



SwaleFlow

Water Management Made Smart

Eyobed Beyene, Eric Chen,
Richard McHorgh, and Sophie
Roberts-Weigert

Outline



Motivation & Concept



Research

Similar Projects

Supporting Design

Market Demand & Metrics



Process

Software

Design & Building

Team Dynamics



Final Product

Electronics

Code

Site Layout & Functionality



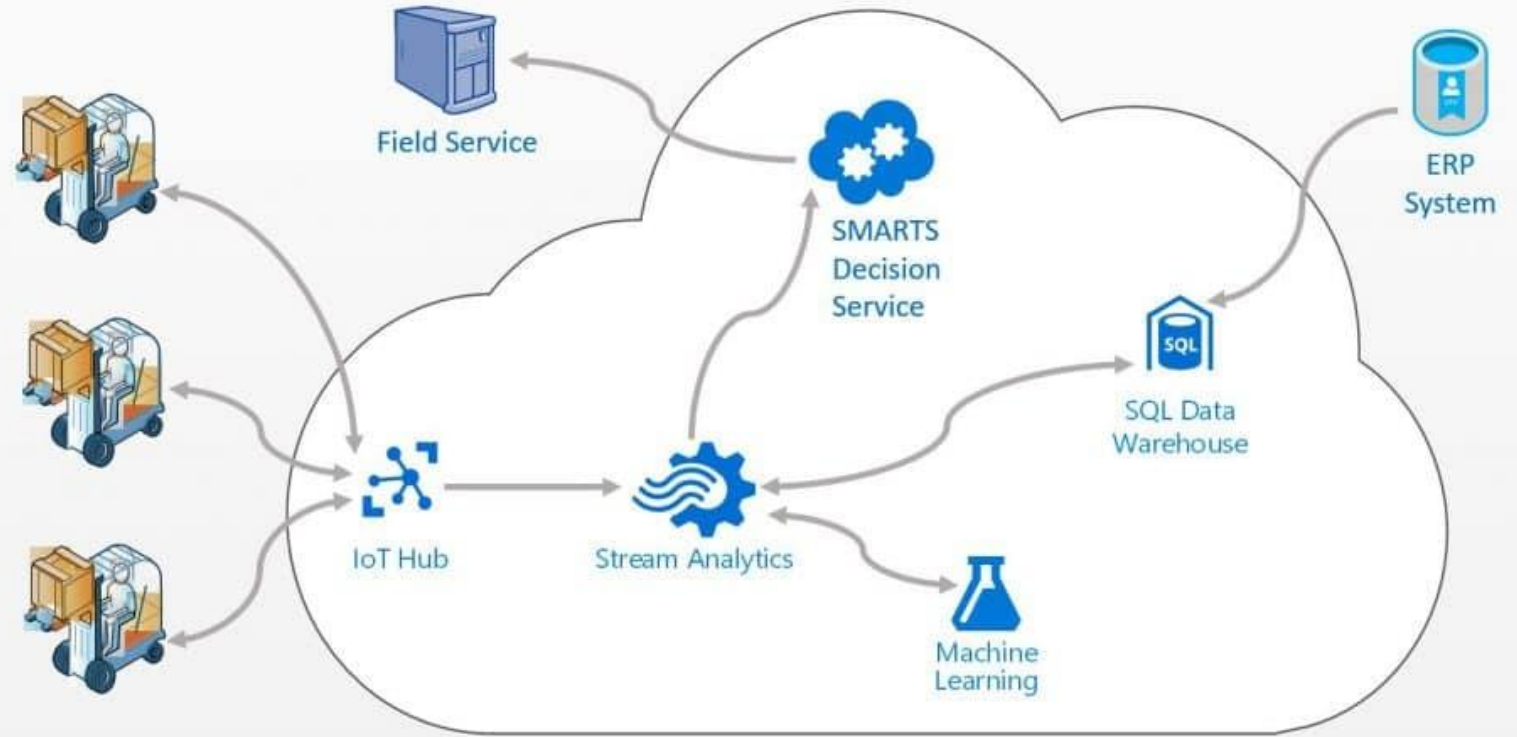
Conclusion

Motivation Demand

The future: IoT &
smart systems

Water management
expense due to
COVID-19

(globenewswire.com,
businesswire.com)



