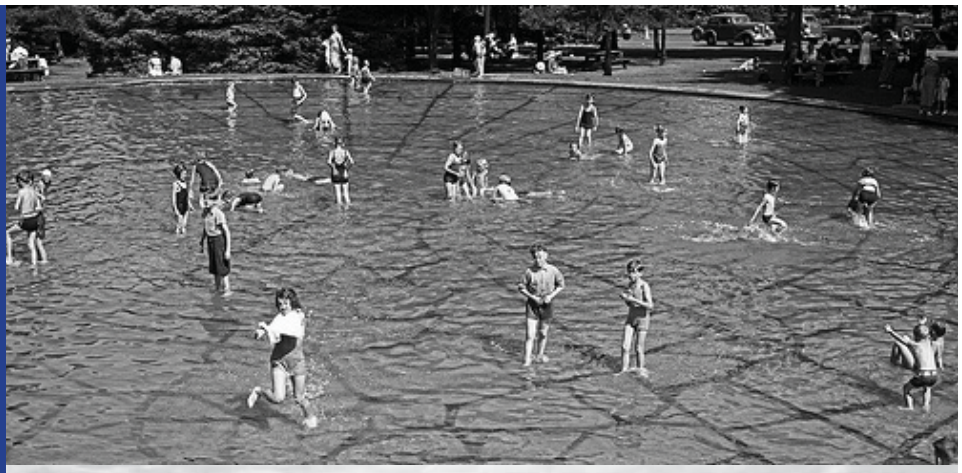

Volunteer Park Sustainability Coalition

Volunteer Park Feasibility Study
Water Use & Conservation

Final Report
1 of 2

24 February 2017

YOUNG | architecture LLC

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LETTER

Mike Cory
VPSC (Volunteer Park Sustainability Coalition)
1402 East Galer Street
Seattle, WA 98112
c/o Friends of the Conservatory

Date: 24 February 2017
Re: Volunteer Park Feasibility Study: Water Use & Conservation

Dear Mike,

Thank you for the opportunity to provide design services for the Volunteer Park Feasibility Study for water use and conservation.

This report is an exploration of the systems in the park that can make the greatest impact for water use. Our team has conducted analysis of Volunteer Park and created a draft report that identifies opportunities for conserving and managing water. The report outlines the research, findings, and feedback from stakeholders that informed our sustainable strategies. Enclosed are plans and sketches that show our proposed design measures. Rough order of magnitude costs and LCCA (Life Cycle Cost Analysis) was generated to assess the feasibility of the proposed measures.

The approach and process of our study is detailed in the draft, including meetings with stakeholders such as the Eco Design Charrette, meetings with Parks and Recreation and the VPSC. We informed, inspired, and involved the community in the project through the public open house events, where we discussed our team's findings, areas of potential park improvements, and sustainable strategies.

Please contact us if there are any questions or comments regarding the draft report.

Sincerely,

Adam Young
Principal Architect
Young Architecture LLC

YOUNG | architecture LLC

110 NW Bowdoin Place
Seattle, WA 98107

206.852.1956
adam@young-architecture.com

Key Objectives

- Improve water use and conservation for Volunteer Park.
- Develop schematic designs sufficient to test the viability of the proposed measures. Provide draft reports for community input.
- Provide construction and maintenance costs of the measures with construction time and impact on the park.
- Set priorities for the proposed sustainability measures in terms of environmental impact, operating cost and benefit to park.

Volunteer Park Feasibility Study on Water Use and Conservation takes a big step closer to implementing sustainable strategies in one of the most historically and culturally significant parks in the city. Our work builds on previous efforts to maintain the unique and historic character of the park while also minimizing the park's impact on the environment.

Volunteer Park is a 43-acre public park in northeast Seattle. It has two major buildings; the Volunteer Park Conservatory and the Asian Art Museum, and other secondary structures including an historic water tower, a reservoir, a children's play area and an amphitheater. Olmsted Brothers' landscape architecture firm originally designed the park in the early 1900s. In 2014, Volunteer Park was designated a Seattle landmark and under this designation projects within the park are reviewed by the Landmark Preservation Board to insure they are consistent with its historic character.

The Volunteer Park Sustainability Coalition, (VPSC), comprised of the Asian Art Museum, the Volunteer Park Trust and the Friends of the Conservatory formed to enhance the environmental sustainability of the buildings, grounds and infrastructure of Volunteer Park. To this end the coalition commissioned a Park Sustainability Improvement Measures (PSIM) report (Dated November 13, 2015) which identifies opportunities, particularly in areas of water collection and conservation, storm water management and energy conservation.

The VPSC received a Small and Simple Neighborhood Matching Fund grant from the Seattle Department of Neighborhoods. Their proposal focused on conceptual design of sustainable improvements for storm water run-off, water collection and water conservation. The DON funds of $20,000 allowed the VPSC to hire a consultant to prepare a feasibility study, which will develop a set of schematic design options and evaluations for sustainable water management. The study will enable the VPSC to move forward with public comment, final design, fund raising and implementation.

The VPSC requested statements of qualification from design consultants to make Volunteer Park more sustainable, and selected the team of Young Architecture LLC after an interview process.

SCOPE OF WORK

- Conduct two public meetings to present preliminary water conservation and concepts for sustainability improvements and to gain ideas and feedback from the Volunteer Park neighborhood community.
- Develop schematic designs sufficient to test the viability of the proposed water saving measures. Provide draft reports for community input.
- Provide construction and maintenance costs of the water saving measures with construction time and impact on the park.
- Set priorities for the proposed water use sustainability measures in terms of environmental impact, operating cost and benefit to park users and the surrounding community.
- Publish a full final report reviewing site facilities and assessing the feasibility and associated costs of various water related park upgrades identified during the project.

STAKEHOLDERS

Stakeholders who were involved in the drafting of the sustainability improvement measures:

Community Initiative:

VPSC (Volunteer Park Sustainability Coalition)

A partnership of the Friends of the Conservatory; Volunteer Park Trust; and the Asian Art Museum.
MISSION
Restore Volunteer Park to its preeminent position as the region's premier Olmsted designed Park, along with the institutions and features that make the park a cultural and recreational treasure.

Anthonio Pettit, Doug Bayley, Lee Richardson, Audrey Van Horne, Mike Cory, Gayle Macy, and Tom Eichbaum

Project Funding:

DON (Department of Neighborhoods)

Karen Selander, Project Manager.

Fiscal Sponsor:

Seattle Parks Foundation

Thatcher Bailey, Executive Director.

Owner:

Seattle Parks and Recreation

Pam Kliment, Department of Neighborhoods Project Manager;
Joelle Hammerstad, Karen Galt, and Casey Rood, Parks Sustainable Operations;
Doug Critchfield, Lisa Chen, Natural Resources Unit;
Jody Blecksmith, Volunteer Park Senior Gardener.

Participant:

Friends of Seattle's Olmsted Parks

Eliza Davidson, Architect/Landscape Designer/Urban Forester
National Association for Olmsted Parks Trustee.

Participant:

Asian Art Museum

Sarah Loudon, Museum.

Future Partners:

Seattle Public Utilities

Salmon Safe

Seattle City Light

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Cascadia College

Chaz Kerns
Intern, Bachelor of Applied Science in sustainable Practices (BASSP)

Executive Summary

EXECUTIVE SUMMARY

The Seattle Parks And Recreation Department categorizes Volunteer Park, an historic Olmsted park, as a horticultural park of highest priority in the park system; Parks staff water plantings even in times of drought, when other parks may not be irrigated. This designation creates a greater need for Volunteer Park to strive for an even more efficient use of water resources.

Our team has embraced this challenge and sought sustainable strategies to balance the needs and uses for water, while respecting the heritage of the park. We familiarized ourselves with the history of the park and the design principles of the Olmsted Brothers firm to remain mindful of the unique character of the park.

Olmsted plan 1910, FSOP.

Ortho photo, 2013, Seattle Parks & Rec.

Approach

Our approach first sought out the most cost effective strategies to reduce the needs for water, improve the infrastructure, and then to harvest and re-use water on site. We began this process by identifying the water that was imported into the park for all needs including irrigation, recreation, and domestic use, and identifying the water leaving the park through storm and sanitary sewer systems. Our aim was to balance the need with the excess resulting in a more sustainable park.

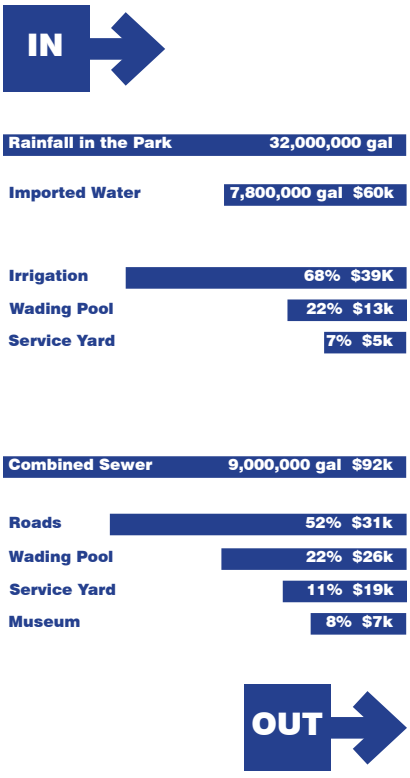
Process & Findings

With assistance from Parks, we analyzed the benchmark data on water usage. Our findings indicated that water is efficiently managed in the Park with state of the art controls and monitoring systems. The data directed us to potential water savings. The primary water use in the park, approximately two-thirds, is for irrigation; the second greatest water need was the wading pool; and the third are the glass houses, conservatory and greenhouses, combined. The reservoir is still operated by SPU, and therefore not included in our study.

The findings were further explored at a stakeholder charrette that included members of the Coalition and Parks. This provided an opportunity to share knowledge about the park, inform each other of ideas, and discuss the future of Volunteer Park.

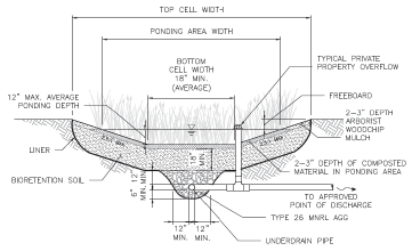
The ideas and concepts generated at the charrette confirmed the irrigation system and the wading pool as high priorities for initial study. The group also discussed the tremendous opportunities of the reservoir, and the ability to utilize the service yard as a behind the scenes engine for sustainable strategies, and an opportunity for an educational display.

At the public open house on September 1st, the findings were presented, and the people who attended echoed many of the same ideas, and offered new ideas and suggestions.

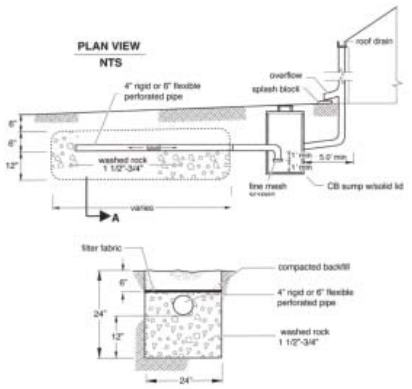


Sustainable Strategies

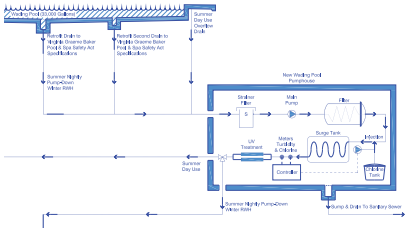
Using the findings and insights of stakeholders, our team developed sustainable strategies that honored the park history, current use, and context. We targeted the largest water consuming features.



Sample Raingarden with Under drain.



Sample Infiltration Trench.



One Line Diagram for Wading Pool.

Water Savings:

Water IN:

- 57% Annual Reduction.
- $33,000 Annual Savings.

Water OUT:

- 62% Sanitary Sewer Water Diverted, and $25,500 Annual Savings.
- 74% Storm Water Diverted, and $5,500 Annual Savings.

Irrigation system

We prioritized the park irrigation system because it consumes the majority of the water, and may be improved with the least amount of cost and minimal impact. Continued work on leaking components, and re-aligning of planting beds and sprinkler heads with one another will provide significant water savings. However, because of projects based on the 1909 Olmsted master plan, anticipated population growth and increased park use, the need for water in the park is likely to increase in the future. These changes increase the importance of an efficient system that balances the water in and out of the park.

Wading Pool

The wading pool is the second highest water user and contributes to both sanitary and storm sewers. Our approach sought to re-use the water on site benefitting from water in and water out savings. To achieve this goal, the pool requires a new water sanitization system that reduces chemicals added to the water, while keeping the historic look and function. This approach would also reduce how much children and toddlers are exposed to chemicals.

Roads & Walkways

Impervious surfaces, primarily roads, represent a hidden cost related to stormwater generated and sent into the sewer system. Paid semi-annually through property taxes instead of utility bills, the fees are nearly equal to that spent on potable water. Our plan utilizes GSI (green stormwater infrastructure) in the form of nearly invisible infiltration trenches, and rain gardens that may be incorporated into the design to mitigate the majority of stormwater on site. This aligns the park with the goals of the City, and Parks & Recreation to minimize stormwater, and should provide annual tax credits to help offset maintenance costs.

Service Yard

The service yard and glass houses would receive storm water during the winter months from the wading pool, and water harvested from the glass roofs. The collected water could be used year-round for indoor needs such as toilet flushing and irrigation of the greenhouses. The prized orchid collection of the Conservatory prefers rainwater to city water, as it has fewer chemicals added. This long term plan provides added value for water savings, and enhanced horticulture.

Since SPU operates the reservoir, it was specifically excluded from our project. However, it was not ignored, and our findings indicated that it could be an incredible asset as a rainwater collection device, enormous cistern, and playful water feature pending on the configuration.

Life Cycle Cost Analysis

We conducted Life Cycle Cost Analysis on the measures taken in the key areas for sustainable strategies identified above. The costs in this report are a rough order of magnitude that will need to be refined as design concepts evolve and become more developed.

Since grants and fund-raising campaigns will likely fund improvements in the park, the return on investment is best measured by a reduction in utility costs that offset any increased on-site maintenance and operations. Other benefits of our plan include greater community involvement and better amenities for visitors.

Environmental Certification Options
While certification is not prescribed or required (yet) for this Volunteer Park water project, pursuit of a certification system may help organize the effort around improved performance and decisions within a complicated ownership / stewardship structure.

Salmon Safe is a local program aimed at improving water quality in Puget Sound. Participation aligns the park with significant grant funding sources that support major water-related capital projects.

Recommendations

Volunteer Park is a popular and well beloved park with a variety of amenities. It is currently well managed, and can do even better, with strategic capital investments. The anticipated added long term maintenance costs of water conservation measures may be balanced by projected utility savings.

Priorities in order of Implementation:

- Repair leaks and improve the irrigation system. Efficiencies gained here have the lowest cost, and some of the highest returns.
- Install GSI to mitigate impervious surfaces. The raingardens and infiltration trenches proposed will reduce stormwater leaving the site, and provide tax credits. They require less maintenance on simple gravity systems, do not require additional power, and have fewer regulations involved in the design.
- Address the wading pool. This feature has the highest profile, most difficult regulations, and complex systems that require more power and maintenance. All the more reason to tackle it. The water and utility savings are huge in all categories. This can help to offset the long term maintenance costs, and added value of clean water with fewer chemicals that will be appreciated by the users of the pool.
- Harvest rainwater from the Glass Houses. This is a more complex system, but largely takes place out of public view. A separated storm sewer exists that needs further modifications to complete the system. With indoor irrigation taking place year-round, there is demand for the water harvested during the rainy season.
- Extend strategies to new project designs. The most cost effective time to discuss and implement water saving strategies is now, it is important to keep communicating with the Museum and Amphitheater projects. There is potential rainwater harvesting from each of these facilities.

These measures represent a meaningful step forward in achieving a sustainable Volunteer Park which will last for future generations to experience and enjoy. They reflect a commitment to achieve a triple bottom line: responsible water usage mindful of environmental, economic, and social impacts.

Schedule

Year One:
- Apply for Grant to Continue Design Work,
- Further Investigate Salmon Safe Certification,
- Coordinate Efforts with the Museum & Amphitheater Projects,
- Assist the VPT with Grant Funding and volunteers to care for the park.

Year Two:
- Raise Funds for Construction,
- Complete Design and Bid.

Year Three-Five:
- Construct Measures.

