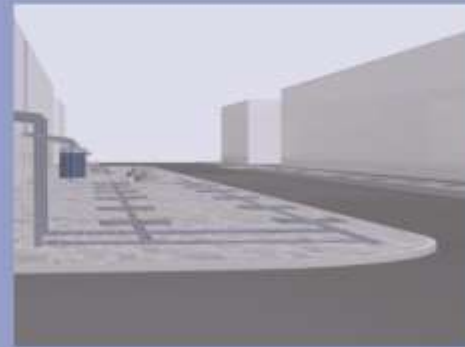
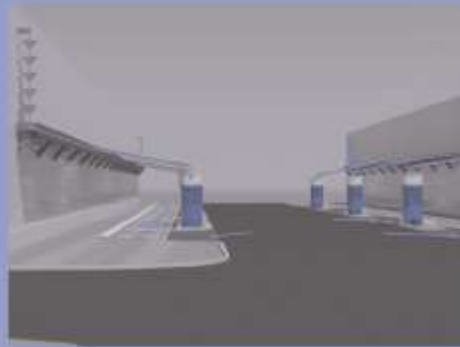
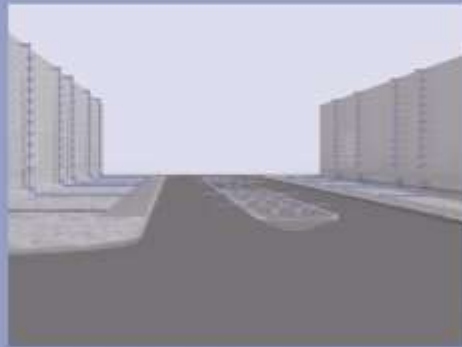


# URBAN APPARITIONS:

MAKING A PLACE THROUGH INTEGRATED  
WATER INFRASTRUCTURES IN AN ARID  
ENVIRONMENT

BY: ANDREW BERNARD



# Committee Members

Chair: [Alf Simon](#)

Secondary Member: [Eric Bernard](#)

Cognate Member: [Richard Zita](#)

# Acknowledgements

Thank you to everyone who has invested in me with their time, inspiration, knowledge and support.

It takes a village to raise a grad student!

# INTRODUCTION

# THE BEGINNING



What more could it be?

*“The whole is  
greater than the  
sum of all parts”  
-Aristotle*

# THE BEGINNING



# THE BEGINNING

## Current Infrastructure Paradigm

- *Infrastructure should be a servant to industry and national defense in which its design and planning should be technical and standardized.*
- *Provides the best service possible using the least amount of resources.*
- *Out of sight, out of mind.*
- *Stormwater runoff has no value.*



# THE PROBLEMS

## CURRENT INFRASTRUCTURE PARADIGM



[http://action.sierraclub.org/site/MessageViewer?em\\_id=162502.0&dlv\\_id=0](http://action.sierraclub.org/site/MessageViewer?em_id=162502.0&dlv_id=0)

## ENVIRONMENTAL DEGRADATION



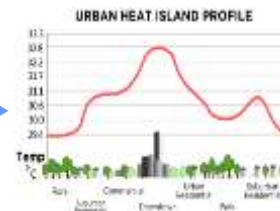
- Increased Runoff Volumes
- Non-point Pollution
- Reduced Aquifer Recharge

## REDUCED SENSE OF REGIONAL IDENTITY



- Not Regionally Responsive
- Water does not seem to be reflected

## REDUCED URBAN COMFORT AND HABITABILITY



- Reduced Tree Canopy and Green Space
- Increased Impervious Surfaces



# PURPOSE

An alternative infrastructure paradigm  
is needed!

- Integrates infrastructure functions with natural processes to achieve greater benefits.
- Reduces impacts on the surrounding environment.
- Serves as a public amenity and contributes to a sense of place.

***Our infrastructure  
can become, once  
again, a testament  
to our technology,  
progress, and our  
true potential.***

# STUDY GOALS

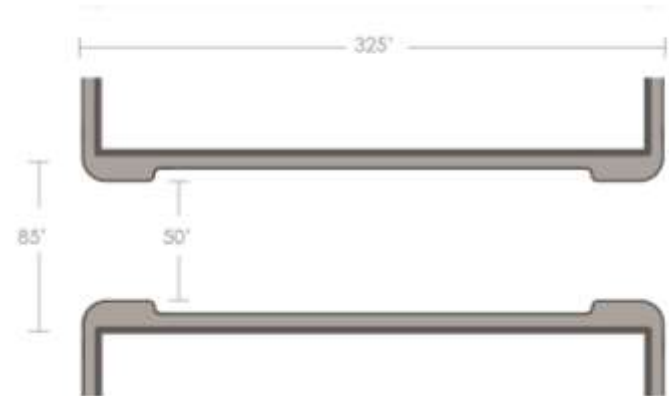
- Create opportunities to **reduce stormwater** (increase infiltration, increase time of travel, capture/harvest, recycle).
- **Integrate** otherwise isolated water infrastructures into a form that responds to regional characteristics to manage stormwater in a sustainable manner.
- Instill a sense of **place or identity**; an **iconic public space** or urban spine through the use of water infrastructure as an anchor).
- Increase **comfort** by utilizing the bioclimatic effects of trees and vegetation to lower the urban temperature, sequester carbon, increase oxygen, and to provide natural greenery.

# RESEARCH QUESTIONS

1. How can the disconnections between otherwise isolated infrastructures and their functions be integrated to reduce negative environmental externalities?
2. How can these infrastructures reflect and contribute to regional character?
3. How can an iconic space be created using water infrastructure as an anchor that increases the comfort in an arid, urban environment?

# METHODS

- Utilize the ubiquitous **urban block** and streetscape as a laboratory.
- **Critical design principles** related to the design goals are distilled through a literature review.
  - Stormwater Management
  - Infrastructure Integration
  - Place-Making
- Design principles are coupled with regional elements and materials to develop a **kit-of-parts**.
- **Typological approach** used to demonstrate the application of the kit-of-parts.



