing to reach contractual targets in the first three years of operations (Lobina and Hall, 2007: 40) [96] Proactiva was reported as halting planned investments due to financial difficulties, "meaning the city may lose 600 million pesos ($202,000) in promised sewerage upgrades." [97]
Ecuador	Interagua	IWL	In July 2007, the regulator fined Interagua for failing to comply with contractual targets for the first five-year period of operations. Interagua was supposed to have reached a total of 55,000 water and sewerage connections during its first five years of operations, but only installed 27,733. In terms of sewerage networks, the utility reached 62% of the goals set out. [98]
Peru	Aguas de Tumbes	Latinaguas	Despite generous support from public funds, Peruvian regulator Sunass reportedly found that in the first year of operations Aguas de Tumbes had failed to extend water supply and sanitation networks and only achieved 5% of the contractually established operational targets. [99]

Source: Lobina and Hall 2007 and others

5.5_Development in the south: public sector and public finance

The continuing importance of public finance for the development of sanitation can be seen in the actual policies being pursued by the four countries which are of the greatest importance for connecting urban populations: Brazil, China, India and Indonesia.

Three of these – Brazil, China, and India – are investing in sanitation, including sewerage connections, using public finance. As a result, Brazil and China are investing enough to achieve the MDGs in full and 80% urban sewerage connections by 2015. India may need further investment, but is actively increasing its tax revenues, which will permit this. The fourth country, Indonesia, has no national programme of investment in sewers using public finance, despite having very healthy government finances, with growing tax revenues. It is being advised by the World Bank to focus on increasing user charges. If it does so, Indonesia will fail to improve its urban sewerage connections to anywhere near the proposed target level.

5.5.1_Brazil

In January 2007 Brazil announced a new four year programme for economic growth, the Programa de Aceleração do Crescimento (PAC), based on investment of $236 billion (504 billion reais) in infrastructure, especially in roads and electricity, but also water, sanitation and housing.[100]

The sanitation investment programme aims to greatly increase the proportion of households connected to sewerage systems. It is half financed by federal and regional state finance, and half by loan finance from the savings funds and pension funds. The total budget of $18.7 billion represents an annual rate of $4.7 billion investment, which is 0.53% of Brazil's gross national income (GNI) – which is sufficient for Brazil to meet its MDG targets in full and the urban sewerage connections target (see below).

The development of sewerage connections in the city of Salvador provide an outstanding illustration of the benefits obtained from expansion of urban sewerage connections.

Table 10: Financing sanitation investment in Brazil 2007-11

	US$ billion
Federal government	5.6
Regional state and municipal budgets and operating surpluses	3.7
Workers' savings fund (FGTS) & federal workers protection fund (FAT)	9.4
TOTAL	18.7

Source: Business News Americas April 27, 2007[101]

5.5.2_Case study – Salvador, Brazil: saving children by building sewers

The experience of the sewerage system in Salvador at the start of the 21st century demonstrates the same lessons evident from the introduction of the sewerage system in London in the mid 19th century. A public system, publicly financed, delivers health benefits, especially to the poorest.

In 1996 the city of Salvador, in Brazil, with a population of 2.5 million, started on a major sanitation programme. Only 26% of the city's households were connected to a safe sewerage system, mainly the upper and middle classes in the oldest part of the city. The primary objective of the new programme was to extend the sewerage system to 80% of households. This involved laying over 2,000 kilometres of new sewers, building 86 pumping stations, and making new connections to 300,000 households. This was completed in eight years, involving 140 construction companies. The total cost of the project was $440m, of which $264m came from a loan by the Inter American Development Bank (IADB). The development of the sewerage system cost about $220 million, half the total project costs. The IADB loan included $20m for maintenance equipment and training. [102]

A major study examined the health of children before and after the extension of the sewerage system. The overall reduction in diarrhoea was 22%, and 43% in the highest risk areas inhabited by the poorest. The effect would have been even greater if the coverage had been improved even further into the poorest areas. The study is the largest ever conducted on a city-wide sewerage programme and its impact on child health. The results are broadly similar to other smaller scale studies which found reductions of 36% and 32%. The study tested for the impact of many other factors, including changes in hygiene behaviour, and the installation of household toilets, but found they had relatively little, or no, effect. Like another study of diarrhoea in North East Brazil, which found that there was no statistically significant benefit associated with having a flush toilet alone[103], the Salvador analysis "also found that an indoor toilet did not explain the reduction in diarrhoea". It was the connection to sewerage which delivered the gains in child health.

The authors of the study concluded: "Our findings contradict those who claim that, 'there appears to be little prospect of further reducing diarrhoea morbidity rates by investing further in sanitation'… Sanitation contributes to many of the Millennium Development Goals, but our results show that urban sanitation, as a highly effective health measure, can no longer be ignored… Because sewerage is mainly external to houses and the fact that it prevents disease transmission in the public domain, public responsibility is to ensure that sewerage is installed. At a typical cost per person of $160, investment in sewerage is too large to be left to cash-strapped municipalities, and needs the involvement of international organisations, and central government and its agencies." [104]

5.5.3_China

The urban sewerage connection rate in China rose from 30% in 1990, to 50% in 2002. [105] Public spending on infrastructure has not only kept pace with the growth of the Chinese economy, it has increased twice as fast: "Since 1995, China's GNI has almost tripled while overall annual municipal infrastructure spending, including roads, has increased six-fold.".[106] The total length of urban sewerage networks increased by nearly 225% between 1991 and 1998, but less than 4% of all the investment in water and sanitation was financed through the private sector.[107]

China is now investing over $10 billion per year (0.4 percent of GNI) and spending another 0.6%of GNI in operating costs in water and sanitation. This combined total of 1% of GNI ($25bn.) is sufficient not only to achieve the MDGs, but also the urban sewerage target (see below). The contribution from development banks and aid has been large in absolute terms but small as a proportion of total cost. Between 1992 and 2013, the World Bank will lend about $7 billion, an average of $0.3 billion per year, which is just over 1% of the current level of China's spending on water and sanitation. [108]

Furthermore, under the 11th Five-Year Wastewater Sector Plan (2006–2010), the Chinese government is putting greater emphasis than in the past on drainage networks, consisting of sewer-only pipelines, combined sewer and storm water drainage. Projected investments in drainage alone amount to a total of RMB 188 billion (US$ 23.81 billion). [109]

China's approach has been favourably compared to that of the World Bank by economist Jeffrey Sachs: "Unlike the Chinese, the Bank has too often forgotten the most basic lessons of development, preferring to lecture the poor and force them to privatise basic infrastructure, rather than to help the poor to invest in infrastructure and other crucial sectors. ….The Bank can regain its relevance only if it becomes practical once again, by returning its focus to financing public investments in priority sectors, just as the Chinese leadership is prepared to do." [110]

5.5.4_India

India is developing new plans for investment in water and sanitation as part of the current five year plan for the economy. Water and sanitation has been given priority in its urban infrastructure programme, and the new plans propose to nearly double the previous finance from central and state governments. The new plans amount to $31.75 billion, about $6.4 billion per year, which is the equivalent of 0.7% of GNI. This could be sufficient to achieve the MDGs and the urban sewerage target. Over 90% of this is to be financed by central and state governments and national financial institutions, with only 8% funded by aid and only 1.5% from the private sector.

