Urban Water

SEEKING CULTURAL, ECONOMIC, AND ENVIRONMENTAL CONNECTIONS

Candice D'Arcangeli. Spring 2012. Thesis Manual

TITLE PAGE

A Design Thesis Submitted to the
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Landscape Architecture
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By
Candice D'Arcangeli

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Landscape Architecture

Primary Thesis Advisor

Thesis Commitee Chair

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Fargo, North Dakota

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DESIGN THESIS

LANDSCAPE ARCHITECTURE

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ABSTRACT

Water is an essential element for human life, not only is it a biological requirement of the human body, it is also an inherent part of our everyday lives. It is so common in everyday life that it is being overused. Due to existing urban development and stormwater management practices, fresh water is being polluted and is unable to recharge underground aquifers. If this approach to design continues, there will soon be situations of undrinkable water and dried up aquifers within the urban city. Currently "70 percent of water pollution in our country comes from non-point sources such as urban runoff (USEPA 2005a)" (Echols & Pennypacker, 2008).

This research seeks to address this problem through a design that focuses on the stormwater runoff in an urban area. The design address es the challenge of creating a sustainable design for urban stormwater that incorporates the three pillars of sustainability: economy, environment, and society. These three pillars create an oppirtunity to generate a unique design for a specific site. They are the touchstones; the guide that assists through the process of design: addressing any environmental issues the site may have, looking for the best economical solutions for the site, and creating a strong cultural connection between the site and the people who will use it. Positioning these three pillars as the touchstones in the design will enable other design elements to be revealed through the function, and form of the design, elements such as aesthetically pleasing views, recreational activities, and education for the people who interact with the design. Through this lens an advantageous design will be shaped and transform current urban stormwater practices into a functional urban water management site, which educates the public on the ecology of water while beautifying the environment around them.

Keywords: Urban Stormwater, Water, Sustainability, Environment, Cultural

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PROBLEM STATEMENT

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How can a design with urban storm water incorporate the three pillars of sustainability: economy, environment and society?

STATEMENT OF INTENT

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STATEMENT OF INTENT

Typology:

Urban Storm Water

Claim:

Creating an urban stormwater system that is beneficial to the economy, environment, and culture of a site, while enhancing how urban water systems are designed and addressing to current water quality issues.

Actor: Landscape Architects, Environmental Designers, City Planners, Artists

Action: Revitalizing urban stormwater systems, planning, designing

Object: Urban stormwater

Manner of Action: Economical, environmental and cultural design focuses

Premises:

(Actor) The designer must be involved in the details and infrastructure of urban stormwater system; while implementing the three pillars of sustainability.

(Action) The design of urban stormwater systems needs to be rejuvenated to be able to support the countless human activities, profuse plant life, and wildlife communities that surround urban life (Girling & Kellett, 2005).

(Object) Urban storm water has the ability to establish cultural, aesthetic, environmental, and sometimes recreational functions to a site. (Girling & Kellett, 2005)

(Manner of Action) Focusing design on the economical, environmental, and cultural impacts urban stormwater has on a site presents the site with a unique design implementation.

Theoretical Premise/ Unifying Idea:

When our design of urban stormwater on a small scale site is created considering the economic, environmental and cultural impacts of urban water runoff, the design improves the environment and the community surrounding it.

Project Justification:

As water is becoming scarce in our world, how we use it has become vitally important to our society (Carpenter & Biggs, 2009). Designers need to look beyond the short term solutions of current urban stormwater management on a site and start considering the long-term solutions. By looking at the economy, environment, and culture of a site, urban stormwater systems can be designed to use all of the resources it offers (Girling & Kellett, 2005). These urban water resources support humans, plants, and wildlife and by taking advantage of these resources, we are creating long-term solutions for current problems.

NARRATIVE

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Water is the main source of life in our society. Not only is it a biological necessity of the human body, but it is also used for religious reasons, exercising, relaxing, playing, socializing, cleaning, and entertaining. As our population grows, water is being consumed in higher quantities than what is being replenished back into the water table and aquifers; because of this, how water is used is becoming crucial to the future survival of the human race. By creating areas that use water at its maximum capabilities while restoring the underground water tables, we have a chance to create a sense of place that embodies a community's culture, environment, and economy.

PROPOSAL

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A USER/ CLIENT DESCRIPTION

The users/clients of my design will include residents, business owners, and anyone who uses or visits Stevens Square Park in Minneapolis, Minnesota. No user or client will take precedent over another; this proposal wants all participants to experience the Stevens Square neighborhood in their own ways. With water as the priority of this site, the user will experience a sense of wayfinding, with places of high imageability created through the use of water. These spaces give the user a unique interactive and educational experience while walking through the site that encourages the awareness of water. The following are more in depth descriptions of my users and their involvement on my site.

A USER/ CLIENT DESCRIPTION

User #1 - Residents

The residential community living in the Stevens Square neighborhood will be most impacted by the site design due to their investment in and proximity to the neighborhood. This neighborhood is considered a historical neighborhood and one of the first neighborhoods built in the city of Minneapolis, Minnesota. Since then, the neighborhood has gone through many changes and is going to be revitialized; because of this, the changes that would occur in the neighborhood will affect the residents of the neighborhood the most, therefore the design will put the residents' best interest first.

User #2 - Surrounding Community

The success of the final design will be so profound for the neighborhood that it will gain the attention of surrounding communities. It will demonstrate creative and beneficial ways to manage stormwater within their own community. Seeing the social, economical, and environmental benefits of the design, they will seek to have similar stormwater implementations within their own neighborhoods.

User #3 - Business Owners

The business owners in the Stevens Square neighborhood will be impacted by the design through the formation of higher densities in the neighborhood, while also increasing the land value. These changes will increase the number of people visiting their stores and shops, therefore increasing profits for the business owners.

MAJOR PROJECT ELEMENTS

The major project elements in this project will include urban stormwater management, culture, education, and the environment. Each of these elements will play a critical role and contribute to the overall design. The overall goal of the design is to manage the stormwater from the neighborhood in a way that incorporates the culture of the community, educates people about current water pollution and scarcity issues, and betters the economy and environment.

These elements will be implemented throughout the neighborhood using a creative lens to attain a unique design. This lens will incorporate the concepts of wayfinding and high imageability. Imageability is defined by Kevin A. Lynch (*Image of the City, 1960*) as "that quality in a physical object which gives it a high probability of evoking a strong image in any given observer…where objects are not only able to be seen, but are presented sharply and intensely to the senses"(pg.9). While he described wayfinding as, "the strategic link is the environmental image, the generalized mental picture of the exterior physical world that is held by an individual. This image is the product both of immediate sensation and of the memory of past experience, and it is used to interpret information and to guide action"(pg.4). These concepts will inspire the implementation of the elements throughout the neighborhood, giving the residents the opportunity to walk through the entire site using all their senses to interact with the elements.

The overall masterplan will create an invigorating new environment for Stevens Square Neighborhood and its surrounding community that will better it economically, culturally and environmentally.

MAJOR PROJECT ELEMENTS

Urban Storm Water Management

The way the stormwater from Stevens Square neighborhood and the surrounding community is currently being managed will be a vital part of my project. Properly accessing the current practices and their impact on the environment will be the first step in dictating the type of stormwater management practices I will choose to implement in my design and will impact the overall success of the project.

Environment

Keeping all the stormwater on site improves the environment by decreasing the amount of runoff that reaches the Mississippi river, helping to decrease flooding. Keeping the water on site, also allows the water to replenish the underground water tables while using plants to clean the water of pollutants.

Culture

What people think about water greatly impacts how they use it; when they consider it as a neverending resource, how they use it does not matter to them. This project will encourage people to see water in a different way and appreciate its value.

Education

People have the tendency to care more about things they are educated about, and this project will seek to educate people on water and its scarcity in an interactive way. As people move through the site they have the chance to learn and interact whether it is a one time visit to the site or multiple visits to the site.

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SITE INFORMATION

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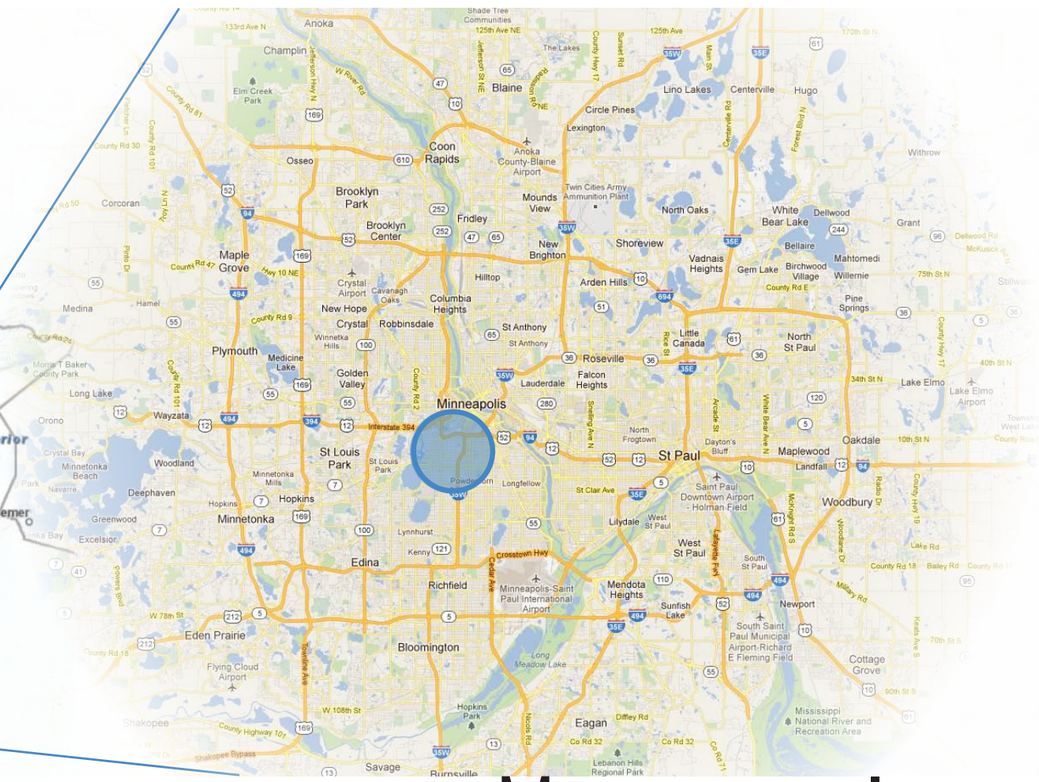
Minnesota



Minneapolis

SITE INFORMATION

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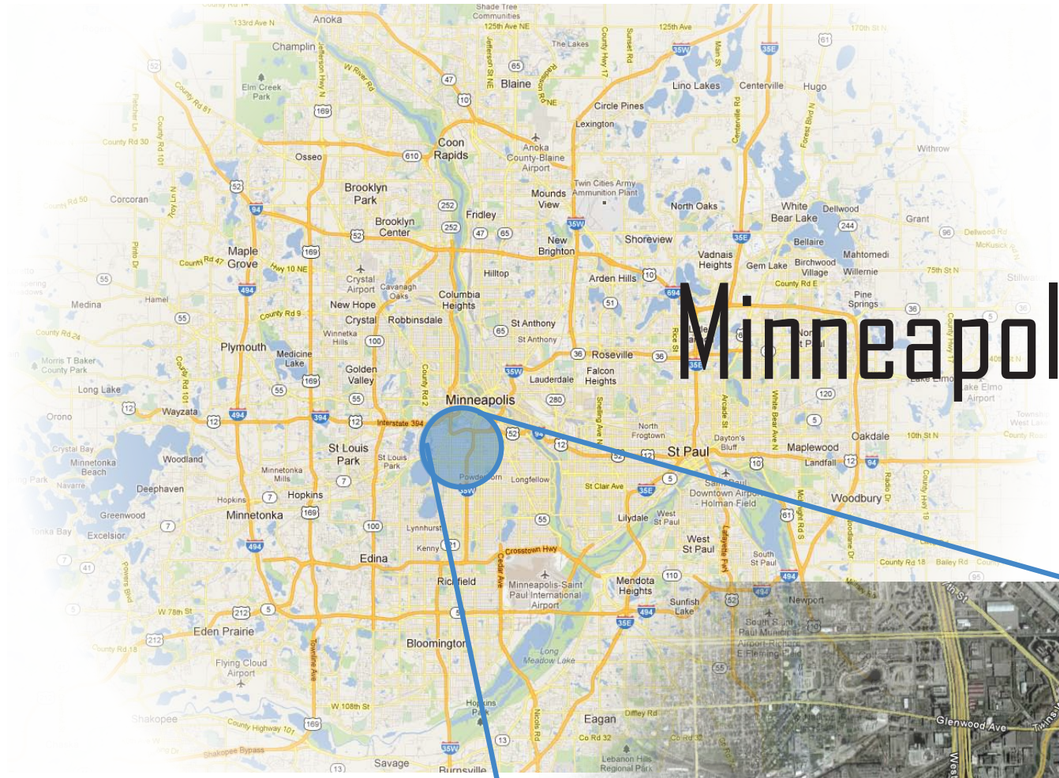

Stevens Square Neighborhood

SITE INFORMATION - MICRO

URBAN WATERFRONT

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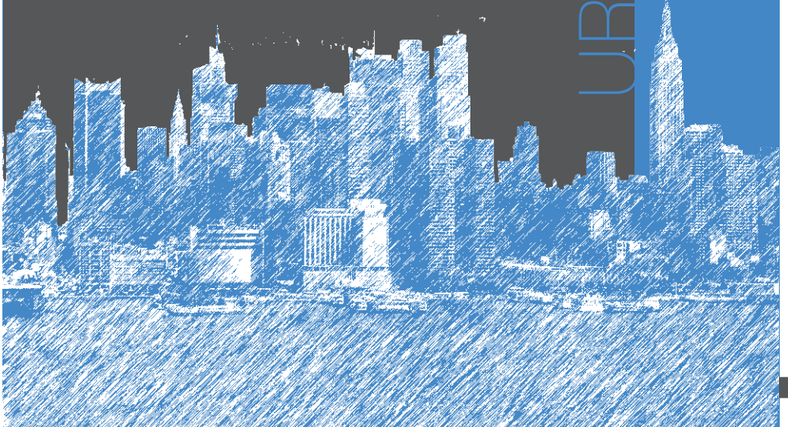
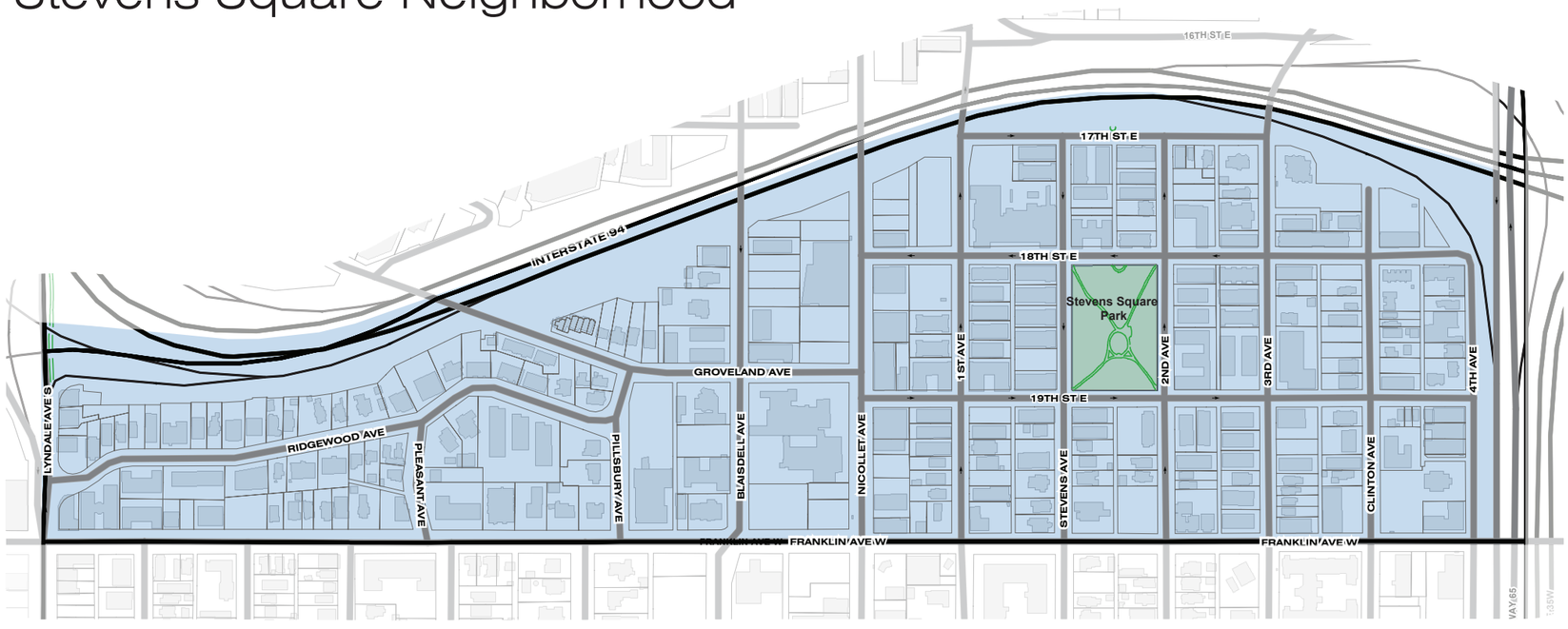


Stevens Square Neighborhood



NARRATIVE

Stevens Square Neighborhood has a high urban population that has a single park at a central location. With the high density of the neighborhood Stevens Square park can be used to bring the urban community of Steven Square Neighborhood together.

PROJECT EMPHASIS

The emphasis of this project will be on the stormwater management of the entire Stevens Square Neighborhood, keeping the water within the site and holding as much of the water on Steven Square Park. This park will then use the water to visibly show and educate tthe public about the scarcity of water and the proper ways of retaining it while being aesthetically pleasing and interactive to the community.

PROCEDURAL PLAN

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Theoretical Premise

Stevens Square Neighborhood considers itself the "Life in the Heart of Minneapolis" and has involved community. This neighborhood seeks to be a place of destination while being a convenient place to live; this project will create a central location that will bring the community together even more, be environmentally sustainable and economically help the neighborhood by being a point of destination and interest for people outside of the community.

Research Direction

The research for this design will revolve around creating a clear definition of sustainability and what it entails in our current age. With a clearer understanding of sustainability it will dramatically affect the outcome of the final design. Another avenue of research will include a comparison of current storm water management practices and new and upcoming practices. This will demonstrate the "do's" and "don'ts" of creating a viable storm water management system. Water quality will then be researched to exemplify the pollution created in urban environments and positive impacts a successful storm water management system can have our water quality.

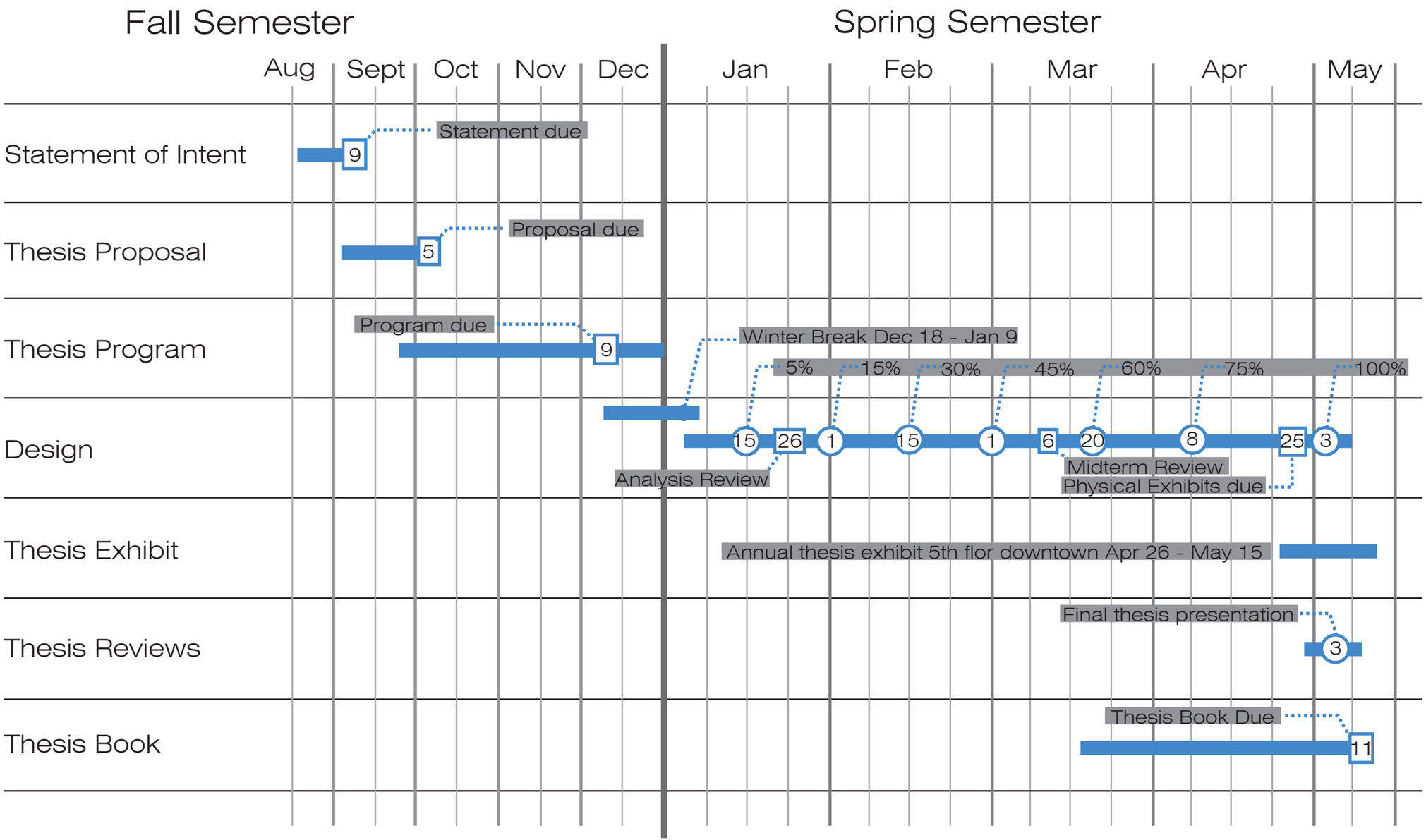
Design Methodology

The design will entail methods of function, form and art to create an environmentally interactive and educational site. The functional aspects will be guided by the three pillars of sustainability and implemented on a storm water management system; the design in the park will be fully functional while introducing a form that initiates an interest in the environment to the public.

Brief History of the Site

Stevens Square was created in 1856 by Richard J. Mendenhall and Dr. Nathan B. Hill who owned most of the land in the surrounding areas, they decided to make it a residential neighborhood. The central location of the land added value to the neighborhood as the city of Minneapolis grew. The rapid growth of downtown Minneapolis created a strong need for apartment buildings. This need was filled within the neighborhood and as it has grown through the years Stevens Square has become a historic part of Minneapolis and is currently mostly occupied by single people between the ages of 25 and 35 who work close to downtown Minneapolis or in the area. The location of Stevens Square makes the neighborhood a sought out place to live that has easy access to many places in the downtown area of Minneapolis.

PROCEDURAL PLAN



PREVIOUS EXPERIENCE

URBAN WATER

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2nd Year

2008 Fall Semester - Kathleen Pepple
Introduction Into Landscape Architecture

2009 Spring Semester - Mark Lindquist
Parks and Open Spaces

3rd Year

2009 Fall Semester - Stevie Famulari
Site Planning and Design

2010 Spring Semester - Kathleen Pepple & Jay Kost
Community Planning and Design

4th year

2010 Fall Semester - Jay Kost
Urban Design

2011 Spring Semester - Stevie Famulari
Remediation Design

5th year

2011 Fall Semester-2012 Spring Semester - Kathleen Pepple
Design Thesis

PROGRAM

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Sustainability

Since the end of the 20th century sustainability has become a well known word among our society, but one that is often undermined of all that it entails. In the past, the needs of the development of our society have always come first without giving thought to the consequences these actions would have on future generations. It has become clear that this type of thinking is having negative impacts on our environment and making the resources that are available today, unavailable to future generations. Sustainability seeks to fix this problem by making future generations a priority while taking care of our current society.

For sustainability to be successful it must entail three components: society (population, lifestyle, culture, and social organization), economy (households, industry, transportation, service) and environment (atmosphere, land, hydrosphere, and biota). These three components or "pillars" are the foundation of sustainability that need to be kept in equilibrium with each other. "A change in one component affects the other two…the balance between all three is the fundamental premise of sustainability." (Novotny, Brown & Ahern, 2010) For example, a pull towards economics can lead to pollution, and impairment to the environment.

Although these three components are what create a sustainable environment, they are not what define it. If you look at the meaning of the word sustainable it means a quality and intention, not a process. "It is an entity's intrinsic capacity to keep itself going perpetuity, and this applies to society, habitat, resources and environment" (Novotny, Brown & Ahern, 2010). Perpetuity means "a thing that lasts forever or for an indefinite period, in particular" (Oxford Dictionaries of the English Language).

Looking at the past we see that sustainability has always been a part of our human nature; generations conserving for future generations, parents trying to make their child's livelihood better than their own, saving money for their child's future. This human nature has now been brought one step further and being applied to all future generations with legal doctrine. It has been argued that future generations have as much right to our current resources as current generations do; "sustainability is based on the legal doctrine that equal opportunities should be provided to each member of society, including children, which is also a well-

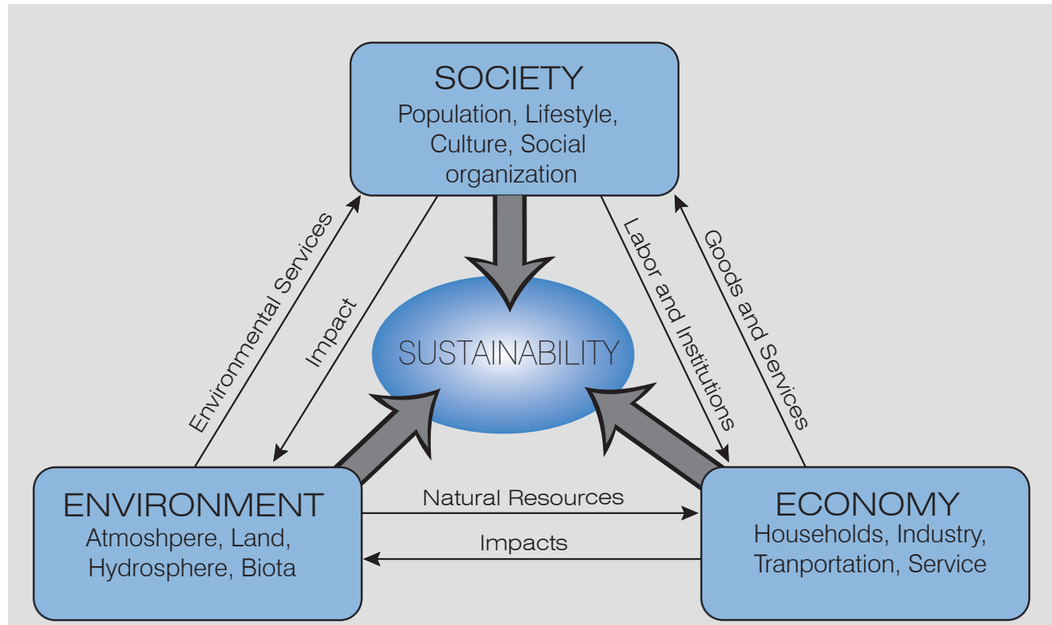


Figure 1. The trinity of factors and impacts determining sustainability. Adapted from Brundtland (1987), Novotny (2003) and Allan (2005).

known concept of intergenerational (parent vs. children) and intergenerational (developed vs. developing nations, affluent vs. disadvantaged population groups) fairness. The World Commission of Environment and Development defines sustainability as "Humanity has the ability to make development sustainable-to ensure that it meets the needs of the present without compromising the ability of future generations to meet their own needs," (Novotny, Brown & Ahern, 2010). This definition clearly identifies the importance of future generations in the creation of sustainable environments but although we have this clear definition we still have to struggle against current paradigm views on how current nature and resources should be used. These two views are:

1. The anthropogenic view regards nature as a resource that should be used and developed for economic gains (Novotny, Brown & Ahern, 2010).
2. The biocentric view regards preserving and restoring nature as the ultimate goal for human beings (Novotny, Brown & Ahern, 2010).

