

AfWA Congress, Kampala

February 26, 2020

Inclusive Sanitation Technologies

Condominial Sewers

CAESB

Kneder@mkmbr.com.br

Brazil

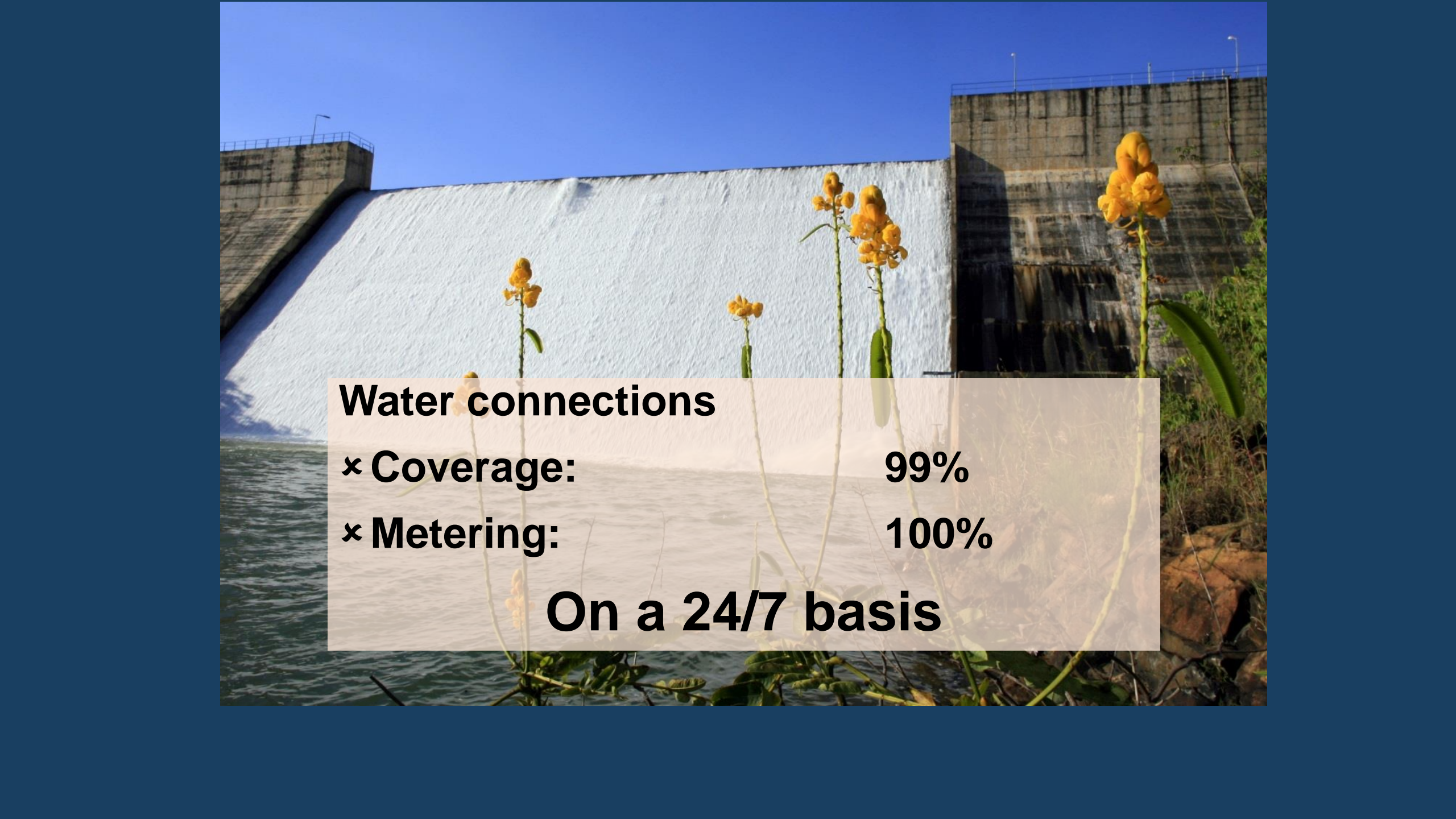
Brasilia

3 million inhabitants



CAESB

- × Population served: 3 million
- × Annual Income: US\$ 400 million
- × Employees: 2,560
- × Water Production: 268 million m³/year
- × Water losses: 28%
- × Water consumption: 228 million m³/year

A photograph of a large concrete dam with water cascading over its spillway. In the foreground, several tall, thin stems with clusters of bright yellow flowers are visible. The sky is clear and blue.

Water connections

- × Coverage: 99%**
- × Metering: 100%**

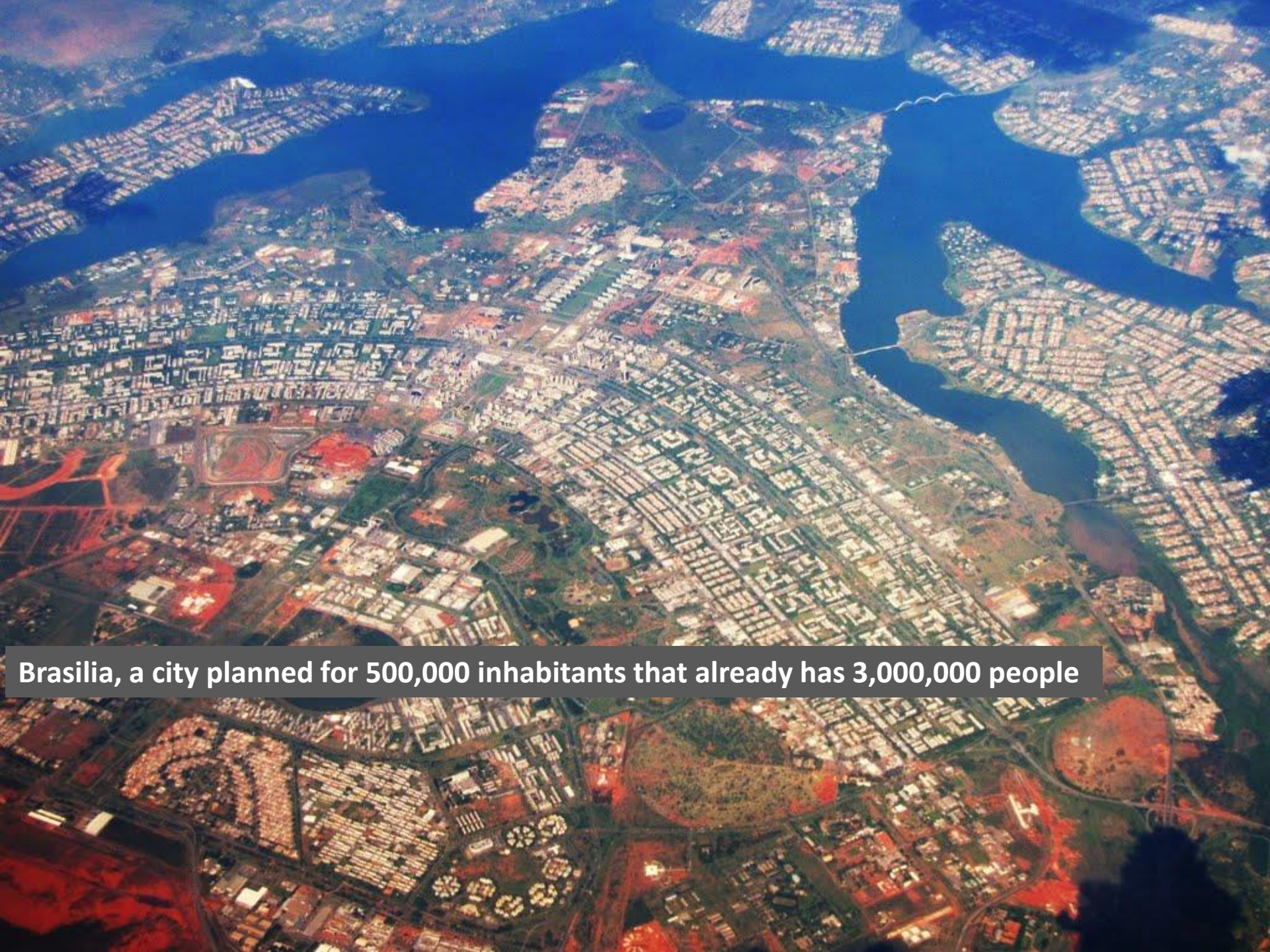
On a 24/7 basis



Wastewater connections:

- × Coverage: 91%**
- × Treatment: 100%**

Including tertiary treatment



Brasilia, a city planned for 500,000 inhabitants that already has 3,000,000 people

Some 25 years ago...