Table 11: Financing of water and sanitation plans of India

Financed by	R crore	$ billion	%
Central government	70,000	17.50	55
State governments	35,000	8.75	28
National banks	10,000	2.50	8
Aid	10,000	2.50	8
FDI/private sector	2,025	0.50	1.5
Total	**1,27,025**	**31.75**	**100**

Currency converted at R40=$1

Source: Planning Commission of India [111]

5.5.5_Indonesia

Indonesia has no comparable national programme for water and sanitation.

A World Bank analysis of Indonesia's public finances in 2007 estimated that Indonesia could spend an extra $15 billion per year,

and that there is a particular need to do so in infrastructure spending. This is partly because it has fallen to low levels, and partly because of the refusal of the World Bank to lend further money to public authorities already in arrears – which includes most of the country's water and sewerage authorities. [112]

The report's main suggestion is that Indonesia should charge higher prices to users of water and sanitation. But the lack of a public investment programme is not being compensated for by private sector investment: the World Bank itself shows clearly that the private sector is not investing in infrastructure in Indonesia.

5.5.6_Japan: donor funding and training to support sewerage development

The experience with sanitation in Asia also illustrates the potential for a supportive role by donors.

The Japan Bank for International Cooperation (JBIC) has acquired considerable experience in assisting developing countries to develop sewerage systems.[113] On the basis of this experience, JBIC highlights the importance of raising public finance through central governments, and for donors to provide capacity-building and training, including the use of public-public partnerships. JBIC recommends:

"Since sewerage systems are very expensive and are sometimes not affordable for the majority of residents, financial support of the central government is indispensable. Economic externality of sewerage, the necessity of preserving the water quality of public water bodies, would justify the financial support by the central government."

With regards to capacity development, JBIC recommends the following:

"In order for sewerage systems to work effectively, capacity development in various areas, ie the training of engineers in designing, operation and maintenance of sewage treatment plants; strengthening of the administrative capacity of local government in order to keep book-keeping of the basic data and records on sewer networks and house connections; strengthening of the administrative capacity of the central government in creating regulatory frameworks for house connections, industrial water, aquatic water quality control; and in creating financial support systems for sewerage development, and the environment and sanitation education." [114]

Public-public partnerships (PUPs) have been used to enhance local capacity building in the design and operation of sanitation systems. A twinning arrangement between Tokyo Metropolitan Sewerage Bureau and Beijing Municipal Design and Research Institute was instrumental to the design of the Gabi Dian wastewater treatment plant, but was then extended to include a sewerage component.

"The first-phase of construction work had started in 1990, and Beijing City itself executed the entire work under its direct management. In March 1993, when the work was almost 80% completed, Beijing City requested Tokyo Metropolitan Sewerage Bureau to provide them with training for sewerage operation and management." The training was funded by JBIC.[115]

Furthermore, Osaka and other municipalities have run training courses in sanitation for public authorities in other Asian countries. The sewerage operator in Osaka, Japan, is the municipal department for public works. The municipal department boasts 100% sewerage coverage (ADB, 2004a: 3, 19), and "investments in sewerage and sanitation during 1997–2001 amounted to ¥336.4 billion ($2.71 million)". Osaka Public Works Bureau has offered training programmes in a number of sewerage-related areas to staff from developing countries. Such programmes were

funded by Japan's governmental agency JICA (Japan International Cooperation Agency). The duration of the typical training programme is 90 days and sessions cover the following topics: finance; renovation of combined sewers; sludge treatment; waste water treatment plant design; history of Osaka sewerage works; asset management; electrical equipment and sewers maintenance; water quality management; storm water drainage. From 2003 to 2007, the department trained a total of 51 staff from 29 countries, mostly Asian, including India and China, but also from the Middle East, Africa and Latin America. It should be noted that other Japanese municipal sewerage operators, including Sapporo city, East Hiroshima city and Kitakyusyu, run similar training programmes.[116]

5.6_Taxation needed

As emphasised by JBIC and the experiences detailed above, raising taxes is central to finance public spending on sewerage connections, or other investment in infrastructure and public services: "Small government and low taxes are not the answer for reaching the MDGs."[117]

Higher levels of taxation are associated with higher levels of economic performance: tax revenue as a share of GNI is about 14% in low income countries, 19% in lower-middle income countries, 23% in upper-middle income countries and 38% in high income countries.[118] The most unequal societies have tended to resist proposals for higher taxation, because the rich would have to pay most. This is one reason why developing countries have not made enough public investment in education, health or water and sanitation.[119] Some of the countries with greatest need for urban sewerage connections have very low taxation levels. In 2002, India only raised 9.9% of GNI in taxes, Bangladesh only 7% of GNI.[120]

A combination of economic growth and more active public investment policies can raise taxes enough to make a difference. In China, economic growth is producing a growth in personal incomes, which means that income tax can start to grow; China may be able to collect 4.5% of GNI in income tax by 2010, with total taxes worth over 18% of GNI. This would reflect a similar process in northern countries in the first half of the 20th century, the same period when much of the investment in sewerage systems was made. In those countries: "moving from an elite income tax raising less than 1% of GNI to a mass income tax raising around 4-5% of GNI is exactly the kind of process through which western countries went during the 1914-50 period." [121]

Similar growth in taxable personal incomes is expected in India. [122] The present Indian government is already increasing tax revenue: between 2006 and 2008 tax revenues have increased by around 50%, with special attention to increased taxation of multinational company profits and capital gains.[123] Indonesia is also experiencing an increase in tax revenues: the World Bank forecasts that non-oil tax revenues will rise from 13% of GNI in 2005 to 14.5% in 2010. [124]

6_Costs, benefits and affordability

6.1_Costs

There have been a series of estimates of the costs of delivering the water and sanitation improvements necessary for the Millennium Development Goals (MDGs).[125] The most recent estimates were published in a report by the World Health Organization in 2008 and were much higher than previous estimates.[126] This was principally because of two methodological approaches adopted in the report. The first was that, in addition to the costs of building new facilities, the estimated annual recurrent costs for hygiene education, operation and maintenance, and capital replacement for these new facilities were added to the figures. In addition, the costs of existing systems in place before the MDGs (including the costs of continuing to operate, maintain and replace the existing stock of water and sanitation provision in these developing countries) were also included.