Although these views seem to be contradictory, most people are not fully committed to either, choosing to include both to their benefit. They do not want to completely exhaust all resources for economic gain and lose the capability of making a profit, nor do they want to destroy the environment. They still consider nature a beautiful, relaxing and enjoying experience.

This thought process inherently brought about urban sprawl and the paradigm our society has been in for the last 40 years. The prosperous had the ability to get away from the polluted and deteriorating city and move out to the country to live closer to nature, while the poor where left behind to endure water contamination and toxic waste in the city. This social problem is also known as environmental injustice and is currently happening in developed and developing countries today. These views lead us back to the trinity of sustainability and the balance needed between each component for sustainability to be successful. Anthropogenic and biocentric views provide a lens to the past and demonstrate the imbalances they created in the trinity of sustainability. Devotion to the anthropogenic view leads to pollution, degradation and ultimately loss of resources while devotion to the biocentric view will create urban sprawl and urban environmental injustice, (Novotny, Brown & Ahern, 2010). Ultimately sustainability involves that all values be in balance with each other to create an urban development that is economically viable, socially accepted and conscientious of the environment and its resources.

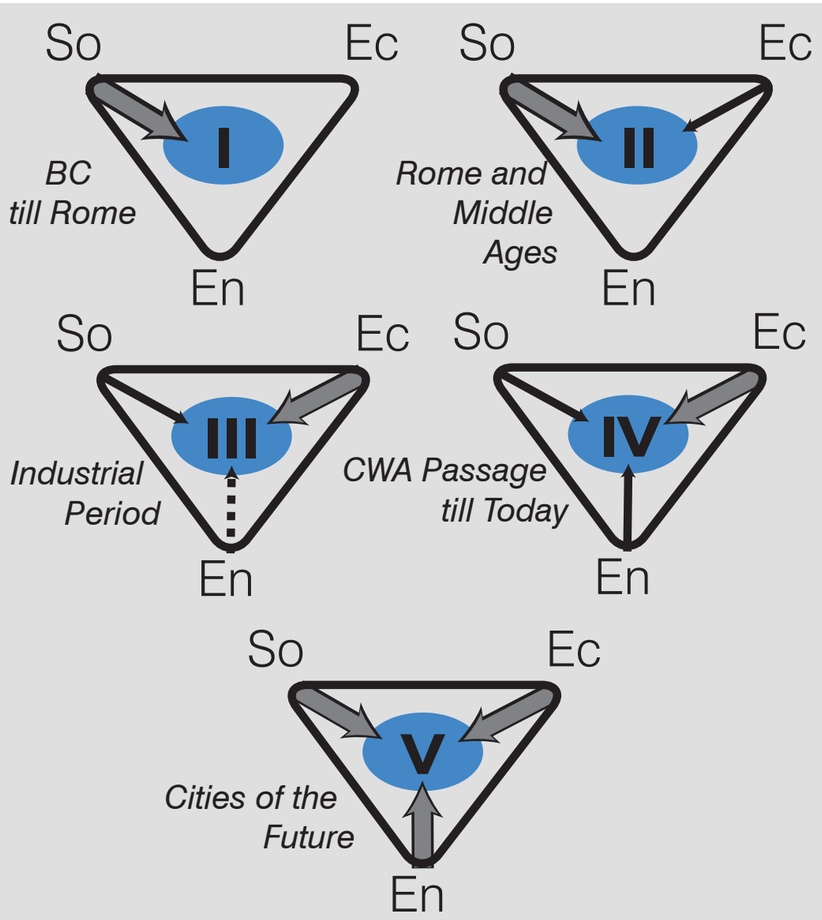
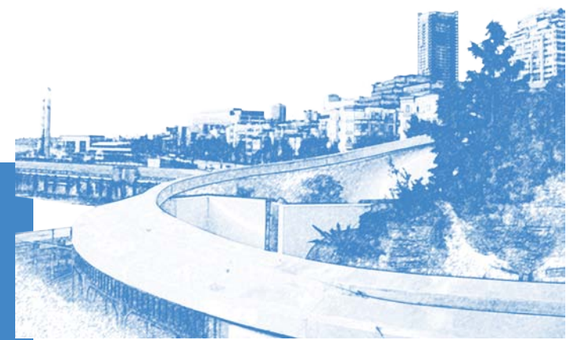


Figure 2. The impacts of three components of sustainability determine the paradigms that occurred in history. (adapted and modified from Allan, 2005, 2008) So - social components, Ec - economic components, En - environmental conponents



Urban Stormwater management

Just like any evolutionary process, urban stormwater management had to initiate somewhere before developing into what it is in this era. History has shown that in areas that have a high population, urbanization arises and some form of water management is implemented. Although there have been populations consisting of over one million people dating back to 800 A.D., modern urbanization came about with industrialization and one of the first cities to reach the one million mark in population was London in 1810. Industrialization was propelled by two forces there: the steam engine and coal mining subsequently increasing the population in the city. At the beginning of the 19th century London created a drainage system that drained the water from the city to the natural stream beds outside the city but did not include the sewage from the city, therefore the people of the city had to distribute their fesses into latrines and cesspools. Eventually this cesspools and latrines started to overflow and London created a system that dumped the sewage into the Thames River which eventually stunk so bad that parliament had to pay to have a new sewage system created.

Like London, the United States went through similar problems in the 1800s although certain areas that could afford it had public water systems. Philadelphia was the first city to create a municipal water system for the city in 1802 and by the mid 1800s the United State had taken a curious turn and a majority of the cities had a public water system that distributed water at a fairly cheap price. But instead of creating separate systems to take care of the sewage from the city, they combined it with the current drainage systems they had therefore distributing city feces into the local lakes and streams. "By 1890 there was a substantial "urban penalty" for urban living: Mortality rate in the U.S. cities were 30% higher than in rural areas," (Baker, 2009). The fire on the Cuyahoga River in 1969 was the game changer for the United States and in 1972 the Clean Water Act was created and has had a major impact on stormwater management systems and the water quality distributed into the rivers and streams. (Figure 4 and 5) From this brief history of stormwater management one thing is made clear: innovation is pushed by crisis.

Currently stormwater management is an underground system that takes stormwater runoff from the city and distributes it into the local river and streams. To remove the stormwater from the roads of the city, drains are placed along the roads about every 500ft, mostly near intersections with the size of the piping underneath the road being determined by the rainfall frequency in the city. The pipe size can vary from 12 to over 96 inches in diameter (Baker, 2009). There are some localized treatments for the stormwater runoff such as detention and retention ponds in parking lots, neighborhoods and big commercial areas giving the sediment in the water a chance to settle and cleaning the stormwater before it joins the river. Although these detention areas do assist in cleaning the water, this type of stormwater management system creates several problems for the water cycle. (Figure 6)

Figure 4 & 5. Photos of the Cuyahoga River on fire. (http://pratie.blogspot.com/2005/03/cuyahoga-river-fire-f-1969.html)

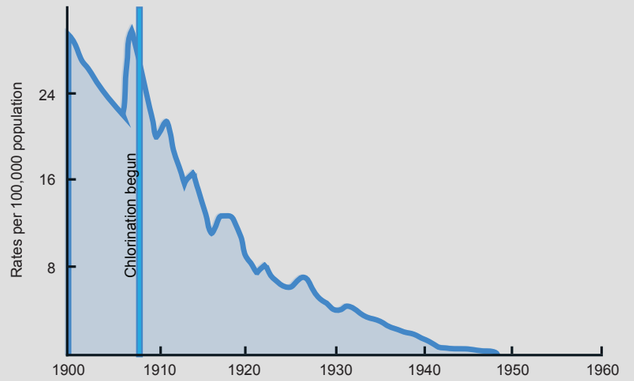


Figure 3. The death rate due to typhoid fever in the United States plummeted in the United States after the introduction of filtration in the late 19th century and chlorination in public water supplies. (Source U.S. Centers for Disease Control and Prevention - 1999)

Groundwater is a part of the water cycle that is affected by current stormwater practices. Presently, groundwater is a resource that can be sought after as a drinking source and "approximately one quarter of the fresh water used in the United States in the year 2000 originated from groundwater" (Baker, 2009).

This being the case, as cities have grown so has the amount of impervious surfaces. Permeation is defined as "to pass through the minute openings in a porous substance or membrane, or make something such as a liquid pass through" (Encarta Dictionary of the English Language). The earth is a permeable surface that water can pass through to recharge the groundwater and water table. By creating impervious surfaces, stormwater is unable to seep through and recharge the groundwater and water tables which will eventually deplete the water table and our fresh water drinking sources. Another negative impact impervious surfaces have on the water cycle is the increase in flow run off during storms. The flow peak and flow volume increase by a factor of 2 to 10, as shown in Figure and an increase in bank erosion caused by increased flow rates and cutting down the stream bank vegetation (Baker, 2009). The increase in flow factor is then increased even more by the lack of vegetation and not only increases the magnitude of floods but also increases the frequency of them. If stormwater management practices continue in this manner the damage will be too extent to reverse.

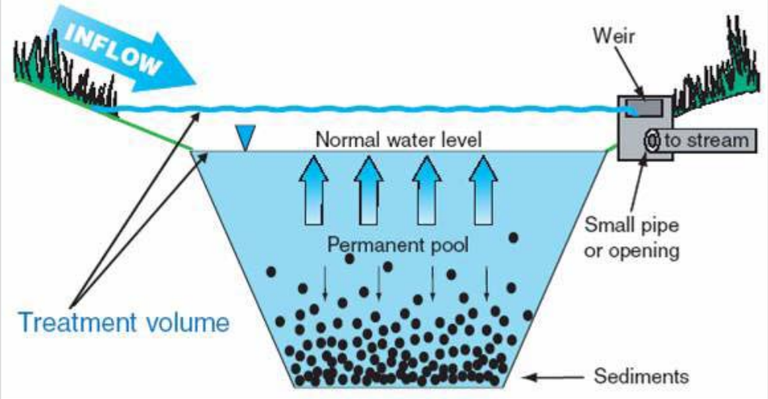


Figure 6. Detention pond for current stormwater practices. (http://www.brevstorm.org/project_type_wetdetponds.cfm)

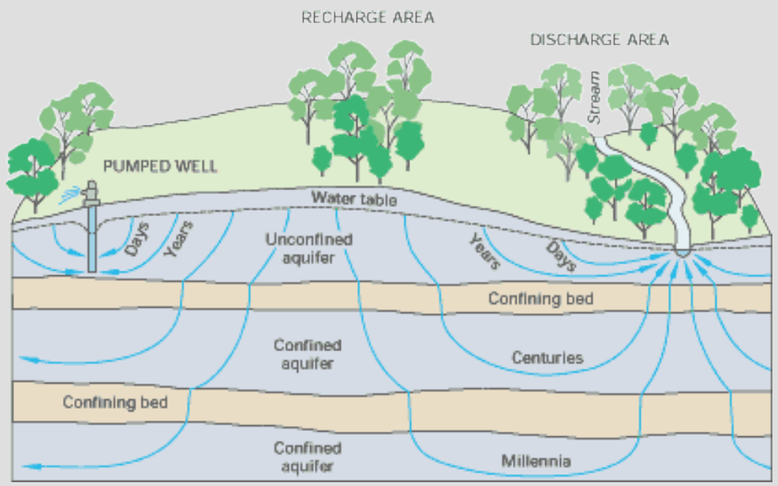


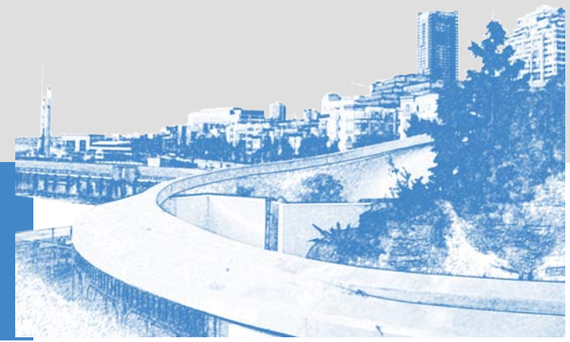
Figure 7. Groundwater flow under a permeable surface. (Winter et al., 1998)

Upcoming Stormwater Practices

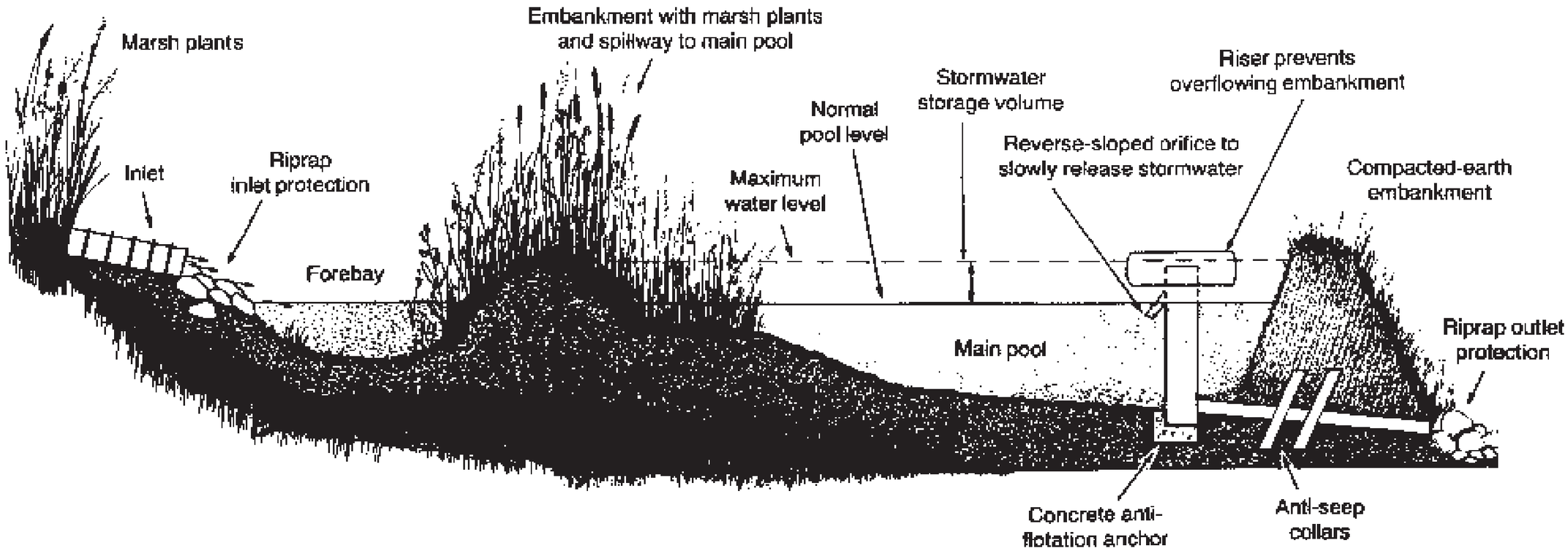
Upcoming stormwater management practices urge the creativity of creating urban stormwater management systems to be an amenity to the site rather than a system focused on moving water off the site in high quantities. Future urban drainage should not only include the component of quantity but also of quality and amenity. (See Figure) Stormwater management practices should have utility goals that allow them to be advantageous and useful in a sustainable manner. The table below lists possible stormwater management design techniques that depict their utilitarian goals while being a sustainable attribute to the environment. These recently popularized stormwater management design techniques have had a significant impact on sustainable design today. They allow the designer to take each site and create a unique, site specific design based on the ecology and social needs of the site. The table below gives objectives and the design techniques to solve them.

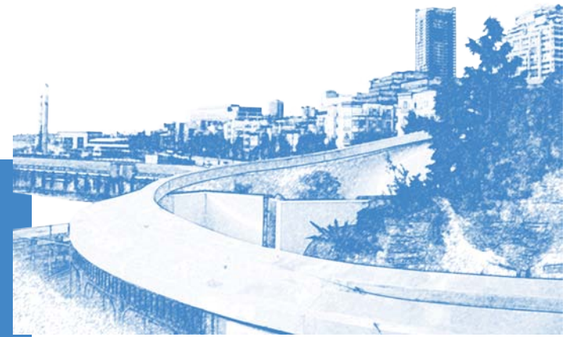
UTILITY GOALS Provide for the hydrological function that protects public health, safety, welfare and aquatic habitat	
Objectives To create systems that:	Design Techniques
Safely convey stormwater away	CONVEYANCE Curbing Pipes Swales Ditches
Reduce downstream flooding	DETENTION Convetional dry basins Extended detention basins Micro-pool ponds
Hold stormwater for reuse	RETENTION A Wet ponds Multiple pond systems B Water harvesting ponds Cisterns
Reduce stormwater pollution	FILTRATION C Bio-rentention gardens Green roof systems Water quality inlets D Constructed wetlands Sand filters Grassed Swales Oil and grit seperators
Promote grounwater recharge	INFILTRATION Dry wells (French Drain) Infiltration trenches Infiltration basins Porous pavements

Table 1. A utility goal table oriented to correlate design objectives and techniques. The lettered design techniques have sectioned drawings on the next page showing how they function. (Source: Echols, S., & Pennypacker, E. (2008))

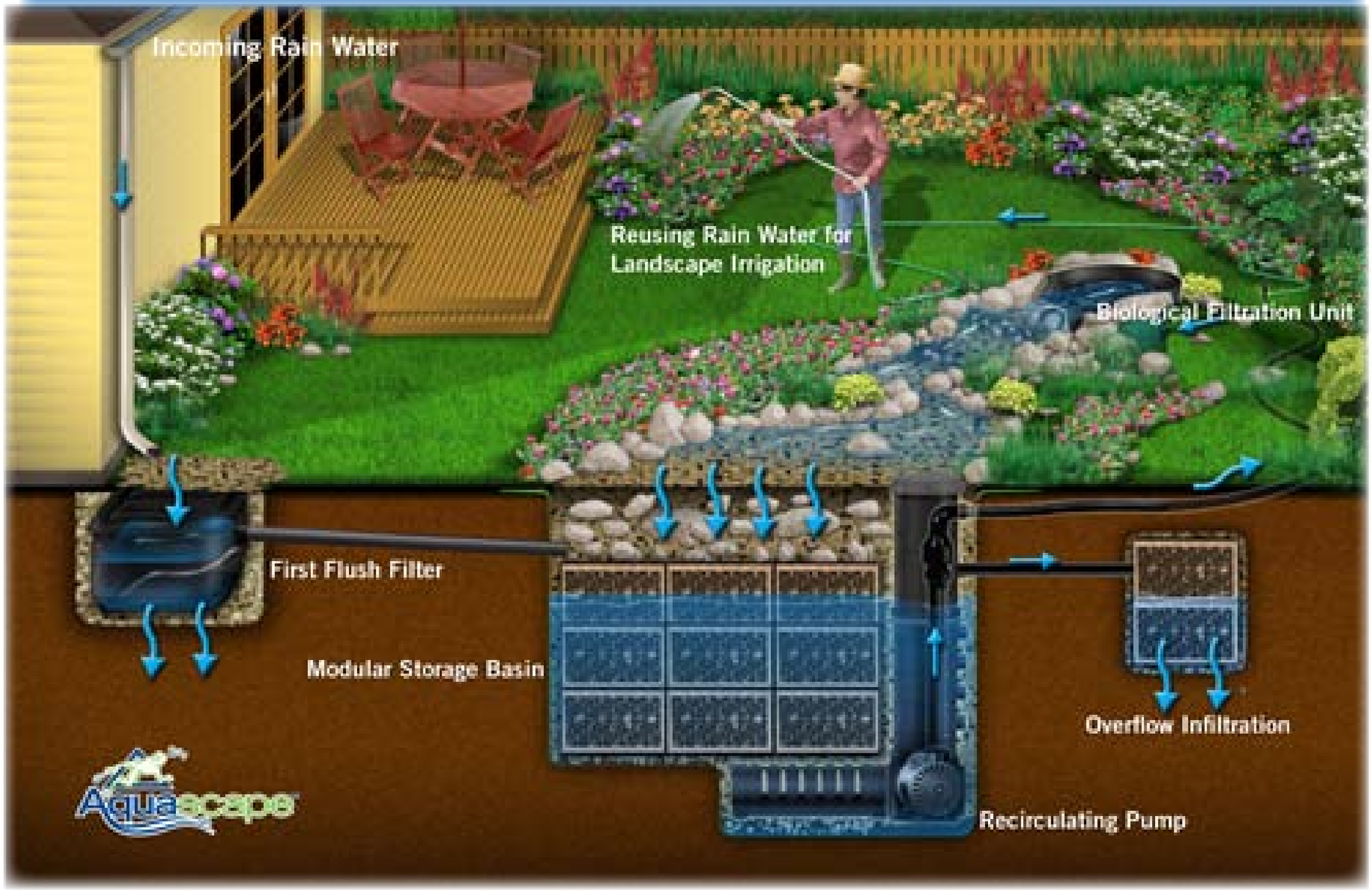


A. Wet ponds are permanent pools of water that allow the stormwater runoff sediment to settle at the bottom cleaning the water of pollutants *(Source: http://h2o.enr.state.nc.us/wswp/SL/v1n2.html)*

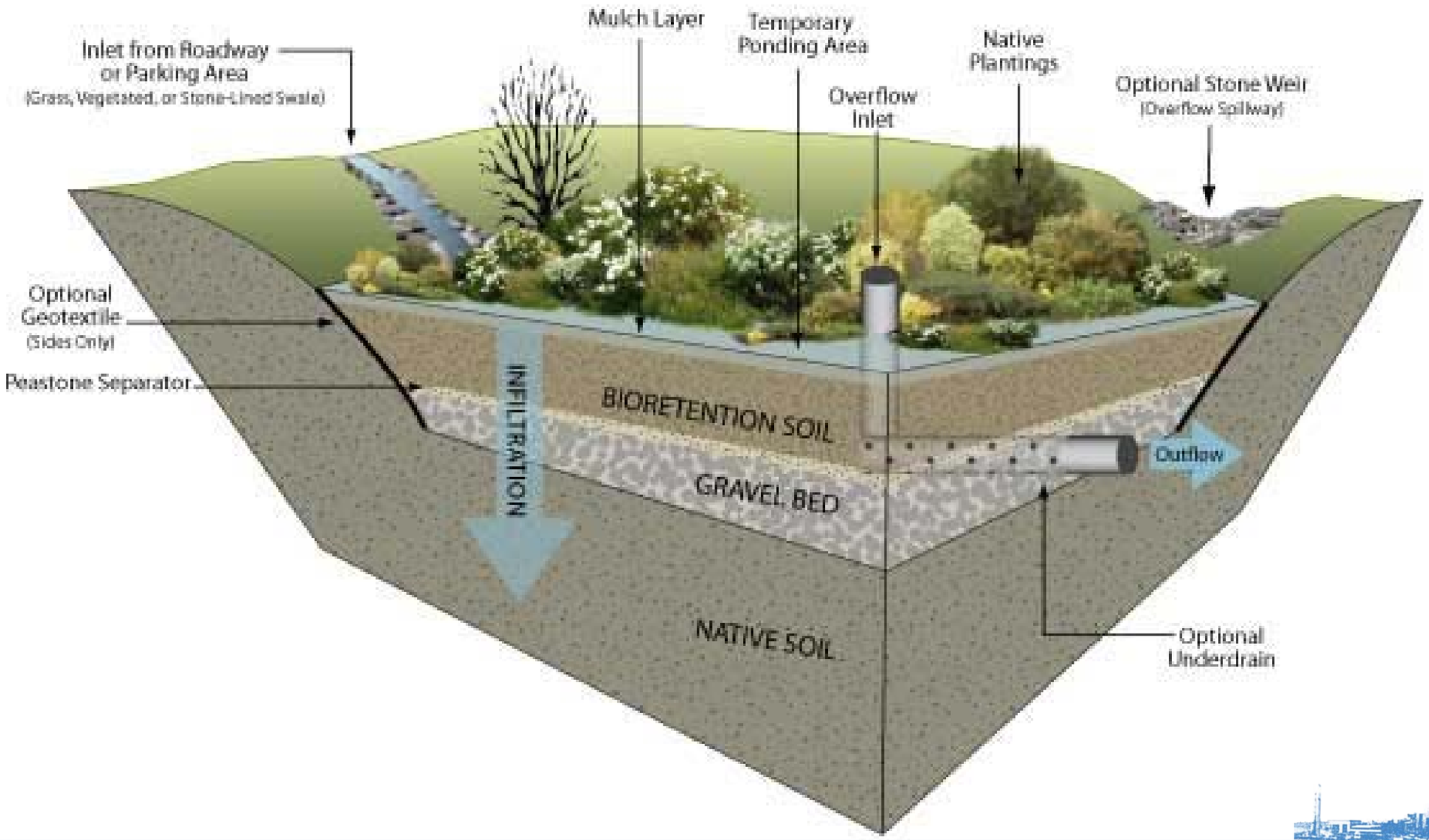


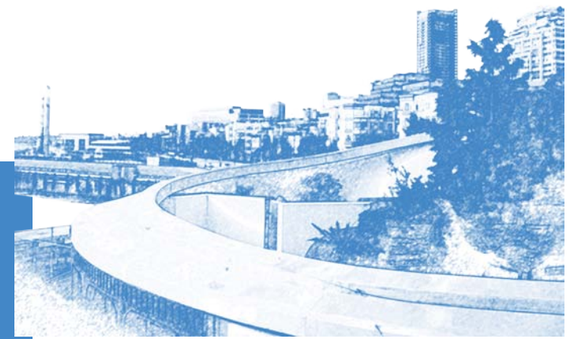


B. Water harvesting ponds allow you to store water from rain storms and use it to water your lawn and garden in future without having to using public water. *(Source: http://www.sterlinggreenery.com/pond_store.html)*

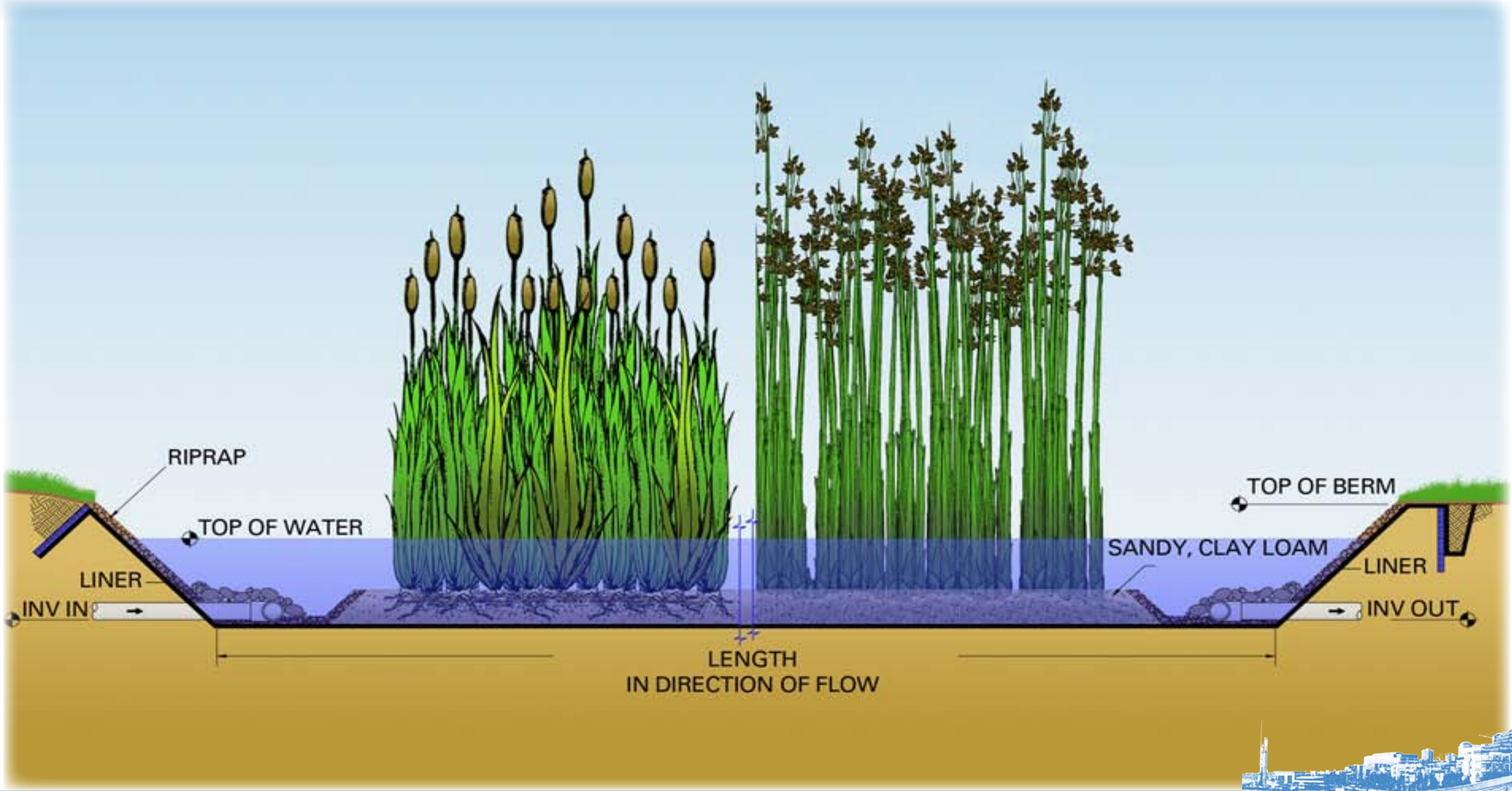


C. Bio-retention gardens or rain gardens are shallow planted depressions that gather stormwater and allow it to infiltrate through the ground. *(Source: http://dcplanning.org/kiosk/bioretention-gardens)*





D. Constructed wetlands treat and clean sewage water or highly polluted water. *(http://www.natsys-inc.com/resources/about-constructed-wetlands/)*



Water quality

As the human population has increased so has the spread of urban development, consequently affecting our water quality. As previously stated when modern urbanization first came about it subsequently affected the water quality of the nearby rivers, streams and lakes. Eventually the pollution became so severe that the legislative created the Clean Water act in 1972 (CWA). (Baker, 2009)

The CWA was a step in a right direction and made it unlawful to put any point source pollutants into navigable waters unless permitted to do so. (EPA) Point sources are comprised of municipal sewages, pipes, man-made ditches, etc. The CWA required that water from these point sources be cleaned of their pollutants, and is considered the end-pipe paradigm. But where water quality is most affected is non-point sources in the urban environment. Non-point sources include, run-off from lawns, erosion from construction sites, gradual decomposition of automobiles, run-off from parking lots, etc. (Bake, 2009) Municipal sewage currently accounts for only 6% of the total Nitrogen (N) and 4% of the total Phosphorous (P) inputs into the U.S. surface waters. (Puckett, 1995) The remainder of the pollution comes from non-point pollutants which also include salts, sediments, lead, pesticides and many other pollutants. (Baker, 2009) The following is an in-depth description list of sources of nonpoint pollutants created by Novontny, Ahern and Brown (2010)

- **Pollution contained in wet precipitation** – Urban rainfall is polluted by wash off of atmospheric pollutants originating from smoke-stacks and traffic.