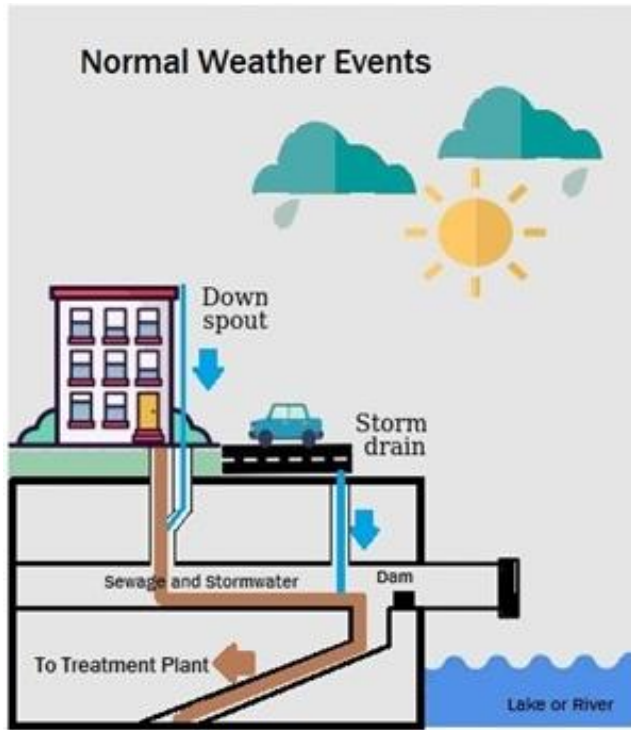
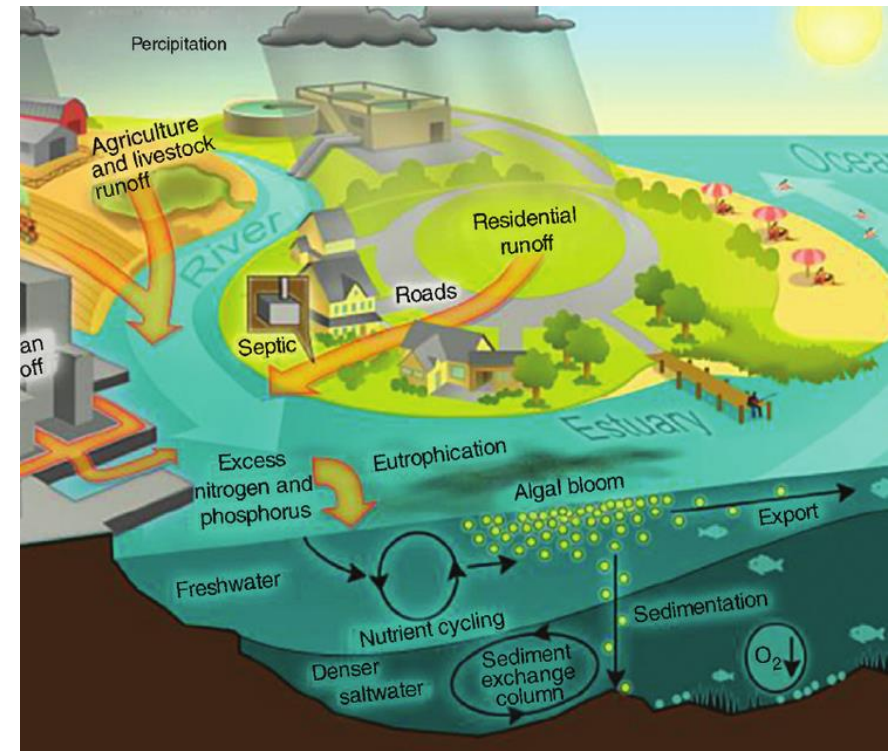


Figure 1



Figure 2



Motivation

Environmental Impact

(dgs.dc.gov, populationeducation.org, researchgate.net, nationalgeographic.org, oceanbites.org, ijc.org)