Findings

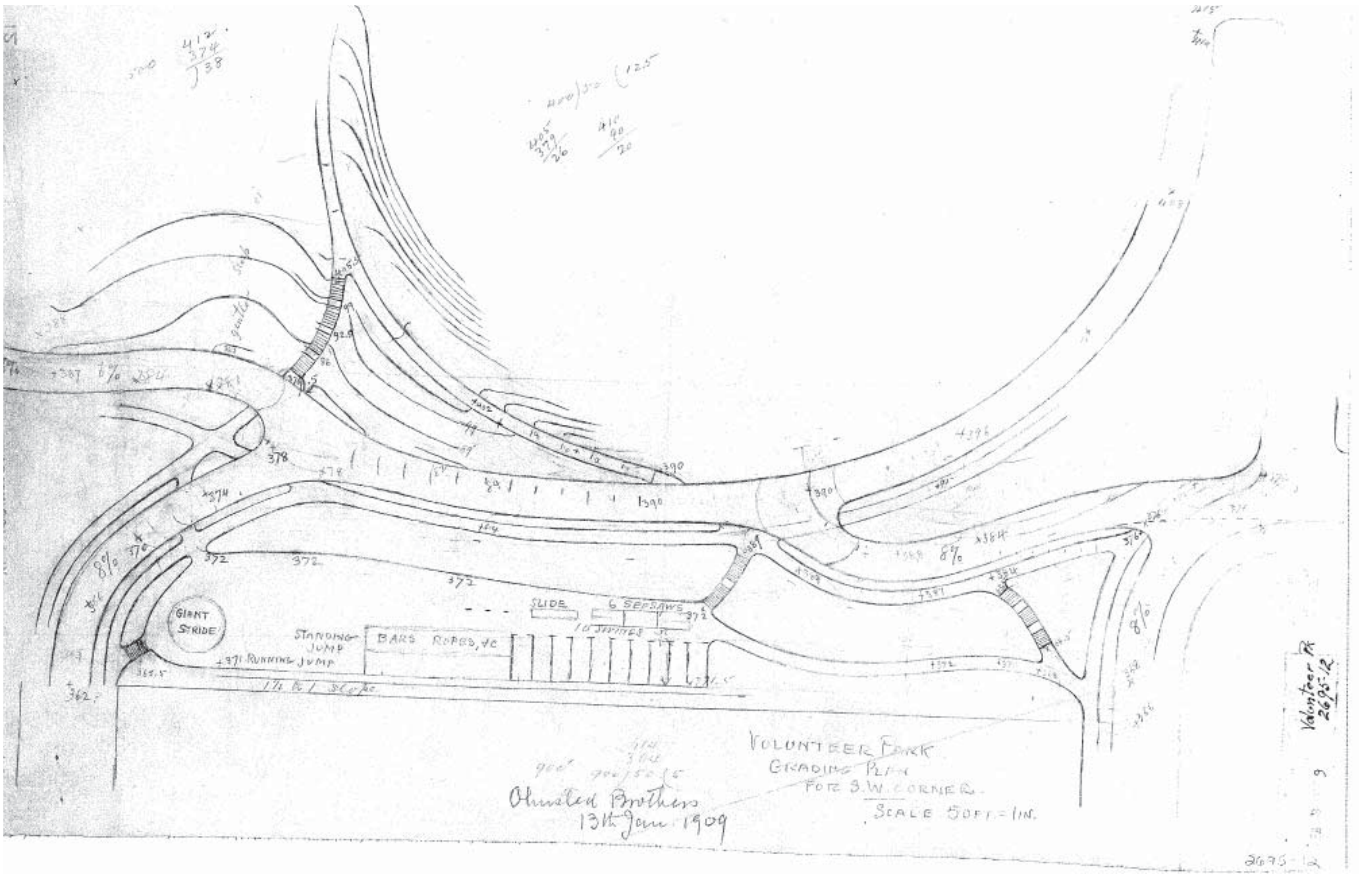
- Olmsted's' Approach and Volunteer Park
- Discovery Process
- Stakeholder Meetings
- Public Open House
- Infiltration Testing
- Certification Systems

INTRODUCTION TO FINDINGS

We gathered intelligence on water usage past and present to chart opportunities for sustainable design measures in the park. Our findings derived from research, engagement, and testing. We familiarized ourselves with the history of the park and the principles and tactics of the Olmsted Brothers firm to build a comprehensive understanding of the unique character of the park. We also learned about the state of the art water controls and metering system and used the data from these tools to analyze the water usage in the park.

We also sought and received insight from the Volunteer Park community. Our team engaged with stakeholders and the public to inform our findings. We held an eco-charrette with key stakeholder which helped us to hear the priorities from their perspective and work together on potential ideas. Our public open house introduced the idea of sustainable changes to the park and garnered feedback on our initial thoughts.

Finally, infiltration tests were performed to hone in on the areas most suitable for infiltration systems. GSI (green stormwater infrastructure) may also be integrated into areas of lower infiltration with systems that utilize dispersion techniques or an under drain. Our team also compared certification systems and found that Volunteer Park could reasonably achieve Salmon Safe certification.

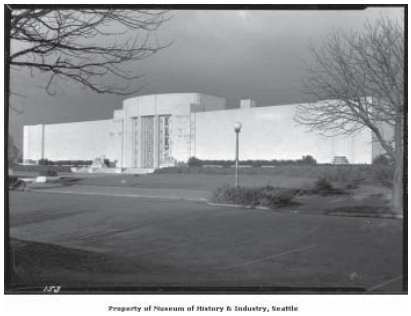


Sketches of the Western Playground by the Olmsted Brother, 1909. FSOP.

Olmsted Plan 1910.

Western playground, 1909, MOHAI. "a playground within half a mile of every home."

Music pavilion, 1912, MOHAI.



Seattle Asian Art Museum 1933.

In-depth research into the history of the park gave the team insight into the challenges and opportunities unique to the park design and the surrounding neighborhood. Olmstedian design principles utilize natural landforms and water features to control storm water, prevent flooding and reduce maintenance costs. Sustainability and long term vision are key components in any Olmsted park.

Volunteer Park

Seattle's Volunteer Park was designed by John Charles Olmsted (1852-1920), the senior partner of the national firm Olmsted Brothers Landscape Architects, located in Brookline, Massachusetts. The park is representative of the picturesque romantic style of the Olmsted Brothers firm.

The naturalistic picturesque style of the Olmsted firm is clearly seen in many of Volunteer Park's key features. Irregular lawns bordered by shrubs and tree plantings frame and mediate views of the surrounding city as well as provide areas for passive recreation. Cars and people circulate on dedicated loops that capitalize on key views. The main area of congregation before the Asian Art Museum shows their preference of geometric and formal elements when designing for crowds.

Volunteer Park also reflects the belief in the psychological benefits of urban parks held by the Olmsted Brothers firm. The passive recreation areas, such as the large interconnected lawns and ample walking paths, created a place for urban dwellers to escape the din and dirt of the city. The natural scenery provided restorative landscapes to view and move through to achieve psychological balance. Native and non-native plant species were artfully mixed to achieve a desired naturalistic visual effect as well as functional framing and borders for the lawns and active areas.

The time line of Volunteer Park's evolution shows that change is a constant, as the park changes with its surroundings and needs of the users. That being said, few substantive changes to Volunteer Park have occurred since 1975 when the park was listed in the National Register of Historic Places.

The second reservoir project in the 1920's shows that Volunteer Park has historically been involved in major water works, and would make a great educational component to reflect on the past and see state of the art systems at work.

The original design shows a playground in the southwestern corner, reportedly set aside for older children. While the western playground is no longer present, it shows that a now dormant part of the park once was an active place as intended to be by design. Further activation from the streetcar does not appear to be likely any time soon, though park visitation may increase from the rail system.

Olmsted Brothers Design Principles

Frederick Law Olmsted created a set of design principles that have served as a blueprint for the creation of beautiful and enduring works of landscape architecture. John Charles Olmsted, through the firm Olmsted Brothers, followed these principles in his work in Seattle.

A Genius of Place

The design should take advantage of unique characteristics of the site, even its disadvantages. The design should be developed and refined with intimate knowledge of the site.

Unified Composition

All elements of the landscape design should be made subordinate to an over-arching design purpose. The design should avoid decorative treatment of plantings and structures so that the landscape experience will ring organic and true.

Orchestration of Movement

The composition should subtly direct movement through the landscape. There should be separation of ways, as in parks and parkways, for efficiency and amenity of movement, and to avoid collision or the apprehension of collision, between different kinds of traffic.

Orchestration of Use

The composition should artfully insert a variety of uses into logical precincts, ensuring the best possible site for each use and preventing competition between uses.

Sustainable Design and Environmental Conservation

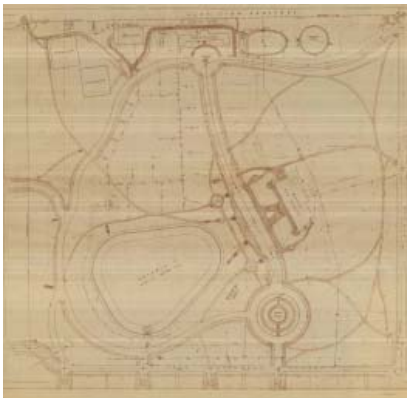
The design should allow for long-term maintenance and ensure the realization and perpetuation of the design intent. Plant materials should thrive, be non-invasive, and require little maintenance. The design should conserve the natural features of the site to the greatest extent possible and provide for the continued ecological health of the area.

A Comprehensive Approach

The composition should be comprehensive and seek to have a healthful influence beyond its boundaries. In the same way, the design must acknowledge and take into consideration what surrounds it. It should create complimentary effects. When possible, public grounds should be connected by green ways and boulevards so as to extend and maximize park spaces.

Natural Systems

Both generations of Olmsted's are well-known for the attention that they paid to the natural systems within their parks. Projects by Frederick Law Olmsted and the Olmsted Brothers firm approached parks and park systems with a long term vision to protect the commonplace nature world of the site not just the spectacular vistas and landscapes. This respect for the local site with its natural scenery, vegetation, and topography grew from a desire to maintain landscapes and natural features for future generations.



Volunteer Park 1947.

Flag Day at the Band Shell, 1936, MOHAI.

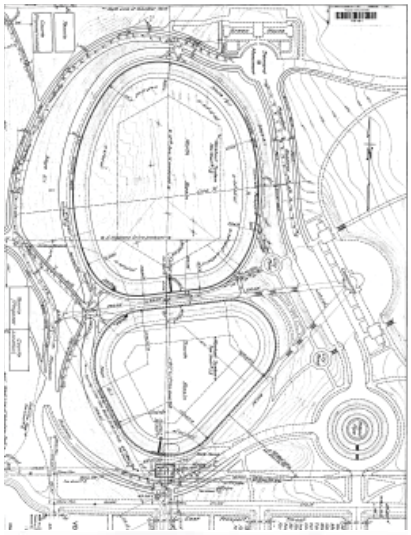
Band Stand Stage, 2009.

Amphitheater Concept Study, 2016, ORA.

Volunteer Park Reservoir, 1926, MOHAI.

Photo 57 – Conservatory in Volunteer Park, 1914
Courtesy University of Washington Libraries, Special Collections, SEA2059

Conservatory 1914.



Second reservoir plan 1920.

Photo 51 – Volunteer Park wading pool, 1913,
ourtesy University of Washington Libraries, Special Collections, SEA0965

Wading Pool, 1913, UW Special Collection.

Another principle guiding their use of water conservation methods in their designs is protection of the overall design. The Olmsted method respected existing water systems and augmented them to protect their parks from flooding. These measures saved the client in maintenance costs, protected the design of the park, and kept the park available to the public. This principle translated into adequate drainage systems which required more up front costs but long term savings. They emphasized that proper comprehensive planning and maintenance was key to the ultimate success of public parks.

Tactics and Projects

- The use of ponds and other water features to capture run off is one tactic used to mitigate and direct storm water (Cannon Hill in Spokane)
- Protection of existing water systems to prevent against unnatural flooding and leaving floodplains undeveloped for effective drainage (East Bay Park System in Oakland, Muddy River in Boston)
- Plantings of native plans and returning landscapes to their natural setting to use less water and to provide better drainage. (Iroquois Park in Louisville, Washington Park in Portland)

Park Time line

1901 Reservoir Built
1909 Olmsted Brothers' Plan Implemented
1912 Conservatory
1915 Original Band Shell
1933 Museum
1972 Band Shell
1988 Lower Greenhouse and Service Yard / Storm Sewer System
2016 Amphitheater
2016 AAM Expansion
2017 Reservoir Determination
2017 Implementation of Sustainability Measures????

Second Reservoir

In 1915, the city council asked for a report on expanding and improving the Cedar River water system in anticipation of a population of one million people in 1950. The report identified the need to enlarge Volunteer Park as part of the improvement of the system and viewed the enlargement as essential. By 1920, the city council had joined the public works department, and the water department in supporting a plan of building a second reservoir at Volunteer Park. A group of residents near the park sent their objections directly to the mayor and by September of that year the citizens, had instituted a temporary restraining order to halt the work which was upheld in King County Court and turned into an injunction which stalled the project.

Southwestern Playground

According to the Board of Park Commissioners minutes from 1909, they approved the building of the playground in the southwestern corner and mention of the plans to build the play area show up in a 1909 report, *Parks, Boulevards, and Playgrounds of Seattle*. Letters from Charles Olmsted indicate that the addition of a playground was important to the Olmsted Brothers firm and Parks.

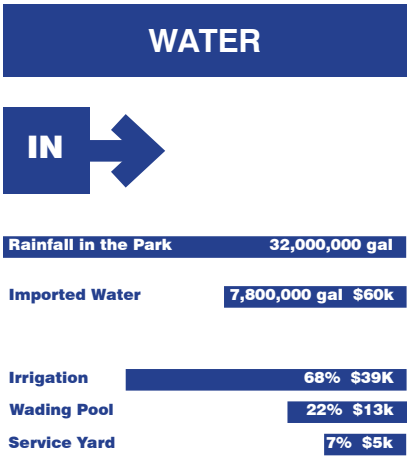
Discovery Process

Our research began by identifying water use in the park. Karen Galt of Seattle Parks and Recreation gave us an overview of water use, budgets, strategies, and monitoring and control systems. She provided meter information about water consumption broken down into five categories of irrigation, glass houses, wading pool, comfort station and band shell.

Lee Richardson the facilities manager for the Seattle Art Museum, Sculpture Park, and Asian Art Museum, provided meter information for water and sewer use at Volunteer Park.

Areas were calculated for roads, paths, and structures in the park to estimate approximate stormwater generated and sent into the sewer system. For the calculations, annual average rainfall was used to approximate the quantities of water.

To simplify the approach we divided the water use into two categories of Water In and Water Out.



Water In:

Total water entering the site including rainfall and potable water from the Cedar River Watershed. Water imported into the site for all uses including but not limited to irrigation (outdoor and indoor), recreation (the wading pool), and domestic use (cooking, drinking, cleaning, showering, washing, and flushing toilets).

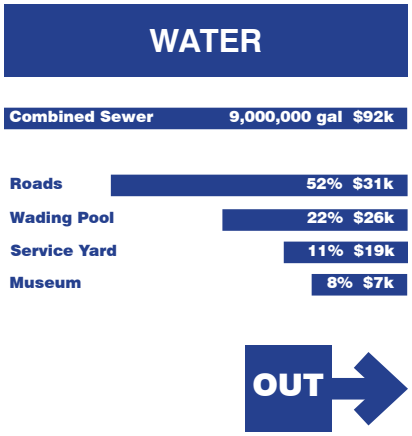
Annual rainfall at the site is estimated to be over 30 million gallons[1]. Imported potable water is metered at approximately 7.8 million gallons annually. Of the water consumed, roughly 68 percent is used for irrigation, 22 percent for the wading pool, and 7 percent for the glass houses (Conservatory, Upper Greenhouse, and Lower Greenhouse). The remaining 3 percent is used by the Museum, Band Shell, and Comfort Station.

Water Out:

Total water leaving the site including stormwater from roads and buildings, irrigation (inside of buildings), and domestic water use inside of buildings and comfort stations. Though some of the irrigation of park lands may end up in the storm sewer, for the purposes of this study, this water is anticipated to remain on site in the lawns and planting beds.

Annual storm water leaving the site is estimated to be approximately 7.1 million gallons. The majority of which is generated by roads 66 percent, which is the feature with the single largest impact. The following contribute approximately 7-8 percent each, tennis courts, museum, and glass houses. The wading pool and walking paths are estimated to contribute about 3 percent each.

1 The reservoir was specifically excluded from our study. The area calculations for impervious surfaces, and annual stormwater leaving the site are not included.



Annual sanitary water leaving the site is equal to the metered amount of water imported to the site with the exception of irrigation, since that water is presumed to remain on the site. The total sanitary sewer is about 2.5 million gallons annually.

The wading pool is the largest contributor at 68 percent, the glass houses at 22 percent, and the museum about 10 percent, and the comfort station and band shell contributing the rest.

Park Specifics:

Irrigation System

The VPT (Volunteer Park Trust) completed an Irrigation System Report[2] in 2014. During the study an apparent leakage rate of 60 gpm was observed during testing when the irrigation system was charged with nothing on at the controller. Watering is ET (Evapotranspiration based) and takes place between 11:30pm and 8am. Calculating the water loss at 60 gpm (gallons per minute) for 8 hours over 100 days is over 2.8 million gallons of water lost due to inefficiency. Accounting for the possibility of a garden hose on at the time of testing behind the Conservatory, the estimate is using approximately 1.2 million gallons as the annual water loss.

The findings of this study highlight the importance of implementing the recommendations made in the irrigation report. Seattle Parks and Recreation has been in the process of making the repairs and improvements to the system. Following the stakeholder charrette, work to bypass the galvanized main pipe, the primary source of leaks, was executed by Parks & Recreation. At the time of our draft, insufficient data had been accumulated to determine how much water was saved. However, the repairs made a noticeable difference, observations by Parks gardeners, volunteers, and frequent users commented that areas that were historically wet after watering, had dried up.

The irrigation report identifies areas of the park where new irrigation is to be installed. The report also identifies missing and broken sprinkler heads, as well as misaligned sprinkler heads that no longer perform their intended function as plantings have grown and changed over time.

Park Master Plan

The master plan for Volunteer Park is the original 1909 Olmsted Brothers' plan. Over time the original plantings, trees, shrubs, and flower beds have expanded from the original footprint. As the park ages, the mature plants will eventually be replaced, and beds will be restored to their original size and location.

Wading Pool

The wading pool is a beloved neighborhood treasure of Volunteer Park, originating from the Olmsted Brothers' plan. The wading pool contributes significantly to water in and water out including sanitary and storm sewers. Discussion with Parks regarding the operations and maintenance of the pool revealed that there are many opportunities for improvements.

2 Volunteer Park Irrigation Report by Two Four / Two Six, Inc, April 15, 2014.

The existing wading pool utilizes outdated technology and does not meet current health code. The trend for new installations is away from wading pools to spray / play parks.

To bring the wading pool into full compliance with Health Code it would need a recirculation system with a chemical controller. If water remains in the pool like a swimming pool, it would also require a fence surrounding the pool with self closing gates and adult latches. A full time wading pool would have increased operational needs requiring daily ongoing maintenance, cleaning, and leaf removal. Parks does not support this type of a system.

The current permit from the health department allows the pool to be filled and drained daily. Whenever there is water in the pool an attendant is present. The attendant tests the water throughout the day and adds chemicals as needed to meet Health Code water standards.