- **Elutriation of toxic metals and PAHs** – Urban precipitation is acidic due to nitrous and nitric oxide emissions from traffic and sulphur acidity from power pants and dissolved metals on metallic roofs and downspouts (zinc or copper) and PAH (carcinogenic polyaromatic hydrocarbons) from asphalt shingles and pavements.

- **Erosion of pervious lands and construction sites** – Urban erosion is much higher than natural erosion, reaching magnitudes of more than 50tons/ha-years. (Figure 8)

Figure 8. Erosion of the Sheyenne River in Horace, North Dakota. (Source: Candice D'Arcangeli)

- **Dry atmospheric deposition -** Urban dust, infrastructure deterioration, and pollen are the main source of particles in dry atmospheric deposition. Some of these particles can come from large distances. For example, the atmosphere in Bejing, China, often contains high concentrations of solids originating from the Gobi desert, several hundred kilometers away.

- **Street refuse accumulation and washoff –** Street refuse that accumulates near the curb, in addition to atmospheric dry deposition in the form of street dust, also contains little, dirt from deteriorating roads, organic solids from vegetation (fallen leaves, grass clippings), and animal (pets and birds) feces (Figure 9)

- **Traffic emissions –** Vehicles deteriorate and deposit solids on the street surface, including metals, asbestos, rubber and oils.

- **Industrial pollution deposits –** Heavy industries located in or near urban areas are a source of pollution far beyond their premises.

- **Application of fertilizers and pesticides on urban lawns –** To maintain lush lawns and eradicate all "weed," lawn-care companies and homeowners tend to use much larger quantities of industrial chemicals per area than farmers. (Figure 10)

- **Application, storage and washoff of de-icing chemicals** – Keeping roads in winter free of ice and snow is done at great cost to receiving water, soil, and ecology. The salt content in urban snowmelt after salt applications is extremely high and toxic (Novotny et al., 1999; Novotny et al., 2008; Novotny and Stefan 2008).(Figure 11)

- **Oil and fuel drips on parking lots** (Figure 12)

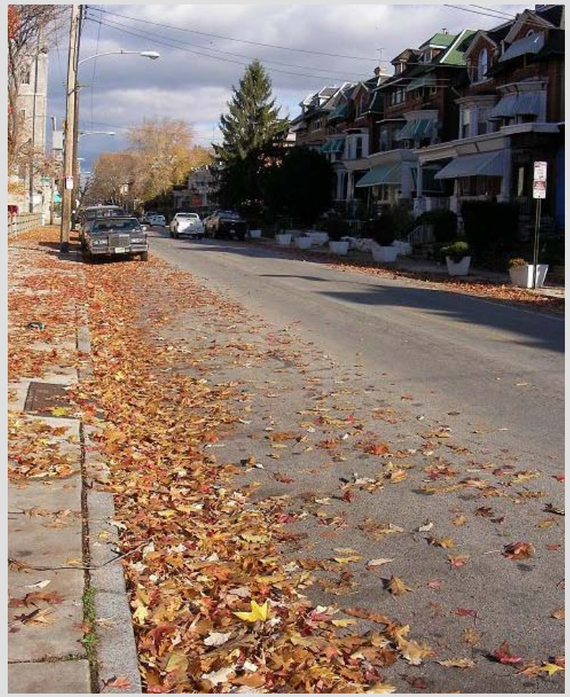


Figure 9. Street refuse collection of leaves on the street. (Source: http://malcolmxpark.org/wp-content/uploads/2007/11/)

Figure 10. Fertilizer being sprayed on a lawn. (Source: http://blog.ocmga.org/)

- **Dry-weather infiltration-inflow (I-I) contributions –** These contributions from various sources are troublesome in most drainage systems. They can be divided into the following two categories:

Polluted:

- Flushing and cleaning impervious areas (dust, vegetation residues, little, pet and bird fecal matter with pathogens)
- Construction site dewatering (sediment)
- Irrigation return flows from watering private lawns, public parks, and golf sources (nitrogen and phosphorus, pesticides)
- Snow and ice melt induced by de-icing chemicals applied on roads and other pavements (very high salinity, toxic metals, cyanides)
- Cross- connections from sanitary into storm sewers (organic matter nitrogen, pathogens)
- Filter backwash form swimming pools

Clean:

- Underground springs and groundwater leaking into sewers (Figure 12)
- Basement dewatering sumps
- Swimming pool and drawdown overflows

- **Illegal entry of pollutants –** Homeowners and small car repair shops sometimes allow car-washing detergents and oil to enter the stormwater inlets.

- **Cross connection of sewage and solids build up in sewers –** Leaking sanitary sewers can contaminate underground storm sewers and culverts and, vice versa, clean water inflows from leaking stormwater and illegal entries of roof drains into sanitary sewers can overload sanitary sewers and treatment plants, causing illegal sanitary sewer overflows. (SSOs)

Figure 11. Salts poured on roads and sidewalks to melt ice and snow during the winter. (Source: http://www.alibaba.com/product-gs/439884022/Ice_Melting_Salt_for_Road_96.html)

Figure 12. Oil from a parking lot during a rain storm dripping into the storm drain (Source: http://www.columbusunderground.com/forums/topic/pollution-mitigation-plans-for-griggs-parkland/)

"According to the EPA (USEPA, 2000b), 45% of all assessed lakes, 39% of rivers and 51% of coastal waters are classified as impaired, meaning that these water do not meet one or more designated uses under the Clean Water Act, with most of this impairment caused by nonpoint sources of pollution." (Baker,2009) This quote makes it apparent that a major portion of water quality is significantly affected by urban populations, and non-point sources. The dilemma with non-point sources is the unrealistic thought that any perfect combination of stormwater management practices will completely clean the water of all pollutants. There are some non-point source pollutants that the system cannot stop and the only way would be for the public to stop using the source that is creating the pollutant. The only way to succeed in that aspect would be to educate people on the impact these non-point pollutants have on the environment and even then it will still come down to a choice for them. A choice, designers cannot control. Therefore there will always be some sort of pollutants impacting the water quality, but being conscious of the pollutants and how it impacts the water quality, steps can be taken to manage the stormwater in ways that minimize the possible negative impacts it will have on the water quality.

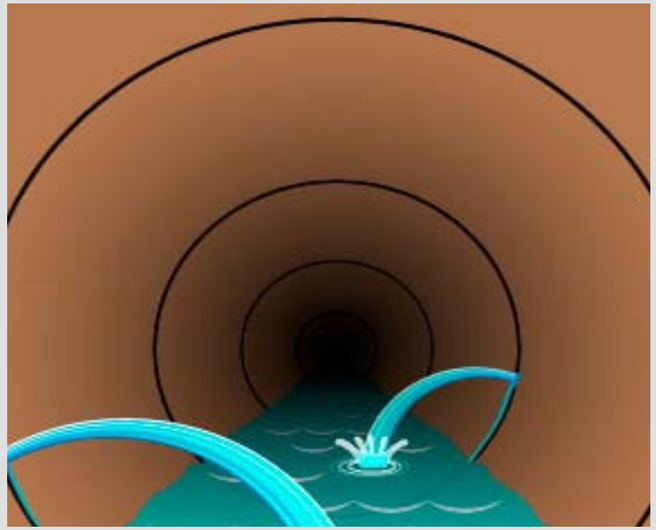


Figure 12. Sewer pipes crack and allow clean water into them or vice versa. (Source: http://caldecottproperties.wordpress.com/2011/07/28/protecting-our-san-francisco-bay-ebmud-regional-private-sewer-lateral-program/)

RESEARCH SUMMARY

Within the last decade Stormwater management water has become a high priority topic among the design world. As civilization has grown and evolved, so has our understanding of our surrounding environment. It is because of this lack of understanding that our current civilization is in the predicament it is in. Technology played a major role in the evolution of humankind and although the technology that has come to be is superb and brilliant, it has come at a price; a price humankind cannot afford much longer. To create technology many resources have been depleted because of the expedient way they have been used. Although it can be argued that humankind was naïve in its development of technology and misused resources, the real question is, have we recognized the problem and started to take steps soon enough to stop this destructive pattern to our environment? The study of better practices of stormwater management system is one such step. Water is probably the most influential element to humankind. We need it biologically to survive, it has aesthetic value, inspires, relaxes, beautifies but can also destroy, erode, create sickness and plague. Yet, through time, we have gradually taken it for granted so much that we are at the point of having contaminated or no more fresh water left for future generations. Therefore, better stromwater management practices need to start to be sustainable in their design, which begins the process of valuing and respecting water once again. My research will focus on three topics to better understand what sustainable management does entail and how it will affect current water quality.

The first topic is sustainability, and although it has become a well known and even overused word in the design world, I felt it was important to fully grasp the subject and be able to explain it better than "it is a design that is self-sufficient." Sustainability requires much more explanation and it is based on the trinity of the environment, society and economics. Sustainability requires a balance of these components for something to be considered sustainable. In history, stormwater practices have never been considered sustainable because of the imbalances within the trinity. Sustainability even goes beyond the present and looks as well to the future. According to Water Centric Sustainable Communities: planning, retrofitting, and building the next urban environment, "Humanity has the ability to make development sustainable-to ensure that it meets the needs of the present without compromising the ability of future generations to meet their own needs" (Novotny, Brown & Ahern, 2010). This advocates the responsibility that we have to future generations because they have as much right to the resources we currently use. This deeper understanding of sustainability will directly affect the outcome of this design.

RESEARCH SUMMARY

The second topic chosen was the research of current stormwater practices and the new upcoming practices. The point of this research was to have a clear understanding how the stormwater management practices evolved into the practices we have now, giving a better understanding of the do's and don'ts of stormwater management. Researching the new upcoming practices will not only directly impact my design by possibly being a part of my design, but also by forming a better understanding of these practices I will be able to implement them properly and in the correct spots ecologically.

The final topic is current water quality and how it has been affected, not only by stormwater management, but also by urban environments. Water quality is most affected by non-point sources throughout the city: sources such as the slats used to de-ice the roads, water run-off of lawns containing the pesticides sprayed on them, quicker erosion along river and stream banks, killing vegetation. These are but a few non-point sources that directly affect the water quality, and eventually water quality will become so bad the water will become undrinkable. These three topics build the foundation for my theoretical premise and will guide me through the steps of utilizing a sustainable stormwater management design that creates better water quality while being an interactive, educational and inspirational design.

10th @ Hoyt Apartment Courtyard

Context

10 @ Hoyt is an apartment complex located in the heart of Portland that sits in Pearl district. This area is prime spot for shopping, restaurants and art. The project was finished while residential developments were booming in the area. In the middle of the apartment complex is an 8,500 sq. ft. courtyard, with the main entrance to the courtyard being a gate on the west side of the courtyard. Surrounding the courtyard are several six-story buildings with apartments on the top 5 floors, and retail space on the ground floor. Portland gets an average of 36 inches of rain each year, therefore the city of Portland requires that any new development projects that have more than 500 sq. ft. of impervious surface manage their stormwater on site. This is exactly what this courtyard does in a creative, unique, and mesmerizing way. This courtyard is a popular get away for the residents of the building, and caught the attention of the public so much so it has become widely accepted among them as a proper stormwater management system.

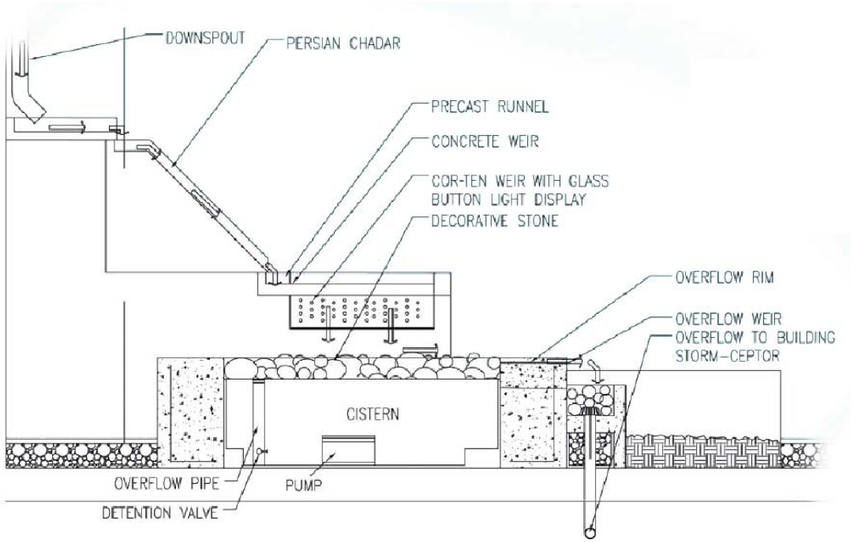
Location:	10th and Hoyt streets, Pearl District Downtown Portland, OR
Date Designed/Planned:	2003
Construction Completed:	March 1, 2003
Construction Cost: Approximately :	$270,000
Size:	8,500 sq. ft.
Landscape Architect:	Koch Landscape Architecture, Portland OR
Client/Developer:	Trammell Crow Residential
Consultants/Architects:	Ankrom Moisan Assosiated Architects, Portland, OR
Managed by:	Riverside Residential

PLAN: STEVE KOCH)

10th @ Hoyt Apartment Courtyard

This project was created by trying to solve different problems: the first being the challenge of creating an aesthetically pleasing, relaxing, and meditational area for the residents of the building. The other was addressing the environmental issues of the stormwater management issues on the site. The designers had to find a way to keep the water on site (function) while using the water to create an interactive and invigorating experience (form). To do this the designers created a detention area underneath the courtyard that would hold the water on site.

This fulfilled two purposes: the first being the sediment in the water had time to settle in the detention area before joining the city stormwater management system and the second was that they were then able to use the water as a display within the courtyard through fountains over planter boxes. The water would be held for 30 hours after the storm, giving the residents 30 hours of the harmonic sounds of running water. The designer, Steve Koch, got his inspiration for the design from Persian gardens. The Persian gardens would display water through the use of fountains and the people there loved to meditate and relax among the sounds the water made which helped to block the sounds from the outside world. According to Steve Koch "You can do a lot of things to mitigate the impacts of stormwater, but typical and mostly mechanical methods provide no culture or aesthetic function; the function here is detention and human delight."



(PHOTO: LANDSCAPE ARCHITECTURE MAGAZINE)

Lewis Avenue Corridor

By SWA

Lewis Avenue Corridor is located amongst the downtown area of Las Vegas, Nevada. Las Vegas is an area that gets visited by over 36 million people a year while the residential population is close to 558,383. The challenges of this design include the arid climate, heat and exposure to the sun for the pedestrians and stormwater management of the site. Currently Las Vegas gets about 10.1 centimeters of rain throughout the year while in the summer average heat is 104 degrees Fahrenheit. This being the conditions of the site SWA had to create a design that incorporated plants that didn't require much water while being able to provide shade for the people walking through this corridor.

The other challenge was managing the stormwater the site does have in a sustainable and aesthetically pleasing way. The unique part of this design is the way the water is incorporated at different levels and how the texture of the materials connects with the water. The different levels vary depending on how much water is on the site, and the stormwater management site is large enough to manage large or small amounts of water depending on the size of the storm, which is a typical factor of storms in the desert area

Location:	Downtown Area, Las Vegas, Nevada
Planned:	2003
Size:	3,500 sq meters.
Landscape Architect:	SWA
Client/Developer:	U.S. Federal Courthouse

Lewis Avenue Corridor

This case study connects with my thesis idea because of the stormwater management systemcreated on the site that is both interactive to the people walking through the corridor, while creating places of high imageability. Walking through the corridor people are surrounded by materials that create the abience of a desert while having the ability to see the stormwater being captured after or during storms. These features create a cool, refreshing, and relaxing walk in the midst of summer heat, making their walk through the corridor a place of rememberance of the soothing emotions that gets them away from the busy, show biz life of Las Vegas.

Ile de Nantes

The Ile de Nantes is located in Nantes France opposite the historic city center of 570,000 inhabitants. Within this island there are 3 variable districts and identifiable districts: the industrial port area to the west (Figure 1), the central suburban area, and the urbanized area. The goal of this project is to keep the originality of the landscape, such as its docklands and industrial tradition, add to the economic development, create an alternative to urban sprawl, renew the relationship of a city with its river, and to rethink public space.

While these are the goals of the project, this case study relates to my thesis, in the way that they are not only managing but trying to create high urban densities and using inventive landscapes to keep the island green. Because my site is one of the most dense neighborhoods in Minneapolis this case study will be useful in demonstrating the sustainable ways to design in a dense area.

Also this island is surrounded by water, making stormwater management a vital issue to the ecology of the water, because the runoff is literally going straight to the water. So the inventive ways they manage the stormwater runoff will be good examples and design inspiration for the ways in which stormwater runoff can be managed on my site.

Location:	Nantes, Frances
Planned:	Current Project
Size:	337 Hectacres.
Landscape Architect:	SAMOA
Client/Developer:	City of Nantes

Figure 1.

Masterplan

Image Sources: ÉCO-QUARTIER DE LA PRAIRIE AU DUC -Un quartier dans un parc,
http://www.claudinecolin.com/en/archives-89-ile-de-nantes-urban-project

CASE STUDIES SUMMARY

URBAN WATER

The three case studies were chosen for my project because of the unique stormwater management systems they created. Each study have completely different problems they had to deal with, the biggest difference being climate. 10 @ Hoyt had the problem of having excess amounts of water consistently, whereas Lewis Avenue and very sparatic rain storms with unpredictable amounts of water and Ile de Nantes was consistantly surrounding by water and had to worry about flooding. 10 @ Hoyt used fountains to show off the water and colored gems at night to illuminate it, while Lewis Avenue created multiple levels of interaction for the people walking through the site depending on the amount of water that was there, if there even was any. Then Ile de Nantes had the challenge of bringing people to the water to interact with it and see it. These three sites where successful in creating interactive, educational experiences for the people who used the site. and were able to use waters' qualities of beauty, grace and inspiration.

HISTORICAL CONTEXT

The Connection Between Humankind and Water

Water has been an element intertwined with humankind since the beginning, so to try and date the beginning of its existence would be trying to date when mankind first came to be. For the purposes of this study we will say that the existence of water and humankind came hand in hand. Water is part of our human biology; it keeps us alive; we are 65% water; a person could not survive more than a mere few days without it. But what other connections do we, as human beings have with water?

We have the biological connection that makes us thirst for it physically, It has the power to rejuvenate our bodies but does it not also have the power to rejuvenate our mind and souls? According to the book, Water: The Use of Water in Landscape Architecture, "with it we can survive, create civilizations, play with it, and make works of art to express the joy of living." And yet again Brain Fagan who wrote Elixir: A history of water and Humankind states, "Water it caresses and comforts us, provides sustenance and refreshment, is something that humanity has cherished since the beginning of history and means something different to everyone.... Water evokes serenity, harmony and peaceful existence, the very essence of life, and is commemorated by grand shrines and elaborate rituals of honor of the deities that ensure the continuity of water – and life itself."

Water is intertwined in so many crevasses of the human life but yet as time has gone on humankind has gradually begun to take advantage of it. According to Rachel Carlson, "In an age when man has forgotten his origins and is blind even to his most essential needs for survival, water along with other resources has become the victim of his indifference." This indifference has grown through time but did not always exist. In history water was cherished, praised, and valued in every way possible, and now it is taken for granted and considered a never ending resource. This historical context seeks to show the historical connections between humankind and water, reminding current societies of the beauty, vibrancy, and significance of water.

Figure 1. Temple of Sybil, Tivoli, today. (Source: http://www.romeartlover.it/Tivoli.html)

Figure 2. Tivoli cascade falls in Italy. The water erodes the rocks and creates forms. (Source: by Ricky David, Flickr)

HISTORICAL CONTEXT

The history of water and humankind has had a unique journey together, to humankind water was a sacred gift to be praised and not a single drop wasted. Early civilizations lacked the technology to have easy access to water therefore water defined societies, and gave power those who had access to it, and as humankind evolved so did technology. Humankind's notions of water changed with the industrial revolution, when water was suddenly an easily accessible resource; from that point on any civilizations that excelled after the industrial revolution had harnessed water and considered it a never ending resource. Fagan (2011) concluded "that humankind and water have gone through three stages from the beginning of its existence till now, each overlapping with each other at some point." (preface xv)

The first stage happened in the distant past and still exists in some places today. At this stage water was an unpredictable resource, often scarce and sacred to many societies. The second stage made a start about two thousand years ago, quickened during the Middle Ages, and reached its climax during the industrial revolution. Water became easily accessible through technology and the ability to pump water from deep underground aquifers and transport it over long distances with much ease. Cities no longer needed to be built close to water sources to survive and flourish. Now during the twenty first century we are in the third stage, humankind finally coming to the realization that water is a resource that will run out and something that should be respected and not taken for granted any longer. (Fagan, 2011, preface xix)

Figure 3. Fortana di Trevi, Rome inspired from the chasm of Tivoli. "Man is the center of the world that comprehends and unites civilisied architecture and wild rocks." (Source: Edwin11 Flickr)

Figure 4. Chateau de Chenonceau a poetic connection between building, bridge and water (Source: http://www.travelfusion.com/blog/2010/06/11/travel-discovery-frances-loire-valley/)

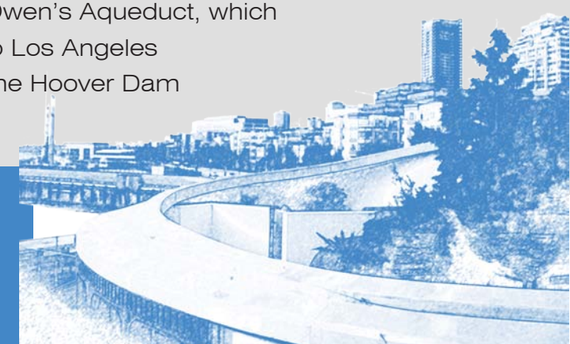
HISTORICAL CONTEXT

Although these three stages do not have exact dates of their beginning and end, the table below (Table 1.) does show the major water developments and events over time, giving a timeline association with the three stages. These stages though broad, do show the clear changes in the connection between humankind and water as time has moved on.

Major Water Developments Timeline

c. 10,500 BCE	Agriculture on the Near East
Unknown date	Earliest efforts at furrow irrigation
Before 7000 B.C.E.	Earliest known well in Cyprus
Before 5000 B.C.E.	Furrow irrigation in Wadi Faynan, Jordan Irrigation in Choga Mami, Iraq
Before 4500 B.C.E.	Irrigation agriculture well established in southern Mesotpotamia and Egypt
3800 B.C.E.	Southern Mesopotamia becomes drier
c. 3100 B.C.E.	Sumerian (Mesopotmian) and Egyptian civilization come into being.
2700-1900 B.C.E.	Mature Harappan civilization in the Indus Valley
c. 2000 B.C.E.	Extensive irrigation works by the pharaohs in Egypt's Fayum Depression
c. 1600 B.C.E	Sophisticated water management at the Minoan Palace of Minos, Knossos, Crete
c.1500 B.C.E.	Maize agriculture and irrigation in the American Southwest
883-859 B.C.E.	Assryians monarch Assurnasirpal II builds canals, a tunnel, and irrigation works at Kalhu (Nimrud), northern Iraq
714 B.C.E	The Assyrian ruler Sargon II admires a qanat in Urartu, Iran, the first record of such a water device
704-681 B.C.E.	Assyrian king Sennacherib's irrigation works at Nineveh
6th Century B.C.E.	Marib dam, Yemen, constructed
594 B.C.E.	Solon promulgates water regulations in Athens
560 B.C.E.	First large-scale Chinese canal digging
After 550 B.C.E.	Qanats spread with the Achaemenid Empire (550-330 B.C.E.)
530	Eupalinos constructs his water tunnel in Samos
312 B.C.E	Aqua Appia, Rome's First Aquaduct, built
300 B.C.E.	Ptolemy I Soter founds a library and museum in Alexandria, an important center of technological development
258-237 B.C.E.	Major drainage and irrigation works in Egypt's Fayum under Ptolemy II and III
256 B.C.E.	Construction of the Dujiangyan irrigation system, Sichuan Province, China (still in use)
1st Century B.C.E.	Vertical waterwheels widespread in the eastern Mediterranean world
25 B.C.E.	Marcus Vitruvius Pollio publishes his De Architectura
50	Segovia, Spain's aqueduct constructed
97	Sextux Julius Frontinus appointed water commissioner for Rome
c.400	Possible irrigation agriculture in Bali, known to be well established by the 8th century
c.450	Hohokam farmers in the American Southwest
1300	Overshot water mills in widespread use in medieval Europe
c. 16th century	Irrigation of Engaruka, Tanzania. Similar furrow irrigation probably well established elsewhere in sub-Saharan Africa by this time
1696-1771	Life Span of Chen Hongmou, influential Chinese irrigation expert
1752	Primitive Newcomen steam engines pump water for London
1753	Frederick the Great completes drainage of the Order Marshes
c.1762-64,1769	Invention of the spinning jenny and water frame for cotton spinning
1776	James Watt develops the first commercially viable steam engine as part of the Industrial Revolution
1907-1924	New York's Catskill Aqueduct system developed
1913	Opening of the Owen's Aqueduct, which supplied water to Los Angeles
1931-36	Construction of the Hoover Dam

Table 1. Major Water Developments adapted from Fagan B. (2007)



HISTORICAL CONTEXT

In the first stage humankind appreciated the many attributes of water. One such attribute being its poetic nature; whether its the never ending movement of waves, reflections of the mountains on the surface or the soothing noise of it cascading down a waterfall (Jellicoe, 1971 pg.10). “It is romantic: romance liberates the imagination and relieves frustrations” (Jellicoe, 1971) Romans appreciated this nature of water and took advantage of it. An emperor of Rome slept at the temple of Sybil in Tivoli, Italy which stood at the top of a cascading waterfall to cure his insomnia. (Figure 1) This same waterfall also inspired sculptors through the rock formations the water created at the bottom of the waterfall. (Figure 2 & 3) In France Chateau de Chenonceaux in Loire Valley, France (1515-23) created a poetic medieval design by merging building and bridge together. (Figure 4) Water has the ability to inspire humankind no matter what form it takes.