Motivation Impact on Homeowners

Flooding

Erosion

Property damage



*Damage done
to homeowner's
property
(bobvila.com)*



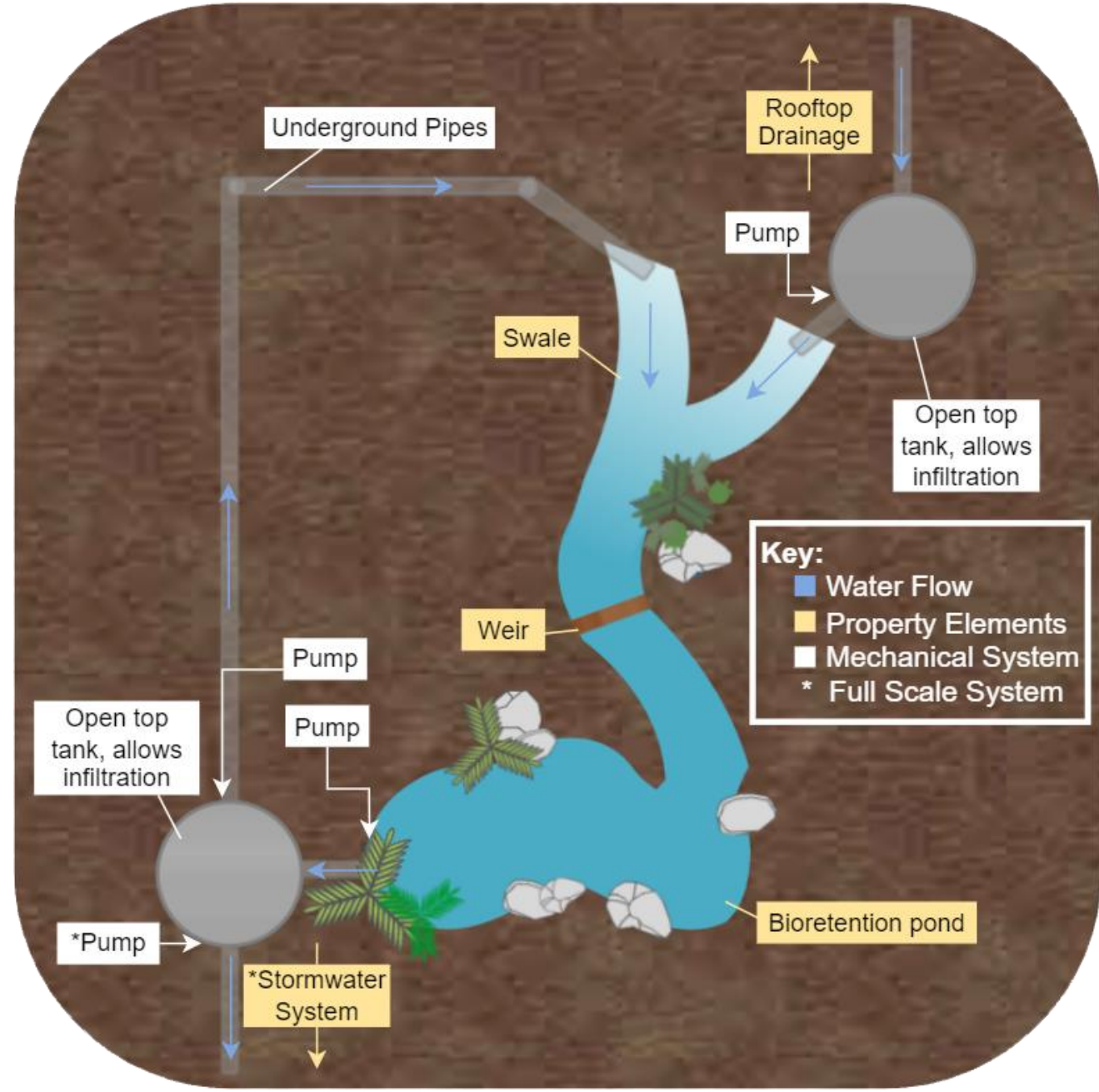
Concept

Water management system

Prevent pollution runoff

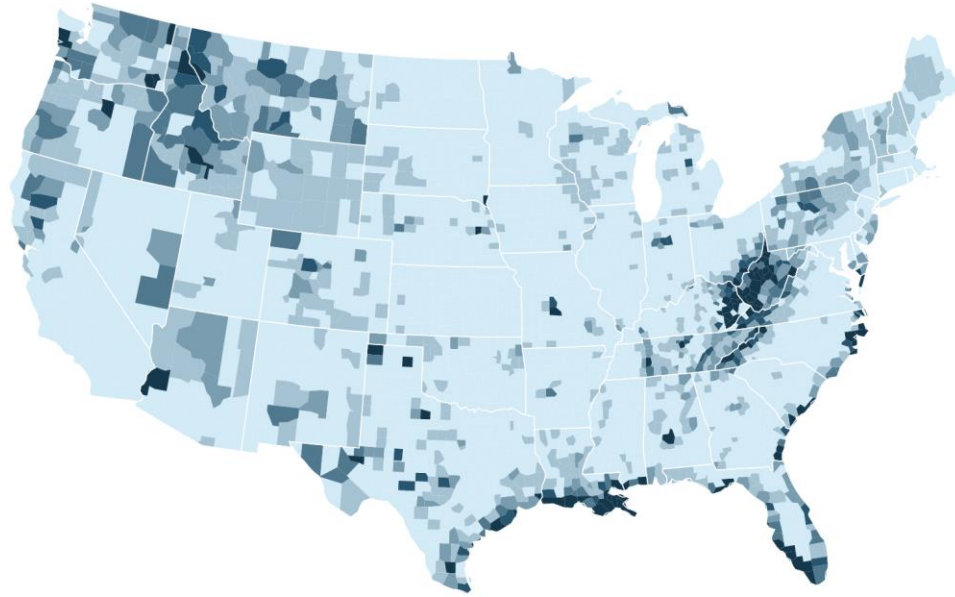
Aesthetically pleasing design

Smart system



Where People Are At Risk For Flood Damage

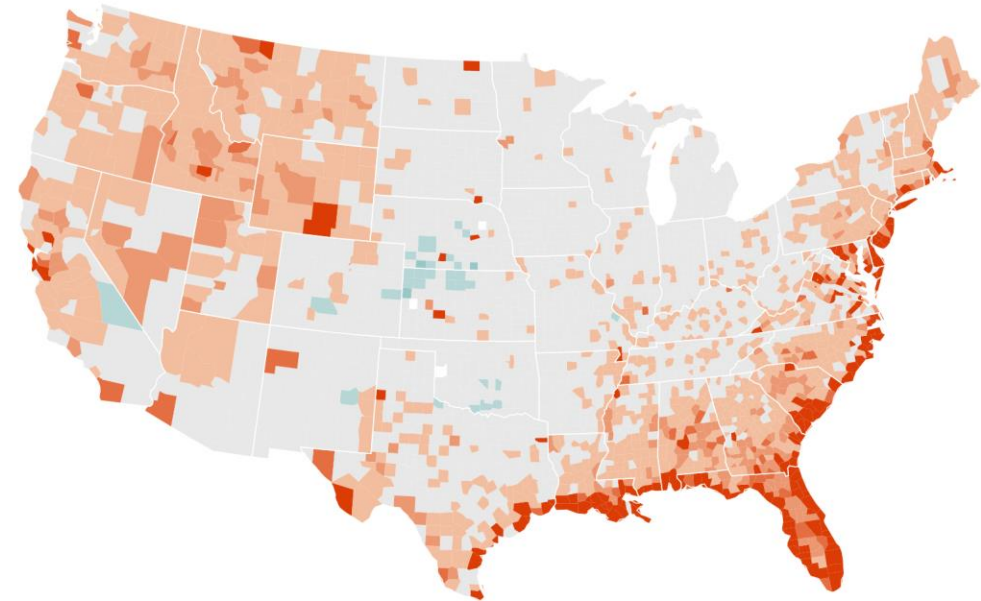
Percent of residential properties at risk by county, 2020



Visual schematic obtained from NPR highlights the risk of flooding based on county

Where Flood Damage Costs Will Increase

The cost of flood damage to homes nationwide will increase by more than 50% in the next 30 years, the First Street Foundation estimates. Counties on the East and Gulf coasts will see the most dramatic increases.



Visual schematic obtained from NPR shows areas where flood damage is most likely to increase in the next 30 years

Market Centers of Influence

(npr.org)

