HIGH LINE CANAL PRESERVATION AND ENHANCMENT PLANNING STUDY – SECTION NO.6 – SUSTAINABILITY ANALYSIS REPORT:

August 21, 2012

Objective:

The purpose of the sustainability assessment analysis was to explore ways to provide establishment and maintenance water for infill tree planting, located along the shoulder of the trail on the opposite side from the canal channel.

Considerations:

Mature tree maintenance water requirements versus newly planted tree establishment and maintenance water requirements vary considerably.

Point of Application:

Established mature cottonwood trees along the banks of the High Line Canal have developed root systems that take advantage of the water loss through percolation into soils along the lower banks and across the bottom of the canal channel.

Newly planted 2” to 3” caliper replacement trees need water applied directly to the root ball of the plant.

Frequency:

Established mature cottonwood trees have the ability to uptake and store water, and can sustain themselves between water applications or water availability.

Newly planted 2” to 3” caliper replacement trees need regular metered water applications of approximately 12 to 15 gallons per week, applied at 2 to 3 gallons per day, through the establishment process.

Sub-surface injection or over-spraying pressurized water for mature tree maintenance:

Drilling deep-root watering wells into the banks and bottom of the canal could destabilize the channel section and may not be located in the center of the mature root system.

Over-spraying the root zone along the banks and bottom of the canal would result in the loss of a tremendous amount of water to evaporation and runoff, and may not penetrate deeply enough into the soil to reach the majority of the mature root mass.

In effect, canal flows are a poor solution for providing water for the establishment of replacement trees, and modern irrigation technology is a poor solution for the maintenance of mature trees along the banks of the canal.

Clearly we have two irrigation conditions with very different needs, requiring two independent irrigation strategies:

Canal flows are the best way to maintain the mature trees along the banks of the channel. Drip or micro spray irrigation, as well as truck watering, are the best ways to establish newly planted trees.

New Tree Establishment Water:

If we were to install a 10’ long double Netafim drip loop with .4 GPH drippers at 12” on ctr. around each new tree, we would be discharging .066 GPM at each tree. A new 1” tap could provide approximately 24 GPM within the safe flow of 10 feet per second. Twenty-four GPM at the tap, divided by .066 GPM per tree, equals 363 newly planted 2” to 3” caliper trees that could be irrigated with a single 1” tap.

Assuming replacement trees would be installed 30’ on center, 363 trees would extend 10,890 linear feet along the canal.

Assuming a static water pressure of 70 PSI at the point of connection, and assuming a 2” CL-200 PVC main line flowing at 24 GPM for the first 3,630 linear feet, a 1.5” CL-200 PVC mainline flowing at 16 GPM for the next 3,630 linear feet, and then at 8 GPM for the last 3,630 linear feet, the friction loss across the system would be 33.9 GPM, providing 36.1 PSI at the last dripper ring. This is more than adequate for the emitters selected.

In order to maximize the value received for the irrigation investment, each point of connection could be used to irrigate trees through establishment in one direction (say upstream from the point of connection). After establishment of the upstream trees, with a small additional investment, the same point of connection could be used to provide establishment irrigation water for trees in the other direction (say downstream from the point of connection) along the canal.

Irrigation costs for year one plantings upstream of the irrigation system point of connection:

a)	System development fee 1” tap commercial	$45,000.00
b)	New tap construction	$11,500.00
c)	New temporary controller with power drop	$2,500.00
d)	Control valve assembly	$250.00
e)	CL-200 PVC mainline @ $2.25 per lin. ft.	$24,502.00
f)	Netafim dripper rings @ $12.00 per tree	$4,356.00
	Total irrigation system cost (upstream trees)	$88,108.00 / 363 trees = $242.72 per tree

Additional irrigation costs for year five plantings downstream of the irrigation system point of connection:

After the upstream trees have been established for the first five growing seasons, with the addition of a $3,500.00 street bore, the existing tap and controller could be used to establish trees downstream from the point of connection at the following per-tree cost:

a)	Directional street bore	$3,500.00
b)	Control valve assembly	$250.00
c)	CL-200 PVC mainline @ $2.25 per lin. ft.	$24,502.00
d)	Netafim dripper rings @ $12.00 per tree	$4,356.00
	Total irrigation system cost (downstream trees)	$32,608.00 / 363 trees = $89.82 per tree

The average per-tree irrigation cost for both upstream and downstream plantings would be $166.27 per tree.

With the phased planting strategy outlined above, a single 1" irrigation tap could provide establishment water to new tree plantings along 4.12 miles of the canal.

Annual tree establishment water costs would be calculated as follows:

a) Twelve gallons per week, multiplied by a 26-week irrigation season = 312 gallons per tree per season, multiplied by 5 grow in establishment seasons = 1,560 gallons total establishment water required per tree, multiplied by an assumed potable water cost of $5.00 per 1,000 gallons, equals a five year grow in establishment water cost of $7.80 per tree.

Truck watering is a legitimate alternative establishment watering strategy that should not be overlooked. Truck watering is currently used for tree maintenance through the portion of the canal maintained by South Suburban Parks and Recreation.

If we assume the following: a labor rate of $17.50 per hour for seasonal labor, an equipment rate of $65.00 per hour for a truck with tank, five minutes for application of 12 gallons of water, and five minutes for hose retraction and drive time to the next tree, we could truck-water 48 trees in an eight hour day, at a cost of $13.75 per tree. Projecting this over a 26 week watering season, it would cost $357.50 to truck-water each tree for one season.

