Water Resilient Communities

A guideline for the design of water resilient neighborhoods

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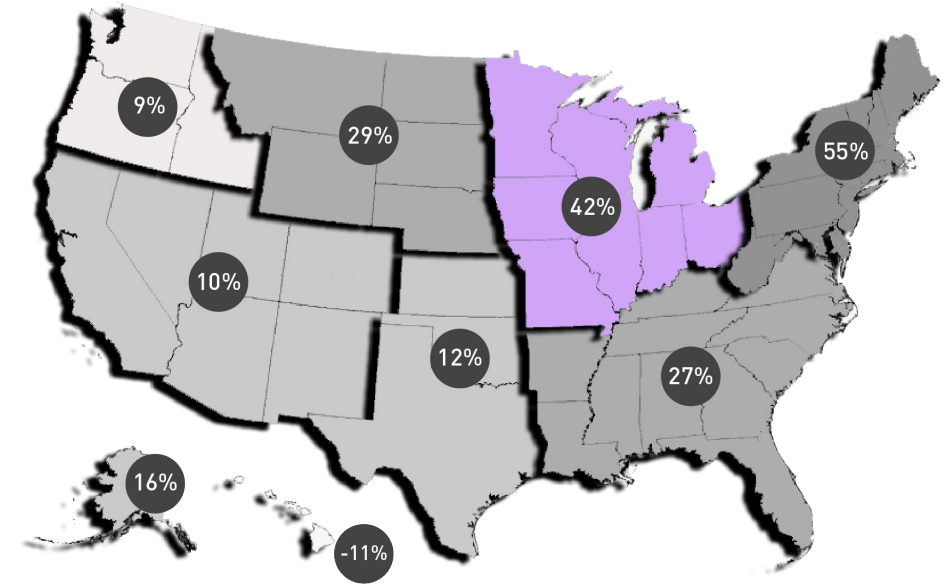
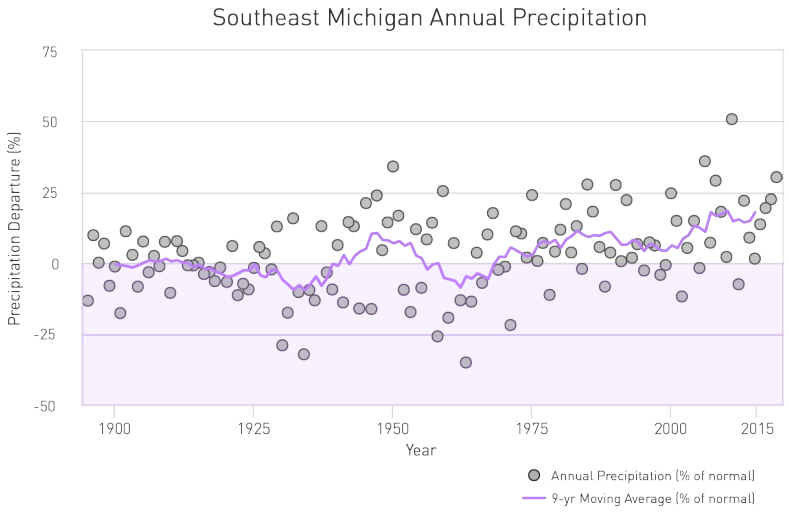
ARCH 562: Propositions Studio | Aquatecture

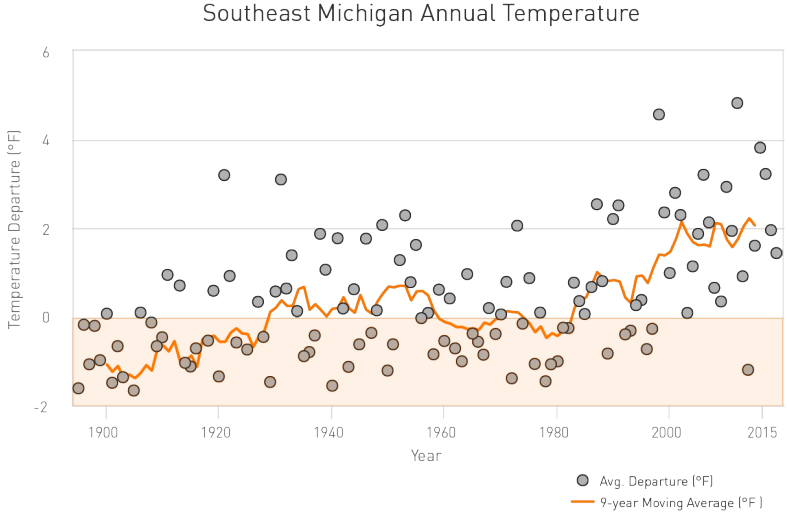
W2020 | Mo 04.27 Final Review

Effects of Climate Change

The Midwest of the United States has seen a 42% increase of rainfall in the amount of precipitation in the heaviest 1% of precipitation events from 1958-2016. This continued upward trend of greater amounts of precipitation being concentrated in very heavy events, particularly in the Northeast and Midwest.