# FRAMEWORK

## WHAT



## HOW

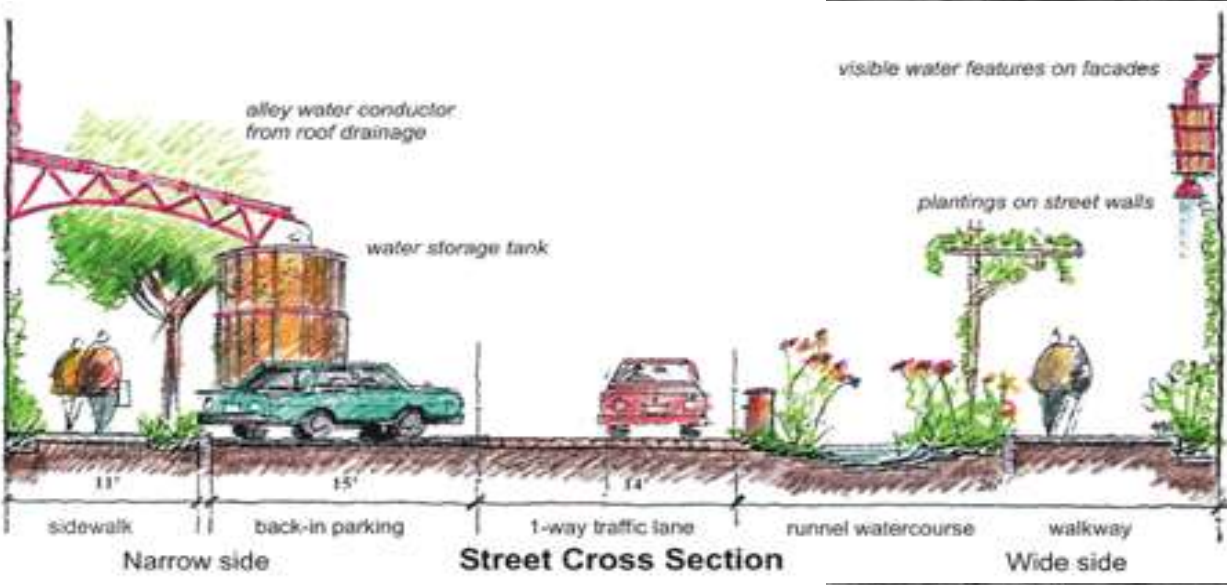


# LITERATURE REVIEW

# LITERATURE REVIEW

- Infrastructure Paradigm
  - Development
  - Environmental implications
- Integrating Infrastructure
  - Green Infrastructure/ LID Design principles/strategies
  - Barriers
- Place – making
  - Design principles
  - Identity
  - Artful Rain Design
- Typology
- Case Studies
  - Vine Street- Seattle Washington
  - Taylor Street Mall- ASU Campus
  - Urban Acequias- Mendoza, Argentina

# CASE STUDIES

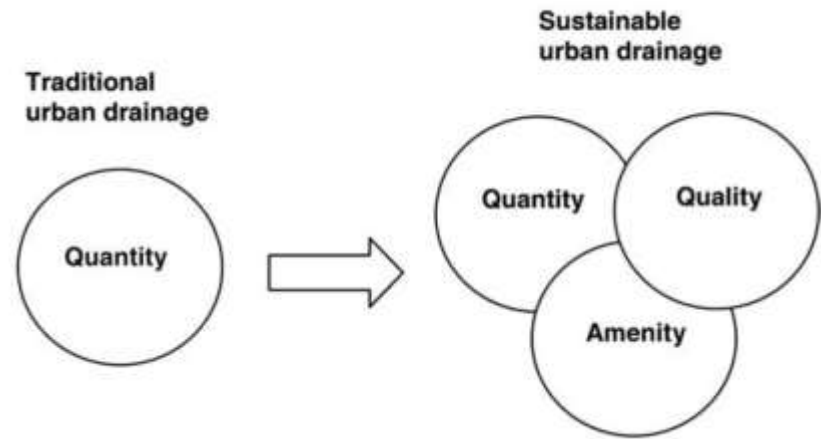




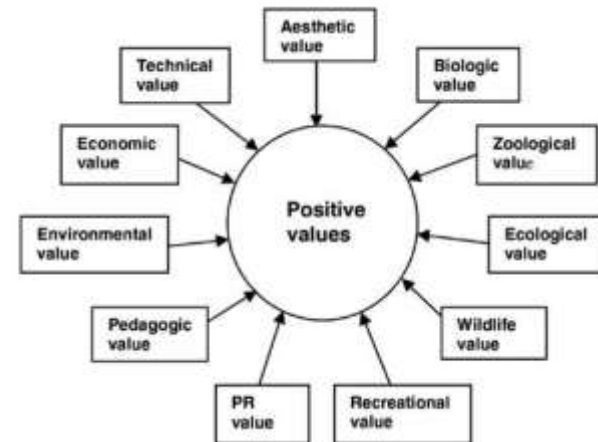
# LITERATURE REVIEW

## Critical Design Principles

- Increase time of runoff travel through storage, infiltration, and conveyance.
- Integrate engineered and natural functions physically as well as visually.
- Integration of regional character offers a link to history and culture.
- Elements should serve multiple purposes.
- Utilize strategies that can function in small spaces.
- A kit-of-parts allows for an infinite combination of design solutions within a framework.
- Design concepts developed from the kit-of-parts can be easily understood through typology.



**FIGURE 1.** Positive Values of Open Storm Drainage (Stahre, 2006).

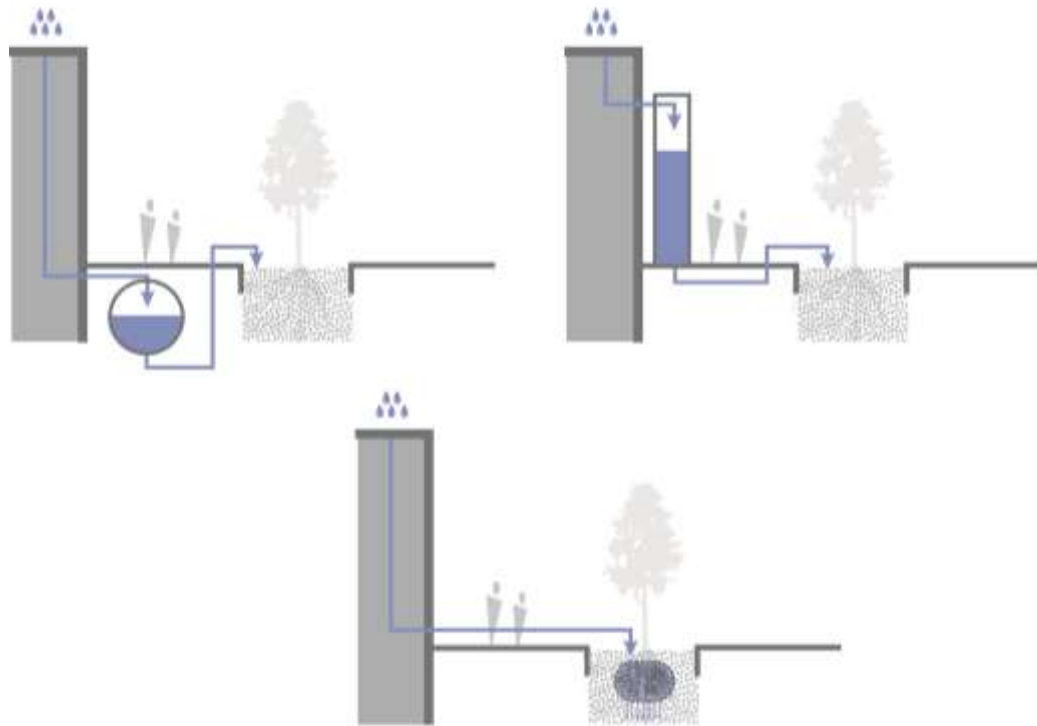
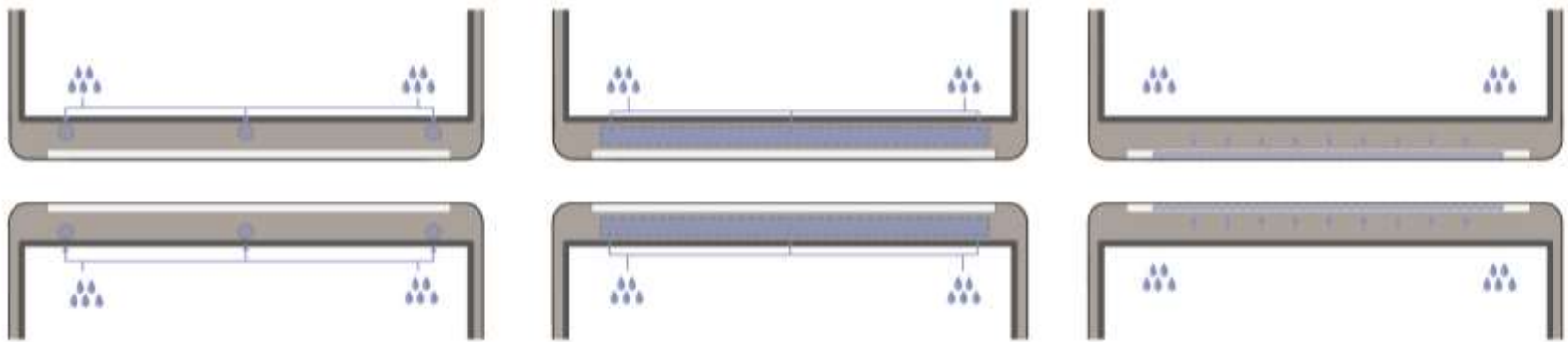


