



Technical Deep Dive on
Integrated Urban Water Management (IUWM)
Tokyo Sep 25 to 29, 2017
Framing IUWM

Integrated Urban Water Management *Wet cities*

Dr. Carlos E. M. Tucci

World Bank Consultant

tucci@rhama.com.br and www.rhama.com.br

Outline

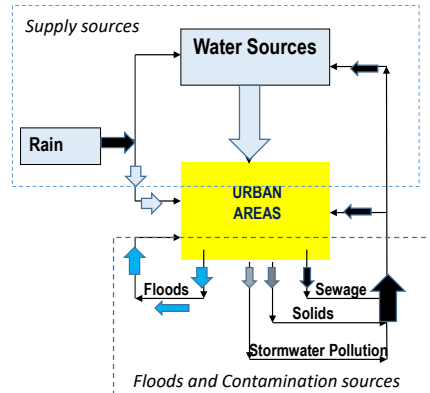
- Main impacts and causes in developing countries cities
- IUWM framework – concepts of sustainability and integration
- Levels of interventions – private and public
- Opportunities in the integrated solutions: *urban recovery and flood management*

2

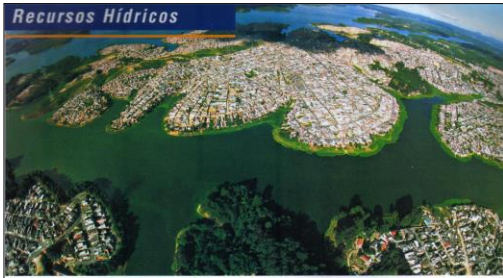
This is the contents of the presentation. It starts with the issues, showing the lack of integration and the resulted problems, mainly in developing countries cities. After is presented the main concepts related to integration of action and sustainability in the same space of urban areas. After is discussed the levels of intervention based private (overall population and its interests) and public intervention based on public policies. In the end is present the slogan of the integration where we can transform the problem in an opportunity to change the city.

Main challenges

- Contamination of water sources – *agriculture and urban areas*
- Inappropriate land use: *unregular land occupation and flood risk areas*
- Lack of basic urban services – *lack of sanitation, solids and stormwater services*
- Increasing floods – *stormwater increasing floods due to urbanization*
- Negative environmental impacts -solid waste, degraded areas, water contamination
- Water related diseases and poor quality of live



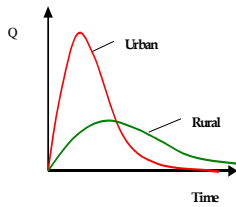
Water has an urban cycle of impacts. The water sources: surface and groundwater are used to supply the cities: human, industrial and services, after it resulted in sewage which should be treated, but in developing countries the coverage is small and sewage polluted the rivers and the waters sources. In addition, rainfall precipitation washes the urban surfaces and polluted the rivers, increase velocity of the flow and floods due to the increase in impervious areas, conduits and channels together with solids from sediments and garbage. These impacts are mainly due to lack of appropriate service and education from population. The consequences are polluted urban environment which increases disease's and poor quality of live. The picture shows the cycle and the drawing the transformation of natural resources in garbage and polluted water.



Contamination of water sources with unregular occupation



River and channels Water quality contamination



Flood increase due to urbanization



Degraded area by increase on flow velocity



Flow obstruction from solids⁴

The above left pictures shows the contamination of water source by urbanization in São Paulo (Guarapiranga). In the right The drainage of a channel in Porto Alegre where it can be seen sewage contamination and garbage. In the bottom left is shown the hydrograph of a rural basin and the same hydrograph when the basin get urbanized, which increases the peak flow and anticipated the peak. This is increase usually is about 6 to 7 times. Bottom middle picture shows the erosion of a stream as result of an upstream urbanization. The last picture shows in the dramatic way of an obstruction in drainage by a Volkswagen car. Obstruction is often due to many large or small detritus.



