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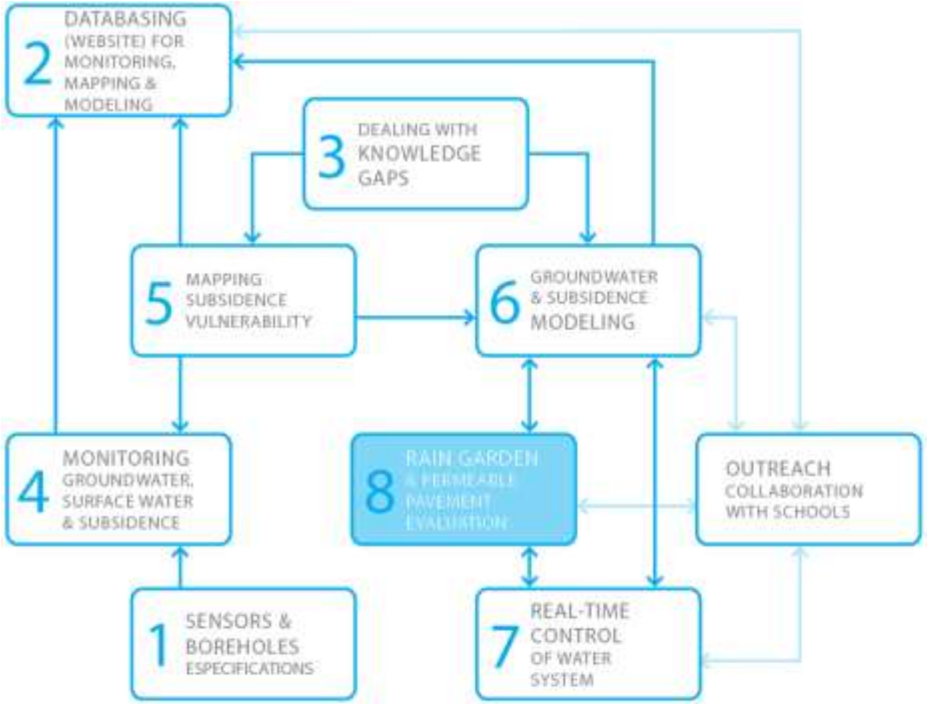

CITY OF NEW ORLEANS

GROUNDWORK New Orleans

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Nature Base Solutions in New Orleans: Opportunities and limitations

Testing, Observing, Discussing.

Roelof Stuurman

Floris Boogaard

Daan Rooze

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  - Undesired drainage of parks (example Audubon)
  - Towards City as a Sponge
  - Large water storage initiatives are needed
  - Costs ($ / m^3)
  - Towards an integrated storm networks water storage approach

Study objectives

The objective was not only hydrological testing of green infrastructure facilities, but also to analyze existing green infrastructure focusing on design, maintenance and cost effectiveness.

These findings provide valuable insight in the infiltration capacity of various facilities for both dry and wet conditions, and indications for design and maintenance improvements.

Project stakeholders (relations)

Organization	Stakeholders and partners
City of New Orleans	Mary Kincaid, Austin Feldbaum
Sewerage & Water Board of New Orleans	Grace Vogel, Tyler Antrup
New Orleans Redevelopment Authority	Abrina Williams, Charlotte Giroux, Seth Knudsen
New Orleans City Park	Jake Webster
Greater New Orleans Foundation	Don Favre
Dana Brown & Associates, Inc.	Dana Brown, Danielle Duhé
Waggonner & Ball	Ramiro Diaz
Groundwork New Orleans	Todd Reynolds, Denzal Peters, Joshua Lewis, Bruce King

Most important conclusions

- **Nearly all tested rain gardens and bioswales functioned well. Most facilities met the norm for emptying within 48 hours to prevent a mosquito infestation.**

- **Permeable pavement tests were less glorious. Only recently constructed sites functioned well and met our guideline of 10 inches/hour.**

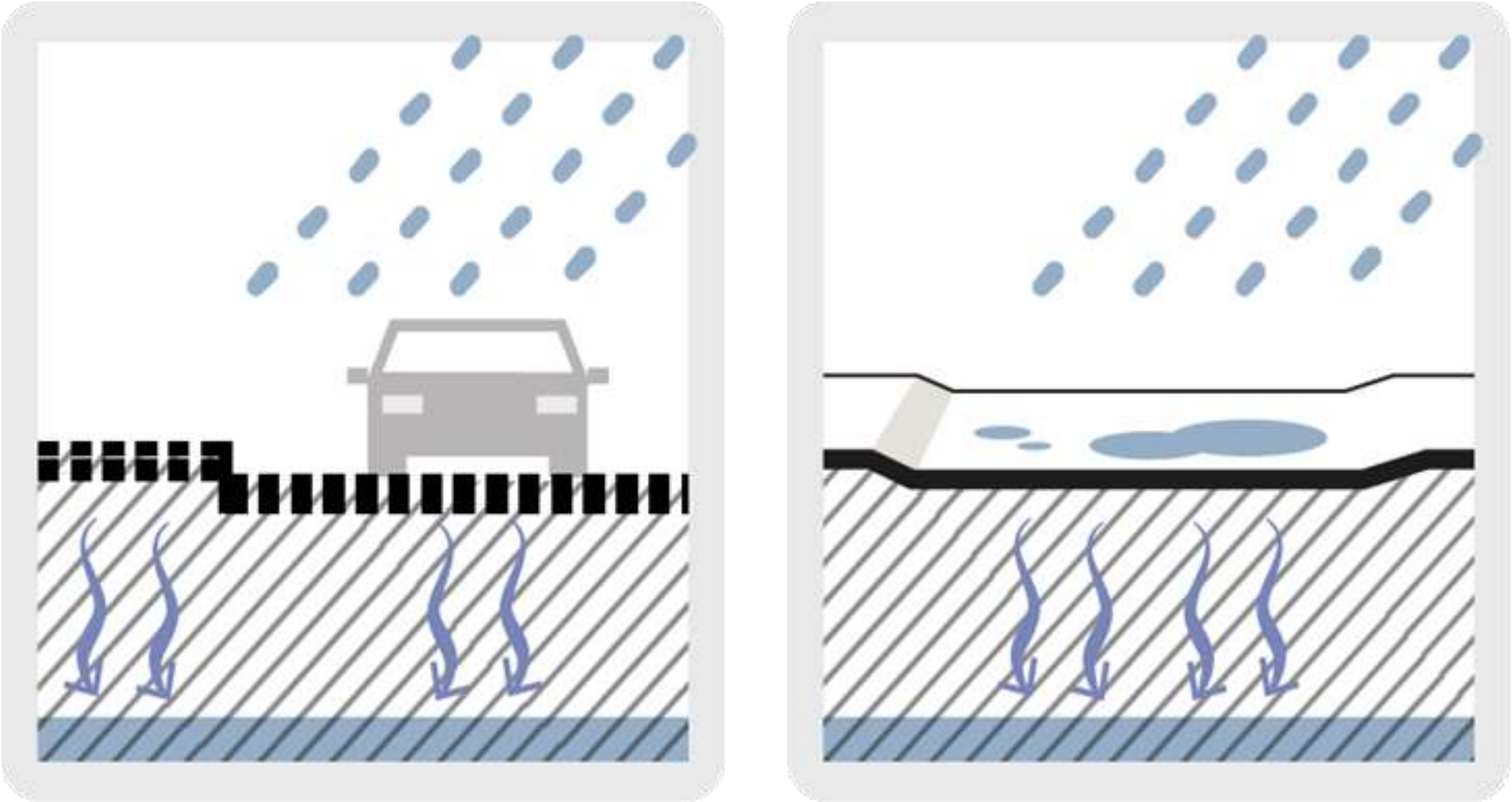
- **The design of rain gardens and bioswales can be greatly optimized by enlarging the storage volume capacity, raising the overflow level, and ensuring that first the rain gardens fill up before street runoff enters the stormwater drainage pipes.**

- **Maintenance of permeable pavement rarely takes place. Rain gardens and bioswales are generally well-maintained, but the focus should be more on sediment removal.**

- **Regarding the larger scale, existing rain gardens, bioswales and other green infrastructure facilities are too small and too expensive and should become more <u>cost effective</u> to meet the water assignment of New Orleans. This water assignment can only be effectively solved by relatively large interventions, such as the construction of large, well-maintained open water bodies (canals), and large storage areas on neutral grounds of streets.**

- **The construction and maintenance costs of existing green infrastructure are <u>relatively</u> high. Money can spend only once. Therefore, at a city-wide scale a strategy is needed for cost-effective design and implementation of green infrastructure taken cost effective maintenance in consideration at the design phase. Keep it simple as possible.**

