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Denver Water School Assessment Program

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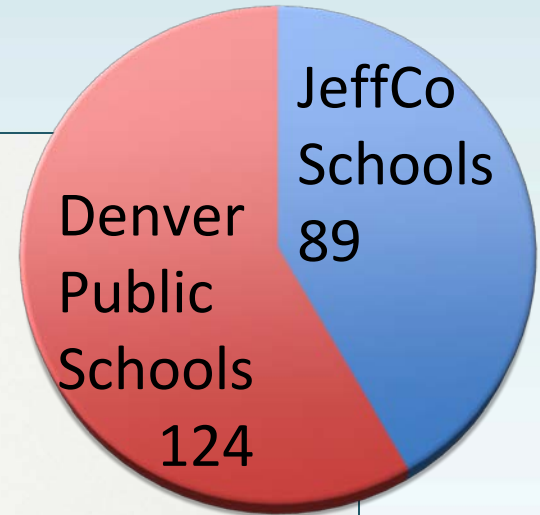


Overview



Engineering Sustainable Change

Looking at the Schools



Project Outcomes



143,000,000
Gallons of
Projected
Water
Savings



21,219 Fixtures
Inventoried



\$660,000
Annual Savings Projected



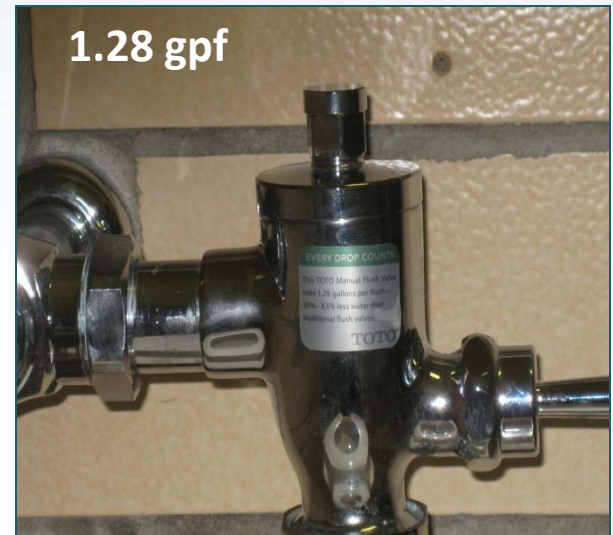
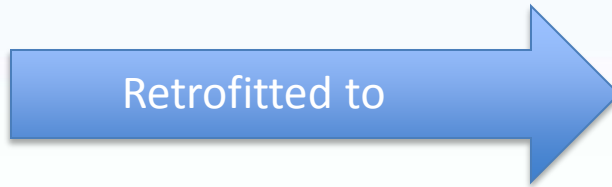
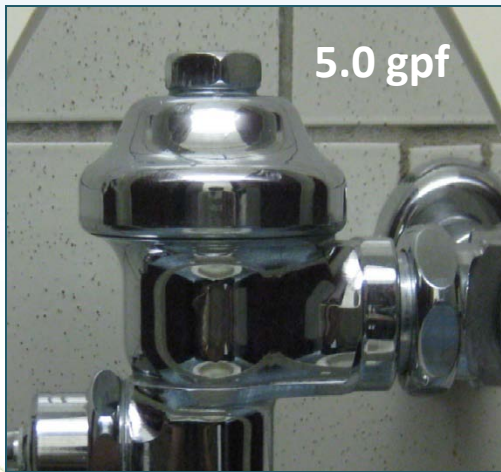
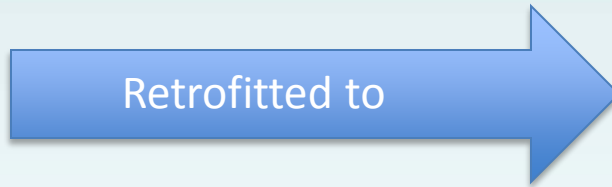
40,704,000 SF
of Irrigated
Area Assessed
(6,563 zones)

