Calming regional aridity

How a regional strategy can mitigate water shortage and support just and resilient urbanism

P5 **Hidde van Beek** **22 June 2022**

Worst Drought in 70 Years Threatens Northern Italy's Food, Power

Bloomberg

June 18, 2022

These maps illustrate the seriousness of the western drought

Historic drought has depleted groundwater, melted the snowpack and dried out lakes — and it will get worse

By Kasha Patel and Lauren Tierney

June 16, 2022 at 10:03 a.m. EDT

Countries need to act now as desertification and drought increase globally

On June 17th, the global community celebrated World Day to Combat Desertification and Drought. Read what one of the Israeli experts in the field has to say about it

Guest Contributor / 19 Jun 2022 • 2 Min Read

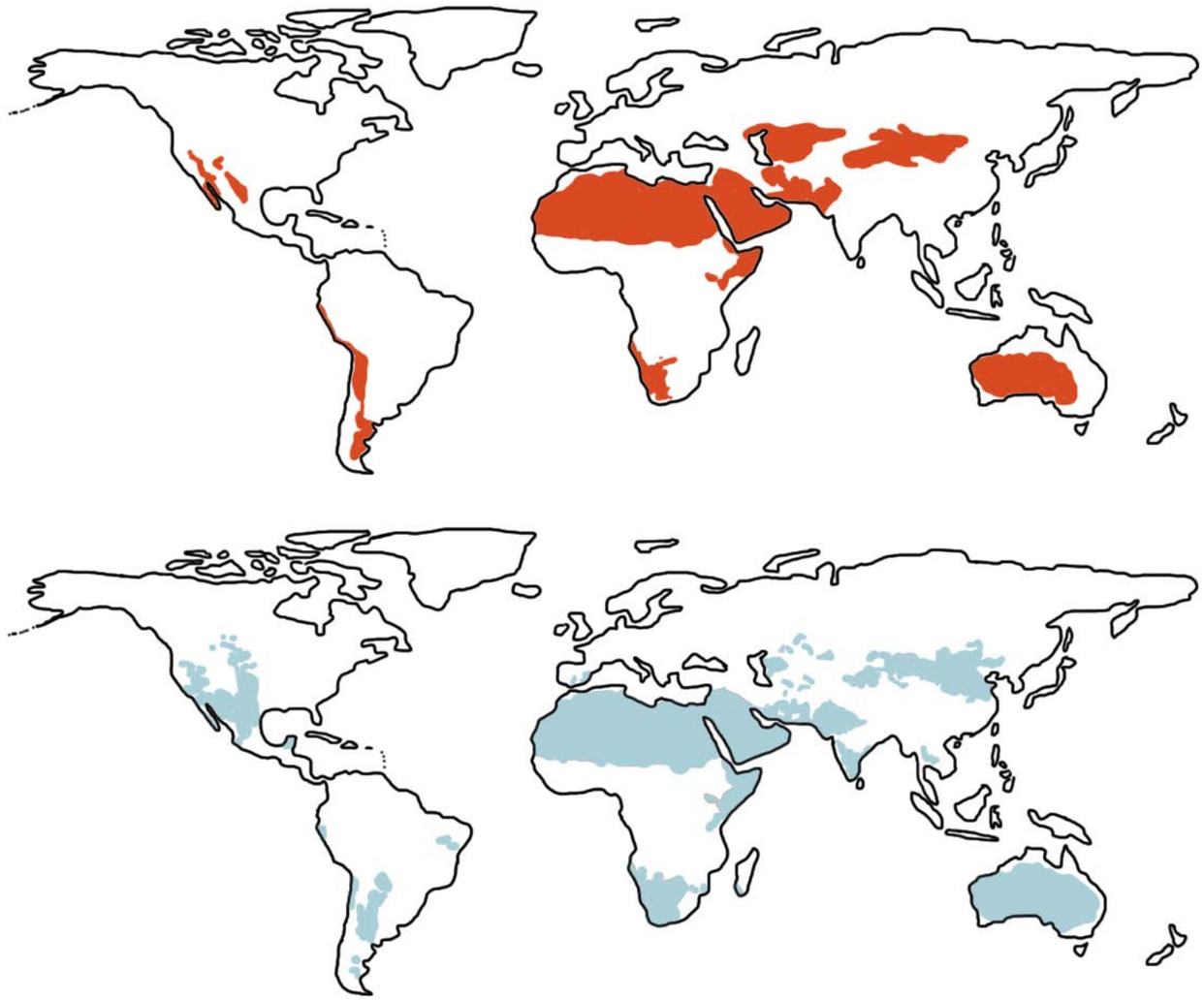
Climate Check: East Africa drought

10th June 2022 Last updated at 16:43

As the Great Salt Lake Dries Up, Utah Faces An 'Environmental Nuclear Bomb'

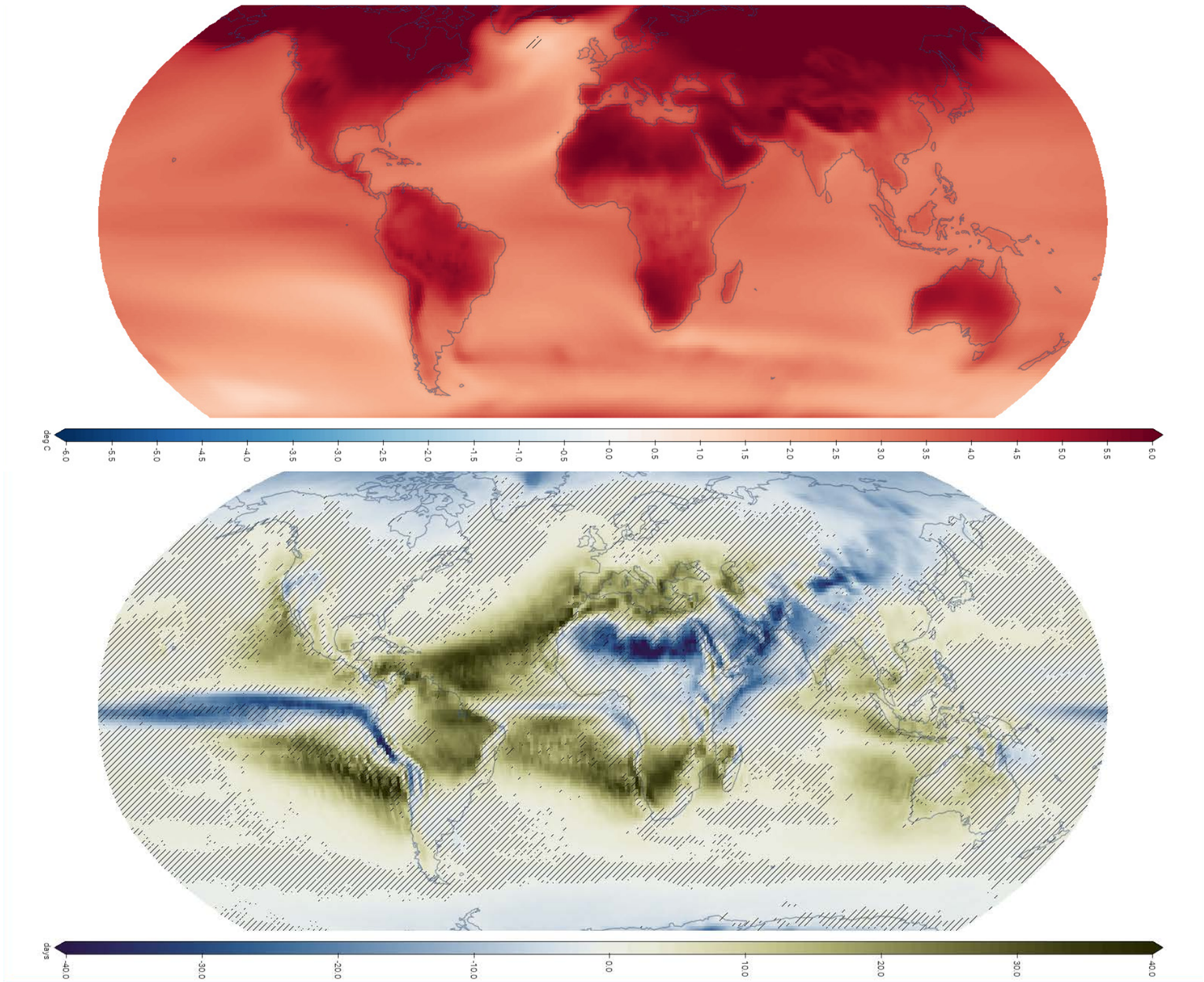
Climate change and rapid population growth are shrinking the lake, creating a bowl of toxic dust that could poison the air around Salt Lake City.