Which brings about the philosophical connections humankind has to water; humankind has studied, contemplated, and tried to create intellectual connections to the water. Whether it is through active water like the Persians used to create their garden oasis’s (Figure 5) or the still reflective waters of the Taj Mahal in India. (Figure 6) According to Water: The Use of Water in Landscape Architecture, “Quietness and action are together the essence of all water design. Each has philosophy of its own and the two are most beautiful when seen in combination.”Throughout history you see examples of both, separate, and combined. As civilizations advanced they started to take advantage of gravity and used it to move water, and make it active. This advancement inspired many designs and gardens. The Palazzo Reale, in Caserta Italy takes a stream along a mountain side and creates an exuberant and enticing visual of water flowing down the mountain for over two miles. The water cascades in a staircase fashion which allows people to walk along it and be lulled into relaxation by the sound of running water. (Figure 7 & 8) This water feature also has some beautiful sculptures that are unique and tell a story as you walk along it.

Figure 5. Persian Garden Oasis (Source: http://www.impress.is/2011/06/unesco-adds-persian-garden-to-world.

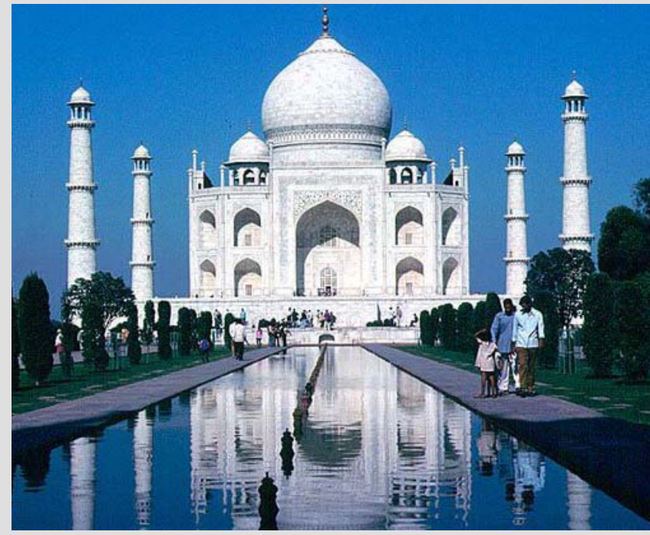


Figure 6. Contemplative waters at the Taj Mahal. (Source: http://ccdc11.wordpress.com/2011/05/01/the-design-of-a-monument-the-taj-mahal/)

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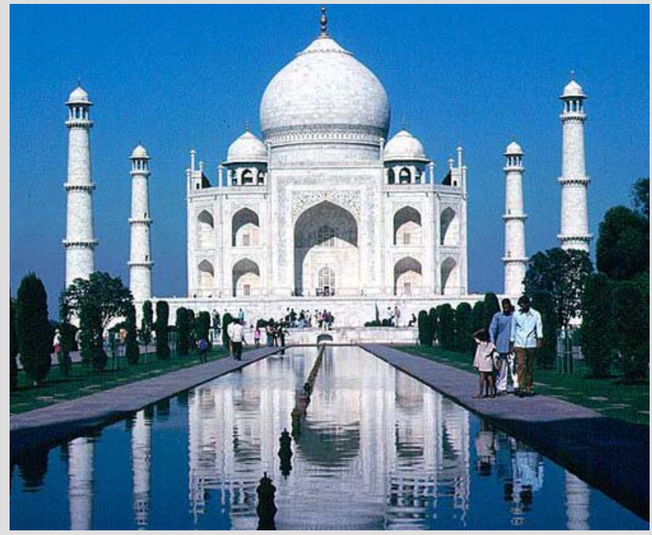


Figure 6. Contemplative waters at the Taj Mahal. (Source: http://ccdc11.wordpress.com/2011/05/01/the-design-of-a-monument-the-taj-mahal/)

HISTORICAL CONTEXT

The advancement in understanding gravity also gave humankind the ability to irrigate larger amounts of crops. The invention of irrigation was a huge feat for humankind; people no longer had to live in question of when the next rainfall would be. Would it be enough rain? Societies were able to develop and grow around these irrigation areas. Civilizations around Mesopotamia, the Nile, and the Indus River of South Asia were the power civilizations because of their access to water and their ability to irrigate. Water gave power to men. One civilization used gravity to water their crops in a unique way compared to the typical canals most other civilizations where using. The Indians of the Kashmir rice fields (Figure 9) created tiers of fields allowing the water to seep from one level to another slowly watering the plants, each level being created by the contours of the land. Although this was created for functional reasons it still has the poetic nature of water in it, each level looking like waves upon the sea.

Then as the industrial revolution came about so did the change of appreciation for water by humankind. Water was no longer difficult resource to get a hold of. It needed to be shown off, splurged, and displayed. Water still influenced people, inspired them, they still found comfort in water, it still impacted the mind. What was lost was the fear of not having it; they no longer had to worry when it would rain, if it would be enough for them to live off until the next time. These worries had vanished and over time had been replaced with a worry free lifestyle when it came to water.

This attitude is just starting to change while we enter the 21st century and modern societies need to be reminded once again of the true value of water, an element that can be so destructive and powerful, yet so graceful and life giving. As the connections of humankind and water have progressed and changed throughout history we have seen the stages humankind has gone through. Water is a life giving source that humankind has appreciated, respected and taken for granted. Our society now has the opportunity to learn from our predecessors and take advantage of the positive effects water can have on our mind, body and soul.

Figure 7 & 8. Chateau de Chenonceau a poetic connection between building, bridge and water (Source: http://www.travelfusion.com/blog/2010/06/11/travel-discovery-frances-loire-valley/)

Figure 9. Kashmir rice fields (Source: Umair Shafiq Mughal, Flickr)

GOALS

Academic:

Through the research and design I hope to provide more insight into the interaction between water and humankind. Creating a design profound enough that it arouse interests those poorly educated on the current issues we have with the environment. Hopefully pushing people to make a lifestyle choice that betters the environment and the water quality as it stands today.

Professional:

My professional goals is to create a design that would have the qualities of a professional. The those in the professional world can take what I have researched and designed serious and usual to the current professional world.

Personal Goal:

My personal goal to a truly unique and invigorating experience for the residents of Stevens Square Neighborhood I want them to feel a part of the urban landscape while enjoying and learning to appreciate one of lifes most precious elements, water.

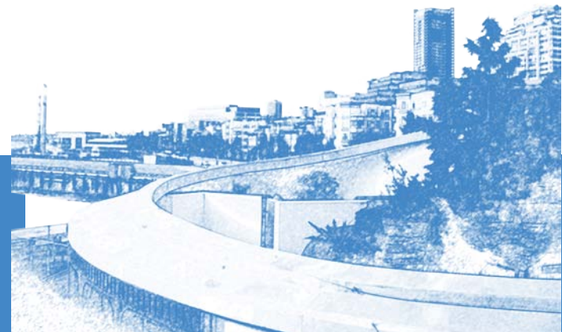
SITE ANALYSIS NARRATIVE

Stevens Square neighborhood is located in Minneapolis, Minnesota just west of the downtown area of Minneapolis. Although not close enough to feel the vibrancy of the downtown atmosphere, it is a neighborhood containing the vibrancy of a young generation that work in the downtown area and live there because of its close proximity. In plain view, Stevens Square neighborhood has a unique shape on the west side of it, created by Interstate 94 which is the boundary on the west side of the neighborhood. It creates an S form contrasting the east side of the neighborhood to the other neighborhoods surrounding it which take the typical square block form. Looking at the texture of the plan you see hard, impervious urban textures while your eye is drawn to the one green spot in the neighborhood, Stevens Square Park. This park is located in the center of the neighborhood and contrasts the urban textures around it just by its green color.

If you were to walk along the streets of the neighborhood you would feel that topographically everything is fairly flat and easily walk able. As a pedestrian the street scale makes you feel safe and secure, to your left you have parking strips and boulevard trees that protect you from traffic driving by while providing shade but not completely blocking you from the sun and to your right you have buildings that average a height of four to five stories and worn down brick textures that give an old neighborhood feeling. The only change in topography throughout the neighborhood is Stevens Square Park which looks a little hill you would want to climb as a child. The peak of the hill is the center of the park giving a completely new outlook of the neighborhood. You are standing there feeling safe because you can see so much, so can see what is happen in every corner of park and the buildings across the street but at the same you feel completely vulnerable standing at the highest point topographically within the neighborhood where everyone else can you see you. I imagine the feeling would be if you were stuck in a snow globe, feeling safe within your globe but uncomfortable because you know someone is just sitting there watching you.

The height of the buildings and trees through Stevens Square neighborhood create a comfortable lighting quality, the buildings provide protection from the sun but do not hinder the quality of the light, rather the sun illuminates the textures and materials of the buildings and the leaves on the trees, especially during the fall when they are changing colors.

View from the center of Stevens Square Park looking towards the north west corner of the park (Source: Candice D'Arcangeli)



SITE ANALYSIS NARRATIVE

Stevens Square is an urban neighborhood so the only vegetation people encounter are the boulevard trees, any vegetation throughout the park and the vegetation separating the neighborhood from the interstate. The only strong connection this vegetation makes too people is the trees, when providing shade and during the fall when the leaves change colors. Walking along the streets in the neighborhood during a windy day, the density of the buildings would be high enough that the buildings would protect you from the wind. The only area wind would be the strongest is Stevens Square park because it is higher topographically and open. The only way you would be protected from wind while in the park would depend on where the wind would be coming from. For instance, if the wind was coming from the west you would be protected from the wind on the bottom of the hill on the east side.

The high walkability of certain streets in the neighborhood and the park create a high pedestrian use environment in the neighborhood, many people in the community enjoy getting off of work and going for walk, escaping to the only vegetative place within miles, Stevens Square Park. This park is a place of refuge, relaxation, and unwinding from a long day of work. The human interaction throughout the neighborhood is highest during the evening after 5pm but because of its close proximity to the downtown Minneapolis area many people do come back the area for their lunch break. Therefore over all there are peak times of human interaction in the neighborhood and consistent human interaction no matter what time it is.

One distressful part of the neighborhood is the mid-west part of the neighborhood where an abandoned building and parking lot are located, although the vegetation around the building add an interesting aesthetic to the streetscape, it does make the streetscape feel a bit unsafe. It also has a fence surrounding it which creates adds an ugly aesthetic to the building and ruins the conformity and unity it shares with the other buildings.

View from the northeast corner Stevens Square Park looking towards the southeast corner of the park (Source: Candice D'Arcangeli)

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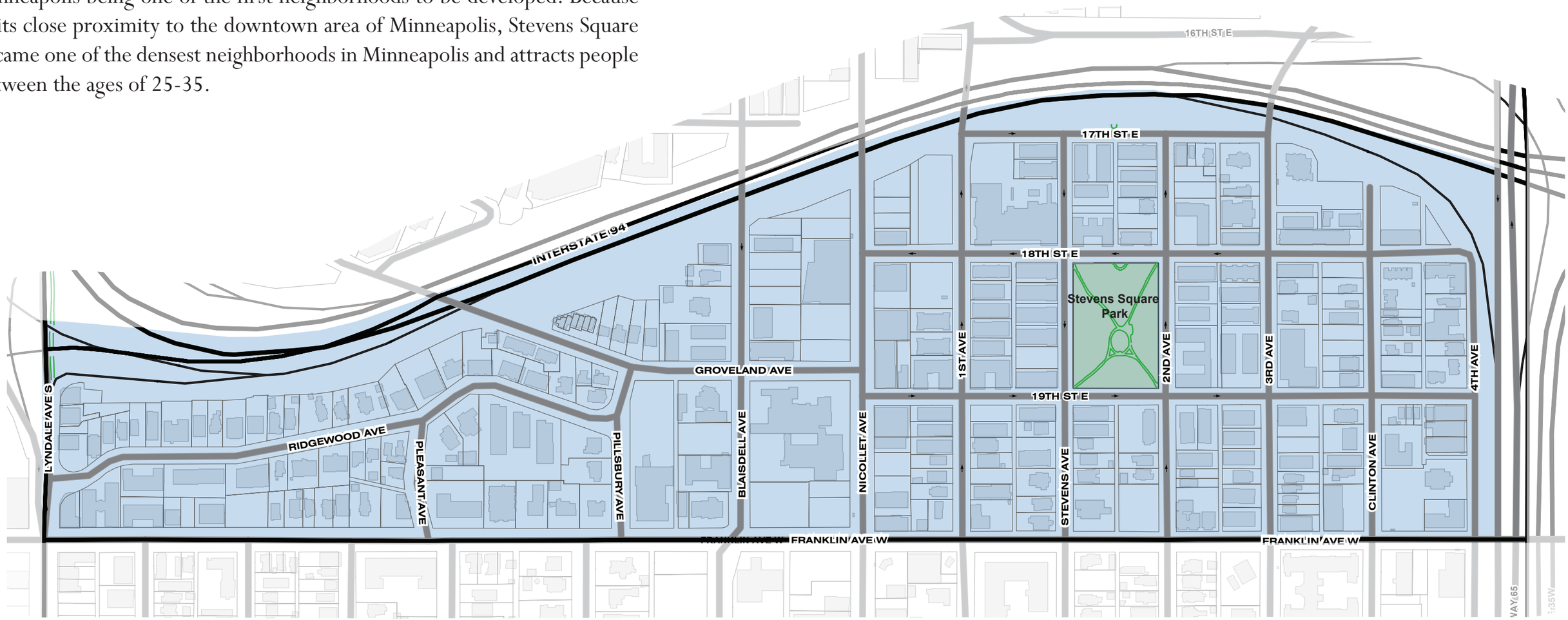
View from the center of Stevens Square Park looking towards the north west corner of the park (Source: Candice D'Arcangeli)

SITE INVENTORY/ANALYSIS

Stevens Square neighborhood is a historic neighborhood to the city of Minneapolis being one of the first neighborhoods to be developed. Because of its close proximity to the downtown area of Minneapolis, Stevens Square became one of the densest neighborhoods in Minneapolis and attracts people between the ages of 25-35.

Downtown Minneapolis



SITE INVENTORY/ANALYSIS

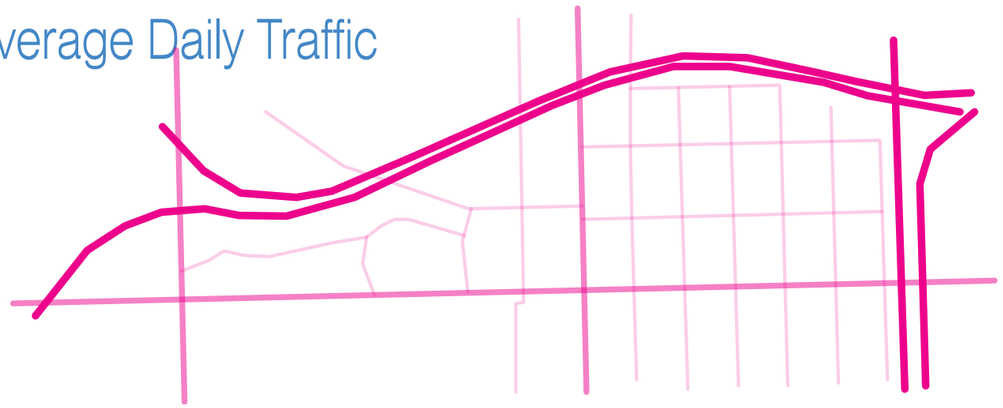
STEVEN SQUARE ROADS

Major Roads
(Interstates and Highways)

Minor Roads
(High traffic city roads)

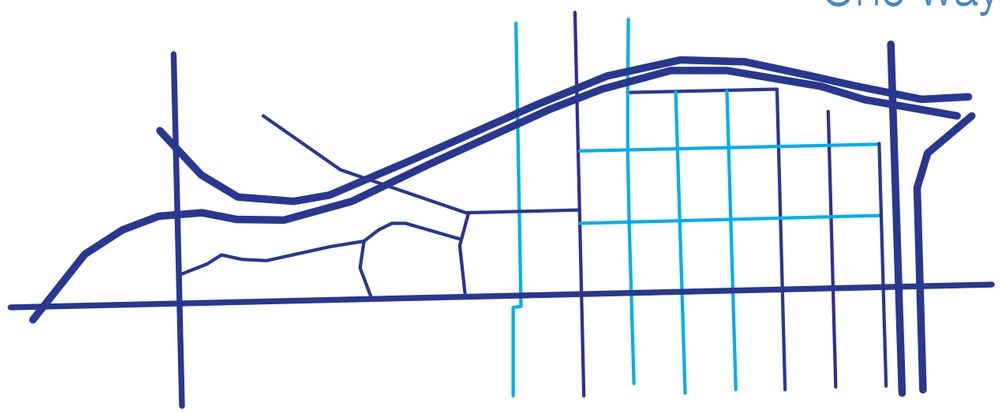
Arterial Roads
(Distribution Roads)

Average Daily Traffic



200,000 cpd **15,000** cpd **8,000** cpd

One ways



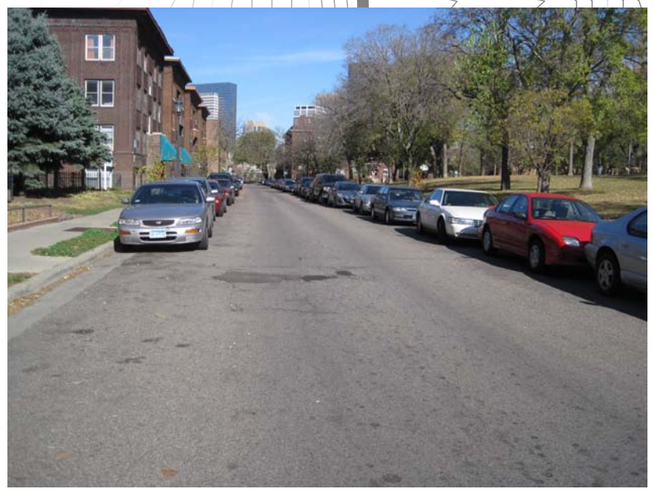
One ways **Two ways**

SITE INVENTORY/ANALYSIS

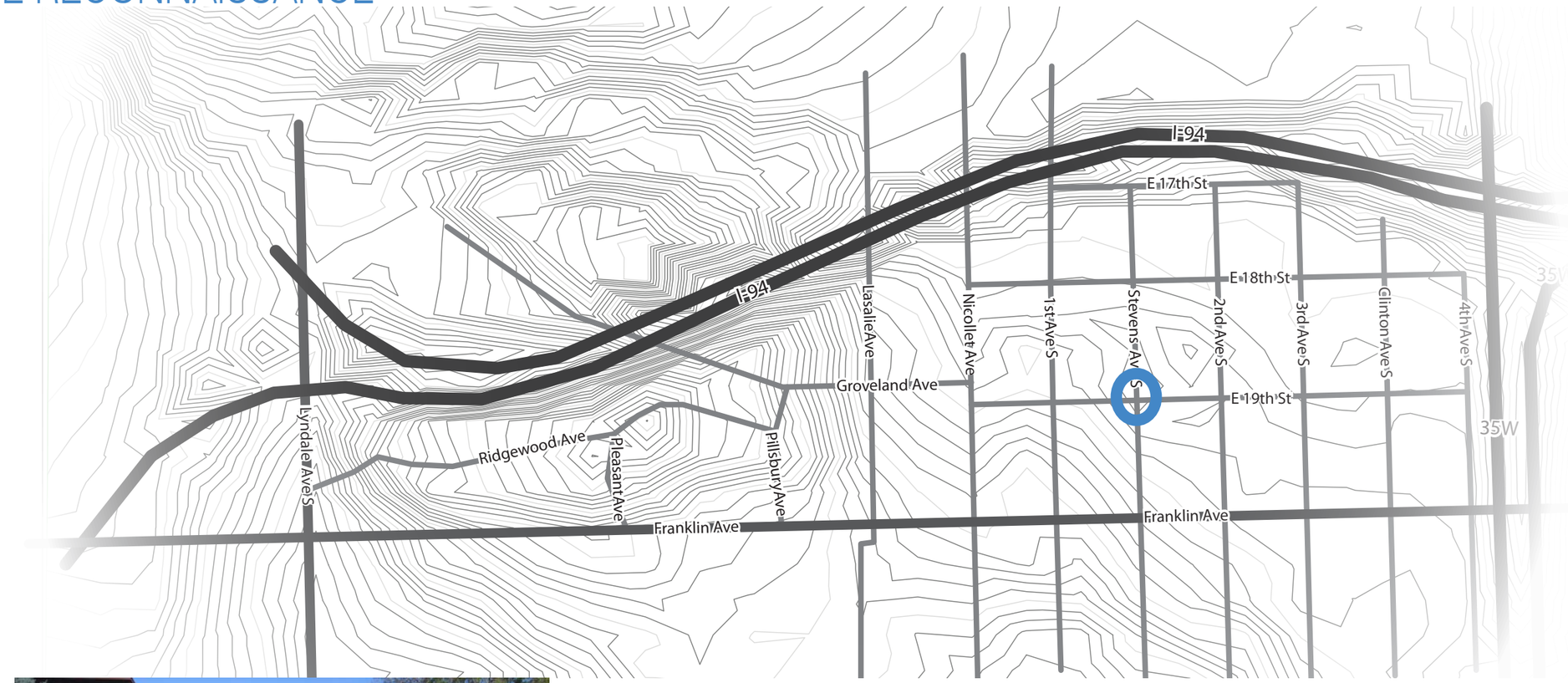
SITE RECONNAISSANCE

West View - from the corner of E 19th St and Stevens Ave S.

East View - from the corner of E 19th St and Stevens Ave S.



North View - from the corner of E 19th St and Stevens Ave S.

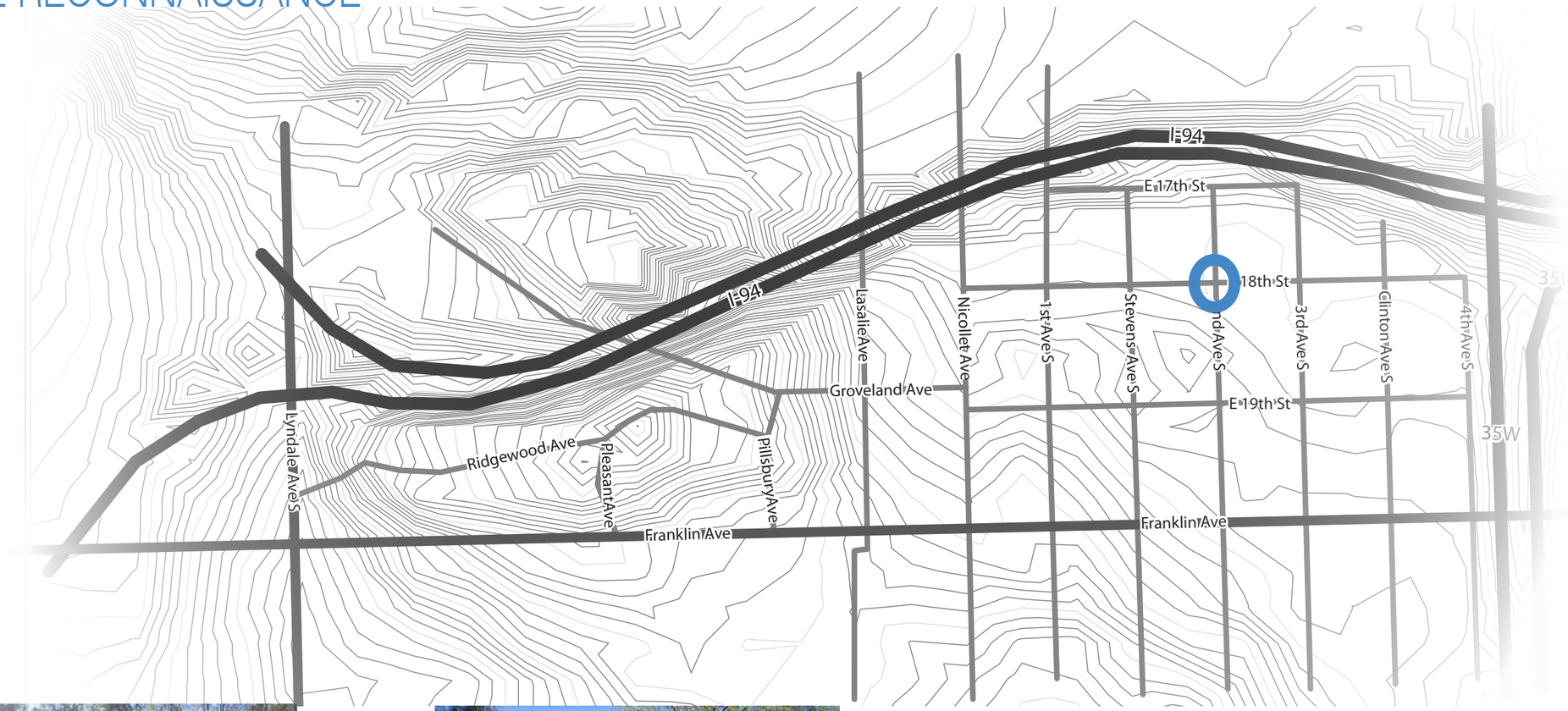


SITE INVENTORY/ANALYSIS

SITE RECONNAISSANCE

North View - from the corner of E 18th St and 2nd Ave S.

South View - from the corner of E 18th St and 2nd Ave S.



West View - from the corner of E 18th St and 2nd Ave S.

East View - from the corner of E 18th St and 2nd Ave S.

SITE INVENTORY/ANALYSIS

STEVENS SQUARE NEIGHBORHOOD HISTORY

1849 - Col. John Harrington Stevens settles in the now designated historic district of Stevens Square.

1889- Up until the late 1880s Stevens Square was mostly used as farm and nursery land.

1896 - Col. John Harrington Stevens house is moved to Minnehaha State Park. The house he built is considered to be the first house ever built in the city of Minneapolis.

1907 - The Land on which Col. John Harrington Stevens house was built on was given to the city and turned into current day Stevens Square park.

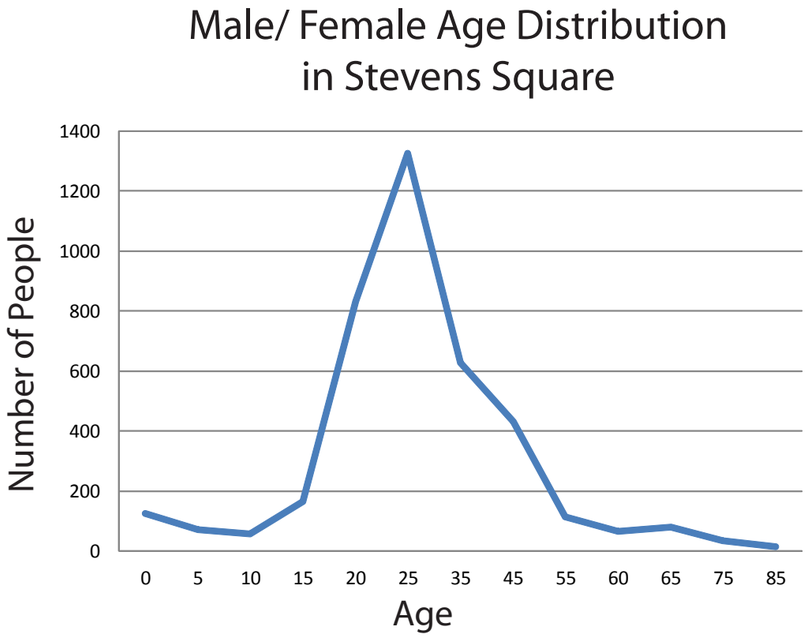
1910-1920s - Due to the growing downtown job opportunities young single workers came to the rural areas of Minneapolis and Stevens Square accommodated this need and built 3-story apartments and small unit housing.