Green infrastructure: Rain gardens & permeable pavement



PART 1: Test results

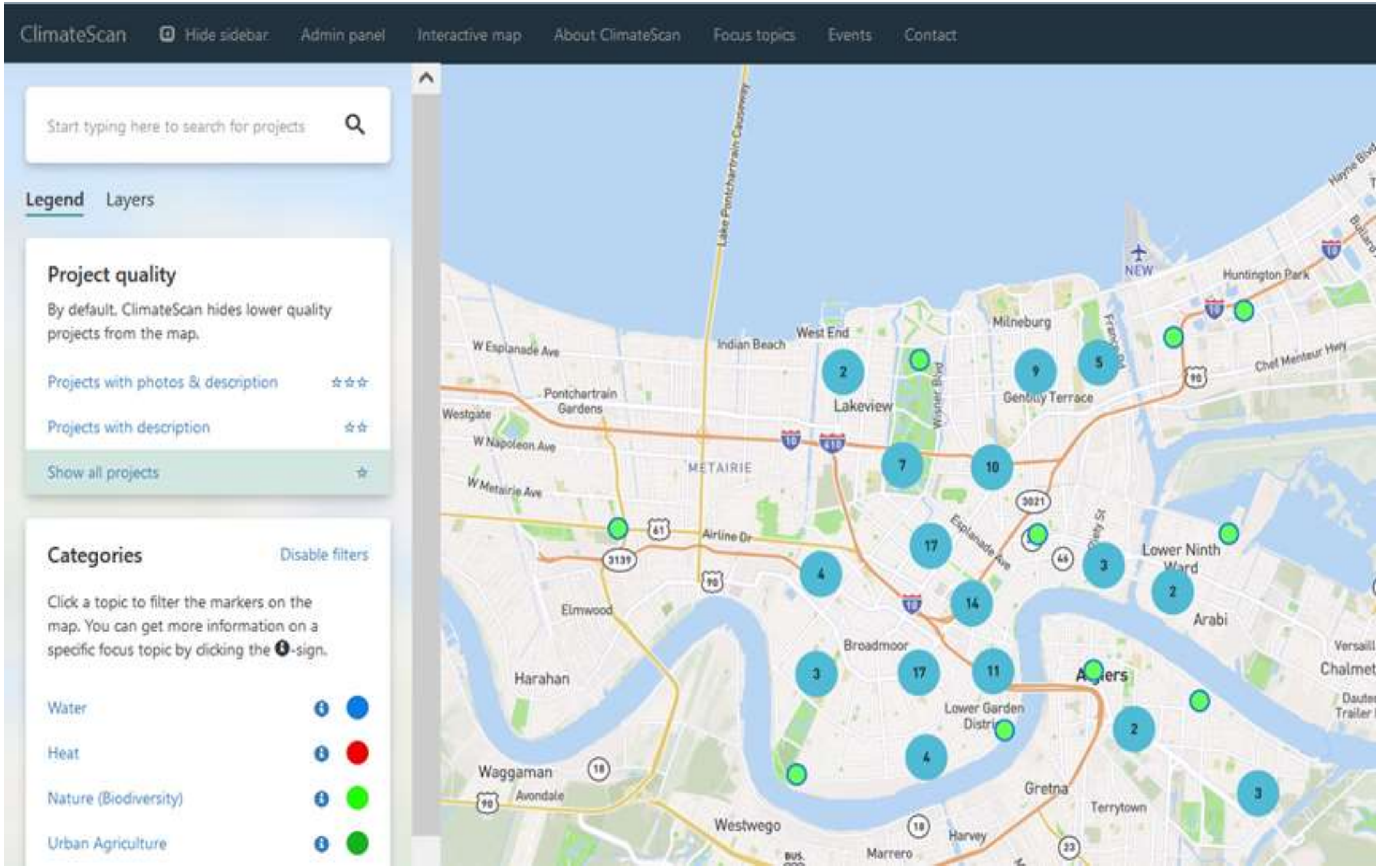
Planning & implementation (October 2022)

P= permeable pavement, BG= green infra	Monday 17th	Tuesday 18th	Wednesday 19th	Thursday 20th	Friday 21
8:30-10:30	BG1: City Park bio retention cell. With visit Dana Brown and Jake Webster (NO City Park)	BG2: Wildair Filmore (incl. installation sensors). *Installation groundwater sensor.*	BG4: Haley Blv with Abrina Williams & Charlotte Giroux and Seth Knudsen (NORA).	Office. Data analysis	BG7: Hollygrove BG11: Hollygrove School of Architecture
11:00-12:30	P1: Administration building City Park. With visit Ramiro Diaz (Waggonner & Ball)	BG6: Milne → 2 tests	BG 12/13: Testing 2 Groundwork raingarden sites along Haley Blv.	BG5a/5b: Aurora, Algiers 2 sites with Abrina Williams (NORA)	BG9: Lafitte Greenway 2 rain gardens, 1 permeable pavement
lunch					
1:30-3:30	P2: SWBNO Carrolton, with visit Grace Vogel (SWBNO)	BG3: 5019 Press Drive, with Abrina Williams & Charlotte Giroux (NORA). *Installation groundwater sensor.*	P3: GNOF parking, with Dan Favre (GNOF) and Ramiro Diaz	Groundwork car broken. Therefore, planning & visiting Lafitte	BG8: City Hall bioswale
4-5:30	P4: Hunters Field parking (Claiborne)	P5: Southern University New Orleans	BG10: GNOF rain garden testing (incl installation EC/level sensor)		Evenings: visits private rain gardens of Tor Tornqvist, Ramiro Diaz.

ClimateScan: Mapping GI locations

The Online citizen science knowledge-sharing platform ClimateScan.org contributes to an accelerated climate adaptation by promoting more green and blue spaces in urban areas.

ClimateScan mapped over 10.000 NBS projects around the globe in 8 years with an average of more than 1500 registered users uploading projects thanks to the openness of the website and active online and offline promotion.



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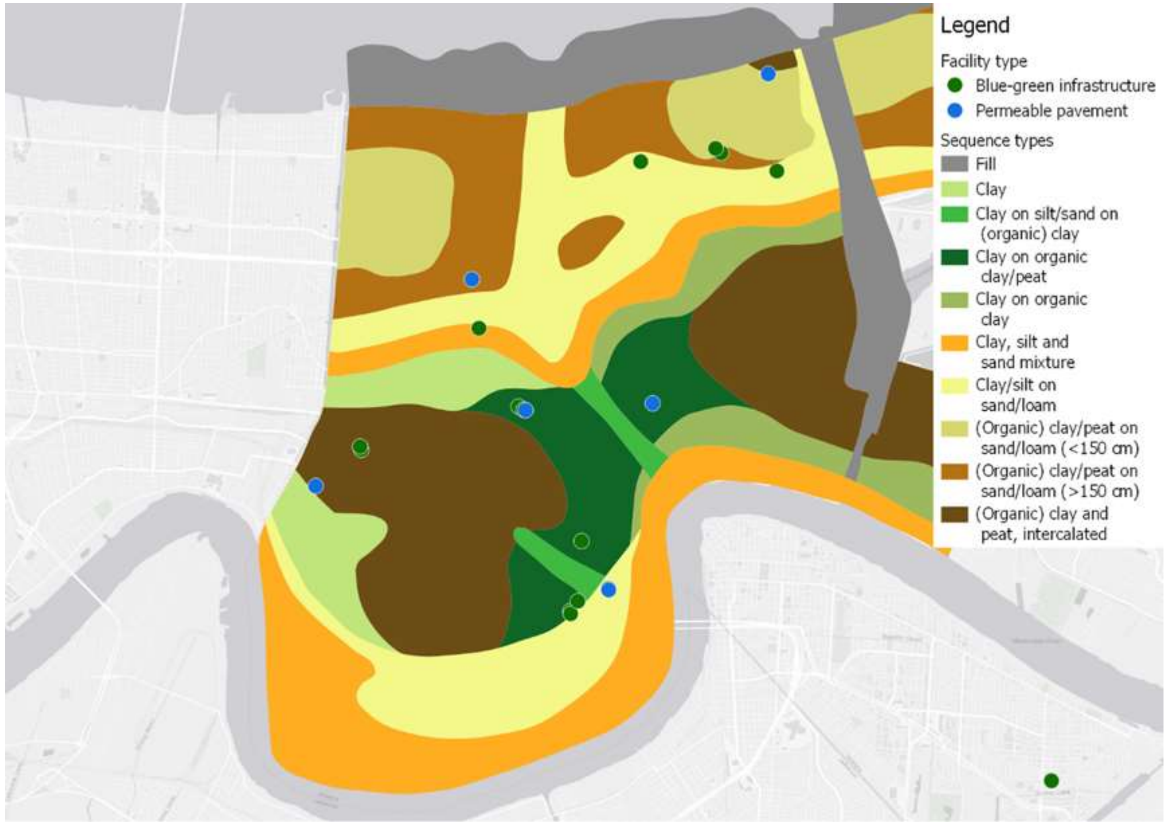
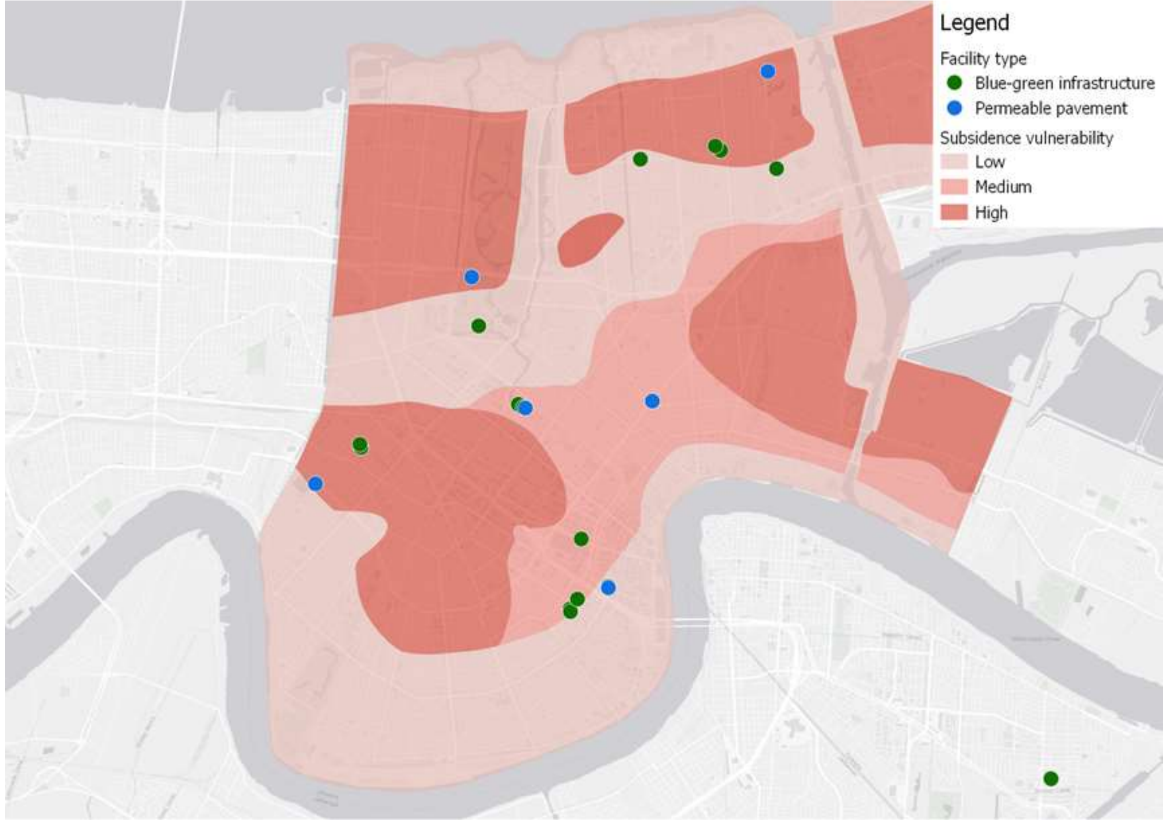
https://www.climatescan.org/