Arid regions & water shortage



Arid regions & water shortage

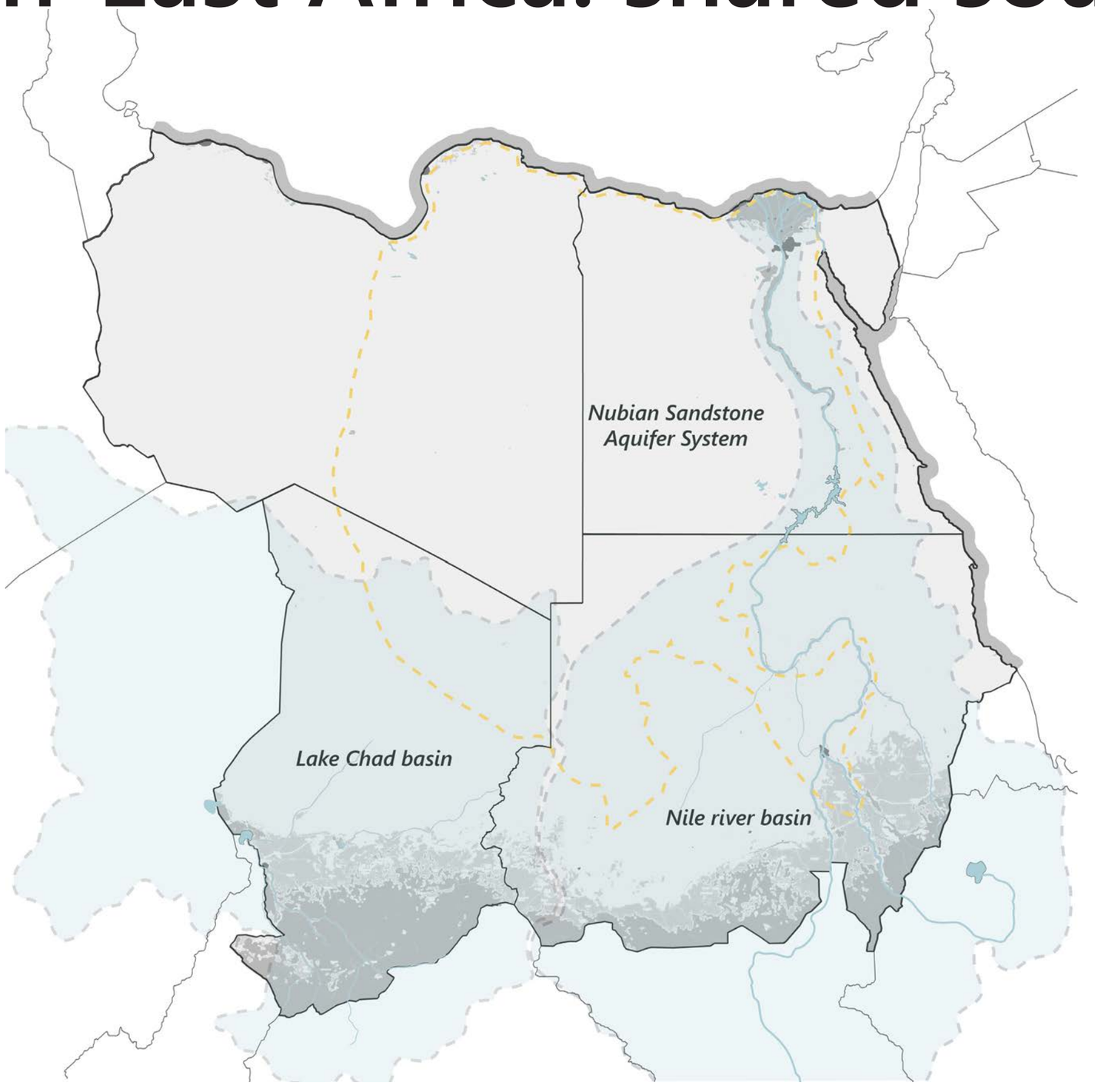
The climate crisis



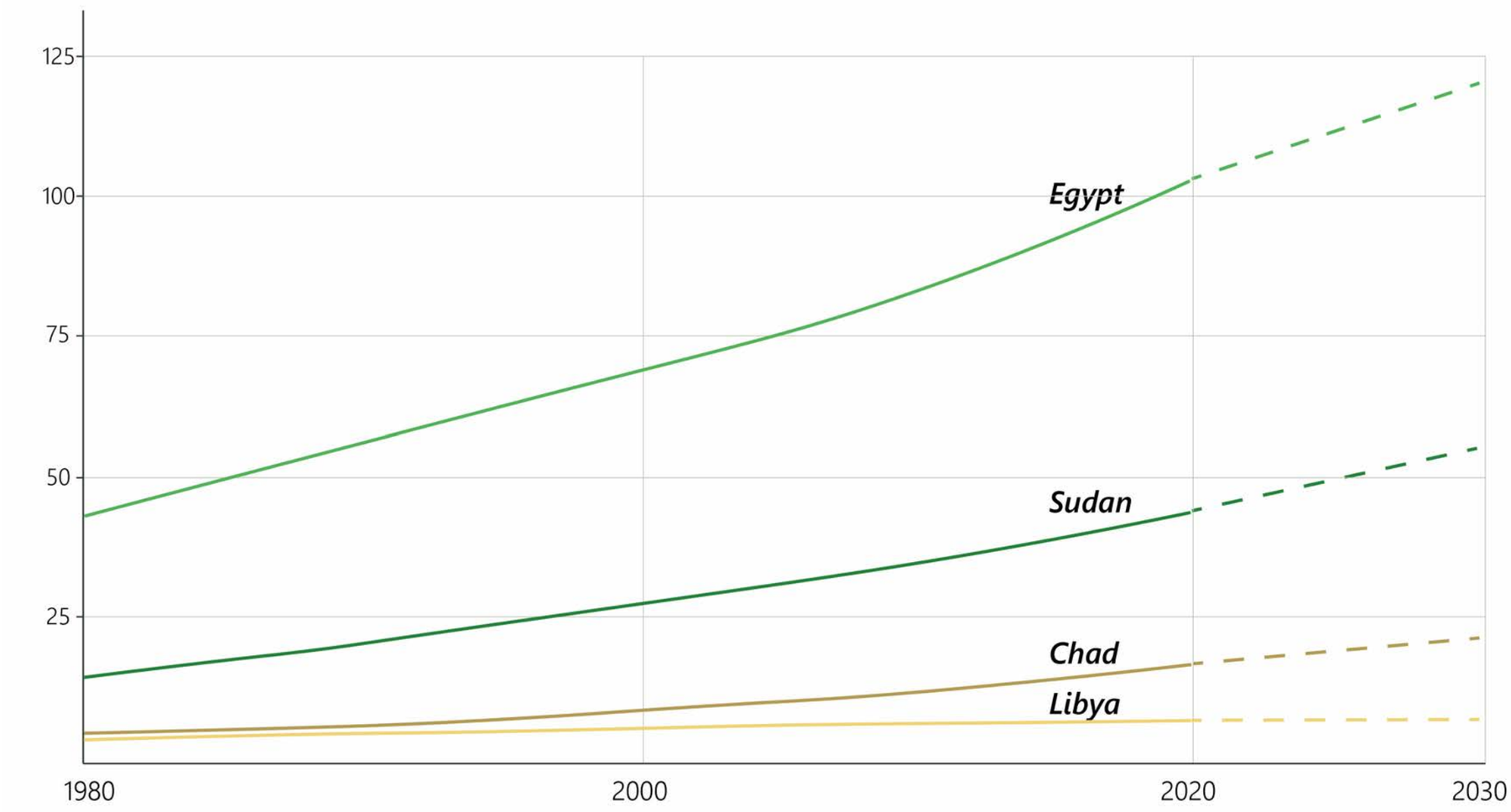
IPCC, 2021: Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Masson-Delmotte, V., P. Zhai, A. Pirani, S.L. Connors, C. Péan, S. Berger, N. Caud, Y. Chen, L. Goldfarb, M.I. Gomis, M. Huang, K. Leitzell, E. Lonnoy, J.B.R. Matthews, T.K. Maycock, T. Waterfield, O. Yelekçi, R. Yu, and B. Zhou (eds.)]. Cambridge University Press. In Press.

North-East Africa

North-East Africa: shared sources



North-East Africa: growth



Population growth 1980-2030 (million people)

Research question

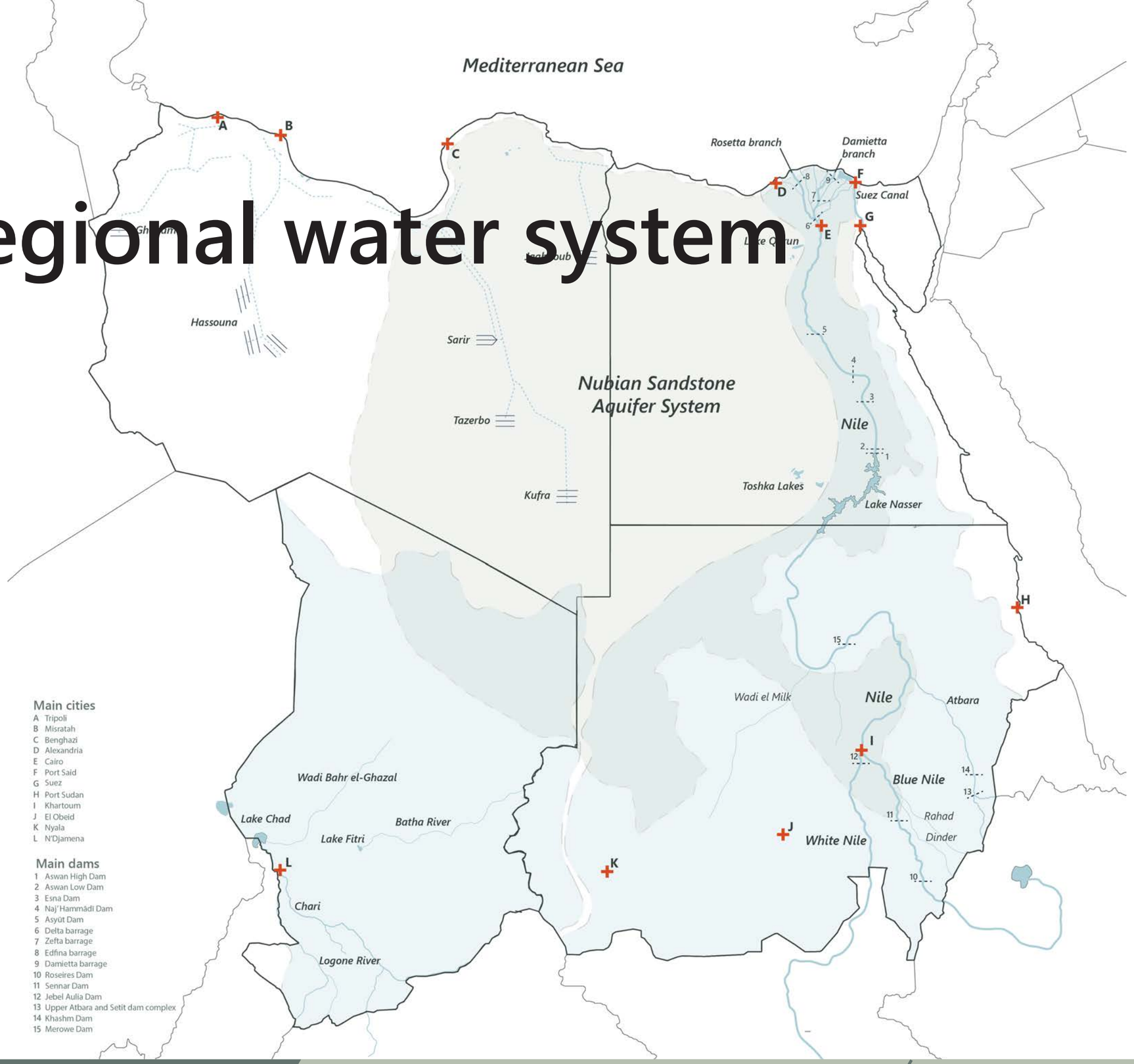
What elements does a regional and transboundary strategy need in order to address current water shortage and mitigate the rising demand and decreasing supply of water in arid regions?

The case study of North-East Africa.