The wading pool is filled with 33,000 gallons each morning and then drained at the end of the day. It takes hours to drain, and if de-chlorinating the water takes place in order to re-use water for irrigation the user experience will be limited while it drains.

Currently, Dichlordihydrate, a stabilized dry chlorine for wading pools, is added to the water and each time this happens all users must leave the pool. At times, in order to increase pH at wading pools Soda Ash or Sodium Carbonate Anhydrous is added. To dechlorinate the water before draining (storm sewer system) Ascorbic Acid is used.

Roads
The roads are asphalt with concrete curbs, and catch basins that send water into a storm sewer. The water in the storm sewer eventually merges with the city combined sewer where it is conveyed all the way to the treatment facility at West Point in Magnolia. Though they do not appear to have a cost, Seattle Parks and Recreation pays $ 55,586.05[3] for surface water as part of their biannual tax bill. The roads comprise 2/3 of the impervious surface in the park and contributes by far the most storm water into the combined sewer.

The water from the road is mixed with oils, fuels, exhaust, and heavy metals from car brakes and other parts. This water has the lowest water quality with the most issues for capture and re-use, including a possible complication in the plumbing code that prohibits collection of rain water from uncontrolled surfaces (such as roadways).

Service Yard / Glass Houses
The service yard is fenced and off limits to the public. It includes the back of the Conservatory, upper greenhouse, service road, cottage, lathe house, Quonset hut, lower greenhouse, and other sheds and storage barns. There are also large scale stockpile areas for soils, mulch, compost, and other landscape needs. This area was identified by stakeholders and the public as an ideal area for locating infrastructure such as cisterns.

Synergies

Watergy:
Saving water reduces energy needed for the transportation, pumping and treatment of potable water.

Micro-Hydro:
Potential of electricity generation with storm water leaving the site, similar to a hydro-electric dam, at a very small scale.

3 King County Treasury Services, Tax Bill for Parcel #2925049087

The VPSC requested review of the stockpiles by our team. The stormwater code requirements for water quality regarding stockpiles requires keeping sediment, materials and toxic waste from entering surrounding sewer infrastructure. Permanent structures over stockpiles do not appear to be required if temporary covers are placed over stockpiles that may leach out contaminates. The adjacent stormwater collection structures (such as catch basins) need to be maintained to help keep materials out of sewer infrastructure. We are showing a permanent structure over the stockpiles in our concept plan to study its feasibility.

There are existing sanitary sewer, and storm sewer systems that include a detention tank. The two systems merge and enter the city combined sewer system in the vicinity of the service yard.

Museum

The Museum is a partner with the VPSC, and very interested in sustainability in the park. Currently, the museum is planning a major renovation[4] that includes seismic and HVAC upgrades as well as an addition towards the eastern greensward of the park. The plan is targeting LEED certification for interiors.

Amphitheater

The Amphitheater project sponsored by the VPT, has completed a feasibility study[5] and concept development[6]. The design team, ORA, has expressed interested in sustainability in the park, shared ideas and considered options for harvesting stormwater.

Reservoir

The reservoir is the single biggest entity in the park. Built in 1901 prior to the Olmsted Brothers' work, it has, enormous potential for water conservation. How much potential? Enough to capture and store all of the water needed for the entire park AND storage for emergency firewater, and a reflecting pond with sailboats, and water source heat pump for the facilities in the park.

The reservoir is owned by the city and operated by agreement with SPU (Seattle Public Utilities). SPU was contacted for this study and a representative came to the stakeholder charrette. Currently, the reservoir is filled about halfway. No longer used for domestic water supply, the stored water is for emergency fire suppression. The future of the reservoir is unknown. SPU is currently conducting an evaluation to determine if the water supply system needs the reservoir. A decision is expected to be announced in the winter of 2017. After that time, there will be extensive public process to evaluate the best public use for the reservoir should it be determined that SPU no longer needs it.

Observations:

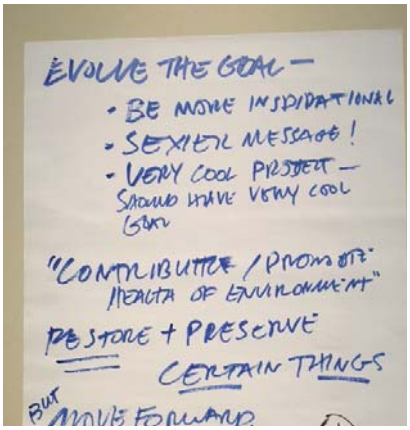
Annual rainfall at the site is estimated to be over 30 million gallons, and an estimated 7 million gallons of which leaves the site in a piped storm sewer after falling on impervious surfaces such as roads and structures. This water that is sent away, at taxpayer cost, is nearly equal to the amount of water imported from the Cedar River Watershed. This provided a snapshot of water flow that formed the concept of keeping the water on site, minimizing impact, and therefore reducing the need for importing potable water to the site.

4 Seattle Landmarks Preservation Board, ARC Presentation #1, 05/27/2016 Asian Art Museum, LMN.
5 Volunteer Park Amphitheater Project, Feasibility Study and Design Program, 03/08/2016, ORA + Walker Macy.
6 Volunteer Park Amphitheater Project, Concept Development, 09/02/2016, ORA + Walker Macy.

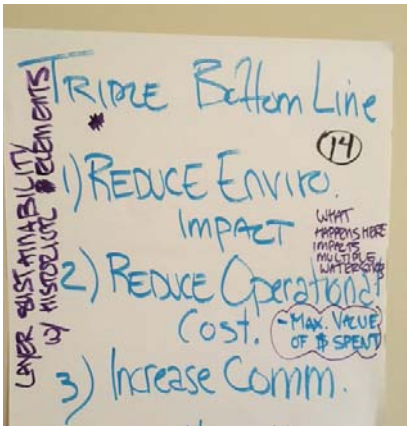
ECO CHARRETTE

Eco Charrette
Our team held the Eco Charrette on June 20th, 2106, at the Asian Art Museum, in the Alvord Board Room.

Participants provided one word or phrase that describes a vision for Volunteer Park to in 20 years. Volunteer Park is....
Community, Neighborhood, Full Inclusion, Preserved – Cultural heritage, Same but better, Stewardship, Self-Sufficient, 100% Sustainable, Integrated, Ahead of the Curve, Flagship – Model, Restorative, Green Space, Solace, Blossoming, Big Trees.



Ideas captured on newsprint for the problem statement.



Triple bottom line for evaluating systems.

Presentation / General Discussion:
The water in and water out findings were presented to the stakeholders for background information and to provide inspiration for the discussion. Afterwards, the general discussion included sharing knowledge about the park from a diversity of backgrounds and perspectives, and the development of a problem statement for the project.

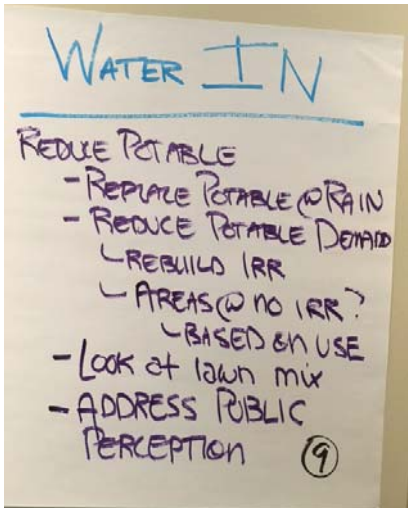
The discussion around the problem statement focused on a triple bottom line that reduced environmental impact, reduced operational cost, and increased community access, health, wellbeing while preserving heritage by educating and layering sustainability with historical elements. Further thoughts were for the problem statement to not just state reductions but also to be more positive, even inspirational.

Our team learned that Volunteer Park is a horticultural park of highest priority in the Park system. This designation means plantings will be watered even in times of drought, when other parks may not be irrigated. Play fields are also of a very high priority, as people must be able to play, and if dormant fields, such as the greenswards, are heavily used the lawns will not recover. Parks classifies fields depending on their use and assigns irrigation along this spectrum with lawns having the highest water need and non-irrigated meadows having the lowest.

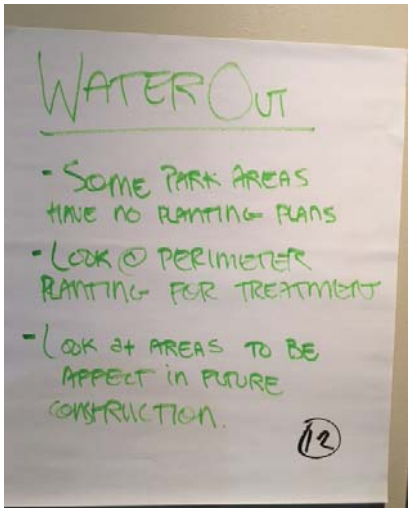
Future park plans include restoration of the Olmsted Brothers' planting plan, replacement strategy for the big tree in the park, and leadership in the park system.

Groups:
The stakeholders were randomly broken down into small working groups of 5-6 people each group with a specific topic for discussion regarding water use in the park. Afterwards each group shared their discussions and their own unique ideas for water conservation. However the most striking realization were the similarities from group to group, each identifying the irrigation/lawns, wading pool, service yard and reservoir as major opportunities for reducing water need and/or water leaving the site.

Of the ideas, a spray park at the wading pool (four spray parks currently in system and six proposed for next year) was suggested, though it would require significant maintenance. Another solution for the wading pool involved utilizing spray park technology for reuse of the water as irrigation.



Water in ideas captured on newsprint.



Water out ideas captured on newsprint.

Sharing of ideas between stakeholder groups.

The private, non-public areas of the park offer a great opportunity for water storage or other equipment with fewer controls and impact on the Park. These off limits parts could also be reopened to the public.

SPU:
Amanda Barnett of SPU (Seattle Public Utilities) attended the second half of the charrette. She responded to the group's ideas and comments related to SPU.

She stated that the Reservoir is operated but not owned by SPU. Representatives of the VPSC requested to be part of the conversation for the future of the reservoir.

SPU grants for on-site infiltration were also discussed and she stated that SPU considers Volunteer Park to be private, because all the sewers in the park are side sewers. Available grant funding is directed towards sewer systems in the right of way.

Impressions
The participants at the Eco Charrette are passionate about Volunteer Park. People who want to make the park better, restore its heritage, and are very committed to sustainability for the park.

Stakeholder Meetings

The design team has met with the VPSC (Volunteer Park Sustainability Coalition) at the regularly scheduled monthly meetings to review progress of the project, and additional meetings on occasion regarding specific issues. Typical activities include tracking the schedule, discussing sustainability strategies, grant funding, park certifications, public outreach, and volunteer opportunities.

The coalition is very interested in identifying additional funding sources and grant opportunities for both capital improvements and assistance with long term maintenance. In addition to the public open house, we planned to present the findings at the Friends of the Conservatory plant sale, however, severe weather prevented the event.

Each month the excitement of volunteers showing up and contributing to the effort reinforces the commitment and need for implementing water saving strategies in the park.

VPSC December monthly meeting. Twelve regular and special meetings held throughout the process.

Meetings with Parks & Recreation

ProView I

The design team briefed Parks at ProView meeting on August 23, 2016. We presented the water use findings, and proposed sustainability concepts, for water in and water out. Water in measures included repair of leaks, reconfigure of sprinkler head locations, and water re-use, primarily from the wading pool. Water out measures included, GSI (green stormwater infrastructure) elements to mitigate stormwater quantity and quality.

Wading pool – the wading pool is currently grand-fathered in on Health and Building Codes. Any changes made would require improvements for full compliance. Volunteer Park wading pool is one of the largest and deepest and most popular in the city.

Parks aquatics manager stated the wading pool takes hours to drain, and if we go the route of de-chlorinating and diverting water to the tank - we need to be aware of the user and maintenance experience of limiting access to the pool while it drains.

She also mentioned that if recirculating system is going to be considered that a spray park should be an option. She noted that if historic appearance was a concern, the spray nozzles could all be mounted in the bottom without the colorful metal structures and still provide an entertaining environment for children.

Respondents stated a desire to stay true to the Olmsted Brothers' plan, and not introduce features that distract from the aesthetic of the park. We were encouraged to create alternatives to removal of the wading pool, as it is iconic and would be greatly missed by the community.

Irrigation – repairs have been made to the irrigation system, and the leakiest component, the galvanized pipe section, has been completely bypassed. Common wet spots from the irrigation system have already disappeared. To realign the sprinkler heads, the planting master plan needs to be solidified.

Parks and Recreation

- ProView - August 23rd
- ProView - November 15th
- Aquatics - November 28th

In the PNW, we need to be more focused on conifers that intercept rainfall during our wet season. Preserving and replacing many of the old trees, some near 100 years, will maintain the character and majesty of the Park and help to better manage water. Many trees are nearing the end of their lifespan and quite a few will be lost to attrition and climate change in the coming years.

West edge – Comments received that reactivation of the west edge of the park would be beneficial because it is a primary entry point for the school. Respondents directed us to explore the idea of developing a play area, but stay true to the Olmsted plan.

GSI & Stormwater runoff - Parks requested adequate long term maintenance coverage. They requested preservation of the Olmsted plan, minimal impact to the design, and consistency with the master planting plan. New infrastructure should be underground or low profile structures, minimizing the visual impact.

General comments – Visual impacts are a major concern and any new systems need to be low maintenance. Historic and significant trees need to be accounted for when suggesting changes around the wading pool and anywhere in the park. The Reservoir – is not included with the design measures.

ProView II

The design team briefed Parks at a second ProView meeting on November 15, 2016, and responded to earlier questions. The water sustainability strategies were presented and well received by all in attendance, with the following comments.

"In urban and suburban settings a single deciduous tree can intercept from 500 to 760 gallons per year; and a mature evergreen can intercept more than 4,000 gallons per year. Even young, small trees help. In a recent Forest Service study a single small tree (Callery Pear) that was only 9 years old, was able to intercept 58 gallons of storm water from a ½ inch rain event (67% of the rain that fell within the canopy)." American Forests

Irrigation - Consider keeping, preserving, and replacing the big trees in the Park. The current policy is not to replace trees that have volunteered and grown in locations that are not on the master plan. Consider some flexibility with the Master Plan to maintain our urban forest.

Wading Pool - Operators would prefer the pump vault to be above ground. The system needs to be accessed frequently during use. A below ground vault is a confined space and requires a special permit. Parks requested that the design team review the wading pool proposed system with Kathy Whitman, Parks Aquatics.

Parks asked if there was a renewable offset option (solar or hydro) for the power generated by the wading pool pumps that could be incorporated into the project. The group appreciated the awareness of the maintenance needs, and requested a minimum of pumps as they are a maintenance item.

Stormwater - Security thought the shrubs should be okay from a CPTED perspective and the biofiltration trenches shouldn't warrant a tripping hazard, and could check with Joy Jacobson who reviews accessibility. Regarding the rain garden, activity from children playing can ruin infrastructure, recommend a more natural design that is less play-oriented. Keep simplicity in mind for all the systems.

SPU reviewed the proposed GSI system and stated that Parks would be eligible to receive a .7-14% credit.

Aquatics Team Meeting

The design team briefed Parks aquatics team at a meeting on November 28, 2016. Kathy Whitman and Tom Dunning,

Wading Pool proposed concept maintains the historic function and aesthetic of the wading pool and moves toward current health code compliance. The operation of the pool remains the same, fill in the morning and drain the pool at night with an attendant present when there is standing water.

The water in the pool will be circulated through a pump room, currently shown in an underground vault. The sanitization system utilizes pumps, filters, BECS controller, ozone, and UV. The goal is to minimize the chemicals used for both people and plants. The water is pumped down to an underground tank / cistern for use as nighttime irrigation. This way the cleanest water will be first used for people, and then for irrigation.

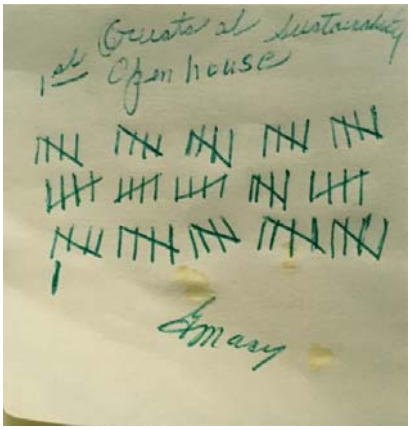
Comments:
Parks aquatics were supportive and liked the project pending resolving the details and required variances with the health department. Further positive effects of water reuse may result in increased water levels in the wading pool from current conservation levels to original design levels, and the season could be extended, providing greater benefit to the community.

Health department issues:
Current operation has a variance for the requirement of a five foot high fence around the pool. Parks is allowed to operate by draining the pool, and keeping an attendant present when filled. This variance would need to be renewed with permit application. Code requires a minimum of chlorine at 3 ppm (parts per million). Typical operation targets 5-6 ppm on a hot day with large use. The chlorine concentration dissipates from sunlight and evaporation. Cyanuric Acid is used as a stabilizer for chlorine. This chemical needs to be researched for irrigation impacts if it is used with the chlorine. The benefit is a more stable chlorine and fewer ppm with a recirculating system. With a recirculating system, a variance could be requested for minor levels of contamination.

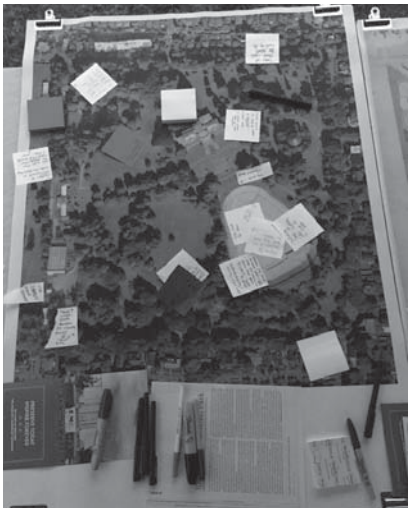
Pump Room:
An underground vault is a confined space and needs a special permit. The BECS controller will need to be accessed multiple times each day when in use. Chemicals will need to be carried down steps into an underground vault. A pump house at grade is far more desirable.