Test locations on soil sequences and subsidence vulnerability maps





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Rain garden test *using fire hydrants*

Rain garden test *using water containers*

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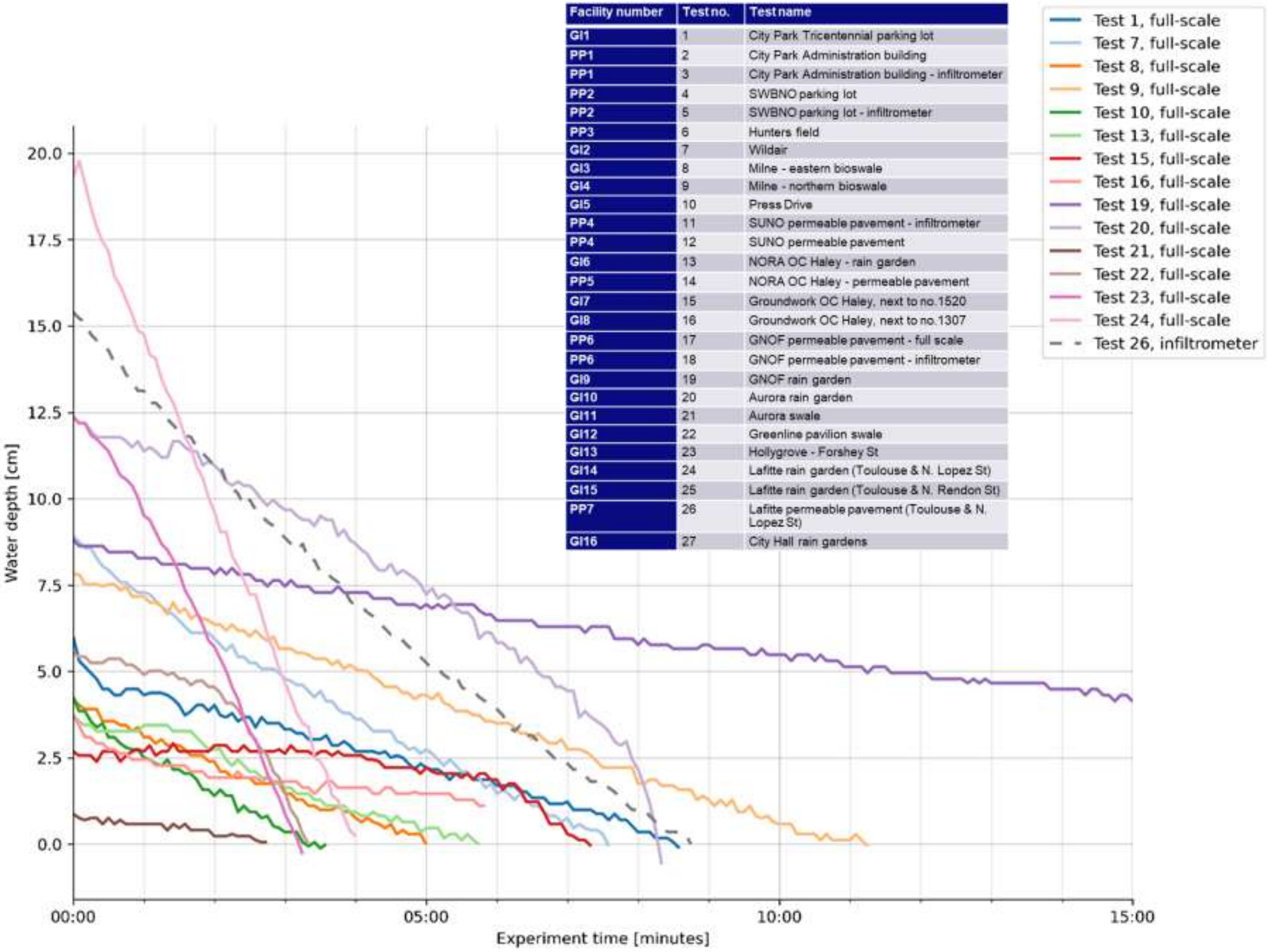
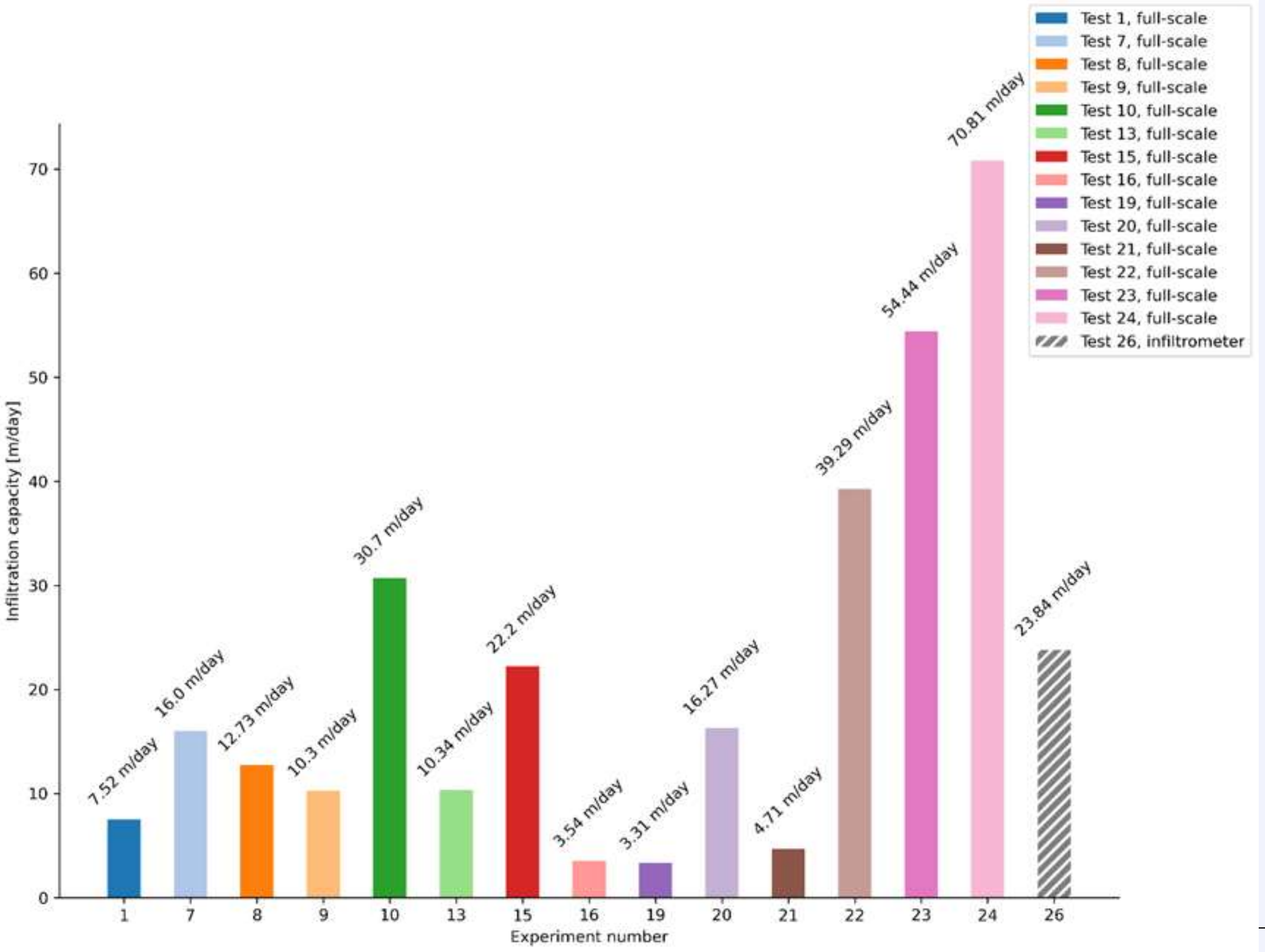
STOP