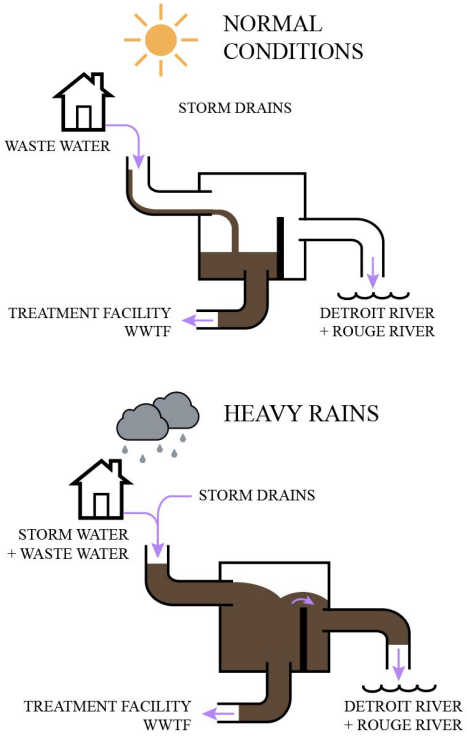


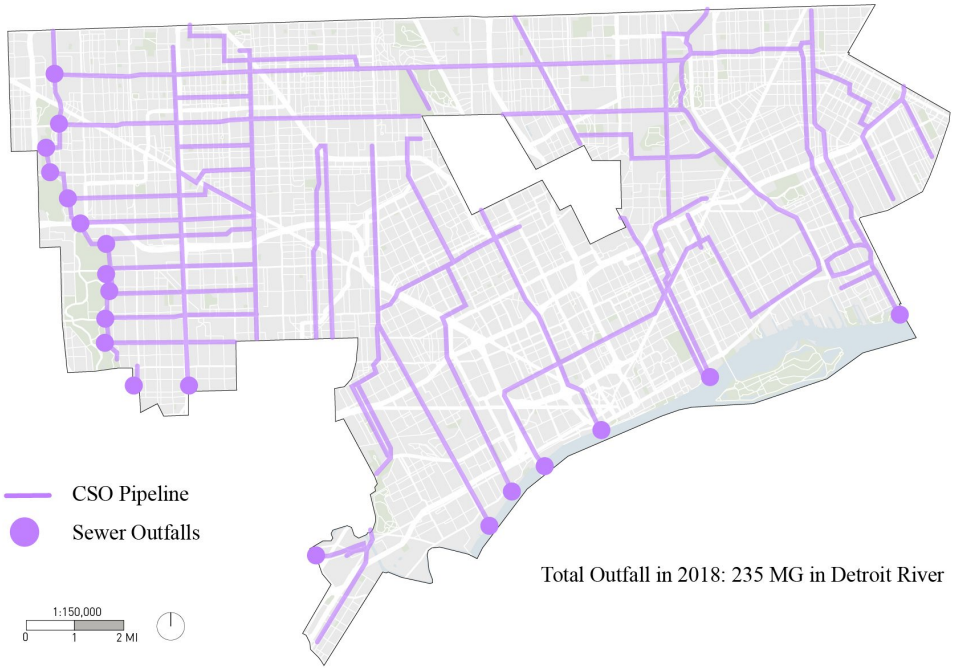




Detroit, MI

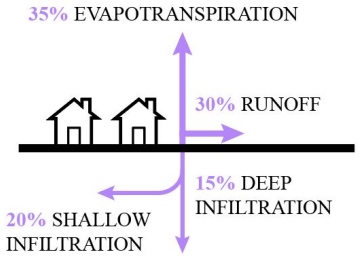
Map of Detroit Combined Sewer System



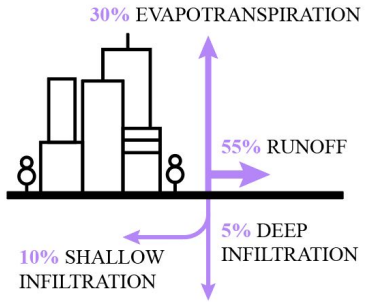


Detroit, MI

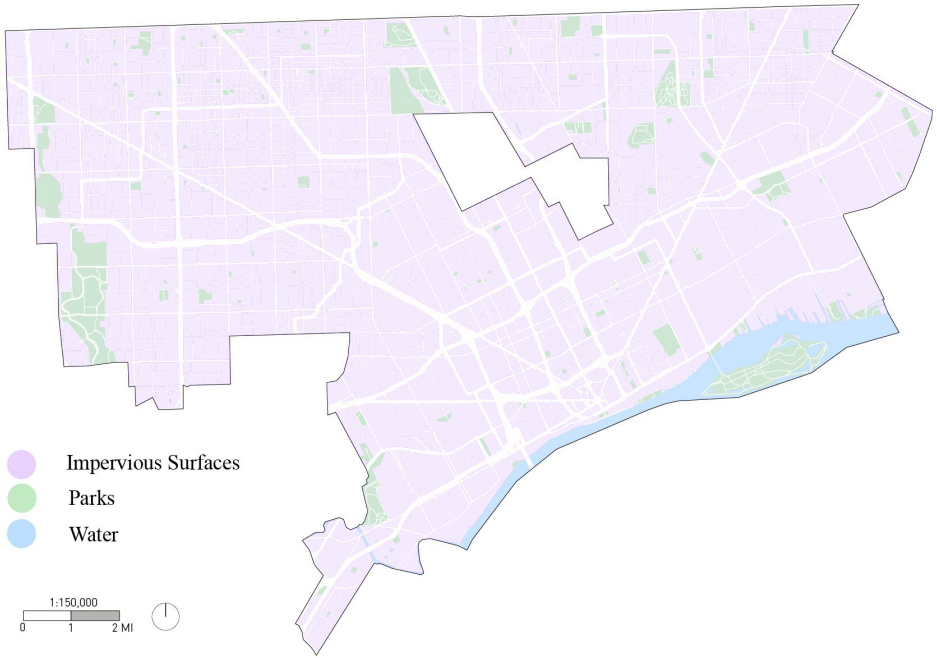
Map of Detroit's Impervious Surfaces



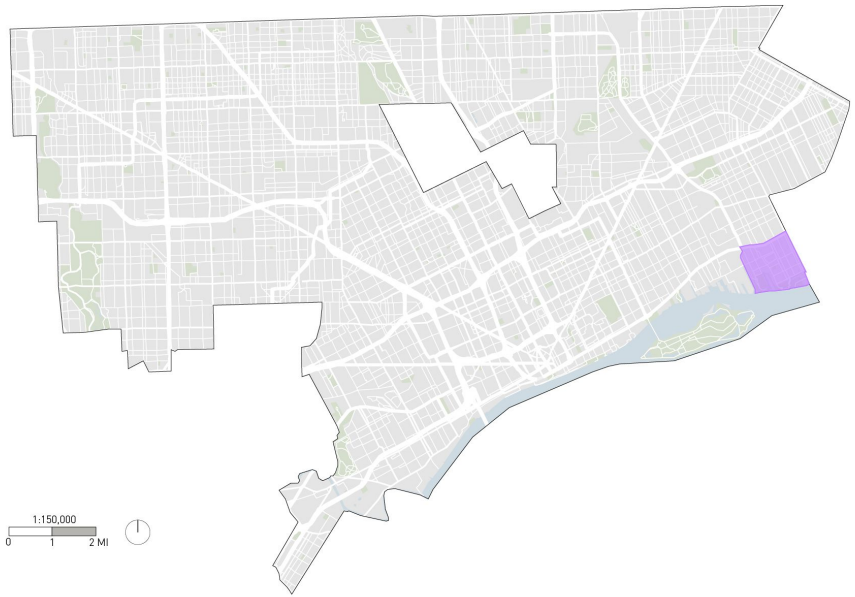
35%-50% IMPERVIOUS SURFACE



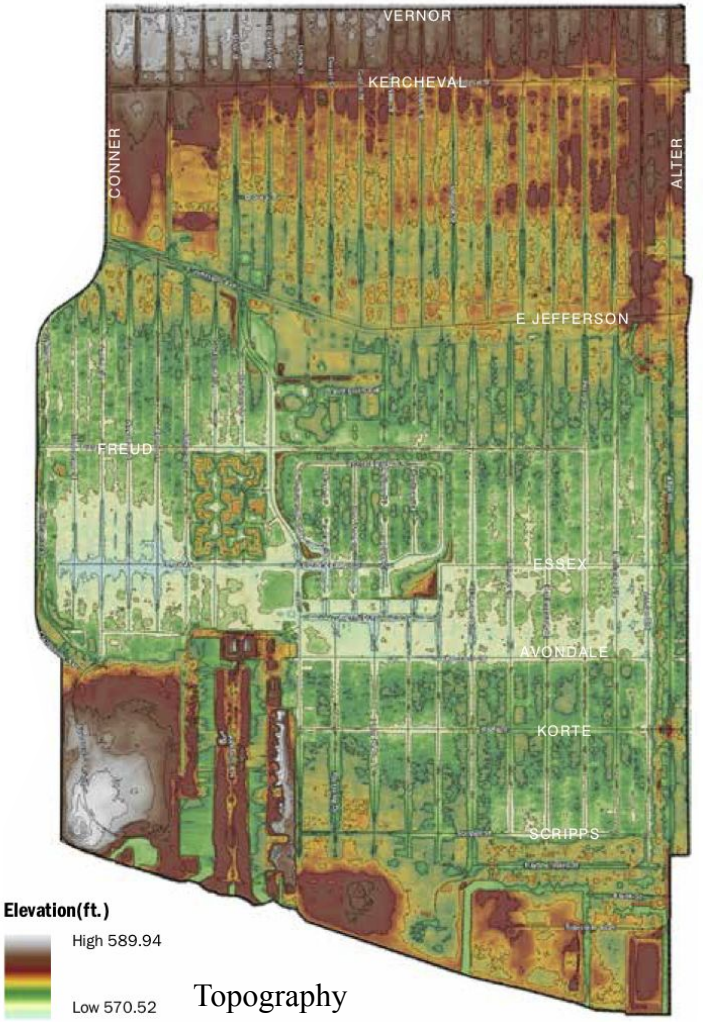
75%-100% IMPERVIOUS SURFACE



The Site: Jefferson Chalmers Neighborhood