Parks will need additional equipment including a turbidity meter for measuring and reporting, a chlorination pump, floor drain to the sanitary sewer, and if below grade, a sump pump. In addition a large tank is required for recirculation. The cistern could serve this purpose, but would need to be much closer.

Wading Pool:
A second drain will be required and both drains and covers retrofit to be VGB (Virginia Graeme Baker) to meet Federal requirements. Operational changes could be made. The pool attendant does not fill or drain the pool, that is done by a pool operator. A full time pool operator is needed for the recirculating system. This person could either replace the pool attendant or be shared by three separate nearby facilities.



Volunteers tallied 76 people who visited the public open house.



Site photo and interactive board with public commentary and ideas.

Public Open House

The first public open house was held on First Thursday, September 1st, 2016, on the steps of the Asian Art Museum in Volunteer Park. Though the weather did not fully cooperate, many curious, interested, and enthusiastic people turned out to contribute their thoughts and ideas.

Below is the tabulation of the questions from the presentation boards.

How Do You Want To Follow The VPSC's Study? (11)

Information on the Volunteer Park Trust website	2
See conservation in action with a rain garden	6
Educational display in the park	2
Access to the study's findings	1

How Do You Want To Provide Feedback To The VPSC's Study? (7)

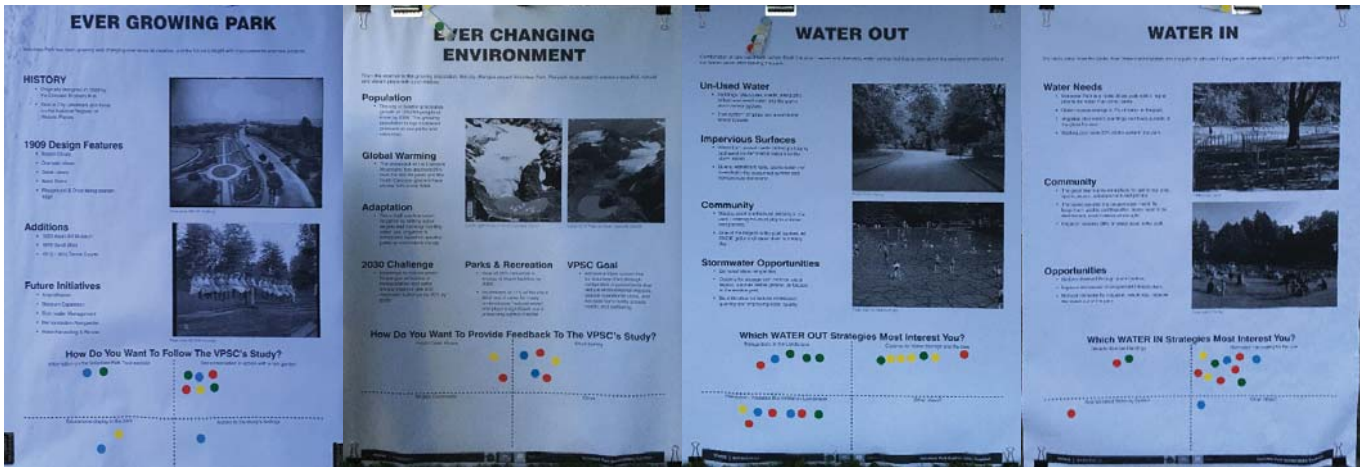
Public Open House	2
Short Survey	5
Written Comments	0
Other	0

Which WATER IN Strategies Most Interest You? (14)

Drought Tolerant Plantings	2
Rainwater Harvesting for Re-Use	10
Sophisticated Watering System	1
Other Ideas?	1

Which WATER OUT Strategies Most Interest You? (19)

Raingardens in the Landscape	5
Cisterns for Water Storage and Re-Use	7
Interactive / Walkable Bio-Infiltration Landscape	7
Other Ideas?	0



Photos of the presentation boards with the voting results. Though somewhat inconclusive, the activity provided an opportunity for public feedback, involvement, and ownership of their park and changes taking place.

PUBLIC OPEN HOUSE

Clayton pointing the way to water savings.

Taking part in the process.

Outreach.


Thought provoking.

Conversations and Trends

The public shared diverse opinions, and ideas, one trend indicated an interest towards capturing water, storing and re-use in the park. The idea of a cistern visible in the park received mixed reviews. Some saw the cistern as an opportunity to showcase sustainability and artwork for murals; others were concerned about graffiti or disruption of the park.

The reservoir continually came up as an opportunity, and people wanting to know the status and future plans for the reservoir.


Audrey providing leadership.


Mike leading the discussion.


Capturing thoughts and ideas.

Public Open House

The second public open house was held on First Thursday, February 2nd, 2017, in the Seasonal House of the Volunteer Park Conservatory. The Conservatory was free to the public and open late for the event.

On First Thursday throughout Seattle Museums are free and open late to the public. We chose this date for each of our events to take advantage of a larger audience circulating through the Park. The Asian Art Museum in volunteer Park is also free and open late on First Thursday.

The event was well attended with 65 people tallied who came to the exhibit, learned about the water strategies, and shared their own ideas. The Capitol Hill Times[1] also covered and reported on the event.

Attendees of the event were both curious and engaged. The overwhelming consensus was very favorable. The wading pool reuse of water was received with glowing appreciation of the immediate impact to saving both water and budget. Similarly, rainwater capture for irrigation was easily understood and received favorable reviews. Diverting stormwater from the combined sewer needed greater explanation. While some of the public were aware of the issue with stormwater, many needed to be reintroduced to the current functioning system, and how the proposed strategies would help.

Just one week after the event, the Seattle Times[2] reported that due to a malfunction during a heavy winter storm event the West Point Treatment Plant was reduced to half capacity and dumping 50 million gallons per day of raw wastewater into Puget Sound. 90% of the effluent is stormwater, emphasizing the benefit of mitigating stormwater on site and reducing impact, overflows and harm to Puget Sound.

1 http://www.capitolhilltimes.com/Content/Default/On-The-Town/Article/Coalition-explores-water-conservation-strategies-for-Volunteer-Park/-3/554/4684

2 http://www.seattletimes.com/seattle-news/puget-sound/raw-sewage-going-into-puget-sound-again-from-damaged-wastewater-plant/

Michael Cory and Tom Eichbaum of the VPSC discussing the plan to the public.

Audrey Van Horne of the VPSC and Project Team Intern Chaz Kerns from Cascadia College.

Gale Macy and Tom eichbaum of the VPSC inspect the setup display.

Brandon Macz from the Capitol Hill Times listening to Adam young explain the wading pool water strategy.

Engaging the public with the strategies.

Volunteer Park Infiltration Tests

Testing was done following the City of Seattle, *Simple Infiltration Test*[1]. We reviewed sites with Seattle Parks & Recreation, and utilities were located prior to digging. The testing took place between August 15th and 28th, 2016. Each site was tested twice, following the Simple Test procedure, except for Site Three where no infiltration occurred. The other five sites each appear suitable for green stormwater infrastructure.

Site 1

Located down hill from the single paved road that runs from the conservatory Westward, eventually bending South near the Tennis Courts. The West side of the park is not irrigated regularly. Site One's soil was composed of sand and small rocks, contributing to a higher infiltration rate. Design Infiltration rate was found to be 4.0 inches per hour.

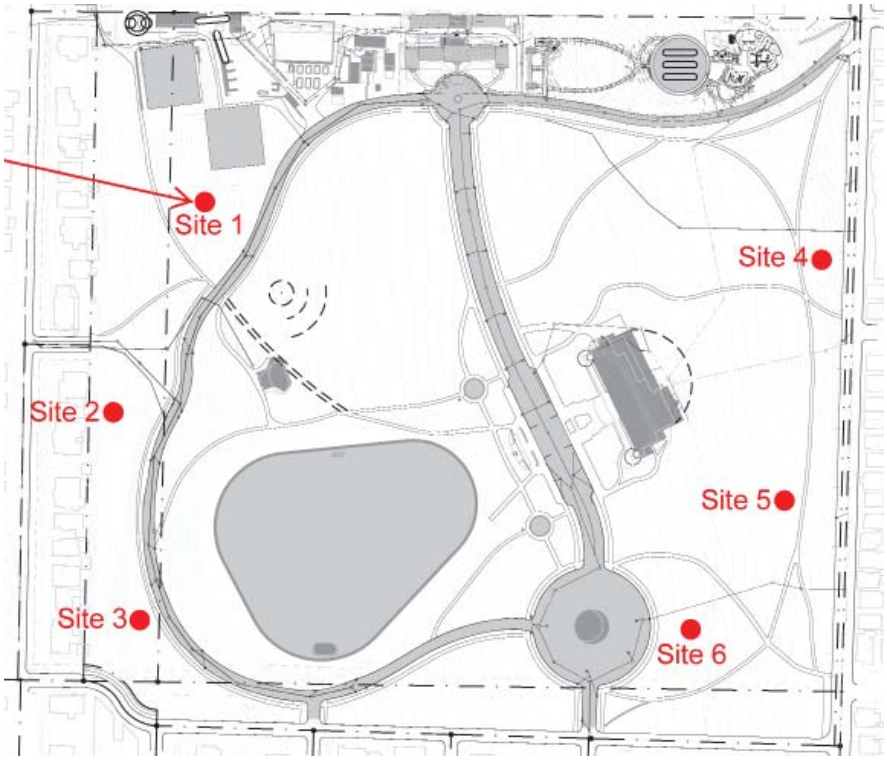
Site 2

Located South of Site One, with further decrease in elevation from both the North and East; likely the lowest test location. Shrub beds and trees near by, yet still no active irrigation systems within proximity. Soil was again, mostly sandy with low amount of small rocks mixed in. Design Infiltration rate was found to be 0.5 inches per hour.

Site 3

Marked on a small bluff near the Southwest corner of the park and visible from the paved roadway. The soil contained a more significant portion of

1 Completed Simple Infiltration Test forms for each test site are included in the appendix.



Approximate locations of test sites.

Site 1 test hole.

Site 2

Site 3 hardpan was encountered, and no infiltration took place.

Site 4 soils consisted of sandy loam which made for better infiltration.

Site 5

Site 6

Site 6

of Seattle's Department of Construction and Inspection.

No subsurface investigation has been completed at this time since preliminary design of potential water features must exist prior.

Minimum and maximum data points on the 2nd graph were taken from the 2nd day of infiltration testing results, except for Site 3 because of the apparent hard pan.

Further research and design is necessary to understand true hydrological characteristics at deeper soil levels, as well as investigation of topographic relevance each proposed site has in regards to water flow.

rocks and eventually hard pan was struck at 1.75ft. A single test run was completed due to the hard pan, which resulted in a Design Infiltration Rate of 0.0 inches per hour.

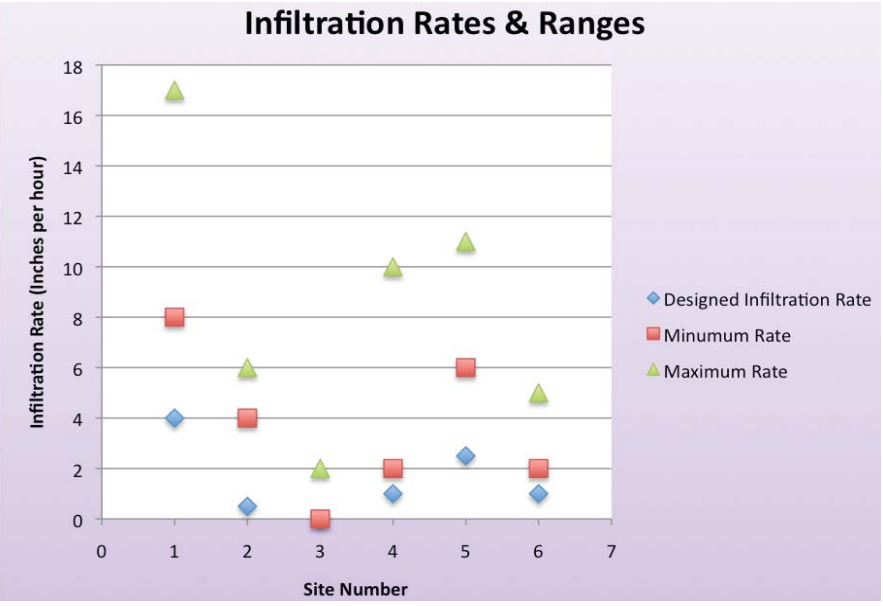
Site 4
Tests were performed just East of the Water Tower with minor declination in contrast to the paved roadway. This location does receive water regularly, as well as greater foot traffic. In comparison to the previous sites, this site was completely covered by well maintained grass. The soil composition was near a sandy loam consistency which projected a Design Infiltration Rate of 1.0 inches per hour.

Site 5
Adjacent to the East gravel path that runs North to South. Again, in a region of well maintained grass with higher foot traffic. The elevated slope was significant relative to the impervious surfaces near by (Art Museum & paved road way). Soil composition continued to resemble a sandy loam consistency that produced a Design Infiltration Rate of 2.5 inches per hour.

Site 6
Located near the Northeast corner of the park, approximately 80 yards North on the gravel path from Site 5. Likely the closest site to Conservatory/Wading Pool impervious surfaces. After penetrating well-maintained and established grass, the soil resembled a loamy sand consistency and lacking abundant amounts of rock. A Design Infiltration Rate of 1.0 inches per hour was calculated.

The results identify several potential sites that suggest suitability for transformation into a green stormwater infrastructure. The East side of the park holds stronger infiltration rates overall, yet the best rate was obtained by Site One.

The Designed Infiltration Rate figure is calculated by taking the lowest infiltration rate recorded and dividing it by two, according to the City



Graph of test sites and infiltration rates.

Environmental Certification Options

Large, public projects often require, or benefit from, achieving an environmental certification such as LEED or Energy Star. Pursuit of a certification system organizes the effort around improved performance and often drives decisions toward results within a complicated ownership structure.

To address the topic of certification options, our team considered and compared over fifteen environmental certification programs for Volunteer Park. While certification is not prescribed or required (yet) for this Volunteer Park water project, stakeholders may elect to follow an established protocol to formalize the effort. If such a program is deemed beneficial in the next phase, we offer the following guidance on which protocols are most applicable.

Two certification options could technically apply to this Volunteer Park water savings project:

1.) Salmon Safe certification (SS)
2.) Sustainable Sites certification (Sites)

We conducted a detailed comparison of these two programs for application at Volunteer Park. Based on our findings, we recommend pursuit of Salmon Safe certification for this historic park.

Rationale for recommending Salmon Safe for Volunteer Park:

- SS is WATER-focused. The ultimate intent is to improve the health of Puget Sound.
- SS is a REGIONAL program supported by local professionals who directly understand the significance of this historic Olmsted park.
- Participation in SS aligns the park with significant grant funding sources that support major bricks-and-mortar water-related capital projects.
- SS provides public outreach and education as part of the certification.
- SS provides on-site field verification during construction projects.
- The SS organization does the majority of documentation work on behalf of the owner, instead of a consultant team doing this work for additional fee. Of course the owner and design team also have responsibilities under SS, however it is much less laborious than the Sustainable Sites process.
- The SS organization has offered a cash discount for Volunteer Park certification through the Myer grant program. Compared to other certifications that offer little support to the owner, the certification cost for SS is much more reasonable. The estimated ROM for SS fees would be $30k for this project, before capital project cost.
- SS is all about an ongoing relationship that improves the health of Puget Sound. They actively collaborate with stakeholders to make meaningful improvement over time.

Salmon Safe, a local program aimed at improving water quality in Puget Sound.

THE Sustainable SITES Initiative®

Sustainable Sites, a national program aimed at holistically reducing environmental impacts of Parks & Public Spaces.

About the Salmon Safe program:

- On-site analysis is conducted by experienced local practitioners in stormwater and ecological site design. They refine the recommendations made in this report to reduce stormwater quantity and to improve stormwater quality on the property.
- Once a commitment is made to address the negotiated recommendations over time, the property is conditionally certified and can market this publicly. Changes do NOT need to be completed right away.
- The Salmon Safe cycle lasts five years. At the end of five years, the property can be re-certified given updated conditions and progress toward achievement of established goals.

Rationale for NOT recommending Sustainable Sites for Volunteer Park:

- While Sites offers an excellent, progressive solution for brand new parks with full flexibility to use modern technology, etc., it is NOT a good fit at historic Volunteer Park.
- Sites is a broader program than Salmon Safe, in that it covers many environmental factors such as energy savings and material waste. However, the scope of this work at VP is limited to water only…making Salmon Safe more appropriate in this case.
- The requirements for Sites are prescriptive and strictly enforced by reviewers in Washington DC. This is essentially a pass or fail system.
- It is inflexible for a reason...which is to appreciably reduce water waste no matter the cost. We feel this approach would be financially infeasible at VP.
- The actual cost of Sites certification would be significantly higher than SS. Sites certification fees would be in the range of $13k, however it could cost $60-90k to complete the reports required to achieve Sites certification. All before actual capital project cost.

About the Sustainable Sites program:

- The Sites program requires reduction of water use in the park by 50 percent, period. No flexibility. No negotiation. No matter the cost.
- Under Sites, the owner and design team do all the work of establishing the baseline, developing strategies to reduce water waste, and documenting compliance.

We look forward to working with the stakeholders in the next phase of this effort to determine if certification will be pursued.

Concept Plans

Problem Statement

At Volunteer Park, Parks spends tax payer money importing water to the site for irrigation and other uses, and at the same time Parks spends money on exporting nearly the same amount from the site.

Triple Bottom Line can be appreciated by visitors if this is accomplished.
Environment:

- Creative and efficient water use that helps to appreciate the natural environment;
- Saves and preserves potable water;
- Reduces energy and carbon footprint from the embodied energy of treating and pumping water over a great distance;
- Reduces the environmental impact from combined sewer overflows into Puget Sound that harm marine life.