Facility number	Test no.	Test name
GI1	1	City Park Tricentennial parking lot
PP1	2	City Park Administration building
PP1	3	City Park Administration building - infiltrometer
PP2	4	SWBNO parking lot
PP2	5	SWBNO parking lot - infiltrometer
PP3	6	Hunters field
GI2	7	Wildair
GI3	8	Milne - eastern bioswale
GI4	9	Milne - northern bioswale
GI5	10	Press Drive
PP4	11	SUNO permeable pavement - infiltrometer
PP4	12	SUNO permeable pavement
GI6	13	NORA OC Haley - rain garden
PP5	14	NORA OC Haley - permeable pavement
GI7	15	Groundwork OC Haley, next to no.1520
GI8	16	Groundwork OC Haley, next to no.1307
PP6	17	GNOF permeable pavement - full scale
PP6	18	GNOF permeable pavement - infiltrometer
GI9	19	GNOF rain garden
GI10	20	Aurora rain garden
GI11	21	Aurora swale
GI12	22	Greenline pavilion swale
GI13	23	Hollygrove - Forshey St
GI14	24	Lafitte rain garden (Toulouse & N. Lopez St)
GI15	25	Lafitte rain garden (Toulouse & N. Rendon St)
PP7	26	Lafitte permeable pavement (Toulouse & N. Lopez St)
GI16	27	City Hall rain gardens

Performance of rain gardens

- All the 15 tested sites conform to the City's criterium of dry-fall within 48 hours. Detention time is sometimes too low to be effective. But some of the tested facilities have a shallow French drain that rapidly drains stormwater towards the storm drainage pipe below the street, reducing effective storage.
- In general, given the available surface area, the potential storage volume could be increased by deepening the depression and elevating the level of the overflow.
- Construction and maintenance costs of green infrastructure facilities are high. This can be justified in case of pilots or creating awareness but will make it extremely hard to cover the entire water assignment.
- Large, and cost-effective facilities (simple design and construction with minor maintenance costs) are needed.
- Often curb cuts and runnels for rain gardens are constructed next to catch basins, transporting street runoff into the existing drainage system instead of into the rain garden
- The vegetation seemed well maintained at most sites (NORA, SWBNO, City). But, at many locations the inflow runnel was not ideally maintained as it is often (partly) filled with sediment from the streets.
- Reflecting back on the total water assignment for New Orleans, the most effective measure remains the addition of surface water bodies.



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Position of catch basins vs. inlet

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Maintenance?

*……...is more then gardening &
important to create support.*

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Full-scale permeable pavement test (parking SWBNO)

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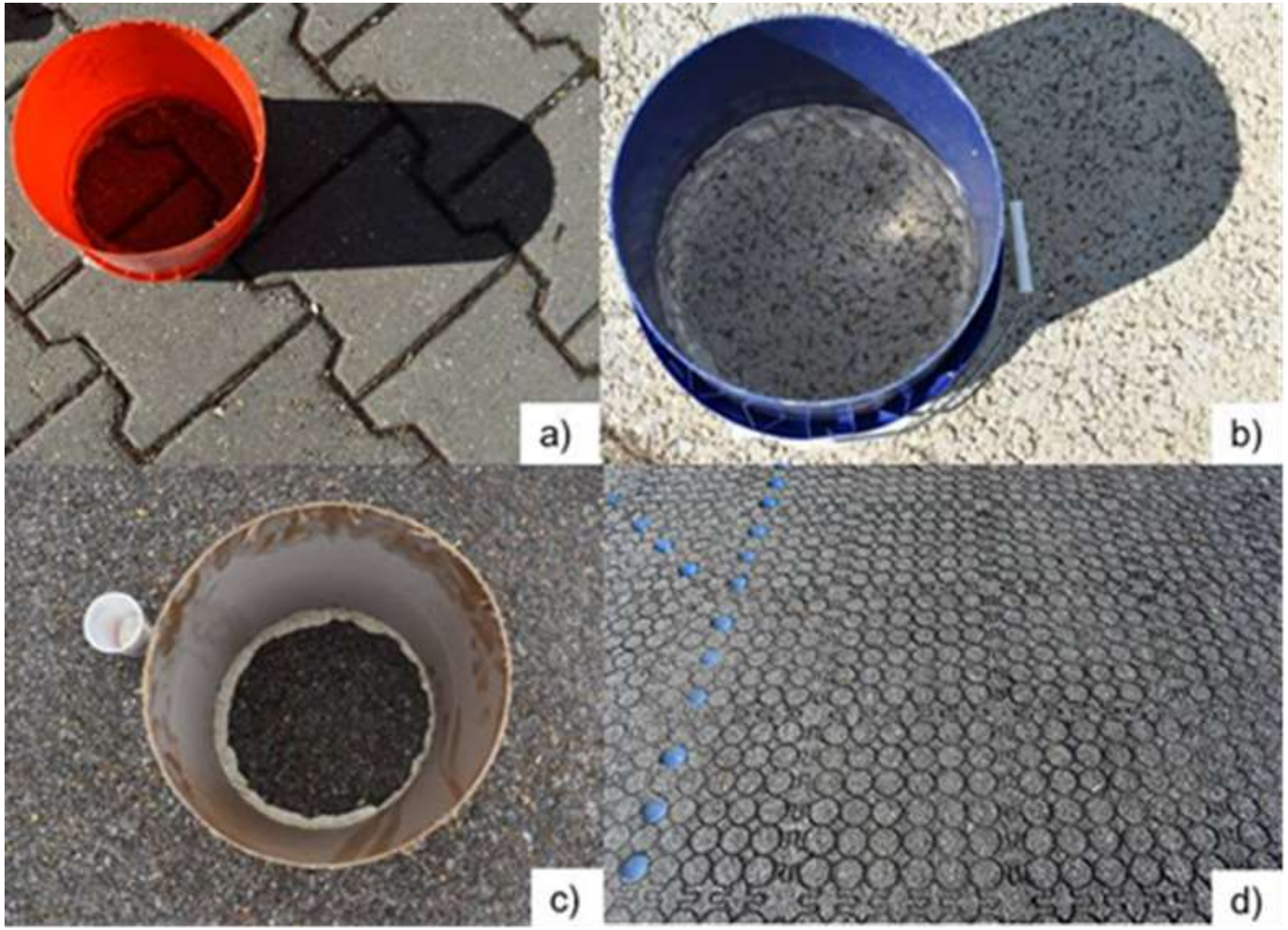
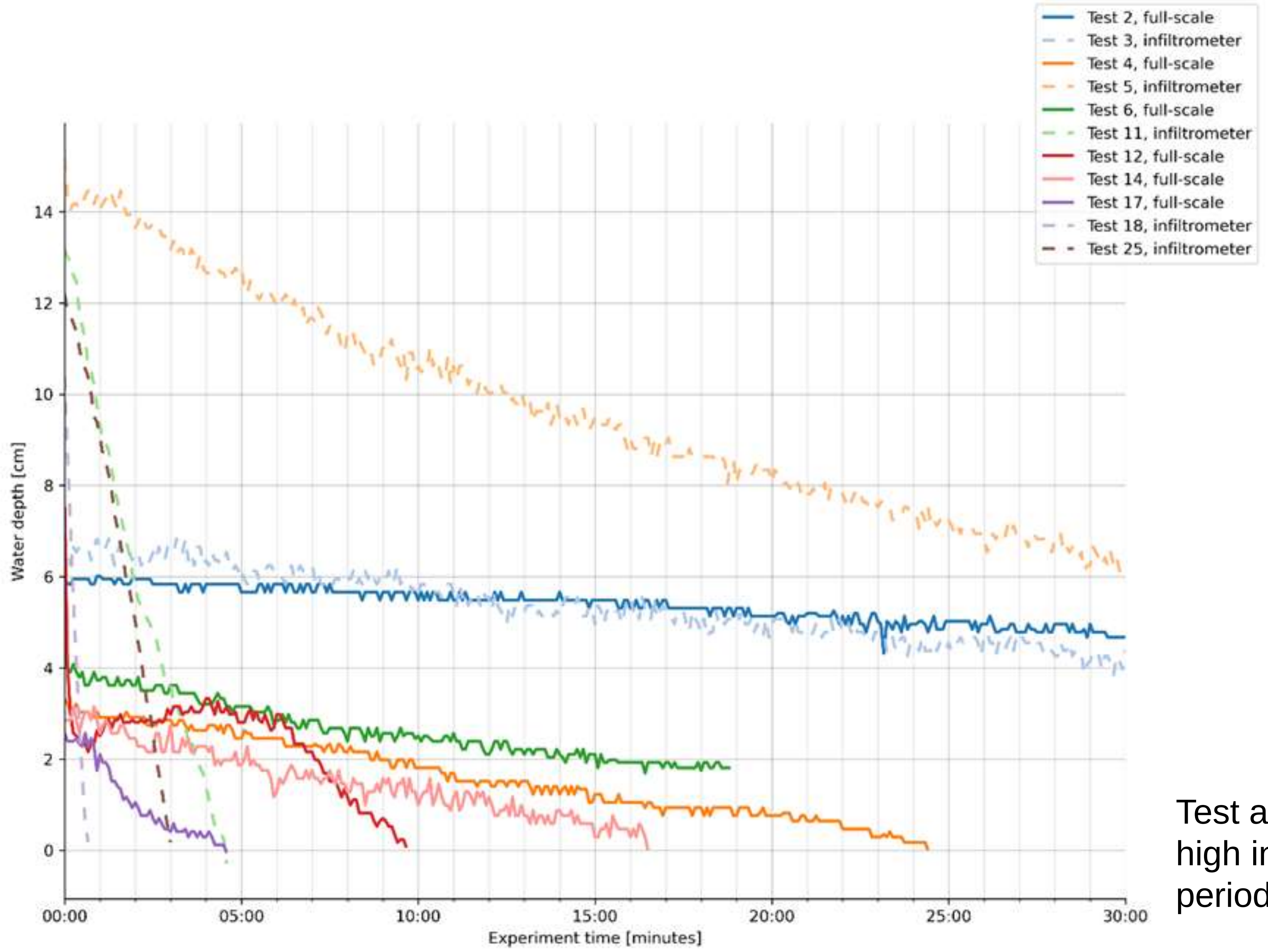
Ring infiltrometer tests