Storyline

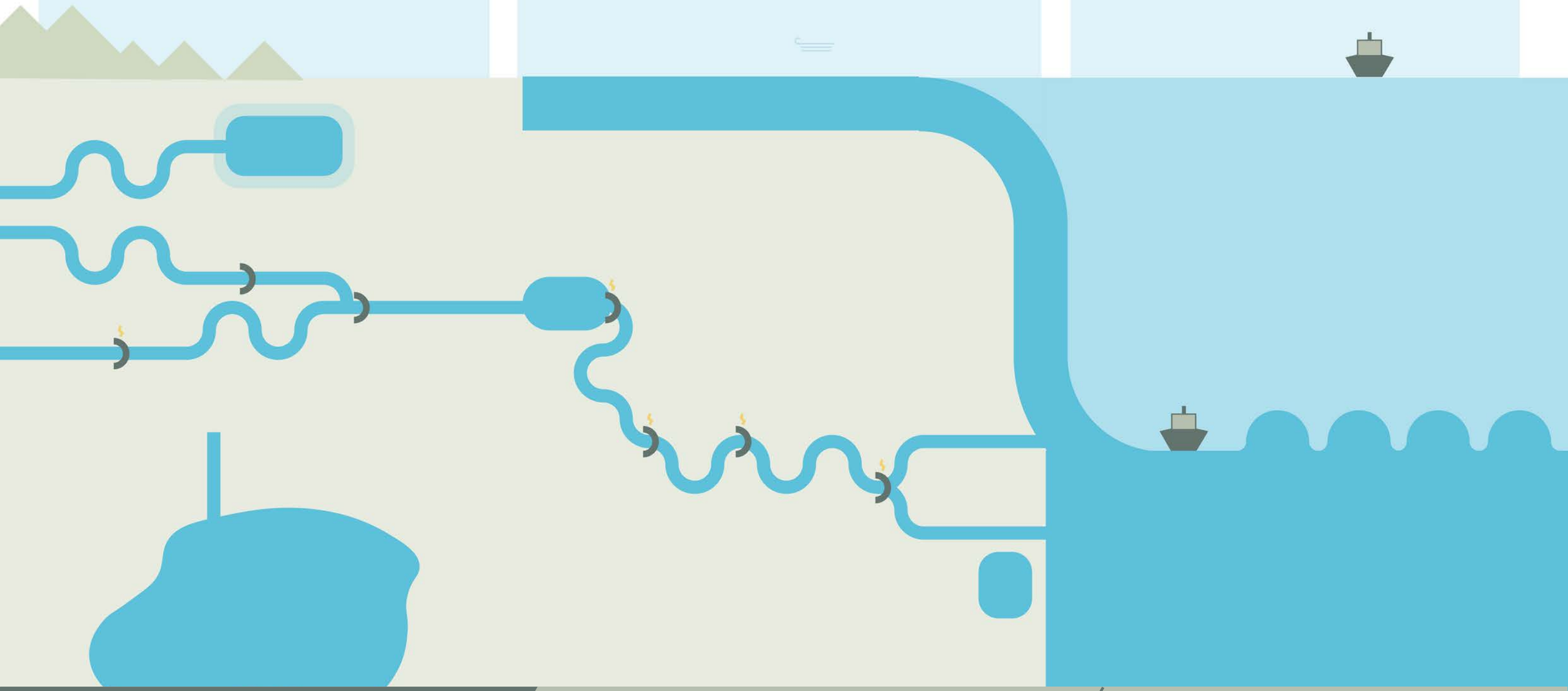
Context | Strategy | Design

Regional water system

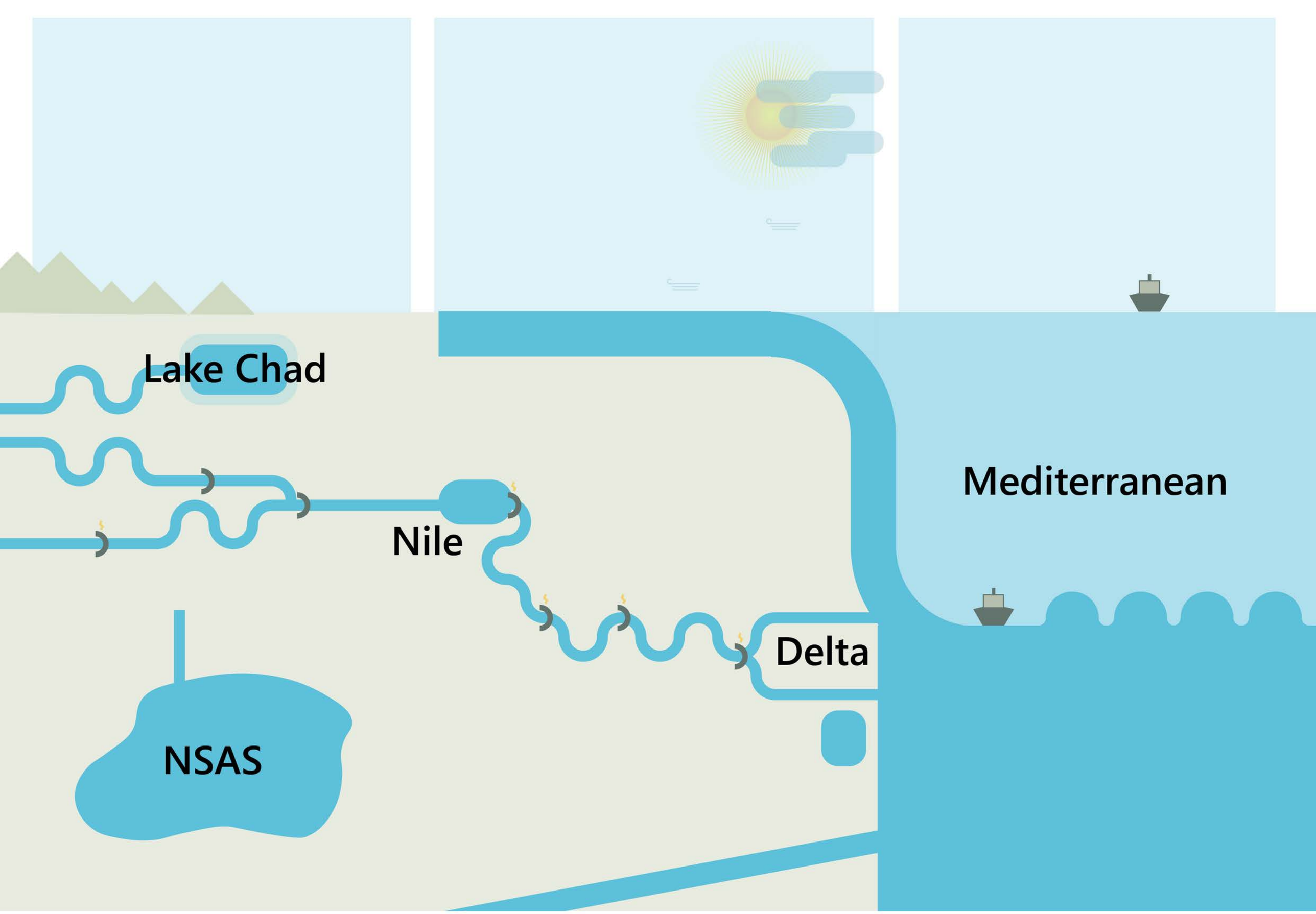


Context

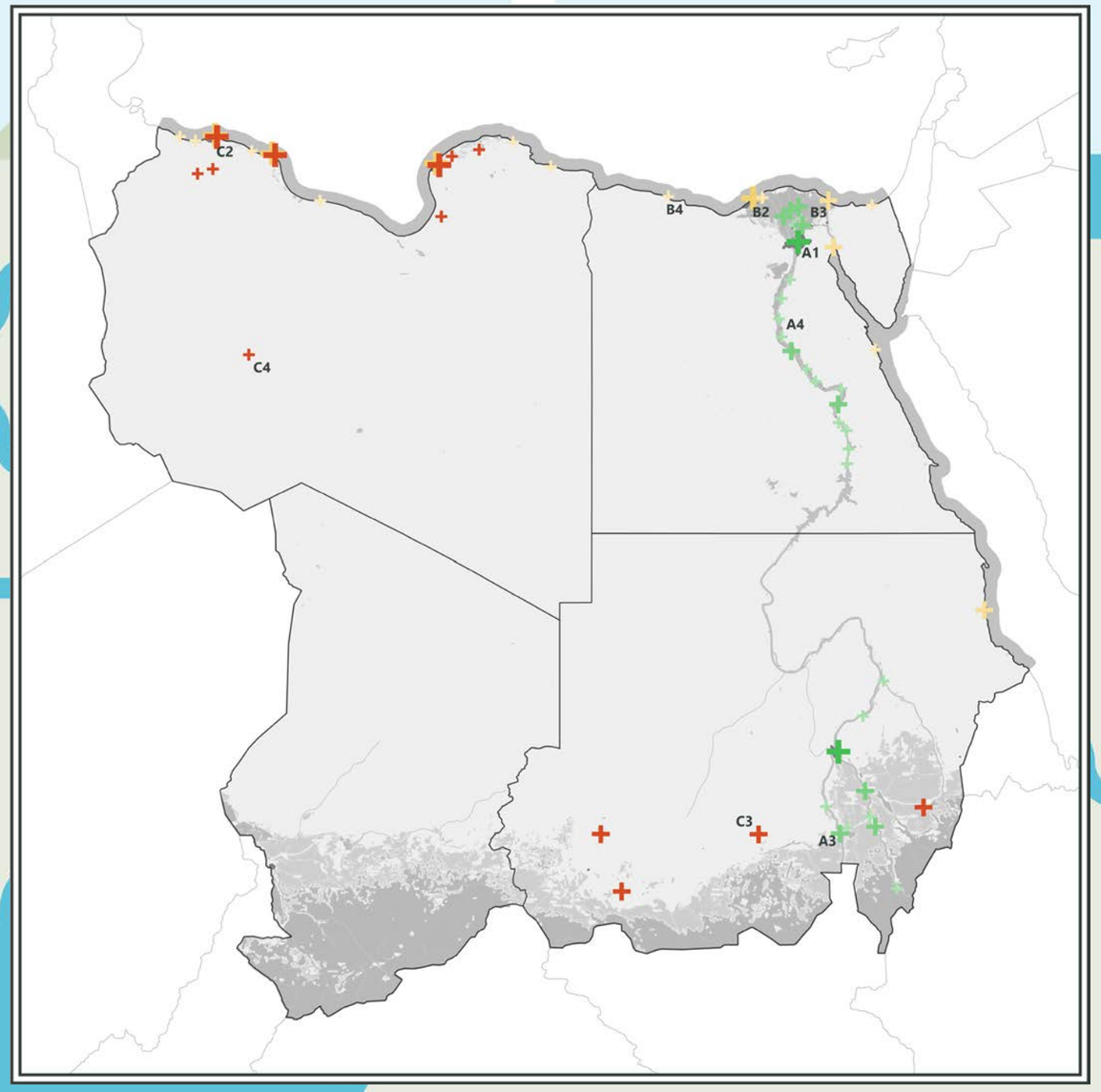
Regional water system

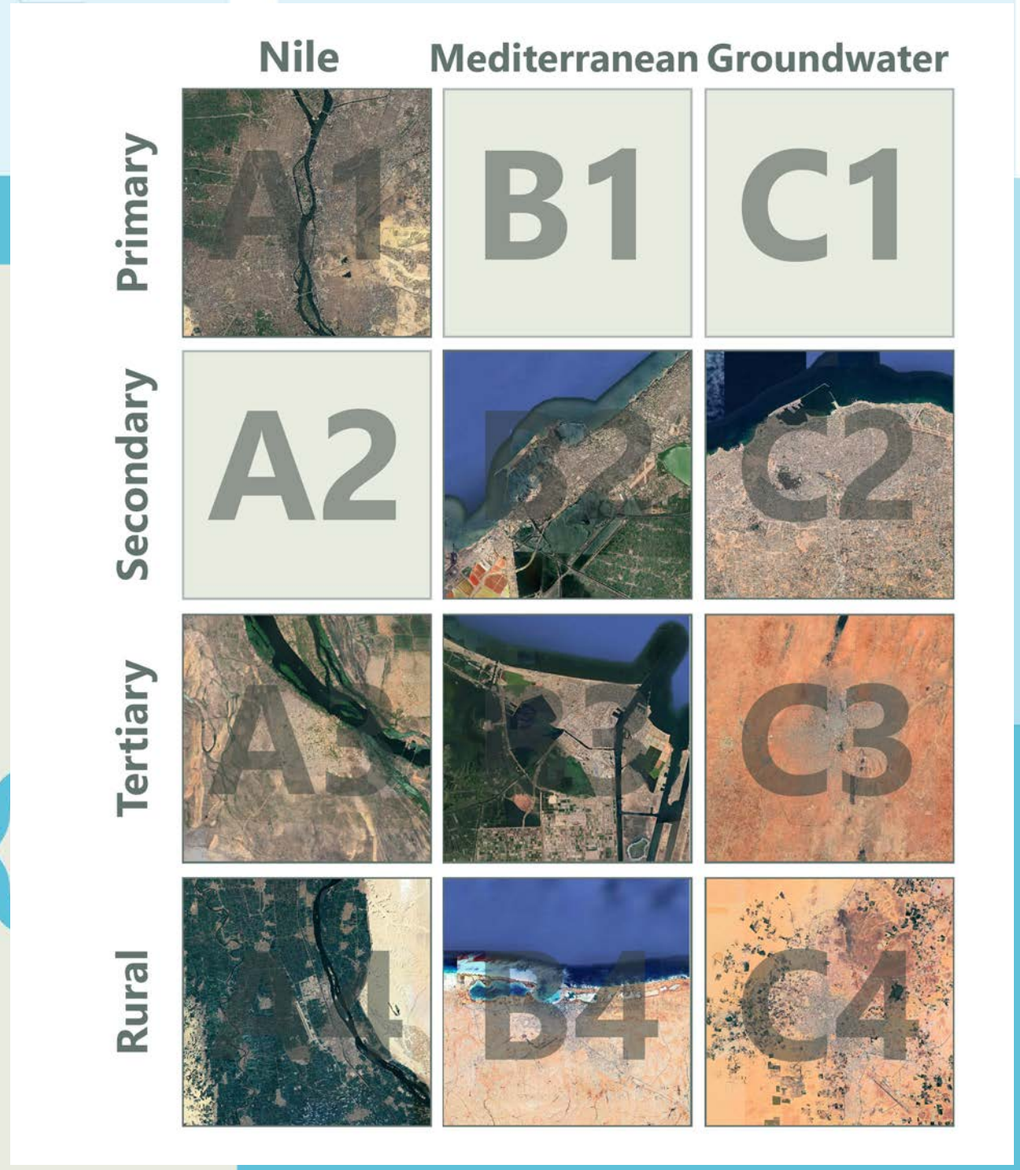


Context


Lake Chad
Nile
Delta
NSAS
Mediterranean

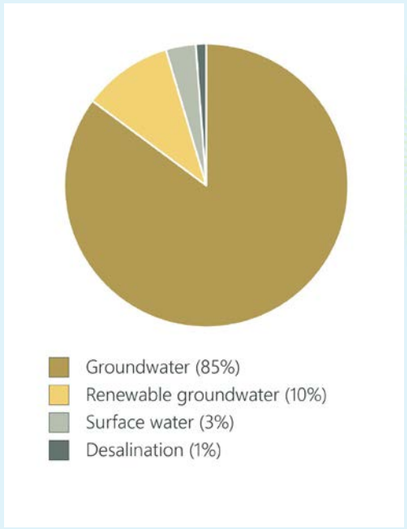
Regional differences