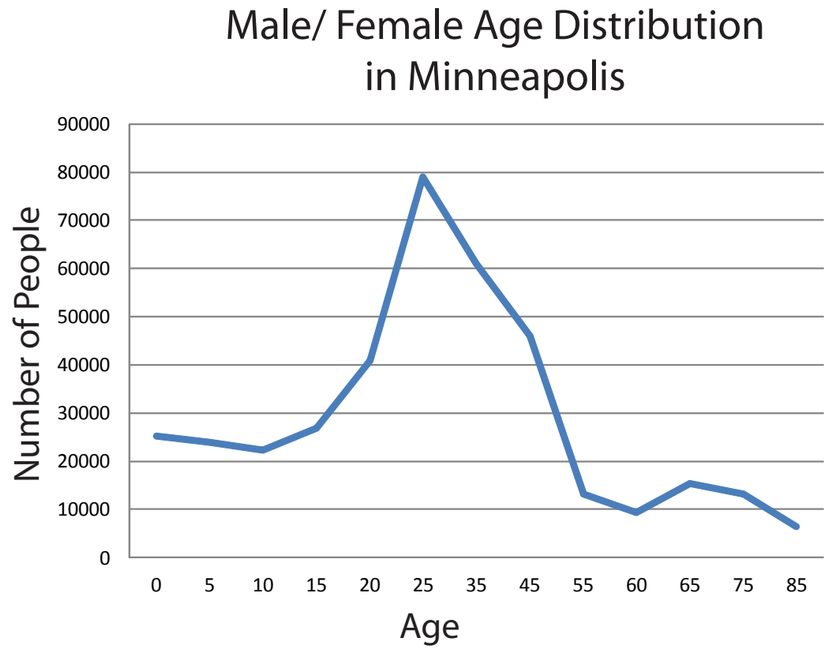
1939 - The original inhabitants of Stevens Square where mostly middle income downtown workers, consisting of mainly women. After World War II when people started moving to the suburbs, the income decreased in the area and the buildings in Stevens Square began to deteriorate. A progression that continued until the 70's

1970 -1980s - Because of the decrease in income in the neighborhood and the introduction of crack, Stevens Square had a high crime rate and was not considered a safe neighborhood.

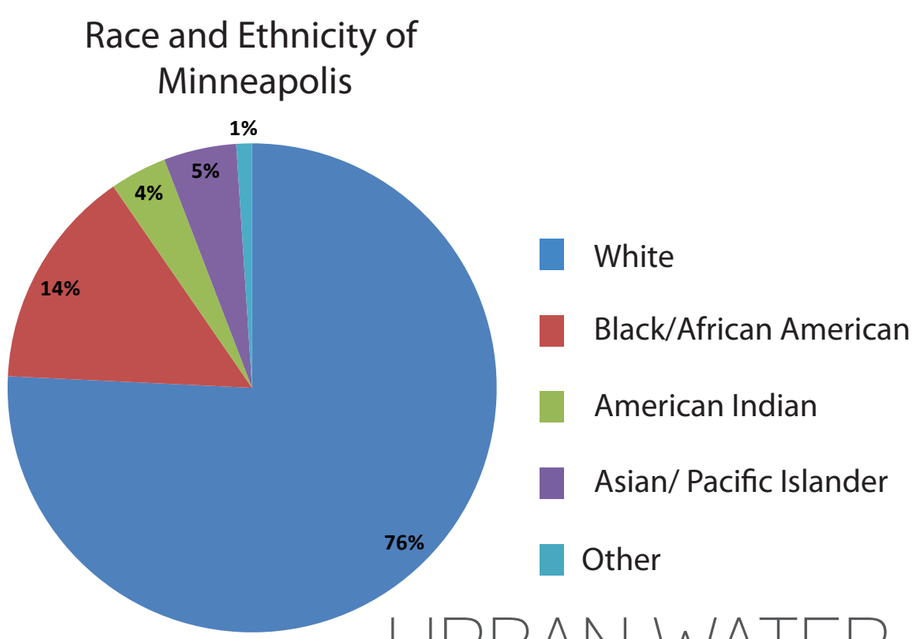
1990s - Present - Stevens Square Neighborhood has been in the process of revitalizing the area and trying to rid itself of the high crime rates and drug use that existed in the 80's. Currently the drug use and crime rate are already much lower than they were in the 80's.

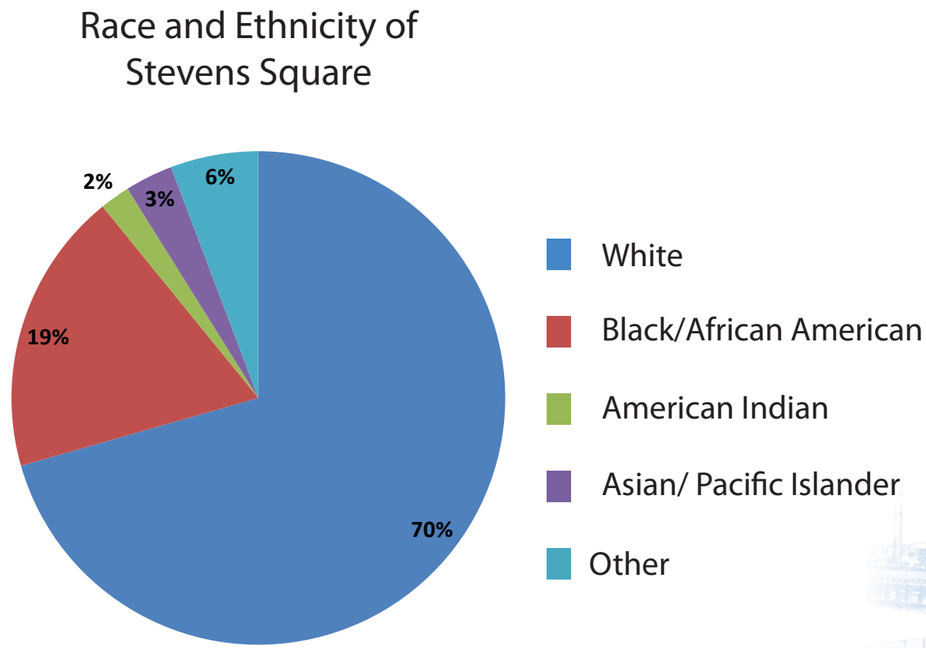
SITE INVENTORY/ANALYSIS - DEMOGRAPHICS



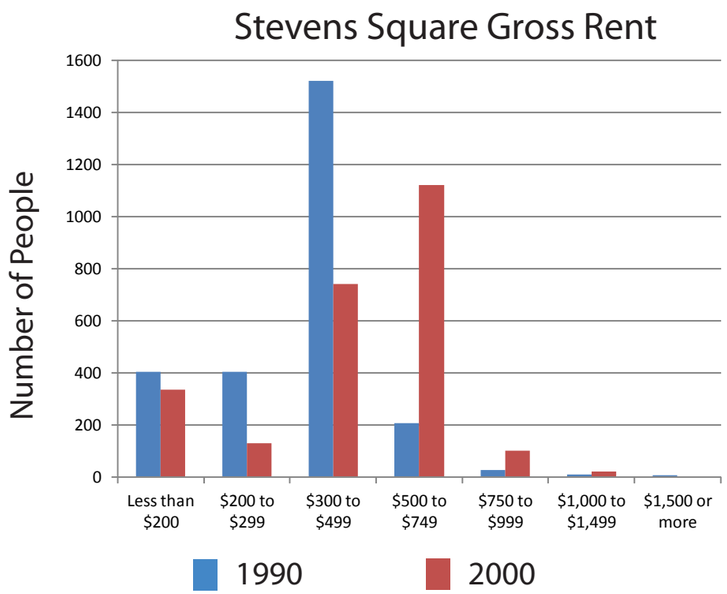


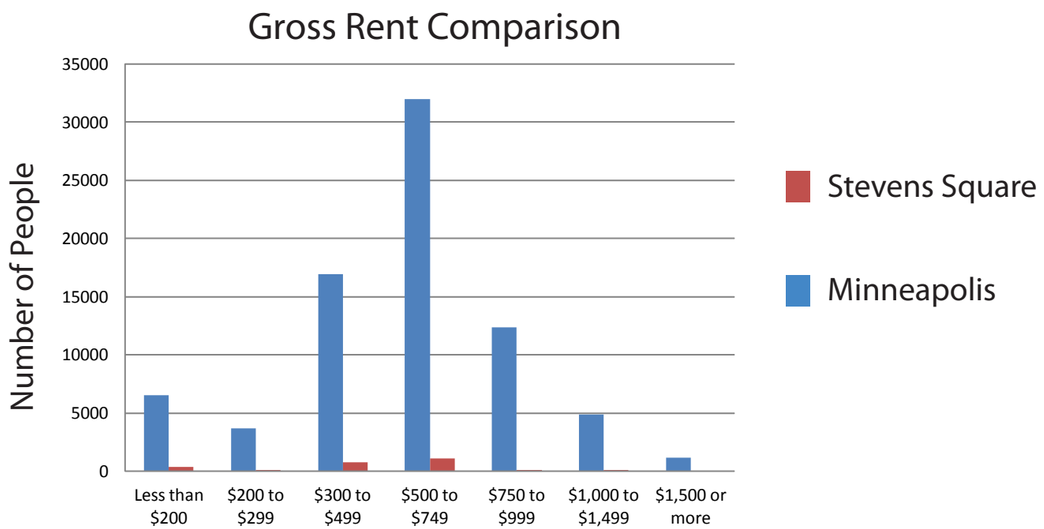
Two conclusions can be drawn from comparing the Age Distribution graphs. First that Stevens Square lacks age diversity within its neighborhood which could potentially effect the overall sustainability of the neighborhood. Second because the majority of the population is between 25 and 35 they are physically more capable of being able to walk further distances to reach their destination.



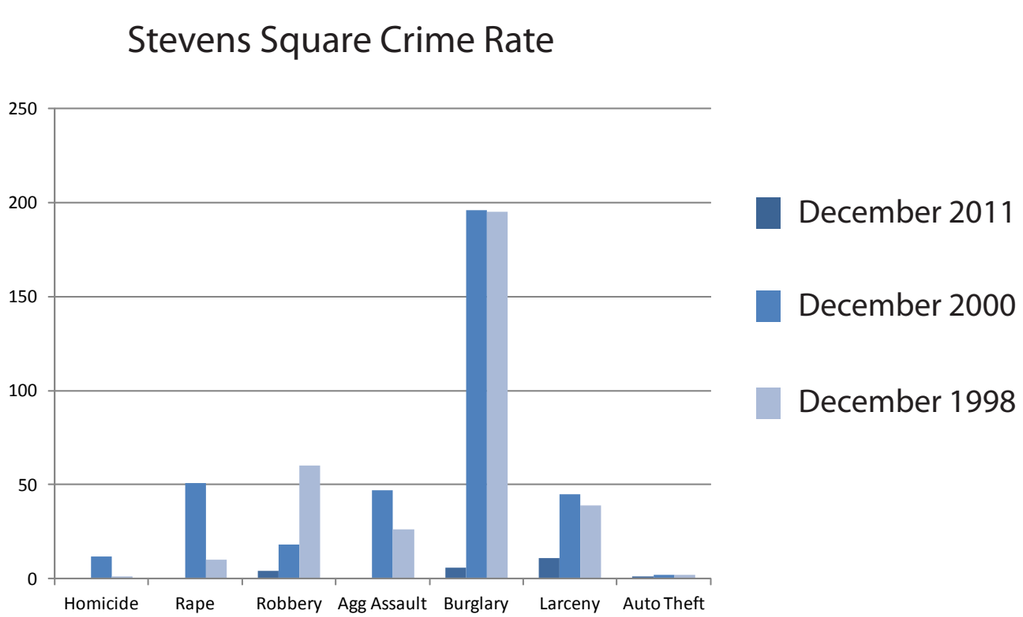


SITE INVENTORY/ANALYSIS - DEMOGRAPHICS

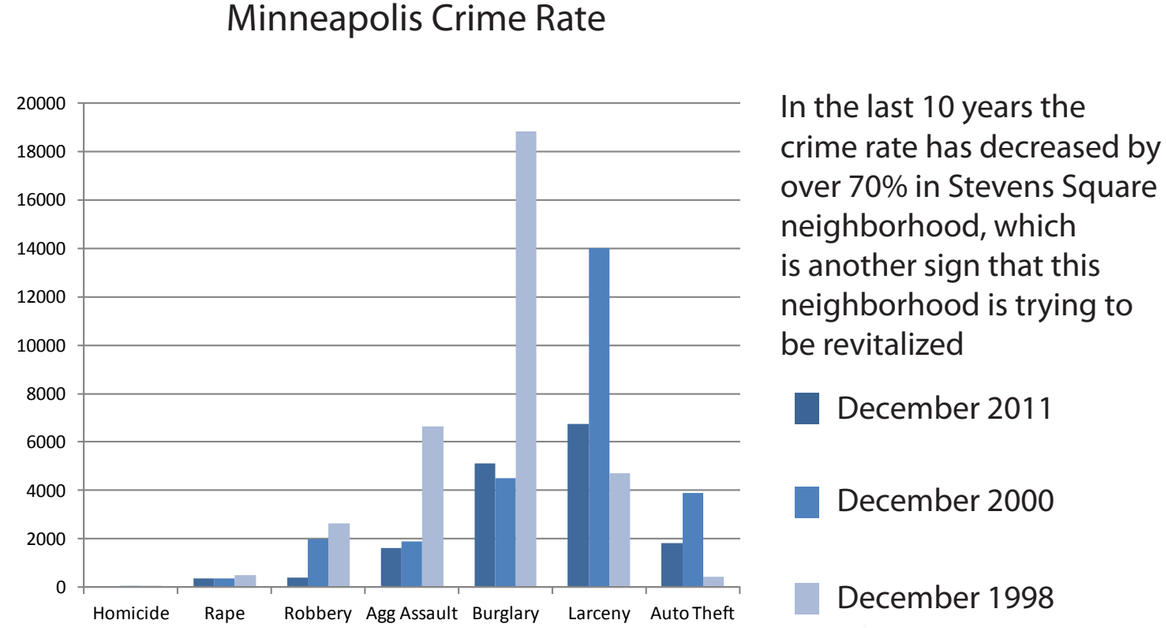




Since 1990 the Gross rent for apartments in Steven Square neighborhood has increased which means the value of the building is increase as well as the income of the people living in the neighborhood.



Source: http://www.minneapolismn.gov/census/



In the last 10 years the crime rate has decreased by over 70% in Stevens Square neighborhood, which is another sign that this neighborhood is trying to be revitalized

December 2011

December 2000

December 1998

SITE INVENTORY/ANALYSIS - BUILDING USE

Building Use Key

- Parks
- Vacant
- Residential
- Apartments
- Commercial

Most of the building use within Stevens Square is being utilized for apartments. Although there are residential areas most of the houses are being rented out.

0 250ft 500ft 1,000ft

Date of Local Disignation:
1989

Date of National Designation:
1993

http://www.minneapolismn.gov/hpc/landmarks/hpc_landmarks_stevens_square

SITE INVENTORY/ANALYSIS

Typical victorian style facade for houses in the neighborhood

Two Building Types

Typical red brick facade for apartments in the neighborhood

Pictures taken by: Candice D'Arcangeli

Building Heights

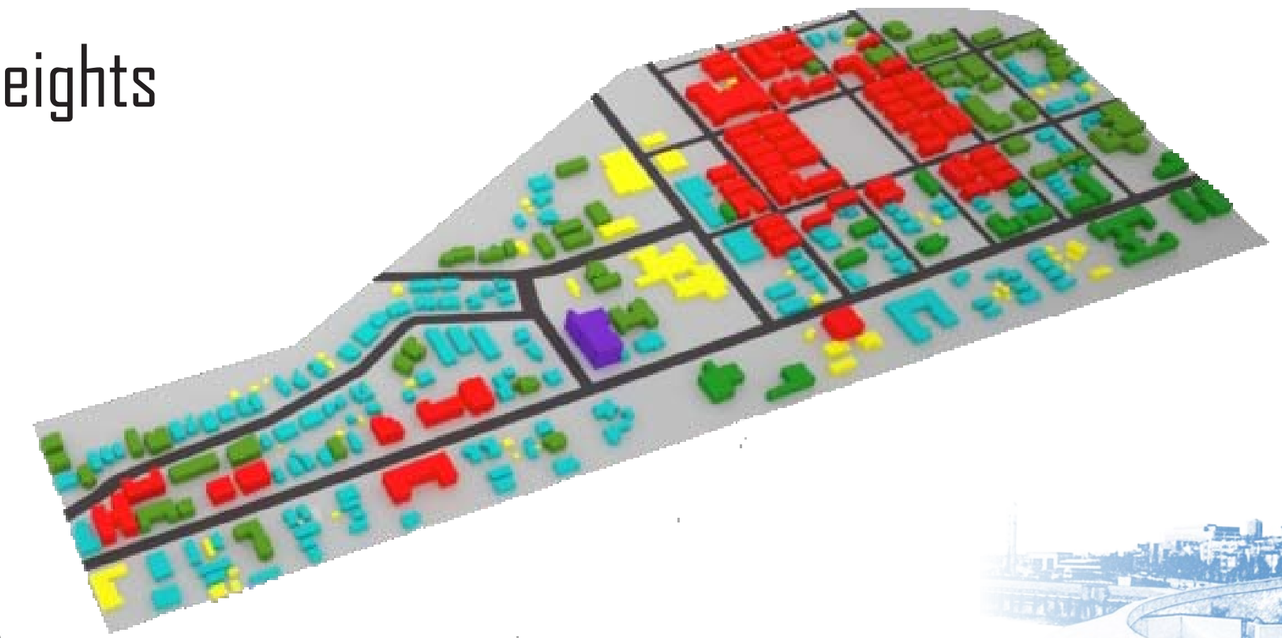
9 Story Building

4 Story Building

3 Story Building

2 Story Building

1 Story Building



The building heights create a comfortable pedestrian scale for person walking through the neighborhood.

SITE INVENTORY/ANALYSIS

People waiting at the bus stop on Franklin and Nicolett on a Saturday around 3pm.

Lighting Poles in the nieghborhood

Sidewalks along busy streets in the neighborhood

Sidewalks surrounding Stevens Square Park

A Historic Building in the historic district of Stevens Square.

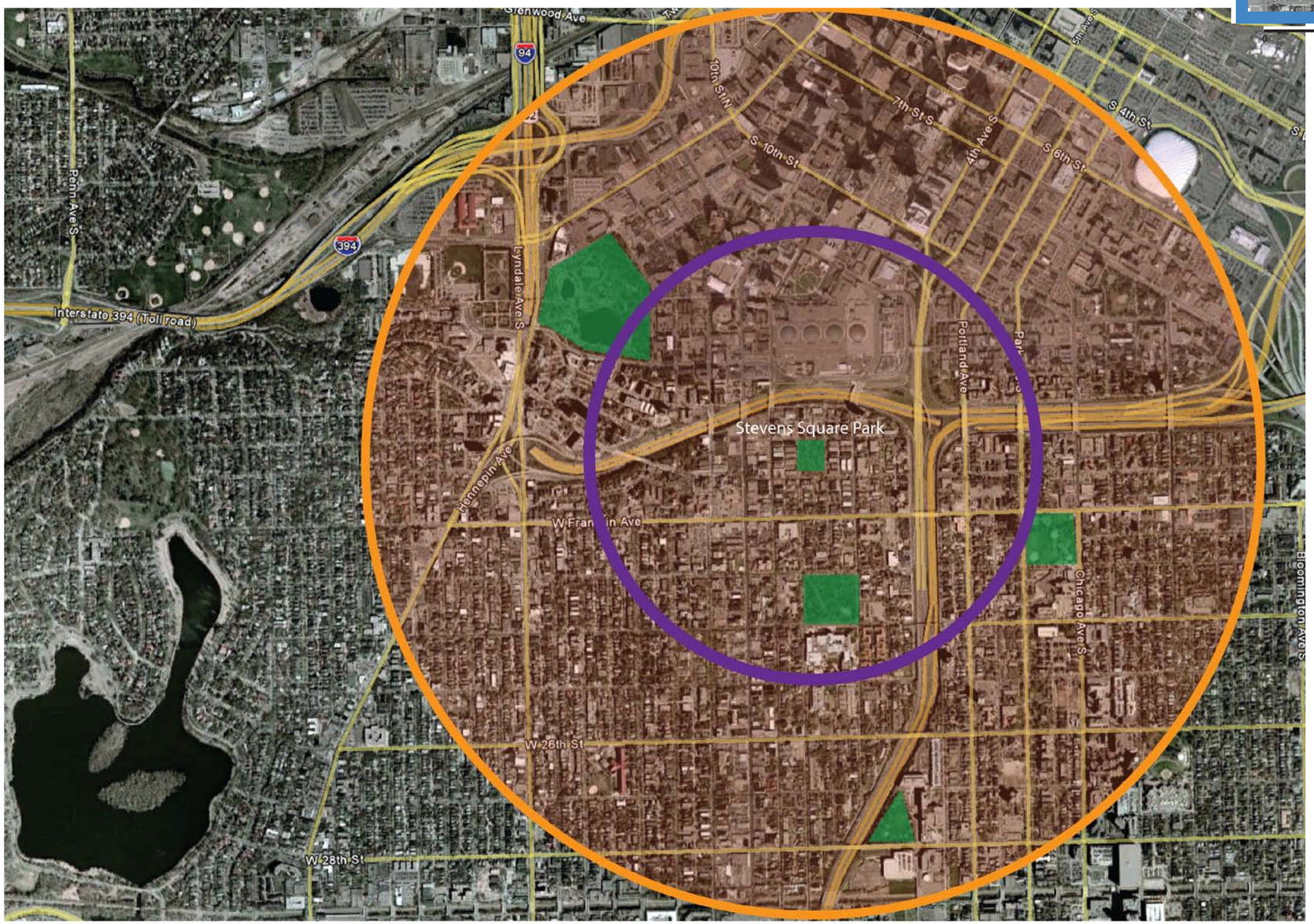
SITE INVENTORY/ANALYSIS

Homeless man sleeping on a picnic table in the middle of the day .

Unique looking fountain pump, that no longer works.

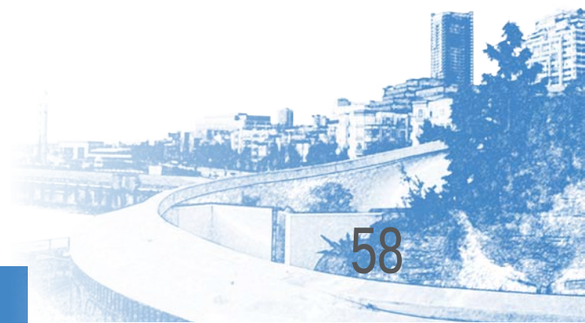
Northwest Corner of Stevens Square Park Panoramic

SITE INVENTORY/ANALYSIS



Stevens Square has the opportunity to create stronger connections to the parks surrounding the neighborhood through the walkability of the neighborhood, and the idea of wayfinding objects.

- 20 minute walk (I mile)
- 10 minute walk (.5 mile)
- Parks



SITE INVENTORY/ANALYSIS

Green Space = 905,702 sq ft

Building Rooftops = 1,616,478 sq ft

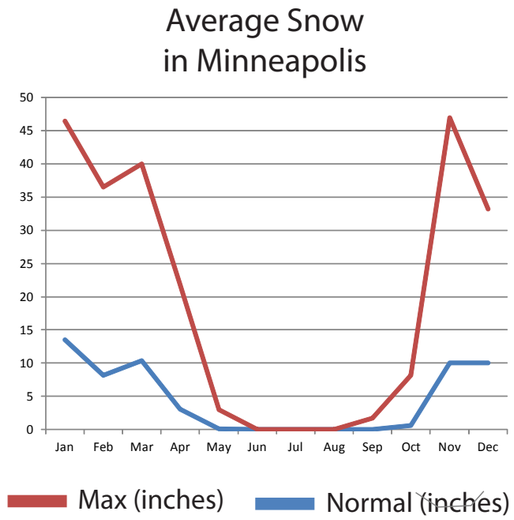
Parking Lots = 762,030 sq ft

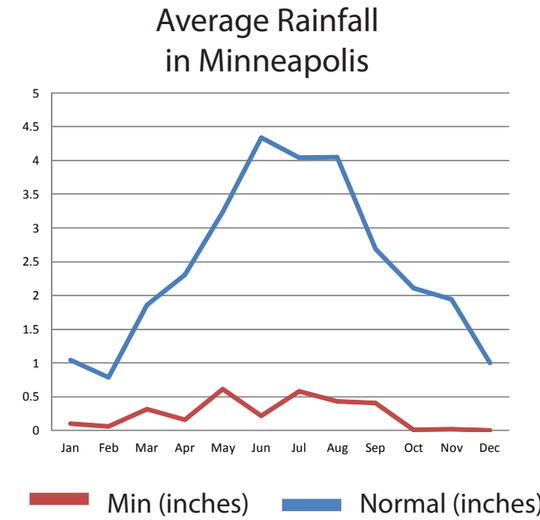
Boulevards/Sidewalks = 772,990 sq ft

Streets = 772,990 sq ft

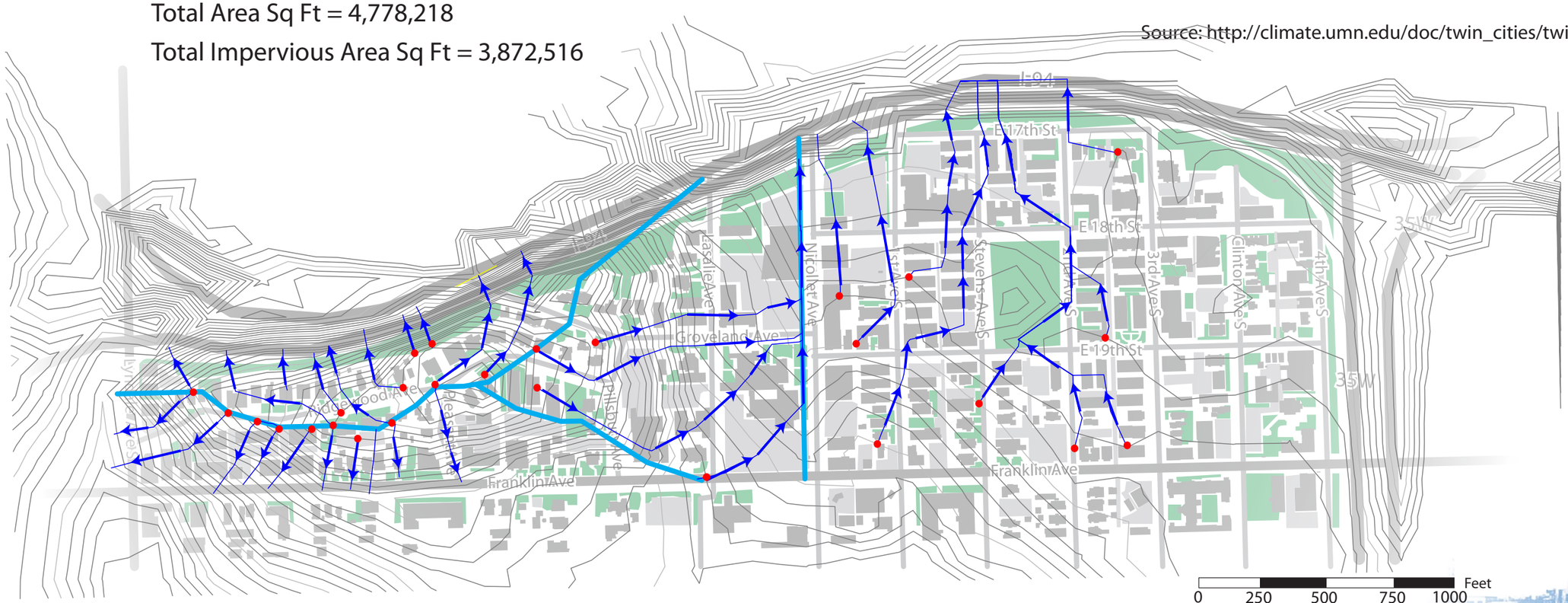
Total Area Sq Ft = 4,778,218

Total Impervious Area Sq Ft = 3,872,516





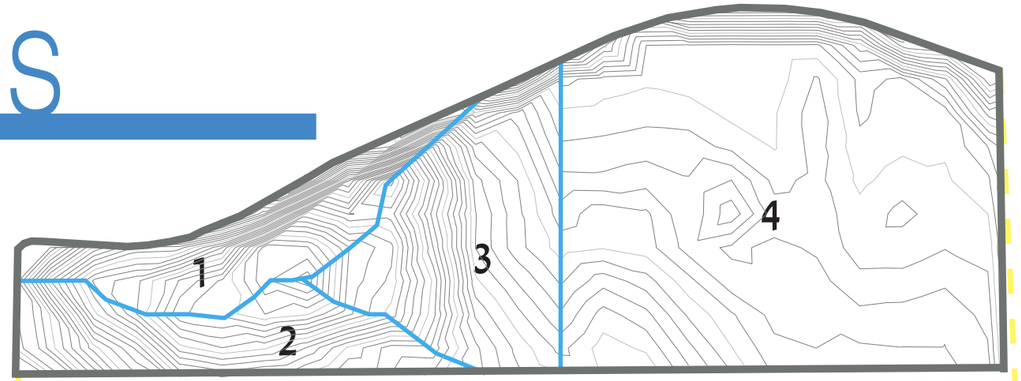
Source: http://climate.umn.edu/doc/twin_cities/twin_cities.htm