Economy:

- Minimizes budget that is allocated for large infrastructure systems that do not, in and of themselves, contribute to the beauty of the Park;
- Helps to keep Park amenities, such as the Conservatory, Amphitheater, and wading pool accessible to the public.

Equity:

- Promotes public access, health, and well being;
- Restores, preserves, and respects the Olmsted heritage;
- Demonstrates and educates the public about sustainable park environments.

Approach

Our approach is a step by step sustainable strategy to start with the lowest hanging fruit and then to reach for the most sustainable star struck ideas. Step one will begin with the easiest, lowest cost improvements that reduce the need for water. Step two will improve the infrastructure of plumbing fixtures, systems, and technologies that are existing in the park to use water more efficiently. And step three will strive for greater sustainability with more involved and complex solutions that may harvest and re-use water on site.

The process seeks to reduce the imported water and the associated costs, by reducing the water leaving the site, and achieving tax credits along the way.

Each or any of the strategies proposed could be implemented on their own or as part of a combined effort. However, for the purposes of the study, we will be reviewing them collectively and estimate their combined impact on the park.

The strategies are listed in order by their impact on the park for water use and utility costs.

Irrigation:

- Fix leaks.
- Modify irrigation system.
- Re-categorize lawns to meadows.
- 18% water savings.
- $12k capital cost.
- Short construction time and minimal impact to park users.
- No additional maintenance.

Concept Strategies

Strategy A: Irrigation / Vegetation Master Plan

Leaks

Our team recommends following the strategies outlined in the Irrigation System Report. Since watering of the plants consumes 2/3 of city potable water used in the park, any reduction in water here will make a greater impact than many of the other sustainable strategies to smaller systems. While it is too soon to measure the effect of eliminating the galvanized supply pipe, by our estimations 1.2 million gallons of water could be saved annually by making these repairs.

Modify Irrigation System to Match Plantings & Master Plan

We recommend following the strategies outlined in the Irrigation System Report. Our concept here is to consider a 10 percent modification from the master plan to reduce areas classified as lawn and increase meadows, planting beds and trees. This can have a significant impact on water use, and if executed carefully, at a very slight departure from the original design.

Our plans outline areas where restoring the original design will increase watering demand, and delineates areas of proposed irrigation for meadows. Our concept is to balance the future needs by retaining planting beds and non-irrigated areas as they currently are in lieu of returning them to water intensive lawn as indicated in the master plan and the irrigation study.

Wading Pool:

- Recirculation system to minimize chemicals.
- Reuse water for irrigation.
- 22% water savings.
- 19% combined sewer reduction.
- $521k capital cost.
- 6 month construction time during off season with minimal impact to park users.
- Additional maintenance offset by utility savings.

Strategy B: Wading Pool

Recirculate Water / Reduce Chemicals

Install an underground vault, with a water sanitization system. This system is composed of filters, Ultra-Violet light tube, BECS chemical controller, ozone additive, and pumps to recirculate the water. This process sanitizes the water and leaves it usable for re-use.

The wading pool would be filled in the morning during hot summer days. While the pool is filled, the water will be constantly recirculated and sanitized. This will keep the water safe, reduce exposing children and infants to chemicals, and keep the pool open longer by reducing down time needed for adding chemicals and not require the attendant to monitor the water chemistry.

At the end of the day, the pool water will be sanitized and pumped down into an underground cistern, instead of sent down the sanitary drain. The water remains in the cistern until 11pm when the Park closes, and the irrigation cycle begins. Our proposed location for the underground cistern is near the irrigation pump house located adjacent to the museum. The construction of the museum addition offers an opportunity to combine efforts, limit disruptions, and utilize equipment on site to install the cistern. The wading pool is currently filled to a minimum, conservation level, of 33,000 gallons. The park needs on average 50,000 gallons each day for irrigation. With this proposed system, the wading pool could be filled to a higher level, increasing fun and splashes, with minimal additional cost, since the water will be reused.

Strategy B2: Wading Pool Stormwater Harvest
Rainwater collected from the wading pool surface in wintertime could be reused for indoor irrigation in the glass houses. The captured water would need to be filtered and then pumped to the service yard cistern where it would be stored.

The wading pool may be considered an uncontrolled surface (such as a road) and the plumbing code prohibits collection of rain water from uncontrolled areas. However, we may be able to use some or all of the water with certain protections and or treatment measures subject to further research and discussion with code officials, primarily the health department.

Strategy C: Roads / Plazas / Pathways

GSI (Green Stormwater Infrastructure)
The concept for stormwater mitigation of impervious surfaces is to minimize visual impact in the formal areas such as the promenade and greenswards, and to incorporate biodiversity into the perimeter areas with more visual raingardens designed to work in harmony with the Olmsted plan.

The existing stormwater infrastructure for the roads and buildings will not be abandoned, but utilized with modifications to divert the stormwater to designated GSI locations, with code required overflows tying back into the existing system.

The majority of the impervious surfaces in the park, will be directed to a GSI facility where infiltration potential will be maximized with respect to soil and groundwater characteristics and public safety. Final design and predicted infiltration rates shall require surveys of the proposed areas and testing of the soils. Our preliminary testing indicates that we can treat a very high percentage of stormwater on site.

The plan was sent for review to the Parks' SPU Stormwater Credit Program contact. Past credits at various parks have received credits that range from 2 percent to 30 percent, with the majority in the sub-10 percent range. For the purposes of this study, 10 percent tax credit is utilized for calculation purposes, until an estimate is received.

Terraced Rain Garden
Utilize Olmstedian landforms and drainage channels (valleys) to minimize the impact on the visual of the historic park while increasing its ability to mitigate storm water. This approach could be expanded to other areas in the park by integrating stormwater collection, treatment and storage into the language of the park (materials like stone, selective structure/formality, framed garden views).

Experiential Rain Garden
Utilize a rain garden on the western edge of the park to mitigate large quantities of stormwater from the roads and evoke playfulness. This concept references a playground which existed according to the 1909 Olmsted Brothers' plan in this location. The experiential rain garden would function as educational display, historic reference, and rain garden.

Roads / Plazas:

- Divert stormwater to GSI.
- 50% stormwater reduction.
- $593k capital cost.
- 3-6 month construction time during off season with minimal impact to park users.
- Additional maintenance required. Volunteer Park Trust may lead volunteer stewardship effort to care for gardens.

Service Yard:

- Rainwater harvesting for indoor use, primarily irrigation.
- 8% water savings.
- 7% combined sewer reduction.
- $344k capital cost.
- 6-9 month construction time outside of public areas with minimal to no impact to park users.
- Additional maintenance offset by utility savings.

Strategy D: Service Yard / Glass Houses

Harvest Rainwater from Glass Roofs

The Conservatory and upper greenhouse roofs currently tie into a storm sewer that is separated from any other source. This piped system flows downhill towards the east side of the lower greenhouse, where it can be intercepted at the first structure before mixing with water from roadways. This can then be piped downhill to the west side of the lower greenhouse where an underground cistern may be located to capture rainwater. From this cistern, the water would either be pumped into the lower greenhouse for use.

Our concept plan reduces the amount of water entering into the existing underground detention tank located in the service yard, and improves the water quality by installing oil water separators at catch basins. Further mitigation could be achieved by directing the water from the tank to a GSI facility at a lower elevation. Our current plan does not include doing so.

Strategy D2: Additional Above Ground Storage Tanks

Harvested rainwater could be moved and stored in additional above ground cisterns. Though visible, these cisterns would be located in the service yard behind the fencing in the non-public parts of the park. This strategy allows for flexibility and future expansion. The visible tanks could become part of an educational display on tours of the behind the scenes park operations.

Strategy D3: Stockpiles

The stockpiles are not required by code to be covered by a permanent structure. However, one option would be to install a structure with a roof of solar panels that could provide cover and additional power for the water harvesting systems. The location of the structure is also suitable for rainwater harvesting sending water to the above ground storage tanks.

Education:

- The tennis courts create an excellent educational opportunity for users.

  By adding to the court rules, diagrams and explanations of storm water mitigation or re-use helps users to understand the impacts and opportunities.

Strategy E: Tennis Courts

GSI

Currently, the tennis courts shed water to catch basins that connect with the combined sewer system. Utilizing the existing infrastructure, the storm pipe shall be diverted to the nearby GSI.

Strategy E2: Alternate - Harvest Rainwater

The tennis courts are also considered uncontrolled surfaces, similar to the wading pool. We may be able to capture water certain protections and or treatment measures subject to further research and discussion with code officials, primarily the health department.

The proximity of the nearby service yard cisterns make this option attractive. A small tank and pump would be required since the tennis courts are at lower elevation than the service yard.

Strategy F: Museum

GSI

The stormwater from the roof would be directed to a GSI located along the path on the east side of the park. Preliminary test results for infiltration were very good at this location.

Strategy F2: Alternate - Harvest Rainwater

The roof of the existing museum has large areas with glass skylights, which make for good clean surfaces for rainwater harvesting. A buried tank underneath the proposed patio near the museum or adjacent to the pump house would make good potential location for a cistern. The water could be used for toilet flushing inside the museum, or if tied into the pump house the water could be directed to the main irrigation system.

Strategy G: Amphitheater

Harvest Rainwater

This project has completed concept studies, and not yet begun schematic design. Early design discussion did include harvesting rainwater off of the roof structure and storage for re-use in a cistern located underneath the stage. The water could be used for toilet flushing, however greatest demand may not coincide with rainfall. Excess water could flow into GSI, or water could be pumped back to cisterns located in the service yard.

Design Phase:

- Incorporating sustainable design strategies and features during design is most cost effective.

  Retrofitting infrastructure after construction is much more cost intensive.

Life Cycle Cost Analysis

LIFE CYCLE COST ANALYSIS

General

The estimate is a rough order of magnitude cost. Care should be taken when utilizing the cost estimate for creating a capital improvement budget as not all of the potential issues have been addressed by the design or are represented in the line items.

Associated Project Costs
The costs shown represent construction cost and a multiplier for associated project costs, such as design, permits, special testing and inspections, project management, construction contingencies, and tax.

Assumptions

The rough order of magnitude costs and analysis are calculated as a whole. To gain the water and monetary savings shown for the park all of the measures need to be implemented. The components for each measure are isolated as much as possible, however there may be some items, that are included as part of a different strategy.

Contingencies

A design and construction contingency has been applied to the construction cost to account for the concept drawings, aspects of the design not yet considered, and unforeseen existing conditions discovered during construction.

Exclusions

Not included are project escalation costs for taking place in the future, or fees associated with fund-raising, grant writing, or project certification.

Return On Investments

The evaluation of benefits as they relate to the triple bottom line is an ongoing process. A simple payback in years does not take into account the value added to the park, environment, or community. The costs do not include potential grants and incentives or fund raising efforts for retrofitting infrastructure which would shorten payback period.

Sustainable Strategies	Water In		Water Out			
			Sanitary		Storm	
Item	Gallons	Cost	Gallons	Cost	Gallons	Cost
Volunteer Park Site ID:2925049087	**7,877,095**	**$ 59,999**	**2,521,664**	**$ 36,991**	**7,117,728**	**$ 55,586**
A: Irrigation Fix Leaks - 5 Valves Replace galvanized main line Re-catagorize lawns to meadows Repair / Modify Heads	5,355,431	$ 39,360				
B: Wading Pool B: Re-Use of Pool Water on Site B2 Re-Use of Winter Rainwater	1,710,302	$ 13,615	1,710,302	$ 24,878	255,995	$ 1,999
C: Roads & Pathways Mitigate stormwater with GSI					4,010,881	$ 31,323
D: Service Yard Deduct Meter for Conservatory Low flow plumbing fixtures D: Harvest Rain Water & Re-Use D2: Additional Above Ground Tanks D3: Stockpile structure & harvest rainwater	547,661	$ 5,062	547,661	$ 8,000	1,441,936	$ 11,261
E: Tennis Courts GSI E2: Rainwater Harvest					590,248	$ 4,610
F: Museum Mitigate stormwater with GSI F2: Harvest rainwater from rooftop	249,739	$ 1,962	249,739	$ 3,923	510,194	$ 3,984
G: Structures Amphitheater Mitigate stormwater	13,963	$ 106	13,963	$ 191	308,474 63,500	$ 2,409

LIFE CYCLE COST ANALYSIS

Sustainable Strategies	Water In Improvements			Water Out Improvements					
				Sanitary			Storm		
Item		Water Reduction Gallons	Utility Savings		Water Diverted Gallons	Utility Savings		Water Diverted Gallons	Utility Savings
Volunteer Park									10%
Site ID:2925049087	51%	4,030,540	$ 29,575	62%	1,566,655	$ 25,555	74%	5,263,688	$ 5,559
A: Irrigation									
Fix Leaks - 5 Valves	1%	53,554	$ 394						
Replace galvanized main line	15%	803,315	$ 5,904						
Re-catagorize lawns to meadows	5%	267,772	$ 1,968						
Repair / Modify Heads	5%	267,772	$ 1,968						
B: Wading Pool									
B: Re-Use of Pool Water on Site	90%	1,539,272	$ 12,254	90%	1,539,272	$ 22,390			
B2 Re-Use of Winter Rainwater	80%	204,796	$ 1,630				80%	255,995	$ 160
C: Roads & Pathways									
Mitigate stormwater with GSI							90%	3,609,793	$ 2,819
D: Service Yard									
Deduct Meter for Conservatory						$ 2,765			
Low flow plumbing fixtures	5%	27,383	$ 253	5%	27,383	$ 400			
D: Harvest Rain Water & Re-Use	70%	384,426	$ 3,553				27%	384,426	$ 300
D2: Additional Above Ground Tanks									
D3: Stockpile structure & harvest rainwater	2%	23,296	$ 82				2%	23,296	$ 18.19
E: Tennis Courts									
GSI							90%	531,223	$ -
E2: Rainwater Harvest									
F: Museum									
Mitigate stormwater with GSI	80%	408,155	$ 1,569				80%	408,155	$ -
F2: Harvest rainwater from rooftop									
G: Structures									
Amphitheater	80%	50,800	$ -				80%	50,800	$ 40
Mitigate stormwater									

Sustainable Strategies	Budget			Triple Bottom Line		
Item	Estimated Construction Costs	Annual Maintenance Costs	Annual Utility Savings	Economy	Environment	Social Equity
Volunteer Park						
Site ID:2925049087	$ 2,449,250	$ 41,000	$ 58,468			
A: Irrigation						
Fix Leaks - 5 Valves	$ 6,000	No Change	$ 394	High priority; cost and environmental value added.		
Replace galvanized main line	Complete	No Change	$ 5,904	Work complete!		
Re-catagorize lawns to meadows	$ -	No Change	$ 1,968	High priority; no cost, master plan and future park goals need to be revisited.		
Repair / Modify Heads	$ 12,000	No Change	$ 1,968	High priority; efficient system saves money and water.		
B: Wading Pool						
B: Re-Use of Pool Water on Site	$ 521,000	$ 15,000	$ 34,644	High priority; cost, environmental, and social equity value added.		
B2 Re-Use of Winter Rainwater	$ 55,000	$ 2,500	$ 1,790	Priority;		
C: Roads & Pathways						
Mitigate stormwater with GSI	$ 593,000	$ 10,000	$ 2,819	High priority; environmental, some cost, and social equity value added.		
D: Service Yard						
Deduct Meter for Conservatory	$ 2,000	No Change	$ 2,765	High priority; saves money, but not water.		
Low flow plumbing fixtures	$ 16,250	No Change	$ 653	Medium priority; saves water and money.		
D: Harvest Rain Water & Re-Use	$ 344,000	$ 5,000	$ 3,853	High priority; value added for plants and public, saves money and water.		
D2: Additional Above Ground Tanks	$ 334,000			Low priority.		
D3: Stockpile structure & harvest rainwater	$ 145,000	$ 1,000	$ 100	Lower priority, does provide opportunity for solar power.		
E: Tennis Courts						
GSI	$ 102,000	$ 1,500	$ -	Priority; reduces water runoff, value added as educational component.		
E2: Rainwater Harvest	$ 85,000			Lower priority, dependent on code modifications, and install of strategy D.		
F: Museum						
Mitigate stormwater with GSI	$ 66,000	$ 5,000	$ 1,569	High priority; design phase is the most cost effective time for implementation.		
F2: Harvest rainwater from rooftop	$ 48,000			High priority; design phase is the most cost effective time for implementation.		
G: Structures						
Amphitheater	$ 120,000	$ 1,000	$ 40	High priority; design phase is the most cost effective time for implementation.		
Mitigate stormwater						

Volunteer Park Water Sustainability Study for:

Volunteer Park Sustainability Coalition

Rough Order of Magnitude (ROM) Construction Cost Estimates for:

VPSC - Feasibility Study

Strategies		Cost	Included		Total
A - Irrigation & Planting	$	11,848	☑	$	11,848
B - Wading Pool	$	520,498	☑	$	520,498
B2 - Wading Pool Rainwater Harvest	$	54,470	☑	$	54,470
C - Roads: Stormwater Mitigation	$	592,094	☑	$	592,094
D - Service Yard / Glass Houses	$	343,544	☑	$	343,544
D2 - Additional Above Ground Tanks	$	333,628	☐	$	-
D3 - Stockpile Structure	$	144,194	☐	$	-
E - Tennis Courts GSI	$	101,096	☑	$	101,096
E2 - Tennis Courts Rainwater Harvest	$	84,698	☐	$	-
F - Museum GSI	$	65,791	☑	$	65,791
F2 - Museum Rainwater Harvest	$	47,817	☐	$	-
G - Amphitheater	$	119,543	☑	$	119,543
Grand Total	**$**				**1,808,884**

ROM Estimates Assisted By:

MENG Analysis

Assumptions, Clarifications & Exclusions:	Percent
1. General Conditions includes contractor mobilization, site office, safety, etc.	15%
2. Design Contingency includes design changes as design progresses.	25%
3. Overhead & Profit (OH&P) includes general contractor (GC) OH&P.	10%
4. Associated project costs are design, permitting, and other Owner soft cost.	35%