Water Conservation Opportunities



Engineering Sustainable Change

Project Description: Indoor Retrofits

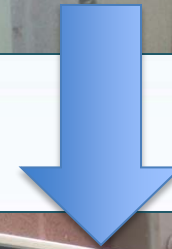
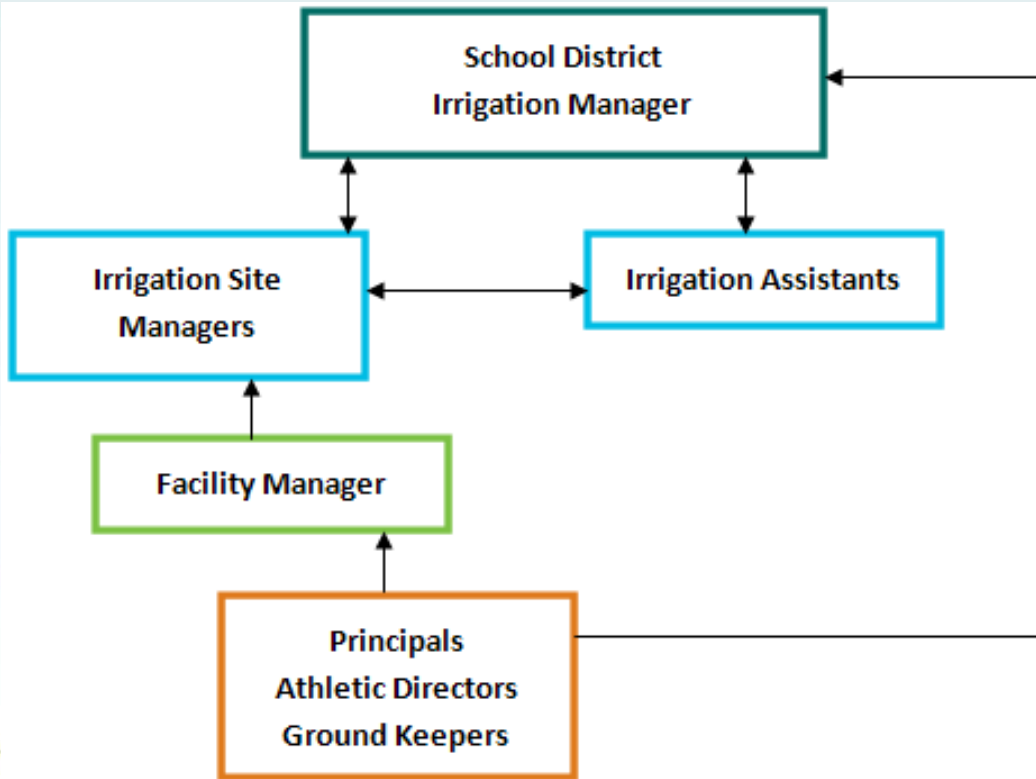