The WHO presented water and sanitation costs separately. However, household sewerage connections require household water connections to flush the sewage, and so it is not meaningful to cost sewerage connections in isolation from water connections.

The WHO estimated total costs for a "base" case of low-cost improvements, but also estimated the costs of providing household connections – in the case of sanitation, to sewers. This increased the overall costs of meeting the sanitation targets by about one third. However it did not fully reflect the costs of meeting the proposed target for urban sewerage, as this requires connection of about 250 million more people than are covered by the existing MDG targets. The proposed target would thus require approximately an extra $60 billion in addition to the WHO "household connections" case (using the upper end of the WHO estimate of the additional cost of sewerage connections of $193-258).
A number of comments can be made on the WHO methodology. Firstly, the inclusion of operation and maintenance costs obscures an important distinction between capital investment in new systems and current expenditure on those systems. This is relevant in discussing the role of borrowing, for example. Secondly, it is hard to justify the inclusion of the continuing costs of existing facilities in a costing of future needs to attain the MDGs – especially as these costs represent over 60% of the total costs of the MDGs, as presented by the WHO. It means that these figures cover, in effect, the total annual budget of running water and sanitation services in developing countries. Thirdly, the estimates are presented as if there was a single global corporation carrying out the work. For example, it assumes that all the expenditure will have an overhead of 10–30% -30% to cover "programme costs". However it is important to remember that these are water and sanitation systems of many sovereign countries.

The table below shows the costs both including and excluding existing systems. A target to provide household connections increases costs of new elements significantly; and the urban sewerage target increases these costs still more.

Table 12:
Costs of meeting MDGs and proposed urban sewerage target by 2015

Urban and rural ($billion), 2005 prices	Total costs to achieve MDG targets 2015		Average annual cost over 10 years	
	Sanitation	Water and sanitation	Sanitation	Water and sanitation
Costs of existing facilities, operation and maintenance (O&M)	216	538	22	54
WHO base case: low-cost improvements				
Costs of new coverage inc O&M	142	184	14	18
Including costs of existing facilities	358	722	36	72
WHO 'household connections'				
Extra cost of household connections: $bn.	114	143	11	15
Total costs of new coverage inc O&M	256	327	26	33
Including costs of existing facilities	472	865	47	87
WHO 'household connections' + proposed urban sewerage target				
Extra cost of proposed urban sewerage target	22	22	2	2
Total costs of coverage inc O&M	278	349	28	35
Including costs of existing facilities	494	887	50	82

Source: WHO 2008, PSIRU calculations (see Annex)

6.2_Cost benefit analysis

Cost benefit analysis attempts to decide whether the costs of a policy, such as universal water and sanitation, are greater than the benefits. The results of such analyses of spending on water and sanitation have been invariably positive.

A detailed cost benefit analysis published by the WHO in 2004 [127] analysed the benefits under the following headings:

(1) Health sector benefit due to avoided illness
(2) Patient expenses avoided due to avoided illness
(3) Value of deaths avoided
(4) Value of time savings due to access to water and sanitation
(5) Value of productive days gained of those with avoided illness
(6) Value of days of school attendance gained of those with avoided illness
(7) Value of child days gained of those with avoided illness

It concluded that in all regions studied, and for all levels of investment – including sewerage connections which are the most expensive – the cost benefit ratio (CBR) is positive. [128] More recent reviews have confirmed this assessment. A Wateraid study estimated the economic value of the health benefits alone to be of the order of $9 for every $1 spent, with higher returns for universal coverage. [129] A recent WHO editorial quotes benefits falling between $3 to $34 dollars per dollar invested.[130]

Table 13: Positive cost benefit ratios for water and sanitation spending (WHO, 2004)

			Intervention 5
WHO region	Part of region	Pop. m.	Full household connections
AFR-E	Africa	481	4.8 x
SEAR-D	South Asia	1689	2.9 x
WPR-B1	East and South East Asia	1488	1.9 x

Source: Hutton and Haller 2004

Another economic benefit not included in the above calculations, would be the creation of large scale employment opportunities in developing countries for the necessary construction, maintenance and operations. This in itself is a major contribution to pro-poor development: "Employment generation is a particularly salient linchpin between economic growth on the one hand, and poverty reduction and

development on the other. Policies that augment the demand for labour are therefore likely to produce desirable social-impact outcomes for developing economies." [131] The health benefits are substantial, whether or not they are reduced to economic terms. The UN World Water Development Report (WWDR), 2006, noted that the greatest benefits for health are derived from sewerage connections: "The scenario scoring highest in actually reducing the burden of water-related disease to nearly zero is that where universal access to piped water and sewerage connections is provided."[132] Commenting on the results of the Salvador sewerage study, an article in the Lancet urged that: "The obvious benefits to poor people of increased provision of sewerage facilities should serve as the mandate for greater investment by all levels of government and civil society in tackling one of the greatest scourges to communities in developing countries – infectious diarrhoea due to poor sanitation." [133]

6.3_Economic capacity

In one sense, the cost benefit analyses answer the question of whether full sewerage connections can be afforded. Since the economic and health benefits clearly exceed the costs, then it is clearly worth spending the necessary money. As the WHO analysis points out, the cost benefit analysis itself does not answer the question of who should pay, and whether they can afford to pay. Affordability is relative to the ability to pay – whether countries, donors, or individuals have sufficient income to afford the expenditure needed.

6.3.1_The donor view: too expensive for the poor

The explicit or implicit position of most of the official donor publications is that in this sense, household sewerage connections cannot be afforded. The WWDR can be taken as typical of this position. It argues that the option of full household connections to sewers and water supply cannot and will not be financed: "In many nations, at least in the next five to 10 years, it will not be possible for the provision deficiencies in most urban areas to be addressed by the conventional model of a (public or private) water utility extending piped water supplies and sewers to individual households."