Volunteer Park Water Sustainability Study for:

Volunteer Park Sustainability Coalition

Estimated Costs for:

A - Irrigation & Planting

Item	Qty	Units	Unit Cost		Total
General Conditions		15%		$	832.50
Site					
Excavation				$	-
Structures				$	-
Remediation				$	-
Architectural				$	-
Mechanical					
Irrigation					
Replace Galvanized Main Line					Complete
Replace/Repair Leaking Valves	5	ea	$ 225	$	1,125
Relocate Sprinkler Heads At Wet Spots	13	ea	$ 200	$	2,600
Relocate Sprinkler Heads Blocked or Misaligned	6	ea	$ 200	$	1,200
Replace Sprinkler heads not Working	5	ea	$ 125	$	625
Electrical				$	-
Design Contingency		25%		$	1,596
	Subtotal			$	7,978
	OH&P	10%		$	798
	Subtotal			$	8,776
	Associated Project Costs	35%	x	$	3,072
A - Irrigation & Planting				**$**	**11,848**

Notes:

1. Planting work excluded; but if added, should result in further irrigation water use reduction.

Volunteer Park Water Sustainability Study for:

Volunteer Park Sustainability Coalition

Estimated Costs for:

B - Wading Pool

Item	Qty	Units	Unit Cost	Total
General Conditions		15%		$ 37,554
Site				
Excavation & Regrade / Contour	1	ea	$ 10,000	$ 10,000
Trenching	480	lf	$ 18	$ 8,640
Structures				
Underground Cistern - 40 kgal	40000	gal	$ 2.25	$ 90,000
Pipe	480	lf	$ 12	$ 5,760
Remediation	480	lf	$ 2	$ 960
Architectural				
Re-purpose Existing Pool Pumphouse	1	lot	$ 7,500	$ 7,500
New Pump House 10 ft x 12 ft with sump	120	sf	$ 200	$ 24,000
Mechanical				
Water Filtration & Treatment	1	lot	$ 20,000	$ 20,000
Filter / UV / BECS / Chlorine				
Water Piping and Surge/Mixing Tank	1	lot	$ 15,000	$ 15,000
Pool Pump	1	ea	$ 7,500	$ 7,500
Pump & Valve Controls	1	lot	$ 8,500	$ 8,500
Modification to Wading Pool	1	lot	$ 25,000	$ 25,000
Cut & Patch Concrete, Install Skimmers & Return; new VGB Drains				
Modifications at Irrigation Pumphouse	1	lot	$ 10,000	$ 10,000
Electrical	1	lot	$ 17,500	$ 17,500
Design Contingency		25%		$ 62,590
	Subtotal			$ 350,504
	OH&P	10%		$ 35,050
	Subtotal			$ 385,554
	Associated Project Costs	35%	x	$ 134,944
B - Wading Pool				**$ 520,498**

Notes:
1. Includes pool modifications, new pump house, new cistern near Museum, and irrrigation pumphouse modifications, and associated piping, power and controls.
2. See Diagrams 3a & 3b.

Volunteer Park Water Sustainability Study for:

Volunteer Park Sustainability Coalition

Estimated Costs for:

B2 - Wading Pool Rainwater Harvest

Item	Qty	Units	Unit Cost	Total
General Conditions		15%		$ 3,930.00
Site				
Excavation & Regrade / Contour				
Trenching	600	lf	$ 18	$ 10,800
Structures				
Pipe	600	lf	$ 12	$ 7,200
Connection at Clean Out	1	ea	$ 2,000	$ 2,000
Remediation	600	lf	$ 2.00	$ 1,200
Road Repair and Patching	1	ea	$ 5,000	$ 5,000
Architectural				
Mechanical				
Pump				$ -
Controls				$ -
Electrical				$ -
Design Contingency		25%		$ 6,550
	Subtotal			$ 36,680
	OH&P	10%		$ 3,668
	Subtotal			$ 40,348
	Associated Project Costs	35%	x	$ 14,122
B2 - Wading Pool Rainwater Harvest				**$ 54,470**

Notes:

1. This is NOT a stand alone price. Tank, Pump, filtration, and controls are included in other concepts. These represent additional costs associated with this strategy.

Volunteer Park Water Sustainability Study for:

Volunteer Park Sustainability Coalition

Estimated Costs for:

C - Roads: Stormwater Mitigation

Item	Qty	Units	Unit Cost		Total
General Conditions		15%		$	42,719.63
Site					
Excavation					
Trenching	2500	lf	$ 18	$	45,000
GSI					
A: Type 3, Infiltration Trench	464	ea	$ 30	$	13,905
B: Type 2, Rain Garden	338	ea	$ 40	$	13,500
C: Type 3, Infiltration Trench	330	ea	$ 30	$	9,900
D: Type 3, Infiltration Trench	762	ea	$ 30	$	22,860
E: Type 1, Rain Garden w/ Underdrain	232	ea	$ 50	$	11,588
F: Type 1, Rain Garden w/ Underdrain	875	ea	$ 50	$	43,770
G: Type 2, Rain Garden	77	ea	$ 40	$	3,060
H: Type 2, Rain Garden	293	ea	$ 40	$	11,715
Structures					
Pipe	2500	lf	$ 27	$	67,500
Inlet structure	8	ea	$ 1,500	$	12,000
Outlet structure	8	ea	$ 2,500	$	20,000
Irrigation Re-route Allowance	1	lot	$ 5,000	$	5,000
Remediation	2500	lf	$ 2	$	5,000
Architectural					
Mechanical					
Electrical					
Design Contingency		25%		$	71,199
	Subtotal			$	398,717
	OH&P	10%		$	39,872
	Subtotal			$	438,588
	Associated Project Costs	35%	x	$	153,506
C - Roads: Stormwater Mitigation				**$**	**592,094**

Notes:

1. See Diagrams 4a & 4b.

Volunteer Park Water Sustainability Study for:

Volunteer Park Sustainability Coalition

Estimated Costs for:

D - Service Yard / Glass Houses

Item	Qty	Units	Unit Cost	Total
General Conditions		15%		$ 24,786.75
Site				
Excavation	1	lot	$ 9,460	$ 9,460
Trenching	1020	lf	$ 18	$ 18,360
Structures				
Underground Tank - 20,000 Gallon	20000	gal	$ 2.50	$ 50,000
Intercept Storm Sewer at Catch Basin	1	ea	$ 5,000	$ 5,000
Pipe	1	lot	$ 1,400	$ 1,400
Re-Route Downspouts	4	ea	$ 1,000	$ 4,000
Oil Water Separator	6	ea	$ 3,500	$ 21,000
Remediation	1	lot	$ 10,000	$ 10,000
Structures				
Pipe	1020	lf	$ 12	$ 12,240
Remediation	1020	ea	$ 1.75	$ 1,785
Architectural				
Mechanical				
Water Filtration system	1	ea	$ 9,500	$ 9,500
Controls	1	ea	$ 7,500	$ 7,500
Pump	1	ea	$ 8,500	$ 8,500
Electrical	1	ea	$ 6,500	$ 6,500
Design Contingency		25%		$ 41,311
	Subtotal			$ 231,343
	OH&P	10%		$ 23,134
	Subtotal			$ 254,477
	Associated Project Costs	35%	x	$ 89,067
D - Service Yard / Glass Houses				**$ 343,544**

Notes:

1. See Diagram 5a; this system collects storm water from the wading pond in winter for rain water harvesting.

Volunteer Park Water Sustainability Study for:

Volunteer Park Sustainability Coalition

Estimated Costs for:

D2 - Additional Above Ground Tanks

Item	Qty	Units	Unit Cost	Total
General Conditions		15%		$ 24,071.25
Site				
Excavation	1	lot	$ 6,075	$ 6,075
Trenching	430	lf	$ 18	$ 7,740
Structures				
Foundations	3	ea	$ 6,500	$ 19,500
Above Ground Tanks - 25,000 Gal ea	3	ea	$ 35,000	$ 105,000
Pipe	430	lf	$ 12	$ 5,160
Architectural				
Mechanical				
Water Filtration system	1	ea	$ 4,000	$ 4,000
Pump	1	ea	$ 3,500	$ 3,500
Pipe, Valves & Controls	1	lot	$ 4,500	$ 4,500
Electrical	1	ea	$ 5,000	$ 5,000
Design Contingency		25%		$ 40,119
	Subtotal			$ 224,665
	OH&P	10%		$ 22,467
	Subtotal			$ 247,132
	Associated Project Costs	35%	x	$ 86,496
D2 - Additional Above Ground Tanks				**$ 333,628**

Notes:

1. See Diagram 5a; this system stores surplus rain water for later use.

Volunteer Park Water Sustainability Study for:

Volunteer Park Sustainability Coalition

Estimated Costs for:

D3 - Stockpile Structure

Item	Qty	Units	Unit Cost	Total
General Conditions		15%		$ 11,475
Site				
Excavation	1	ea	$ 5,000	$ 5,000
Structures				
Foundation	1	ea	$ 5,000	$ 5,000
Architectural				
Steel Superstructure	1	ea	$ 20,000	$ 20,000
Coatings	1	ea	$ 5,000	$ 5,000
Mechanical				
Water Filtration system	1	ea	$ 1,500	$ 1,500
Electrical				
Power, Net-metering	1	lot	$ 7,500	$ 7,500
Solar Panels, 5 kW array, 500 sf	5	kW	$ 6,500	$ 32,500
Design Contingency		25%		$ 9,125
	Subtotal			$ 97,100
	OH&P	10%		$ 9,710
	Subtotal			$ 106,810
	Associated Project Costs	35%	x	$ 37,384
D3 - Stockpile Structure				**$ 144,194**

Notes:

1. See Diagram 5a; provided covered storage and modest net-metered renewable energy (PV) system.

Volunteer Park Water Sustainability Study for:

Volunteer Park Sustainability Coalition

Estimated Costs for:

E - Tennis Courts GSI

Item	Qty	Units	Unit Cost	Total
General Conditions		15%		$ 7,294
Site				
Excavation				
Trenching	520	lf	$ 18	$ 9,360
GSI				
Type 2, Rain Garden	380	ea	$ 40	$ 15,187
Structures				
Pipe	520	lf	$ 27	$ 14,040
Connection at Catch Basin	2	ea	$ 3,500	$ 7,000
Irrigation Re-route Allowance	1	lot	$ 2,000	$ 2,000
Remediation	520	lf	$ 2	$ 1,040
Architectural				
Mechanical				
Electrical				
Design Contingency		25%		$ 12,157
	Subtotal			$ 68,078
	OH&P	10%		$ 6,808
	Subtotal			$ 74,886
	Associated Project Costs	35%	x	$ 26,210
E - Tennis Courts GSI				**$ 101,096**

Notes:

1. GSI only; rain water harvesting not included.
2. See Diagrams 4a & 4b.

Volunteer Park Water Sustainability Study for:

Volunteer Park Sustainability Coalition

Estimated Costs for:

E2 - Tennis Courts Rainwater Harvest

Item	Qty	Units	Unit Cost	Total
General Conditions		15%		$ 6,111
Site				
Excavation				
Trenching	260	lf	$ 18	$ 4,680
Structures				
Pipe	520	lf	$ 27	$ 14,040
Connection at Catch Basin	2	ea	$ 3,500	$ 7,000
Remediation	260	lf	$ 2	$ 520
Architectural				
Mechanical				
Water Debris Filtration	1	ea	$ 2,000	$ 2,000
Pump	1	ea	$ 3,500	$ 3,500
Pipe, Valves & Controls	1	lot	$ 4,000	$ 4,000
Electrical	1	ea	$ 5,000	$ 5,000
Design Contingency		25%		$ 10,185
Subtotal				$ 57,036
OH&P		10%		$ 5,704
Subtotal				$ 62,740
Associated Project Costs		35%	x	$ 21,959
E2 - Tennis Courts Rainwater Harvest				**$ 84,698**

Notes:

1. Rainwater harvesting system. This is NOT a stand alone price. Tank, Pump, filtration, and controls are included in other concepts. These represent additional costs associated with this strategy.
2. This scheme is not shown in a diagram.

Volunteer Park Water Sustainability Study for:

Volunteer Park Sustainability Coalition

Estimated Costs for:

F - Museum GSI

Item	Qty	Units	Unit Cost		Total
General Conditions		15%		$	4,747
Site					
Excavation				$	-
Trenching	400	lf	$ 18	$	7,200
GSI					
Type 3, Infiltration Trench	328	ea	$ 30	$	9,846
Structures					
Underground Tank (under Concept B)					
Pipe	400	lf	$ 12	$	4,800
Connection at Catch Basin	2	ea	$ 3,500	$	7,000
Irrigation Re-route Allowance	1	lot	$ 2,000	$	2,000
Remediation	400	lf	$ 2	$	800
Architectural					
Mechanical					
Electrical					
Design Contingency		25%		$	7,911
	Subtotal			$	44,304
	OH&P	10%		$	4,430
	Subtotal			$	48,734
	Associated Project Costs	35%	x	$	17,057
F - Museum GSI				**$**	**65,791**

Notes:

1. This estimate provides stormwater mitigation for the museum roof areas with GSI.

Volunteer Park Water Sustainability Study for:

Volunteer Park Sustainability Coalition

Estimated Costs for:

F2 - Museum Rainwater Harvest

Item	Qty	Units	Unit Cost	Total
General Conditions		15%		$ 3,450
Site				
Excavation				$ -
Trenching	100	lf	$ 18	$ 1,800
Structures				
Underground Tank (under Concept B)				$ -
Pipe	100	lf	$ 12	$ 1,200
Architectural				
Mechanical				
Water Filtration system	1	lot	$ 7,500	$ 7,500
Controls	1	lot	$ 4,000	$ 4,000
Pump	1	lot	$ 3,500	$ 3,500
Electrical	1	ea	$ 5,000	$ 5,000
Design Contingency		25%		$ 5,750
		Subtotal		$ 32,200
		OH&P	10%	$ 3,220
		Subtotal		$ 35,420
		Associated Project Costs	35% x	$ 12,397
F2 - Museum Rainwater Harvest				**$ 47,817**

Notes:

1. This estimate provides rain water harvesting (RWH) for the Museum, assuming the Museum project itself includes inside RWH plumbing, and Concept B provides the cistern.

Volunteer Park Water Sustainability Study for:

Volunteer Park Sustainability Coalition

Estimated Costs for:

G - Amphitheater

Item	Qty	Units	Unit Cost	Total
General Conditions		15%		$ 8,625
Site				
Excavation	1	lot	$ 5,000	$ 5,000
Trenching	100	ft	$ 18	$ 1,800
Structures				
Underground Tank - 10,000 Gallon	10000	gal	$ 3	$ 30,000
Piping	100	ft	$ 12	$ 1,200
Architectural				
Mechanical				
Water Filtration system	1	lot	$ 5,000	$ 5,000
Controls	1	lot	$ 3,500	$ 3,500
Pump	1	ea	$ 2,500	$ 2,500
Piping	1	lot	$ 4,500	$ 4,500
Electrical	1	lot	$ 4,000	$ 4,000
Design Contingency		25%		$ 14,375
Subtotal				$ 80,500
OH&P		10%		$ 8,050
Subtotal				$ 88,550
Associated Project Costs		35%	x	$ 30,993
G - Amphitheater				**$ 119,543**

Notes:

1. Coordination with amphitheater project may reduce cost.

Appendix

REFERENCES

Sources

- VMP - Volunteer Park Vegetation Management Plan, prepared by Forest Restoration Program for Seattle Department of Parks and Recreation, Draft, March 2005
- Volunteer Park Irrigation Report by Two Four / Two Six, Inc, April 15, 2014.
- Seattle Landmarks Preservation Board, ARC Presentation #1, 05/27/2016 Asian Art Museum, LMN.
- Volunteer Park Amphitheater Project, Feasibility Study and Design Program, 03/08/2016, ORA + Walker Macy.
- Volunteer Park Amphitheater Project, Concept Development, 09/02/2016, ORA + Walker Macy.
- Periodic Dam Safety Inspection Report, Volunteer Park Reservoir, King County, Washington, April 2007, Publication No. 07-11-015, Washington State Department of Ecology
- King County Treasury Services, Tax Bill for Parcel #2925049087
- Friends of Seattle's Olmsted Parks, Volunteer Park Landmark Nomination, 2011.

MEETING NOTES

Project: date: 2016.06.20 time: 11:00 am

VPSC (Volunteer Park Sustainability Coalition)
Feasibility Study

Purpose:

Stakeholder Charrette

Location:
Asian Art Museum, Alvord Room
Volunteer Park

Attendance:
Doug Critchfield, Lisa Chen, Jody Blecksmith, Karen Galt, Casey Rood - Parks & Recreation;
Lee Richardson, Sarah Loudon - AAM (Asian Art Museum);
Mike Cory, Anthonio Pettit, Tom Eichbaum, Gayle Macy - FOC (Friends of the Conservatory);
Doug Bayley, Eliza Davidson - VPT (Volunteer Park Trust);
Katrina Morgan, Robin Thaler, Clayton Beaudoin, Doug Smith, Adam Young, Design Team.
Amanda Barnett, SPU

Brief Description:

- These minutes summarize the proceedings of the Volunteer Park Sustainability Coalition – Feasibility Study: Stakeholder Charrette. Please report any revisions to the author within 5 business days.