DESIGN

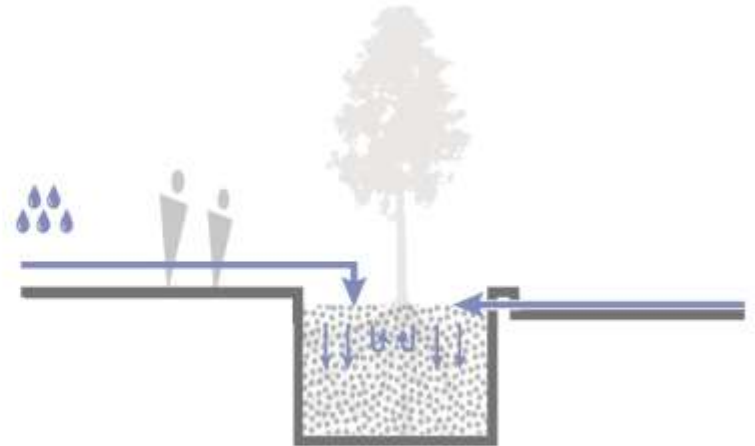
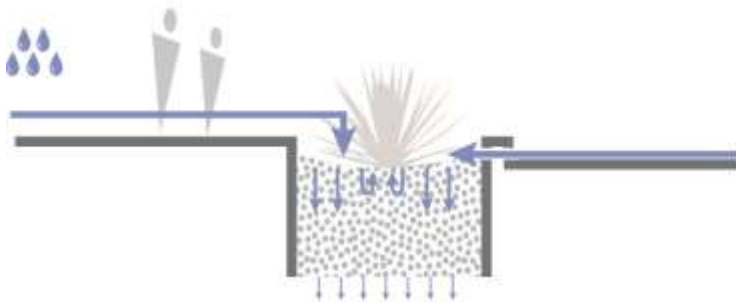
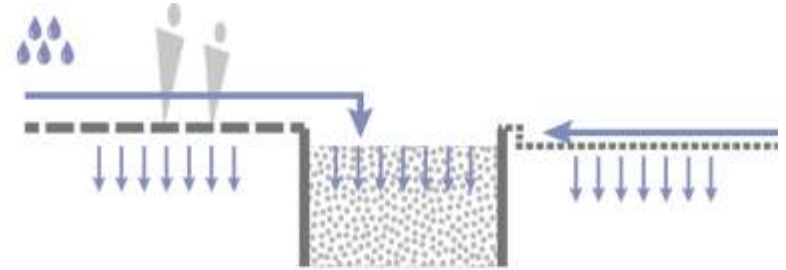
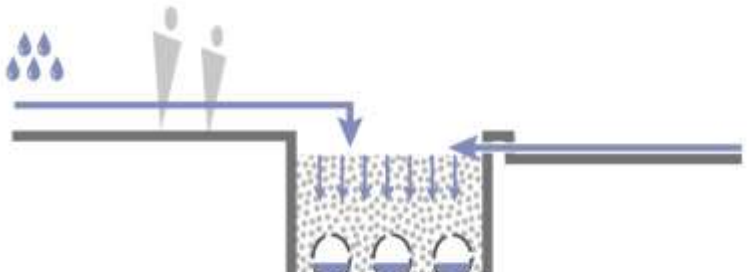
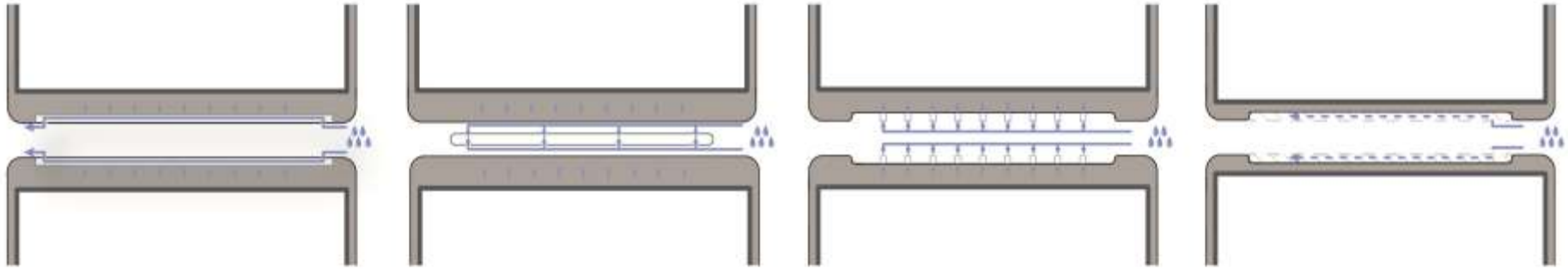
# REGIONAL ELEMENTS AND INSPIRATIONS