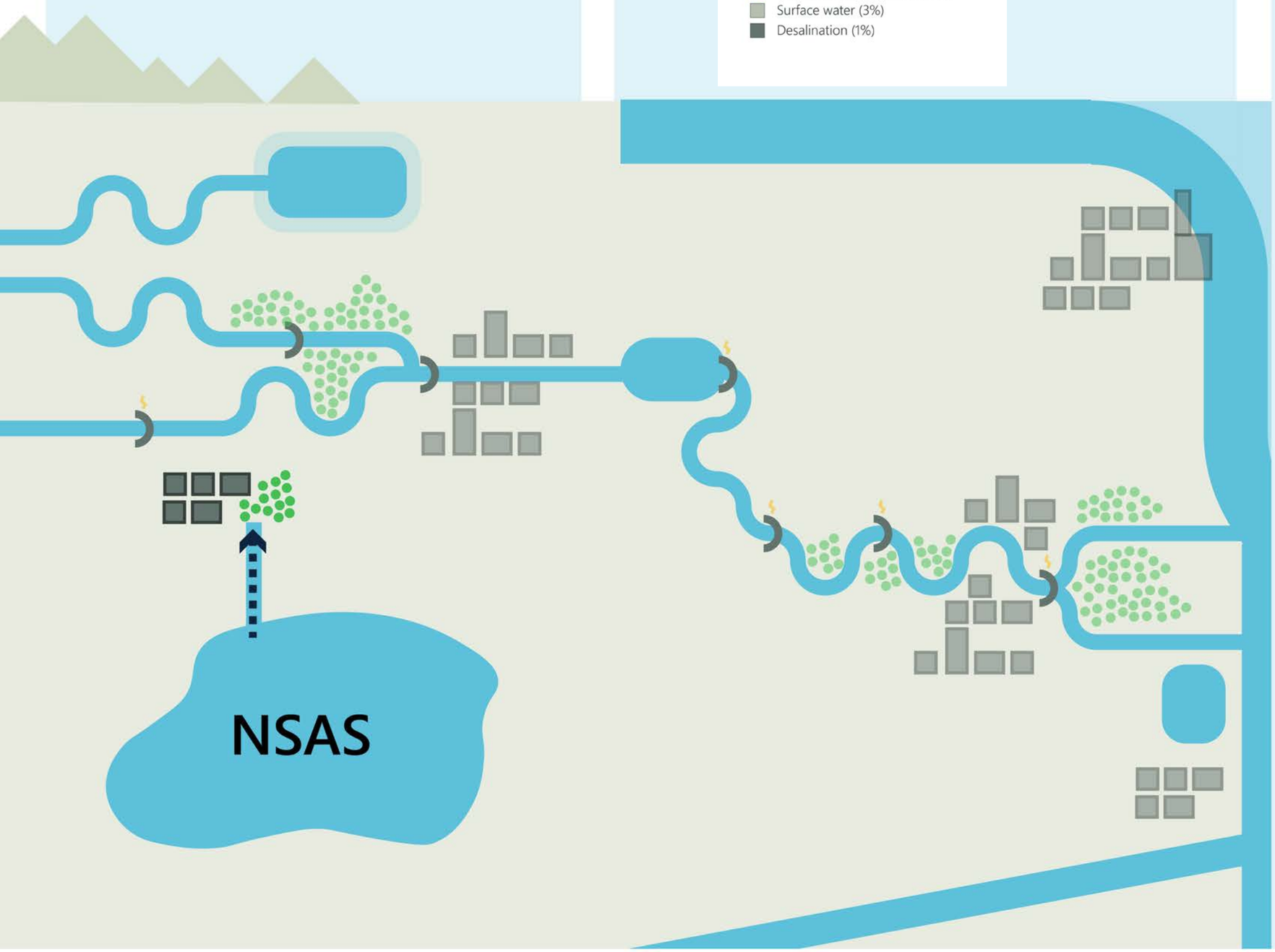


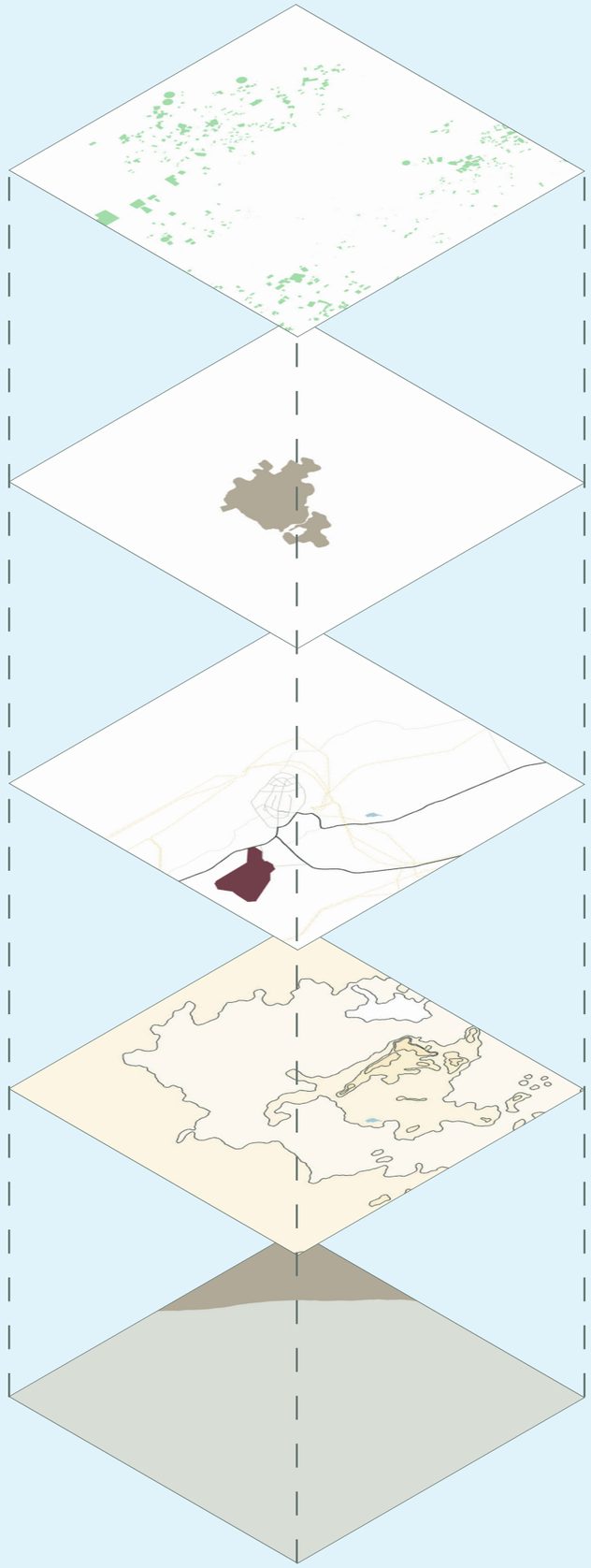


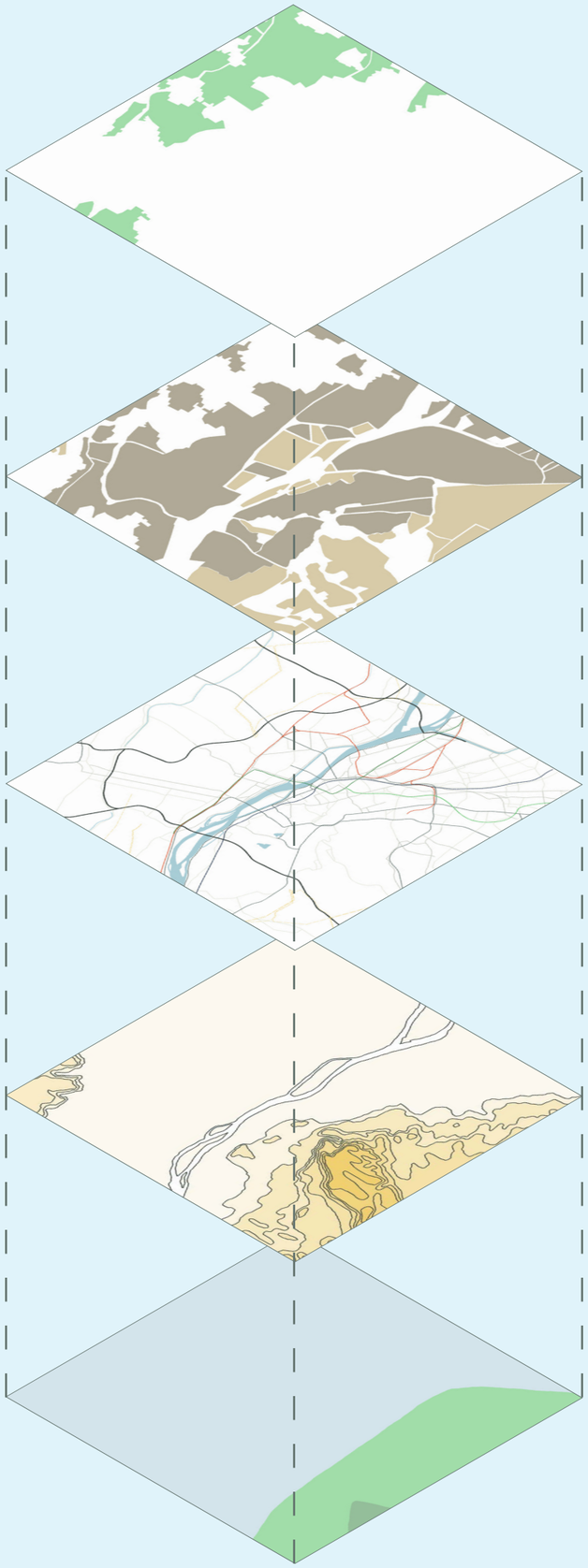
Depleting sources

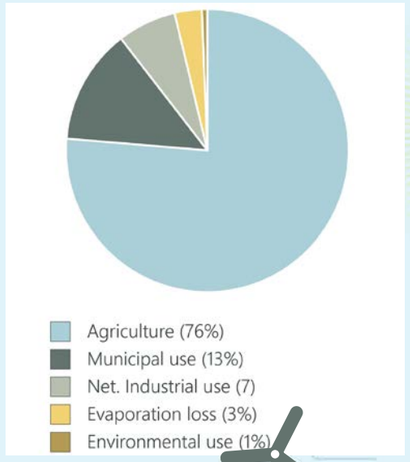
85%
of Libyas fresh water comes from a depleting source







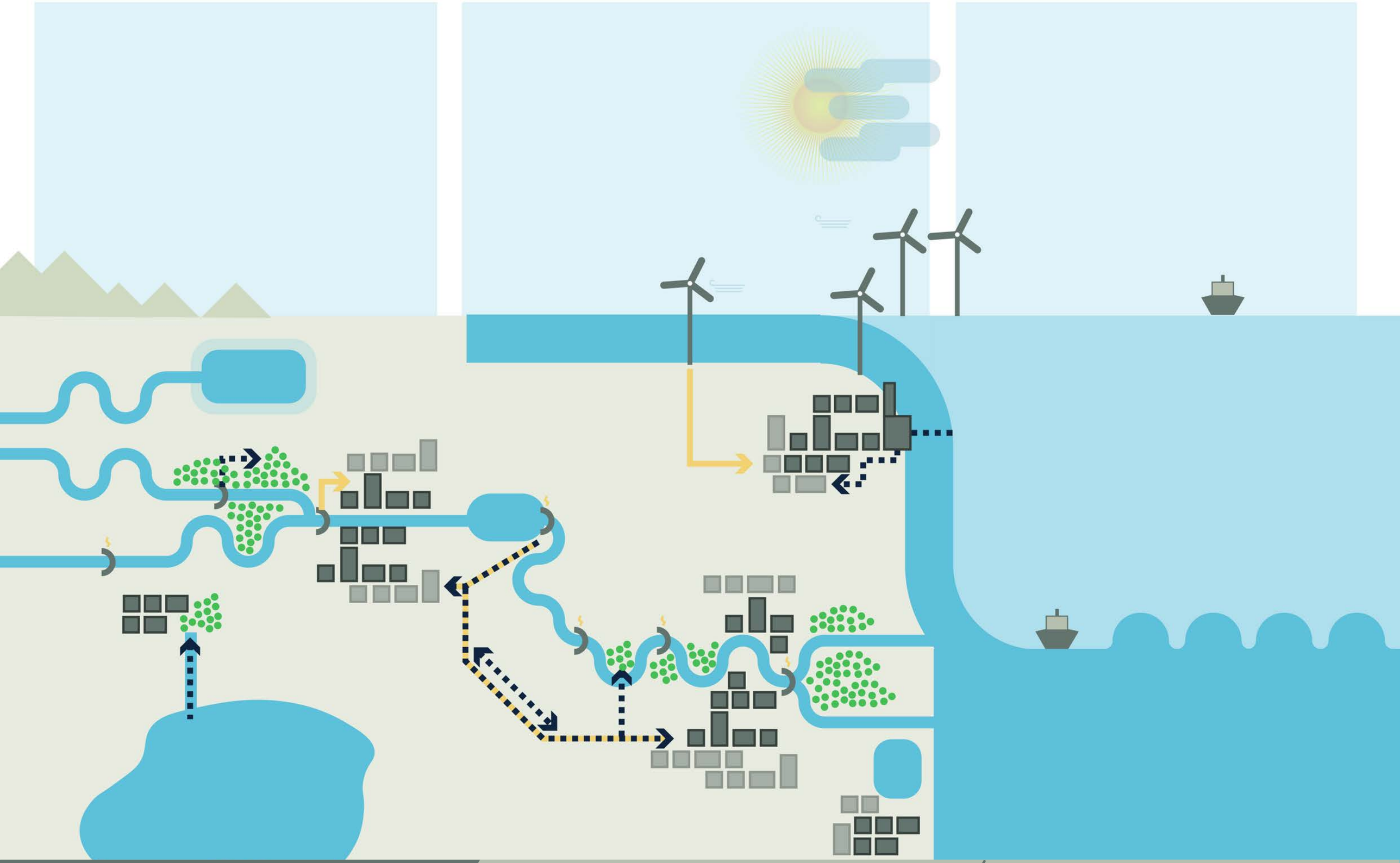




Rapid urbanisation

210 million people

will be expected to live in this region by 2030 (currently ± 165 million)