It offers the following three reasons for this:
— the cost of achieving these gains is "above income levels in developing countries"
— "population growth and burgeoning water demand have convinced most policymakers that the cost of water system development will increasingly have to be met by users"
— "there is not enough capital to finance the high costs of expanding and extending provision of household water and sewer connections and of building the institutional capacity to undertake this – and manage the systems once they are constructed whether publicly or privately."[134]

The first point is not supported by any evidence of what countries can or will afford and implies that developing countries cannot expect any international assistance. The second implies that the costs have to be met by users – through full cost recovery – and so nothing can be financed that users cannot afford to pay for. This denies the possibility of redistribution through taxation, the core traditional technique for financing sewerage extensions – or through international aid. The third point, that 'there is not enough capital', is simply incorrect. As already noted, middle income countries such as China, and Brazil have already committed substantial amounts of public capital to investment in water supply and sewerage, and continue to do so. Also there is $167 trillion – that is $167,000 billion – of global financial assets managed by pension funds, insurance companies, sovereign wealth funds, private investment banks and others.[135] Most of these invest a significant proportion of their assets in government-guaranteed bonds to fund public investment in utilities such as water and sanitation.

6.3.2_What can be afforded: national affordability

National affordability is the most important issue. In practice, the great majority of the resources for extending water and sanitation come from national resources. Especially in the larger countries, such as India and China, aid can only meet a small proportion of needs. Private sector investment contributes little, and so government revenues are the key source for financing developments. There is a political reason for this too. The countries concerned are all sovereign states, and so decisions are – or should be – taken by governments of those states. The key decisions are taken in Beijing, Delhi, Brasilia, Jakarta and other capital cities, not in Washington, London or Paris.

The table overleaf estimates the costs facing countries. It sets out estimates of the annual costs for the 20 countries needing the greatest number of urban sewerage extensions (as shown in Table 6) as these countries cover nearly 90% of the need for urban sewerage connection.

It estimates costs for the urban sewerage target alone; and for the full cost of the MDGs (with household connections, urban and rural and the extra needed for the proposed urban sewerage target). For each of these two definitions, it then expresses these costs as a percentage of each country's economy (GNI), and calculates the amount needed in excess of 1% of GNI, as an indicator of how much international aid might be needed. The urban sewerage targets are calculated by reference to the connections needed in each country (as shown in Table 6), and a global average cost for new connections derived from the WHO estimates. The full costings for the MDGs, plus urban sewerage targets, are then calculated by grossing up the figure for urban sewerage connections in line with the global relationship between this figure and the full cost of the MDGs. The estimates illustrate the likely scale of national needs, subject to the limitations of data on coverage and costings. One feature of the results is that the cost of urban sewerage represents a high proportion of the total MDG costs with household connections.

The costings allow the discussion of affordability in terms of the country's own economy, by reference to the percentage of GNI needed. And then some discussion of what aid may be needed, by calculating what is needed to finance each country's needs beyond 1% of its own GNI.

Table 14 shows that 14 out of these 20 countries can achieve the urban sewerage target, and the full MDGs for sanitation and water, rural and urban, with full household connections, for less than 1% of GNI per year. For many of the middle income countries the cost is less than half of one per cent of GNI per annum. China, Brazil and India are already planning to spend as much on development of water and sanitation as these estimates suggest is needed for the MDGs with household connections and the urban sewerage target (see above). Even including the running and depreciation costs of existing services, which effectively includes the running costs of all water and sanitation services, only half of these countries would need to spend more than 1% of GNI (see extended table in Annex).

It is not credible to dismiss this level of commitment as "unaffordable". When a number of developing countries have clearly decided that they are prepared to invest on this scale, it is inappropriate for international financial institutions to declare that they "cannot" afford it.

These levels of spending are affordable elements of public investment in relation to the size of economies, especially in view of recent growth rates. The average level of public investment in developing countries on all infrastructure has varied between 7% and 10% of GNI over the last 35 years, and is generally considered to be too low.[136] Therefore spending 1% on new investment in water and sanitation is not an excessive burden.

Most of these countries have experienced sustained economic growth in recent years. Between 2001 and 2006 China averaged growth of 9.7% per annum, India 7.6%; but other much poorer countries have also grown, including Mozambique (average annual growth rate of 8.6% between 2001 and 2006), Vietnam (7.6%), Tanzania (6.4%), Bangladesh, Iran, Nigeria (5.6%), Ghana, Pakistan (5.2%), Indonesia (4.9%), Philippines (4.6%), the Democratic Republic of Congo (4.2%), and Brazil (2.9%).[137] Spending an extra 1% of GNI on investment in water and sanitation is thus allocating part of this growth. It is not a claim on other uses of existing income. This level of spending makes greater demands on the taxation systems of countries. The taxation collected by some countries is adequate for these levels of public spending, but others need to increase the tax collected. India collected only 12.5% of GNI as tax in 2004, Bangladesh 10%, the Democratic Republic of Congo 8%, Pakistan 13% and the Philippines 15%; while other low income countries collect more, for example Ghana 24%.[138] Establishing sustainable public revenues, and building the capacity of public authorities, are important elements in development. Water and sanitation investments can drive these developments as they did in European and North American countries a century ago.[139]

Table 14: National affordability: costs as percentage of national income

	National income group	GNI 2006 ($ billion)	Urban sewer target (millions)	Annual cost of urban sewer target ($ million)	%GNI	Annual cost of MDG HC + urban sewer target ($ million)	% GNI
China	ML	2641.6	251	6275	0.24	7878	0.30
India	L	906.5	184	4591	0.51	5764	0.64
Indonesia	ML	315.8	73	1825	0.58	2291	0.73
Brazil	ML	892.8	60	1498	0.17	1881	0.21
Nigeria	L	92.4	43	1086	1.18	1364	1.48
Philippines	ML	120.2	34	852	0.71	1069	0.89
Pakistan	L	122.3	32	797	0.65	1000	0.82
Bangladesh	L	69.9	27	681	0.97	855	1.22
Iran	ML	207.6	25	630	0.30	790	0.38
Democratic Republic of Congo	L	7.7	15	386	5.01	485	6.29
Vietnam	L	58.1	14	358	0.62	450	0.77
Argentina	MU	201.4	13	321	0.16	403	0.20
Thailand	ML	193.7	12	302	0.16	379	0.20
Sudan	L	29.9	11	281	0.94	352	1.18
Egypt	ML	101.7	11	270	0.27	340	0.33
Venezuela	MU	164.0	10	247	0.15	310	0.19
Ethiopia	L	12.9	10	243	1.89	306	2.37
Malaysia	MU	141.4	10	238	0.17	299	0.21
Myanmar	L		9	230		288	
Korea Rep	H	856.6	9	214	0.03	269	0.03
Total of above				**21,325**		**26,773**	
Total for all developing countries				**27,800**		**34,900**	

Source: PSIRU calculations from World Bank, JMP, UN ESA and WHO data (see Annex)
Income groups: L=low income; ML=lower middle; MU=upper middle; H=high.