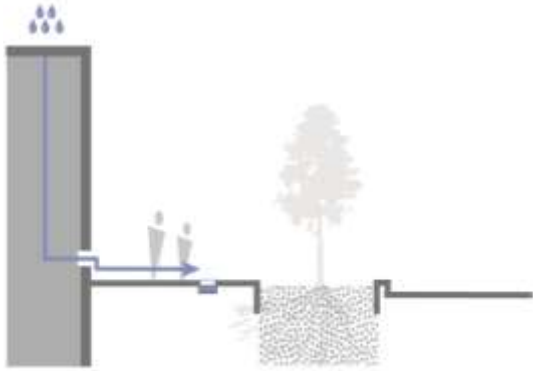
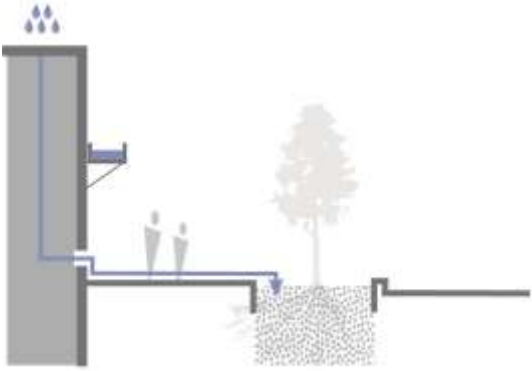
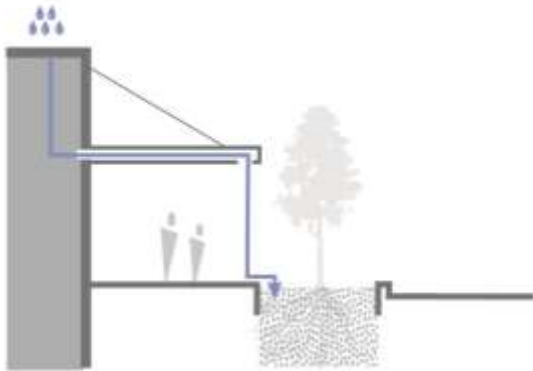
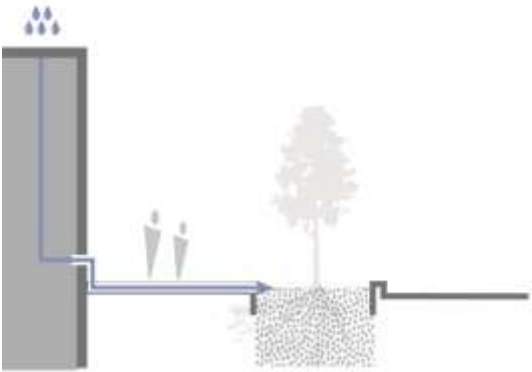
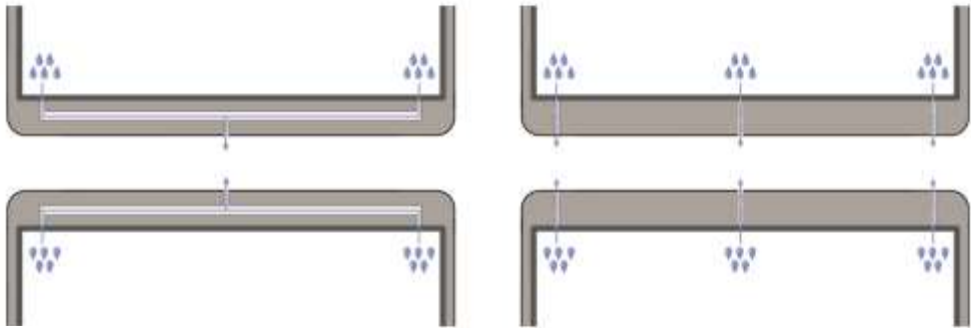
# STORAGE STRATEGIES



# INFILTRATION STRATEGIES



# CONVEYANCE STRATEGIES



# SITE

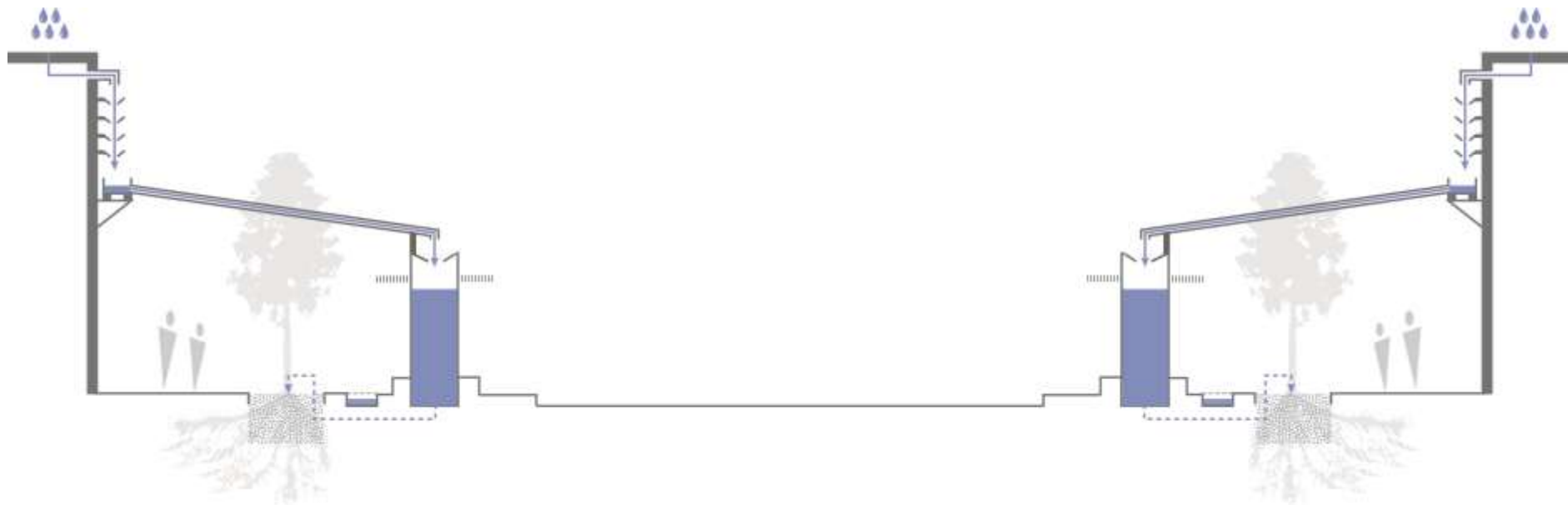
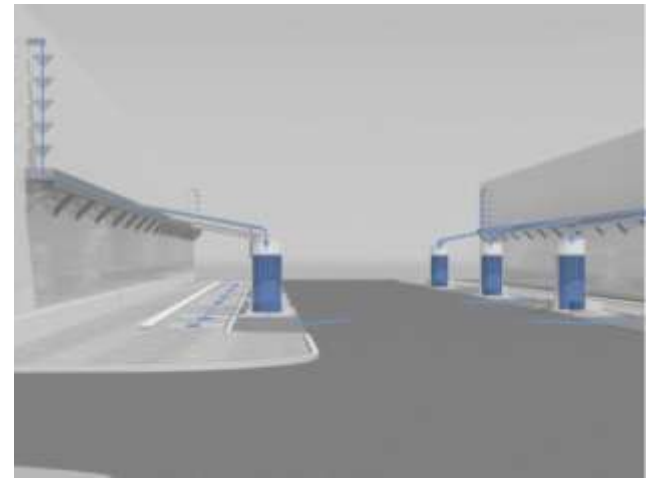
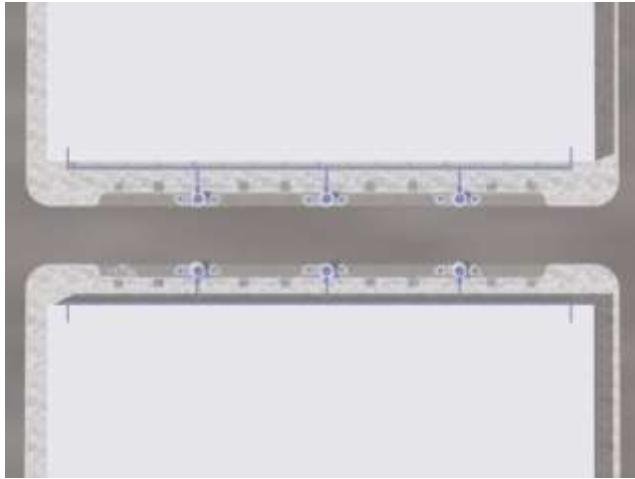