Market Research

Global Smart Water
Market CAGR: 10.1%

Fastest Growing Market:
Asia Pacific

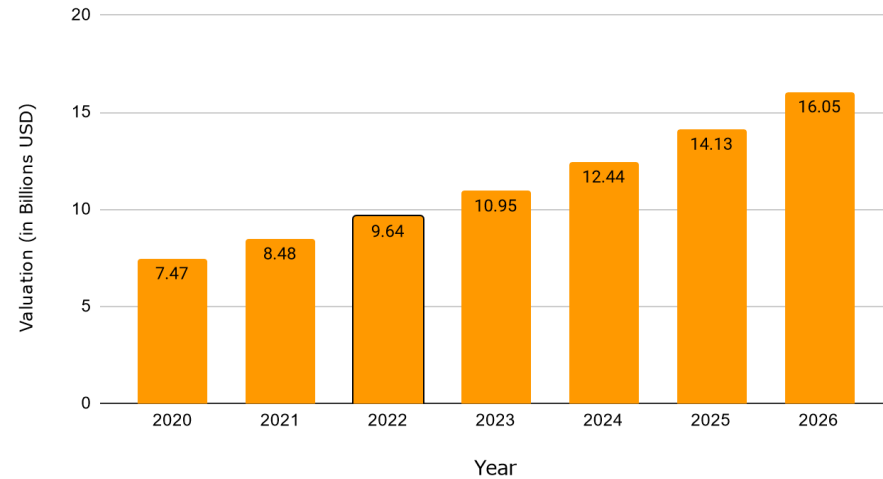
U.S. Stormwater Market
CAGR: 13.6%

$$CAGR = \left(\frac{V_{\text{final}}}{V_{\text{begin}}} \right)^{(1/t)} - 1$$

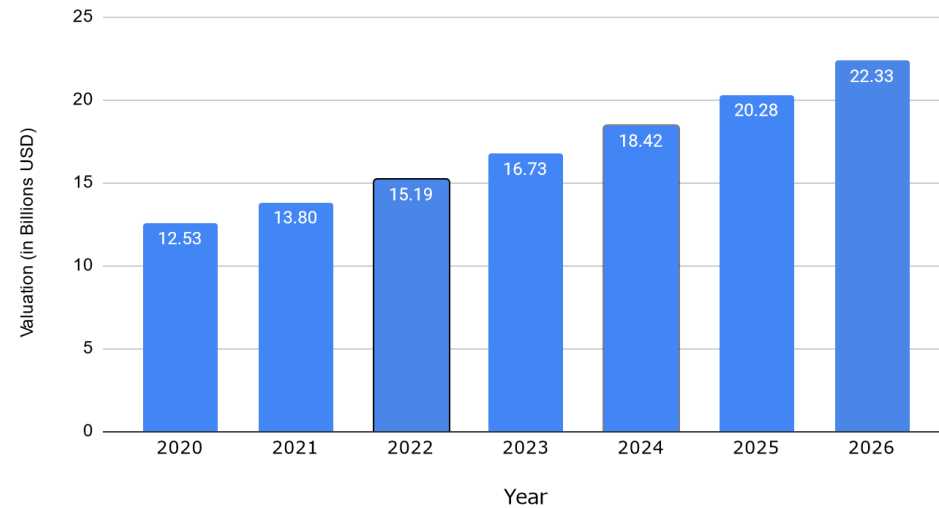


Disclaimer: Does not account for economic impact of COVID

Smart Water Management Market Value (2020-2026)



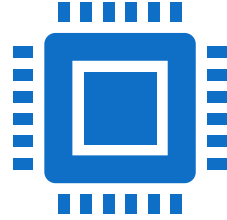
Stormwater Management Market Value (2020-2026)



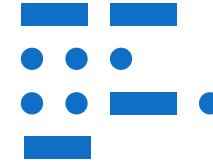
(marketsandmarkets.com,
marketwatch.com)