Floods due urbanization increase, river reduction capacity (solids and sediments), and occupation of the valley



Integrated impacts: lack of water supply, sewage, drainage, solids and illegal occupation



Bad practice of closing channels

5

The left above picture shows a flood on Tiete River São Paulo due a urban drainage event. In right side shows a channel with all types of issues: Sewage without treatment, Garbage, illegal occupation, lack of capacity for storm water and water supply. This in an integrated problem. In the bottom left the picture shows the amount of garbage inside of a channel under construction. This is unsustainable scenario since in a few years the channel will be filled with garbage .There is a need of maintenance, which is more complex for a closed channel. This picture tell us that we should deal with garbage and try to do not close a channel.

Causes

- Fast urbanization in most developing countries without control of land use → In 2050 world population will be 70% urban. Most of the increase will be in developing countries
- Lack of sanitation and solid waste management and loss of water sources; → Proportion of sewage treated in developing countries is still low; bad investment decisions and lack of cost recovery
- Increase of impervious areas (land use) and unsustainable drainage (channels and conduits)- *erosion, contamination and floods* → Impervious areas increase flood frequency; channels and conduits cost six times sustainable solutions and increase negative impact
- Fragmented institutional approach- *lack of capacity, information's and cost recovery* → Bad services, no goals and indicators, lack of capacity building, cost recovery and enforcement

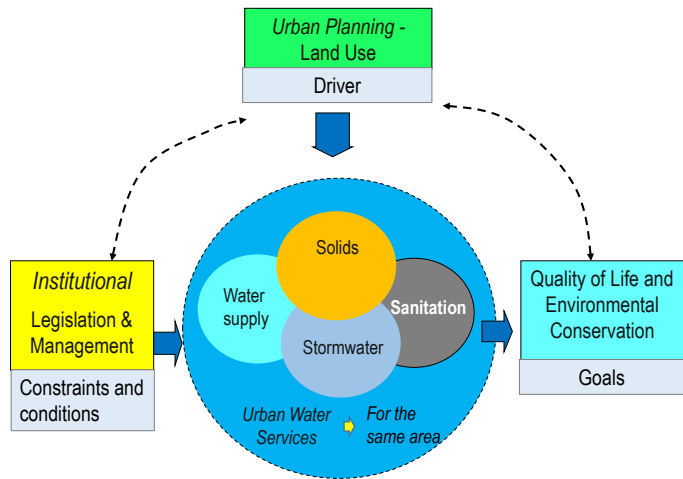
6

This slides shows the relationship between the issue and the main cause.

Urbanization has been fast in 20th and 21th centuries, because of population grow and the job attraction of industrial and service which are in the cities. Nowadays, in USA 90% of jobs are in services, 8% in industry and 2% in agriculture. This is the world tendency and in 2050 the world population will be about 70% urban. Everyone which is going to be born will live in cities and an important number of people are moving to the cities. Most of this process is in poor and developing countries which does not treat sewage and dump in the rivers. There are not enough investments on this countries and the cost recovery is very low. Impervious areas increase in the proportion on 50 m²/person. The consequences are more floods, erosion, pollution and degraded areas. The cities in developing countries when address the problem are spending 3 to 7 time as compared with developed countries with unsustainable solutions. They do not have institutions to deal with these issues and when there is institutions they are fragmented in dealing with this integrated problem. For instance, there are no storm water institutions in developing countries. In most of the services there are not equilibrium on cost recovery. Most of time people are willing to pay for mobile phone, but not for water services.

IUWM Framework

- The main driver of IUWM is land use and its Planning
 - The society needs basic Institutional construction
 - Urban water services should be integrated in the space solution
 - Urban water services should take account of land use aspects and institutional constraints...
- ...in order to improve quality of life and the urban environment



Integration means: provide all service to the same planned *space*

7

The main driver in urban areas is the land use or the urbanization. Based on the urbanization and its distribution the services are provided. The four services in Urban waters are: water supply, sanitation (sewage collection and treatment), Storm water, and Solids management. These services are integrated in each area, but usually they are provided by different institutions which do not talk to each other. Institutional construction to deliver services is key in the integration. The main goals should be quality of life and conservation. Development of indicators of these goals is a task for each urban area. The Institutional aspects are a necessary condition for a successful management.