# T TYPOLOGY DEMONSTRATIONS

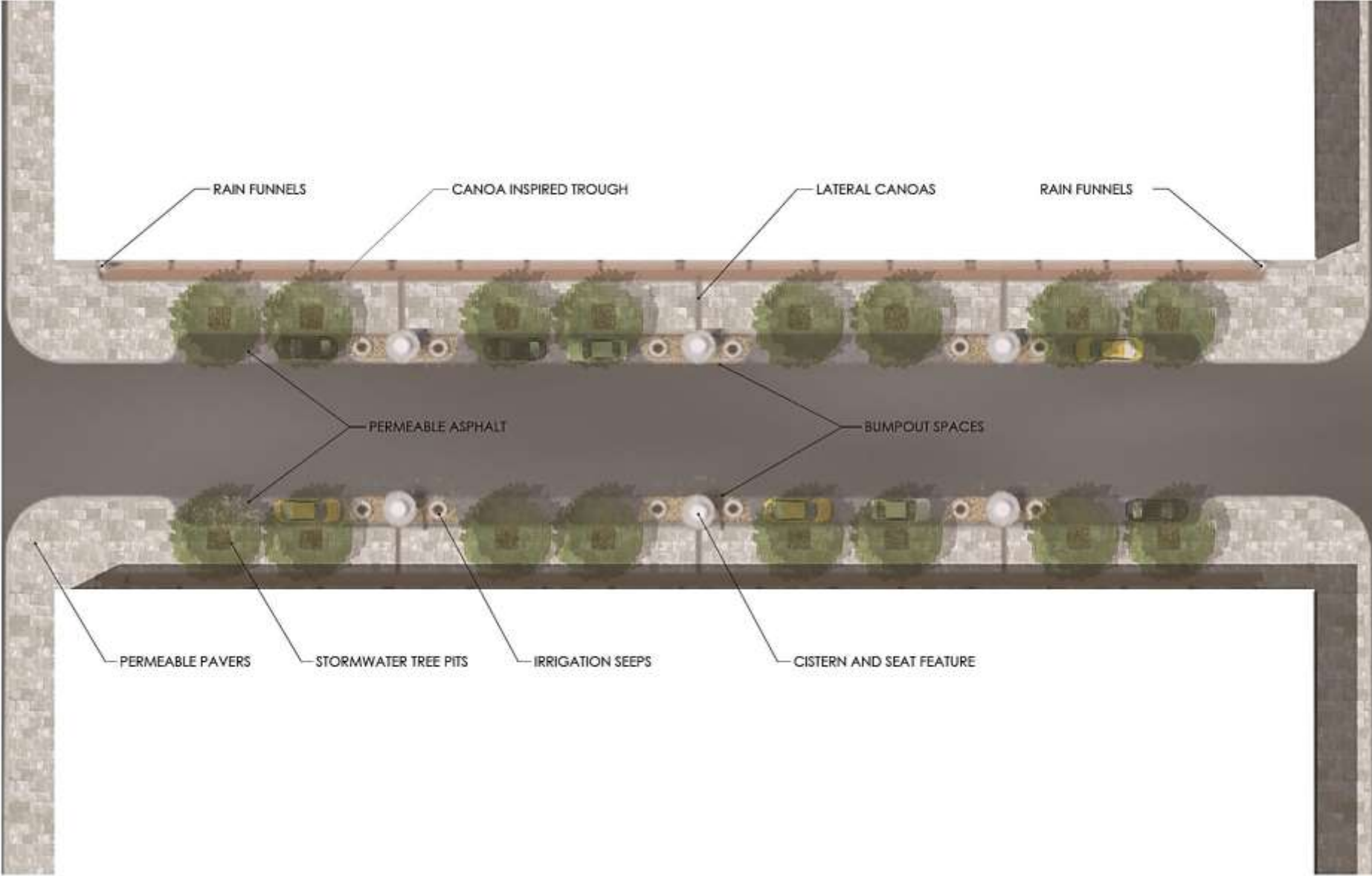
- Conveyance
- Infiltration
- Place



# Demonstration 1- Conveyance