Outdoor Process

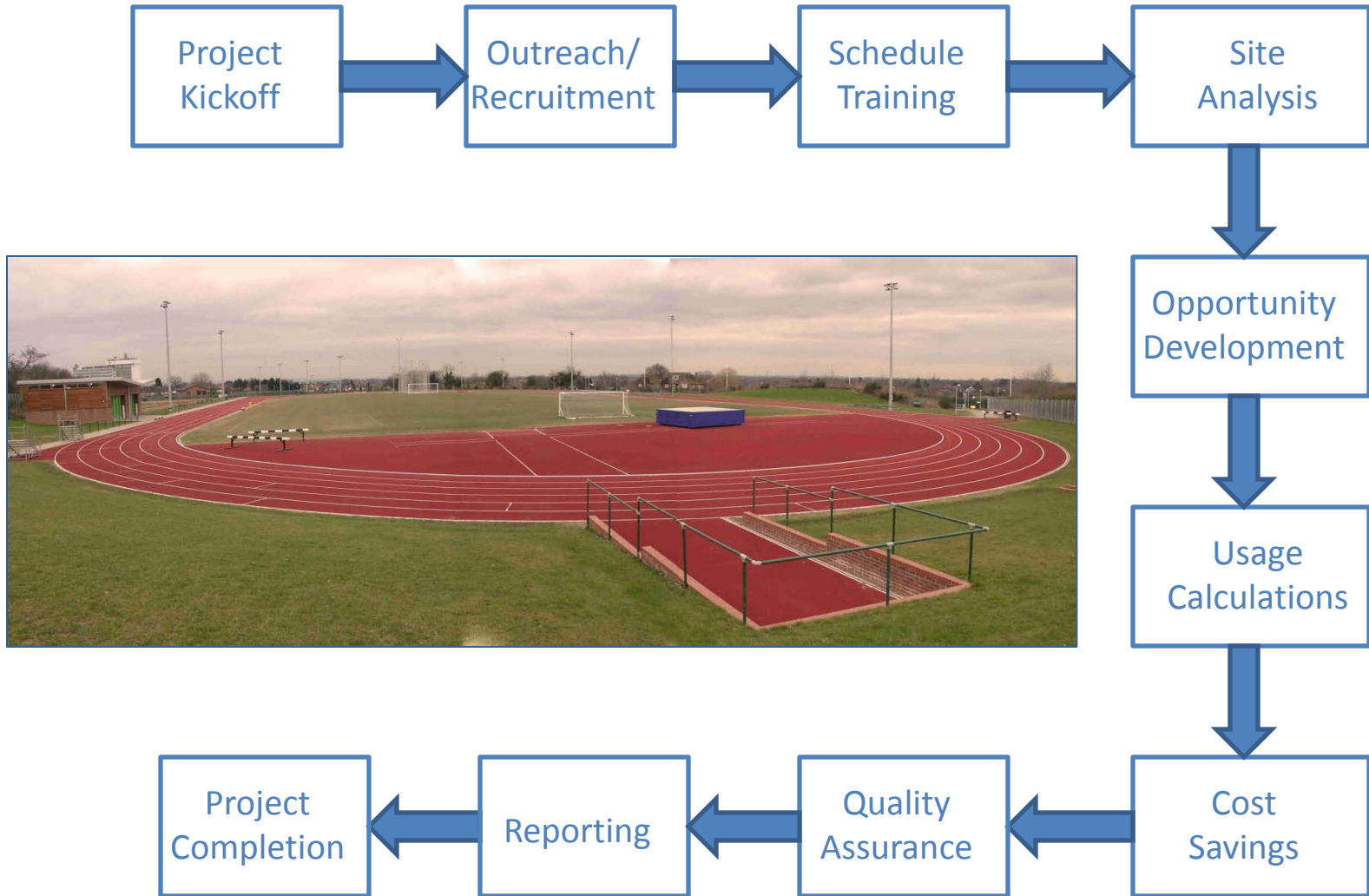


Engineering Sustainable Change

Outdoor Opportunities



Assessments from Start to Finish



Methodology – Student Engagement



Training Manual



Instructions for Looking at Your Water Fixtures

A. Before You Start- What Should You Do to Get Ready?

1. **Plan Your Time:** Plan to spend about 3-5 minutes in each bathroom or other room to look at the water fixtures and record what you find.
2. **Look At the School Map in Your Binder.** Find all the bathrooms and other rooms that have water fixtures. While they have already been highlighted for you, you may find some fixtures in your building that weren't highlighted, so please be sure to include those too. Give each of them a number, starting with 1. (Room 1, Room 2, Room 3, etc.).
3. **Make Sure You Take What You Need.** Your team should bring these things with you when you check your fixtures:
 - a. Your three ring binder, which includes:
 - These instructions
 - Building maps with highlighted restrooms
 - Your site sheet
 - Safety information, including emergency phone numbers
 - Contact information for the assessment coordinators at Brendle Group
 - b. Your tool kit, which includes:
 - Pencils/writing utensil
 - Flow bag (provided)
 - Stopwatch (provided)
 - Clipboard/something to write on
4. **What If You Have Questions or need help?**
 - a. Talk to your adult team leader first.
 - b. If your adult team leader can't help, call your trainers, Katy Ulrich, Jeff Lasker, or Elizabeth Mozer at (970) 207-0058. Or, you can email Katy at kulrich@brendlegroup.com, Jeff Lasker at jlasker@brendlegroup.com, or Elizabeth Mozer at Emozer@brendlegroup.com.