Site Layout



Electronics



Code

Final Product

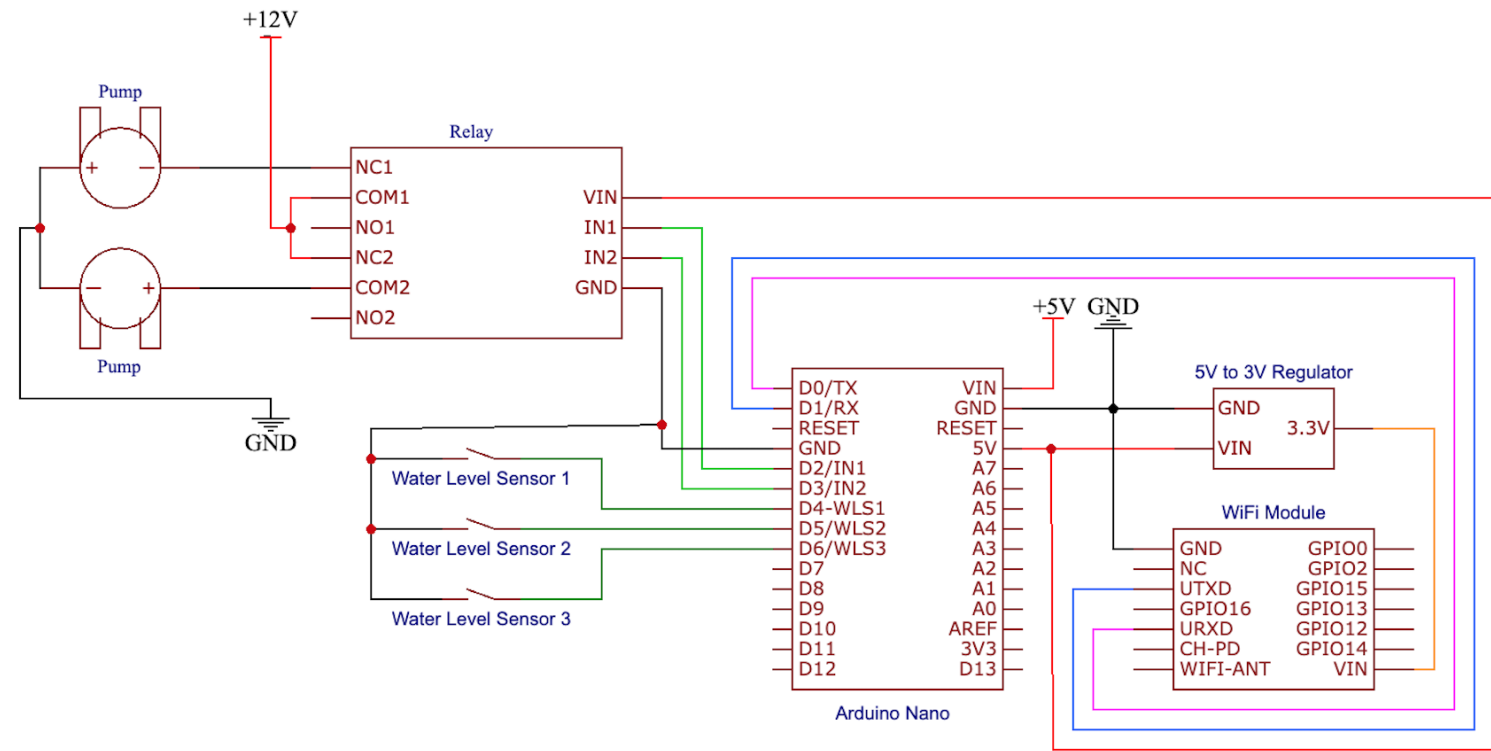
Assembly



Dimensions

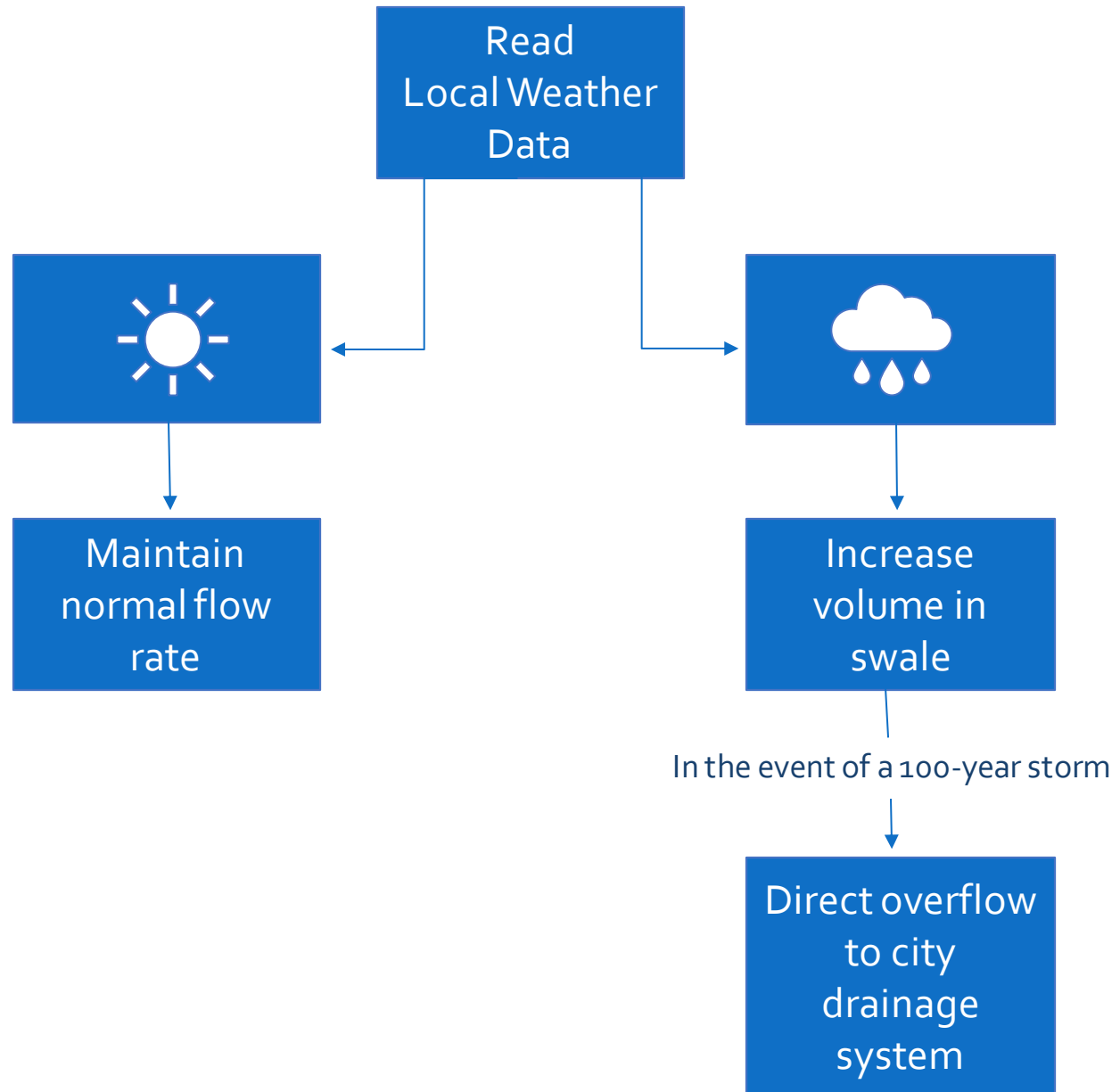


Electronics Schematic



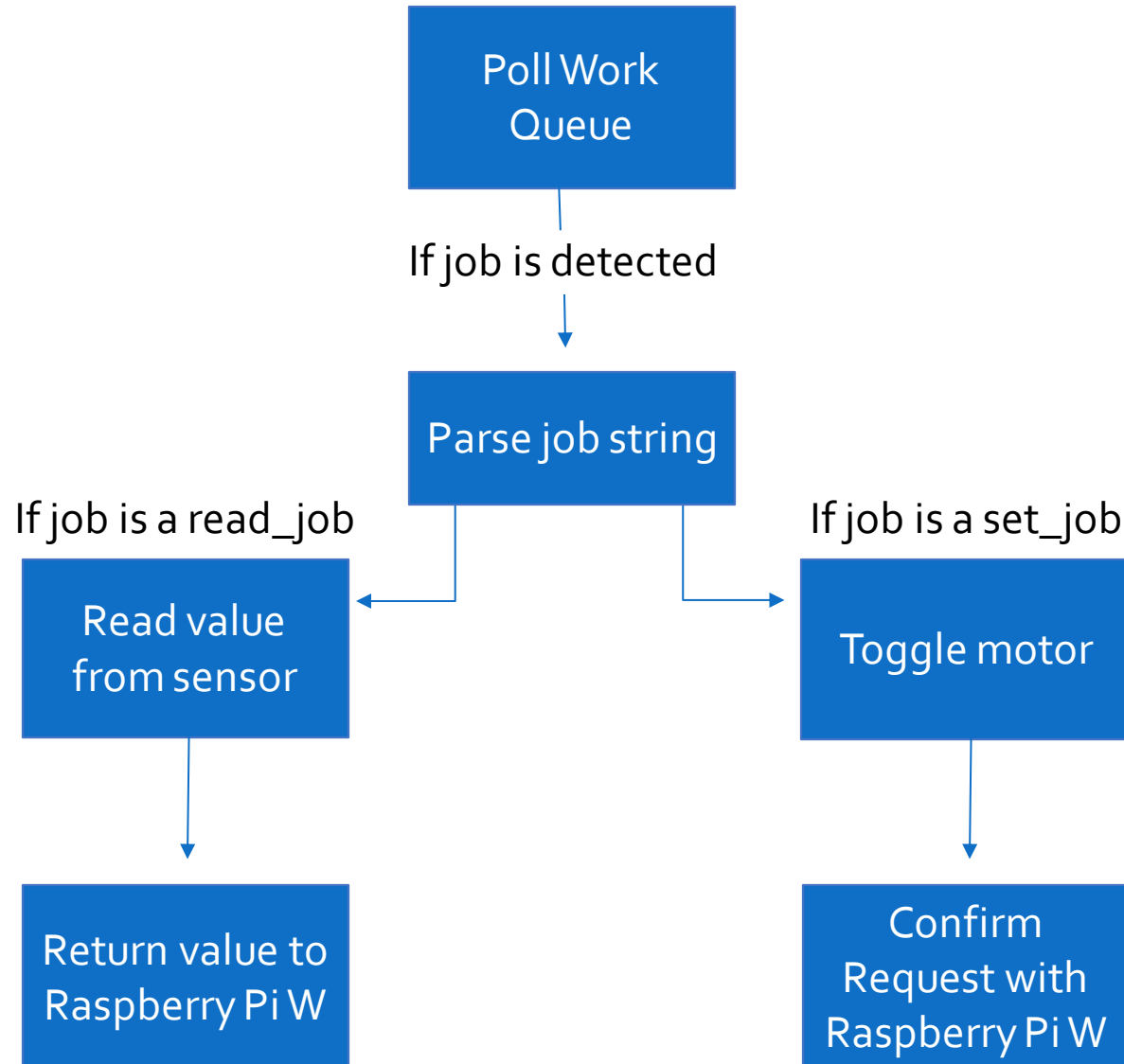
Code Block Diagram

Raspberry Pi Zero W



Code Block Diagram

Arduino Nano /
Raspberry Pi Pico



Demo



SwaleFlow

Water Management Made Smart

System Beyond, Flow 2.0 has
the best technology and top tier
materials designed.