Sustainable Solutions for IUWM

- **Land use:** reduction of irregular occupations; avoid occupation of areas of risk; regulations and incentives for sustainable occupation, efficient transport;
- **Water Supply & Sanitation:** protection of river basin to preserve the quality of water sources; efficiency in WSS services; high coverage of sanitation and water quality goals for the river and Treatment plants;
- **Flood management and Stormwater:** regulation of flood spaces, incentives and regulations for source measures to increase on-site infiltration; detention facilities; integrated amenities
- **Solid waste:** collection and treatment (sanitary landfills); avoid proliferation of degraded areas; preserve functionality of hydraulic infrastructure; reduce-reuse-recycle
- **Integrated solutions** Develop all the services for the same area. Usually the best division are the creek basin inside of the city in order to comply with the impacts from upstream to downstream.

8

The main sustainable solution aspects of IUWM are to improve urbanization with reduction of irregular occupation, avoiding risk areas and decrease the incentive for invasion. Improve urbanization taking into account all services, but in first stage transport, energy and water are the important one. In water supply and sanitation the protection of water supply basins is key. Increase the coverage of sustainable sewage with elimination of contamination and recover the rivers. Storm water is extremely depend of urbanization. Regulation to hold peak flood increase an incentives to source measures and green infrastructure, use infiltration and storage instead of channel and integrated it with amenities. In flood plains the development alternative for risk area such as parks and recreation or preservation are needed in order to decrease the population on these areas. In solid waste management is important to increase value of the garbage with incentives to recycling and improve management with educational processes and pricing the services per volume. Integrated solution is mainly an institutional approach. The services has to be integrated in the space and each city requires an institutional process after assessing its conditions.

IMPROVING ON SITE MEASURES AND LAND SCAPE

Infiltration decreases the overland flow and recharge the groundwater, recovering the natural hydrologic cycle



Improve the urban landscape, infiltration and heat



Allow infiltration in the vegetation and side walk



Improve the local environment and decrease the heat



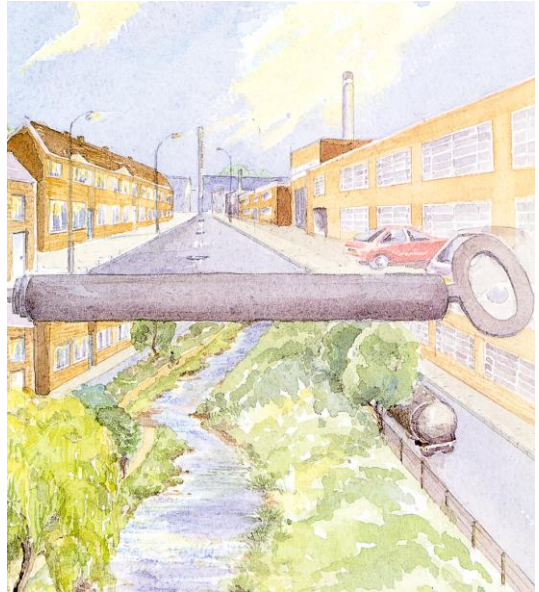
Storm water detention, environment landscape and amenities

9

This pictures shows how it is possible to improve urban environment and dealing with the services. The above left picture shows the public area with a lot of areas for infiltration and to receive water from impervious areas. This kind of environment give value to the properties, but requires more maintenance. In the above right side the picture show it is possible to open the curb in order increase infiltration in the vegetation. In the picture below left is presented a green roof which helps on temperature and in the right shows a urban reservoir (detention) integrated to green areas.

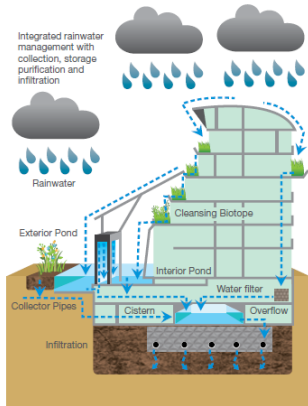
Level of actions

- *At the private level – at source*
...encouraging environmental certification such as Green Building, LEED, among others, bringing value to the investment. This area actions at source: *building, plot development*
- *At the public level – urban area*
...undertaking new developments with sustainable standards for urban recovery which represents an opportunity to change the city. *It represents an area of the city*