SITE INVENTORY/ANALYSIS

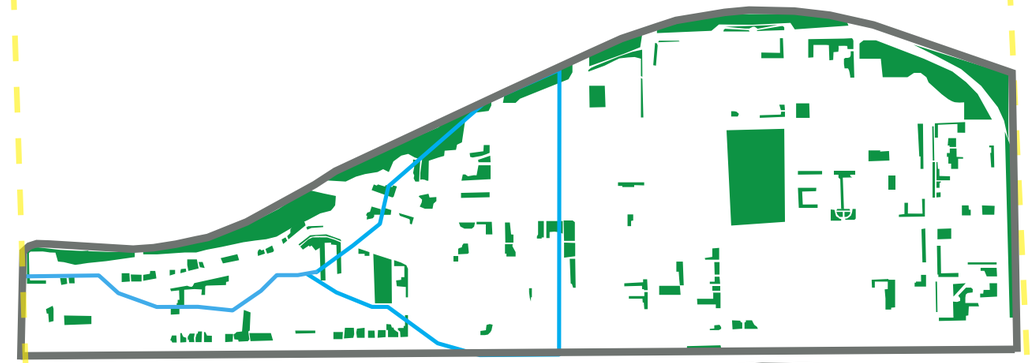
Total Area:

Subcatchment Area 1 - ***482,728 sq ft*** Subcatchment Area 2 - ***646,578 sq ft***
Subcatchment Area 3 - ***890,010 sq ft*** Subcatchment Area 4 - ***2,844,502 sq ft***



Green Space:

Subcatchment Area 1 - ***176,278 sq ft*** Subcatchment Area 2 - ***86,381 sq ft***
Subcatchment Area 3 - ***11,020 sq ft*** Subcatchment Area 4 - ***510,373 sq ft***

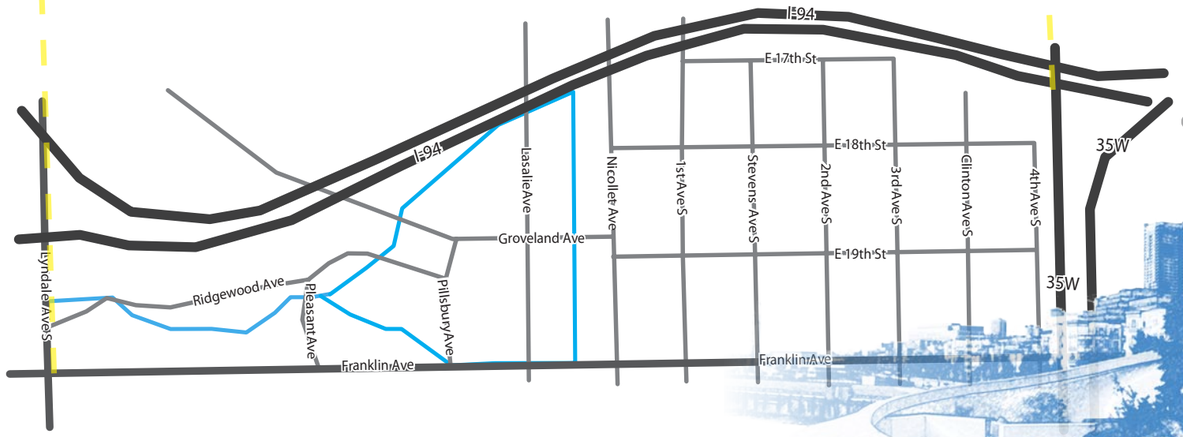


Rooftops/Parking:

Subcatchment Area 1 - ***120,335 sq ft*** Subcatchment Area 2 - ***389,745 sq ft***
Subcatchment Area 3 - ***449277 sq ft*** Subcatchment Area 4 - ***1,458,948 sq ft***

Streets:

Subcatchment Area 1 - ***45,086 sq ft*** Subcatchment Area 2 - ***159,021 sq ft***
Subcatchment Area 3 - ***91,523 sq ft*** Subcatchment Area 4 - **465,994 sq ft**



URBAN WATER

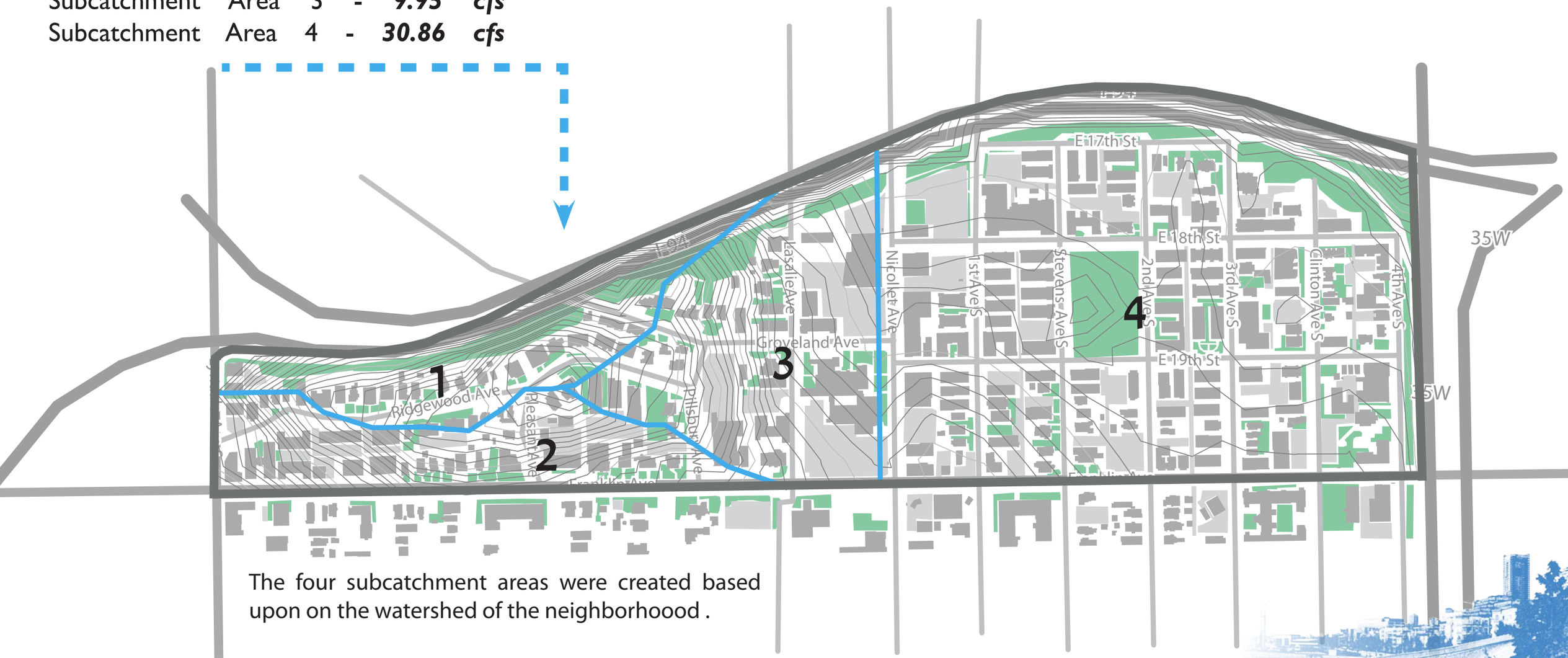
SEEKING CULTURAL, ECONOMIC & ENVIRONMENTAL CONNECTIONS

SITE INVENTORY/ANALYSIS

Runoff Rate 1yr/30min Storm:

Subcatchment	Area	1	-	***4.08***	***cfs***
Subcatchment	Area	2	-	***8.64***	***cfs***
Subcatchment	Area	3	-	***9.95***	***cfs***
Subcatchment	Area	4	-	***30.86***	***cfs***

Currently throughout the neighborhood stormwater runoff is disposed of in the storm drains and taken directly to the Mississippi river. These maps show the high amount of impervious surface within the neighborhood which increases the amount of runoff and non-point pollution going to the river. By creating small stormwater management interventions throughout the entire neighborhood they will capture and hold significant amounts of stormwater runoff which can then be reused at a later time or allowed to infiltrate the soil and revive the water tables beneath.



The four subcatchment areas were created based upon on the watershed of the neighborhoood .

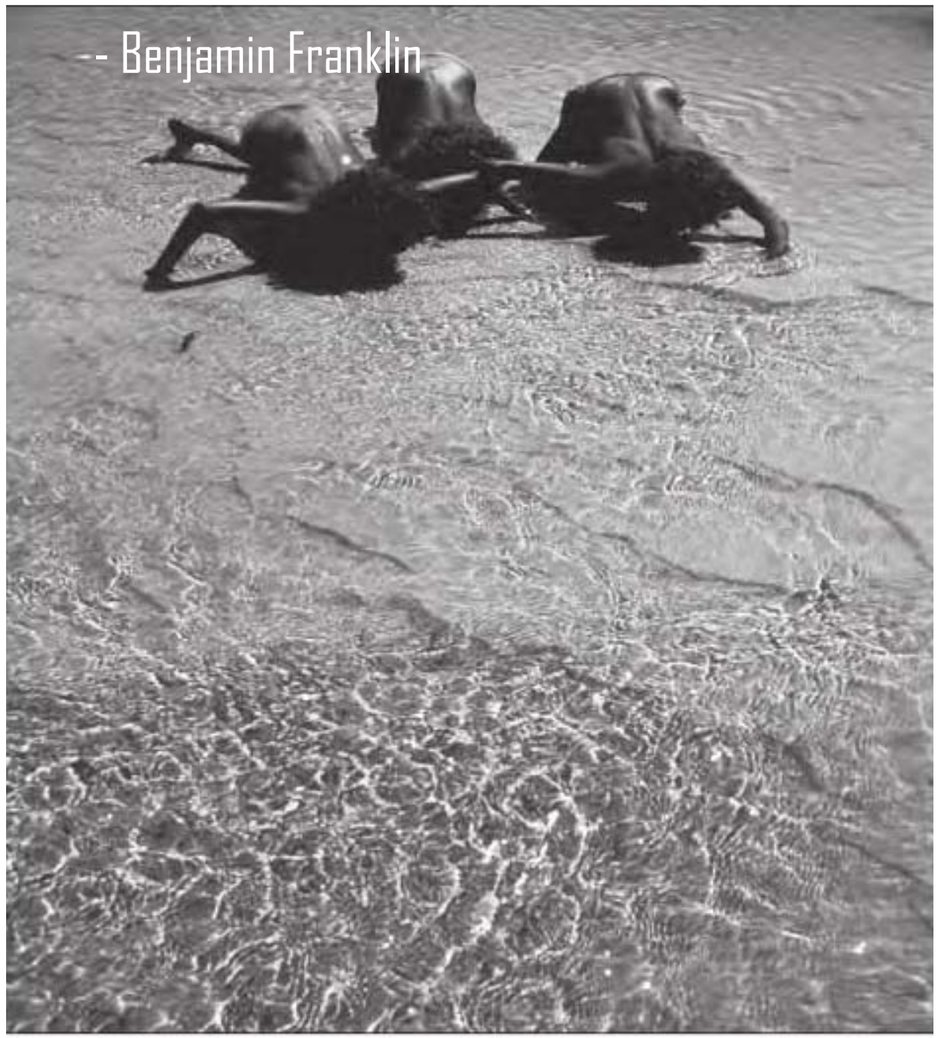
SITE INVENTORY/ANALYSIS

The Australian Aborigines are a primitive culture established in the Austrailian desert where water is a vital part of their daily lives and the way they keep track of where the water is through songs and dances that lead them to oasis's of water. The songs describe the land, and require the aborigines to use all their senses. This concept has become my design inspiration, and will be linked with the idea of way-finding and high imageablility researched by Kevin A. Lynch.

Lynch described way-finding as "In the process of way-finding, the strategic link is the environmental image, the generalized mental picture of the exterior physical world that is held by an individual. This image is the product both of immediate sensation and of the memory of past experience, and it is used to interpret information and to guide action."

He then defined Imageability as, "that quality in a physical object which gives it a high probability of evoking a strong image in any given observer...where objects are not only able to be seen, but are presented sharply and intensely to the senses." Through using the aborigines wayfinding practices, I plan to seek strong imageability throughout my neighborhood.

These three ideas combined will push me to design the neighborhood in a way that creates memorable areas for people to discover as they walk throughout the neighborhood.



Aborigine children drinking from a stream
Source: *Elixir: A History of Water and Humankind pg 9*

FINAL DESIGN

URBAN WATER

SEEKING CULTURAL, ECONOMIC & ENVIRONMENTAL CONNECTIONS

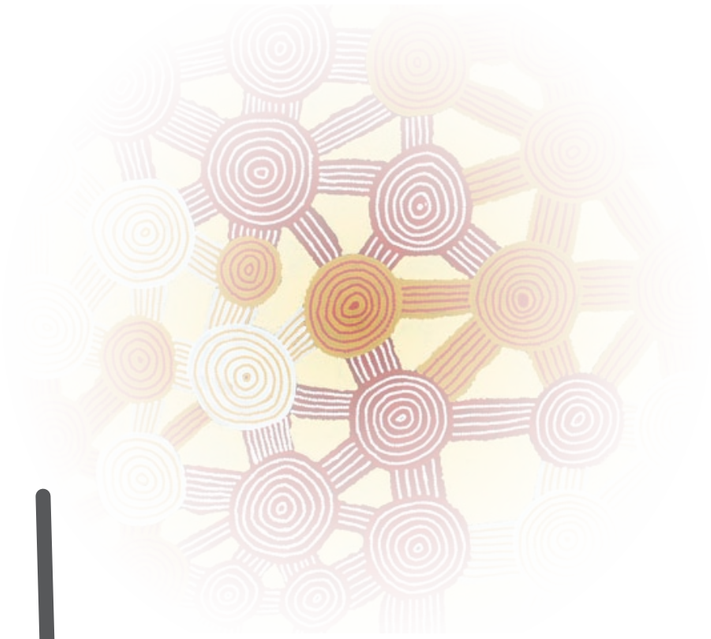
MASTERPLAN

Masterplan Legend

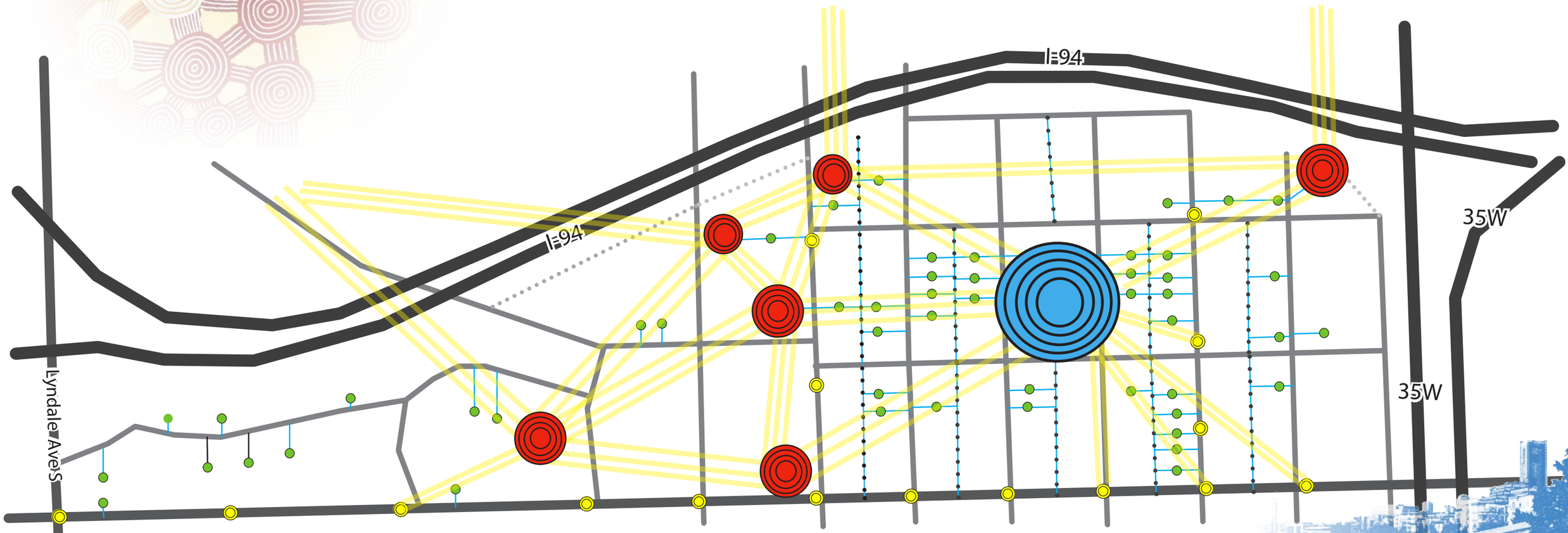
- Existing Buildings
- Proposed Mixed Use Buildings
- Plazas
- Parks/Pocket Parks
- Alleyways
- Gutter Areas Between Buildings
- Bike Path

URBAN WATER

MASTERPLAN



Australian Aborigine Art inspired the connections throughout my design. The image to the left is a work of art called the "Tingari Cycle" by Warlimpirrnga Tjapaltjarri inspired by the Tingari people and depicts the Dreaming song lines connecting the aborigines to the water in the desert. The Tingari men were a respected group of ancestral leaders that voyaged throughout the dessert finding water and mapping it through song, often bringing young novices to teach and pass down their knowledge to the next generation. The circles represent gathering areas or watering holes for the tribes to come together. The lines represent the journeys, paths to each area that become the "song", that guide them to the water. My design emulates these same connections throughout the neighborhood; the parks and plazas represent the gathering areas or "watering holes" for the community and the smaller interventions, such as gutter areas, become the connection points, the places people walk through to get to the parks/plazas.

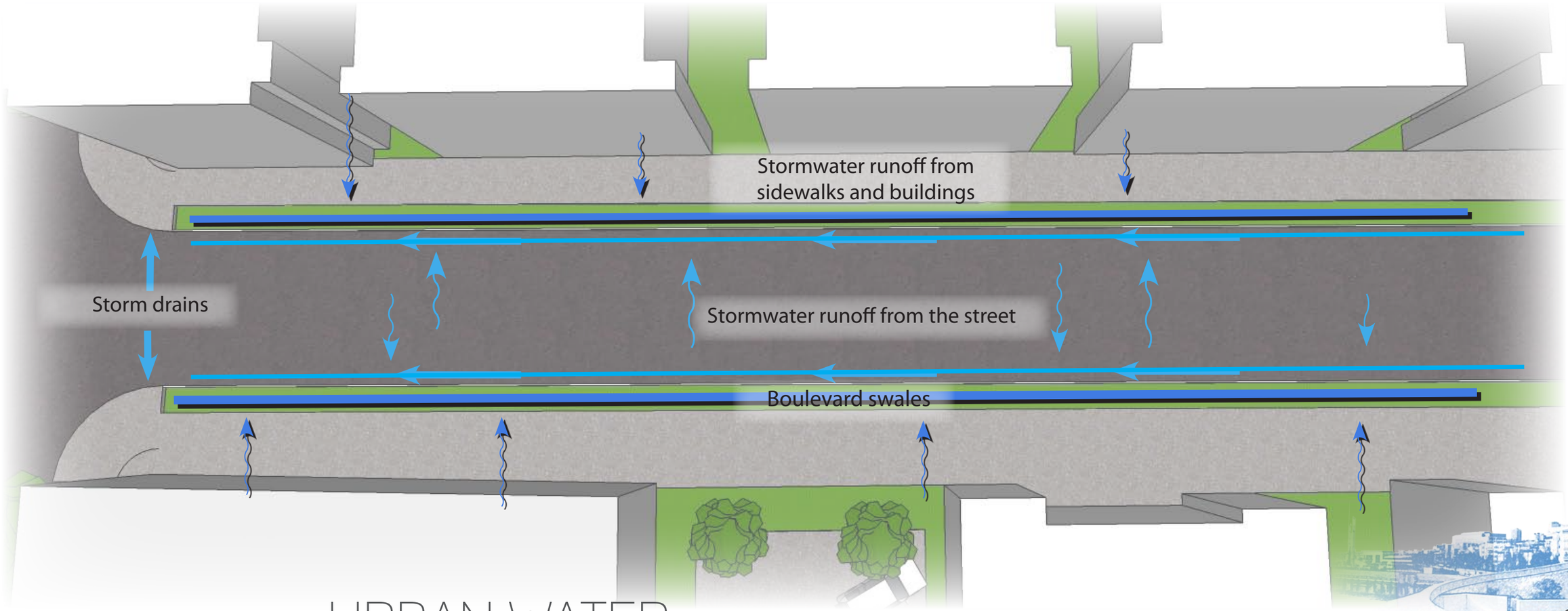


URBAN WATER

SEEKING CULTURAL, ECONOMIC & ENVIRONMENTAL CONNECTIONS

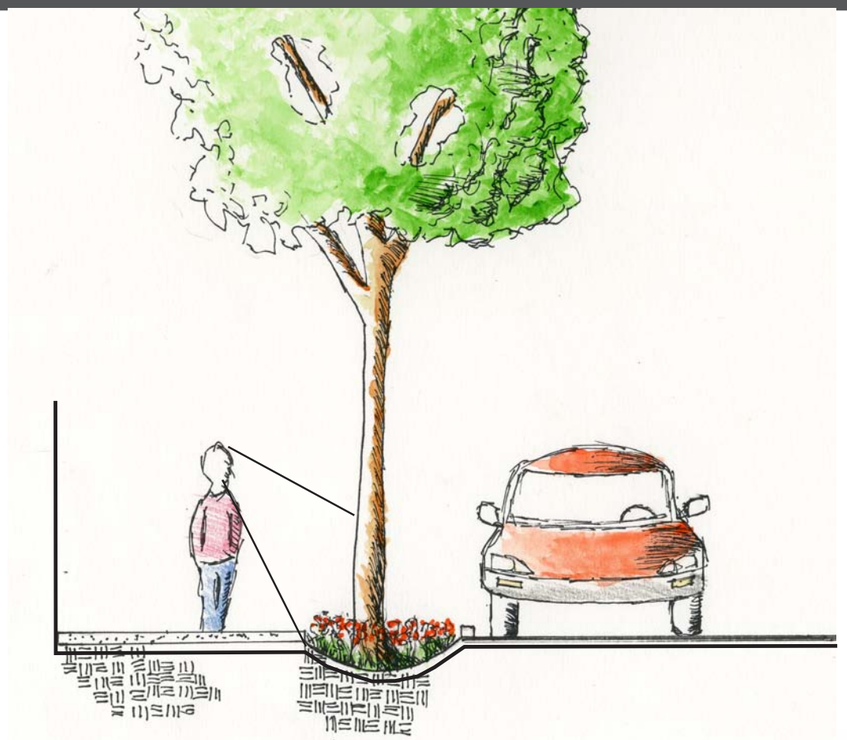
Boulevards - raingarden swales

All the boulevards throughout the neighborhood will be turned into raingarden swales that will capture runoff from the sidewalks and buildings. These swales will not affect the normal storm drains and will be able to handle up to 7 inches of rain before the water will overflow into the storm drains. These swales will have any array of colored plants making the boulevards places of high imageability while demonstrating water.



BOULEVARDS

The streetscape will be pedestrian scale creating a feeling of safety and security as the pedestrians walk throughout the neighborhood. At night it will be well lit and the bus stop will create places of atracttion because of their bright light.