Discussions:

1.01	**Introduction exercise. Provide one word or phrase that describes what you would like the Park to be in 20 years:** 1. Community! 2. Solace 3. Trees 4. Neighborhood 5. Ahead of curve 6. Denser 7. 100% Sustainable 8. Repair 9. Same, but better 10. Growth, trees, population, stewardship 11. Self-sufficient 12. Flagship – Model 13. Full inclusion 14. Blossoming 15. Preserved – Cultural heritage, Green space 16. Cohesion 17. INTEGRATED
1.02	**General discussion:** 1. O&M = full evaluate 2. Carbon footprint for park 3. Energy + Water (watergy) 4. Lawn = Sometimes functions similar to pavement re run-off 5. Could run-off be harvested for irrigation? 6. Run-off goes all the way to Magnolia!!! 7. Infrastructure impacts 8. Turf maintenance

1.03	**Ideas – (Water Out):** 1. SPU Grant for on-site infiltration 2. Curb cuts at lower loop road with level spreaders to down slope 3. Pervious paving/surfaces: Starting with tennis courts, pathways: pervious "gravel" ILO paved 4. Aerate turf to improve designed: Spring (fertilizer issues). Fall 5. Neighborhood system? 6. Replace trees
1.04	**Ideas – (Water In):** 1. Use reservoir to collect storm and supply irrigation/other. 2. Repair of existing irrigation systems – See current leek report from Jody. 3. Dew harvesting 4. Rainwater harvesting 5. Recycled wading pond water 6. Aerate turf 7. Drought tolerant = especially grass seed (turf). Train plants = Mst play 8. Irrigation systems – RCM! Head springs trees, broken, "de-heading" (beheading?) 9. Sub-metering 10. Let lawn go dormant in summer (brown)Reduce Potable
1.05	**Opportunities:** 1. Water gushing at NW corner all year-round (measure?) 2. Spray park at wading pool (4 currently in system = 6 next year) – high O7M cost – if kept fully operating (high maintenance feature) 3. Education, school, neighbors, etc 4. Insufficient restroom facilities (6 All Gender stalls planned for the Amphitheater project)
1.06	**Water In** 1. Reduce Potable 2. Reduce potable with rain 3. Reduce potable demand - Rebuild IRR - Areas at no IRR? Based on use 4. Look at lawn mix 5. Address public perception 6. Retrofit all buildings water use to be the most efficient - New bathrooms do not connect to sewer - Composting - Living machine 7. Retrofit wading pool to cycle water 8. Integrate purple water system 9. V.P Central utility district 10. Alternate energy for any water pumping 11. Service yard is opp. For education 12. City must participate – Support 13. Are deduct meters used for all IRR water 14. Composition and ratio of lawn|shrubs|trees impacts watering needs and amount of water runoff. 15. Hierarchy: Volunteer Park is a horticultural park of highest priority in the Park system, and plantings will be watered even in times of drought, when other parks may not be irrigated. Playfields are also of a very high priority, as people must be able to play, and if dormant fields are heavily used the lawns will not recover. There is a parks classification of lawn type that will determine watering needs. 16. Irrigation system must be fixed. Determining a leakage rate or loss would be helpful for grant

	applications and understanding how big the problem actually is. 17. Wading pool, leadership role. There are 60 wading pools city wide. Utilize spray park technology, and a storage tank, to use the water for irrigation at the end of the day.
1.07	**Water Out** 1. Some park areas have no planting plans 2. Look at perimeter planting for treatment 3. Look at areas to be affect in future construction 4. Understand turf run-off – French drains at bottom of hill 5. Clay courts with storage underneath 6. Volunteer Park has a diversity of plantings and various types of environments that range from formal to informal. Discussed the possibility of creating a rain garden in the SW area where the Olmsted playground was originally located. Idea was acceptable pending the design. Any new plantings would need to be approved by the landmarks preservation board, and long term maintenance and care would need to be considered. 7. Private, non-public areas of the park offer a great opportunity for water storage or other equipment with fewer controls and impact on the Park. These off limits parts could also be reopened to the public, like a Willy Wonka chocolate factory. 8. Infiltration trench could be utilized, possibly located underneath walking paths. 9. Rainwater could be harvested and stored in a fence/cistern system along the park perimeter, and between the private and public areas.
1.08	**Triple Bottom Line:** 1. Reduce environmental impact – What happens here - impacts multiple waster shed? 2. Reduce operational cost – mas. Value of $$ spent 3. Increase comm. 4. Access * Health * Well being 5. Preserve / Respect heritage / Educate 6. Layer sustainability with historical elements
1.09	**Goals/Strategies** 1. Important – Choose what water features you want to keep 2. Lawn is iconic – must be preserved 3. Evolve the goal – - Be more inspirational - Sexier message! - Very cool project – should have very cool goals 4. “Contribute/ promote health of environment” 5. Restore + Preserve But move forward 6. Define the intention 7. Reservoir - We want to be part of discussion - How to get resolution, “One more year” + as been said for many years 8. Wading pool - Make more water efficient - Look at spray park technology + reservoir - Look at metro bus restroom for equipment - Use reservoir for alternate storage in off season

1.10	**Future of the Park** 1. Big tree replacement plan 2. Restore Olmsted plan, reduce size of shrub beds 3. Leader of the Park system
1.11	**SPU:** 1. Reservoir is not owned by SPU. 2. Requested to be part of the conversation for the future of the reservoir. 3. Volunteer Park is considered to be private, all the sewers in the park are side sewers. Available grant funding is directed towards sewer systems in the right of way.

Action Items:

- Start Design!
- Discovery:
    - Identify needed info/data/drawings to begin work.
    - Discover potential of micro hydro at storm sewer outlets particularly the NW corner.
    - Parks master plan. Needed for coordination with feasibility study.
    - Who owns the reservoir?
    - Identify storm water fees associated with the Park.
    - Need copy of the Volunteer Park O&M budget.
    - Identify code requirements for the soil storage areas.
    - Status of the Metro KC Bus Station Building.
- Discuss/Review:
    - latest irrigation plan from Karen Galt / discover quantity of leakage;
    - central vs distributed rainwater harvesting/ greywater etc, recycled and reuse;
    - potential collaboration with the cemetery;
    - leaks associated with reservoir (Per Dept. of Ecology Dam Safety Report, 27 gal/min/one million gallons, an acceptable level of leakage for SPU water supply systems. Reservoir capacity is 20 million gallons and about half full, therefore 270 gal/min leakage. Not specifically known where that water is going.)
- Quick Calculations:
    - Quick calculations, estimate potential impact,
    - Start to identify appropriate certification system
- Sustainable Strategies:
    - Wading pool water reuse
    - Fix leaking irrigation system
    - Deduct meter for the Conservatory
    - East storm watershed –
    - West storm watershed

Next Meetings:

- July 7th, VPSC, public meeting planning / monthly meeting
- July 19/20 Public Open House (pending)

cc:
File.

- - End -

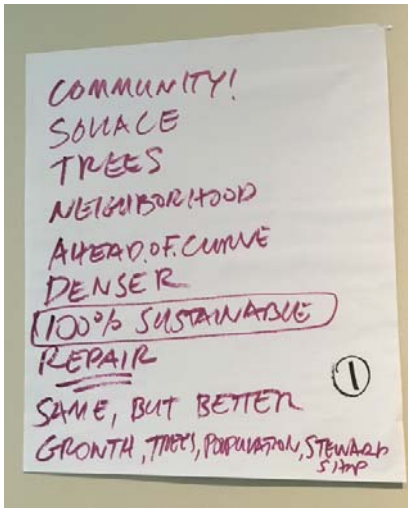
Minutes for Volunteer Park Sustainability Project

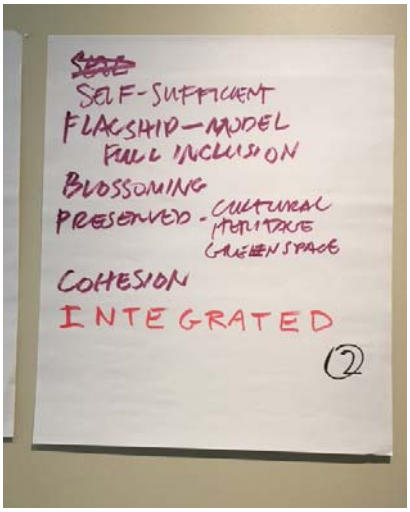
#	COMMENT DATE	REVIEWER'S NAME	REVIEWER'S COMMENT	RESPONSE DATE	RESPONDER NAME	RESPONSE COMMENT	RESOLVED
1	08.23.2016	Blecksmith	Determine if chlorinated water could be treated quickly enough to use for irrigation	08.23.2016	Whitman	Timing for in-pool dechlorination would need to be factored into the process	On Hold
2	08.23.2016	Whitman	Check to see if changes to the site would mean that facilities need to be updated to meet WAC code	08.23.2016	Whitman		On Hold
3	08.23.2016	Whitman	Consider switching from a wading pool to a spray park	08.23.2016	Baldwin	Stay true to the Olmsted plan. Do not introduce features that distract from the esthetic of the park	On Hold
4	08.23.2016	Whitman	If moving toward the Spray Park idea, keep features low to the ground	08.23.2016			On Hold
5	08.23.2016	Conner	Try to come up with alternatives to removal of the wading pool	08.23.2016	Conner	It is iconic and would be greatly missed by the community	On Hold
6	08.23.2016	Borer	Be cautious of the trees and how they would be affected by rerouted piping	08.23.2016			On Hold
7	08.23.2016	Blecksmith	Solidify what the "master plan" is before presenting ideas to the public or going forward with planning	08.23.2016			On Hold
8	08.23.2016	Blecksmith	Address the current placement of the sprinkler heads	08.23.2016			On Hold
9	08.23.2016	Blecksmith	Be sure to consider updated irrigation systems- there have been many recent updates to the park	08.23.2016	Baldwin	Usage data may be skewed: check to see if Young is working from old data	On Hold
10	08.23.2016	Blecksmith	Consider maintenance needs of any new equipment being installed	08.23.2016			On Hold
11	08.23.2016	Kollar	GSI for road runoff: make sure there will be enough	08.23.2016	Young	Looking to salmon-safe certification for grants,	On Hold

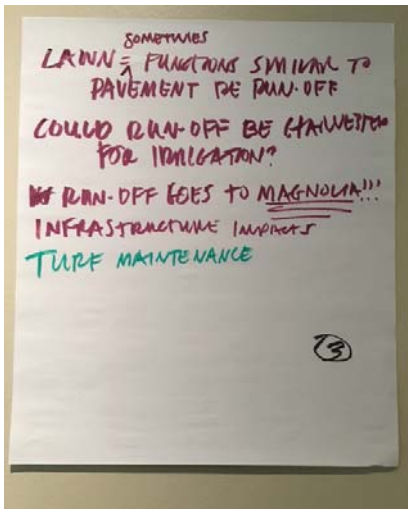
			maintenance crew coverage long-term			partnering with non-city groups	
12	08.23.2016	Kollar	Check requirements and restrictions for building near the reservoir	08.23.2016			On Hold
13	08.23.2016	Hwang	Stay true to the Olmsted plan- do not impact the design significantly, stay consistent with the master planting plan	08.23.2016	Hwang	Look to underground or low profile structures. Minimize the visual impact of any new structures	On Hold
14	08.23.2016	Conner	Look to work being done in the SE corner by museum, etc.	08.23.2016			On Hold
15	08.23.2016	Hwang	Theatre may be remodeled- be aware of the work planned for that area	08.23.2016			On Hold
16	08.23.2016	Baldwin	Make sure what is presented at community meeting meets King Co Code	08.23.2016	Baldwin	Do not mention the idea of a spray park at this point	On Hold
17	08.23.2016	Baldwin	Infiltration: get geotech reports	08.23.2016			On Hold
18	08.23.2016	Baldwin	Make sure SPU is on board with any changes near the reservoir	08.23.2016			On Hold
19	08.23.2016	Baldwin	The trees are extremely important: make sure any impact to trees is minimal	08.23.2016			On Hold
20	08.23.2016	Baldwin	Explore the idea of developing a play area, but stay true to the Olmsted plan	08.23.2016			On Hold
Grand Totals (20 items)							

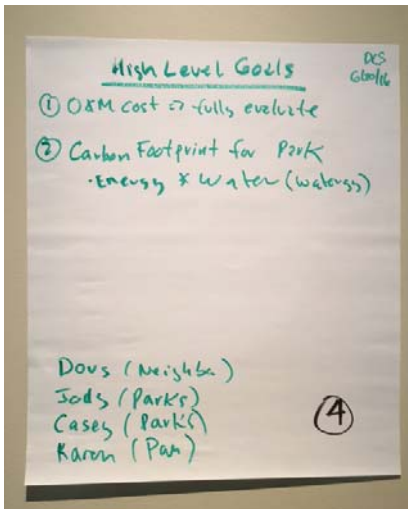
ECO CHARRETTE

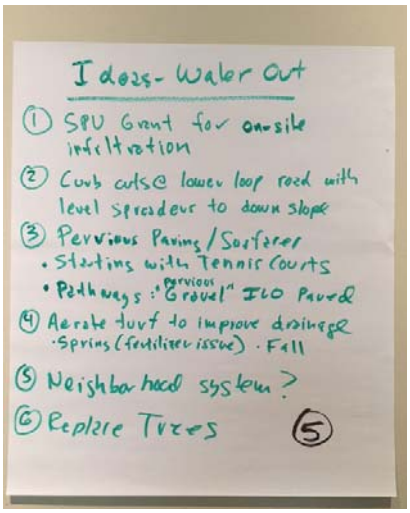
June 20th, 2016 Eco Charrette participant contributions captured on newsprint.

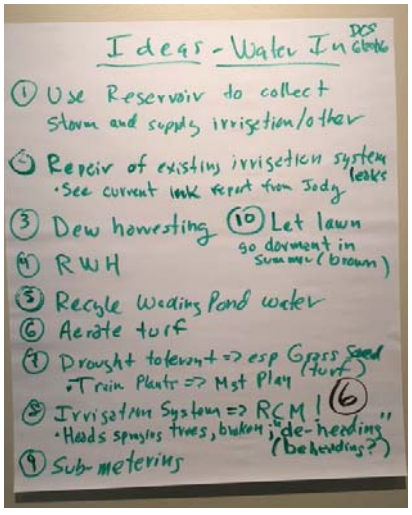


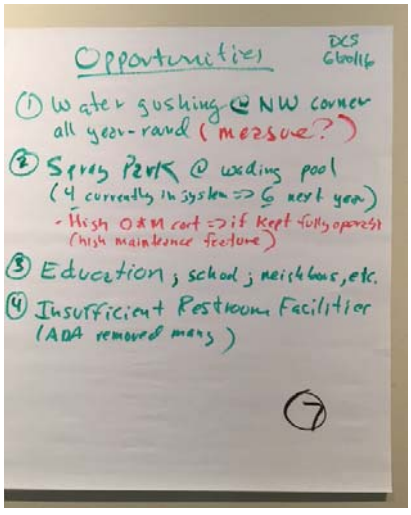


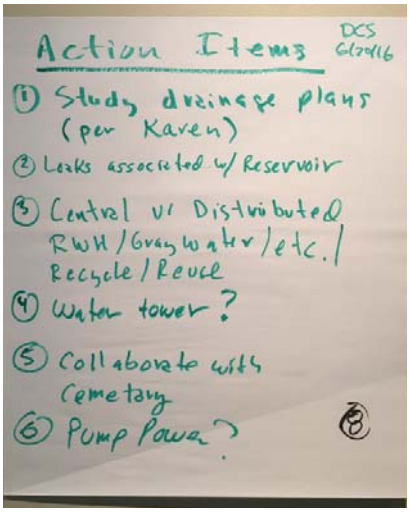


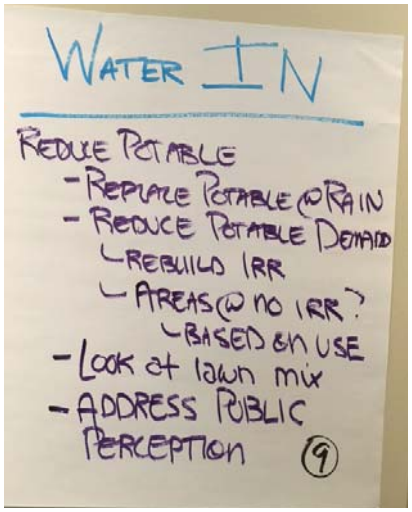


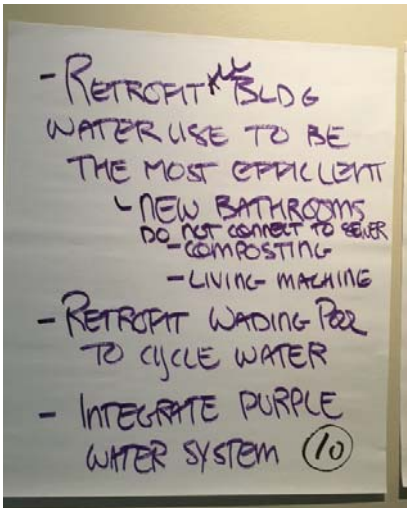


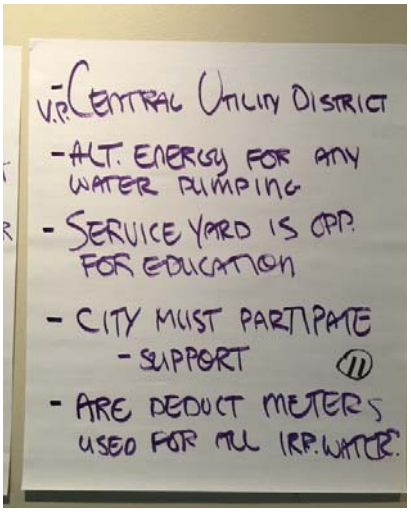


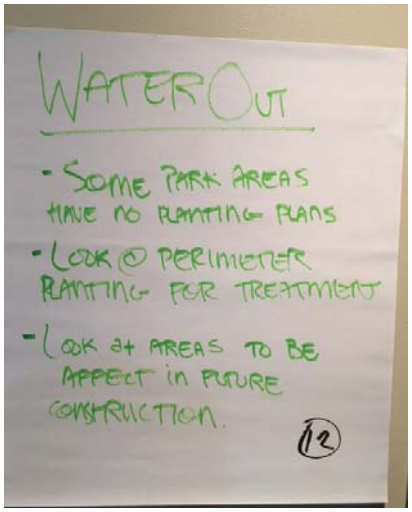


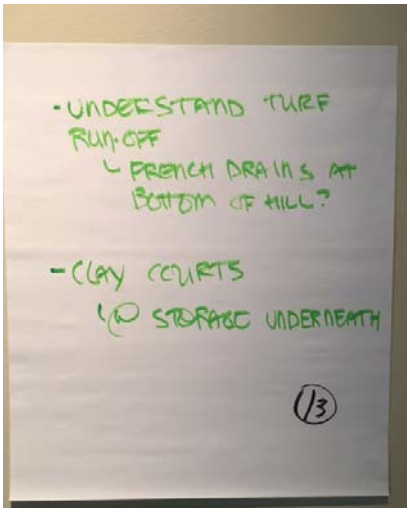


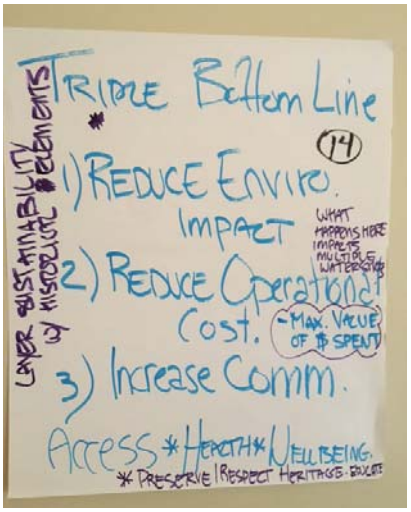

WATER IN
REDUCE POTABLE
- REPLACE POTABLE W/ RAIN
- REDUCE POTABLE DEMAND
└ REBUILD IRR
└ AREAS @ NO IRR?
└ BASED ON USE
- LOOK AT LAWN MIX
- ADDRESS PUBLIC PERCEPTION
(9)