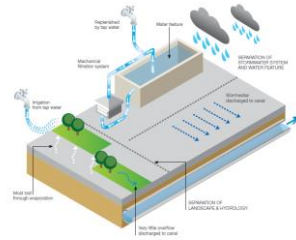


Nowadays, there are two major ways to develop sustainable measures: At private levels it has been by certification and regulation. Certification is a way to show that a construction is developing sustainable solutions and there are a few private institutions which certify the projects based on indicators. The regulation is the public requirement to comply with the impacts such as increase floods in storm water by limiting the flow from properties, together with reduce sediments and improve water quality. At public level the solution is by an urban recovery integrated to the interventions in part of the cities. It can be developed in three stages: infrastructure (water, sanitation drainage and solids, transport, resettlement, etc) amenities and education: parks, school, museum, etc; and urban operation which brings investment to the area and cost recovery by taxes and construction permits trading.

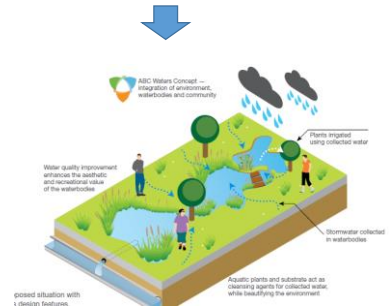
Local or Source Level



conventional



Green development



The traditional constructions used concrete everywhere. At local source sustainability is the collect rain water (harvesting) , use green roof, green walls and internal water pond and reuse. In the left picture is shown the rain entering the building going to green areas and collected in an interior pond and cistern. It export to exterior areas and pond and finally flowing out in a sustainable way. In the picture of the right is shown the usual concrete occupation transformed in more green space.

At public level - Integrated solutions

- For an urban area – develop all services for the same area and improve the urban development
- There are three levels of action
 - I – infrastructure – develop sanitation, solids management, storm water; transport, resettlement, etc
 - II – Amenities, prevention, education and cultural: parks, recreational equipment's, schools, museum, etc
 - III – New Investments – Urban Structure Operation: Housing, Shopping, Hospital, Universities, Economic Mechanisms in the Urban Structure Operation, etc.



Sewage treatment, storm water, urban recovery, solids, transport, etc

12

Remarkable intervention is shown in pictures of the urban recovery from Seoul. A River which was covered by concrete and speedway was recovered with a transformation which integrated sanitation, solids management, storm water, transport, among others, improve the area amenities and bring more investments. In the three steps of urban recovery, The cost was about US\$ 360 millions in a basin of 62 km² and 35 months of for projects and implementation.

Integration at Public Level

- Area of 13 km² inside of river dikes which is often flooded by Storm water in of Teresina, Brazil;
- Poor population without overall infra structure;
- Interventions developed was on:
 - ✓ Sanitation: collection and sewage treatment;
 - ✓ Solid Management: improve the services;
 - ✓ Storm water and flood control;
 - ✓ Integrated lagoon to park with recreational facilities, school, museum, among other
 - ✓ Resettlement of population in risk area;
 - ✓ Urbanization of the area in parks, streets for transport ways
 - ✓ Alternative job opportunities

TERESINA, BRAZIL



Teresina is a World Bank project in Northeast of Brazil in a part of the city with 100,000 inhabitants and 13 km². There was floods, solids, poor population with lack of all infrastructure. The integrated intervention was developed for part of the city in the first phase and now is underdevelopment the second phase. It integrated sanitation of the neighborhoods around the lakes, improve de storm water and flood control, parks recovery with recreation, museum, school, resettlements, job opportunities, transport .This process has transformed the area of the city and improve quality of live, water quality and environment.

Conclusions

- IUWM is a process with a long term vision
- IUWM should be developed in stages and requires continuous actions
- Institutional strengthening and capacity building are conditions to move from planning to actions
- A holistic approach that integrates actions and measures in the urban space is more efficient to achieve economic, social and environmental goals

14

IUWM requires long term investments and change in the way to develop the city. It requires the development in stages with continuity. This a difficulty since in the political arena, the administration changes every 4 years. However, if there a strong public participation the new administration needs to go ahead on this type of investments. The Institutional development requires steady institutions and utilities with strong capacity building with State type of employee which keep the memory and development of strategic projects. Integration is a word to be used for space areas in all aspects of services and outputs for society goals in economic, social and environment.