Water coverage around 100%

Sanitation under 35%

**Many environmental problems, huge demand
on sanitation**

A big challenge for the Company

A decision was taken, increase sanitation coverage to the same level of water

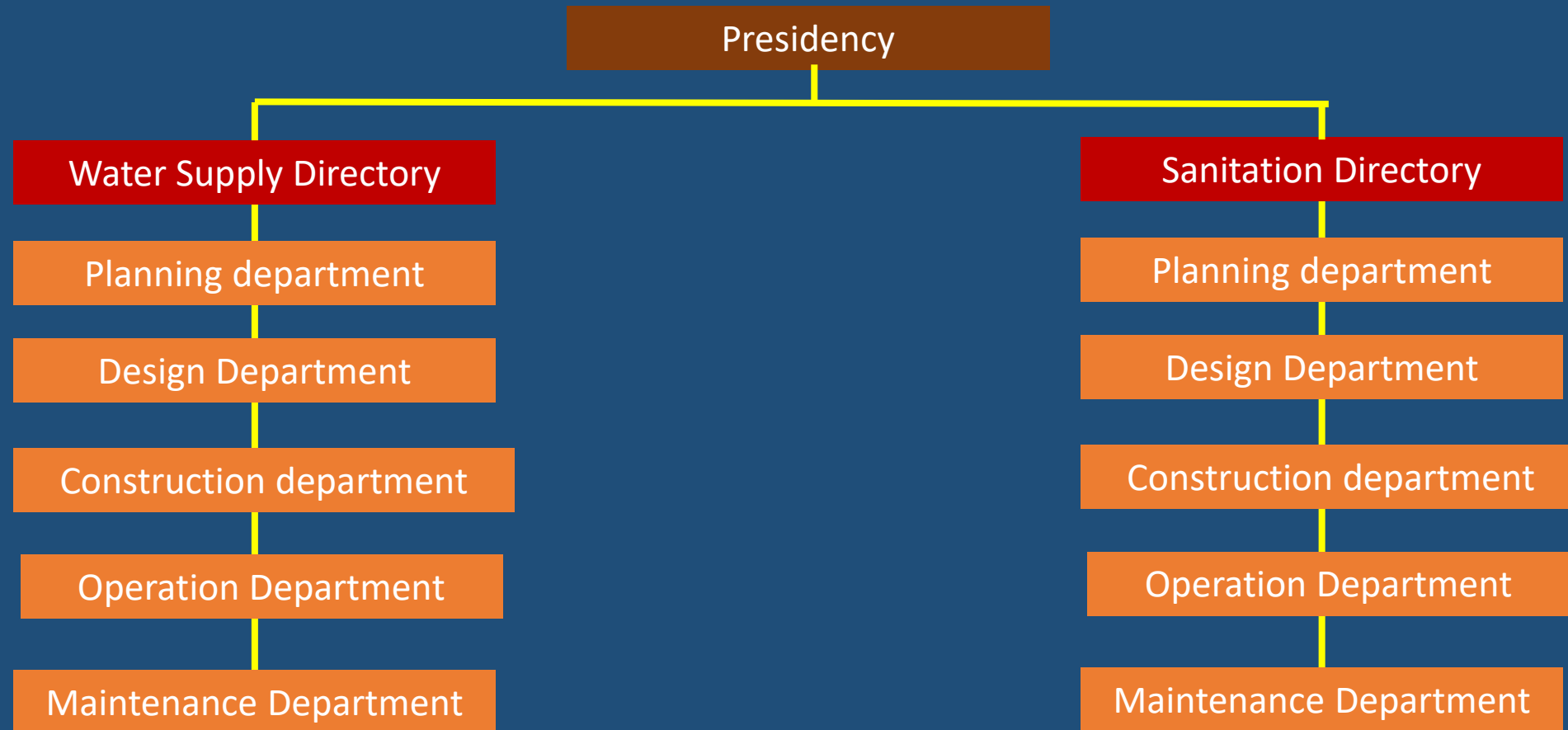
For the existing urban areas and for the new low income urban areas



Poor periphery

The first action:

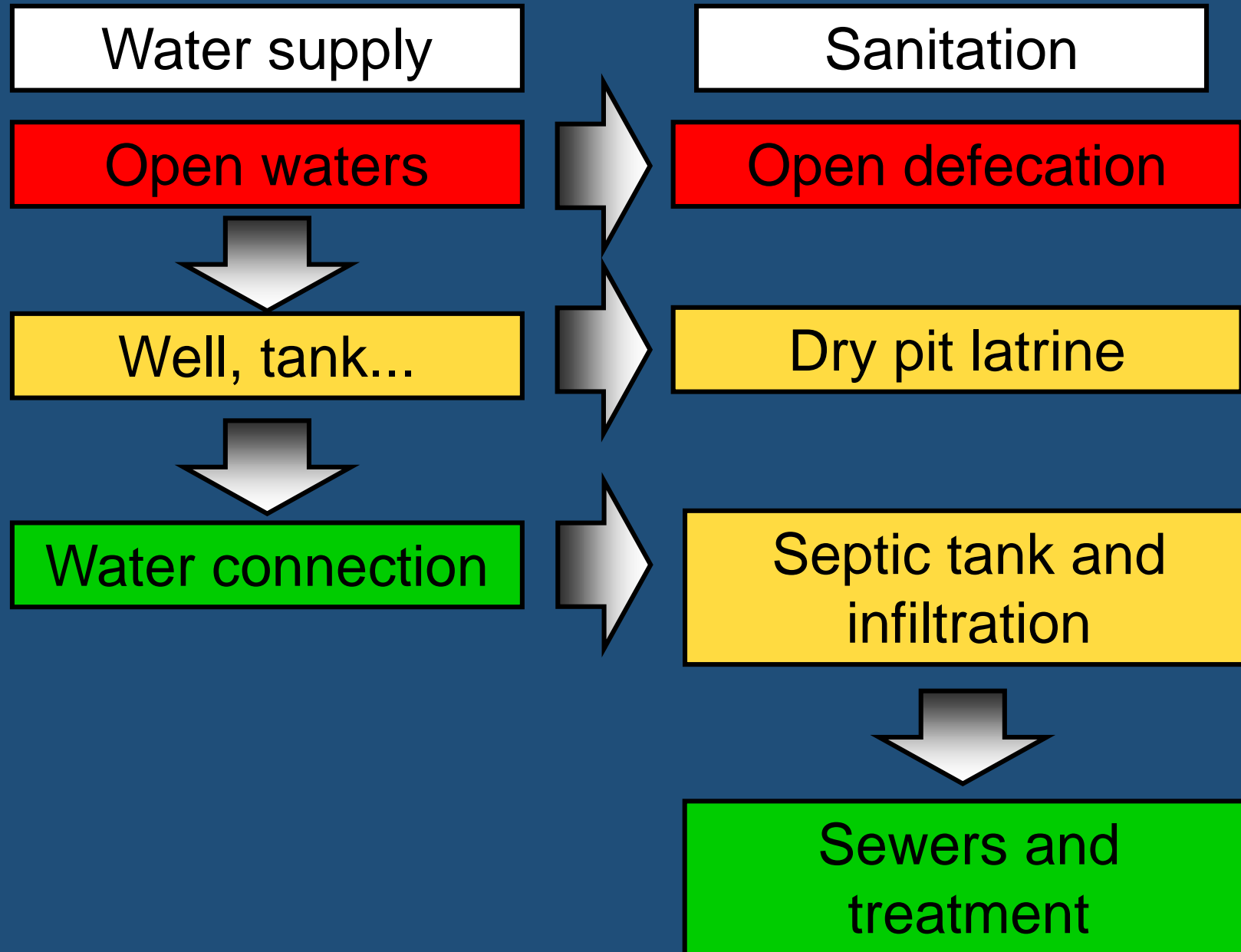
Give the sanitation the same organizational status as for the water supply area



As investment for sewers was quite high, initially Caesb wanted to rely on "on site" sanitation solutions