6.3.3_What can be afforded: global affordability and aid

One way of addressing the global affordability question is whether the world economy as a whole has capacity for this level of spending. Tested against the capacity of the global economy, achieving the MDG targets, plus urban sewerage connections, costs 0.08% per annum of global GNI. This is modest for a key public investment in infrastructure, with very high economic returns and major gains in public health. If full existing costs of the water and sanitation systems are added in, so that the figures represent total costs of investment and operation of water and sanitation for most people on earth, the total comes to only 0.2% of global GNI. In light of the actual spending levels noted above, this seems a quite feasible level of global resources.

This is an abstract exercise, however, because there is no global government and taxation system to redistribute the income of the global economy. The only mechanisms which attempt this task are the aid programmes of the rich countries, and the investment programmes of the development banks. So the real test is whether this amount of aid required can be afforded, realistically by the richer nations.

It needs to be emphasised again that developing countries are sovereign states which decide how much should be invested in water and sanitation. It is inaccurate and unnecessary to assume that the entire cost of achieving the targets must be carried by aid. As noted above, many countries are getting on with financing sanitation and sewerage programmes from their own national taxation, and aid plays only a marginal role. So the first question to be established is how much of the required money might be provided by aid?

The table overleaf calculates aid on the basis that it is meant to reduce the burden on a country's economy. So the figures show what would be needed to cover the costs of sewerage and the MDGs in excess of 1%, 0.75%, or 0.5% of GNI.

On any such rule, aid should be concentrated on a few countries. Under the 1% threshold, the aid required would be heavily concentrated in two countries – Nigeria and the Democratic Republic of Congo – followed by Ethiopia and Bangladesh. These four countries account for half of all the aid required at this level. A number of African countries, including Sudan, Ghana, Tanzania, Mozambique, Madagascar, together with Haiti, would also require significant aid at this level (see Annex for details on other countries). At the 0.75% level, Nigeria, the Democratic Republic of Congo, Ethiopia, Bangladesh, Philippines, Sudan, and Pakistan account for over half of all the aid required. Middle income countries only start receiving significant aid if it covers costs above 0.5% of GNI. Indonesia and the Philippines both require significant aid, because the current level of sewerage connections is so poor. India and Pakistan would also receive large amounts of aid at this level.

Table 15:
Global affordability: the need for aid

	Income group	Annual cost of MDG HC + urban sewers %GNI	Aid needed to cover spending >1% of GNI ($million)	Aid needed to cover spending >0.75% of GNI ($million)	Aid needed to cover spending >0.5% of GNI ($million)
China	ML	0.30			
India	L	0.64			1232
Indonesia	ML	0.73			712
Brazil	ML	0.21			
Nigeria	L	1.48	440	671	902
Philippines	ML	0.89		168	468
Pakistan	L	0.82		83	389
Bangladesh	L	1.22	156	331	505
Iran	ML	0.38			
Democratic Republic of Congo	L	6.29	408	427	446
Vietnam	L	0.77		14	159
Argentina	MU	0.20			
Thailand	ML	0.20			
Sudan	L	1.18	53	128	203
Egypt	ML	0.33			
Venezuela	MU	0.19			
Ethiopia	L	2.37	177	209	241
Malaysia	MU	0.21			
Myanmar	L	N/A			
Korea Rep	H	0.03			
TOTAL for all developing countries			**2236**	**3603**	**7919**

Source: PSIRU calculations from World Bank, JMP, UN ESA and WHO data (see Annex)

Income groups: L=low income; ML=lower middle; MU=upper middle; H=high.

The total amount of aid required to support spending on the combined targets over 0.5% of GNI is $7.9 billion. This compares with actual aid for water and sanitation of $5.9 billion in 2005 ($4.5 billion from donors and $1.4 billion from development banks).[140] This implies an increase, but a feasible increase: aid for water and sanitation increased by $0.9 billion per year from 2002 to 2005, and a continuation of this upward trend is a possibility. So even this high level of aid is a realistic target.

A redistribution of existing aid would be appropriate, however. Ten per cent of aid for water and sanitation in 2001-2005 was spent by the USA in Iraq. Of the 10 countries which appear to need most aid on our estimates, only two (India and Vietnam) were amongst the top ten recipients of water and sanitation aid. Instead, five of the top ten recipients were North African countries, and the largest was China. This pattern of spending reflects the target markets of the multinational companies, but not the pattern of needs. [141]

Table 16:
Aid: going to the wrong countries?

Country	Income group	Aid needed to cover spending >0.5% of GNI ($ million)	Annual average aid for water received from donors 2001-2005
Iraq			343
China			287
India	L	1232	210
Malaysia			151
Palestinian admin areas			129
Indonesia	ML	712	
Nigeria	L	902	
Bangladesh	L	505	
Philippines	ML	468	
Democratic Republic of Congo	L	446	
Pakistan	L	389	
Sudan	L	203	
Ghana	L	167	
Vietnam	L	159	114
Tanzania	L	149	
Egypt			84
Jordan			93
Tunisia			71
Morocco			91

Source: OECD 2007 http://www.oecd.org/dataoecd/20/61/40162562.pdf and PSIRU calculations

The figure of $7.9 billion is also a fairly low burden on the incomes of the richer countries. It represents 0.02% of the combined GNI of high income countries. This is equivalent to about $6.50 per capita per year in high income countries, or 12 cents per week. It seems quite disproportionate to describe such levels of finance as “unaffordable”.

If funded through borrowing, the combined targets would require only 0.03% of the global finance capital of pension funds, insurance companies, sovereign wealth funds and banks, all of whom may be expected to be interested in such long term investments.

This is a very different conclusion from that reached by the WHO study on costs, which concluded that "there is an enormous overall financing gap at the global level".[142] The key difference is that this paper takes account of the capacity of countries to finance expenditure through public finance; treats aid as a supportive supplement, not the implicit source of all wealth; and recognises that the development of water and sanitation infrastructure, including sewers, has to be based on public finance, not consumer spending.