Assuming that newly planted trees would need to be truck watered for five grow-in establishment seasons, it would cost $1,787.50 to manually establish newly planted trees.

It should be noted that depending on species, soils, slope and solar aspect, some trees may require supplemental water beyond the first five years.

Conclusions:

Although the upfront infrastructure investment is considerably less for truck watering, the long term costs are considerably higher than the cost of providing automatic irrigation to newly planted trees.

It should be noted that the automatic irrigation costs projected above are based on a fixed number of trees, installed at one time in a uniform distribution, in order to maximize the irrigation infrastructure investment. Additionally, the cost of irrigation system winterization and routine maintenance would need to be factored into the analysis to more accurately reflect the cost of providing automatic irrigation for tree establishment.

The advantage to truck watering is the flexibility it offers to establish smaller groups of trees or trees planted remote to any potential irrigation water source.

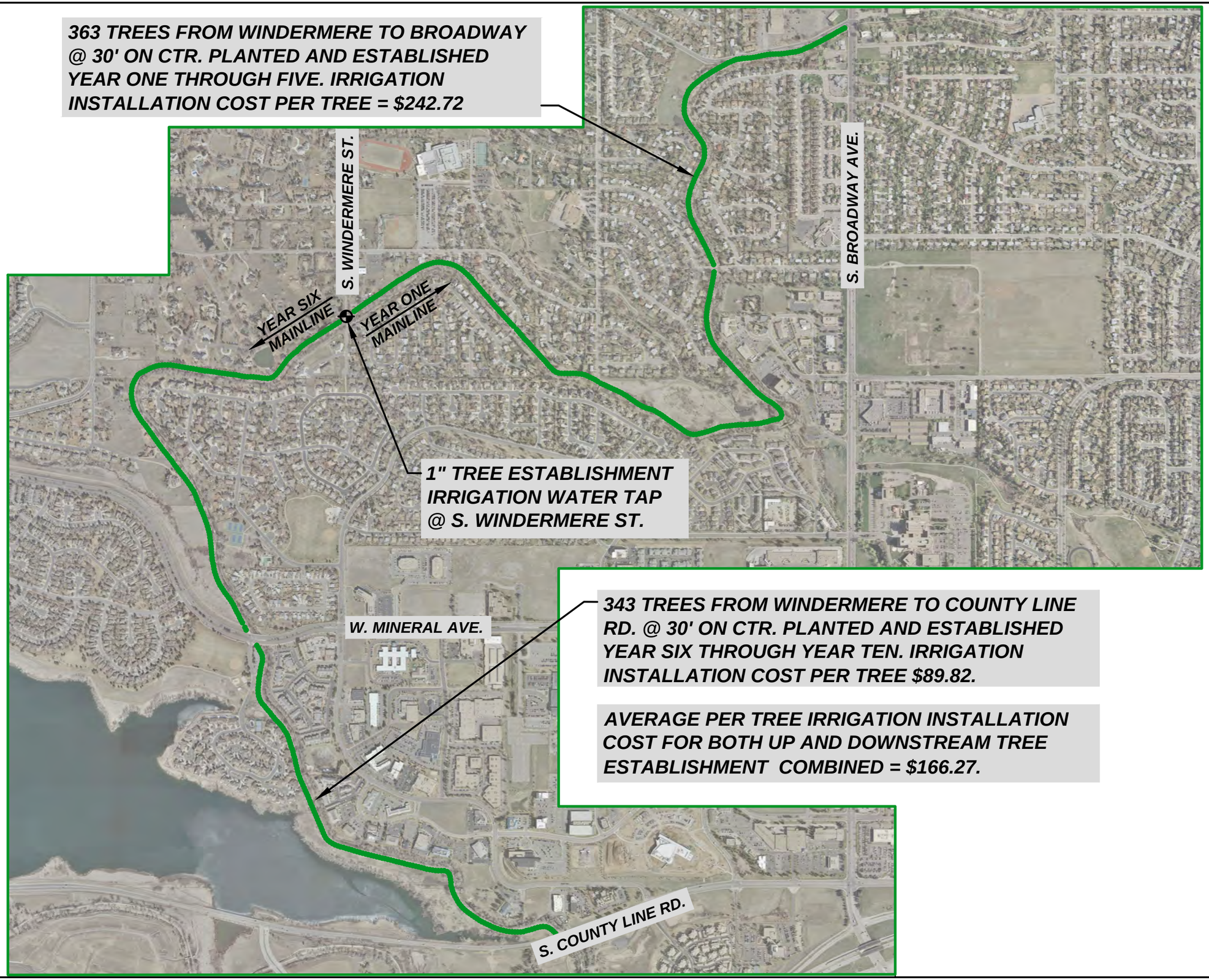
Recommendations:

Where large numbers of trees are to be planted in a uniform distribution, fully automatic drip irrigation should be provided for grow-in establishment water.

Where smaller groups of trees are to be planted in remote locations, truck watering may be the preferred method or strategy for providing grow-in establishment water.

In all cases, a grow-in establishment water strategy should be developed, and the required funding appropriated prior to the installation of any trees.

Any proposed irrigation system installation would need to meet all of the Denver Water Board engineering requirements in place to protect the High Line Canal dam from washouts or undermining.



NORTH

1"=150'

0 75' 150'

HIGH LINE CANAL
PRESERVATION AND ENHANCEMENT
PLANNING STUDY
Irrigation Strategy / Limit Concept Plan

Designed by:	
Reviewed by:	
Date:	
Project Number:	

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