**Salvation Army Kroc Community Center – Philadelphia, PA**
**Methodology for Landscape Performance Benefits**

## Environmental

- ***Captures the first 1" of stormwater runoff from the site and building and infiltrates or uses it onsite.***

Stormwater volumes and facility performance data is based upon the Post Construction Stormwater Management Report prepared for the project by Duffield Associates, Inc. July 2008. Standard hydraulic and hydrologic methods were utilized to develop estimates of the post construction performance of the stormwater facilities for varying rainfall events. The report states '… during the growing season, the cisterns and rain gardens provide storage for up to two inches of roof runoff from the majority of the community center and the entirety of the two athletic pavilion buildings" (page 8). The porous pavement "will capture 2.4 inches of runoff" from contributing drainage area (parking lot). The cumulative volume of runoff captured from the various stormwater facilities equates to 1" of water over the total site area. Cistern volumes were not included in this computation as it cannot be demonstrated that they will have available capacity during the dormant season. Use of the cisterns during the growing season indicates that the site is capable of capturing runoff beyond 1" during these times of the year.

- ***Reduced the rate of stormwater runoff by 98%, 97%, and 64% for the 2, 10, and 100 year storms, respectively, when compared to predevelopment conditions.***

In the predevelopment condition the site was overwhelmingly impervious surfaces with approximately 9.26 acres of the 12.43 acre site being concrete, asphalt, and compacted gravel. The post development condition contains approximately 5.30 acres of impervious surfaces, a reduction of approximately 43%. The Post Construction Stormwater Management Report prepared for the project by Duffield Associates, Inc. summarized the computations for the site's pre and postdevelopment hydrology. Standard TR-55 and TR-20 methodologies for were utilized to estimate the discharges. The predevelopment discharges, estimated to be 42.2 cubic feet per second (cfs), 70.9 cfs, and 119.0 cfs for the 2, 10, and 100-year storm events respectively were reduced in the postdevelopment condition to 0.8 cfs, 2.2 cfs, and 43.5 cfs. The resultant reductions were 98% for the 2-year event, 97% for the 10-year event, and 64% for the 100-year event. These results were accomplished by the stormwater management system design that consists of porous paving, bio-swales, and rain gardens. The linked systems provide not only significant filtering functions through dense plantings and porous soils but provide significant detention capacity through surface ponding in the rain gardens and subsurface storage in aggregate beds below the athletic field and porous paving parking lot.

- ***Increased ecological quality by 34 times that of the former site, as measured by the Plant Stewardship Index, an assessment of native biodiversity based on a site's plant list.***

The site was a city impoundment parking lot prior to this design. It was at least 75% pavement with scant vegetation. The pre-existing site was not observed by the LAF research team but vegetation was described by the project landscape architect as a high percentage of exotic invasives, such as Paulonia and Knotweed.

The plant design of the site is based on a native plant community approach using species representative of the freshwater wetland, forest, and meadow habitats of southeastern Pennsylvania.

The Plant Stewardship Index was used to calculate the ecological integrity of the site. A free calculator from Bowman's Hill Wildflower Preserve, New Hope, PA was employed for the calculation. www.bhwp.org.psi. Native meadow grass and lawn mixes were not included in the PSI calculation.

Background of PSI methodology:

PSI is based on a series of calculations related to coefficients of conservatism (CC) numbers assigned by leading botanists and ecologists to each plant documented on the site. Leading botanists and ecologists in the Pennsylvania/New Jersey Delaware Valley Region --Ann Rhoads, Jack Holt, Janet Ebert, Bill Rawlyk, Emile DeVito, Mary Leck, Leslie Jones Sauer and others, used their collective knowledge to develop the CC's used for this calculation. (https://www.ser.org/midatl/pdf/Miles_Arnott.pdf*)*

*The PSI assignment of native status is more conservative than that of many landscape architects. For example, Rhus aromatica was used in the plant list but is not on the state plant list but is noted to occur in New Jersey's upland Sommerset, Middlesex and Mercer Counties. In our opinion, the collective experience and knowledge of the plant experts should guide this performance metric.*

CC"s range from 1 – 10.
PSI = Total Mean C x Sqrt N
(PSI = Total Mean Coefficient—of both native and non-native species-- is multiplied by the square root of the total of the number of native plant species)

Scores for Salvation Army Kroc Community Center:
Plant Stewardship Index (adjusted FQI): **33.72**
Total Mean C: 4.77
Native Mean C: 4.96

"As the population of native plants increases, the PSI score will go up. As the population of specialist plants increases, the score will go up (the Mean C will increase slightly). As the diversity of plants increases, the score will go up
www.bhwp.org.psi ."

According to Botanist Anne Brennan of Bowman's Hill Wildlife Preserve PSI's can range from 1 – 100. While in theory, a site can achieve 100, it is very rare. Dr. Brennan stated that a range of 10-20 PSI is common for the Philadelphia metropolitan area. Very disturbed sites tend to score below 10 PSI. A site scoring above 30 is considered a high quality site. SAKC scored 33.72 PSI. It should be noted that the site is monitored by the project landscape architect Chris Mendel (on his own time). He visits weekly and weeds out invasive species, such as Purple Loosestrife.