Technical Guidelines and orientation was given to the new customers

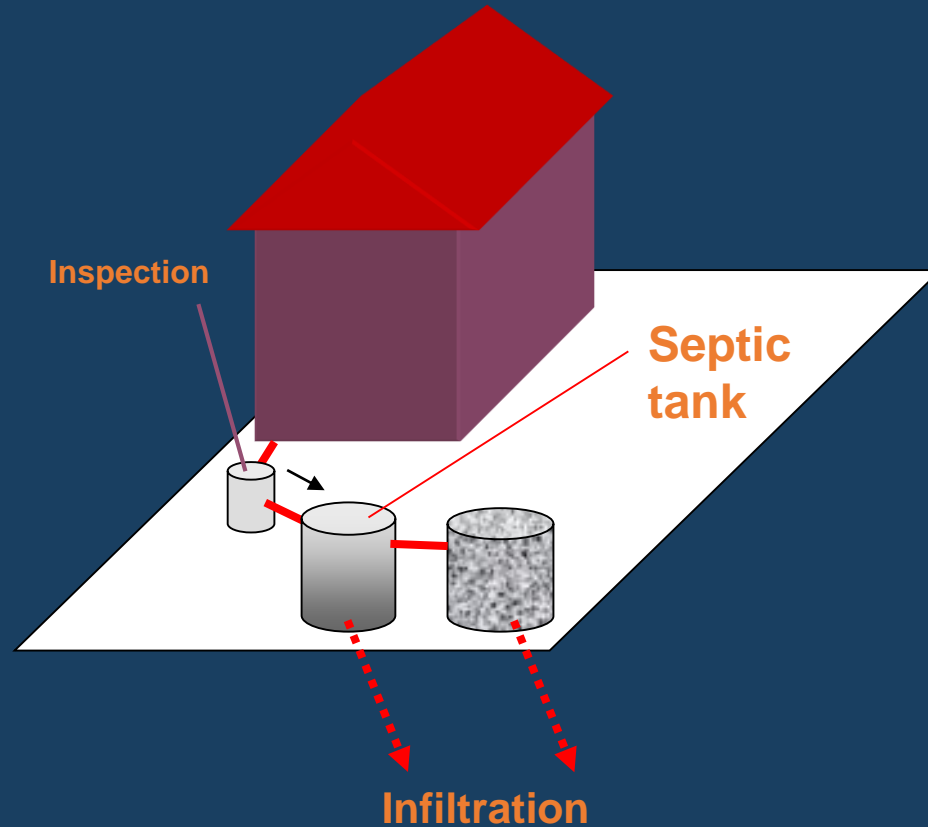
Natural path for water and sanitation services



On site sanitation solution

Doesn't require sewers

- Collection, treatment and final disposal at the household level





Positive aspects expected

- **Simple technology**
 - **Provided by the householder**
 - **No regular operation is required**
- **Good sanitary results when properly designed and constructed**
- **High implementation flexibility**
 - **Desludging usually available**



Negative aspects that we were facing

- **Expensive for the householder**
 - **Poor construction**
- **Overflow in areas with low soil permeability**
 - **Grey water**
 - **Overflow on rainy season**
 - **Improper sludge disposal**
- **Complicated for larger constructions**
 - **Inadequate in high densities**
 - **Ground water contamination risk**
 - **Green house emissions**

**We quickly focused on network
solutions**



Positive aspects expected to network solutions

- No restriction on urban density
- No restriction on building size
- Doesn't depend on soil permeability
- Immune to rainy season
- Includes wastewater and sludge treatment
- Improved sanitary and environmental results

So Caesb adopted network solutions as the final goal for urban settlements sanitation

**Conventional sewers
were the initial option**

Resulted in Caesbs Sanitation Philosophy

On site solutions are recommended for low density areas, or, as a temporary solution in high density areas, until a network solution is implemented

Network solution, with wastewater collection and treatment, is the most adequate sanitation system for urban areas

**But we had some problems related to
conventional sewers**



- **High investment costs**
- **Low number of connections**
- **Low willingness to pay**
- **Bad use of the infrastructure**
- **A lot of maintenance required in low income areas**

So what are the problems we could identify related to “Conventional” solutions for sewers:

- **Emphasis on the infrastructure only (public network)**
- **Poor assessment of the “real” situation at the project area. Office design.**
- **Population is not seen as a part of the project**
- **Little or no consideration for the connections**
- **No consideration for internal installations**
- **Little consideration for the operation/maintenance**
- **No consideration on tariffs / sustainability**
- **No considerations for the threatening environment in low income areas**
- **No considerations on system management**
- **Investment too high**

Low connection rates

- **Client shows no interest in connecting**
- **Client has no money to connect**
- **No adequate internal installations**
- **Lack of technical orientation**
- **Internal Installations lower than the sewer lines**
- **Septic tank at the back of the lot**
- **Connecting requiring breaking floors and walls**
- **Existing connection to a drain**
- **Fear of the tariff**

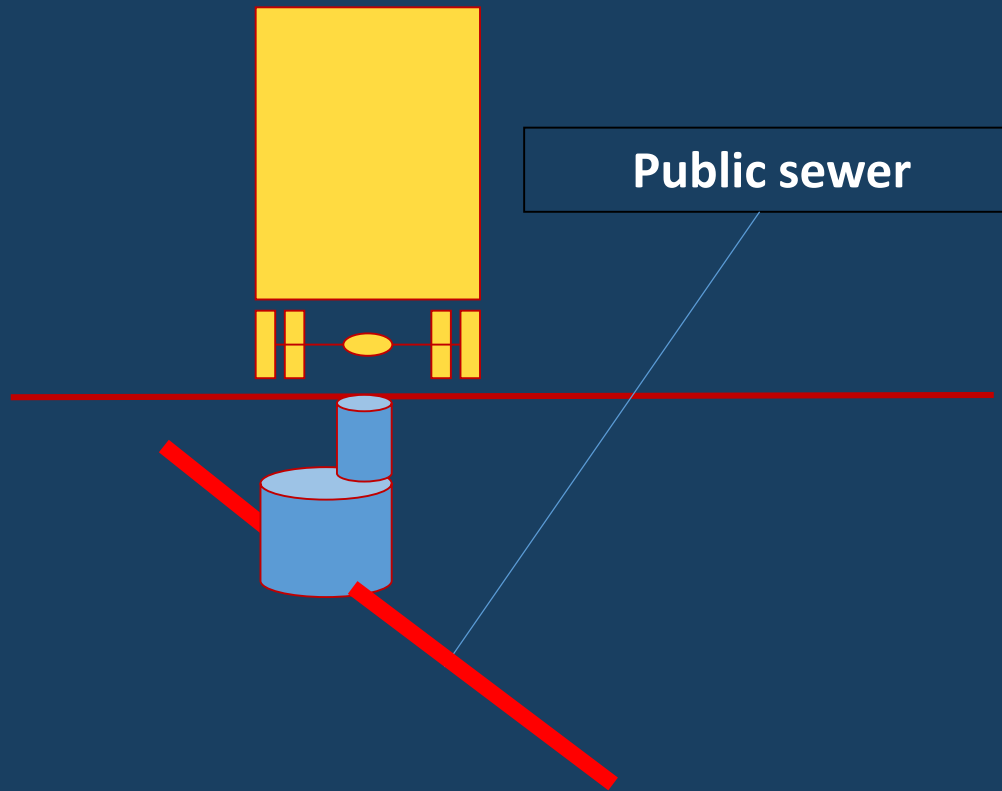
**It became clear that we had to work in
different directions**

- **Reduce Investment Costs**
 - **Behavior Change**
- **Promote connections**

Investment Cost reduction

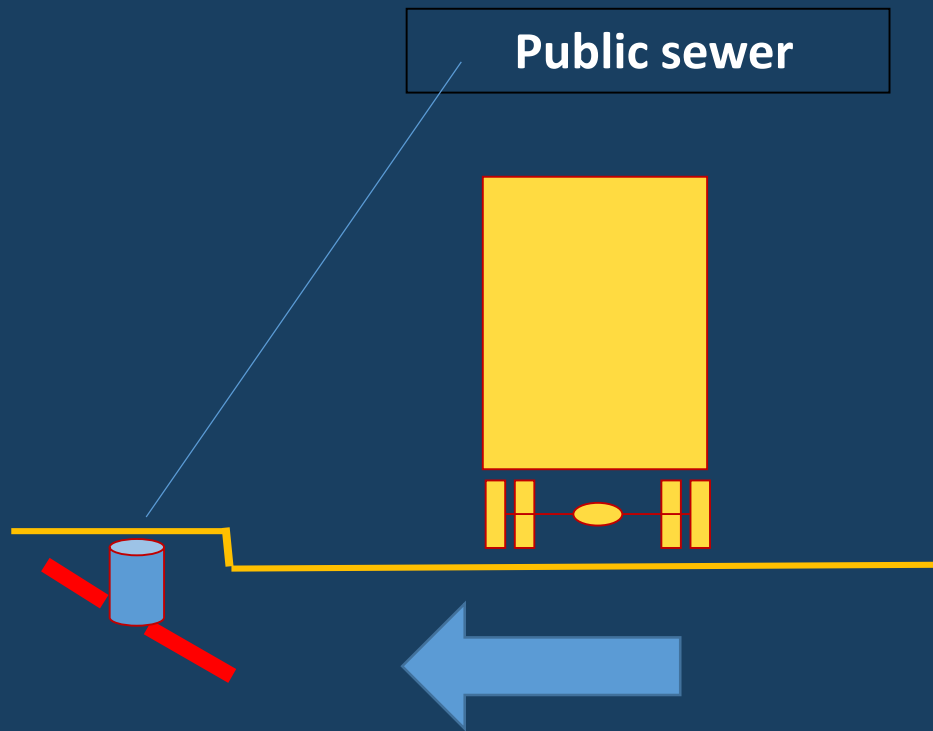
Sewers main investment costs:

- **Excavation volumes**
 - **Manholes**



**The location of sewers
impacts the
construction costs**

**Location at the roads
require deeper sewers
and stronger manholes**



**Moving the sewers to
safer areas could
reduce their depth**

**And also reduce the
size of manholes**

**Move sewers to the side-
walk or even to the lots areas
could significantly reduce
costs**

**The limit is the depth
necessary to allow the
household connection**



Sewers location





Fotos: Compesa



Sidewalk Branch construction – Tacaimbó - Brazil

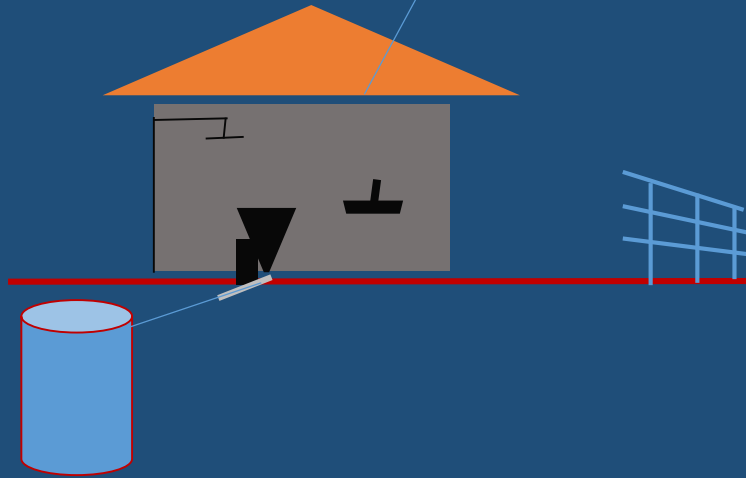
**So we had to start looking for the
household connection**

**Curiously, we realized that for most of
Conventional Sanitation projects, the
connection isn't part of the project itself**

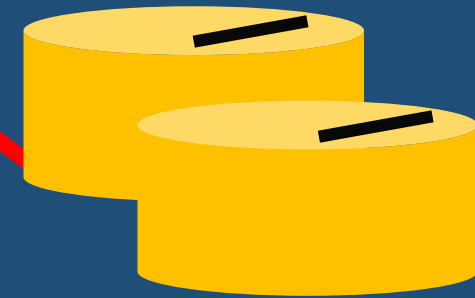
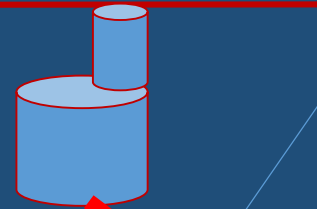
**The community is never a part of the
project.**

Conventional System

House Installations
with septic tank



Public sewer

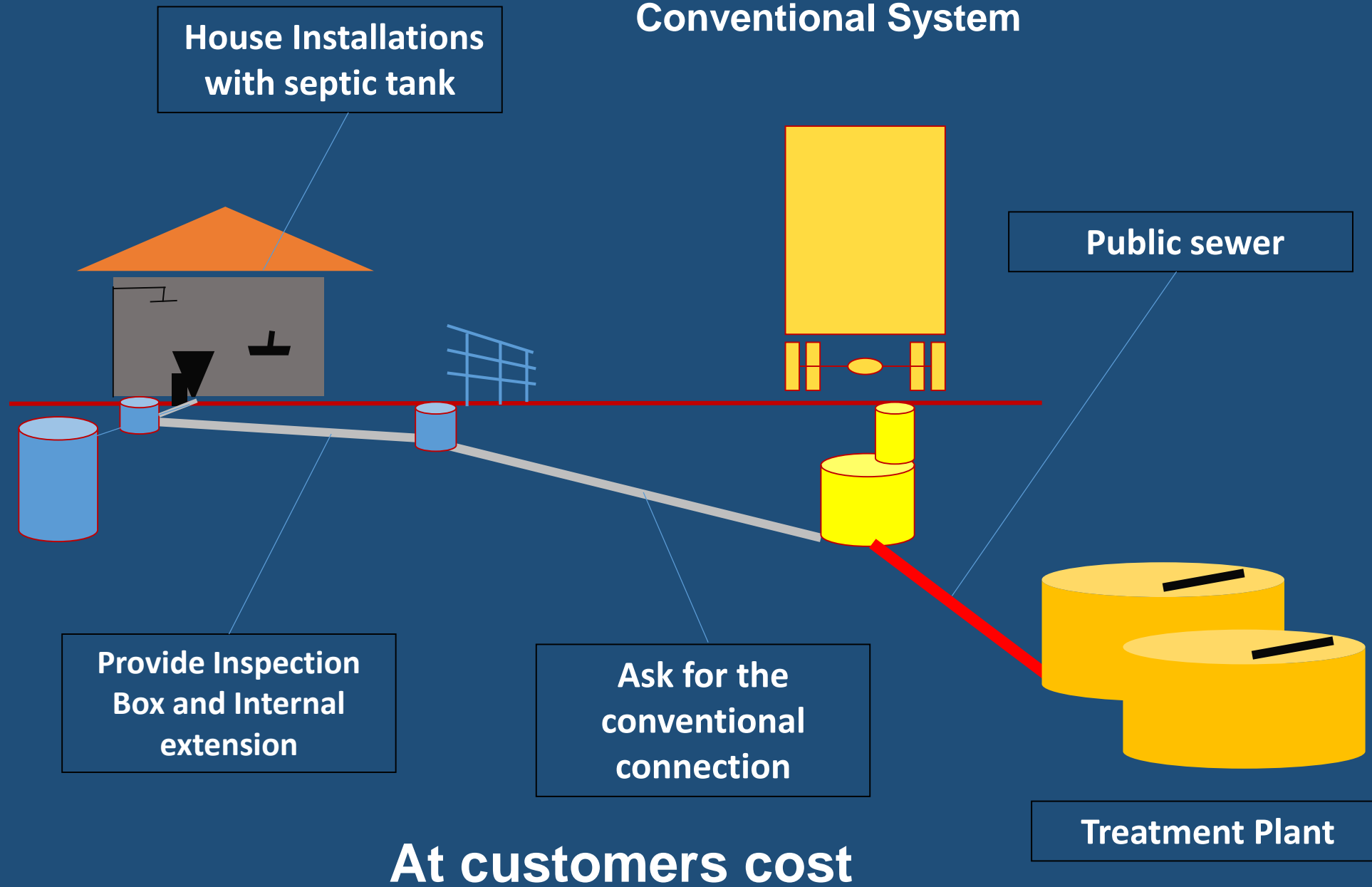


Treatment Plant

We want the people to connect, to pay their bills, to correctly use the system, to have adequate hygienic habits

But the community is never a part of the project.

Conventional System



At customers cost

Some improvements...