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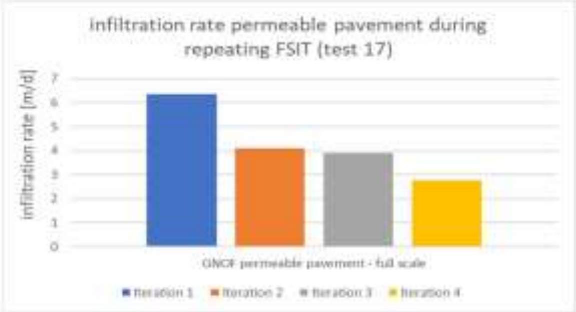
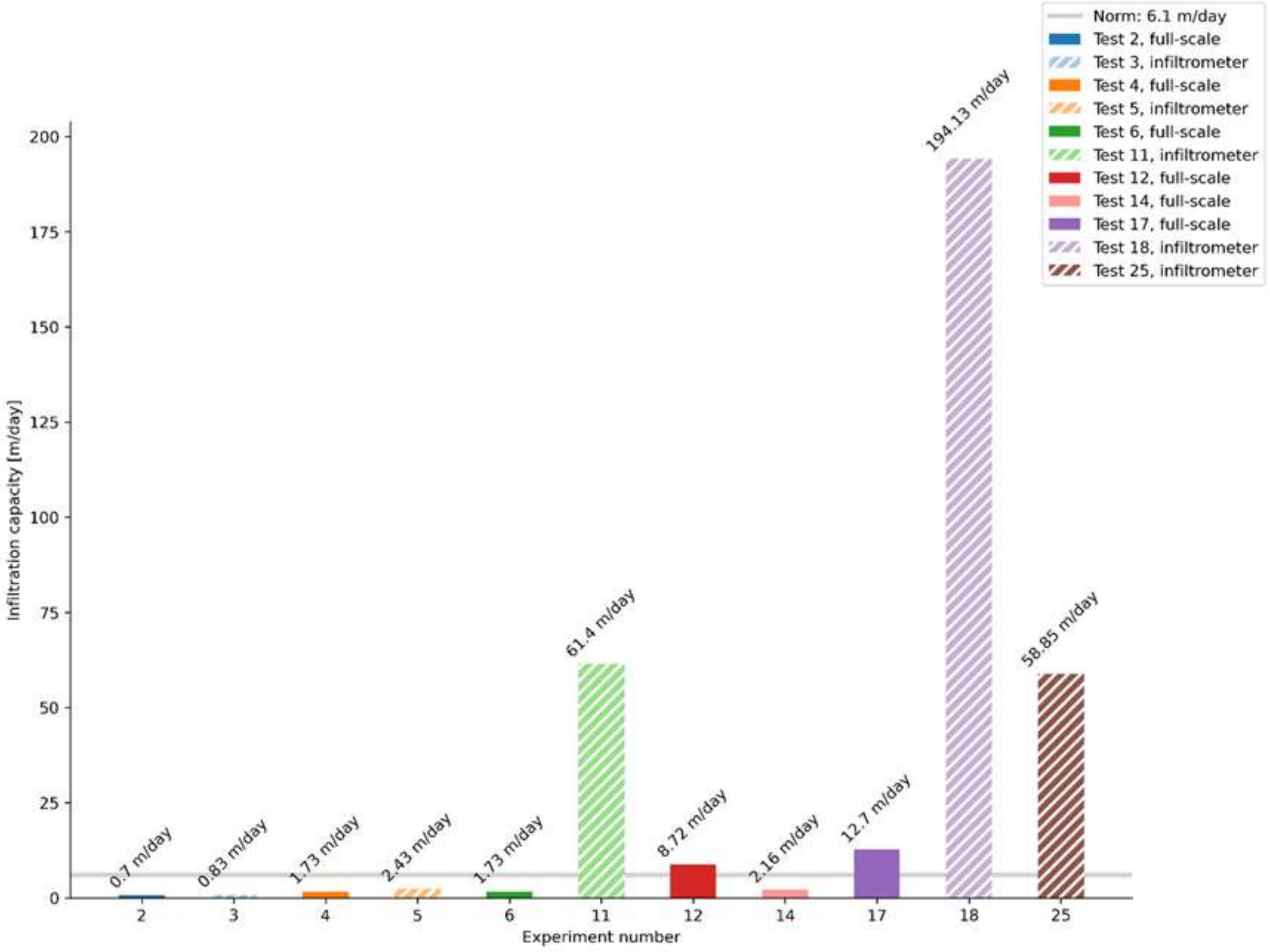


Test are also repeated showing a high increase of empty time in wet periods due to saturation

Performance of permeable pavements

- Only two of the 11 full-scale tested permeable pavement facilities conform to our infiltration criterium of 10 inches/hour. The infiltrometer results are consistently higher.
- Recently constructed permeable pavement functions better (e.g. Southern University).
- Often, permeable pavement is constructed adjacent to green zones. A design transporting storm water from e.g. a parking lot into these green zones can be more effective in terms of costs and stormwater volume detention.
- Maintenance of the permeable pavement sites is necessary but is not yet part of general maintenance plans. In addition, the required machinery for cleaning permeable pavement is not readily available for private parties.



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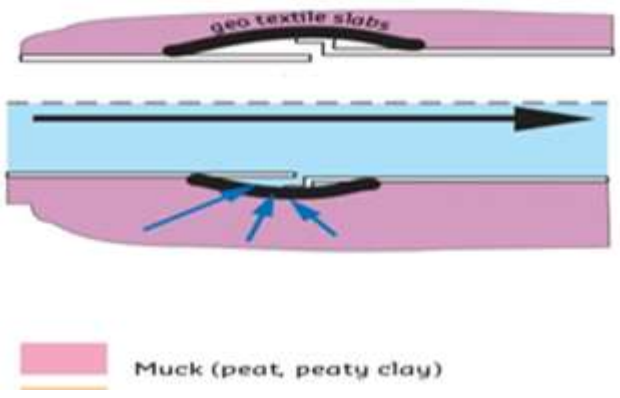
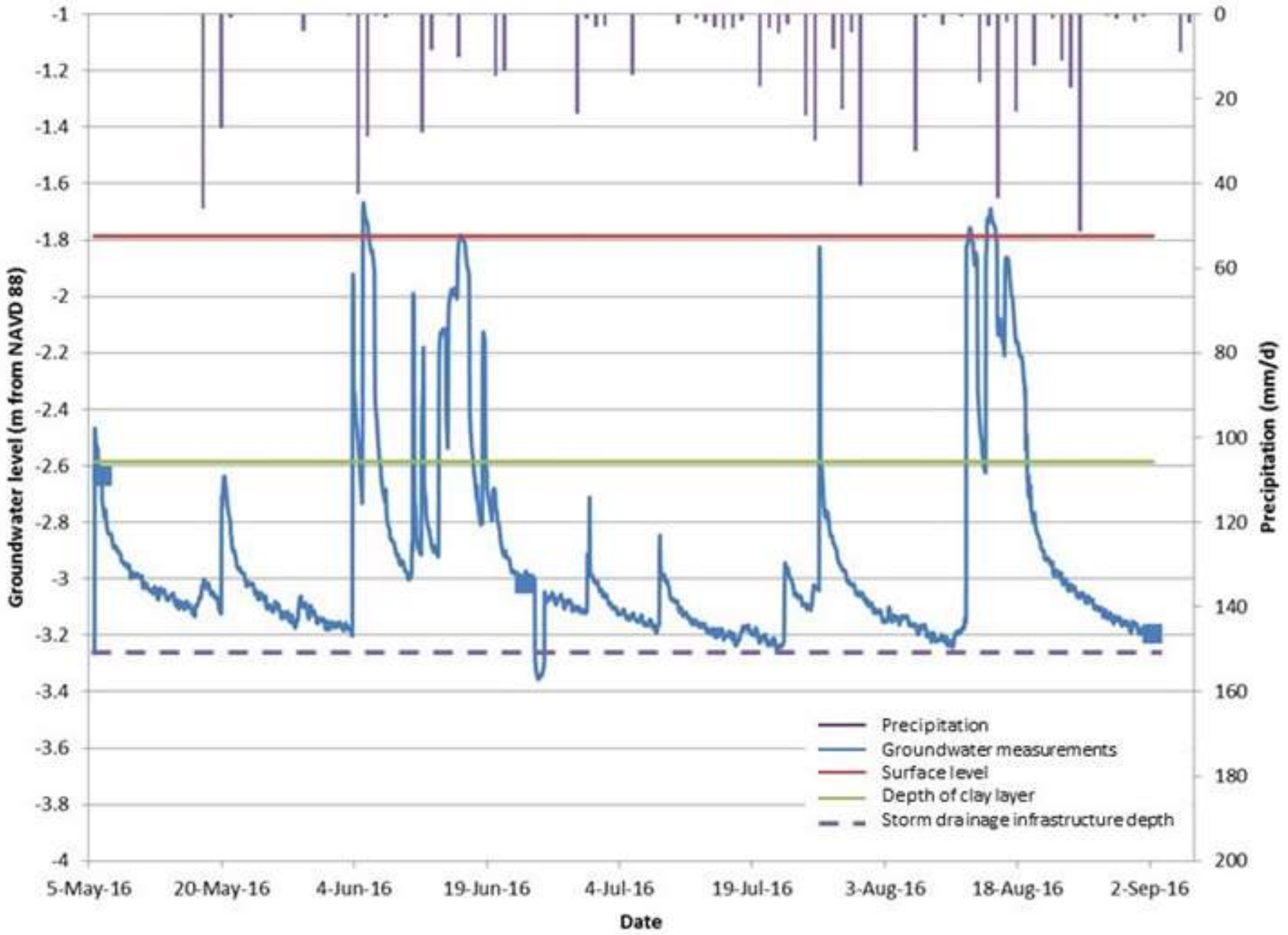
PART 2: General considirations

