



# LANDSCAPE PERFORMANCE SERIES

## **Cherry Creek North Improvements and Fillmore Plaza – Denver, CO Methodology for Landscape Performance Benefits**

### **Environmental**

#### **Projected to reduce mid-day air temperatures by 6°C (11°F) as a result of increasing tree canopy on the site by 49%.**

Measured from the site base map, there were 528 existing trees within the project boundary. The project installed an additional 258 shade trees. The calculation here is based on the 10-year projected outcome. Canopy size of a large deciduous tree is about 250 SF, and an ornamental deciduous tree is about 175 SF. Assuming that the quantity of the street trees is split 50/50, then the average shaded area is 212.5 SF per tree. Therefore the total additional shaded area is:

$$212.5 \text{ SF per tree} \times 258 \text{ trees} = 54,825 \text{ SF}$$

Temperatures are lower under tree canopies due to shading and evapotranspiration. Maximum mid-day air temperature reductions due to trees are in the range of 0.04°C to 0.2°C per percent canopy cover increase (Nowak). This study has two assumptions: (1) 50% of the trees are large deciduous trees and the other 50% are ornamental deciduous trees, and (2) The site's mean air temperature will on average drop 0.12°C with every 1% increase in canopy cover.

- Shaded area before construction: 212.5 SF/tree × 528 trees = 112,200 SF
- Projected 10-year outcome after construction: 112,200 SF + 54,825 SF = 167,025 SF
- Increased percentage of shaded area: 54,825 ÷ 112,200 = 48.9%
- Reduction of air temperature due to the increase of tree canopy: 48.9 × 0.12°C ≈ 6 °C

#### **Reduces annual water consumption for irrigation by 3,376,000 gallons, saving \$17,600 annually, by replacing over half of the spray-irrigated turf with drip-irrigated, water-wise perennials and shrubs.**

All of the following calculations in this project (except for the property value calculation) used 2008 as the baseline year and 2011 as the comparison year. The project replaced over half of the spray-irrigated turf with drip-irrigated, water-wise perennials and shrubs, that reduced annual landscape water consumption from 9,582,000 gallons in 2008 to 6,206,000 gallons in 2011 (data from Hydro Systems, Inc.). Denver utility tracking spreadsheets showed that 2008 winter irrigation consumption (October 28 through May 2) was 0 gallons, and summer (May 3 through Oct 27) was 9,582,000 gallons. In 2011, after the landscape improvements, winter-water consumption totaled 378,000 gallons, and summer 5,828,000 gallons. The amount of water budget saved in this project is calculated as follows:

Irrigation water rate in Denver is \$1.20 per 1,000 gallons in the winter (October 28 through May 2), and \$4.81 per 1,000 gallons in the summer (May 3 through Oct 27).

Water savings were calculated by subtracting water costs in 2011 by 2008:

$$\$4.81 \times 9,582 - (\$1.20 \times 378 + \$4.81 \times 5,828) = \$46,089 - \$28,486 = \$17,603$$

**Reduces annual energy consumption for outdoor lighting by 223,000 kilowatts, saving \$12,700 in energy and \$1,000 in maintenance and material costs each year.**

The project uses full-cutoff lights and LED lights to reduce the energy cost. The full cutoff lights are more effective than other fixtures, since light that would otherwise have escaped into the atmosphere may instead be directed towards the ground (Wikimedia Foundation). Therefore, the use of full cutoff fixtures can allow for lower wattage lamps to be used in the fixtures, producing equal or sometimes a better effect. In this project, the pedestrian light pole design has reduced the number of lamps per pole from three to one because of using full-cutoff lights. The LED lighting also contributes to the energy savings in this District. Typically the LED lights will use less than 10% electricity than the replaced incandescent bulb.

Based on the Scanlon Szynskie Group lighting consultant's power consumption spreadsheet, energy consumption decreased from 420,756 kW in 2008 to 197,806 kW in 2011. Thus the energy savings in this project is 420,756 kW – 197,806 kW = 222,950 kW.

The annual capital cost saving is calculated by subtracting the 2011 cost (\$24,901.84) from the 2008 baseline cost (\$37,635.70). The result is \$12,733.86.