Tools of the Water Assessment Trade



Data Collection Sheet

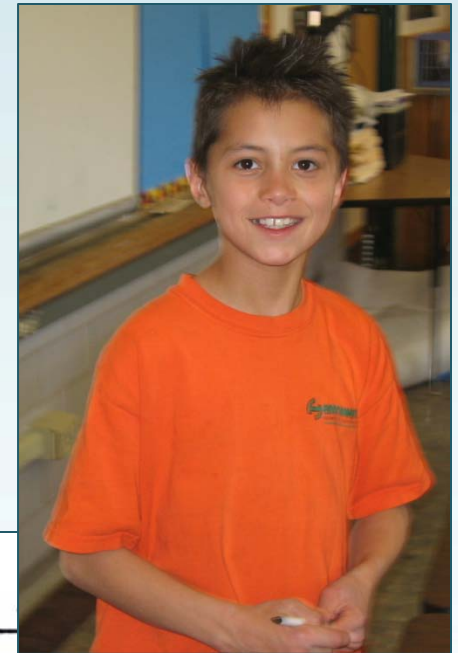
Building Name	School Name								
Assessment date(s)	8/3/09								
Assessment completed by	Katy								
Supervisor's name	Ms. Smith								
	<table border="1"> <tr> <td></td> <td>Current Usage</td> <td>Proposed Usage</td> <td>Water Savings</td> </tr> <tr> <td></td> <td>1,141.31 kgal</td> <td>629.57 kgal</td> <td>511.74 kgal</td> </tr> </table>		Current Usage	Proposed Usage	Water Savings		1,141.31 kgal	629.57 kgal	511.74 kgal
	Current Usage	Proposed Usage	Water Savings						
	1,141.31 kgal	629.57 kgal	511.74 kgal						

Code Key

f - faucet, **t** - toilet, **tt** - tank toilet,
tr - trough, **u** - urinal,
s - showerhead.

Room #	Room Description (if Other, please describe in Notes)	Existing Fixture Type	Existing # of Fixtures	Rated flow (gpm/gpf, if available)	Measured flow (gpm)	Low Flow? (y/n)	Notes
1	bathroom	t	1	3.5		n	
1	bathroom	T	2			y	
1	bathroom	f	1	2.2	2.0		leaking
2	bathroom	u	3			n	
2	bathroom	tr	4		0.5		Single/Auto
2	bathroom	t	1			y	
3	classroom/lab	f	1	2.5	4.0		missing screen

Fun Student Participation

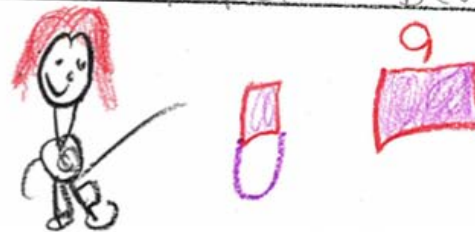


Name: Sam

I think you like Denver water park. I like it.

I like the toilet paper cuz it's soft.

I like the toilet paper cuz it works.



Student and Teacher Feedback



- “I’m so excited about this project because seeing a boy’s bathroom is on my list of 500 things to do before I die!!”
- "We are proud to be part of this project."
- "The kids really had a good time gathering data. We saw all sorts of parts of the school we had never seen before. They were also amazed at how many different readings they got all over the building."
- "...this has been such a valuable project for my class . . . thank you for the opportunity! ...My class loved this project. Thanks for including our school and for your patience..."
- "I just wanted to thank you. The kids enjoyed being part of the survey and hopefully a few ideas about water conservation stuck with them."

Final Report



Final Report

Water Conservation Analysis for Denver Public Schools and Jeffco School District



From 2009 to 2010 Jefferson County, Denver Public Schools, and Denver Water implemented a project to help reduce the water consumption in schools. This project involved evaluating DPS and Jeffco indoor water use to identify, analyze, and recommend projects to reduce utility and operational costs for the school district as well as reduce demand for water from Denver Water.