Context

First conclusions

- Unsustainable water system
- Regional dependency
- Local differences

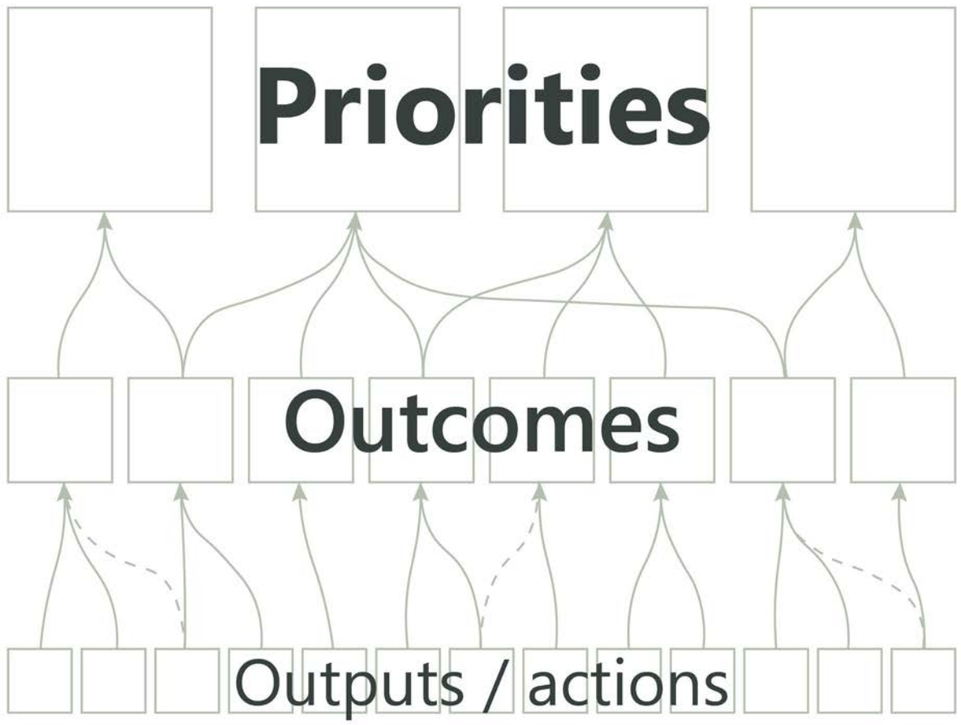
The vision map

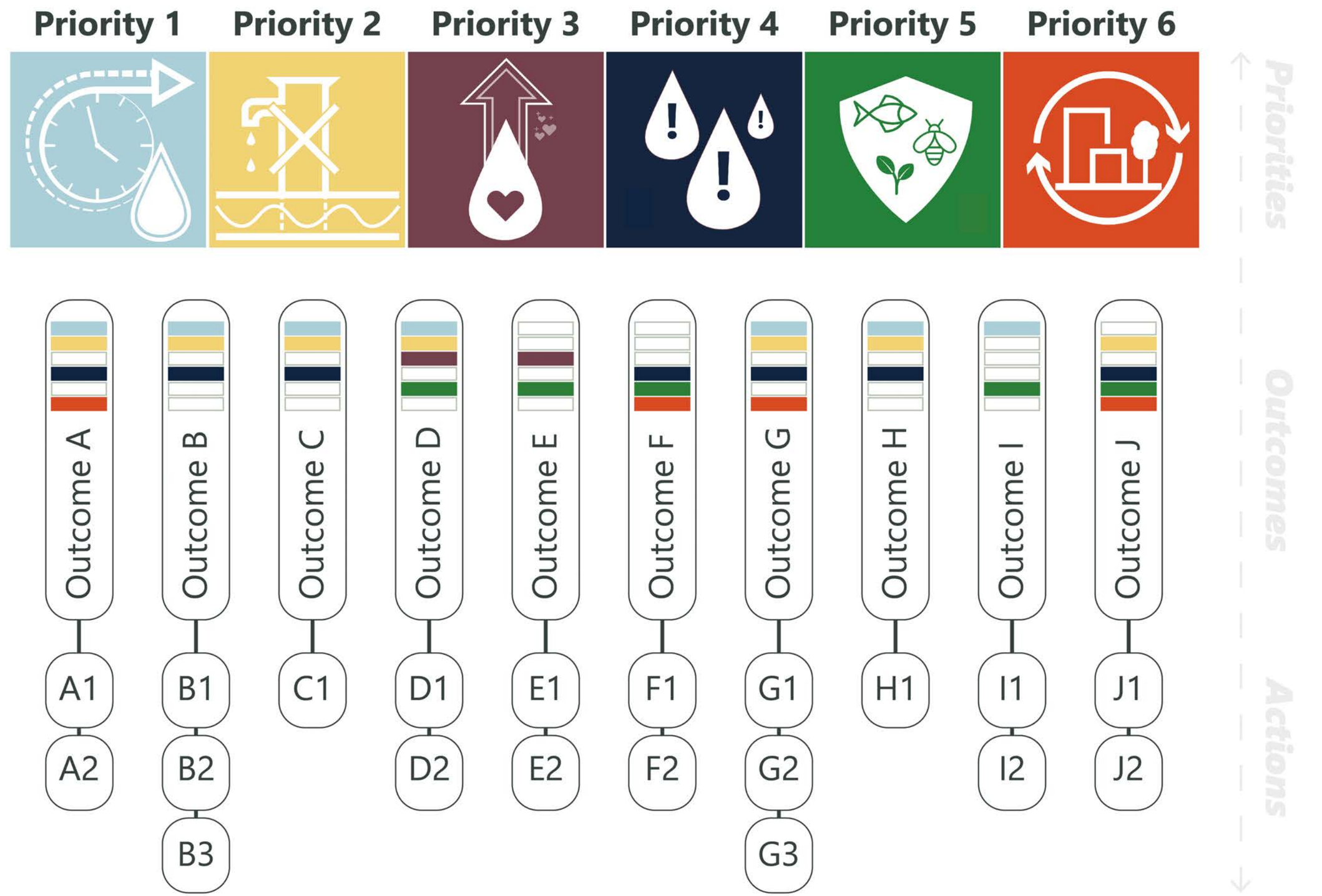
Legend

- *Limit groundwater extraction*
- *Up to date desalination plants*
- *Innovate old plants*
- *Build new sustainable plants*
- *Improve near water biodiversity*
- *Improve irrigation efficiency*
- *Protect important nature areas*
- *Inner city water re-use and improved infrastructure*
- *Improve cooperation*

The regional strategy

- Aim to guide countries



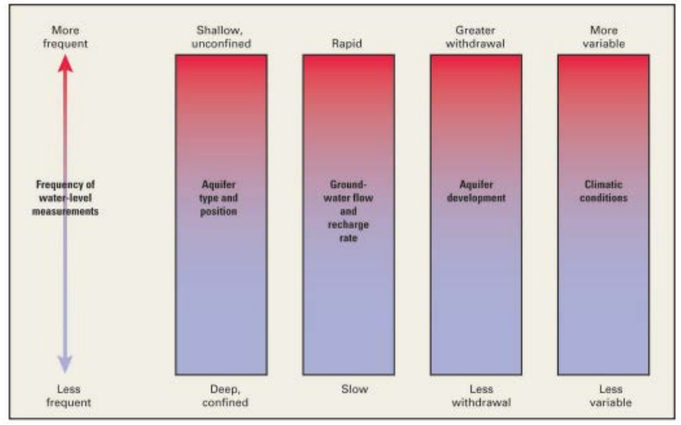

Priority 1
Priority 2
Priority 3
Priority 4
Priority 5
Priority 6
Priorities
Outcomes
Actions
Outcome A
Outcome B
Outcome C
Outcome D
Outcome E
Outcome F
Outcome G
Outcome H
Outcome I
Outcome J
A1
A2
B1
B2
B3
C1
D1
D2
E1
E2
F1
F2
G1
G2
G3
H1
I1
I2
J1
J2

Strategy

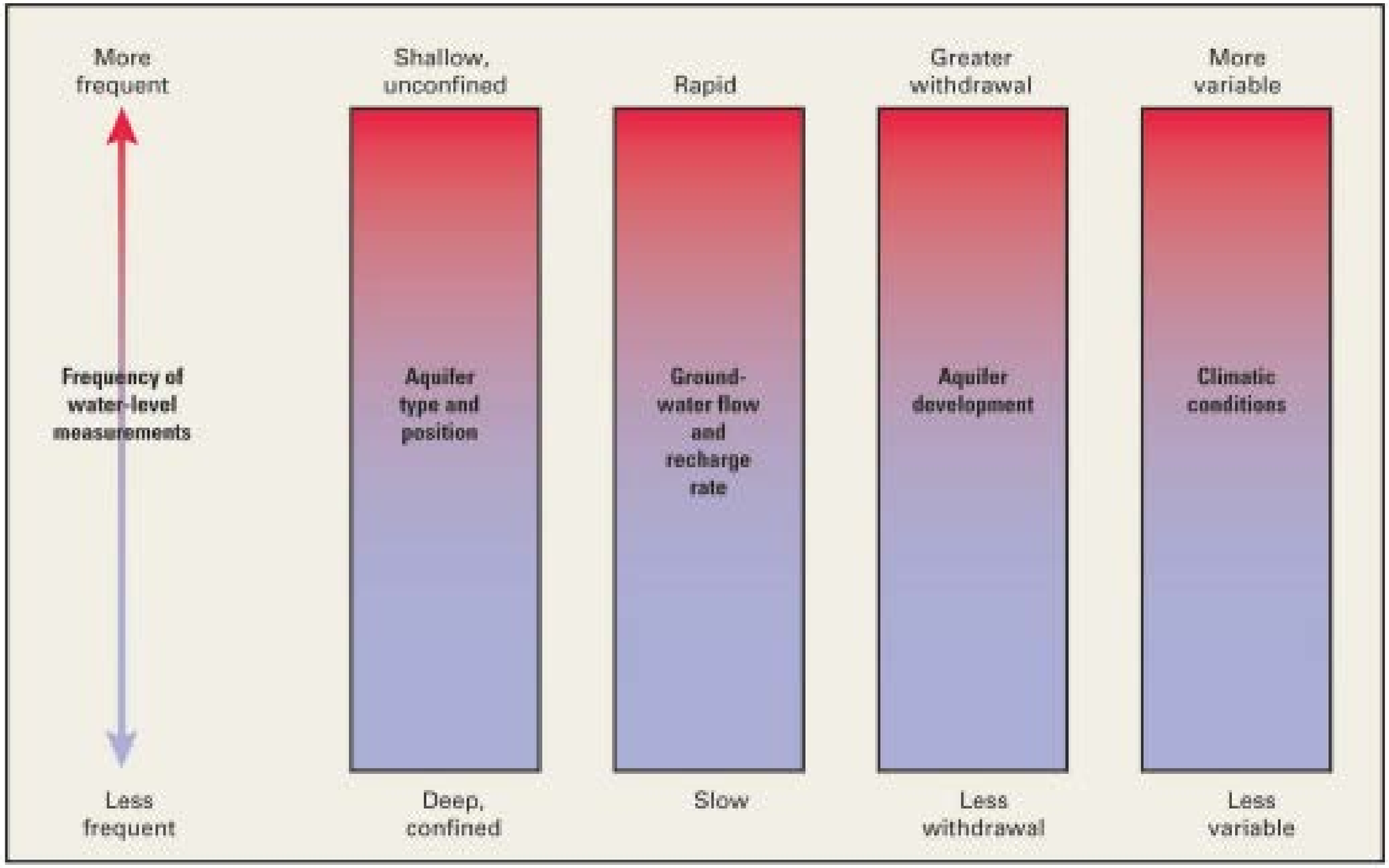
1. Long term availability of water

- increase sustainability
- less dependent on depleting sources

- National Framework for Groundwater Monitoring US



1. Long term availability of water



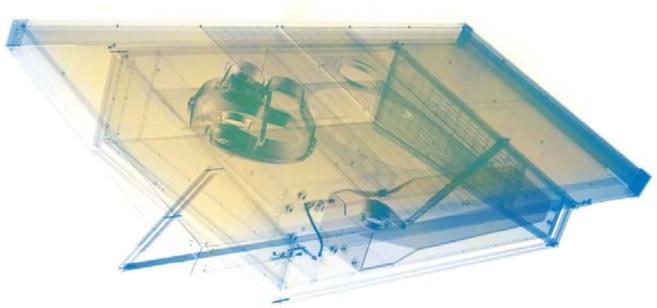
Advisory Committee on Water Information. (2013). A national framework for ground-water monitoring in the United States. https://cida.usgs.gov/ngwmn/doc/ngwmn_framework_report_july2013.pdf