- **Presenting the project to the community**
 - **Educational activities**
 - **Surveys....**

Still the community is away from the project

**We learned that the utility shouldn't wait for the user
to come after the project**

The project should go after the user

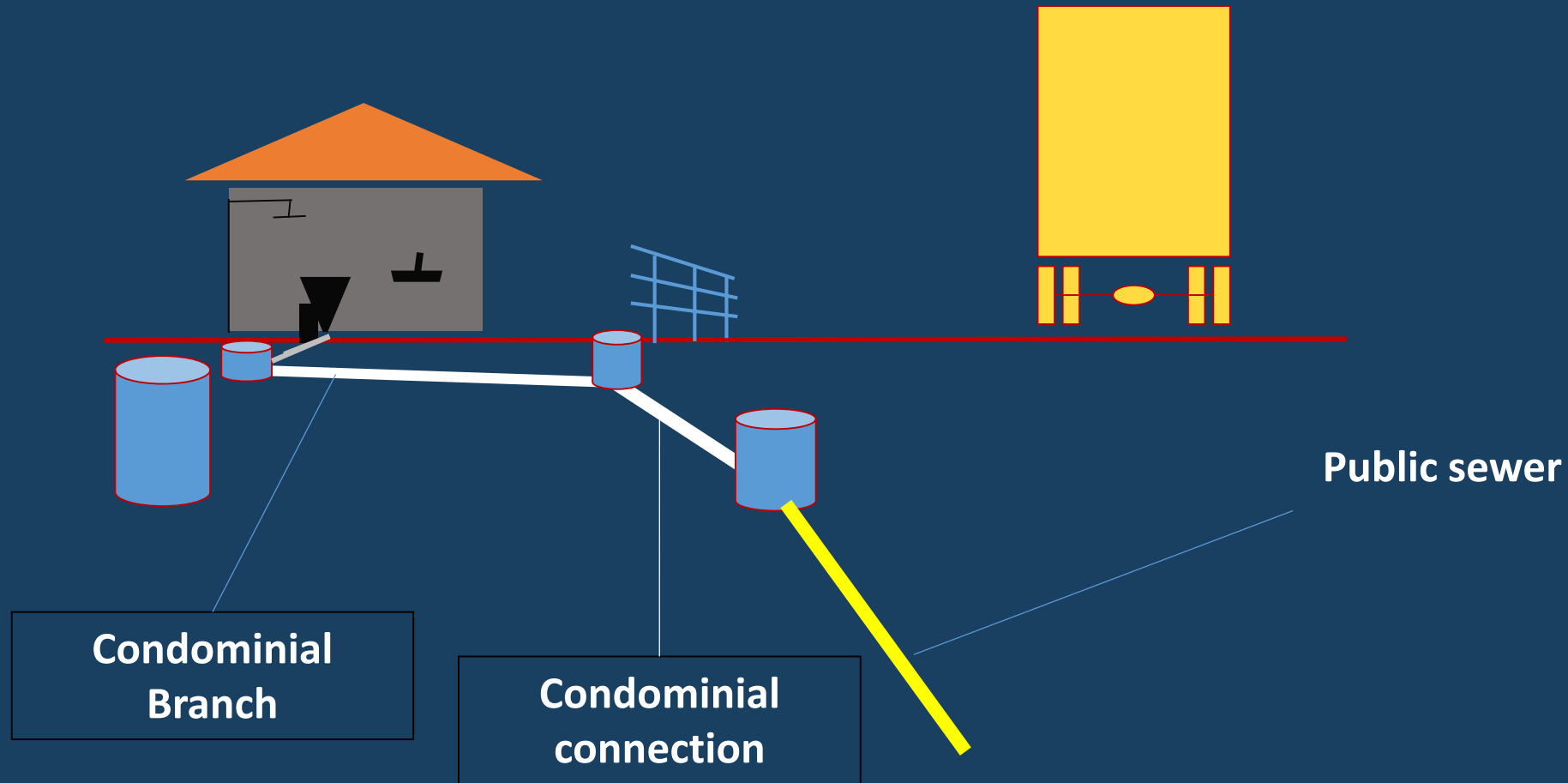
**This changes the way the sewers are designed and
constructed**

What used to be the final step at the Conventional system became the the first step at the Condominial Model

Connections are the first thing to look for in a sanitation project !

Construction starts up-stream and goes on down-stream to the treatment plant

Condominial System



All provided by the Project, discussed and agreed with the customer



Shared Connection – The Condominial Branch

**When we focus on the connection,
optimization can result in shared
connections**

City of Tacaimbó – North East Brazil



City of Tacaimbó – North East Brazil





Fotos: Compesa



Fotos: Compesa



Fotos: Compesa

The system was separated in two parts:

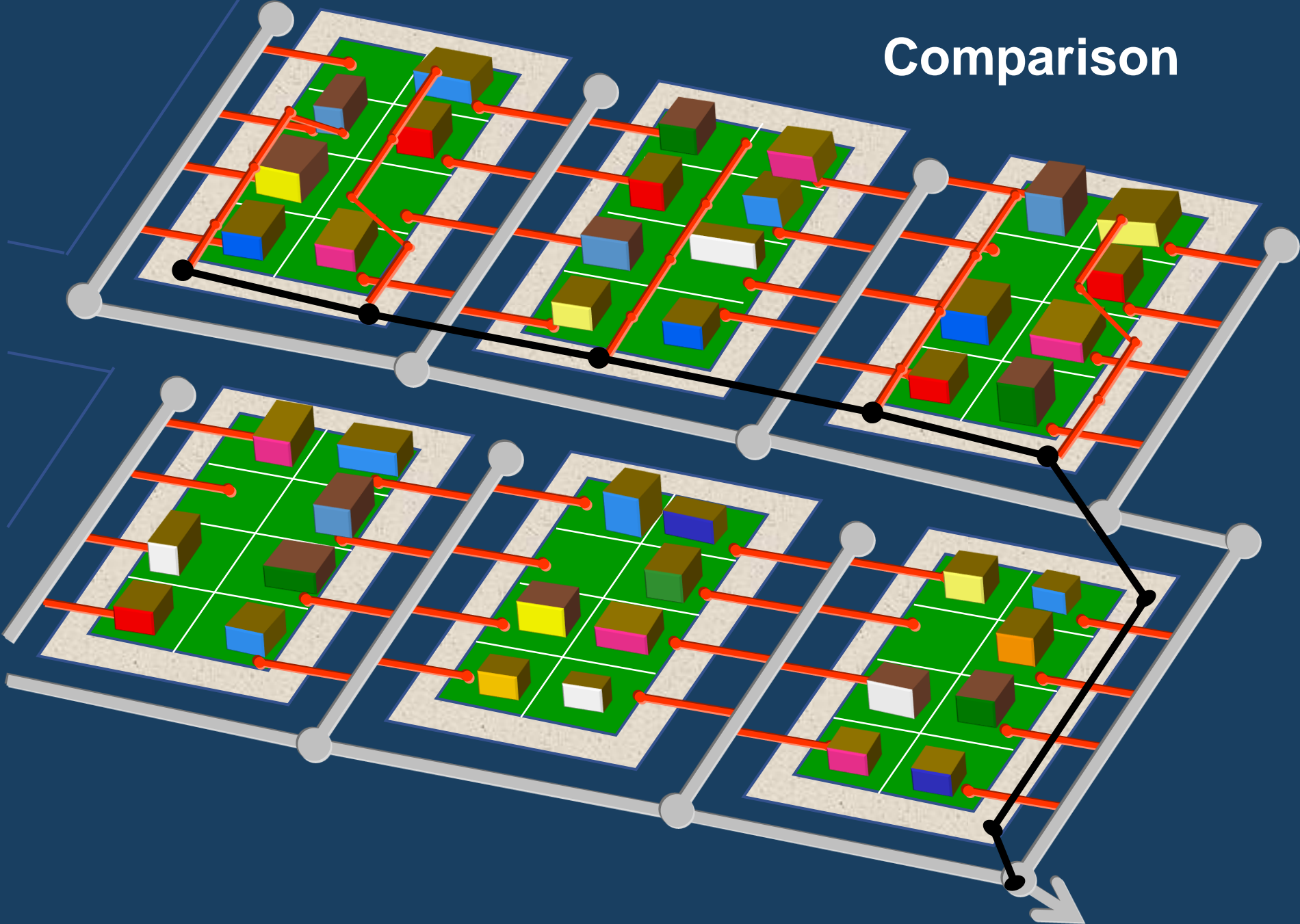
The “shared connection” part, close to the households. Shallow and with small inspection boxes

The Condominial Branches

The “mostly conventional” part, thorough out the city, with stronger manholes and deeper sewers