Groundwater drainage considerations





- ❑ **Nearly all urban groundwater is drained by underground pipes;**
- ❑ **Groundwater levels rise fast, and drops relatively fast towards depth of pipes;**
- ❑ **Therefore, nowadays existing Green Infrastructure will not help to reduce subsidence**
- ❑ **After renovation the groundwater level it will help!**

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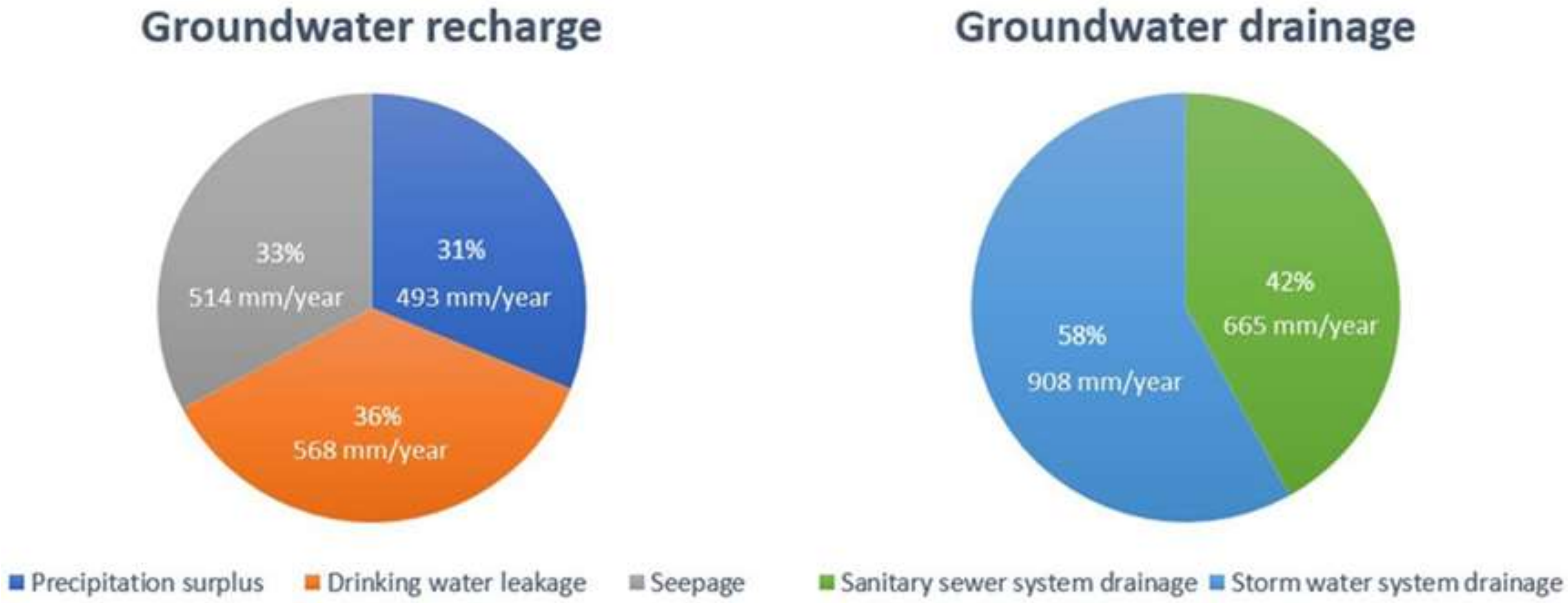
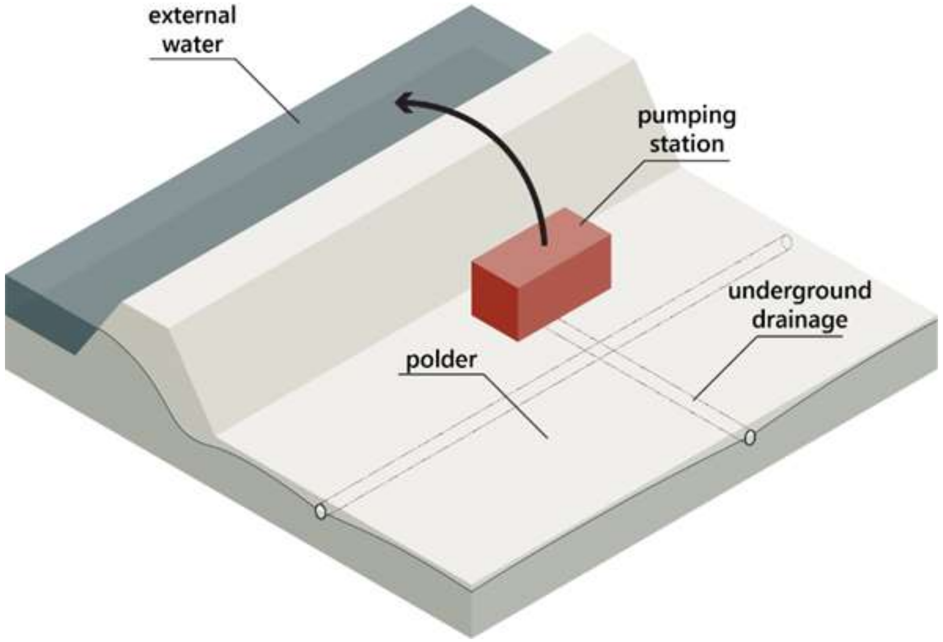
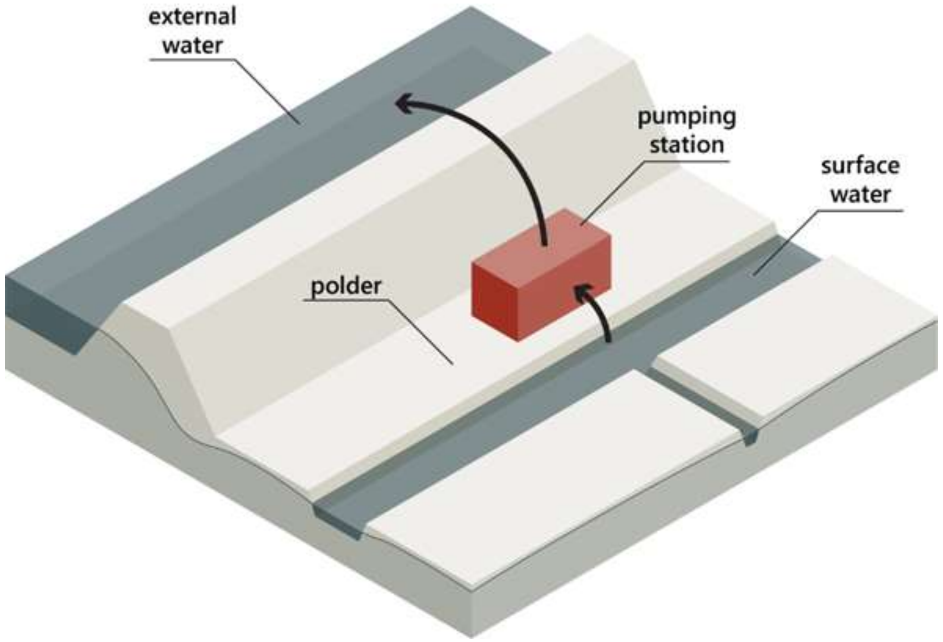
A particular urban water balance