To achieve this objective engineers, undergraduate engineering students, and DPS and Jeffco student volunteers completed site assessments for a total of 213 schools between the two districts. This approach gave students from participating schools the opportunity to evaluate end-use fixtures in their own school and to enhance understanding of water use and conservation.

	JEFFERSON COUNTY	DENVER PUBLIC SCHOOLS
Schools assessed	89	124
Students involved	5 teams; 78 total	41 teams; 441 total
Building Square feet assessed	6,898,000	12,292,000
Irrigated area assessed	21,214,000	19,490,000
Fixtures inventoried	8,798	12,421
Total water use	347,000 kgals/year	500,000 kgals/year
Annual cost for water	\$1,505,000	\$1,555,000
Potential indoor and outdoor water savings	38,000 kgals	105,000 kgals
Potential energy savings	20,000 therms	59,000 therms
Potential annual indoor and outdoor cost savings	\$226,000	\$434,000
Cost to implement end-use fixture upgrades	\$2,100,000	\$3,542,000
Cost to implement irrigation upgrades	\$499,000	\$805,000
Total Project Payback (includes incentives from Denver Water)	4 years	7 years



Alameda High
1255 S WADSWORTH BLVD



Project Background

Brendle Group, Inc., Aqua Engineering, Inc., and Red Oak Consulting were selected by Denver Water to assess conservation opportunities at specific Jefferson County Schools. Water conservation opportunities in each school focus on three main areas: indoor end-use fixtures, indoor process water, and outdoor-irrigation water use. The information below is a summary of the site observations, opportunities, water savings, cost savings, implementation costs, and payback at Alameda. The main project report contains detailed information about the project and findings.

Site / Water Balance

Alameda High was built in 1960 and is 200,450 ft² with an irrigated area of approximately 684,847 ft². Based on the water-consumption data provided by Denver Water, Alameda uses an estimated 9 kgals/occupant of potable water and is spending approximately \$30,900 per year for potable water and sewer. The pie-chart on the right shows the average annual breakdown of indoor and outdoor potable water usage at Alameda. Raw water is used for irrigation when available, however, raw water consumption data was not provided, therefore is not included in any data presented herein.



Outdoor Water Use

Irrigation System Observations

- Raw Water:** Both raw water and potable water are used for irrigation. Potable water is typically used during the shoulder seasons when raw water is not available.
- Irrigation Backflow:** An irrigation backflow assembly is installed.
- Sprinkler/Pipe Findings:** Broken backflow assembly is installed. Perpendicular to grade. Inadequate sprinkler coverage. Sprinkler arcs are not adjusted properly. Sprinklers are not matched precipitation rate. Impacts and rotors operate on same zone(s). Plugged sprinklers. Sprinklers do not have internal check valves. Spray sprinklers do not have internal pressure regulators.
- Controller Findings:** Rain sensor(s) are not utilized. Existing irrigation controller(s) are not climate-based.
- Operations:** Zone run times are not programmed for water conservation.

Water Conservation Opportunities

- Address the sprinkler/pipe findings shown above.
- Replace existing irrigation controller(s) with climate-based controller(s).

Total Outdoor Consumptive Savings

Based on five years of consumption data provided by Denver Water, the average annual outdoor potable water use for Alameda is estimated to be 5,440 kgals. For this facility, saving opportunities related to outdoor water use were investigated and determined to be minimal. Although saving opportunities are minimal, implementing the opportunities above may provide other benefits such as higher quality turf and reduced pumping costs for the raw water.

Total Outdoor Implementation Cost and Simple Payback

If Alameda replaces the existing irrigation controller(s), properly programs the controllers, and installs rain sensor(s), the cost is estimated to be \$5,025. Since there is minimal water use savings, there is no simple payback associated with the opportunities. The costs associated with maintenance opportunities and landscape renovations are not included in the cost and payback calculations. Information regarding the costs associated with these items is included in the overall project report.

Key Lessons Learned



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Challenges



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Q & A

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