# Demonstration 1- Conveyance

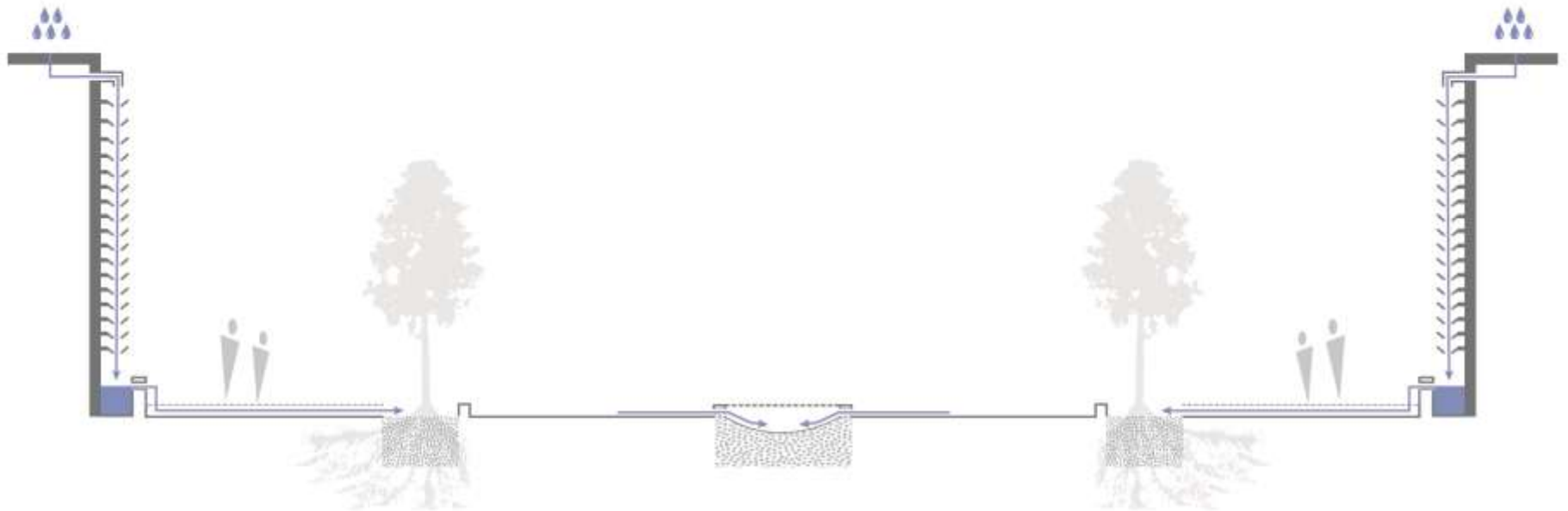
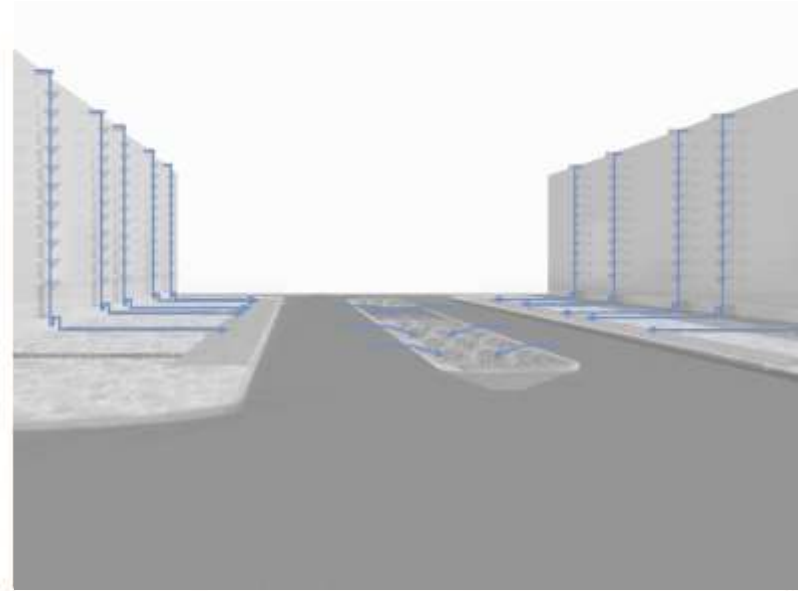
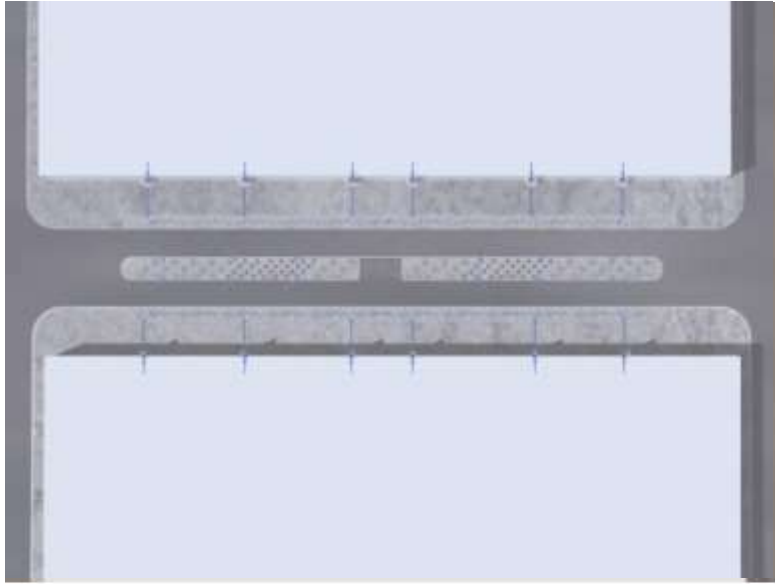