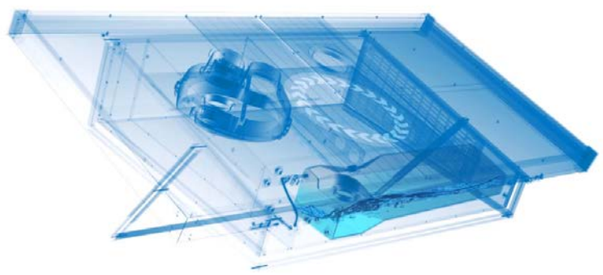
2. Decrease dependency on unsustainable sources

- increase sustainable sources
- decrease use
- create awareness

- new technologies

2. Decrease dependency on unsustainable sources



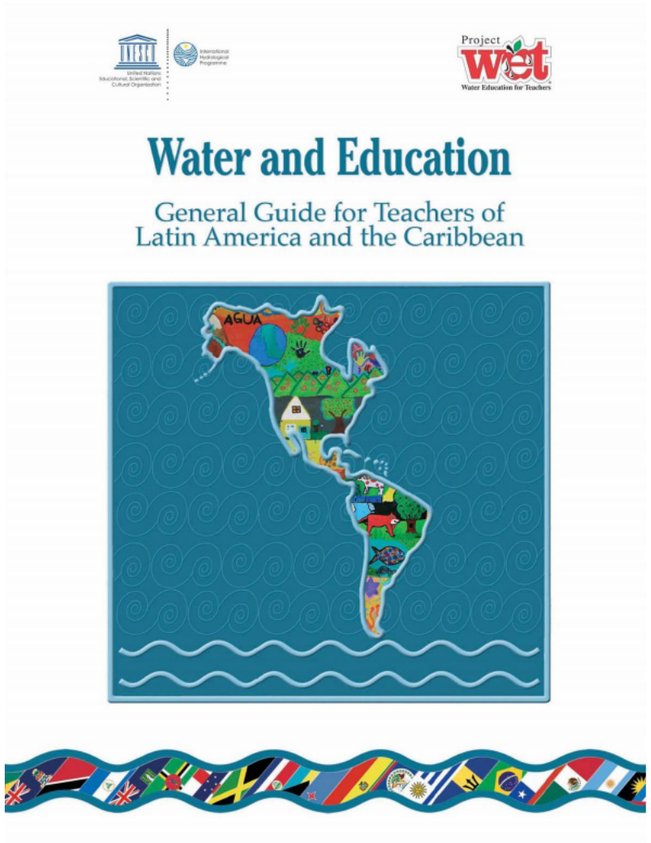


SOURCE Global. (2022). Renewable Drinking Water. SOURCE Water. https://www.source.co/

3. Improved water quality

- regulate wastewater
- educate people
- general guide for teachers

3. Improved water quality



UNESCO. (2012). Water education for sustainable development. https://unesdoc.unesco.org/ark:/48223/pf0000215884/PDF/215884eng.pdf.multi

World Cup Surge

■ **Recommended Age:**
Part I: 9 to 15 years old
Part II: 15 to 18 years old

■ **Subject Areas:**
Government, Environmental Science, Health

■ **Duration:**
Preparation time:
Part I: 15 minutes
Part II: 15 minutes
Activity time:
Part I: 30 minutes
Part II: up to one week

■ **Setting:**
Classroom

■ **Skills:**
Interpreting (defining problems); Applying (problem solving; proposing solutions); Evaluating; Presenting (public speaking, persuading, reporting)

■ **Related Activities:**
Students learn about methods of tracking water quality in "Reaching Your Limits." Water conservation methods are introduced in "Every Drop Counts."

■ **Vocabulary**
bacteria, microorganism, nutrient, wastewater treatment plant, overflow drain

Activity adapted from:
Project WET Curriculum and Activity Guide

What do most people do during a football game's halftime?

▼ Summary
Students do in-depth research and present action plans to solve the problem of increased demands on a community's wastewater treatment plant.

Objectives
Students will:
- illustrate how demands on some treatment plants cause overflow;
- explain problems with sewage overflow;
- propose solutions to a water management problem;
- recognize how presentation strategies influence public policy.

Materials
- *Tokens or popcorn*
- *Cups*
- *A bucket or other container*
- *Copies of* ***Garden City Request for Proposals (RFP)****,* ***Supplemental Form****, and the newspaper article,* ***Treatment Plant Braces for "World Cup" Surge***
- *Chalk*

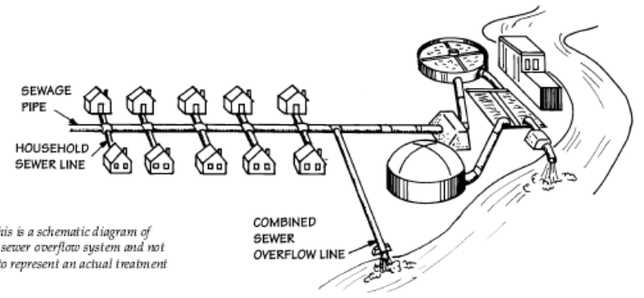
Making Connections
All over the country, millions of toilets are flushed daily. Generally the systems that collect and treat wastewater function efficiently. But when there are backups or the system becomes over-extended during periods of heavy use, managers must assess the situation, make decisions, and implement them. By conducting their own investigations and making presentations, students experience the processes involved in setting management policies and practices.

Background
Most urban communities depend on wastewater treatment plants to ensure that water used by residences and businesses returns to nature clean. Engineers and city planners consider many factors when they design wastewater treatment plants. These considerations include: current and projected population growth, types of businesses, high usage periods, financial resources available to build appropriate treatment systems, and government regulations (laws and standards).

However, as populations grow (sometimes far exceeding the expectations of planners) and as the infrastructures of plants age, treatment plants may be unable to handle the increased output of residential waste. Many municipalities are familiar with surges (peaks) when a large number of people simultaneously contribute to the waste system (e.g., mornings, lunch time, and during the halftime of a World Cup game). In some cases, surges cause systems to overflow or back up. During times of overflow, some plants must dump excess waste directly into a body of water, such as a river or an overflow pond.

Unsightly and odorous, untreated waste leads to multiple health hazards for humans and wildlife. Sewage contains bacteria, protozoa, and viruses that normally live in the intestines of humans and other animals. Waterborne diseases such as dysentery and hepatitis are transmitted by contaminated water.

Organic waste promotes the growth of many microorganisms. When populations of bacteria and other single-celled organisms increase dramatically (bloom), they use more than their share of oxygen and nutrients. Toxins, produced by the microorganisms, and reduced oxygen levels endanger plants and animals. When sewage ends up in waterways, humans are warned not to eat shellfish and other aquatic life because they may harbor poisons released by the microorganisms.



NOTE: *this is a schematic diagram of combined sewer overflow system and not intended to represent an actual treatment plant.*

To treat increased amounts of waste, several alternatives are evaluated by managers. Options include building larger treatment plants or encouraging residents to reduce their water use. Residents can conserve water by limiting daily toilet flushes, placing a bottle of water in their tanks to reduce the water used per flush, and installing toilets that use very little water.

Sometimes, water management policies must change. This involves government planning boards consulting experts on methods to alleviate the problem. Boards evaluate plans based on available funds and on the needs and expectations of their communities.

Procedure
▼ ***Warm Up***

Ask how many students have watched a footbal finals match or other major sporting event. What do the people do during halftime? Tell students that they will participate in a simulation that demonstrates what happens to wastewater treatment systems when unusually large numbers of people simultaneously flush!

▼ ***The Activity***

Part I

1. **Draw a chalk line down the middle of the room.** Tell students this line represents a sewage pipe running underground. Near one end, draw a short line perpendicular to the first line. This represents the escape or overflow pipe that leads into a river. (A picture of a river or fish may be placed at the end of this pipe.)

2. **Arrange chairs along each side of the line.** Each chair represents a house on a street (see illustration). (The sewage pipe is buried beneath the street.) By each chair, place a cup of tokens or popcorn pieces. These tokens represent waste materials.

3. **Place two students at one end of the line—the end closest to the escape pipe.** They represent the treatment plant. Tell students that, in this simulation, five seconds are required for the treatment plant to clean the waste from each household. One student collects the tokens in a bucket while the other counts off five seconds.

4. **Have the remaining students stand in front of the chairs and count off by fours.** Tell them that when you call "Flush!" and a number, students with that number should pick up a token, leave their homes, and walk down the pipe to the sewage plant. They should stand an arm's length from the student in front of them.

5. **When a student reaches the sewage plant, he or she gives the token to the student representing the plant and returns home.** This procedure is repeated for all students in line. If all students have their waste treated within one minute, the system has not overflowed.

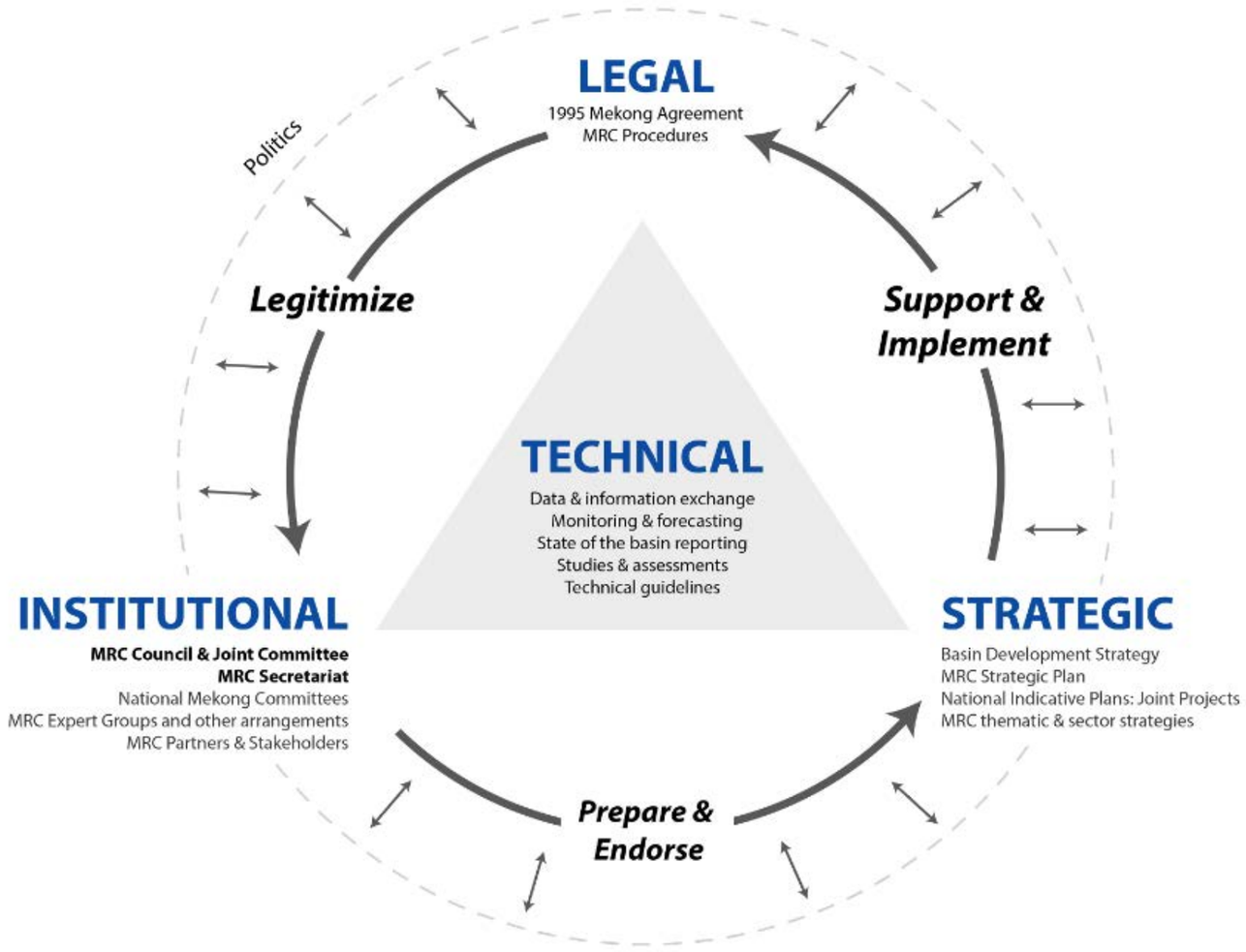
6. **Begin the activity by calling "Flush! One."** Allow all number

Strategy

4. Mitigate current shortage

- increasing available water
- decreasing water use
- collaborating through a shared regional framework

4. Mitigate current shortage



Kittikhoun, A., & Staubli, D. M. (2018). Water diplomacy and conflict management in the Mekong: From rivalries to cooperation. Journal of Hydrology, 567, 654-667.

