



LANDSCAPE PERFORMANCE SERIES

The Willow School – Gladstone, NJ Methodology for Landscape Performance Benefits

Case Study Brief Prepared by:

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Environmental

Reduces potable water consumption by 375,000 gallons per year by using harvested rainwater to flush school toilets. This saves \$2,230 annually.

The lower school's 13,500 square foot roof is used to harvest rainwater that falls directly on it. Harvested rainwater is stored in a 50,000 gallon underground cistern that is used to supply the building's low flow toilets and urinals.

Historical monthly average precipitation data was retrieved from www.weatherbase.com. Monthly precipitation averages, indicated in the table below, were recorded from a weather station located Somerset, NJ, approximately 16.5 miles from the Willow School.

Monthly harvested rainwater volume was calculated by taking precipitation averages (rainfall inches divided by one inch per foot) and multiplying the roof catchment (13,500 sf.).

$$13,500 \text{ cf} \times (44.6 \text{ rainfall inches} \div 12 \text{ in/ft}) = 50,175 \text{ cf of rainfall}$$
$$50,175 \text{ cf} \times 7.48 \text{ gals/cf} = 375,309 \text{ gals}$$

Economic savings was calculated using rates found on American Water Company's website, which services Bedminster Township in Somerset County, N. Charges for water service are \$5.9405 per 1,000 gallons. (<http://www.amwater.com/files/EffectiveWaterWastewaterRates-5-1-2012.pdf>)

$$375,309 \text{ gallons}/1000 \text{ gallons} = 375.309 \times \$5.9405 = \$2,230$$

Estimated Rainwater Harvested and Potable Water Savings

Month	Average Monthly Precipitation (in)	Estimated Rainwater Harvested (gals)	Potable Water Savings (\$)
Jan	3.3	27,771	165
Feb	2.5	21,039	125
Mar	3.8	31,980	190
Apr	3.8	31,980	190
May	3.8	31,980	190
June	3.6	30,296	180
July	4.7	38,553	235
Aug	4.2	35,345	210
Sept	4	33,662	200
Oct	3.6	30,296	180

Nov	3.6	30,296	180
Dec	3.7	31,138	185
Avg Annual	44.6	375,335	2,230

Treats and infiltrates 380,000 gallons of wastewater annually with a system that includes constructed wetlands and a sand filter.

Figures for the volume of treated wastewater were collected weekly by lead operator Roger Parr at Applied Water Management. The volume was recorded through the use of a water meter totalizer that measured the total gallons of water leaving the sand filter. Figures indicate that an average of 1,042 gallons per day, 380,257 gallons in total, was treated and infiltrated onsite from January 1, 2011 until December 30, 2011.

Water Leaving the Sand Filter (gals/day)

Month	Total (gals)	Avg. (gals/day)
January	23,291	751
February	44,728	1,597
March	33,882	1,093
April	42,963	1,432
May	32,255	1,040
June	32,341	1,078
July	1,443	47
August	24,178	780
September	35,547	1,185
October	28,545	921
November	37,520	1,251
December	43,564	1,405
Total	380,257	1,042

Social

Engages all 250 students in an educational curriculum that includes landscape processes and ethics. When a sample of students were asked to list environmentally-friendly features of green buildings, 82% listed landscape features such as rainwater harvesting, composting, vegetable gardens, or wetlands. When asked about stormwater, 86% of students knew that asphalt and concrete were not the best ground surfaces for managing stormwater around a building.

The following curriculum, listed in the Willow School Green Ribbon Application, engages students in a sustainable education that focuses on landscape processes and ethics.

Kindergarten students learn about landscape processes by participating in school-wide Harvest Soup Celebration by harvesting vegetables from the school garden.

1st grade students examine the how school facilities reflect the school's values and the value of preserving natural resources by using recycled materials.

2nd grade students study the history of the school grounds through excavating historical sites and collecting artifacts that explain how the land was previously used. Students also learn in depth about the sustainable landscape features including the holding tanks, septic systems, plant beds, sand bed and infiltration bed.

3rd grade students graph the compost and trash waste generated at lunch throughout the year.

4th grade students look at how other cultures rectify impure water conditions and brainstorm their own solutions.