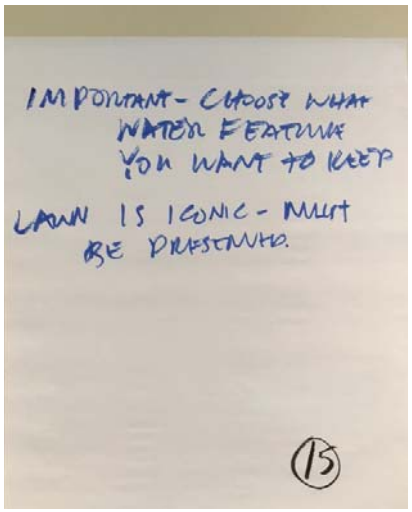

- RETROFIT ALL BLDG WATER USE TO BE THE MOST EFFICIENT
└ NEW BATHROOMS DO NOT CONNECT TO SEWER - COMPOSTING
- LIVING MACHINE
- RETROFIT WADING POOL TO CYCLE WATER
- INTEGRATE PURPLE WATER SYSTEM
(10)

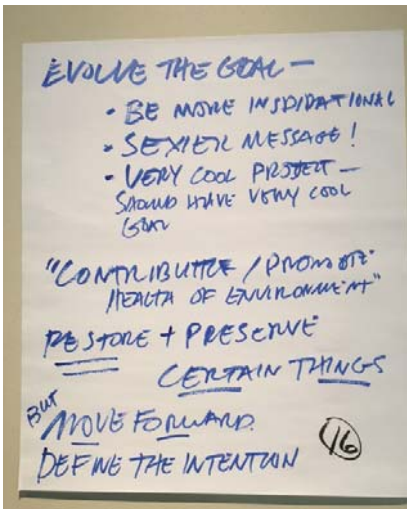

V.I. CENTRAL UTILITY DISTRICT
- ALT. ENERGY FOR ANY WATER PUMPING
- SERVICE YARD IS OPP. FOR EDUCATION
- CITY MUST PARTIPATE
- SUPPORT
(11)
- ARE DEDUCT METERS USED FOR ALL IRR. WATER?

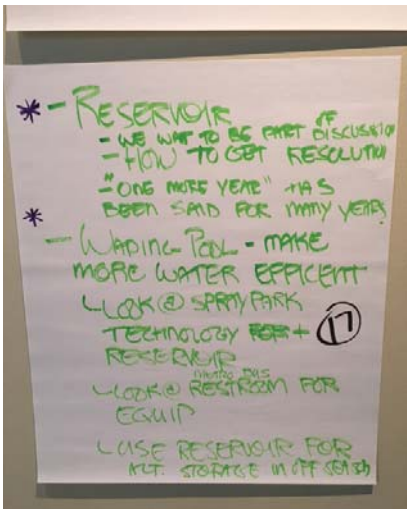

WATER OUT
- SOME PARK AREAS HAVE NO PLANTING PLANS
- LOOK @ PERIMETER PLANTING FOR TREATMENT
- LOOK AT AREAS TO BE AFFECT IN FUTURE CONSTRUCTION.
(12)


- UNDERSTAND TURF RUN-OFF
└ FRENCH DRAINS AT BOTTOM OF HILL?
- CLAY COURTS
└ NO STORAGE UNDERNEATH
(13)


TRIPLE Bottom Line
LAYER SUSTAINABILITY ELEMENTS W/ HISTORICAL
(14)
1) REDUCE ENVIRO. IMPACT
WHAT HAPPENS HERE IMPACTS MULTIPLE WATERSHEDS
2) REDUCE OPERATIONAL COST.
- MAX. VALUE OF $ SPENT
3) INCREASE COMM.
ACCESS * HEALTH * WELLBEING.
* PRESERVE | RESPECT HERITAGE · EDUCATE


IMPORTANT - CHOOSE WHAT WATER FEATURE YOU WANT TO KEEP
LAWN IS ICONIC - MUST BE PRESERVED.
(15)


EVOLVE THE GOAL -
- BE MORE INSPIRATIONAL
- SEXIER MESSAGE!
- VERY COOL PROJECT - SHOULD HAVE VERY COOL GOAL
"CONTRIBUTE / PROMOTE HEALTH OF ENVIRONMENT"
RESTORE + PRESERVE
CERTAIN THINGS
BUT MOVE FORWARD
DEFINE THE INTENTION
(16)


* - RESERVOIR
- WE WANT TO BE PART OF DISCUSSION
- HOW TO GET RESOLUTION
- "ONE MORE YEAR" HAS BEEN SAID FOR MANY YEARS
* - WADING POOL - MAKE MORE WATER EFFICIENT
└ LOOK @ SPRAY PARK TECHNOLOGY FOR RESERVOIR
(17)
└ LOOK @ RESTROOM FOR EQUIP
└ USE RESERVOIR FOR ALT. STORAGE IN OFF SEASON

Site 1

INFILTRATION TEST RESULTS AND CERTIFICATION

Infiltration Test #1 Results

Table 1 (15-min)

Time (15-min)	Depth of Water (inches)	Infiltration Rate (in/hr)
320	12	---
335	9.75	9
350	8.75	4
405	7.25	5
420	6.25	4
435	5.50	3
450	4.50	4

Table 2 (30-min)

Time (30-min)	Depth of Water (inches)	Infiltration Rate (in/hr)
	12	---

Table 3 (60-min)

Time (60-min)	Depth of Water (inches)	Infiltration Rate (in/hr)
	12	---

Infiltration Test #2 Results (Required if performed April through October – see step 4 above)

Table 1 (15-min)

Time (15-min)	Depth of Water (inches)	Infiltration Rate (in/hr)
320	12	---
335	11.25	3
350	10.00	5
405	9.00	4
420	8.00	4
435	7.00	4
450	6.50	2

Table 2 (30-min)

Time (30-min)	Depth of Water (inches)	Infiltration Rate (in/hr)
	12	---

Table 3 (60-min)

Time (60-min)	Depth of Water (inches)	Infiltration Rate (in/hr)
	12	---

☑ The lowest infiltration rate from the tables above = 2.0 in/hr (Measured infiltration rate)

- *If the lowest measured infiltration rate is less than the minimum rate associated with an infiltration BMP (see Table 4 below), that BMP cannot be used.*
- *If the measured infiltration rate is less than all minimum infiltration rates for infiltration BMPs, no further investigation is required.*

☑ Design infiltration rate = Measured infiltration rate x 0.5 = 1.0 in/hr

SIGNATURES ARE REQUIRED

I certify that I have followed the procedures outlined in this document to determine the infiltration BMP feasibility and infiltration rate.

Infiltration Test performed by:

Print Name Chaz J. Kerns

Signature _____ Date Aug. 28th, 2016

Subsurface Investigation performed by:

Print Name _____

Signature _____ Date _____

Page 4 OF 5

Site 2

INFILTRATION TEST RESULTS AND CERTIFICATION

Infiltration Test #1 Results

Table 1 (15-min)

Time (15-min)	Depth of Water (inches)	Infiltration Rate (in/hr)
320	12	---
335	8.25	15
350	4.75	14
405	3.50	5
420	12.00	14
435	7.25	19
450	5.00	9

Table 2 (30-min)

Time (30-min)	Depth of Water (inches)	Infiltration Rate (in/hr)
	12	---

Table 3 (60-min)

Time (60-min)	Depth of Water (inches)	Infiltration Rate (in/hr)
	12	---

Infiltration Test #2 Results (Required if performed April through October – see step 4 above)

Table 1 (15-min)

Time (15-min)	Depth of Water (inches)	Infiltration Rate (in/hr)
320	12	---
335	10.50	6
350	8.00	6
405	5.75	9
420	3.50	9
435	1.25	9
450	9.25	11

Table 2 (30-min)

Time (30-min)	Depth of Water (inches)	Infiltration Rate (in/hr)
	12	---

Table 3 (60-min)

Time (60-min)	Depth of Water (inches)	Infiltration Rate (in/hr)
	12	---

☑ The lowest infiltration rate from the tables above = 5.0 in/hr (Measured infiltration rate)

- *If the lowest measured infiltration rate is less than the minimum rate associated with an infiltration BMP (see Table 4 below), that BMP cannot be used.*
- *If the measured infiltration rate is less than all minimum infiltration rates for infiltration BMPs, no further investigation is required.*

☑ Design infiltration rate = Measured infiltration rate x 0.5 = 2.5 in/hr

SIGNATURES ARE REQUIRED

I certify that I have followed the procedures outlined in this document to determine the infiltration BMP feasibility and infiltration rate.

Infiltration Test performed by:

Print Name Chaz J. Kerns

Signature _____ Date Aug. 28th, 2016

Subsurface Investigation performed by:

Print Name _____

Signature _____ Date _____

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Site 3

INFILTRATION TEST RESULTS AND CERTIFICATION

Infiltration Test #1 Results

Table 1 (15-min)

Time (15-min)	Depth of Water (inches)	Infiltration Rate (in/hr)
320	12	---
335	9.0	12
350	7.0	8
405	6.25	7
420	4.75	6
435	3.5	6
450	2.5	4

Table 2 (30-min)

Time (30-min)	Depth of Water (inches)	Infiltration Rate (in/hr)
	12	---

Table 3 (60-min)

Time (60-min)	Depth of Water (inches)	Infiltration Rate (in/hr)
	12	---

Infiltration Test #2 Results (Required if performed April through October – see step 4 above)

Table 1 (15-min)

Time (15-min)	Depth of Water (inches)	Infiltration Rate (in/hr)
320	12	---
335	9.5	10
350	8.0	6
405	6.5	6
420	5.5	4
435	4.5	4
450	4.25	2

Table 2 (30-min)

Time (30-min)	Depth of Water (inches)	Infiltration Rate (in/hr)
	12	---

Table 3 (60-min)

Time (60-min)	Depth of Water (inches)	Infiltration Rate (in/hr)
	12	---

☑ The lowest infiltration rate from the tables above = 2.0 in/hr (Measured infiltration rate)

- *If the lowest measured infiltration rate is less than the minimum rate associated with an infiltration BMP (see Table 4 below), that BMP cannot be used.*
- *If the measured infiltration rate is less than all minimum infiltration rates for infiltration BMPs, no further investigation is required.*

☑ Design infiltration rate = Measured infiltration rate x 0.5 = 1.0 in/hr

SIGNATURES ARE REQUIRED

I certify that I have followed the procedures outlined in this document to determine the infiltration BMP feasibility and infiltration rate.

Infiltration Test performed by:

Print Name Chaz J. Kerns

Signature _____ Date Aug. 28th, 2016

Subsurface Investigation performed by:

Print Name _____

Signature _____ Date _____

Page 4 OF 5

Site 4

INFILTRATION TEST RESULTS AND CERTIFICATION

Infiltration Test #1 Results

Table 1 (15-min)

Time (15-min)	Depth of Water (inches)	Infiltration Rate (in/hr)
305	12	---
335	11.5	2
405	11.5	0
435	11.0	2
505	10.5	2
535	10	2
605	9.75	1

Table 2 (30-min)

Time (30-min)	Depth of Water (inches)	Infiltration Rate (in/hr)
	12	---

Table 3 (60-min)

Time (60-min)	Depth of Water (inches)	Infiltration Rate (in/hr)
	12	---

Infiltration Test #2 Results (Required if performed April through October – see step 4 above)

Table 1 (15-min)

Time (15-min)	Depth of Water (inches)	Infiltration Rate (in/hr)
	12	---

Table 2 (30-min)

Time (30-min)	Depth of Water (inches)	Infiltration Rate (in/hr)
	12	---

Table 3 (60-min)

Time (60-min)	Depth of Water (inches)	Infiltration Rate (in/hr)
	12	---

☑ The lowest infiltration rate from the tables above = 0 in/hr (Measured infiltration rate)

- *If the lowest measured infiltration rate is less than the minimum rate associated with an infiltration BMP (see Table 4 below), that BMP cannot be used.*
- *If the measured infiltration rate is less than all minimum infiltration rates for infiltration BMPs, no further investigation is required.*

☑ Design infiltration rate = Measured infiltration rate x 0.5 = 0 in/hr

SIGNATURES ARE REQUIRED

I certify that I have followed the procedures outlined in this document to determine the infiltration BMP feasibility and infiltration rate.

Infiltration Test performed by:

Print Name Chaz J. Kerns

Signature Chaz Kerns Date Aug. 17th, 2016

Subsurface Investigation performed by:

Print Name _____

Signature _____ Date _____

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Site 5

INFILTRATION TEST RESULTS AND CERTIFICATION

Infiltration Test #1 Results

Table 1 (15-min)

Time (15-min)	Depth of Water (inches)	Infiltration Rate (in/hr)
325	12	---
340	9.5	10
355	8.0	6
410	7.75	1
425	6.0	7
440	4.5	6
455	4.0	2

Table 2 (30-min)

Time (30-min)	Depth of Water (inches)	Infiltration Rate (in/hr)
	12	---

Table 3 (60-min)

Time (60-min)	Depth of Water (inches)	Infiltration Rate (in/hr)
	12	---

Infiltration Test #2 Results (Required if performed April through October – see step 4 above)

Table 1 (15-min)

Time (15-min)	Depth of Water (inches)	Infiltration Rate (in/hr)
325	12	---
340	10.0	4
355	8.5	6
410	7.25	5
425	6.0	5
440	5.5	6
455	4.5	4

Table 2 (30-min)

Time (30-min)	Depth of Water (inches)	Infiltration Rate (in/hr)
	12	---

Table 3 (60-min)

Time (60-min)	Depth of Water (inches)	Infiltration Rate (in/hr)
	12	---

☑ The lowest infiltration rate from the tables above = 1.0 in/hr (Measured infiltration rate)

- *If the lowest measured infiltration rate is less than the minimum rate associated with an infiltration BMP (see Table 4 below), that BMP cannot be used.*
- *If the measured infiltration rate is less than all minimum infiltration rates for infiltration BMPs, no further investigation is required.*

☑ Design infiltration rate = Measured infiltration rate x 0.5 = 0.5 in/hr

SIGNATURES ARE REQUIRED

I certify that I have followed the procedures outlined in this document to determine the infiltration BMP feasibility and infiltration rate.

Infiltration Test performed by:

Print Name Chaz J. Kerns

Signature Chaz Kerns Date Aug. 17th, 2016

Subsurface Investigation performed by:

Print Name _____

Signature _____ Date _____

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Site 6

INFILTRATION TEST RESULTS AND CERTIFICATION

Infiltration Test #1 Results

Table 1 (15-min)

Time (15-min)	Depth of Water (inches)	Infiltration Rate (in/hr)
320	12	---
335	8.0	16
350	4	16
405	<1	16
420	8	16
435	4	16
450	<1	16

Table 2 (30-min)

Time (30-min)	Depth of Water (inches)	Infiltration Rate (in/hr)
	12	---

Table 3 (60-min)

Time (60-min)	Depth of Water (inches)	Infiltration Rate (in/hr)
	12	---

Infiltration Test #2 Results (Required if performed April through October – see step 4 above)

Table 1 (15-min)

Time (15-min)	Depth of Water (inches)	Infiltration Rate (in/hr)
320	12	---
335	7.75	17
350	4.5	13
405	2.5	8
420	<1	10
435	8.75	13
450	5.5	13

Table 2 (30-min)

Time (30-min)	Depth of Water (inches)	Infiltration Rate (in/hr)
	12	---

Table 3 (60-min)

Time (60-min)	Depth of Water (inches)	Infiltration Rate (in/hr)
	12	---

☑ The lowest infiltration rate from the tables above = 8.0 in/hr (Measured infiltration rate)

- *If the lowest measured infiltration rate is less than the minimum rate associated with an infiltration BMP (see Table 4 below), that BMP cannot be used.*
- *If the measured infiltration rate is less than all minimum infiltration rates for infiltration BMPs, no further investigation is required.*

☑ Design infiltration rate = Measured infiltration rate x 0.5 = 4.0 in/hr

SIGNATURES ARE REQUIRED

I certify that I have followed the procedures outlined in this document to determine the infiltration BMP feasibility and infiltration rate.

Infiltration Test performed by:

Print Name Chaz J. Kerns

Signature _____ Date Aug. 17th, 2016

Subsurface Investigation performed by:

Print Name _____

Signature _____ Date _____

Page 4 OF 5