5. Improve biodiversity & protect the environment

- decreasing depletion (near nature)

- regulating wastewater and overuse

- nature based solutions (NBS)

5. Improve biodiversity & protect the environment

UNDP Climate. (2021, June 25). Colombia's infinite wetlands. https://undp-climate.exposure.co/gcf-colombia-wetlands

6. Resilient and sustainable cities

- drought warnings
- adapting cities

- drought early warning systems (DEWS)

6. Resilient and sustainable cities

U.S. Drought Monitor

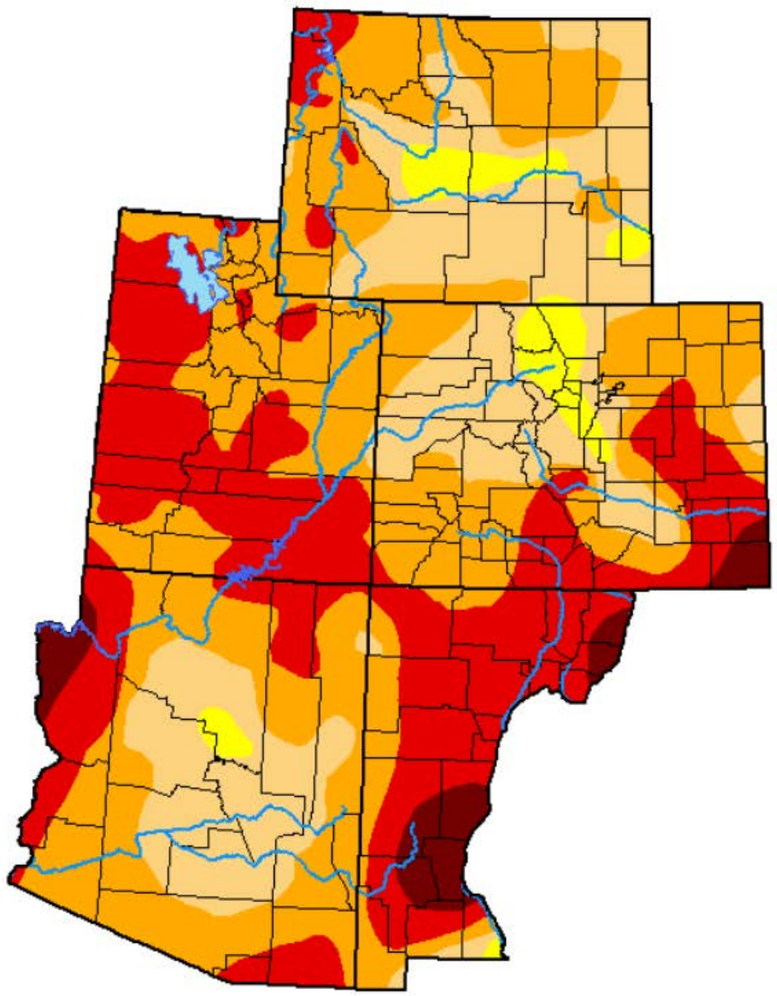
Current U.S. Drought Monitor map for the Intermountain West Drought Early Warning System (DEWS) region with data valid for May 17, 2022. The U.S. Drought Monitor is updated each Thursday to show the location and intensity of drought across the country.

31.87% of the Intermountain West DEWS region is experiencing extreme to exceptional drought (D3–D4).

U.S. Drought Monitor Categories

- D0 - Abnormally Dry
- D1 - Moderate Drought
- D2 - Severe Drought
- D3 - Extreme Drought
- D4 - Exceptional Drought

Map and legend colors may be altered when using dark or high-contrast mode.



NOAA/NIDIS. (2020, December). Missouri River Basin Drought Early Warning System (DEWS) Strategic Action Plan. https://www.drought.gov/sites/default/files/2021-10/2021%E2%80%932023_MRB_StrategicPlan_lowres.pdf

Strategy

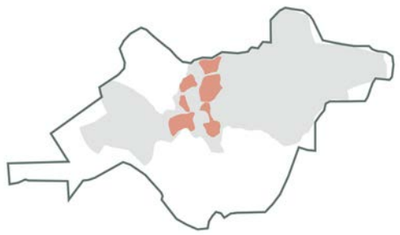
Conclusions

- Regional coherence
- Local elaborations
- Easy to link to strategy by priorities / themes

Greater Cairo region

Greater Cairo region

Main urban types



A. Dense, old, unplanned

Image by Looch (2021).

Image by Mohamed (2021).

B. Old, planned

C. New, planned

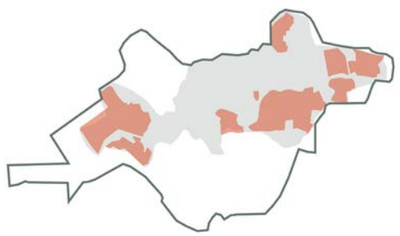


Image by Higgins (n.d.).

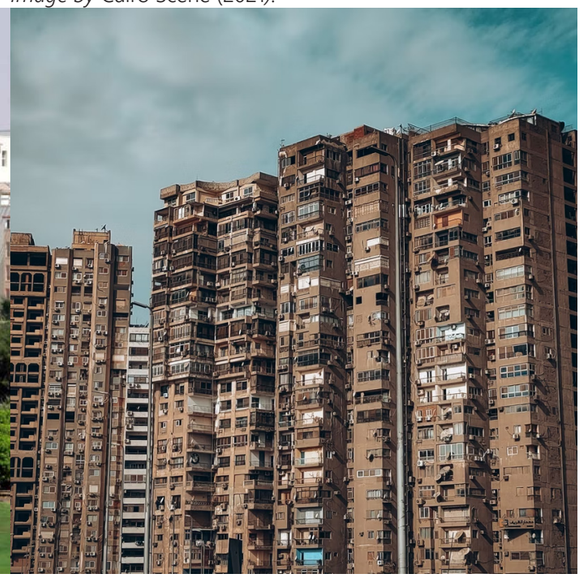
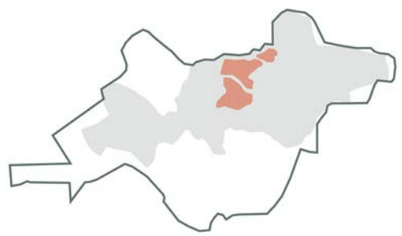


Image by Cairo Scene (2021).

D. Dense, new, unplanned

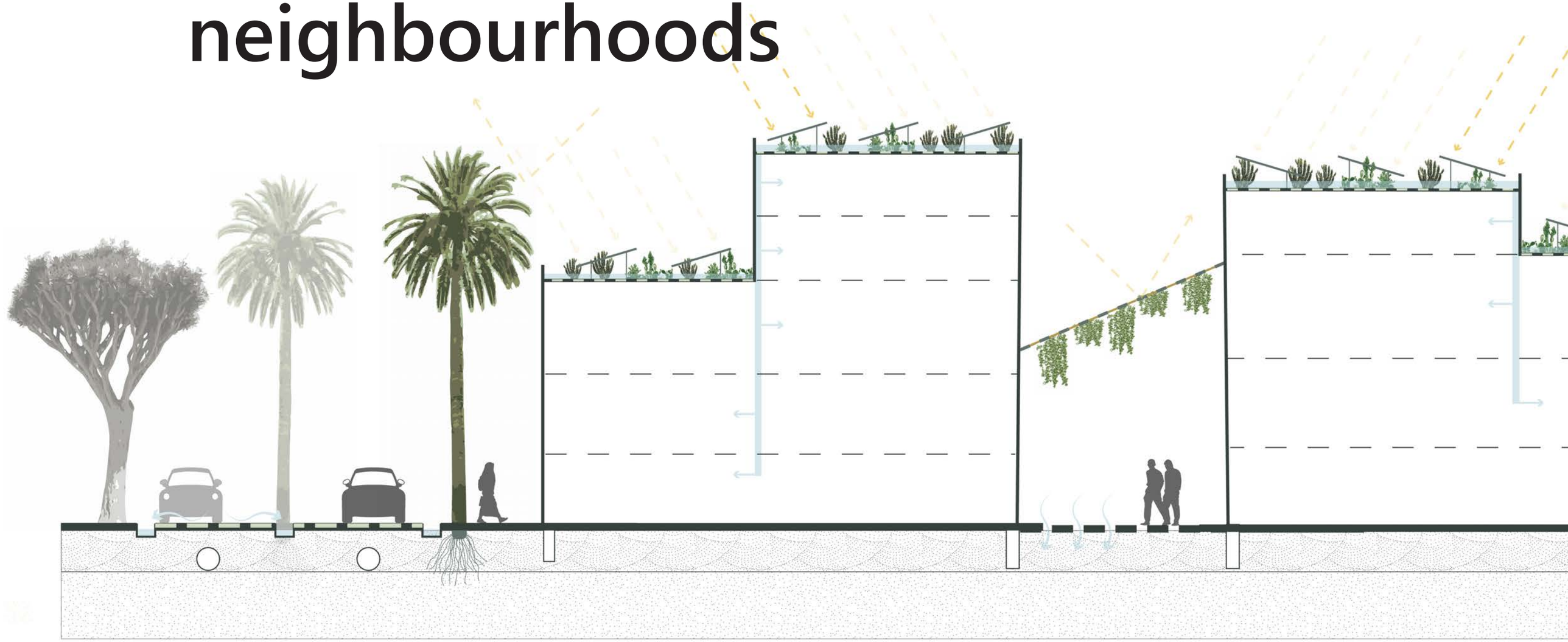


Type A: dense, old and unplanned neighbourhoods

Azabache, A. (2019, September 26). Market in Cairo, Egypt [Photograph]. Unsplash. https://unsplash.com/photos/hz4tKDvQHoo

El-Rashidi, S. (n.d.). Bulaq, Cairo [Photograph]. Barakat. https://barakat.org/project-reports/documenting-historic-commercial-buildings-in-bulaq--cairo/

Type A: dense, old and unplanned neighbourhoods

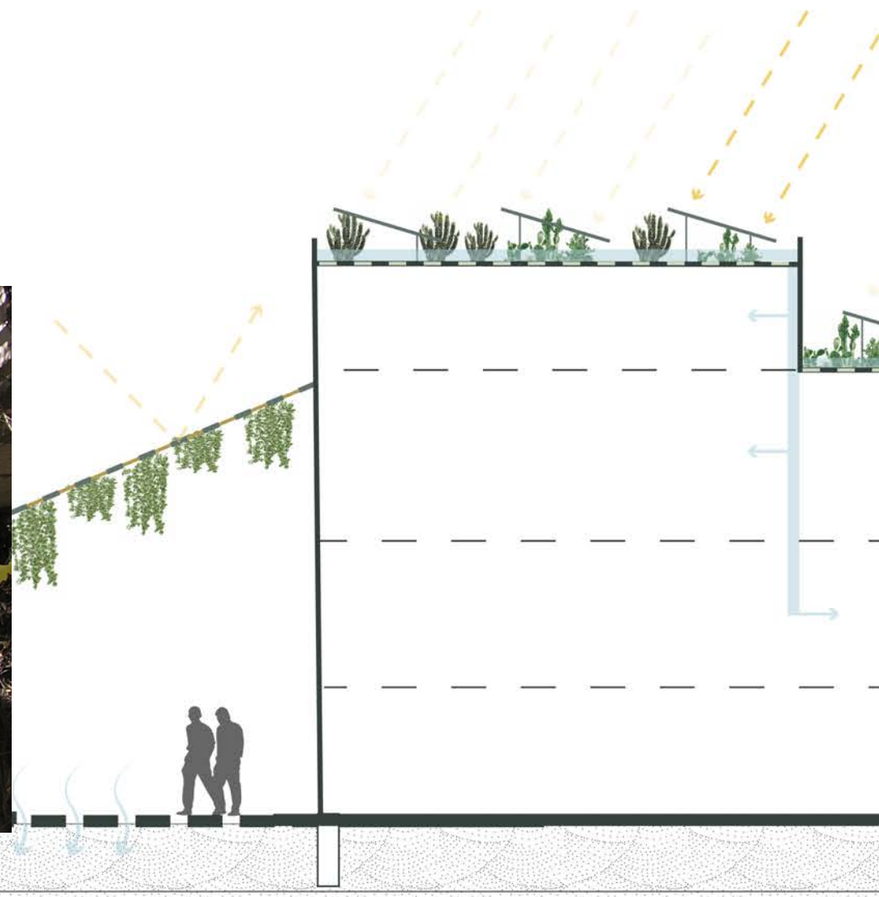


Design

Type A: dense, old and unplanned neighbourhoods

Kokai, A. (2015, February 14). Rooftop cactus garden [Photograph]. Wikimedia Commons. https://commons.wikimedia.org/wiki/File:Rooftop_cactus_garden_%2816427658080%29.jpg