Polders without canals





- ❑ **Lack of surface water storage**
- ❑ **Need for open water**

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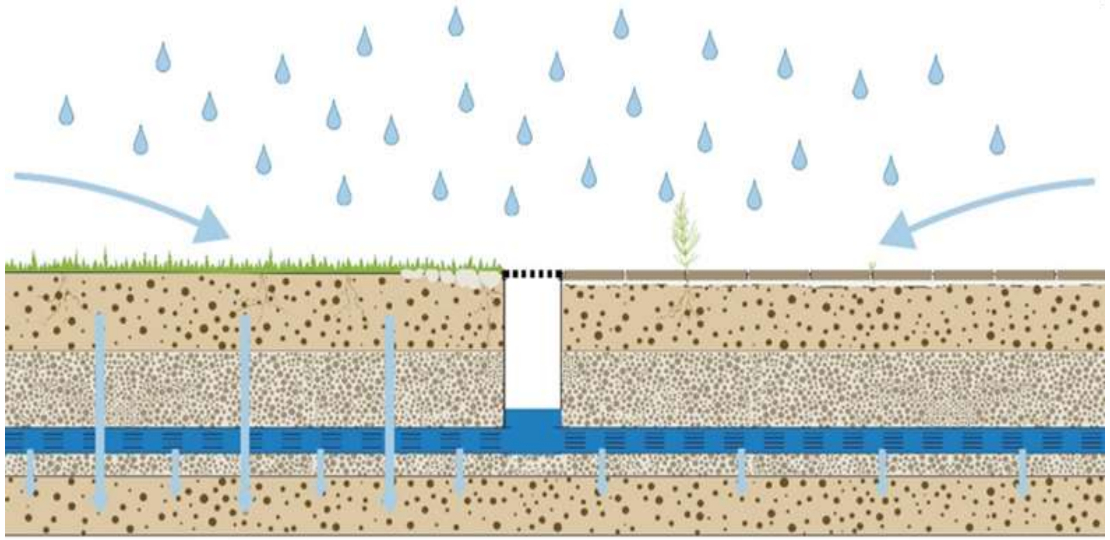
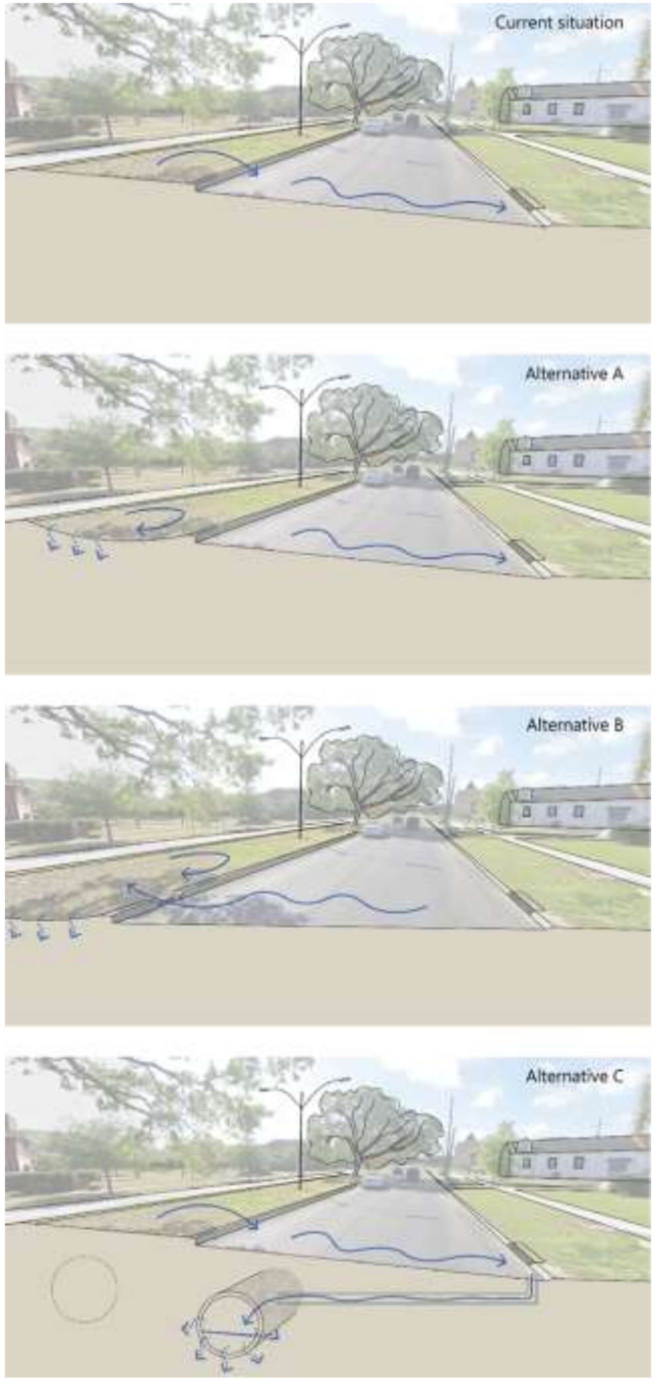
Large storage interventions needed

- **The water assignment of New Orleans can only be met by large interventions, such as:**
  - **creating open water,**
  - **miles-long green infrastructure lines in the median strips (neutral grounds) of large roads (e.g. Elysian Fields) or**
  - **in the Streetcar network.**
  - **Parks (Audubon, City Park etc.) should not discharge storm water into public storm drainage system and should be use as emergency storage area.**
- Good examples of recently constructed larger green infrastructure interventions are (1) the Storm water park at Southern University (Emmett W Bashful Blvd, 217,000 SF storage) and (2) the long Planted bioswale parallel at Prentiss Ave, near Press Dr. (145,000 SF storage).

Making use of “neutral grounds”. Are “IT-drains” an opportunity?