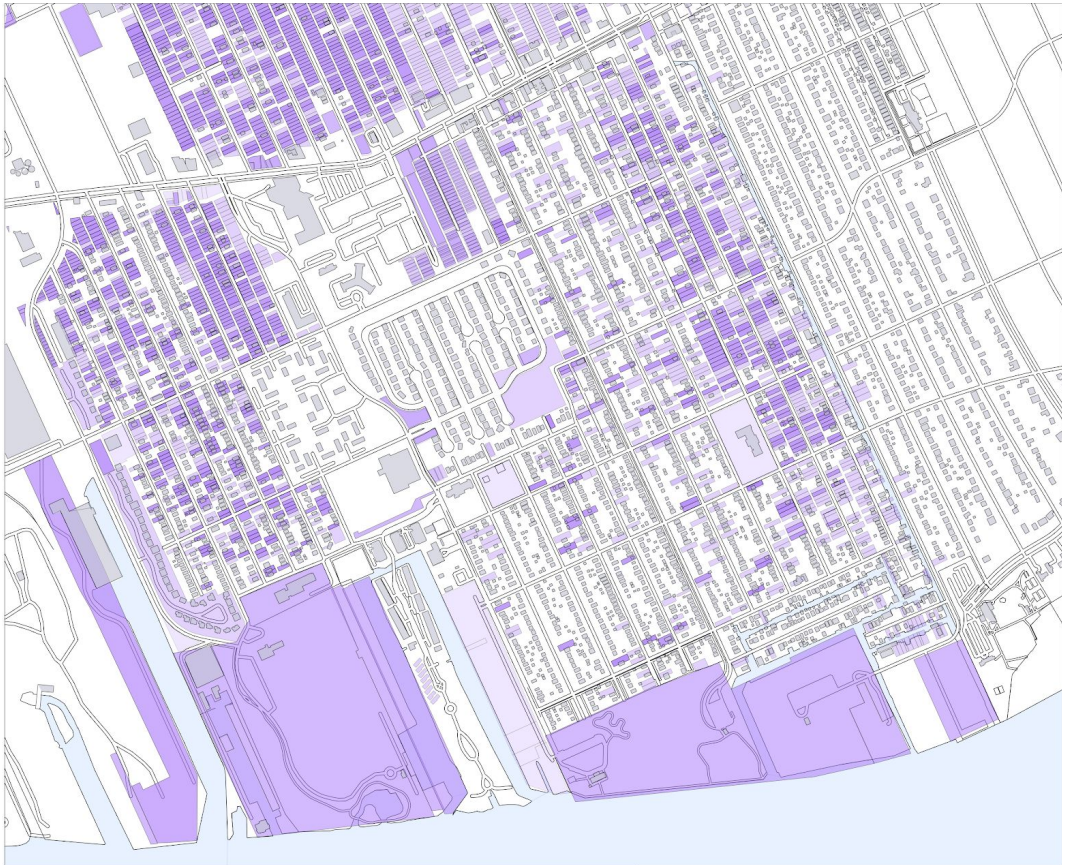
100 year Flood Map created by FEMA 2014


VERNOR
KERCHEVAL
CONNER
ALTER
E JEFFERSON
FREUD
ESSEX
AVONDALE
KORTE
SCRIPPS
Elevation(ft.)
High 589.94
Low 570.52

Topography

The Site: Jefferson Chalmers Neighborhood

Complied map of
Vacant lots and buildings
Underutilized parks
Detroit Land Bank owned parcels



Water Management Strategies - “Kit-of-Parts”

Traditional Building (existing to remain)
The existing houses to remain. No specific flood-proofing measures.