The Public Sewers

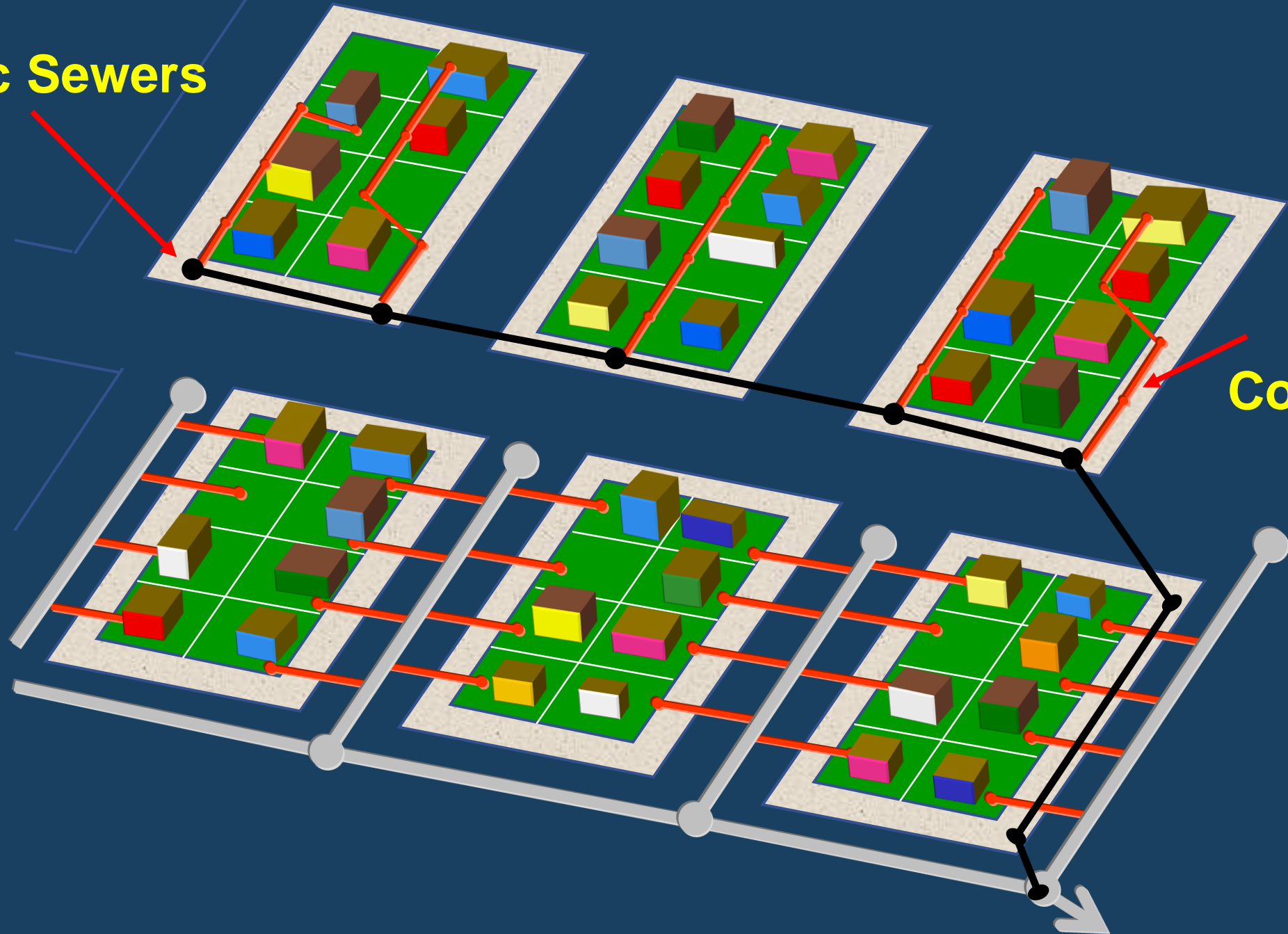
Comparison



Reducing extension of sewers

The shared connections result in smaller extensions for the sewers

Public Sewers



Shared Connections

Public sewers

- Public sewers are designed to collect the wastewater from the block, collecting in one point only, at its outlet
- Location, diameter and depth are optimized according to the Condominial Branch
- Location looks for protected areas
- Inspection devices according to depth and location



101

100

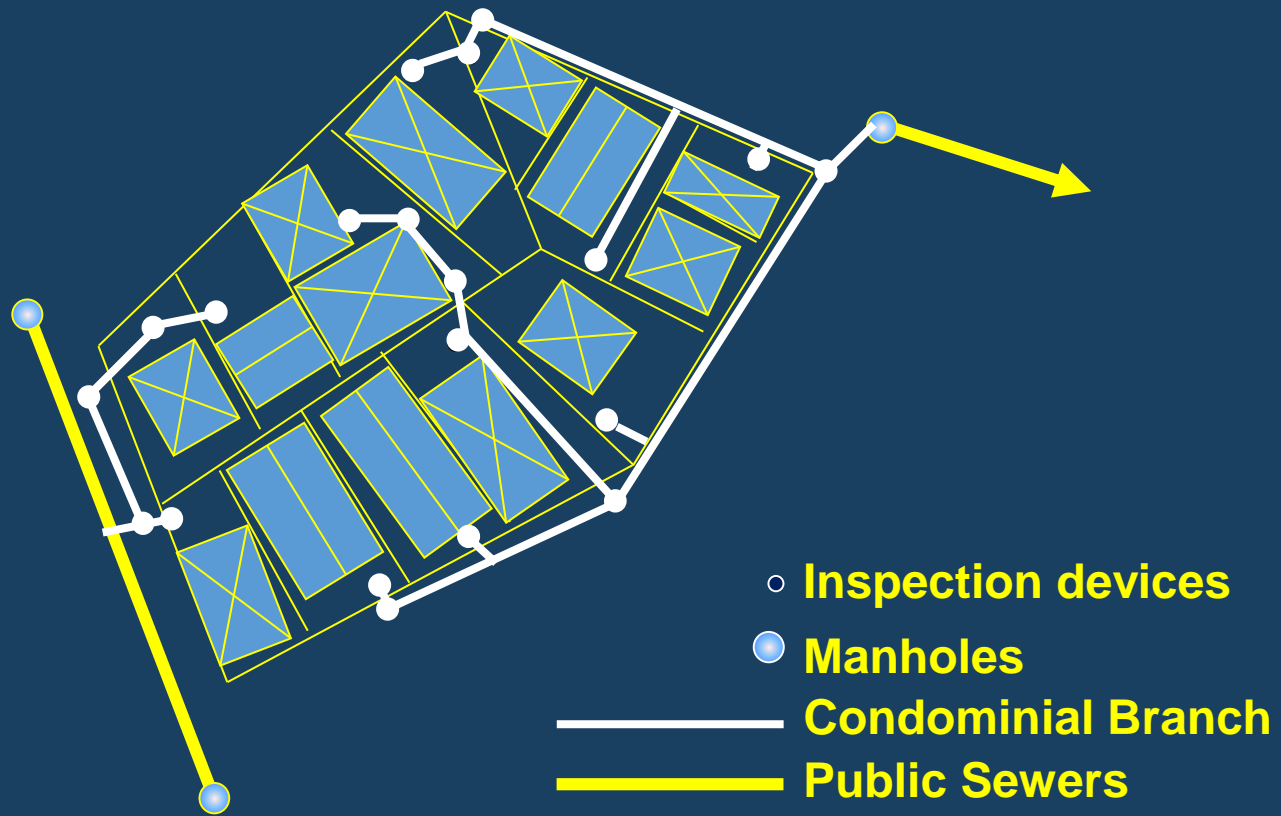
99

98

Shared Connection (Condominial branches)

- Collects the wastewater from the households of the block
- Only small diameters are required (100 /150 mm)
- Minimum slope: 0.5 – 1,0%
- Most of the pipes are located at protected areas allowing very shallow trenches (30 cm)
- Inspection devices can be small and lightly constructed (30 cm diameter)