The project installed LED lights on 83 banner poles and 21 directories. LED lights have a very long lifespan, usually greater than 50,000 hours, which is at least four times of conventional outdoor lighting. As a result, the District does not need to replace bulbs as often, which in turn reduces the quantity of lights and offsite storage costs. These costs total approximately \$1,000 per year.

Detailed numbers were provided by Cherry Creek North Business Improvement District (BID).

Wall	Total Length (ft)	Section Height (ft)	Section Width (ft)	Total volume (CF)	Estimated % concrete	Concrete			Actual Trap Rock Used			Additional Trap Rock needed if not using Concrete								
						Volume concrete (CF)	total lbs (110 lbs/cf)	total tons (2,000 lbs)	Volume trap rock (CF)	total lbs (185 lbs/cf)	total tons (2,000 lbs)	Volume of trap rock (CF)	total lbs (185 lbs/cf)	total tons (2,000 lbs)						
1	166	3	2	747	0%	0	0	0	747	138,195	69	0	0	0						
2	170	3	2	765	0%	0	0	0	765	141,525	71	0	0	0						
4	200	3	3	1,800	50%	900	99,000	50	900	166,500	83	900	166,500	83						
7	309	3	3	2,781	50%	1,391	152,955	76	1,391	257,243	129	1,391	257,243	129						
8	258	3	3	2,322	50%	1,161	127,710	64	1,161	214,785	107	1,161	214,785	107						
10	45	3	3	405	50%	203	22,275	11	203	37,463	19	203	37,463	19						
11	45	3	3	405	50%	203	22,275	11	203	37,463	19	203	37,463	19						
12	95	3	3	855	50%	428	47,025	24	428	79,088	40	428	79,088	40						
13	10	3	3	90	50%	45	4,950	2	45	8,325	4	45	8,325	4						
A	5	3	3	45	25%	11	1,238	1	34	6,244	3	11	2,081	1						
B	30	3	3	270	25%	68	7,425	4	203	37,463	19	68	12,488	6						
C	27	3	3	243	25%	61	6,683	3	182	33,716	17	61	11,239	6						
D	27	3	3	243	25%	61	6,683	3	182	33,716	17	61	11,239	6						
E	15	3	3	135	25%	34	3,713	2	101	18,731	9	34	6,244	3						
F	43	3	3	387	25%	97	10,643	5	290	53,696	27	97	17,899	9						
G	50	3	3	450	25%	113	12,375	6	338	62,438	31	113	20,813	10						
H	250	3	3	2,250	45%	1,013	111,375	56	1,238	228,938	114	1,013	187,313	94						
Total Ton of Concrete						318			Total Ton of Trap Rock			778			Ton of Trap Rock			535		
cost per ton						15			cost per ton			56.00			cost per ton			56.00		
Total cost of Concrete						4,772			total cost of Trap Rock			43,555			Cost of Trap Rock			29,965		
Total concrete used (ton)						318			<u>truck trips avoided</u>											
Total cost of concrete used						4,772			Additional trap rock needed if no concrete: 535 tons											
Additional cost of trap rock if no concrete was used						29,965			Tons per truck load:						35					
									Trips avoided:						15					
Total savings by using concrete						25,193			Miles per round-trip between supplier in Canada to Troy:						736					
									Total miles avoided:						11,250					

**Removes up to 80% of solids in the stormwater runoff from Fillmore Plaza using an underground water treatment vault.**

A CDS® (continuous deflective separation) stormwater treatment vault is installed in Fillmore Street south of 2nd Avenue to treat the 5-year storms and to discharge the treated runoff into Denver's stormwater drainage system. Runoff captured from the trench flows through the diversion weir which allows bypass to occur when discharge exceeds the capacity of the stormwater treatment vault. The CDS system uses induced vortex to separate and trap debris, sediment, and oil and grease. Floatable and neutrally buoyant contaminants are held within the separation chamber while negatively buoyant debris is stored in the sump.

The CDS system is effective in removing the pollutants in the stormwater. Laboratory evaluations show that the CDS units are capable of removing 70% of the free oil and grease from stormwater (Contech CDS Operations and Maintenance Guidelines for CDS Units). Typically in the United States, CDS system are designed to achieve an 80% annual solids load reduction based on lab generated performance curves for a gradation with an average particle size of 125-microns (um) (Contech CDS Guide).

