Daybreak Community
Methodology for Landscape Performance Benefits

- ***Retains 100% of storm water that falls on the site for up to a 100-year storm with no impacts on or connections to the municipal storm sewer system.***

Verified by civil engineer, Nolte and Associates. All storm water is directed to on-site swales, constructed wetlands, dry wells and/or infiltration basins in the parks and open space system to supplement irrigation and to cleanse and infiltrate the water. The storage capacity of these combined systems is greater than the volume generated in post-construction conditions up to and including the 100-year storm event. There are no connections to the South Jordan municipal stormwater sewer system. In the case of a greater than 100-year storm event, excess water tops designated street curb locations and utilizes the street cross-section for storage and movement of water through South Jordan and into the Jordan River.

- ***Saves approximately 1.5 million gallons of potable water each year by using an innovative drip irrigation design. Projected annual savings at build-out are 17.2 million gallons, saving approximately $54,000 annually.***

Worst-case water use calculations were obtained from Design Workshop and used to represent “typical” water use of surrounding communities. 10% of this number was used to estimate the gallons saved through “10% efficiency” drip irrigation technology.

Build-out is expected by 2025, and Daybreak is currently only at 8% of build-out. Projections were calculated by multiplying current savings by a ratio and then by current South Jordan water rates:

> Worst case water use per year: 14,973,899 gallons of potable water used for current built portion of Daybreak (Design Workshop, 2004).
> 14,973,899 x 0.10 = **1,497,390 gallons of potable water per year saved**
>
> Projected annual water savings for 100% build-out:
> 1,497,390 x 100/8 =**18,717,375 gallons saved annually at full build-out**
>
> Water saved is multiplied by South Jordan water billing rates (HOA area C):
> $2.90 per 1,000 gallons (South Jordan City, 2011)
> 18,717,375 x $2.90/1,000 = **$54,280 annual savings at build-out using 2010 water rates.**

- ***Promotes species diversity with nearly 2.5 times the national average for comparable wetland bird populations present in man-made Oquirrh Lake and the surrounding wetlands.***

Typical wetlands of similar ecotype were researched to obtain an estimated average bird populous. This value was compared to the bird counts performed at Oquirrh Lake by the Audubon Society and presented as a proportion (Kantrud, 1984). Acres of wetland created was provided by published Design Workshop literature.

- ***Reduces auto trips with 88% of neighborhood students currently walking or riding bikes to school. This is expected to reduce auto trips by 2.3 million miles a year at build-out, saving 102,000 gallons of fuel and reducing carbon emissions by 950 tons annually.***

To calculate trip miles saved, average number of households with children were estimated and multiplied by the1/4 mile rule, over the number of days in a typical duration of education per year:

> 20,000 residential units at build-out @ 71.8% with children (US Census Bureau, 2011)
> 20,000 x .718= 14,360 families
> 1/2 mile return-trip drive, 2 times daily for 180 days each year (US Department of Education, 2002)
> 1/2 x 2 x 180 x 14,360 = 2,584,800 trip miles driven annually at build-out

A study by the University of Utah Department of Family and Consumer Studies and published in the Journal of Environmental Psychology in the fall of 2010 (Napier et al., 2011) shows that 88% of students walk to school.

> 88% reduction = 2,584,800 x .88 = **2,274,624 trip miles saved**

Current average U.S. auto efficiency is 22.4 mpg

> 2,274,624 / 22.4 = **101,545 gallons of fuel saved**

To calculate carbon footprint reduction from trip loads, trip distance was entered into the ALG Carbon Calculator, by using the metric of a midsize petroleum engine (Future Climate, 2011)

> Use ALG Carbon Calculator divide trip distance by 52 and provide vehicle fuel efficiency rate

- ***Reduced carbon footprint by 9,110 tons, saved 23,000 gallons of fuel and saved over $1.6 million in concrete and transportation costs by reusing materials onsite and recycling construction waste.***

Carbon footprint reduction was calculated by first researching manufacturing average carbon dioxide emissions per ton of concrete. This value was multiplied by the amount of concrete reported as recycled by the client:

> Total concrete needed provided by Client: 1,600 tons
> Total CO2 emissions per ton of cement = 1.1 tons (Malhotra, 1998)
> 1.1 x 1,600 tons needed = 17,600 tons of carbon avoided by using recycled materials

Trip load impact was added to the equation by first calculating the ratio of cement to concrete, then by researching typical carrying capacities of payload trucks and dividing total amount needed by this volume. To obtain number of trips needed, feasible cement and concrete manufacturing plants were located and total distance was calculated by adding number of trips needed from cement to concrete plant, and from concrete plant to project site.