Dr. Brennan noted that if the majority of the pant species area able to survive in the long term without a lot of human intervention, then this will remain a high quality site. She cautioned "In the short term, the score is obviously based on what was recently planted (and is therefore artificial), so it's not as meaningful until some time passes. Comparison over time is at the heart of PSI (Anne Brennan email communication with Mary Myers, August 5th, 2011)."

- ***Sequesters 15,293 lbs of carbon dioxide annually in the 562 new trees and shrubs planted onsite.***

This benefit was calculated using the plant list provided by the landscape architect and the national trees benefit calculator.

The Tree Benefit Calculator is not as precise or scientific as other forest assessment tools and this is mentioned on the www.treebenefit.com website. Patterson and Coelho (2009) write about but do not critically assess iTree as the calculating tool of National Tree Benefits Calculator. Bonnfaci (2009) identifies STRATUM software as the basis for the National Tree Benefits Calculator. But after examining both STRATUM and UFORE (another tree calculating program) she ended up using the Tree Benefits Calculator to assess trees in Somerville, Massachusetts. Her attempt to use UFORE yielded little information. Because she was hindered by lack of data acquisition tools to accurately measure attributes such as crown size and tree height necessary for the more precise modeling offered by UFORE.

McPherson (2010) works for the National Forestry Service, the branch of government that developed STRATUM. He writes about the thinking behind iTrees noting that STRATUM was the foundation for what is now referred to as iTree Streets and was "based upon 20 years of urban forest science (McPherson, p. 230)." McPherson notes specifically that the software was developed with landscape architects, (and others) in mind who might be interested in analyzing the benefits and costs of municipal forests. Presumed to be an author of the software, he makes a strong case for the logic behind its methodology.

> "The approach was to first divide the US into 16 climate zones (based upon length of growing season, minimum temperature, building energy use patterns), then select a representative city within each zone to study intensively. The representative cities had to have updated tree inventories (20,000 – 100,000 trees); accurate information on planting dates for aging a sample of approx. 900 trees; and large old trees present in the community. In each reference city, 30 to 60 trees from each of the 22 major tree species were aged and measured. Then linear regression was used to fit predictive models with diameter at breast height (dbh) as a function of age for each species. Predictions of leaf surface area, crown diameter, and height metrics were modeled as a function of dbh using best-fit models. Geographic data were collected for use in iTree Streets' numerical models. That data included temperature, precipitation, air pollutant concentrations, and fuel mix for energy production (McPherson, p 231)."

While it is not possible to be absolutely precise using iTree, it is certainly one of the most convenient software models to use. What it lacks in precision is made up for with ease. It is possible that this software tool will become more precise over time, as additional data related to urban forests and specific tree types/benefits are developed by the USFS and others.

## Economic

- ***Saved $575,000 in disposal fees and prevented 12,500 cubic yards (17,500 tons) of material from entering landfills by reusing 100% of the existing pavement onsite.***

Existing pavement depths were established based upon pre-construction on-site investigations. Each pavement type was equated to an appropriate proposed aggregate type and then crushed and sorted before being incorporated into the proposed construction. Areas of each pavement type were multiplied by the depths to account for the total cubic yardage. There was approximately 2,690 CY of Asphalt, 2,410 CY of Concrete, 7,000 CY of aggregate stone sub-base, and 375 CY of railroad ballast on site. These materials were multiplied by an estimated weight of 1.4 tons per CY to arrive at the total tonnage recycled on-site. The recycled materials were used for sub-base below paved areas and for bulk aggregate fill.

The total amount of materials reused on site was approximately 12,500 cubic yards or 17,500 tons, as discussed above. The approximate savings costs for disposal were obtained by soliciting pricing during July of 2011 from a commercial construction demolition debris recycling operation.

Disposal at a recycling center was used as they are standard practice within the demolition industry and disposal at a solid waste landfill, at much higher costs, would overstate the potential savings. Quoted costs for disposal were $30/ton for asphalt, $23/ton for concrete or stone, and $98/ton for general construction debris (containing wood, steel, etc.). The location of the facility in Southampton, PA was plotted vs. the site and an average round trip of 30 miles with an average speed of 35 mph and a 15 minute load and unload time was assumed. A cost of $11.65 was used for hauling and was taken from the RSMeans Site Work & Landscape Cost Data 2011 manual The costs where then computed as follows:

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| Asphalt: | (3,800 tons x $30/ton) + (2700 CY x $11.65/CY) = $145,455.00 |
| Concrete: | (3,400 tons x $23/ton + ( 2410 CY x $11.65/CY) = $106,676.50 |
| Stone: | (10,300 tons x $23/ton) + (7,390 CY x $11.65/CY) = $322,993.50 |

Estimated total disposal costs: **$575,125.00**

## References:


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