5th grade students use chemical testing to examine the water quality of the Raritan River's upper branch which flows through their campus.

6th grade students used experimental design to create projects that focus on plants. Experiments used one of the garden plots on campus.

7th grade students record quantitative and qualitative changes of eight self-selected plants on campus throughout the year. Through their accumulated knowledge of the campus, students give tours to students, parents, faculty, and staff.

8th grade students write their own land ethic in Language Arts through their accumulated knowledge and experience at the Willow School.

Laura Smith from University of Michigan (2011) surveyed 44 middle school students (grades 6,7,8) about "Green Building Environmental Literacy". Among other questions, the students were asked:

Please write a list of environmentally friendly building features with which you are familiar. You do not have to fill in all the blanks if you do not know four (4) environmentally friendly building features.

Students listed up to four features. Any student who mentioned rainwater harvesting, composting, the garden, or constructed wetlands was counted. Eighty-two percent (82%) of the students listed at least one landscape feature in their answer. Only eight students did not mention any landscape features.

In another question the students were asked:

"Stormwater" is the term for rain water that falls around a building. In the landscaping around green buildings, we prefer to use ground surfaces that promote a more natural water cycle. Which group of ground surfaces would be the best for managing stormwater around a building?

Thirty-eight out of forty-four (86%) students answered correctly choosing "Grass, Plants, Gravel" and did not choose "Asphalt, Concrete, and Gravel".

References

C. Cullen (personal communications, June 7, 2012)

U.S. Department of Education (2012). Green Ribbon Schools. Retrieved from:

<http://www2.ed.gov/programs/green-ribbon-schools/2012-schools/nj-willow-school.pdf>

Smith, L. (2011). [Green building literacy survey for doctoral dissertation]. Unpublished raw data.

Engages all 250 students in gardening throughout the year. An estimated 1% of the school's food comes from the school vegetable gardens and adjacent fruit trees.

Recycles an average of 280lbs of organic waste each month as compost for the vegetable gardens. Nearly all students surveyed always compost organic waste at school.

According to the Willow School's New Jersey Green Ribbon Schools Application (Walsh 2012), every class participates in the school garden where students "put garden to table into action every season." An estimated 1% of the school's food is grown in the school gardens and adjacent

fruit trees. An average of 283.33 pounds of compostable materials are collected on campus every month and recycled back into the school's garden throughout the year.

In Laura Smith's Survey (2011) "Green Building Environmental Literacy", forty-four Willow School middle school students were asked the following question:

In general, how often do you compost organic waste at school?
(scale: 1=never, 5=always).

The resulting mean was 4.95 indicating that nearly all students surveyed always compost organic waste at school.

References

Smith, L. (2011). [Green building literacy survey for doctoral dissertation]. Unpublished raw data.

Walsh, K. (2012) U.S. Department of Education Green Ribbon Schools 2012. Retrieved from:

<http://www2.ed.gov/programs/green-ribbon-schools/2012-schools/nj-willow-school.pdf>

Cost Comparison Methods

Landscape volunteers save the school \$2,160 in weeding and maintenance costs each year, when compared to maintaining the same area with hired labor.

Emmett Kresge, director of facilities at the Willow School, provided annual maintenance estimates for the native perennial beds and retention beds. According to Kresge, he estimates that it takes two laborers 80 man-hours to complete the annual weeding and maintenance. The majority of the grounds maintenance for perennial beds and retention beds occurs in Spring. In 2012, the Willow School introduced Spring Clean Up Day, where parents and students were encouraged to contribute 3 to 4 hours of their time cleaning up the school grounds. An estimated 20 students and 10 adults participated in the event by hand weeding and cutting back overgrown vegetation and recycling the debris in the school's compost and mulching beds. After the Spring Clean Up Day, the remaining maintenance of the perennial and retention beds was completed in 16 man-hours, (Kresge). The average wage for grounds day laborers is about \$15/hour. Kresge estimates that the total cost of maintaining the perennial beds and retention beds in 2012 was about \$240 in labor.

2 laborers x 80 hours x \$15/hour = \$2,400 total estimated maintenance costs
2 laborers x 16 hours x \$15/hour = \$240 expected 2012 maintenance costs
\$2,400 - \$240 = \$2160 volunteer savings