> 1,600 tons of concrete needed = 22,068 cubic yards
> Ratio: 6 bags of Portland cement to 1 cy of concrete
> 6 x 22,068 = 132,408 bags
>
> Each bag weighs 97 lbs (Malhotra, 1998). Payload truck can carry 75,000 lb.
> 75,000 / 97 = 773 bags per trip
> 132,408 / 773 = 171 trips from cement plant to concrete plant

106 miles each way from cement to concrete plant (x 2 round trip) = 212 miles per trip
212 x 171 = 36,252 trip miles

Typical concrete mixer truck can carry 10 cy of concrete
22,068 /10 = 2,207 trips needed

5.5 miles each way from nearest feasible concrete plant to Daybreak = 11 miles per trip
11 x 2207 = 24,277 trip miles
36,252 + 24,277 = 60,529 total trip miles for specifying new concrete

This process was repeated to include the amount of recycled construction waste that was reused onsite rather than being shipped to a recycling center: Total volume of waste was divided by typical carrying capacity of a one-ton dump truck, then multiplied by the return-trip distance to the nearest feasible recycling center. Total distance between trips for concrete and waste recycling was entered in to a carbon calculating software program. Finally, trip impact carbon reduction and cement product carbon reductions were summed to calculate total carbon impact reduction.

43,500 tons or 87,000,000 lbs of crushed rock reused
Crushed rock = 2,200-2,700 lb /cy = 32,222 cy on average

Typical dump truck capacity is 5 cy (assuming 8 mpg diesel truck)
32,222 / 5 = 6,444 trip loads needed

10 miles to nearest rock recycling business (x 2 for round trip) = 20 round trip distance
20 x 6,444 = 128,888 trip miles needed

60,526 +128,888 = 189,414 total trip miles avoided by recycling onsite construction waste and rock

Fuel savings were estimated by multiplying total trip distance between concrete importation and waste exportation at 8 mpg diesel rate. Divide total trip distance by /mpg fuel efficiency for gallons of fuel needed.

Typical diesel v8 truck @ 8mpg
189,414 / 8 = **23,676 gallons of fuel saved**

Current fuel prices for diesel were estimated at $3.56 / gallon (for 2010).
23,676 x 3.56 = $84,287 in fuel cost savings

Material savings were estimated by researching concrete prices and multiplying average cost of concrete by total amount of recycled concrete.

$70 x 22,068 = $1,544,760 in material cost savings

84,287 + $1,544,760 = **$1,629,047 total savings**

Cost Comparison

- ***Engineers estimate over $70 million in storm water infrastructure savings over the life of the Daybreak project due to the elimination of municipal impact fees and the dramatic reduction in conventional conveyance infrastructure. This estimate includes $30 million in residential impact fees, residential entitlements by owner, and reduced in-ground infrastructure.***

Calculations generated by civil engineer, Nolte and Associates.

- ***Using on-site nursery acclimation, species and age diversity and tree-by-tree computer-chip monitoring reduces tree mortality by 60% over typical rates, saving an estimated $2 million in replanting costs for the project goal of 100,000 trees planted.***

Typical tree mortality rates were researched and compared to those reported by annual Daybreak on-site nursery inventory. The difference between the two is presented as a ratio of reduction.

Daybreak mortality rate: 4-5% vs. typical mortality rate at 10-12% (Ulam, 2010)
11% (national avg.) – 4.5% (avg. in Daybreak)/ 11%= **60% mortality reduction**

Cost savings were calculated by first researching typical installation prices of installed 2" balled and burlapped trees from local nurseries. Difference in mortality was multiplied by the projected 100,000 trees to be planted at Daybreak (RioTinto, 2010), and then by the typical installation price of balled and burlapped tree installation. Finally, the cost of microchip materials and installation costs was subtracted from this number for a total cost savings.

100,000 trees at typical mortality rates of 10-12% = 11,000 trees to replace
100,000 trees at Daybreak mortality rates of 4-5% = 4,500 Daybreak trees to replace
11,000 – 4,500 = 6,500 trees that would otherwise have to be replaced

Typical 2" balled and burlapped tree, installed from Daybreak Contactor bids = $360
6,500 x $360 = $2,340,000 cost savings from tree replacement

$3 microchip per tree = $300,000 cost investment
$2,340,000 – $300,000 = **$2,040,000 savings**

References

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