# Demonstration 1- Conveyance

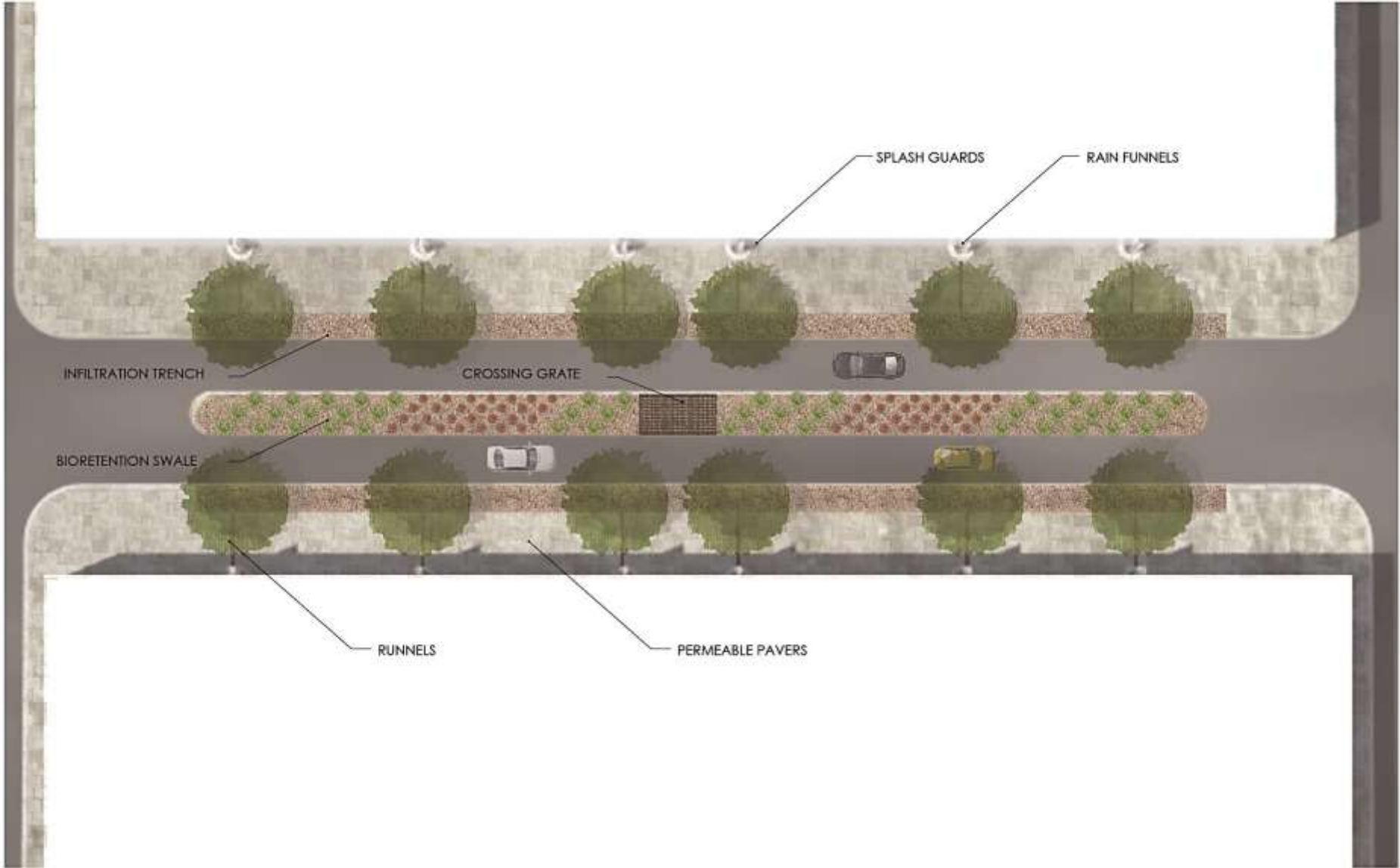




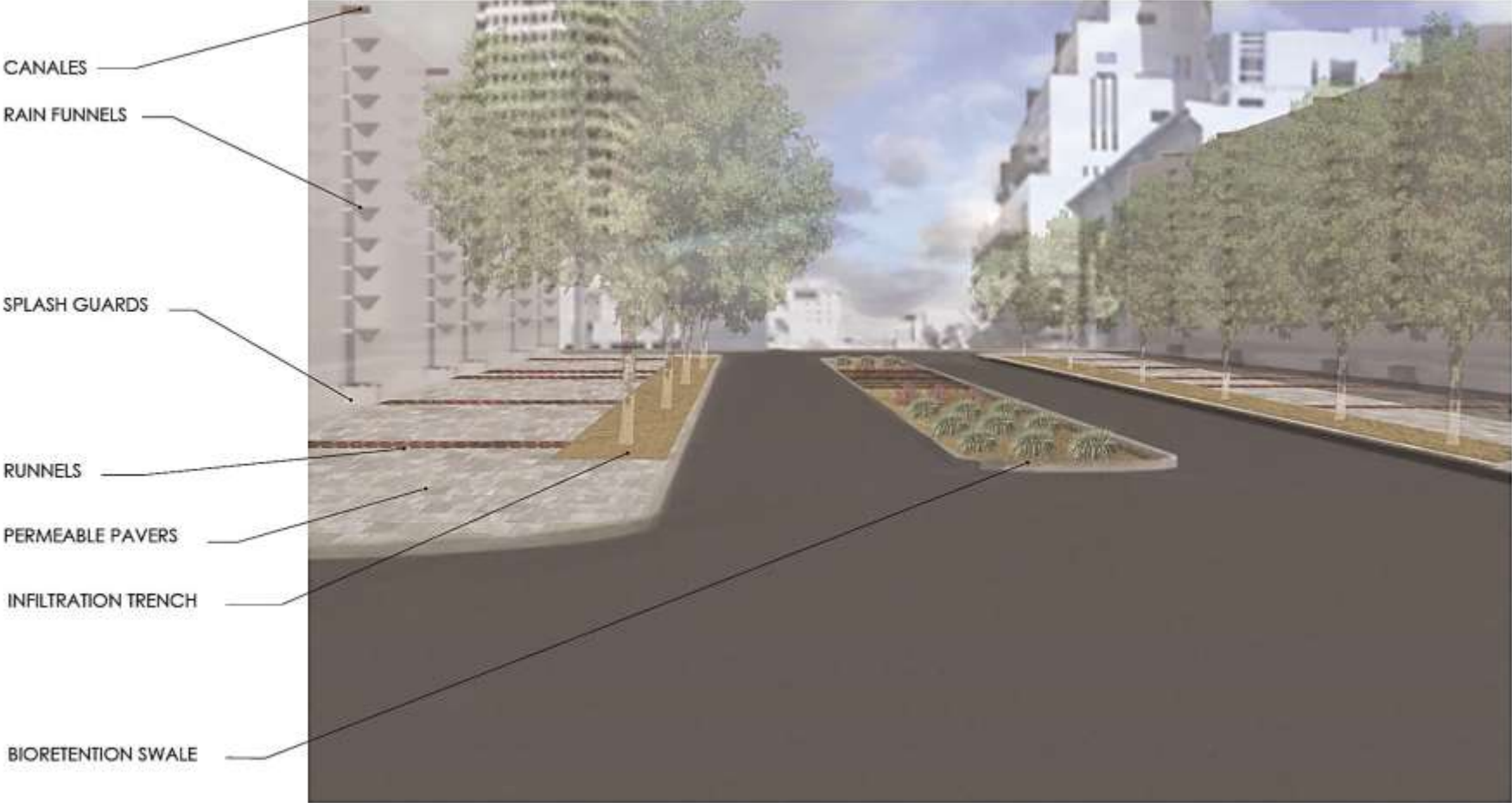
# Demonstration 2 - Infiltration



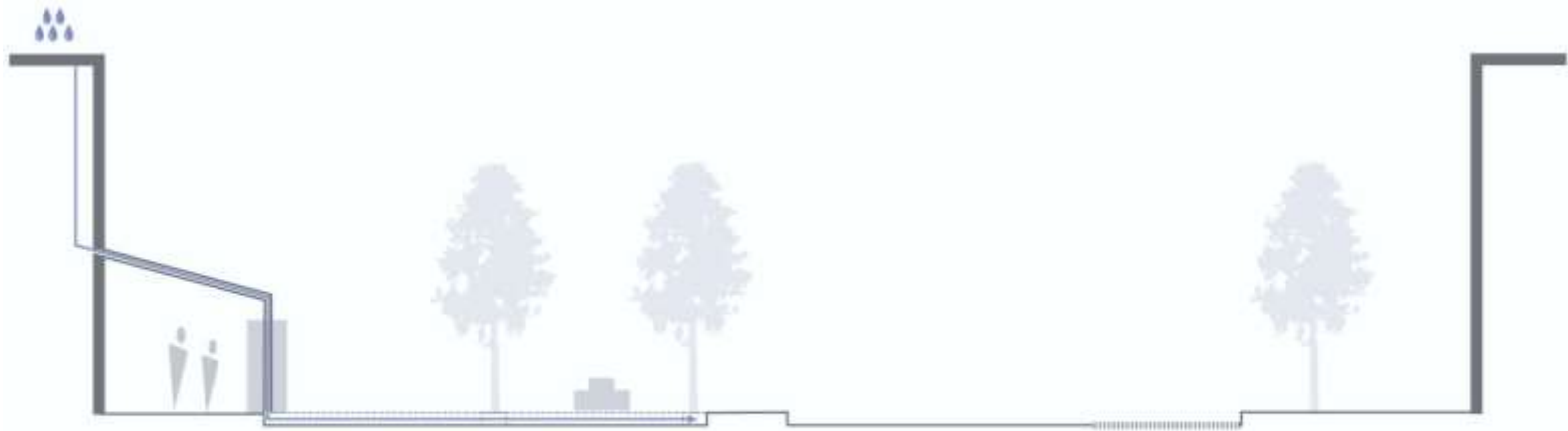
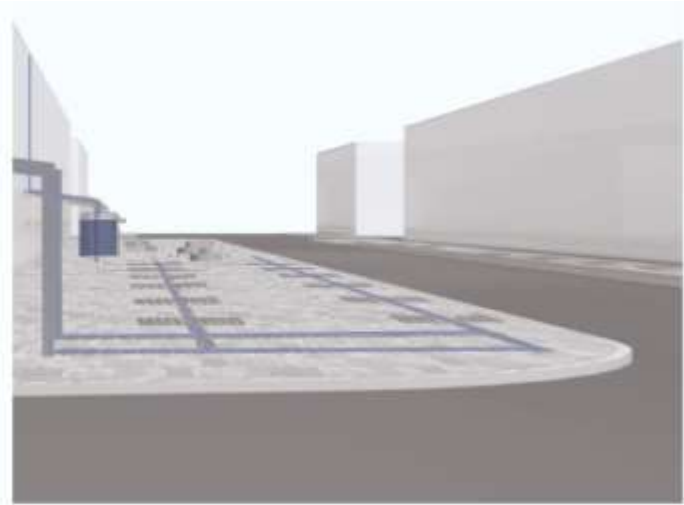
# Demonstration 2 - Infiltration



# Demonstration 2 - Infiltration

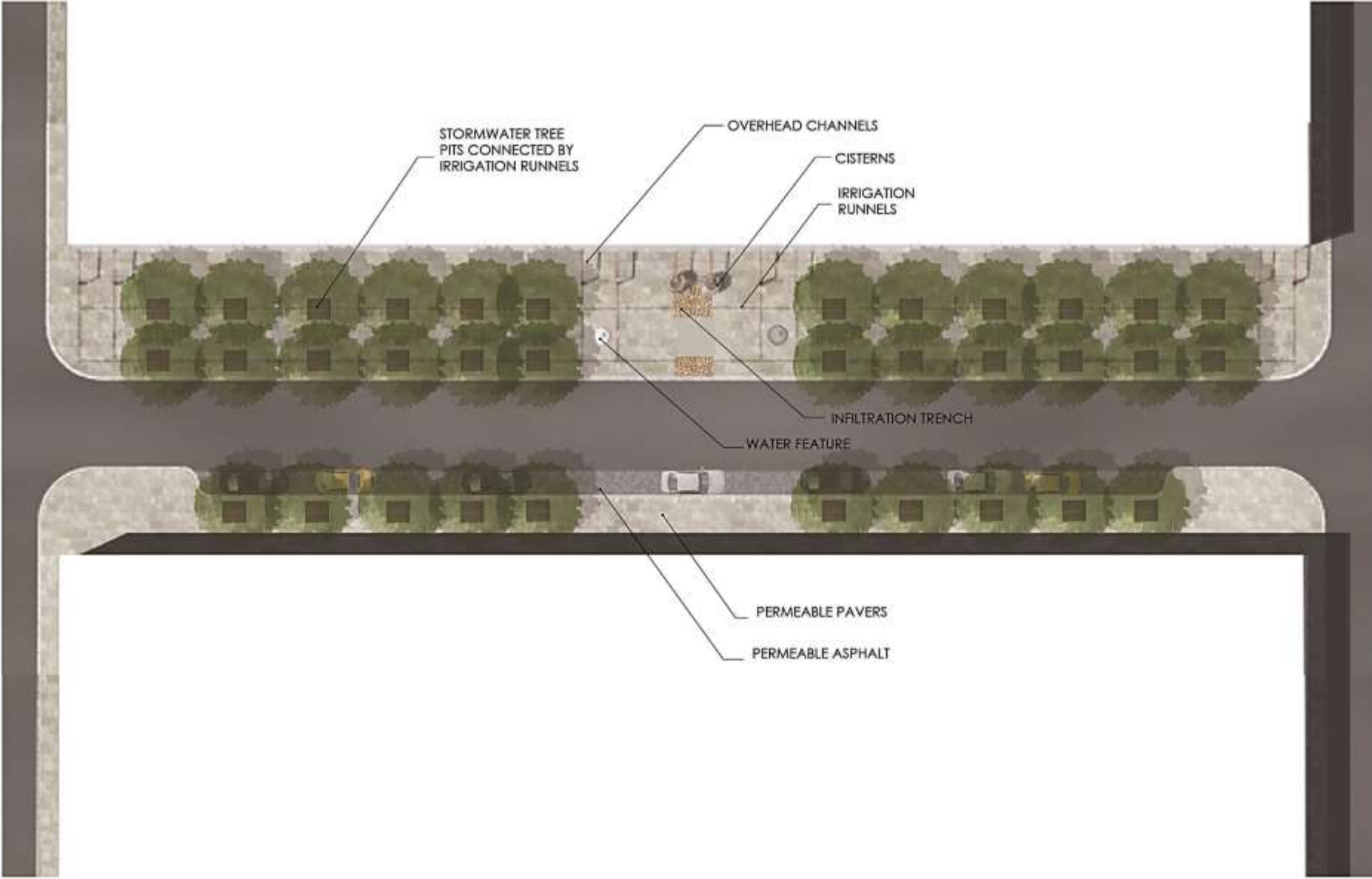


# Demonstration 3 - Place





# Demonstration 3 - Place



# Demonstration 3 - Place

CISTERNS

WATER FEATURE

OVERHEAD CHANNELS

IRRIGATION RUNNELS

PERMEABLE PAVERS







# Conclusions

- Evidence of the design principles and strategies are found in each demonstration and contribute to defining a unique character and place and reducing the impacts of runoff.
- Integration of infrastructure and natural processes is evident in the form of infiltration trenches, swales, and the use of stormwater for irrigating street trees.
- Vertical and horizontal space is optimized to increase the time of travel for runoff.
- Street trees create comfortable and inviting spaces.
- Regional identity is evident in the form of runnels, canoa channels, and an acequia-like experience along the street.
- The infrastructure systems are easily understood and highly visible.

**Thank you for investing!**

By: Andrew Bernard  
MLA Candidate - 2014

# Feedback and questions?