Dry-Proof Water Exclusion Strategy Building
A dry-proof (or flood-resistant) building is designed to prevent water from entering the building using waterproof materials and construction.

Wet-Proof Water Entry Building
A wet-proof (or flood resilient) building allows water into the buiding to avoid structural damage but is constructed so that the impact of flooding and the clean up time is minimised.

Elevated Building
An elevated building is one in which the flood levels are raised above the predicated flood level. Typically the undercroft area should not be used or occupied as this would reduce flood storage.

Amphibious Building
An amphibious building is a floating building that is designed to rest on fixed foundations for the most part. However, during an extreme flood it rises between guideposts, buoyed by the flow of water. It can cope with large flood level variations.

Floating Building
A floating home is a building that rests on a bouyant base or foundation, designed to rise and fall with the level of the water.

Micro Hydroelectic
Water flow with a fall of at least 1.5m can be used to turn a water wheel to generate power.

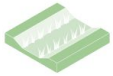
Floodable Relief Channels
Naturalistic or artificial channels designed to divert water from one part of river to another during periods of high river flows, away from major settlements.

Green Roof
A planted roof or wall to a building that helps to control runoff slowing the flow down to the ground, store rainwater and filter out pollutants.

Rain Garden
A rain garden acts as a method to store excessive rainwater, before it soaks away plants and soil layers filter water before entering the groundwater systems.

Terraced Waterfront
A gently sloping area designed to drain water evenly off impermeable areas and filter out silt and other material.

Floodable Parks and Playgrounds
Hard and soft landscaped spaces that can be designed to store vairable depths of water, reducing pressues on the sewer system during heavy rainfall or creating space for flood water away from buildings.



Bioswales
A shallow channel designed to convey, infiltrate, store and treat run off rainwater. They can be used to transport runoff to storage ponds or basins or discharge to a watercourse.

Wetland Buffers
Retention ponds with more emergent aquatic vegetation adn a smaller open water area. The wetlands store water and release it slowly. Biological treatment occurs through the vegetation.

Rainwater Harvesting
Rainwater harvesting is the accumulating and storing of rainwater.

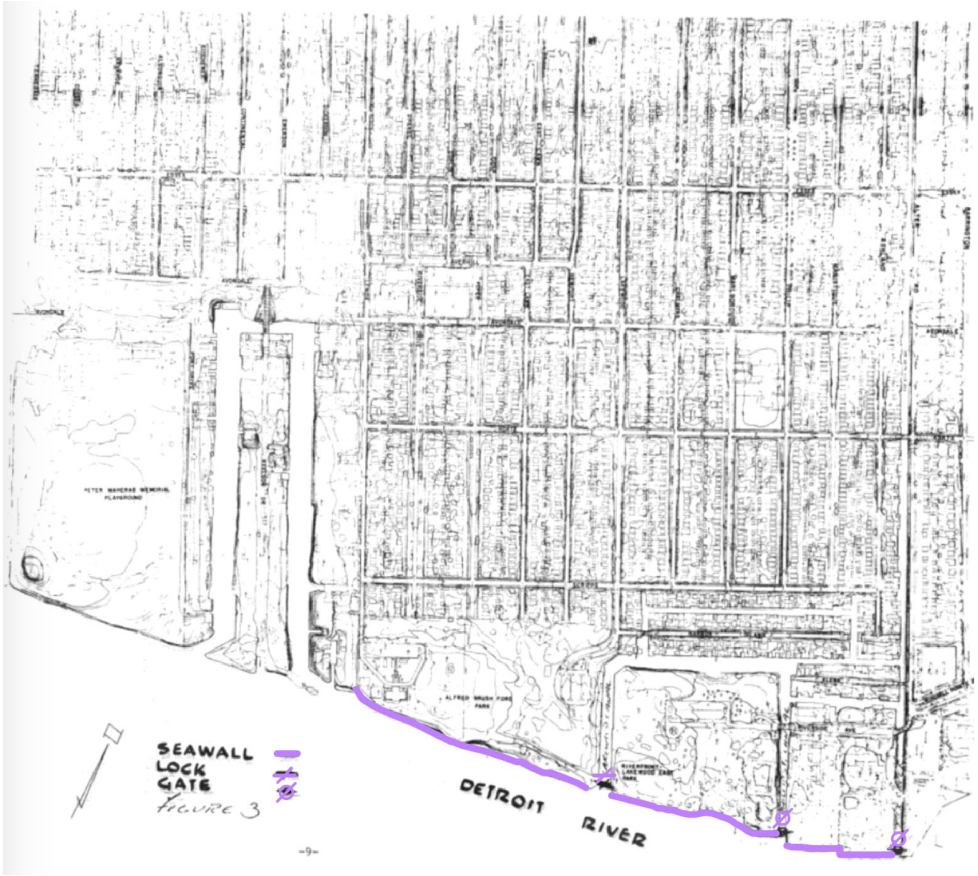
Permeable Paving
Surfaces which allow water to soak gradually into the ground. It can treat runoff and remove pollutants.

Investigations

Managed Realignment

Investigations

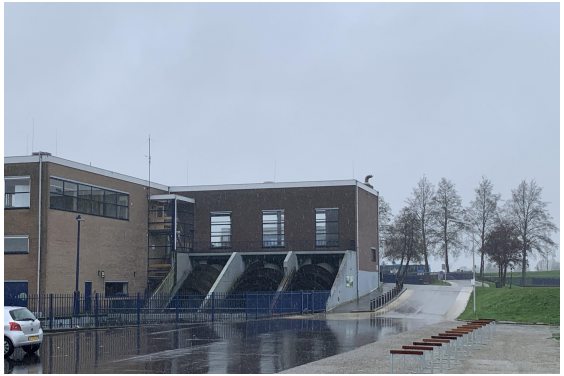
Addition of a Dike, a Levee, a Berm, or a Seawall



1980 Detroit Flood Line and Protection Study: Environmental Impact Statement

Investigations

Others:

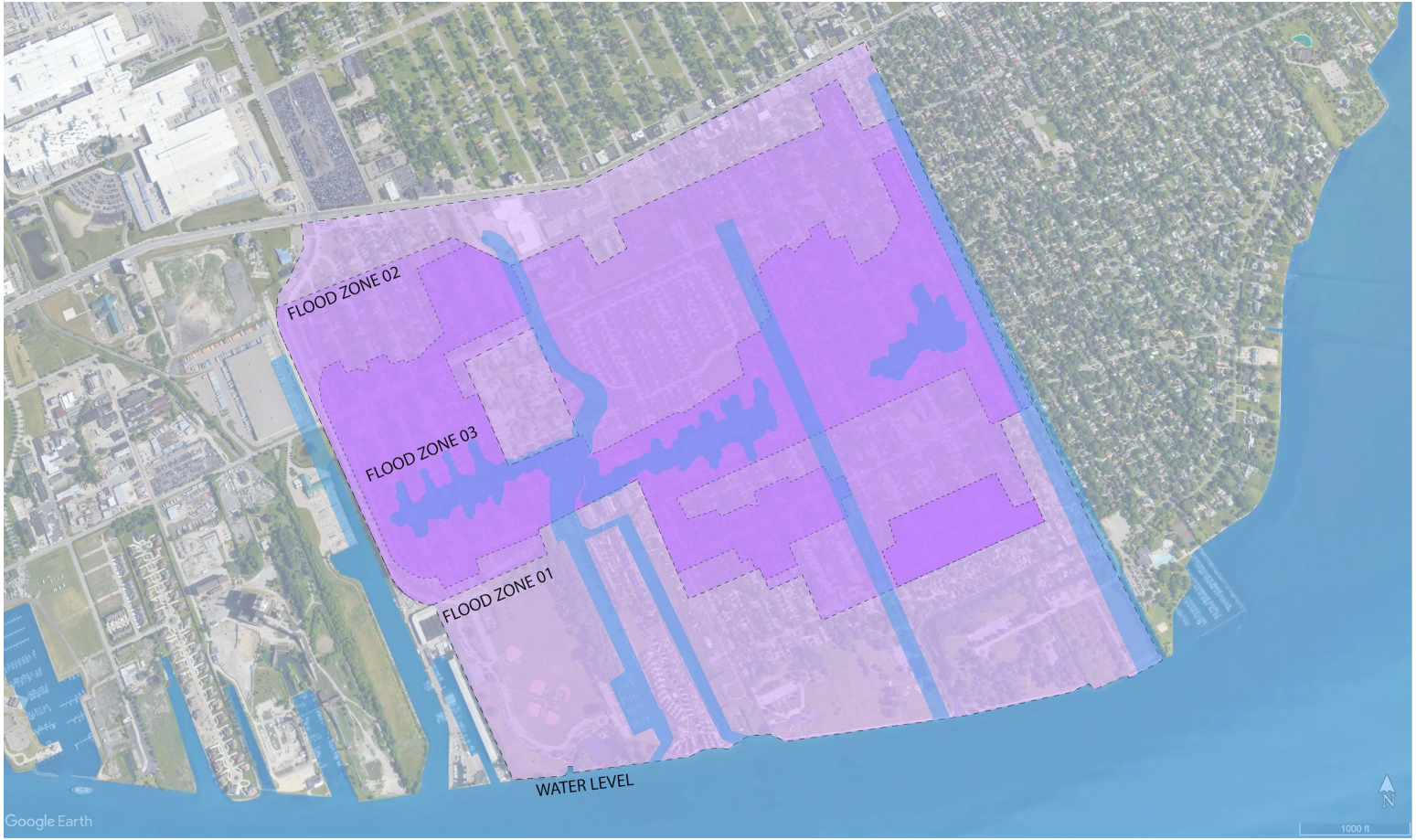


Windmills and Water Pumps

Storm Surge Barriers

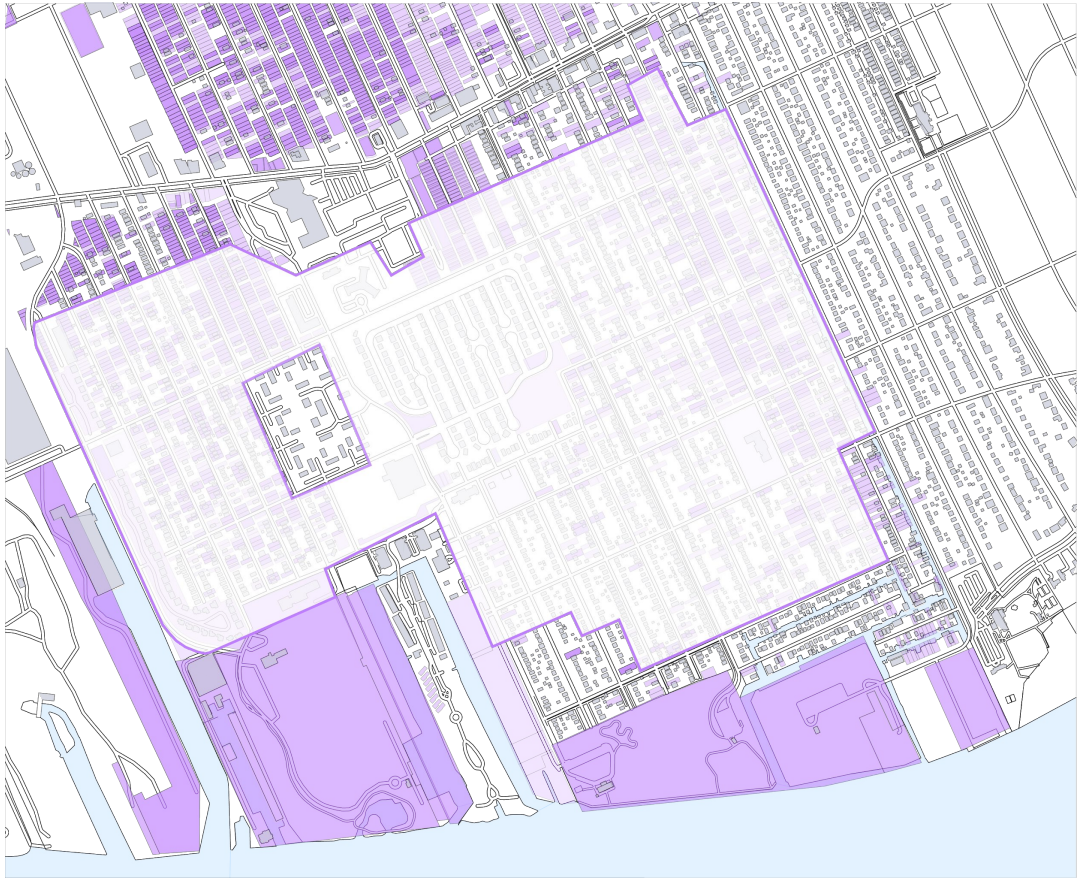
Topography

Implementation



Implementation

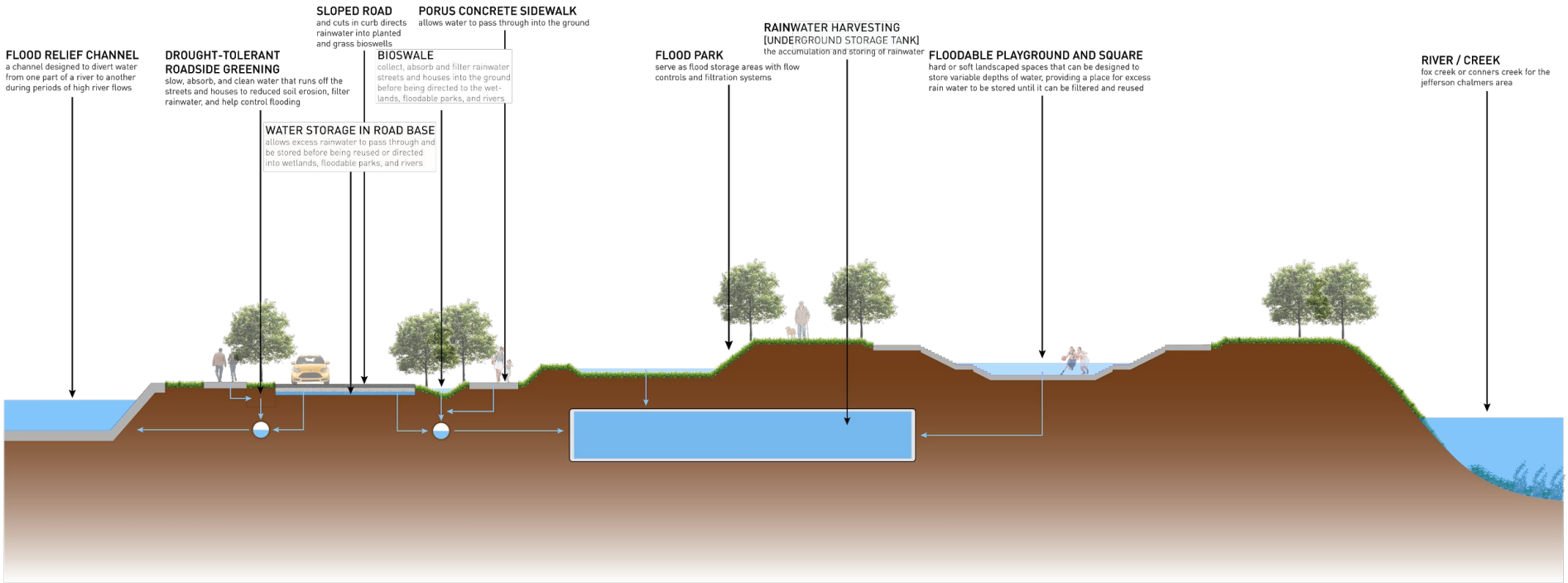