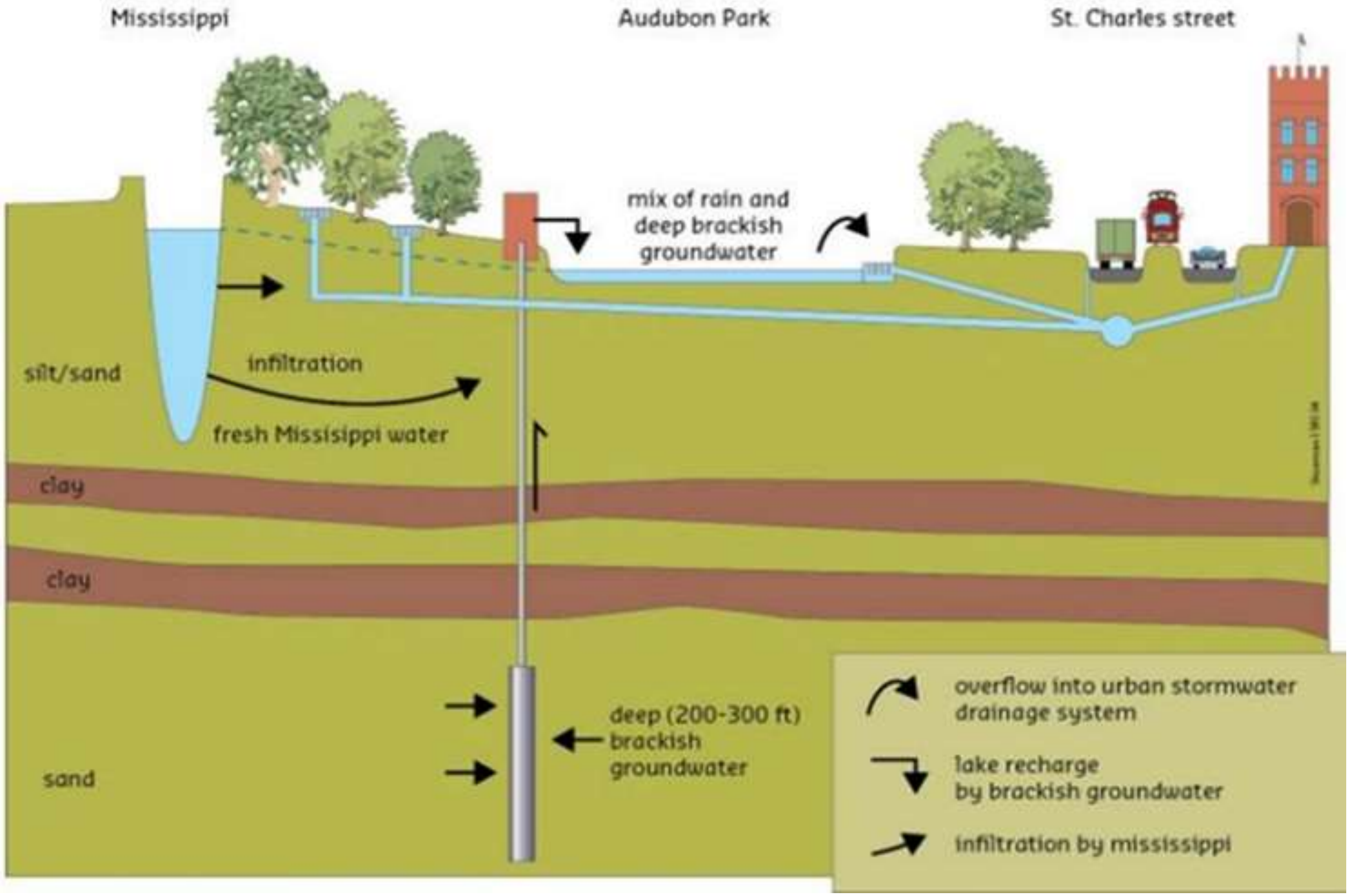




Examples of neutral grounds storage opportunities

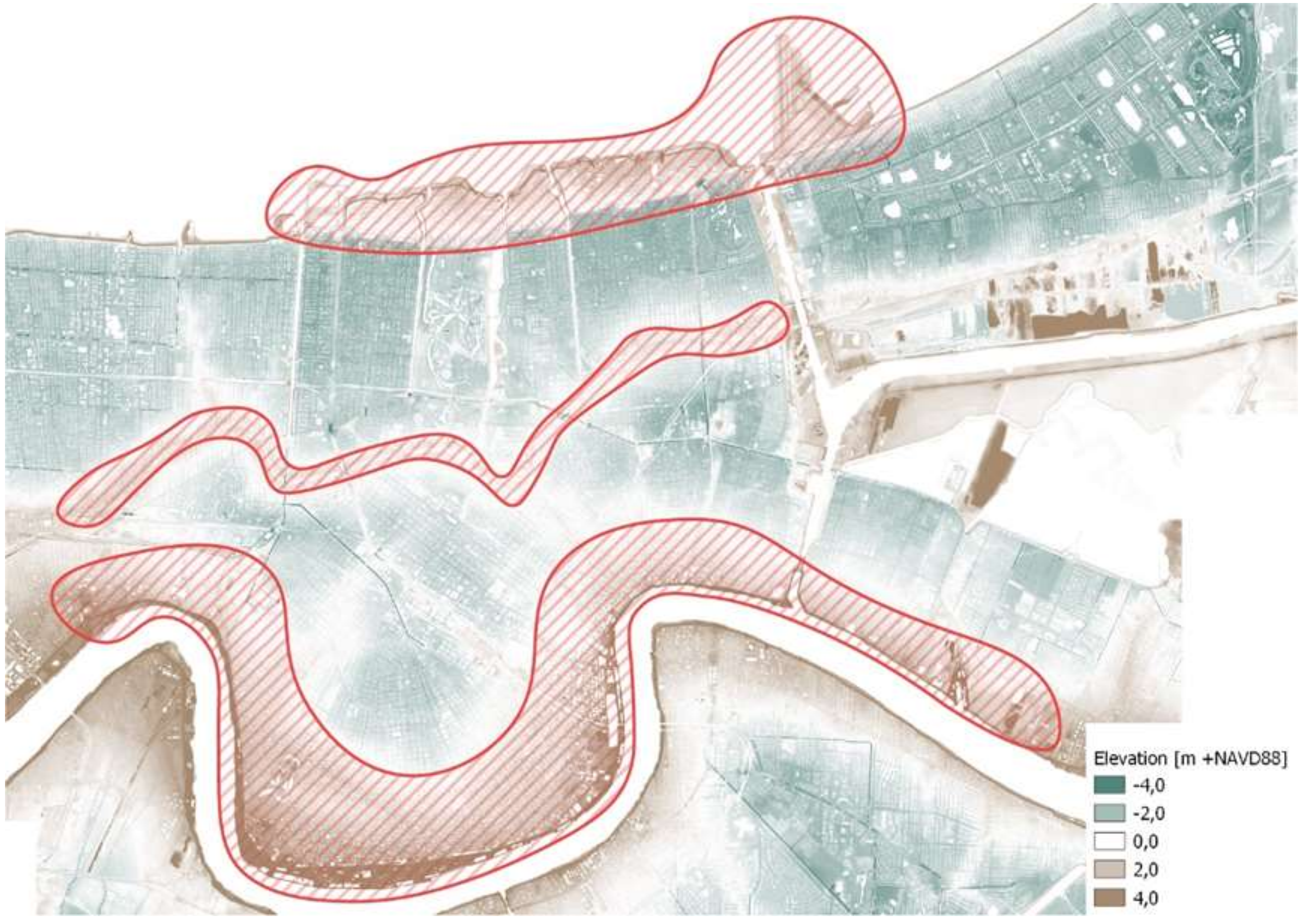
Stop “undesirable” storm water drainage

- ❑ Reduce storm drainage in the public areas
- ❑ Towards parks without pumps
- ❑ Storing water for periods of drought



Proposed priority zoning for Green Infrastructure

- At the higher ground's along river are many residential, business and school plots with relatively large gardens. These locations are ideal for the construction for green infrastructure. The objective should be to retain as much rain water as possible. In addition, water from roofs near the river should be discharged into the river. The aqueducts of the New Orleans Convention Centre are a great example.
- Along Metairie and Gentilly Ridge the objective should be the same.
- Also, the elevated area along Lake Pontchartrain possess great opportunities to retain water. At private plot scales (often with large gardens), but also the University (UNO) campus should reduce storm drainage towards the lower grounds.



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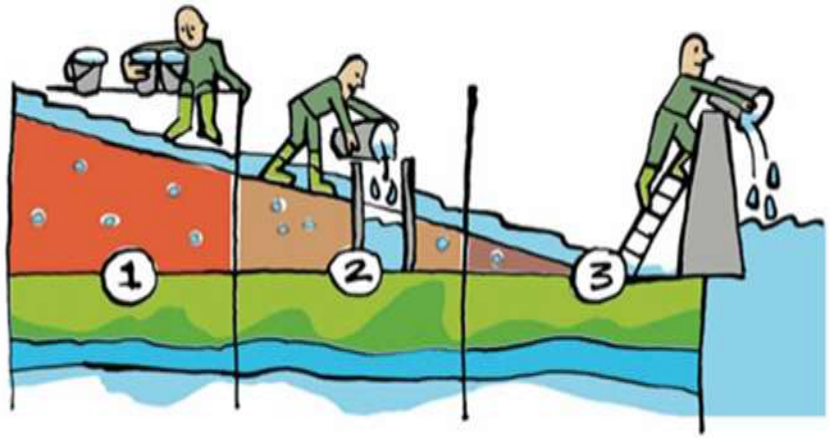
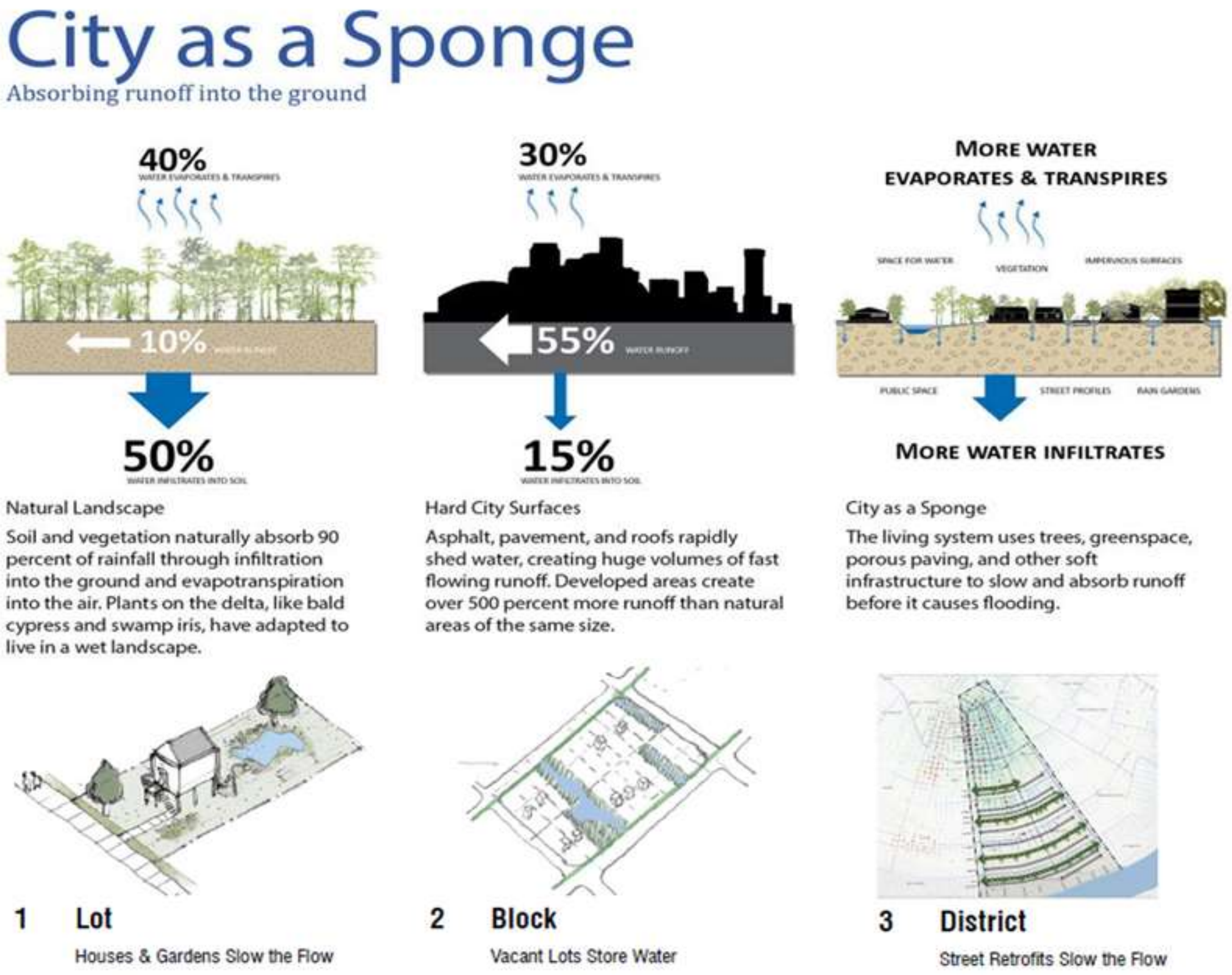
Storage costs ($\$/m^3$)

- The design and construction costs vary greatly;
- The overall average storage costs are 1960 $/m3 of storage;
- the average maintenance costs amount to 82.57 $/m3/year.
- Based on these numbers, filling up of the total water assignment of Gentilly (575,000 m3) will cost approx. 1 billion dollars. The yearly maintenance costs will then be 47 million dollars per year.
- Conclusion: better cost-effective solutions are needed

Towards an integrated storm networks water storage approach (1)





Towards an integrated storm networks water storage approach (2)

1. Start retaining and storing water at lot scale (the capillaries of urban water system)
2. Organize (1) at a block scale (and monitor results)
3. Start actions at high grounds,
4. Improve designs (storage volume, inlets, vegetation etc.), supported by monitoring → lessons learned!
5. Street network: understand flow and find storage neutralizing storage locations,
6. No discharge of storm water from parks etc.
7. Design and construct large scale green infrastructure water storage zones,
8. Adapt storm water model to analyze above-mentioned interventions
9. Map planned network renovations (drinking water, waste water, storm drainage water)
10. Map Green infrastructure
11. Try to integrate other functions like ecology and recreation
12. Improve awareness program
13. Improve maintenance

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