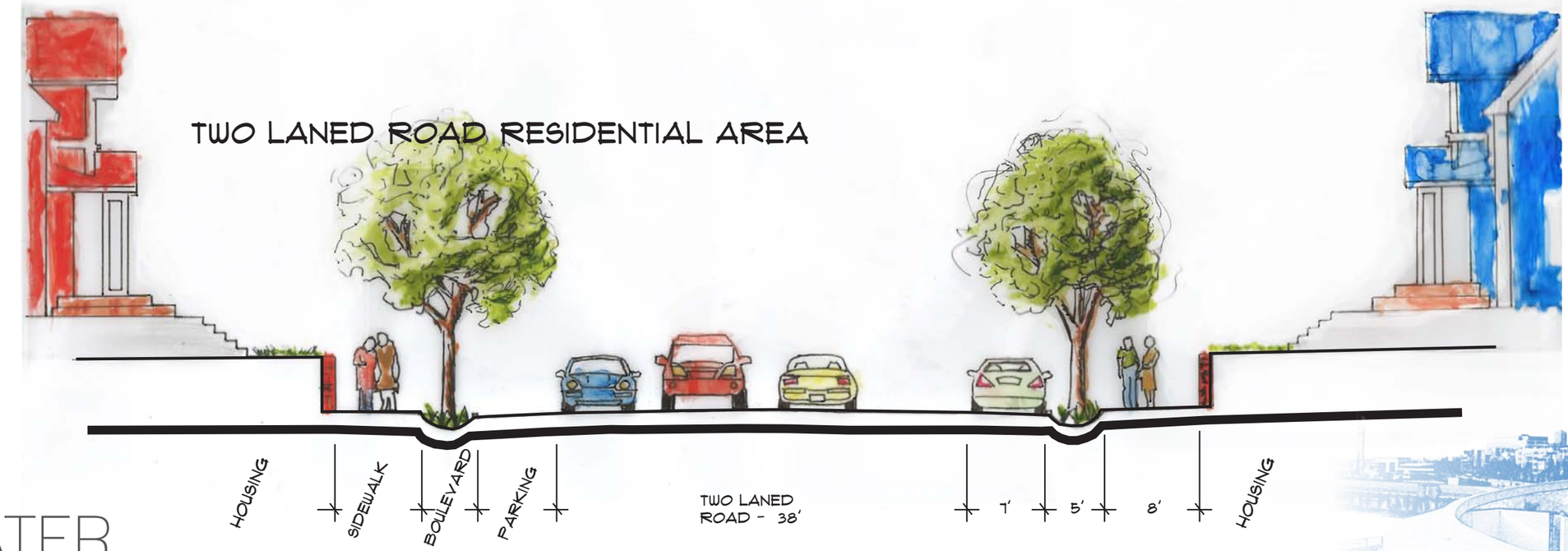


ARRAY OF PLANTS WITHIN THE SWALE

PLANTING PLAN EXAMPLE

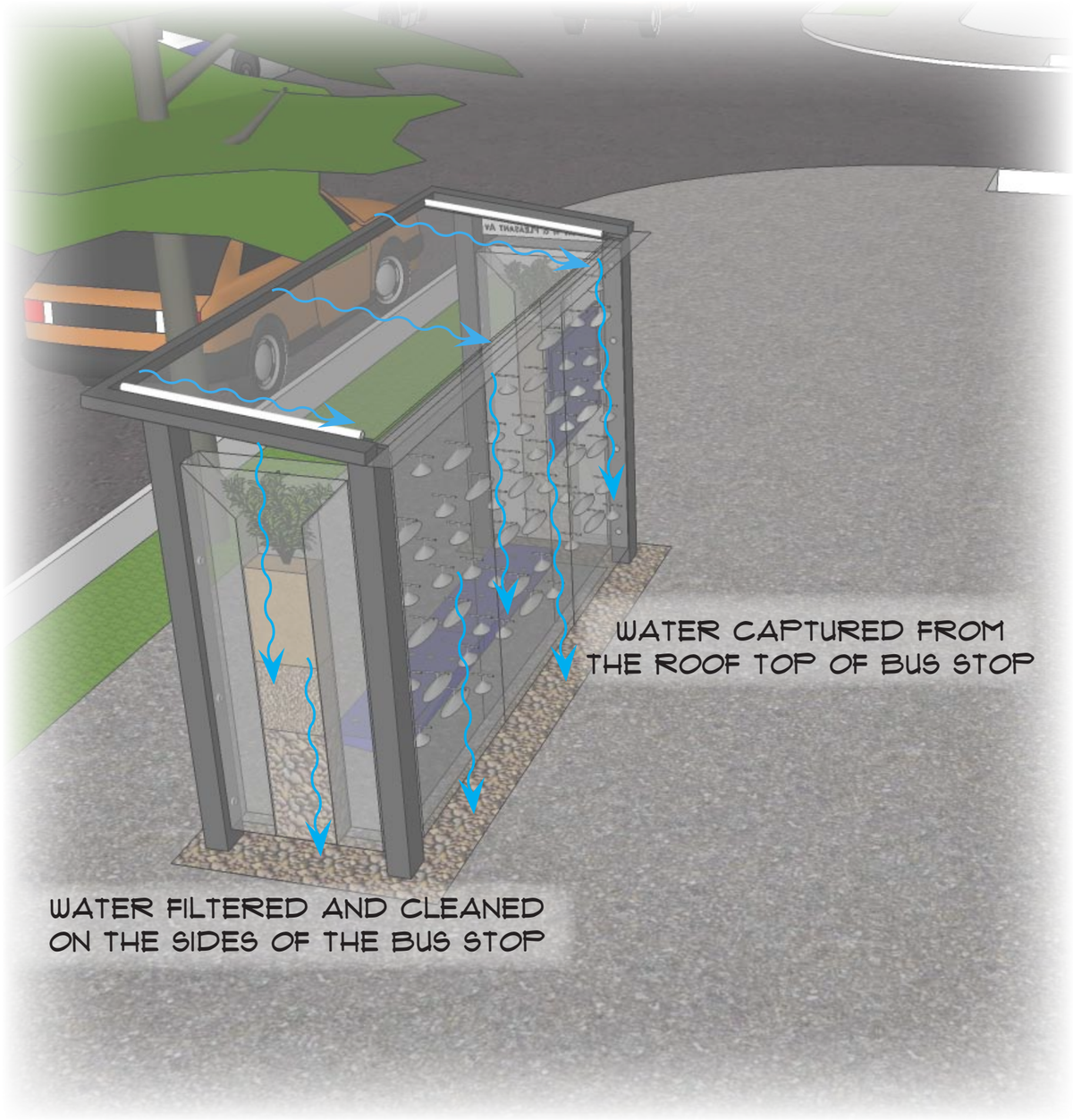
	Species:	Sun:	Location:
	Fox Sedge/ Carex vulpinoidea	Full	Part Bottom
	Bur Oak/ Quercus macrocarpa http://www.bemisfarmsnursery.com/tree_descriptions.htm	Full/Part	Bottom/Top
	Astilbe/ Astilbe	Full/Part	Part Bottom

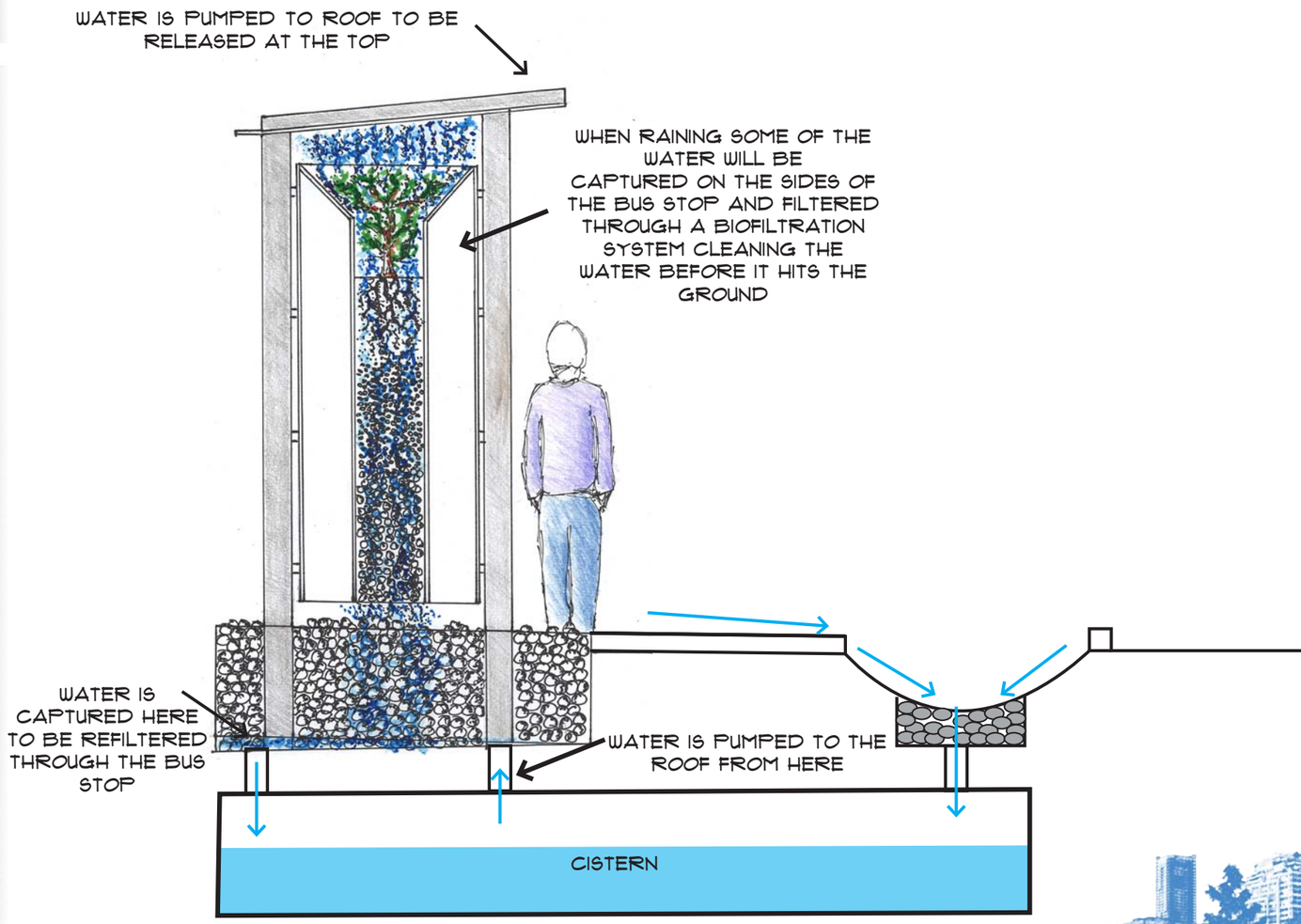
http://www.swallowtailgardenseeds.com/perennials/astilbe.html



BUS STOPS

My design takes advantage of the amount of time people spend at bus stops waiting for the bus and uses it to demonstrate water and educate them. The water is pumped to the roof, flows across it and makes a “song” as it hits the symbols in between the two glass panels on the back side. Once the water gets to the ground it is then captured in a cistern underneath and eventually repumped back to the roof.

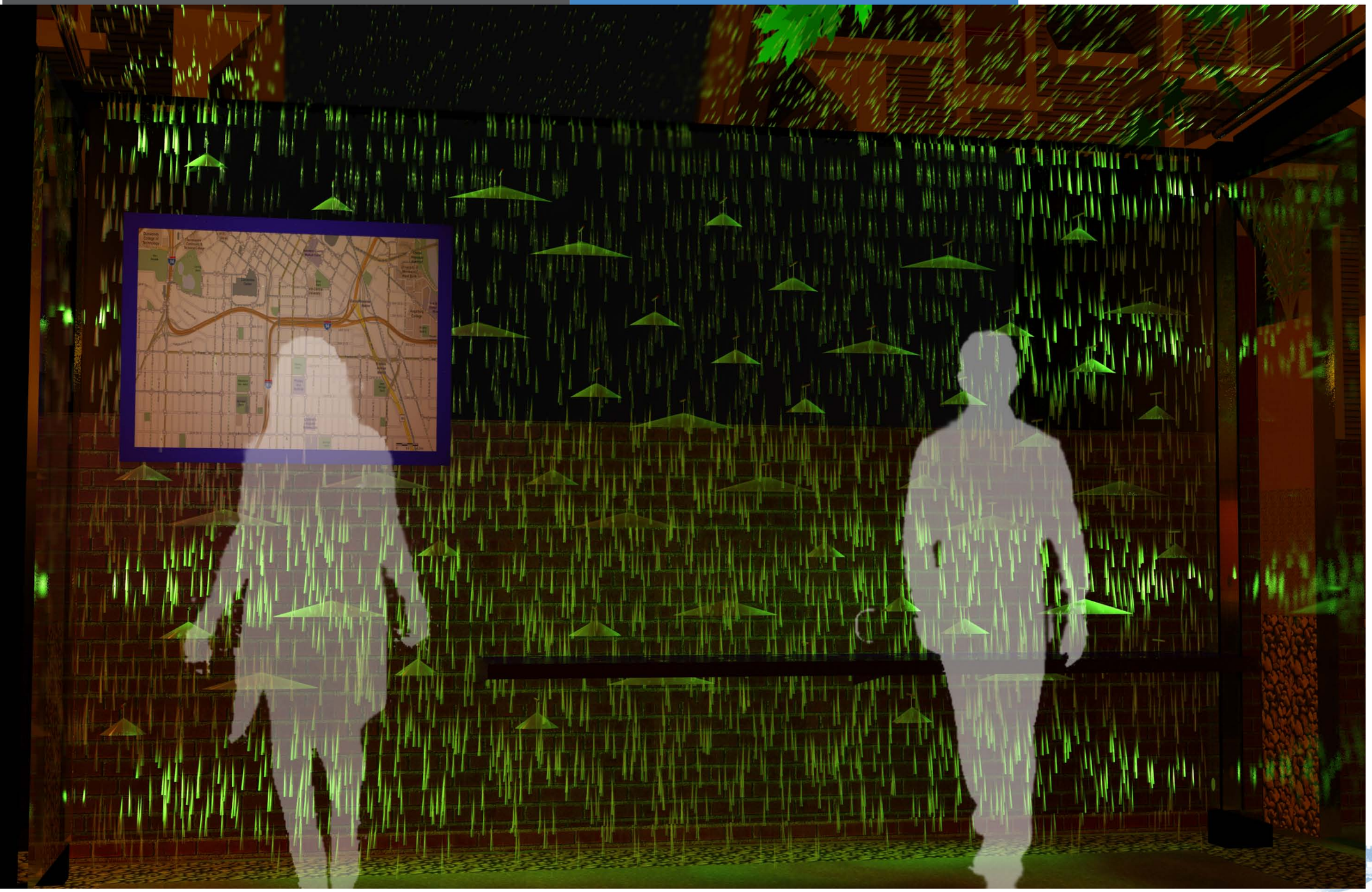




BUS STOPS

The flow rate at which the water is pumped onto the roof will correlate with the distance of the bus. The closer the bus is the faster the flow rate will be, while increasing the intensity of the “song” being created by the water.

BUS STOPS



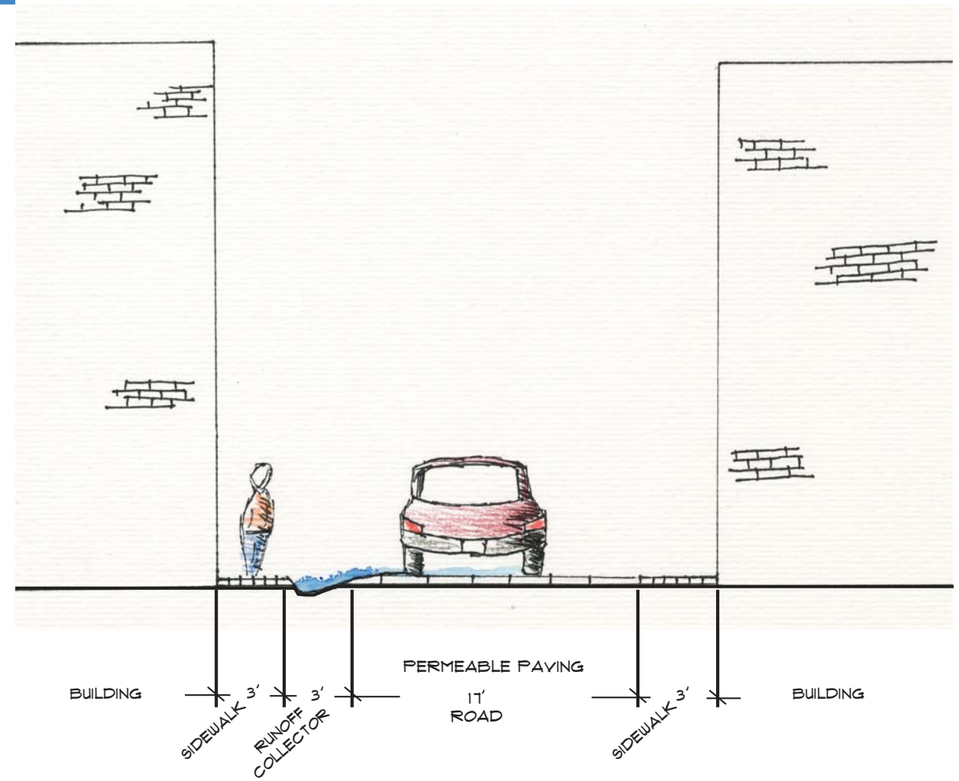
At night there will be lights shining through the glass that will change colors as the bus gets closer to the bus stop, informing people how far the bus is.

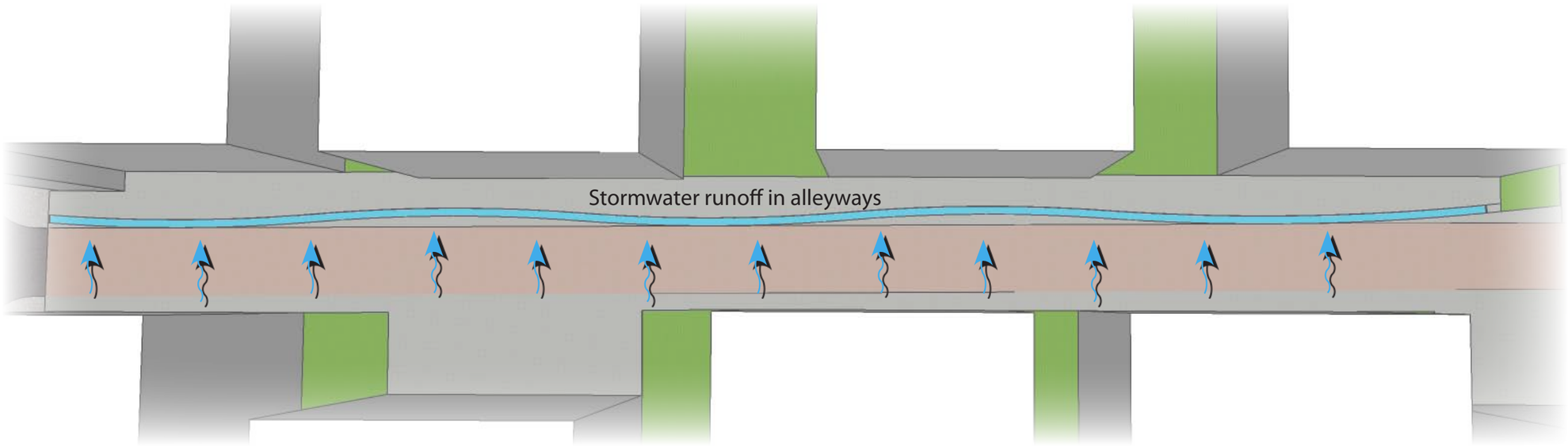
BUS STOPS

Only main bus stops along the edge of the neighborhood and Nicollet Ave. will have water circulating through them, but every bus stop will have some type of feature that demonstrates water. An example would be creating a bus stop that demonstrates water in the winter through cycles and the prisms they create when light refracts through them.

ALLEYWAY

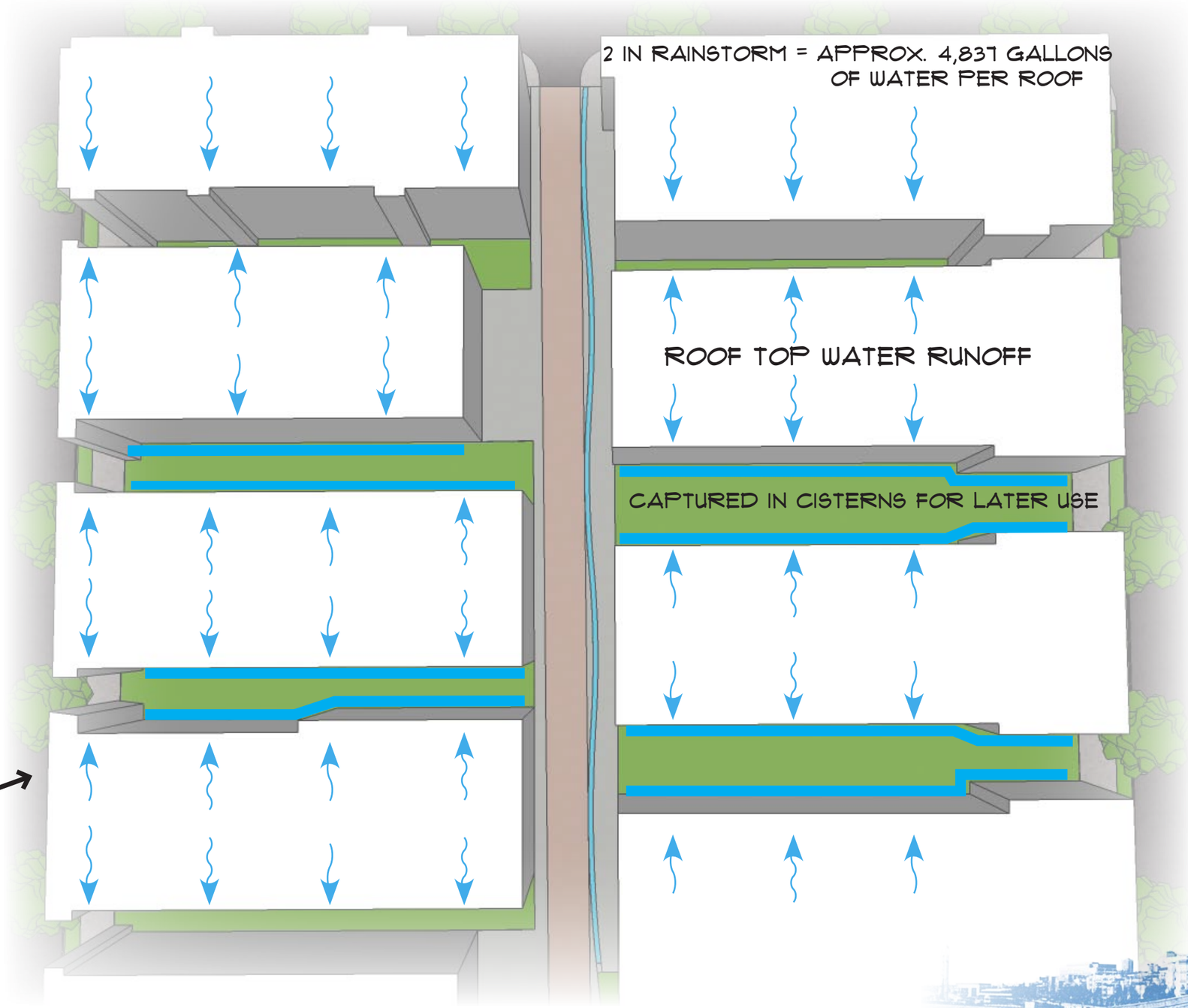
All the alleyways will be repaved with permeable brick that will allow the water runoff to penetrate through the soil and recharge water tables. By repaving the alleys they will become more inviting for pedestrians and bikers creating a vertical connection throughout the entire neighborhood. Along the road of the alley there will be a change in paver pattern and color to signify where pedestrians should walk. Also along the side there will be a small trench that will collect water while it is raining and take the water to a storm drain, this allows people to see the water being managed and interact with it.





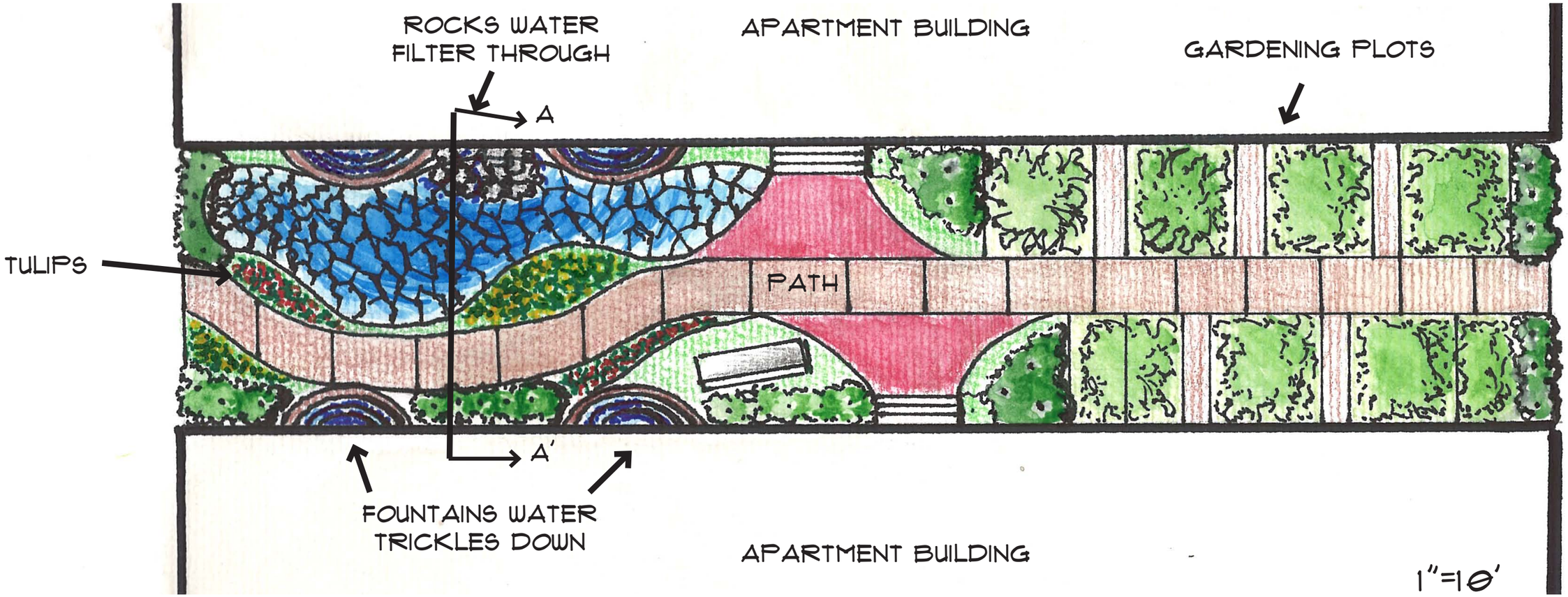
AREA BETWEEN BUILDINGS

Because Stevens Square is such a high density neighborhood, collecting runoff from the rooftops will help decrease the amount of runoff reaching the stormwater drains. These areas are great opportunities to get the community involved in caring for the landscape around them while also teaching them about the importance of water and how it can be used in a more sustainable manner. These area will offer gardening plots to the tenants using the water harvesting from the rooftops to water their plants. Although they will have to grow plants that require low amounts of light because of the height of the buildings.

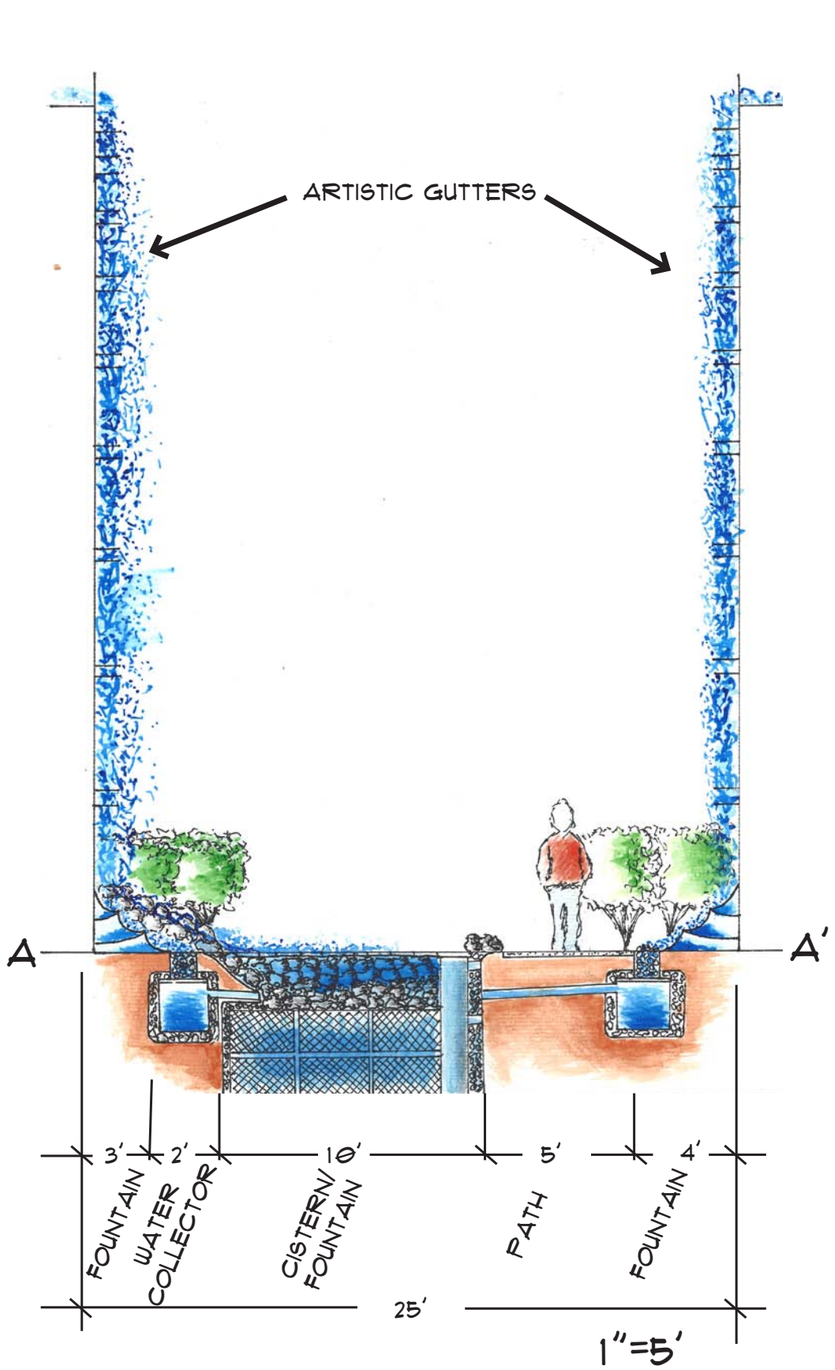


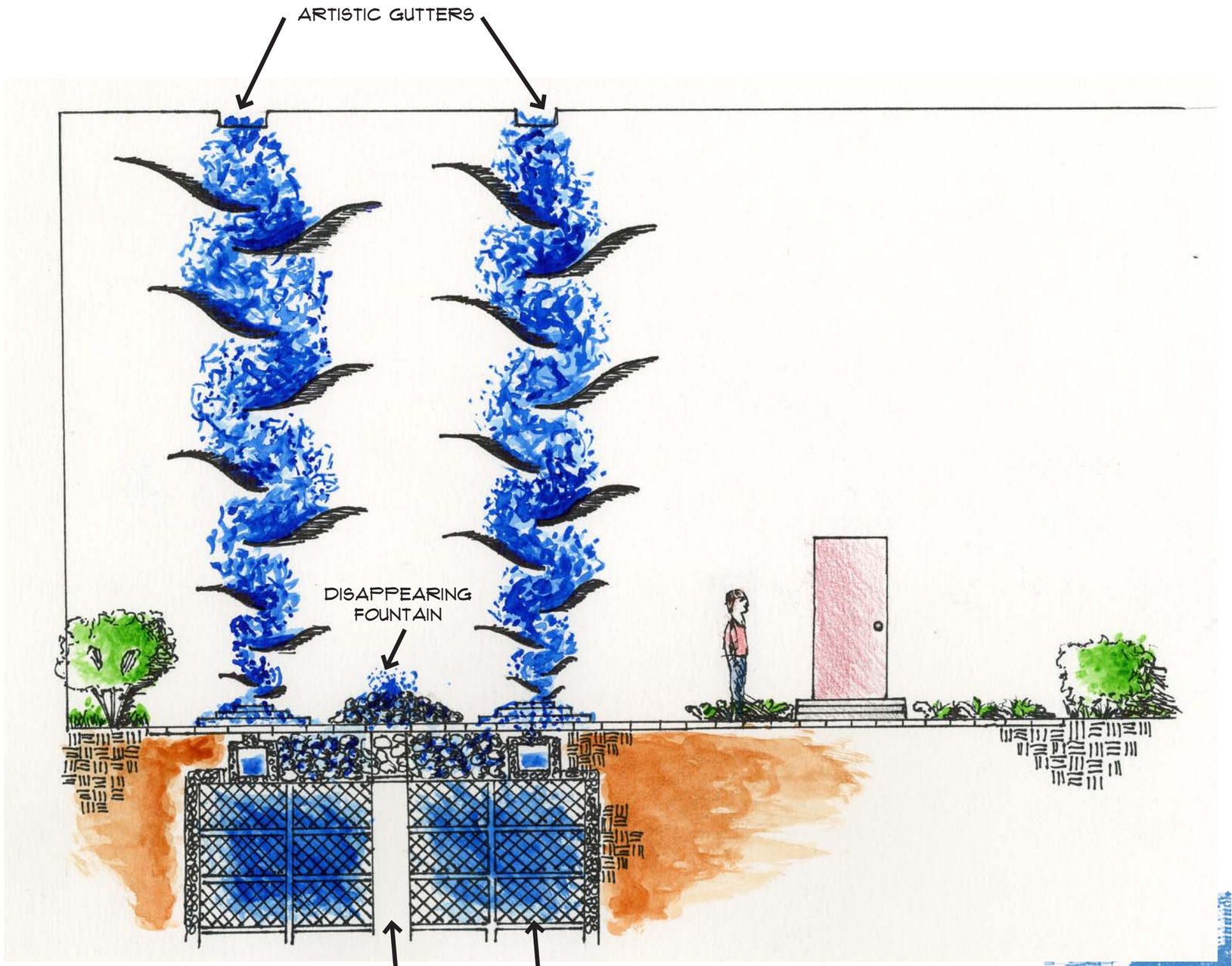
The water will be collected from the rooftop and stored in cisterns underground for later use by the tenants.