Table 17:
Affordability in relation to global economy and aid from high income countries

	$ billion	Annual cost of total MDGs HC + urban sewerage target	Annual cost of MDGs + urban sewerage target + existing costs	Annual cost of aid to support cost of MDGs + urban sewerage over 1% of GNI	Annual cost of aid to support cost of MDGs + urban sewerage over 0.5% of GNI
		34.9	88.7	3.6	7.9
Global GNI 2006	48482	0.08%	0.20%	0.007%	0.016%
High income GNI 2006	37529			0.01%	0.02%
Global finance capital	167100	0.03%	0.11%		

Source: calculated from World Bank GNI stats, McKinsey 2007, table 11

6.3.4_Case study – Stone Cross, England

A group of 32 houses in Stone Cross, a village in the countryside of Sussex, in southern England, are being connected for the first time to a sewerage system. The work is needed because the existing septic tanks and cesspits were polluting the environment, and so posed a danger to public health.[143]

The water company, Southern Water, is charging the villagers the standard connection fee of £276.81 per household.[144] But these charges only cover 0.6% of the cost, which is £1.5 million. The other £1,491,142.08 is being spread between all the customers of Southern Water, about four million people. This adds less than 40p per person to the annual water and sewerage bill (equivalent to about 80 cents in US currency).

The Stone Cross sewers show two things: Firstly, the need for cross-subsidy to achieve the public benefits of sewerage. If the principle of full cost recovery was applied, the Stone Cross villagers would have to pay a connection charge of £46,875 per household. Instead, the capital expenditure is paid for collectively, by all users.

Secondly, if the same principle of cross-subsidy was applied internationally through aid, the cost of the target for the MDGs with urban sewer connections in all the cities in developing countries would be remarkably low. The total annual aid required to support all spending over 0.5% of GNI is $7.9 billion – but spread across Europe, the USA and the other high income countries, with a population of 1.223 billion, this would cost $6.46 per person per year.

That is only eight times the per capita cost of the Stone Cross sewers.

6.4_What can be afforded: comparative spending and revenue decisions

6.4.1_Demand stimuli

The global banking crisis that emerged in 2007 has reduced global economic growth. The USA government has announced a reflationary package worth $150 billion in a single year. The purpose of this is to provide an economic stimulus to help avoid a world recession. The managing director of the International Monetary Fund, Dominique Strauss-Kahn, has called for global reflationary measures: “This has become a global problem that requires a global solution …. Emerging markets need to join industrial countries in the macroeconomic and regulatory policy response.”[145] Private sector borrowing through bond issues in developing countries fell sharply at the end of 2007, and “emerging market economies that are heavily dependent on capital inflows could be particularly affected”. [146]

A programme of sewer construction would provide a very good economic stimulus. The annual total of $34.9 billion needed for the MDGs, plus the urban sewerage target, could be financed through increased public borrowing by national or international bond issues, for example. The boost to demand would be about 0.3% of developing country GNI, more modest than the USA package, which represents about 1% of USA GNI.

It would have an additional major economic benefit by creating hundreds of thousands of jobs in southern countries. This would provide a boost to employment incomes and so reduce poverty, and create more taxable earnings and spending power which could help finance further public investment.

6.4.2_Northern Rock

The support from the UK Government for Northern Rock has now been consolidated in a nationalisation which is estimated to cost £100 billion ($200 billion).

This amount would be sufficient to finance more than half the entire costs of the MDGs and the urban sewerage target in every city on earth.

The purchase of Northern Rock is an investment made for economic and social reasons, and is expected to produce some returns, although with significant risk of losses. A similar amount invested through loans for sewerage and water in developing countries would also provide economic and social returns, though also with some degree of risk.

6.4.3_Company profits

The profits recorded by Exxon, Shell and BP in 2007 amount to $40.6 billion, $27.6 billion and $17.2 billion respectively, a total in a single year of $85.4 billion.[147] Much of this profit was made from activities in oil-rich, but sewer-poor, countries such as Nigeria.

A 10% windfall tax on these profits would be sufficient to finance all the aid needed in one year to support the achievement in full of the MDGs, plus urban sewerage targets, throughout the world.

6.4.4_Arms spending

Total global military expenditure in 2006 was about $1,200 billion. The biggest three spenders accounted for more than half of this: USA ($529 billion), UK ($59 billion) and France ($53 billion).148

Half of the amount spent by these three countries on arms in one year would pay for almost the entire ten year cost of achieving the MDGs in full, plus the urban sewerage connections target.

6.4.5_Iraq

Recent calculations of the costs of the war in Iraq and Afghanistan show that the monthly expenditure by the USA on these wars is around $16 billion, an annual total of £192 billion dollars.

One fifth of this amount would be sufficient to finance the total annual cost of achieving the MDGs, plus the urban sewerage connections target, for every city in the world.

Table 18: Affordability comparisons

	US$ billions	$ per capita
Global annual cost of full MDGs and urban sewerage target	35	
USA reflationary package	150	
UK nationalisation of Northern Rock	200	
Global military expenditure 2006	1200	
Annual USA current spending on Iraq and Afghanistan wars	192	
Exxon + Shell + BP profits 2007	87	
Global annual cost of aid needed for full MDGs and urban sewerage target	7.9	$6.46
Cost of Stone Cross sewers		$0.80

7_Conclusion

Analytical conclusions

There are four key analytical conclusions to be drawn from the evidence presented in this report:

1. The health benefits of household sewerage connections are so certain and so great that they should be incorporated as central to the Millennium Development Goals (MDGs), not dismissed as an expensive 'extra'. The need for sewerage in cities, in particular, is so fundamental that it should be incorporated as a new target in the MDGs: "To halve by 2015 the proportion of the urban population without household connections to a sewerage system."

2. The finance for developing sewerage systems has to come from public finance, as it has done in the north. It will not be successfully delivered by the private sector, and it will not be affordable for the poor on this basis. The private sector's failure to extend sewerage systems in the south demonstrates the need to abandon this ideology.

3. The costs of sewerage systems is justified by the health and economic benefits achievable.

   Sewerage programmes are affordable for the national economies of countries with the great majority of people needing connections. The additional benefits in terms of employment and stimulus to the global economy are important additional benefits of a programme of sewer extensions.

4. The aid required is affordable for donor countries and should be targeted at the countries with greatest need. The requirements are modest when compared with other items of expenditure by high-income countries.

Policy conclusions

Three broad policy conclusions can also be drawn from this report.

1. In analysing affordability, the starting point must be national policies and economies. Aid is only a marginal element in this process, and so it is misleading to see donors as the key policy-makers or aid as the key economic resource. When analysed at national level, it is clear that the financial requirements are affordable for most countries. The need for aid should be assessed in relation to national needs and affordability, not by reference to the total global cost of developing water and sanitation systems, most of which will be met nationally.

2. Developing countries should make urban sewerage as great a priority as high-income countries did in the past, and continue to plan for development of household water and sewerage connections. A number of countries are already doing so, led by those that are most independent of pressures from international financial institutions or donor countries, notably China, Brazil and India.