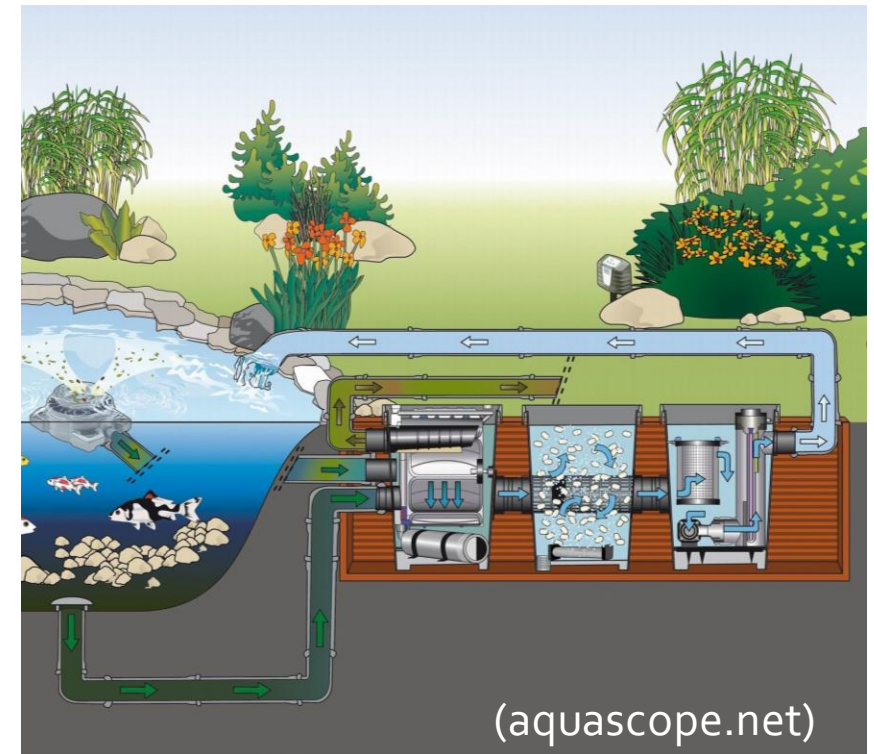
Next Steps

Future Ideas

Create app for customers

Filter pond water

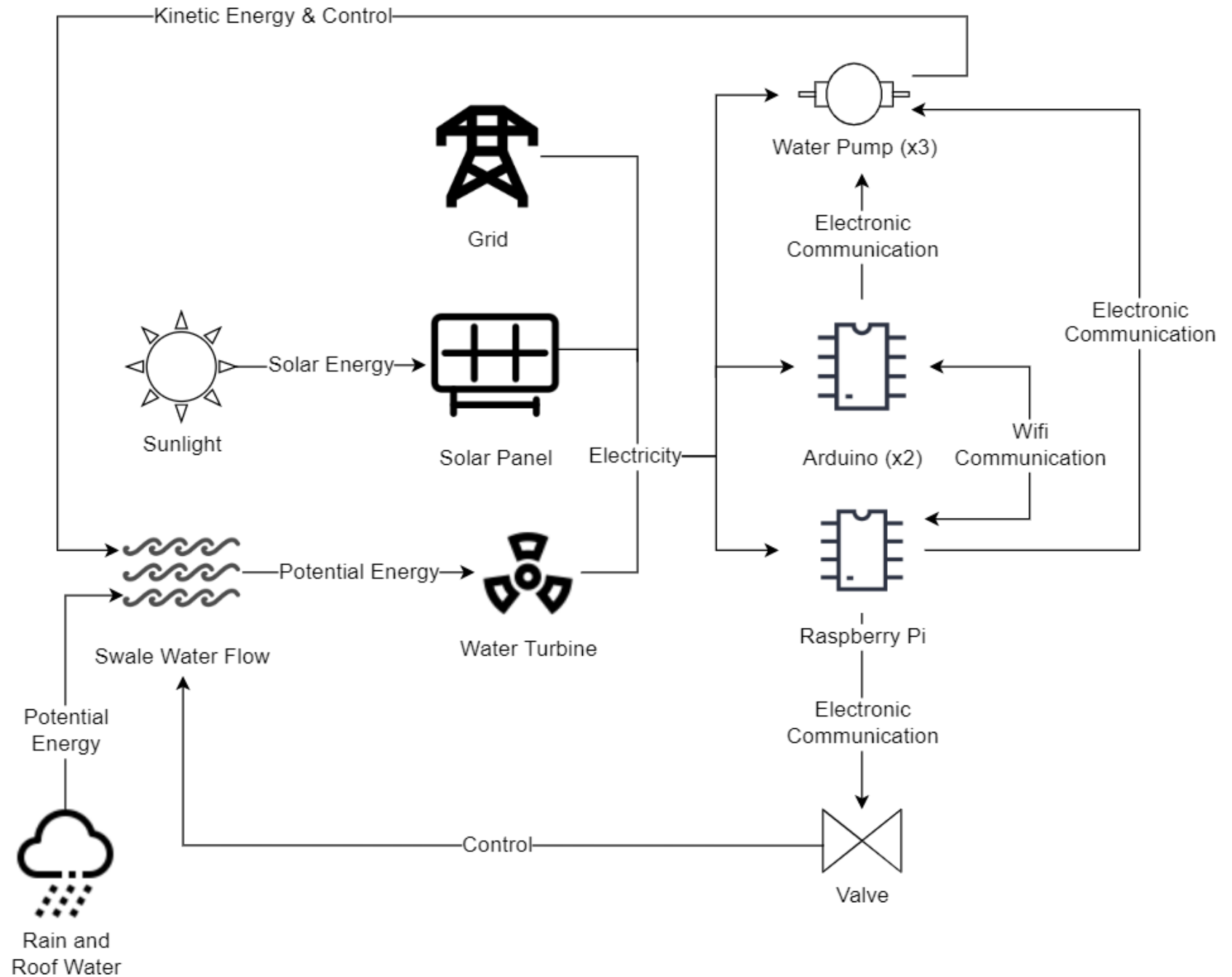
(trendhunter.com)



(aquascope.net)