Type A: dense, old and unplanned neighbourhoods



M. (2021, October 14). Calle Sierpes in Seville [Photograph]. Parenthood & Passports. https://parenthoodandpassports.com/3-days-in-seville-spain/

Julo. (2005, October 29). Pergola Wroclaw [Photograph]. Wikimedia Commons. https://commons.wikimedia.org/wiki/File:Pergola-Wroclaw-wnetrze.jpg

Type A: dense, old and unplanned neighbourhoods

Design

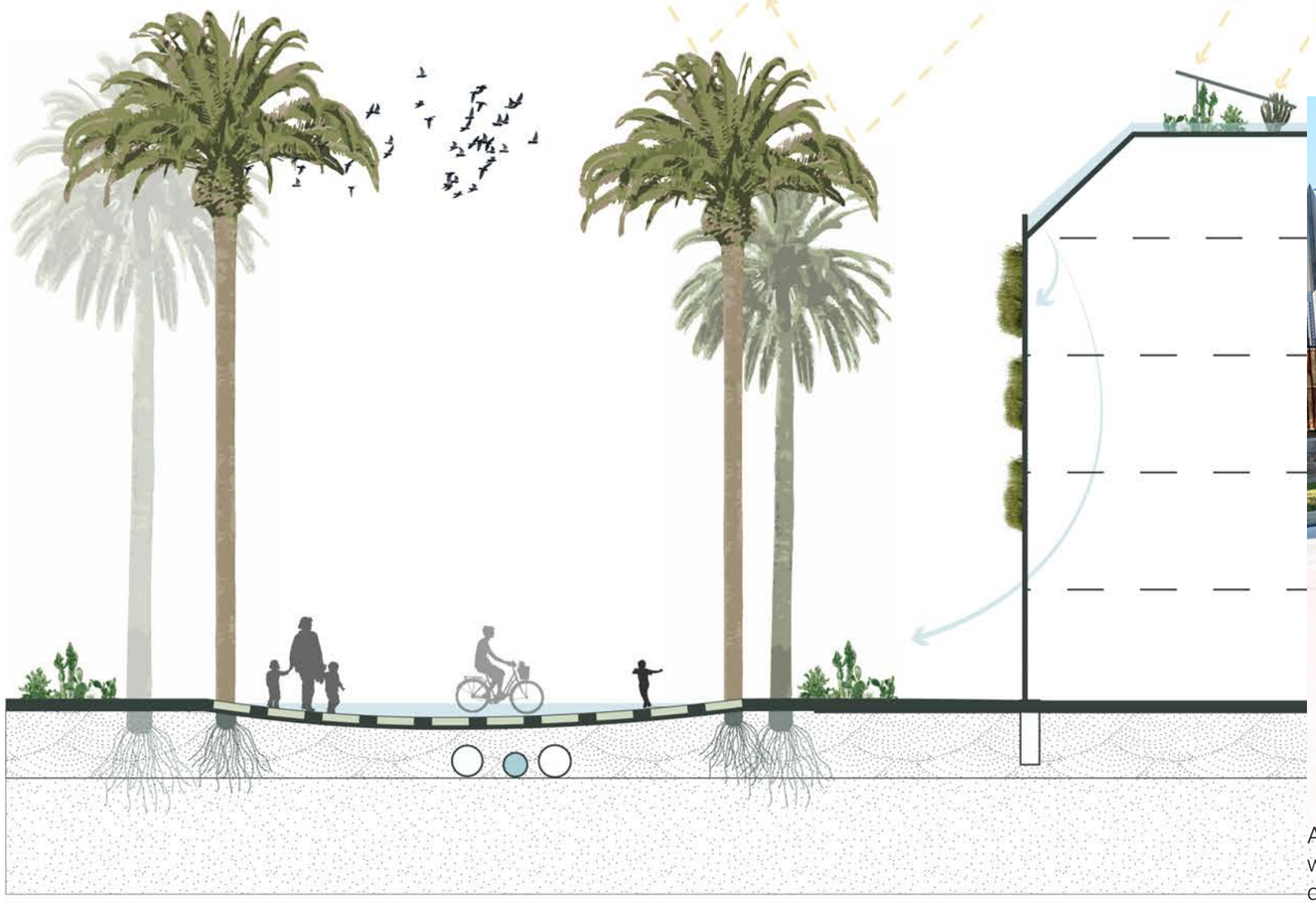
Type B: old & planned neighbourhoods

Cairo Scene. (2021, August 6). Memory of the city' book to highlight Garden City's urban heritage [Photograph]. Cairo Scene. https://cairoscene.com/ArtsAndCulture/Memory-of--the-City-Book-to-Highlight--Garden-City-s-Urban-Heritage

Type B: old & planned neighbourhoods

Design

Type B: old & planned neighbourhoods



Abdallah, C. (2018, April 28). Los Angeles is painting the streets white (again), and your city might be next [Photograph]. Archdaily. https://www.archdaily.com/893171/los-angeles-is-painting-the-streets-white-again-and-your-city-might-be-next

Type B: old & planned neighbourhoods

Baldwin, E. (2018, September 20). Climate tile designed to catch and redirect excess rainwater from climate change [Illustration]. Archdaily. https://www.archdaily.com/902399/climate-tile-designed-to-catch-and--redirect-excess-rainwater-from-climate-change

Type B: old & planned neighbourhoods

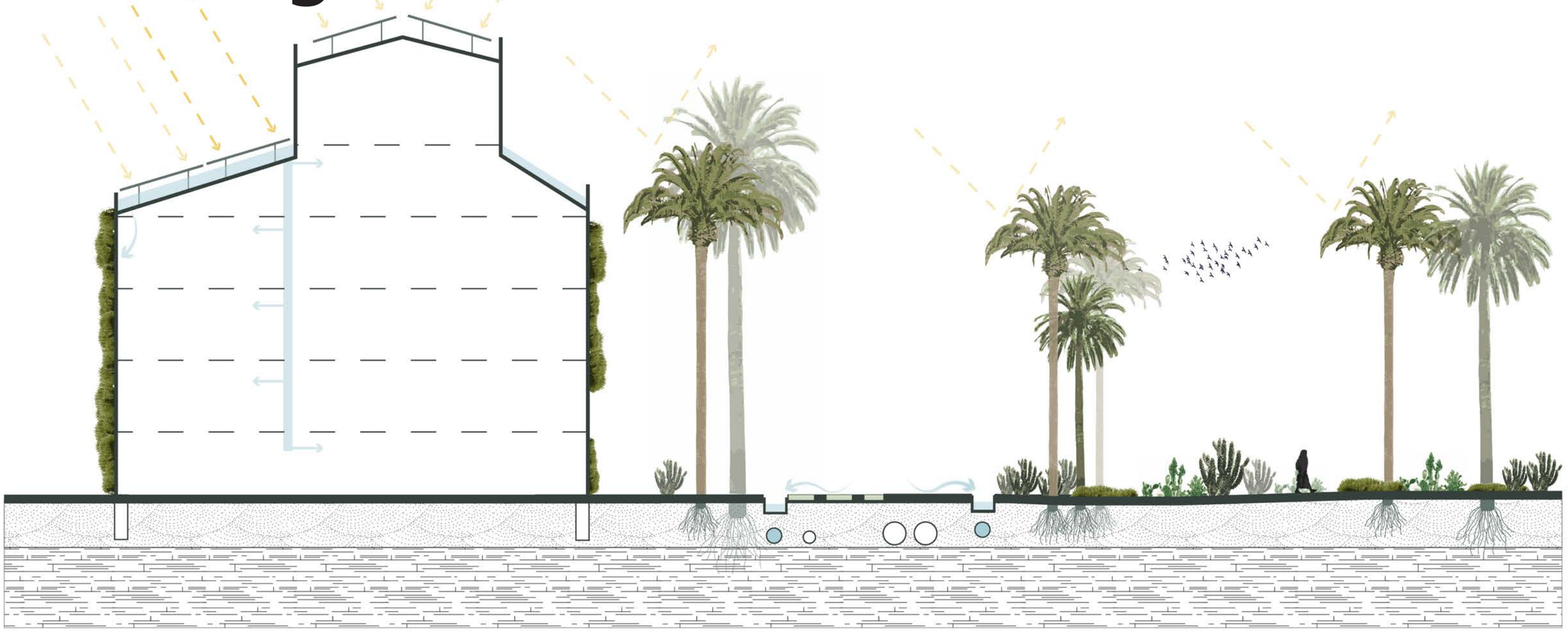
Design

Type C: new & planned neighbourhoods

Looch, C. (2021, September 8). A guide to the best neighbourhoods to visit in Cairo [Photograph]. The Culture Trip. https://theculturetrip.com/africa/egypt/articles/a-guide-to-best-neighbourhoods-to-visit-in-cairo/

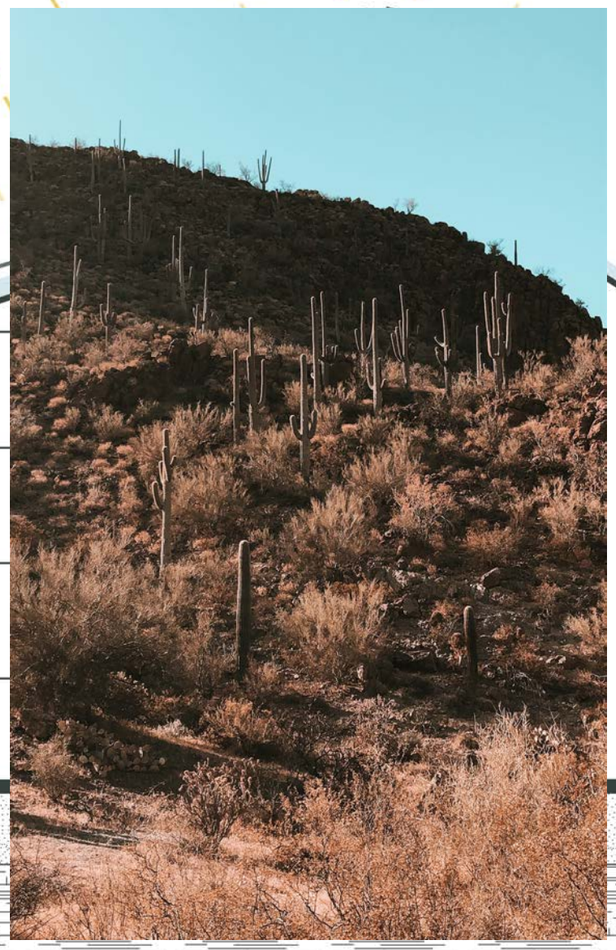
EGE. (n.d.). Mivida, New Cairo [Photograph]. EGE Systems. http://ege.systems/solar-street-light/mivida-new-cairo

Type C: new & planned neighbourhoods



Design

Type C: new & planned neighbourhoods



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Design

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Type D: new & unplanned neighbourhoods

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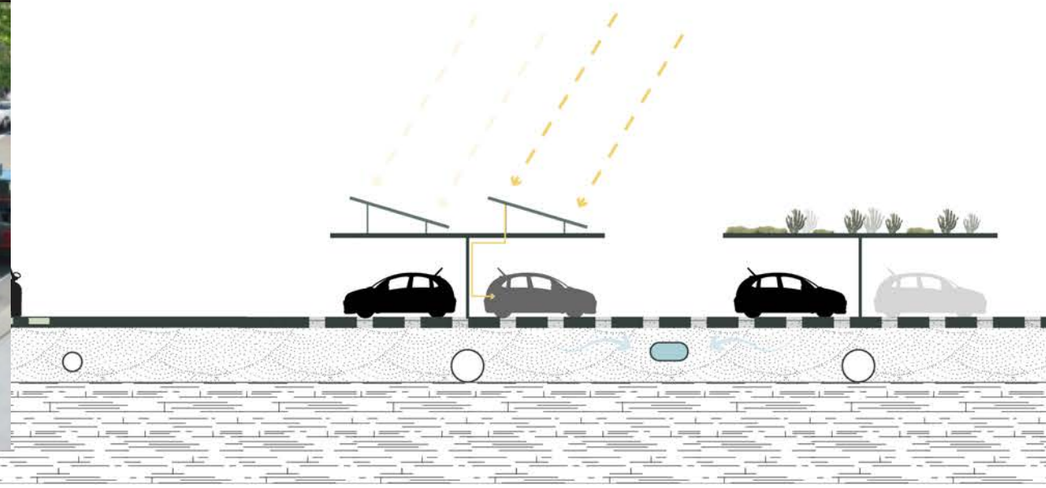

Design

Type D: new & unplanned neighbourhoods

Design

Conclusions

- Regional strategy needs local interpretations
- Many differences on small scale
- Top-down vs bottom-up
- current needs vs future threats

Reflection

- Location visit - local perspective
- Outside perspective
- Broad analysis, more depth in further research

Thank you!