   Countries that are more inclined to follow the policies of the international bodies, such as Indonesia and the Philippines, are failing to do so. The important financial issue is to ensure that sufficient taxes are raised to finance urban sewerage systems. Attempts to finance them through user charges to recover costs, or attempts to involve the private sector in investment, are likely to be expensive irrelevances that will slow down achievements. Countries such as Indonesia and the Philippines need to develop major public spending programmes to develop urban sewer systems.

3. The major donor countries and development agencies are currently pursuing policies that undermine what is needed for the development of urban sewerage systems. Donors should stop encouraging countries to try and finance development of sewerage systems through cost recovery from users, and stop encouraging countries to believe that the private sector will make any significant contribution to investment in sanitation. They should instead encourage countries to build the taxation capacity needed to finance this investment, and provide support and training for capacity building through public-public partnerships, following the model of Japan. Aid should be focused on the countries in greatest need of assistance to meet the costs of urban sanitation, in particular low-income African countries, led by Nigeria and the Democratic Republic of Congo.

8_Further reading

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9_Annex: Calculation of tables on needs and affordability

Table 1

Data is taken from the report of the joint monitoring programme: JMP 2006 Meeting the MDG drinking water and sanitation target: the urban and rural challenge of the decade. WHO and Unicef 2006 www.who.int/water_sanitation_health/monitoring/jmp2006/en/index.html. The data is taken from the final table on page 40: the figures for annual connections needed have been multiplied by ten to generate totals over the whole 10 year period. The JMP notes that "Regional values do not add up to totals."

Table 2

All data – on 2004 urban populations, improved sanitation and and sewerage connection levels – is taken from the JMP website on sanitation at: www.wssinfo.org/en/31_san_intro.html. Although the JMP collects this data on household sewerage connections, it did not publish any of it in the 2006 mid-term assessment, which only presented information on "improved" sanitation.

Table 5

	2004 urban Population (millions)	Household sewer connection % coverage in 2004	Numbers with sewer connection 2004 (millions)	Numbers with no sewer connection 2004 (millions)	2015 urban population forecast (millions)	Extra connections needed by 2015 to halve unconnected (millions)	Target household sewer connection % in 2015
North Africa	80	73	58	21	121	46	87
Sub-Saharan Africa	268	19	51	217	386	179	60
Latin America and Caribbean	428	62	265	163	508	146	81
East Asia	579	50	289	289	750	273	75
South Asia	459	24	110	349	624	277	62
South East Asia	235	9	21	214	327	157	55
West Asia	129	83	107	22	171	50	92
Oceania	2	32	1	1	3	1	66
Total of above	**2179**	**41**	**903**	**1277**	**2890**	**1141**	**71**
World total	**3113**	**56**	**1744**	**1369.89**	**3845**	**1255**	**78**

This has been calculated from the data in Table 2, plus the urban population forecasts for 2015 in World Urbanisation prospects: 2007 revision http://esa.un.org/unpp/. The forecasts use slightly different regional definitions from the JMP, and so they have been adjusted to exclude Japan from Eastern Asia; exclude Kazakhstan, Kyrgystan, Tajikistan, Turkmenistan, and Uzbekistan from Southern and Central Asia; and creating a forecast for Oceania by adding the urban population forecasts for Melanesia, Micronesia, and Polynesia. The numbers needing connection have then been calculated by halving the numbers unconnected in 2004; subtracting the result from the population for 2015; and from this total subtracting the population already connected in 2004. The resulting connection rate in 2015 is then calculated. The CIS has been omitted from the table because the countries in the region are grouped very differently in the UN and JMP data. The connection rate is already very high.

Table 6

	2004 urban Population (millions)	Household sewer connection % coverage in 2004	Numbers with sewer connection 2004 (millions)	Numbers with no sewer connection 2004 (millions)	2015 urban population forecast (millions)	Extra connections needed by 2015 to halve unconnected (millions)	Target household sewer connection % in 2015
China	683	523	50	262	262	251	75
India	416	304	25	76	228	184	63
Indonesia	147	103	2	2	101	73	51
Brazil	185	154	53	82	73	60	77
Nigeria	94	62	23	14	48	43	62
Philippines	70	51	7	4	47	34	54
Pakistan	76	53	40	21	32	32	70
Bangladesh	55	35	7	2	32	27	54
Iran	57	46	19	9	37	25	60
DR Congo	31	18	4	1	17	15	52
Vietnam	30	22	14	3	19	14	57
Argentina	40	35	48	17	18	13	74
Thailand	24	20	0	0	20	12	50
Sudan	23	14	1	0	14	11	51
Egypt	38	31	68	21	10	11	84
Venezuela	30	23	61	14	9	10	81
Ethiopia	20	12	2	0	12	10	51
Malaysia	23	16	41	7	9	10	71
Myanmar	19	15	10	2	14	9	55
Korea Rep	41	39	65	25	14	9	83
South Africa	32	27	70	19	8	9	85
Korea DPR	16	14	12	2	12	7	56
Ghana	15	10	13	1	9	7	57
Tanzania	14	14	3	0	13	7	52
Angola	13	6	19	1	5	7	60
Côte d'Ivoire	12	8	18	1	7	6	59
Mozambique	10	7	4	0	7	5	52
Peru	22	20	67	14	7	5	84
Kenya	11	14	9	1	12	5	55
Yemen	10	5	44	2	3	5	72
Afghanistan	10	7	6	0	6	5	53
Morocco	20	18	70	13	5	5	85

This has been calculated from the urban population and sanitation data on the JMP website at www.wssinfo.org/en/31_san_intro.html, plus the urban population forecasts for 2015 in World Urbanisation prospects: 2007 revision. The numbers needing connection have then been calculated by halving the proportion unconnected in 2004; subtracting the result from the population for 2015; and from this total subtracting the population already connected in 2004. The resulting connection rate in 2015 is calculated by halving the proportion unconnected in 2004. The detailed table reproduced here covers all 32 countries where more than 5 million new connections are required. These countries require 1,119 million new connections, 83% of the total estimated for all regions.