Future Ideas

Power and Control Schematics



References

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npr.org

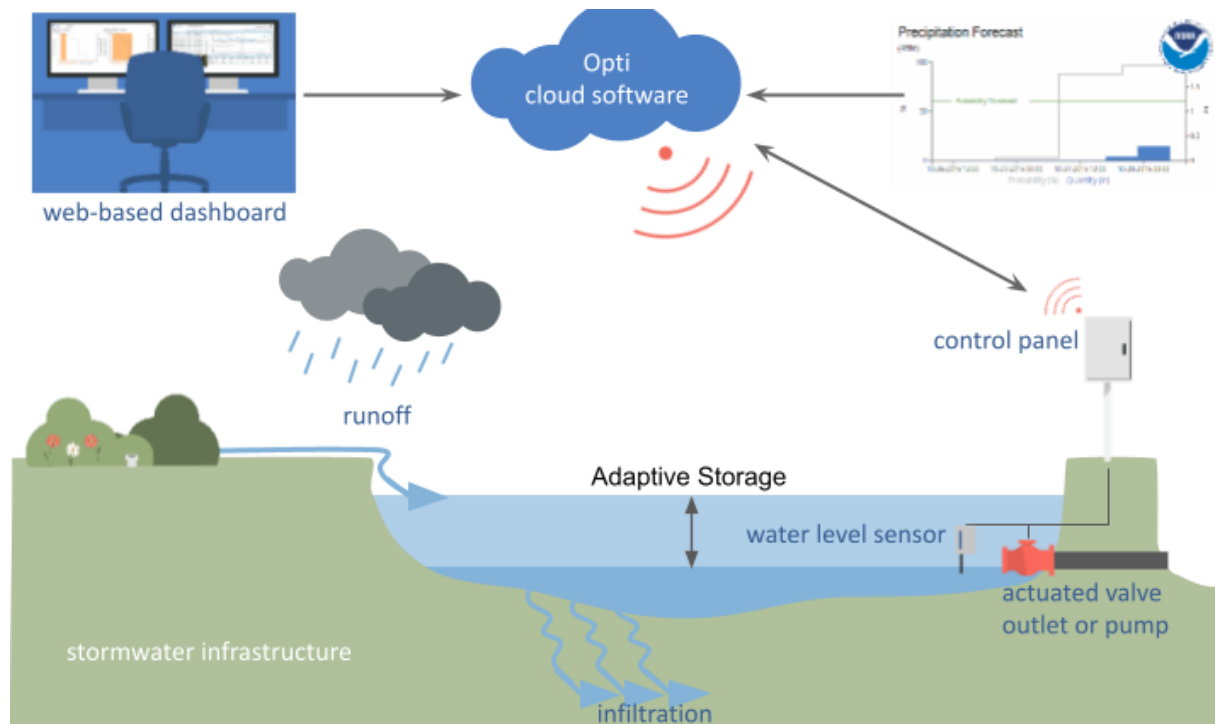
oceanbites.org

populationeducation.org

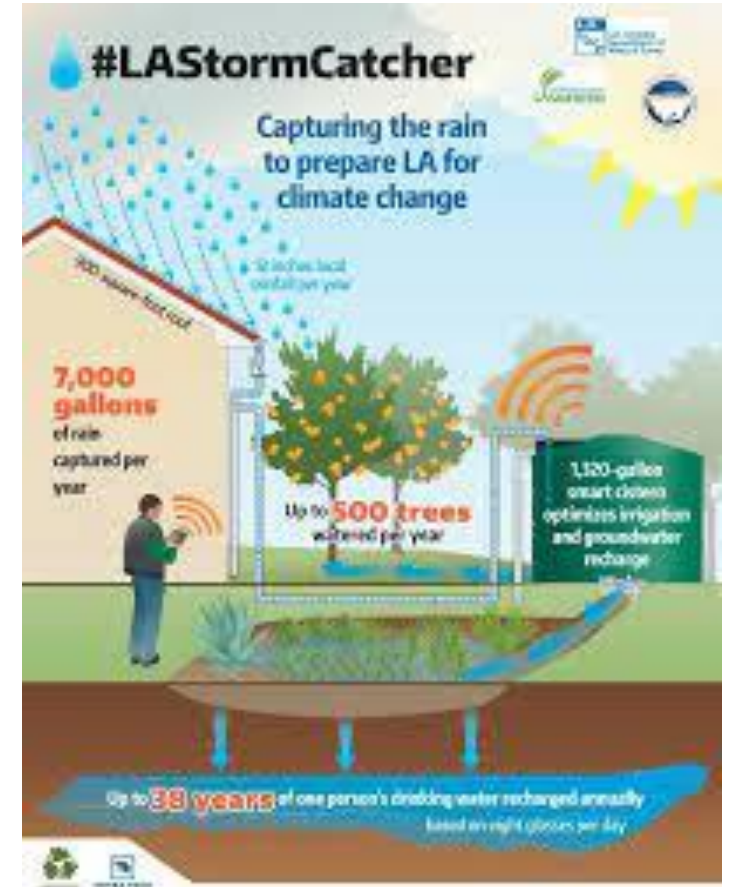
researchgate.net

trendhunter.com

Market Comparison



Community water management system
(washingtonnature.org)



Residential water management system
(stormwater.wef.org)

Contaminants Found in Runoff

Table 1.1 Common Pollutants in Urban Stormwater Runoff and Their Sources (SWQTF, 1993)

Pollutant	Automobile/ Atmospheric Deposition	Urban Housekeeping / Landscaping Practices	Industrial Activities	Construction Activities	Connections other than Stormwater	Accidental Spills and Illegal Dumping
Sediments	X	X	X	X		
Nutrients	X	X	X	X	X	X
Bacteria and Viruses	X	X		X	X	X
Oxygen Demanding Substances		X	X	X	X	X
Oil and Grease	X	X	X	X	X	X
Anti-Freeze	X	X		X	X	X
Hydraulic Fluid	X	X	X	X	X	X
Paint		X		X	X	X
Cleaners and Solvents	X	X	X	X	X	X
Wood Preservatives		X		X	X	X
Heavy Metals	X	X	X	X	X	X
Chromium	X	X	X			
Copper	X	X	X			
Lead	X	X	X			
Zinc	X	X	X			
Iron	X		X			
Cadmium	X		X			
Nickel	X		X			
Magnesium	X		X			
Toxic Materials						
Fuels	X		X	X	X	X
PCBs	X				X	X
Pesticides	X	X	X	X	X	X
Herbicides	X		X	X	X	X
Floatables		X	X	X		

(doee.dc.gov)

Customer Tax Incentives

Table 2: Examples of local incentives for green infrastructure

	Stormwater Fee Discounts	Development Incentives	Grants	Rebate/ Installation Financing	Awards/ Recognition
CA: Santa Monica			✓	✓	
CA: Palo Alto				✓	
CO: Denver	✓				
DC: Washington				✓	
FL: Gainesville	✓				
FL: Maitland				✓	
FL: Orlando	✓				
FL: Sarasota County		✓			
GA: Gwinnett County	✓				
GA: Henry County	✓				
IL: Chicago		✓	✓	✓	✓
IL: Rock Island				✓	
KS: Wichita	✓				
KY: Louisville/Jefferson County	✓				
KY: Sanitation District No. 1	✓				
MA: Reading	✓				
MD: Montgomery County				✓	
MN: Burnsville				✓	
MN: Maplewood				✓	
MN: Minneapolis	✓			✓	
MN: New Brighton	✓				
MN: Saint Paul	✓				
MO: Kansas City	✓				
NC: Charlotte	✓				
NC: Durham	✓				
NC: Raleigh	✓				
NY: New York		✓			
OH: Columbus	✓				
OH: Cincinnati				✓	
OK: Tulsa	✓				
OR: Portland	✓	✓	✓	✓	✓
OR: Sandy	✓				
PA: Philadelphia	✓	✓			✓
SC: Beaufort County	✓				
TN: Knox County		✓			
TX: Austin	✓			✓	
U.S. Virgin Islands			✓		
VA: Chesapeake	✓				
VA: Prince William County	✓				
WA: Bellevue	✓				
WA: King County	✓		✓		✓
WA: Marysville	✓				
WA: Seattle	✓	✓	✓	✓	

(doee.dc.gov)

Team Dynamics Roles

Sophie – Team Lead

- Organization, Logistics & Time Management
- Design & Communication

Eric – Researcher & Documenter

- Research
- Photography

Eyobed – Researcher & CAD Designer

- Research
- Site Model

Richard – Programmer & Technology Specialist

- Code
- Electronics

Team Dynamics Information & Communication



Slack – General Communication & File Sharing



Notion – Task Assignment / Gantt Chart, Links & Files



OneDrive – Document Storage



Google Docs – Meeting Notes



GitHub – Code Sharing



Skype & Zoom – Video Meeting Site



Google Photos – Photo Sharing

Summary

- Robust design
- Helps the environment
- Aesthetically pleasing
- Market expected to grow
- Tax incentives for customers

References

cleanwateraction.org

stormwater.wef.org

Washingtonnature.org

Washingtonpost.org

populationeducation.org

Businesswire.com