**Up to 60% of all sewers extension is made of
condominial branches**

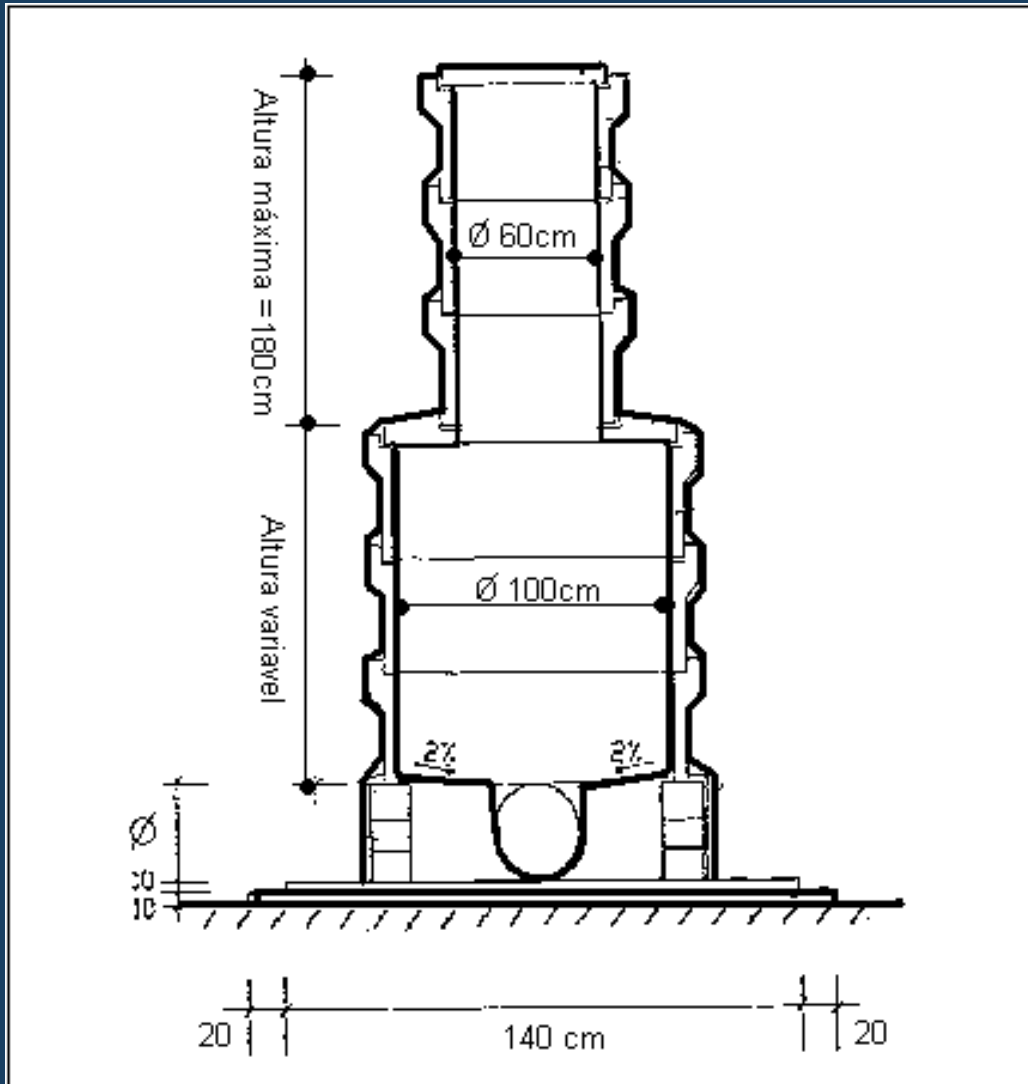


Results of the new design criteria

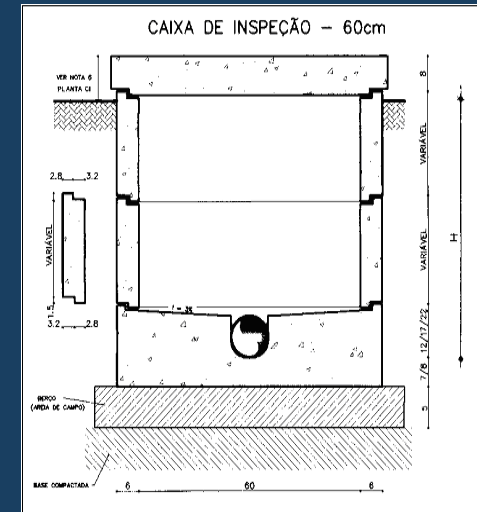
- **Investment: up to 40% reduction**
- **Maintenance: up to 60% of sewers extension very easy to maintain – shallow, small bore pipes**

Reducing Manholes costs

Shallower pipes, located on more protected areas, allow the use of smaller inspection boxes



Manhole



Inspection box



Manholes



Inspection Boxes



Sealed Inspection Box

Connecting the people

**Immediate connection provides the
expected benefits and generates cash
for the utility**

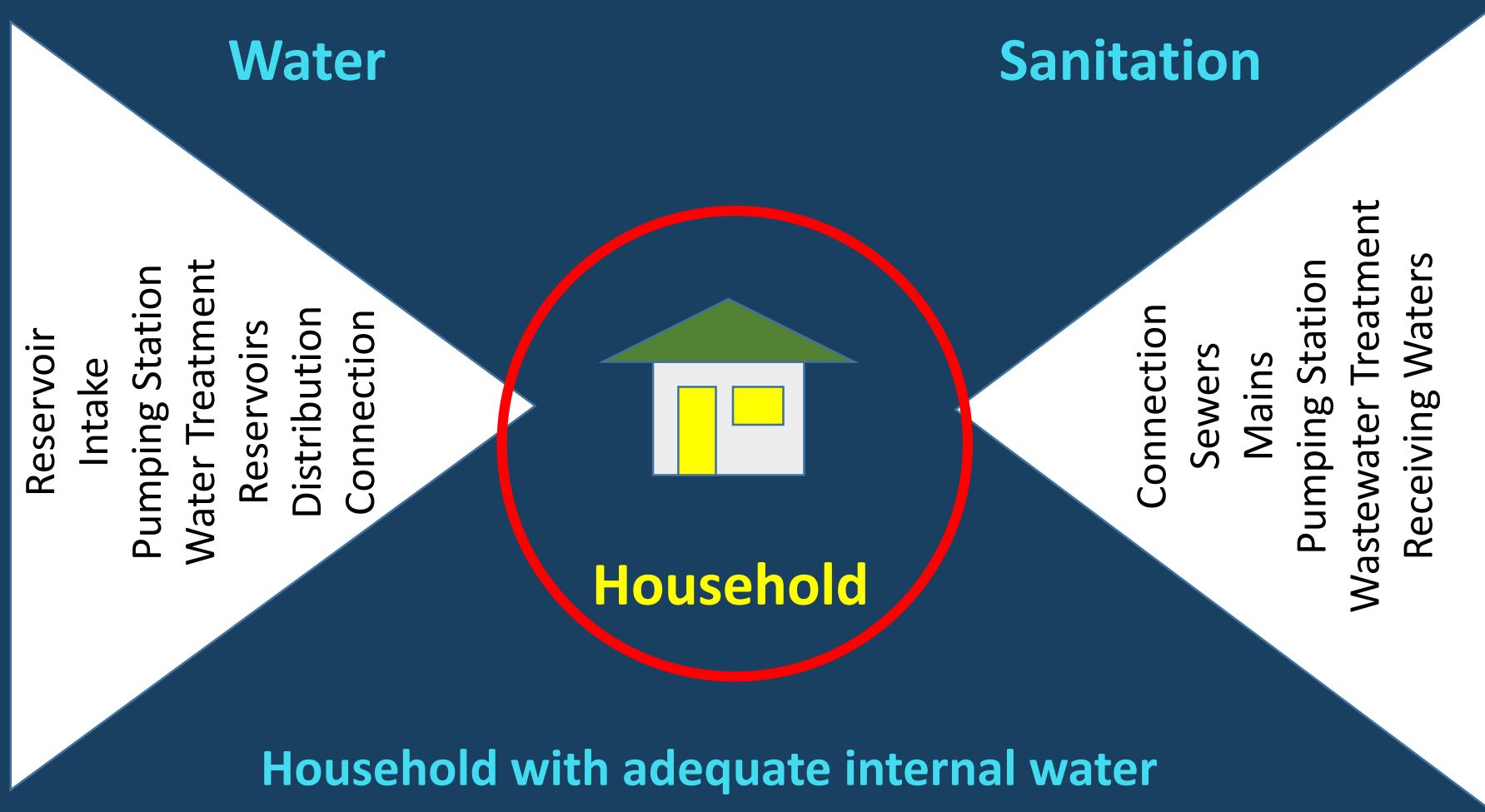


Fotos: Compesa



Promoting household facilities

**Provide the minimal installations to
allow the wastewater connection**



**Household with adequate internal water
and sanitation installations**
Key element on the water sanitation chain



Includes:

Water connection with appropriate water volume

- **Basin (Hands, dishes washing)**
- **Shower (Body Hygiene)**
- **Tank (Clothes washing)**
- **Toilet (urine and feces)**

Should be located at the household itself

But we can help, providing:

- **Technical advise**
- **Sanitary Module basic design**
- **List of materials and services**
 - **Cost estimation**
- **Negotiate cheaper materials by local suppliers**
 - **Create local labor force**
 - **Negotiate micro-credits**
- **Direct support during construction**

.....and eventually: Subsidies



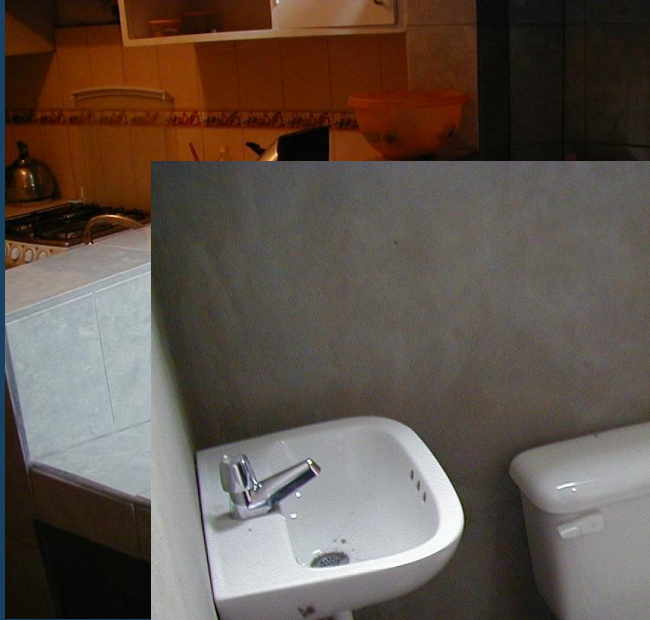
Fotos: Compesa



Fotos: Compesa



Fotos: Compesa



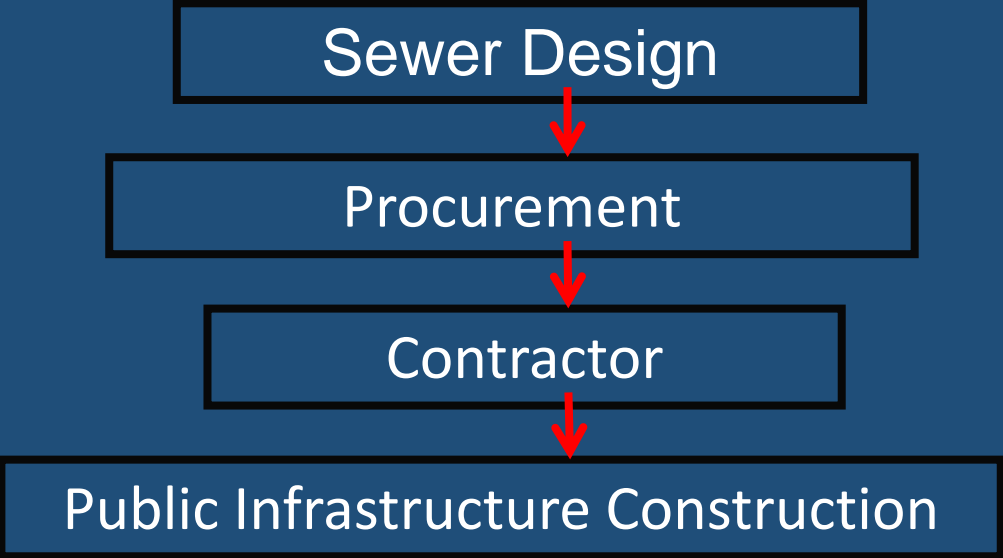
**All work within the lots involves the
community**

**Participation, discussion, suggestions,
decision taking**

**The Condominial Meetings
The Agreement Letter**



**In order to make this possible, we had to
change the way we implemented the
sewers**



Traditional way

GAP....



Technology

Preliminary Sewer Design

People

Procurement

Social/Technical team

Client/Community

Connection / Final Design

Contractor

New way

Innovation

Connection Construction

Public Infrastructure Construction



Field based design







**Followed by immediate
construction**



Fotos Engesolo/Cesan



Fotos Engesolo/Cesan



Fotos Engesolo/Cesan



Fotos Engesolo/Cesan

**30 years later, more than
1.5 million people
connected**

For the rich and for the poor areas

And still going on!

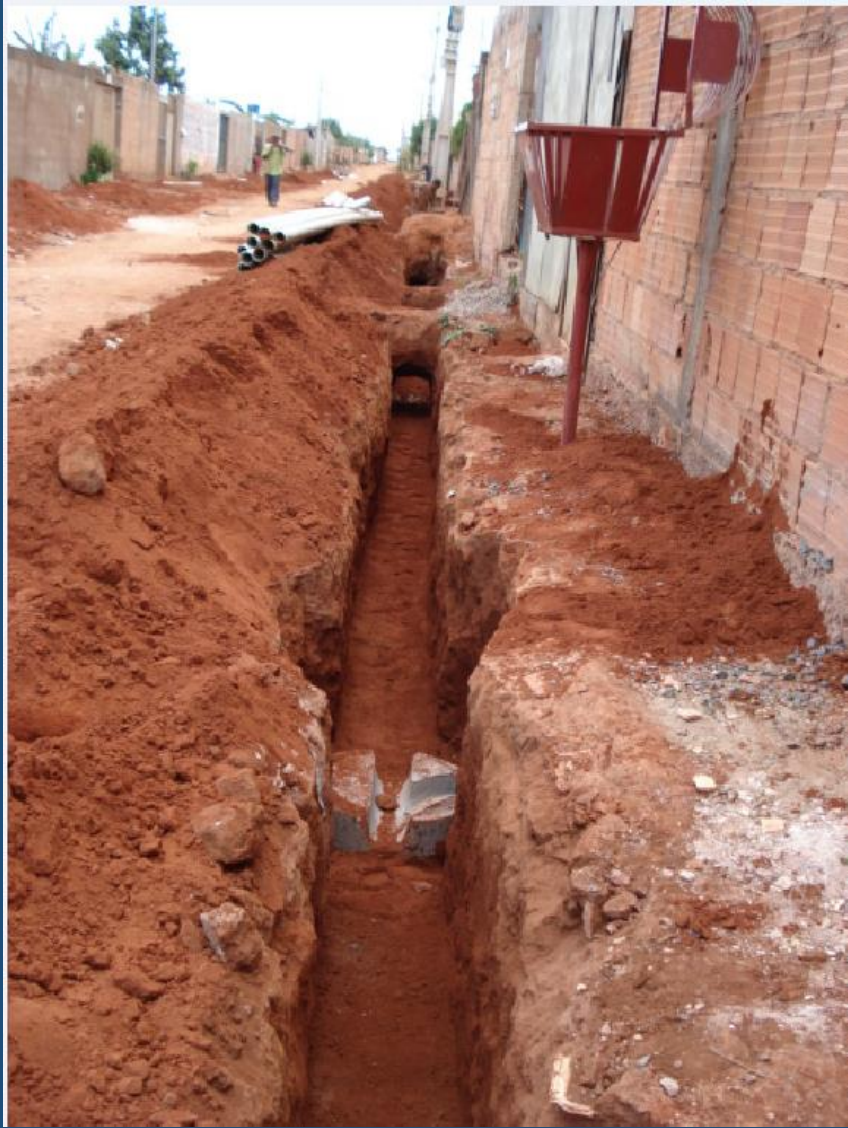


**Sol Nascente community :
100.000 inhabitants**

Works to date.....

SOL NASCENTE	
Connections	5.800
Population	26.680

	Extension	Cost - USD	Cost/m - USD
Public Sewers	19.599,18	1.302.857,96	66,48
Condominial Branches	58.583,00	1.032.794,65	17,63
Total	78.182,18	2.335.652,61	



Typical results for the system

Sewers total extension: 3 m/inhabitant

Shared Connections: 75% of the total extensión

Public Sewers: 25% of the total extensión

Average costs:

Shared connections: 20 USD/m

Public Sewers: 70 US/m

Condominial Sanitation for 100,000 people

225 km shared connections - 4.5 million USD
75 km Public Sewers - 5.25 million USD

TOTAL 300 km sewers - 9.75 million USD

97.5 USD / inh
341 USD / connection

New opportunities to try.....

Hose instead of pipes

- **Better hydraulics**
- **No joints**
- **Flexible**



New opportunities to try.....

Fittings instead of Inspection Boxes

- Cheaper
- Easier to handle
- No access for rubbish



Thank You!

Klaus Dieter Neder
kneder@mkbr.com.br