## **Social**

### **Reduced crime in the District by 39%, from 180 incidents in 2009 to 110 in 2011.**

"This is something everyone knows: A well-used city street is apt to be a safe street. A deserted city street is apt to be unsafe." -- Jane Jacobs

The upgraded infrastructure and new lighting system created a safe environment for pedestrians. In addition, the 20 new "Art and Garden Places" create distinct areas throughout the District enriching the pedestrian experience, reinforcing the unique character of the District, and encouraging people to take a moment to relax and linger. These small open spaces increase the vitality of the District and make it safer to pass through.

This crime result is based on the dot counting from the Denver Crime Statistics & Maps. The crime statistics use National Incident Based Reporting System (NIBRS), an incident-based reporting system in which agencies collect data on each single crime occurrence. The crime number in this 16-block District is largely reduced from 180 in 2009 to 110 in 2011.

(Source: Denver City Crime Maps 2009 and 2011, Denver Police Department, <http://www.denvergov.org/PoliceDepartment/CrimeInformation/CrimeStatisticsMaps/tabid/441370/Default.aspx>)

## **Economic**

### **Increased the District sales tax revenues by 16% (over \$1 million) in the first year after construction. This was more than double the rates of increase for both the city and the entire Denver Metro Area.**

Based on 2010 year-end sales tax receipt figures, the Cherry Creek North BID received \$7,389,285 in sales tax, which is a 16% increase compared to 2009 (\$6,363,315). This rate more than doubled the surrounding areas. Compared to 2009, sales tax receipts in 2010 increased 6.5% in Colorado, 7.1% in the Denver Metro Area, and 6.5% in the City of Denver. The calculation of this performance benefit is listed below.

$$(\$7,389,285 - \$6,363,315) \div \$6,363,315 = 16\%$$
$$16\% \div 7.1\% = 2.25 \text{ (more than doubled)}$$

### **Decreased retail vacancy rates from 13.6% in 2009 to 7.2% in 2012.**

The walkable and desirable new streetscape keeps the District strong in a competitive retail environment. According to the Aggregate Historical Vacancy Report and Cherry Creek North BID Economic Indicators, the vacancy rate in 2011 was 9.8%, which has declined by 3.8% from 2009 (13.6%). The vacancy rate was further declined to 7.2% in March, 2012, the lowest value since 2008.

It is also worth mentioning that the District has 1,053,174 SF retail space. There has been no increase in retail square footage since 2008.

### **Saved \$188,000 by reusing 331 light pole footings and bases in place on the site.**

The unit price of a new footing was approximately \$550. The total cost of 331 new footings is:  
 $\$550 \times 331 = \$182,000$

The demo cost of removing a light pole from its base is \$142, and the cost for removing a light pole and its base is \$160. Therefore the cost for removing strictly the base is  $\$160 - \$142 = \$18$ . This resulted in savings of  $\$18 \times 331 = \$5,958$  (around \$6,000) for base removal in this project.

Therefore, the total savings in light pole footings and bases are:  
 $\$182,000 + \$6,000 = \$188,000$

### **Methodology for Cost Comparison**

**Over half of the spray-irrigated turf grass area was replaced with drip-irrigated, water-wise perennials and shrubs. This reduces annual water consumption for irrigation by 3,376,000 gallons, saving \$17,600. The low-water plants are estimated to save an additional \$10,000 per year in reduced maintenance costs.**

See Methodology for Performance Benefit #5.

In addition, the low-water landscaping requires less maintenance than turf. Calculated by the irrigation system designer, the annual operating budget was reduced by approximately \$10,000. Therefore, the total saving annually would be:  $\$17,603 - \$10,000 = \$7,603$

### **References**

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- 2) Cherry Creek North BID. (2012). Cherry Creek North Economic Indicators.
- 3) Cherry Creek North BID year-end Financial Statement.
- 4) Cherry Creek North Business Improvement District (BID) document.
- 5) Denver Police Department: Denver City Crime Maps 2009 and 2011. Available online at: <http://www.denvergov.org/PoliceDepartment/CrimeInformation/CrimeStatisticsMaps/tabid/441370/Default.aspx>
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- 7) Newmark Knight Frank, Cherry Creek North Aggregate Historical Vacancy Report.
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9) The Denver Post Website. [http://www.denverpost.com/news/ci\\_16653824](http://www.denverpost.com/news/ci_16653824)