Tables 15 and 16

	Group	GNI 2006 ($ billion)	Urban sewer target (millions)	Annual cost ($ million)	% GNI	Grossed up to MDG HC + urban sewers ($ million)	% GNI	Possible aid need >1% of GNI ($ million)	Possible aid need >0.75% of GNI ($ million)	Possible aid need >0.5% of GNI $m	MDG HC + urban sewers $m + existing costs	%GNI
China	ml	2641.6	251	6275	0.24	7878	0.30				20022	0.76
India	l	906.5	184	4591	0.51	5764	0.64			1232	14650	1.62
Indonesia	ml	315.8	73	1825	0.58	2291	0.73			712	5823	1.84
Brazil	ml	892.8	60	1498	0.17	1881	0.21				4779	0.54
Nigeria	l	92.4	43	1086	1.18	1364	1.48	440	671	902	3466	3.75
Philippines	ml	120.2	34	852	0.71	1069	0.89		168	468	2718	2.26
Pakistan	l	122.3	32	797	0.65	1000	0.82		83	389	2542	2.08
Bangladesh	l	69.9	27	681	0.97	855	1.22	156	331	505	2173	3.11
Iran	ml	207.6	25	630	0.30	790	0.38				2009	0.97
DR Congo	l	7.7	15	386	5.01	485	6.29	408	427	446	1232	16.00
Vietnam	l	58.1	14	358	0.62	450	0.77		14	159	1143	1.97
Argentina	mu	201.4	13	321	0.16	403	0.20				1025	0.51
Thailand	ml	193.7	12	302	0.16	379	0.20				963	0.50
Sudan	l	29.9	11	281	0.94	352	1.18	53	128	203	896	3.00
Egypt	ml	101.7	11	270	0.27	340	0.33				863	0.85
Venezuela	mu	164.0	10	247	0.15	310	0.19				787	0.48
Ethiopia	l	12.9	10	243	1.89	306	2.37	177	209	241	777	6.02
Malaysia	mu	141.4	10	238	0.17	299	0.21				759	0.54
Myanmar	l		9	230		288		0	0	0	733	
Korea Rep	h	856.6	9	214	0.03	269	0.03				684	0.08
South Africa	mu	255.3	9	214	0.08	269	0.11				683	0.27
Korea DPR	l		7	183		230		0	0	0	583	
Ghana	l	11.8	7	180	1.52	226	1.91	108	137	167	574	4.86
Tanzania	l	13.4	7	172	1.28	216	1.61	82	116	149	549	4.10
Angola	ml	32.4	7	171	0.53	215	0.66			53	546	1.68
Côte d'Ivoire	l	16.0	6	140	0.87	176	1.10	16	56	96	446	2.79
Mozambique	l	6.9	5	129	1.87	162	2.34	93	110	127	411	5.96
Peru	ml	82.7	5	124	0.15	155	0.19				395	0.48
Kenya	l	20.5	5	121	0.59	152	0.74			49	385	1.88
Yemen	l	16.4	5	120	0.73	150	0.91		27	68	381	2.33
Afghanistan	l	8.1	5	117	1.45	147	1.82	66	87	107	374	4.62
Morocco	ml	58.0	5	114	0.20	143	0.25				363	0.63
Madagascar	l	5.3	4	96	1.80	120	2.26	67	80	93	305	5.75
Nepal	l	8.0	3	83	1.03	104	1.30	24	44	64	263	3.29
Ecuador	ml	38.1	3	81	0.21	102	0.27				260	0.68
Haiti	l	4.1	3	75	1.84	94	2.30	53	64	74	240	5.86
Bolivia	ml	10.3	3	74	0.71	92	0.90		15	41	235	2.28
Senegal	l	8.9	3	72	0.81	90	1.02	1	24	46	230	2.58
Uganda	l	8.9	3	71	0.80	89	1.00	0	22	44	226	2.54
Mali	l	6.1	3	70	1.15	88	1.44	27	42	57	223	3.66
Benin	l	4.7	3	63	1.34	79	1.68	32	44	56	201	4.27

	Group	GNI 2006 ($ billion)	Urban sewer target (millions)	Annual cost ($ million)	% GNI	Grossed up to MDG HC + urban sewers ($ million)	% GNI	Possible aid need >1% of GNI ($ million)	Possible aid need >0.75% of GNI ($ million)	Possible aid need >0.5% of GNI $m	MDG HC + urban sewers $m + existing costs	%GNI
Guinea	l	3.7	2	55	1.48	69	1.85	32	41	50	174	4.71
Cuba	l		2	54		68		0	0	0	172	
Burkina Faso	l	6.3	2	53	0.84	66	1.05	3	19	35	168	2.67
Zambia	l	7.5	2	53	0.70	66	0.88		10	29	168	2.24
Cambodia	l	6.9	2	52	0.75	65	0.94		13	30	165	2.39
Paraguay	ml	8.4	2	51	0.61	65	0.77		2	23	164	1.95
Chad	l	4.7	2	51	1.09	64	1.36	17	29	41	163	3.46
Malawi	l	2.2	2	48	2.17	60	2.73	38	43	49	152	6.93
Togo	l	2.2	2	47	2.13	59	2.68	37	42	48	150	6.81
Niger	l	3.7	2	41	1.11	52	1.39	15	24	33	131	3.55
Nicaragua	l	5.2	2	39	0.76	49	0.95		10	23	126	2.41
Sri Lanka	ml	25.7	1	36	0.14	46	0.18				116	0.45
Congo	l	3.8	1	35	0.93	44	1.17	6	16	25	113	2.96
Rwanda	l	2.3	1	31	1.36	39	1.70	16	22	28	99	4.32
TOTAL group		**7835**	**978**	**24440**	**0.31**	**30681**	**0.39**	**1966**	**3168**	**6961**	**77978**	**1.00**
Group as % of developing countries			**85**	**88**		**88**						
TOTAL developing countries			**1150**	**27800**		**34900**		**2236**	**3603**	**7919**	**88700**	

The cost estimates for the MDGs in water and sanitation and 80% urban sewerage connections are based on the needs assessments in Table 6, the WHO cost estimates published in Hutton G. and Bartram J. 2008 Global costs of attaining the Millennium Development Goal for water supply and sanitation. Bulletin of the World Health Organization January 2008, 86 (1) http://www.who.int/entity/bulletin/volumes/86/1/07-046045-ab/en/index.html, and World Bank data on gross national income (GNI) taken from World Development Indicators database http://go.worldbank.org/3JU2HA60D0. The costs for achieving the connection targets for urban sewerage is calculated by multiplying (a) the Table 6 estimates of numbers needing connection, by (b) an approximate average cost of $250 per person connected, derived from the WHO study by averaging the total new spending for full household sanitation connection across the 1.052 billion which the WHO paper says are covered by these totals. The costs for achieving the MDGs as well is derived by multiplying these estimates for the costs of urban connections by the ratio between the total costs of urban sanitation connections alone and the full costs of MDGs with household connections, for water and sanitation, in the WHO study. The main columns shown in the body of the report do not include the continuing costs of pre-existing operations; the full table here does so, for completeness. The basis of the aid calculations is as explained in the text.

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