Area of Potential Stormwater Management Implementation



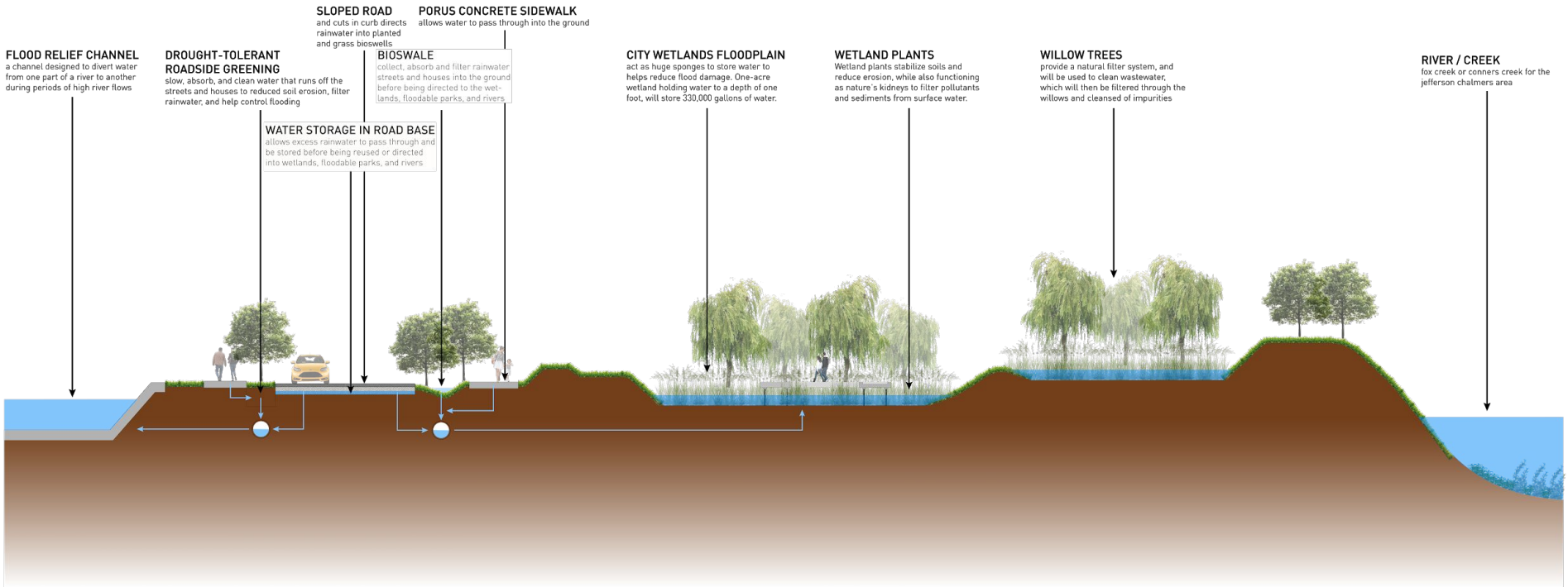
Solution


FLOOD RELIEF CHANNELS
PARKS/
RECREATIONAL
AREAS
STREAMS/
CREEKS
WATER NETWORKS
PONDS/LAKES
FOX CREEK
WETLANDS
DETROIT RIVER
N
1000 ft