MASTERPLAN


ROCKS WATER FILTER THROUGH
APARTMENT BUILDING
GARDENING PLOTS
A
TULIPS
PATH
A'
FOUNTAINS WATER TRICKLES DOWN
APARTMENT BUILDING
1"=10'

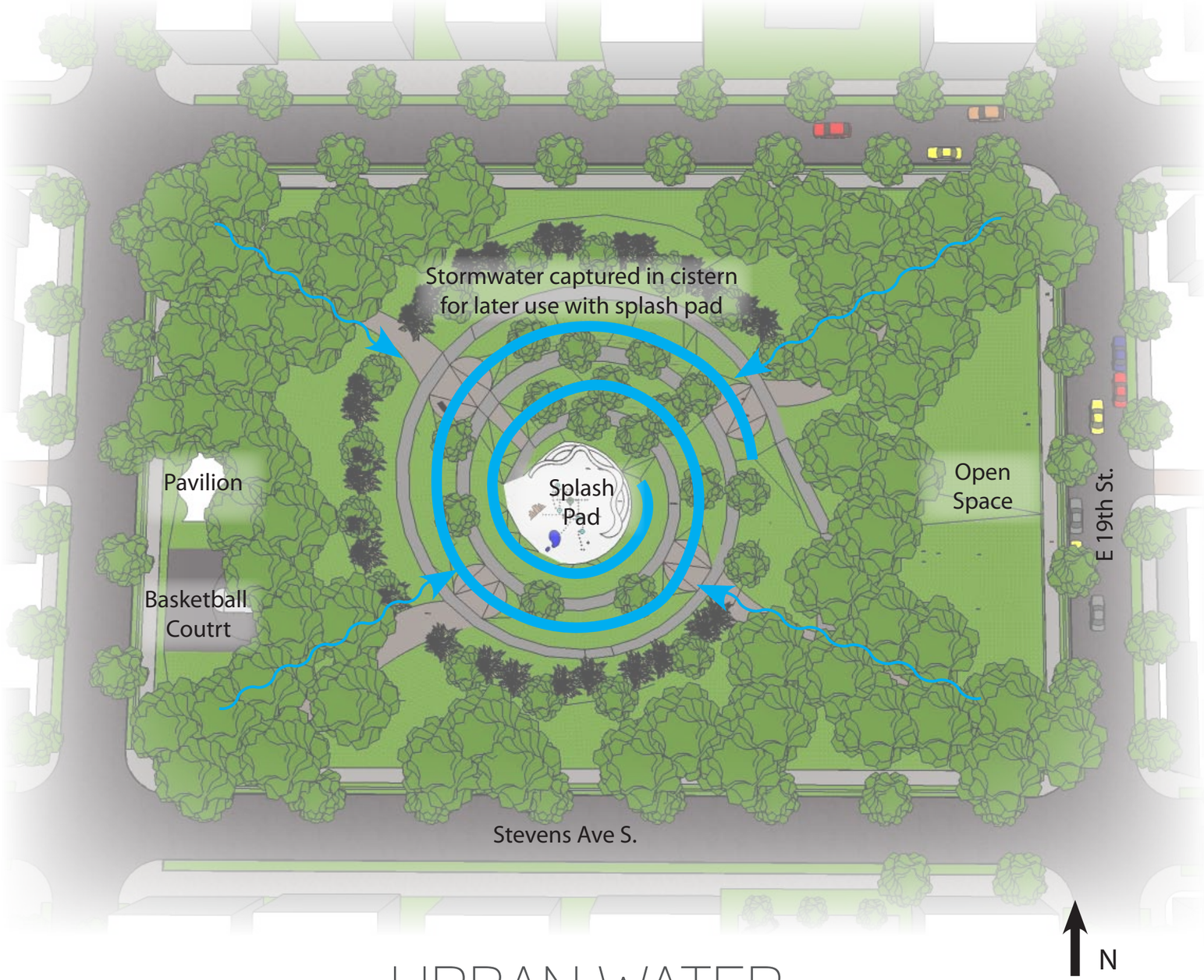
AREA BETWEEN BUILDINGS

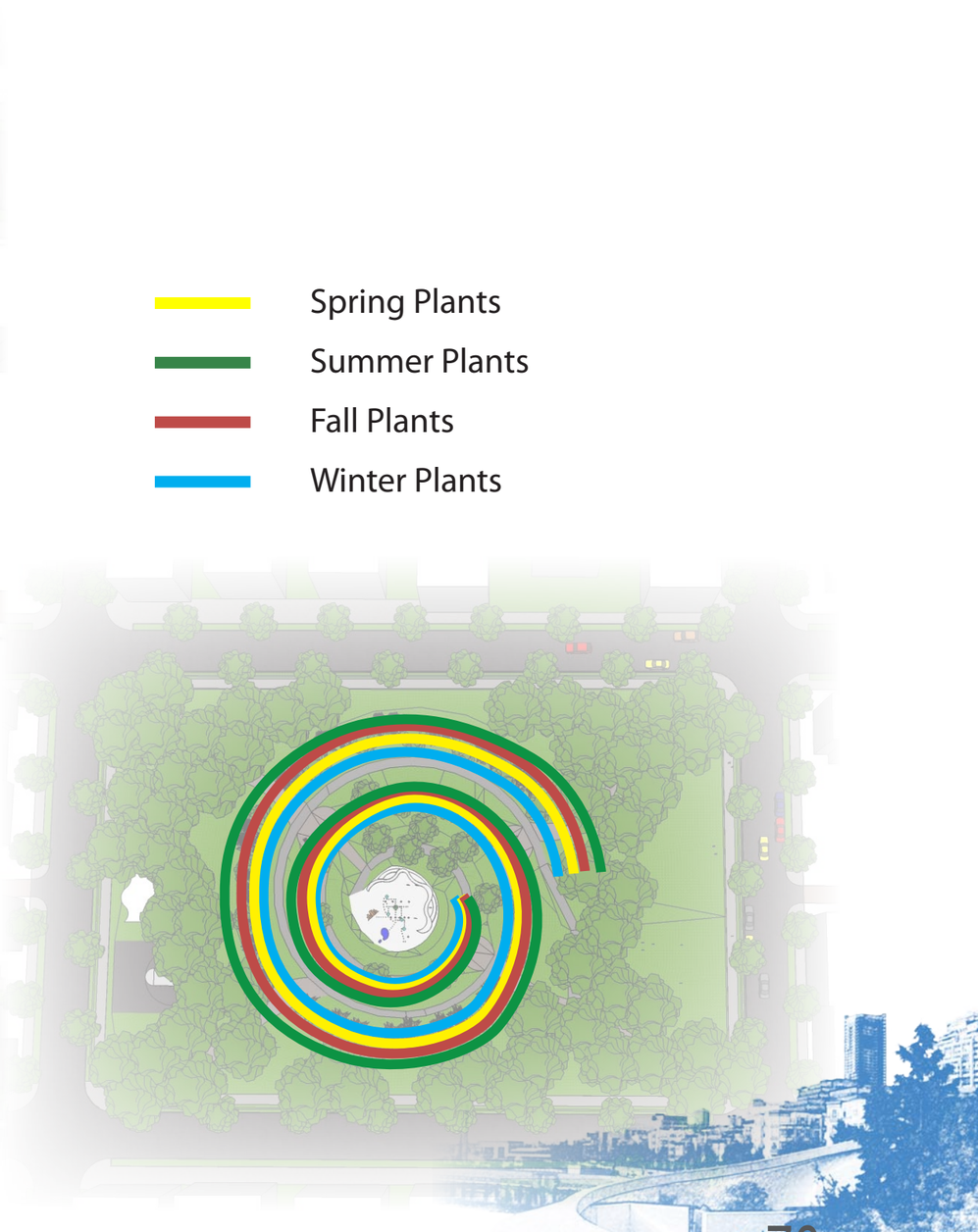




PARKS

There will be several parks throughout the neighborhood that connect together by serving different purposes for the community. For example Stevens Square Park will serve as a recreational park while another park may be used to meditate and relax . Because Stevens park is the biggest park and centrally located within the neighborhood a detailed deisgn was created for it.

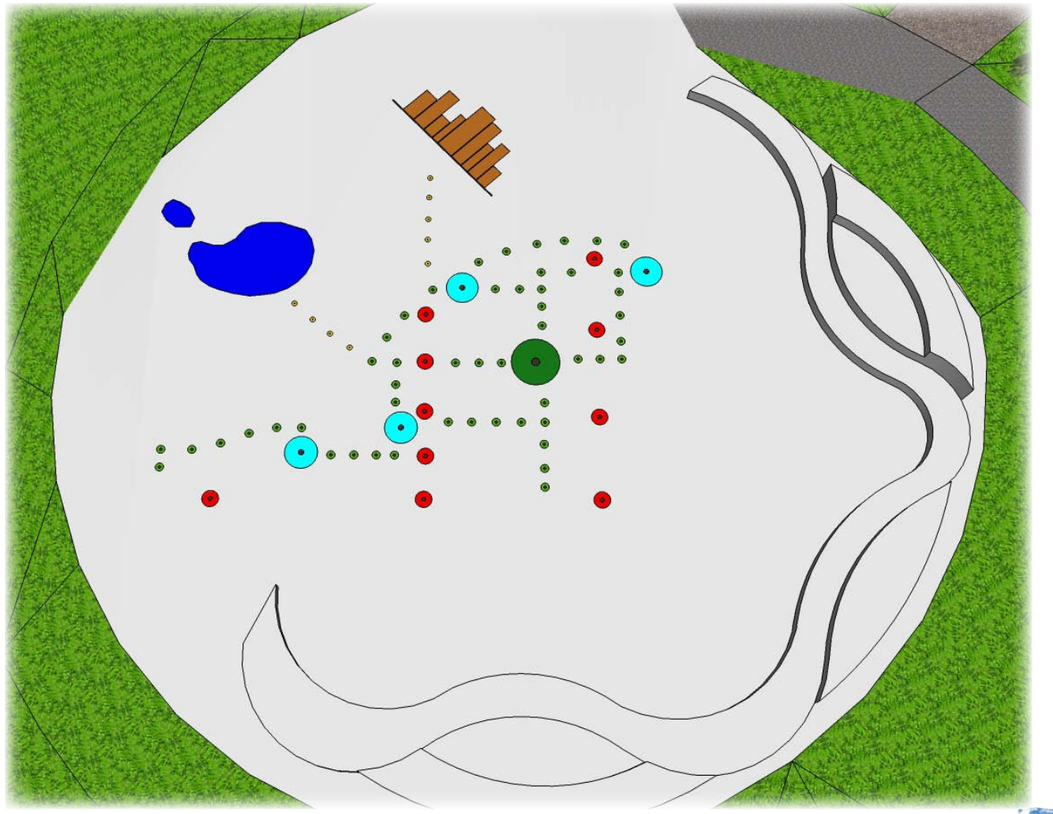




PARKS

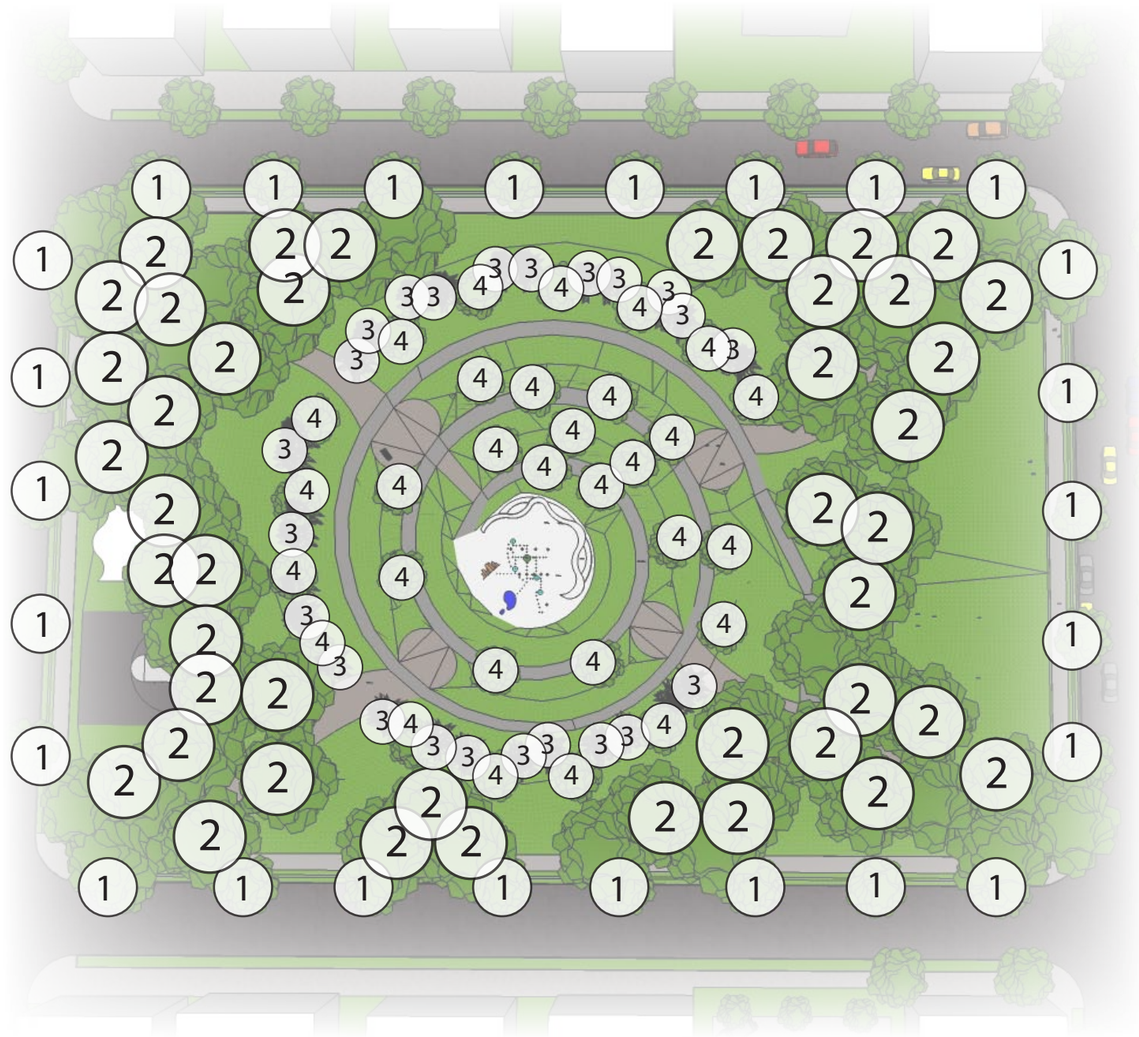
To emulate the Aborigines in the center of the park is a swirling circle path and swale that has a gentle decreasing slope which captures any runoff during a storm. The water is then carried to the center of the circle where it is stored in a cistern and is used for a splash pad in the middle of the circle. The path that leads to the center of the park is surrounded by vegetation creating a strong ecology for the park and inviting environment for wildlife. The vegetation surrounding the path will correlate with every season as well as ensuring that no matter what season it is the park will be alive with color.

- Main Jet - *Stevens Square Park*
- Semi-Main Jets - *Open Spaces*
- Pattern Jets - *Bus Stops*
- Mini Jets - *Area Between Buildings/Boulevards*
- Mini Jets - *Connection Paths*



Resting Area

Plant Name:	Type:	Sun:
Winter		
Red Osier Dogwood/Cornus sericea	Decidious Shrub	Part Sun
Paper Birch/ Betula papyrifera (2)	Decidious Tree	Full Sun
Douglas Fir/ Pseudotsuga (3)	Coniferous Tree	Full/Part Sun
Spring		
Astilbe/ Astilbe	Perennial Flower	Full/Part Sun
Hyacinths/Hyacinthus	Perennial/Bulb	Full/Part Sun
Hydrangea/Hydrangeas	Perennial	Part Sun/Shade
Tulips/ Tulipa	Perennial/Bulb	Full/Part Sun
Wisteria/Wisteria	Vine/Shrub	Full/Part sun
Summer		
Coneflowers /Echinacea	Perennial Flower	Full Sun
Peonies/ Paenia	Perennial Flower	Full/part Sun
Rhododendrons/ Rhododendron	Perennial Flower	Part Sun/Shade
Fox Sedge/ Carex vulpinoidea	Grass	Full-Part
Fall		
Amur Maple/ Acer ginnala (2)	Decidious Tree	Full/Part Sun
Bigtooth Maple/ Acer grandidentatum (2)	Decidious Tree	Full/Part Sun
Red Maple/ Acer Rubrum (4)	Decidious Tree	Full/Part Sun
Bur oak/ Quercus macrocarpa (1)	Decidious Tree	Full/Part Sun



PARKS

OVERALL GOALS

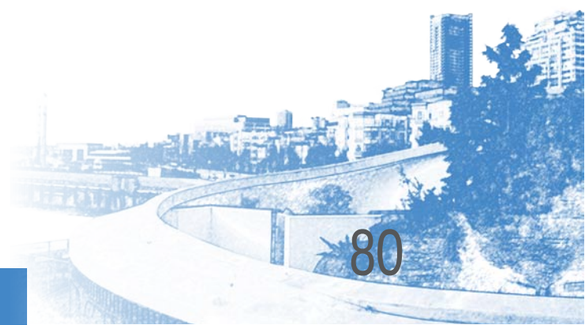
Project Goals:

1. The incorporation of aboriginal wayfinding as a guide to experience the neighborhood and its natural attributes for pedestrians, applying the high imageability created through the utilization of all the senses.

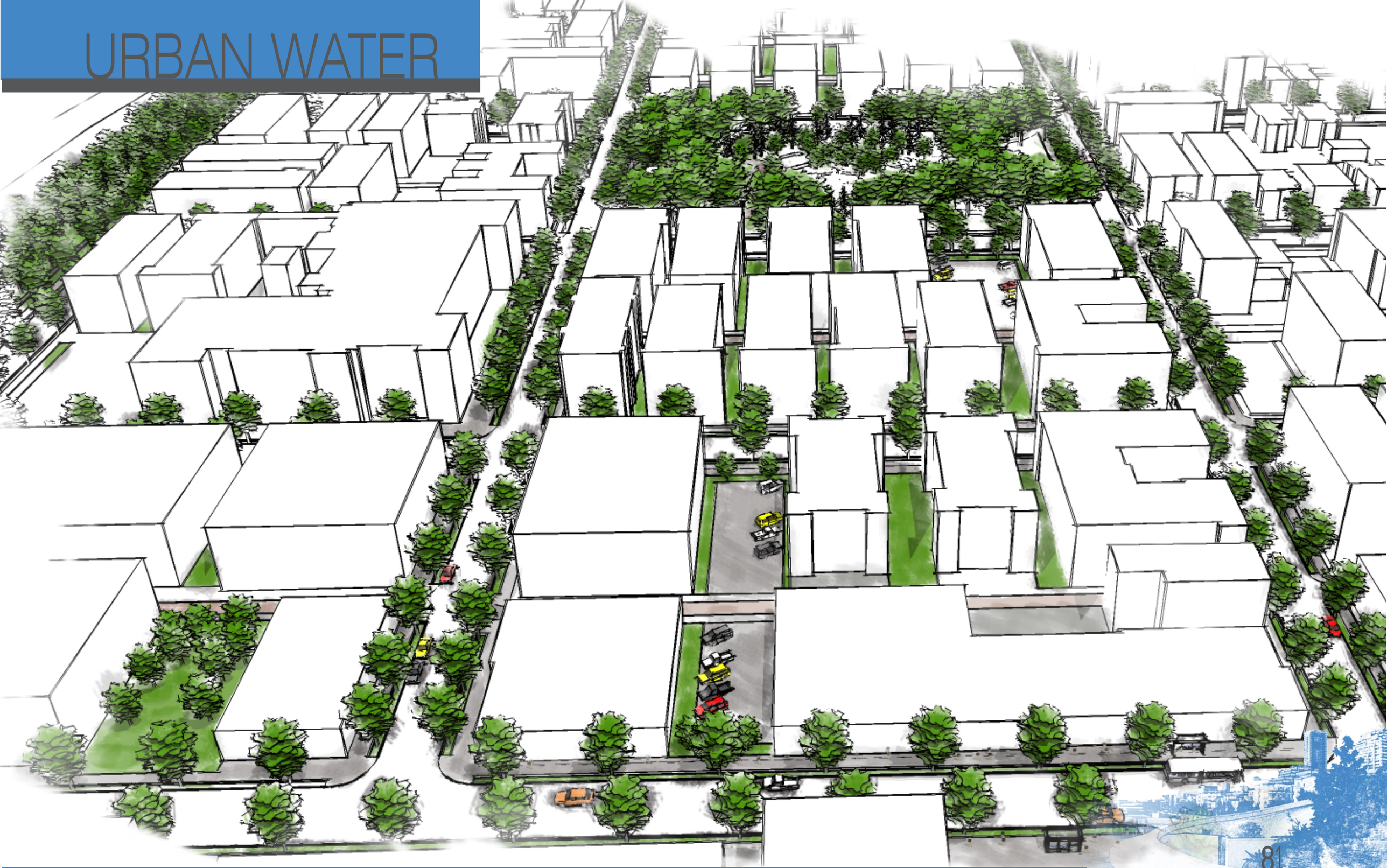
2. Respecting the simplicity of aboriginal sensibilities, dramatically increase the ratio of green space, indigenous vegetation and newly introduced plantings in relation to the existing preponderance of urban hardscape.

3.As the native Australians honor the search for water with traditional water sticks, they create a network of sustenance throughout the arid desert, providing a system of land water management passed generationally for basic survival. The creative development of a diverse yet simple and direct storm water management program in the Steves Square Neighborhood honors the basic importance of rainfall, providing an interactive and educational construct.

4. Through these deliberate plantings, unique green space and water retention areas, increase the viability and economic attraction of the neighborhood during an era of financial challenges and stress.



URBAN WATER



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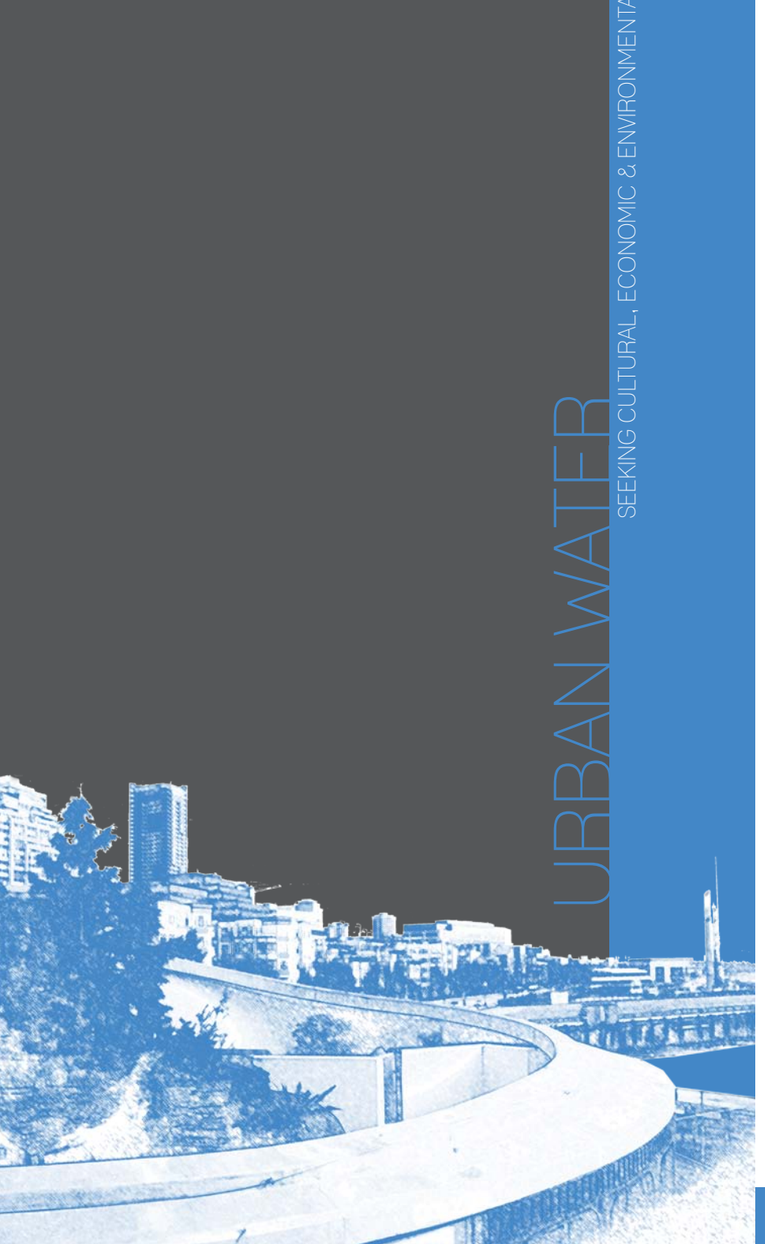
PERSONAL IDENTIFICATION

URBAN WATER
SEEKING CULTURAL, ECONOMIC & ENVIRONMENTAL CONNECTIONS



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"NDSU has been a life changing school, that has educated me, brought people into my life and made me who I am today."