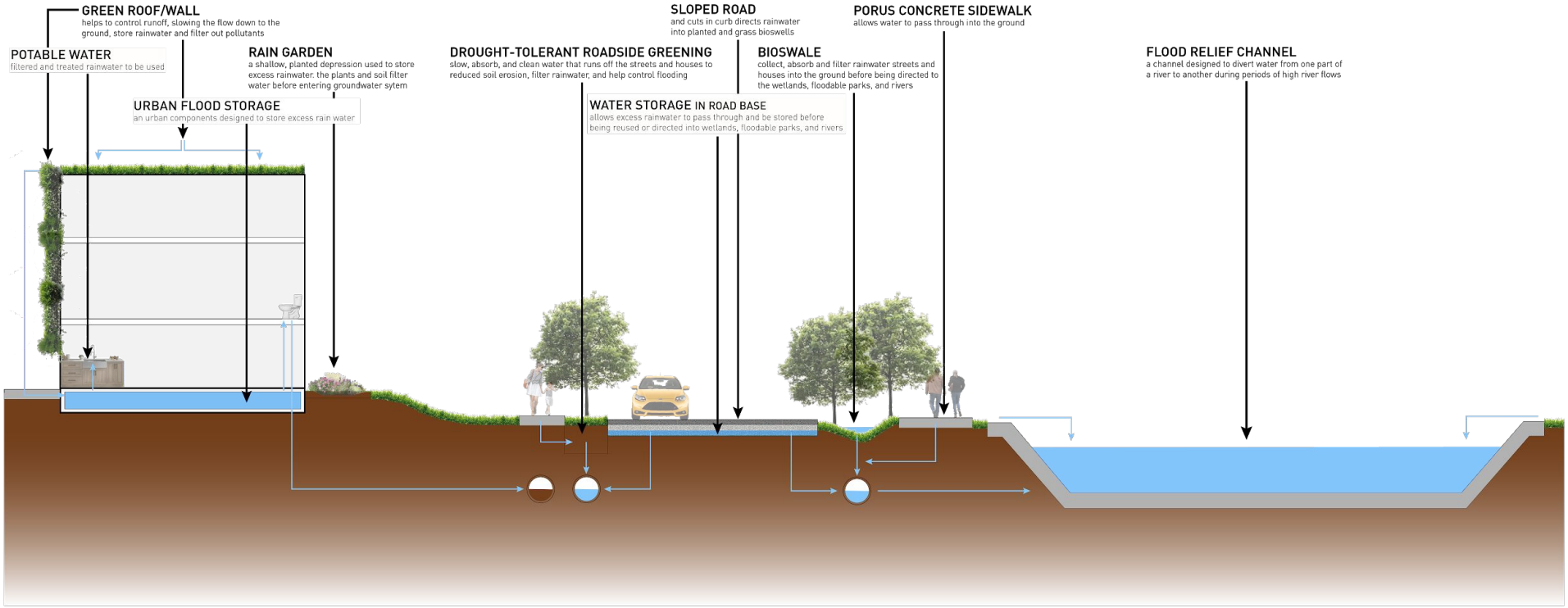
Floodable Parks



Wetlands


FLOOD RELIEF CHANNEL
a channel designed to divert water from one part of a river to another during periods of high river flows
DROUGHT-TOLERANT ROADSIDE GREENING
slow, absorb, and clean water that runs off the streets and houses to reduced soil erosion, filter rainwater, and help control flooding
SLOPED ROAD
and cuts in curb directs rainwater into planted and grass bioswells
PORUS CONCRETE SIDEWALK
allows water to pass through into the ground
BIOSWALE
collect, absorb and filter rainwater streets and houses into the ground before being directed to the wetlands, floodable parks, and rivers
WATER STORAGE IN ROAD BASE
allows excess rainwater to pass through and be stored before being reused or directed into wetlands, floodable parks, and rivers
CITY WETLANDS FLOODPLAIN
act as huge sponges to store water to helps reduce flood damage. One-acre wetland holding water to a depth of one foot, will store 330,000 gallons of water.
WETLAND PLANTS
Wetland plants stabilize soils and reduce erosion, while also functioning as nature's kidneys to filter pollutants and sediments from surface water.
WILLOW TREES
provide a natural filter system, and will be used to clean wastewater, which will then be filtered through the willows and cleansed of impurities
RIVER / CREEK
fox creek or conners creek for the jefferson chalmers area

Flood Relief Channel



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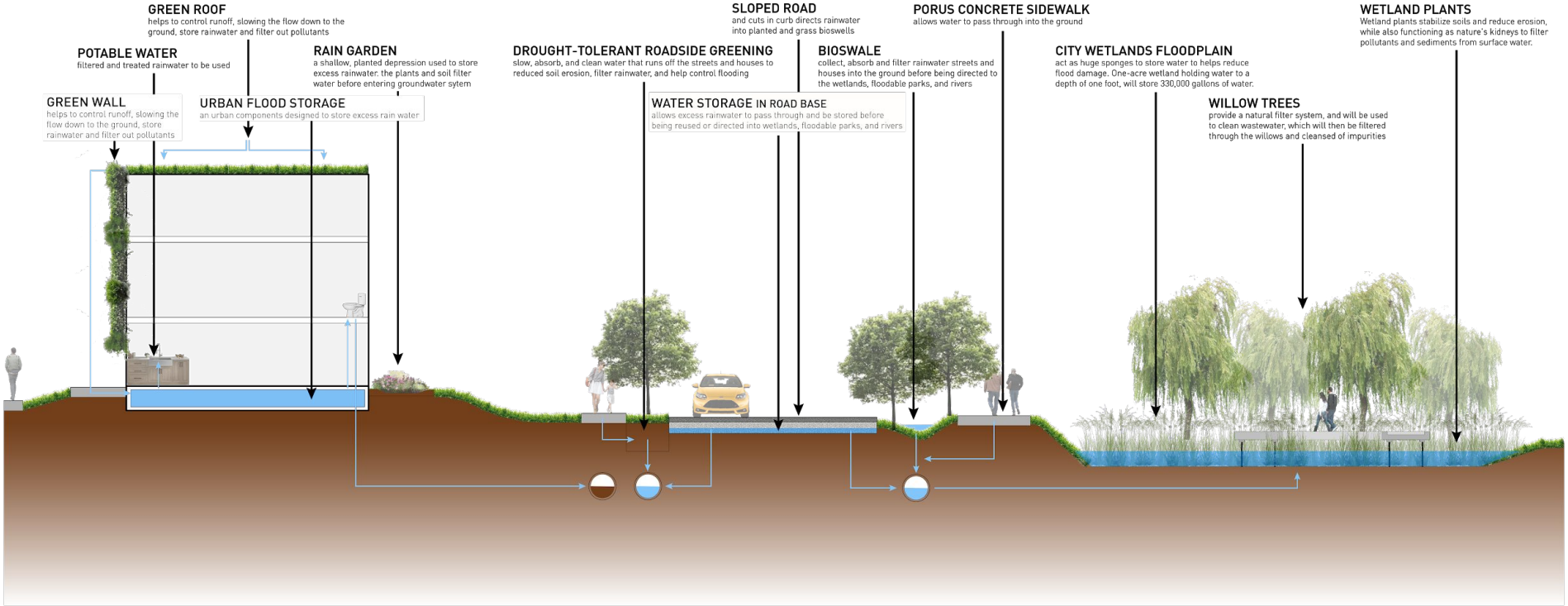
GREEN ROOF
helps to control runoff, slowing the flow down to the ground, store rainwater and filter out pollutants
POTABLE WATER
filtered and treated rainwater to be used
RAIN GARDEN
a shallow, planted depression used to store excess rainwater. the plants and soil filter water before entering groundwater sytem
GREEN WALL
helps to control runoff, slowing the flow down to the ground, store rainwater and filter out pollutants
URBAN FLOOD STORAGE
an urban components designed to store excess rain water
SLOPED ROAD
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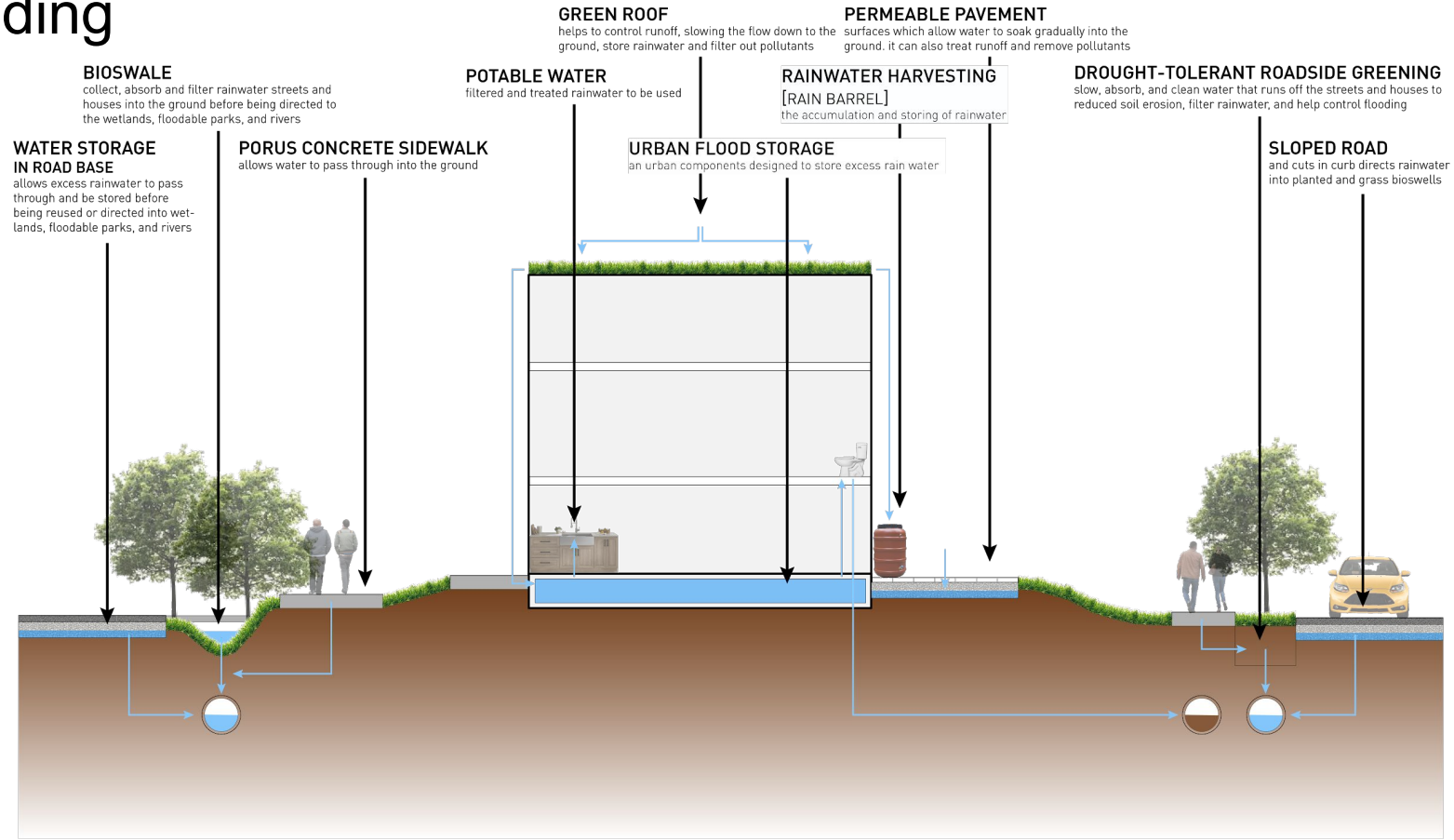
Building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POTABLE WATER
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RAINWATER HARVESTING
[RAIN BARREL]
the accumulation and storing of rainwater
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Solution

Building Typologies