City of DuPont
1700 Civic Drive
DuPont, WA 98327

City Council Workshop
Tuesday, October 18, 2016

6:00 pm

AGENDA

Page

1. CALL TO ORDER

2. DISCUSSION ITEMS

2 a) Proposed amendment to DuPont Municipal Code Chapter 25.35 Mixed Use District to consider provisions for indoor storage (joint discussion with the Planning Commission) (Mayor);

3-15 b) Tree Advisory Board Center Drive Re-planting (G. Lim);

16-49 c) Street Tree and Sidewalk Pilot Study and long term solution (G. Lim);

d) Budget discussion topics: Public Works-Water/Stormwater; Public Safety; Other and Reserve Funds (P. Barry).

3. QUESTIONS/COMMENTS

4. ADJOURNMENT

Regular Council Meeting - October 25, 2016 @ 7:00 pm

Council Workshop Proposed 2017 Budget - October 25, 2016, directly following Regular Council Meeting

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Agenda Item # 2a)

MEETING DATE: October 18, 2016

- ☐ Consent Agenda
- ☐ Discussion Item
- ☐ Unfinished Business
- ☐ New Business
- ☑ Other Workshop

TITLE:

Joint work session with the Planning Commission to discuss proposed text amendments to the DuPont Municipal Code Title 25 regarding Indoor Storage (File No. TEXT-16-01).

Department:	Planning	Discussion Date:	10/18/16
Originator:	Staff	First Reading Date:	11/08/16
Assigned to:	Jeff Wilson, Planning Director	Public Hearing Date:	11/08/16

BUDGET IMPACT: Yes ☐ **No** ☑ **FUND:**

Amount Budgeted		
Additional Required		

DETAILED SUMMARY STATEMENT:

Amendment to DuPont Municipal Code (DMC) Title 25 to create a new "Mixed Use District-2 (MXD-2)" zone district under new Chapter "(DMC 25.36)." The new MXD-2 District will allow Indoor Storage, which is not currently allowed, subject to certain other requirements that may include a Development Agreement, but will be otherwise similar to the existing requirements of the MXD District. The proposed amendment will also include other related text amendments including revisions to DMC Section 25.10, Definitions, which will add a definition for Indoor Storage and make other organizational code improvements. Concurrent with the proposed text amendment will be a proposed rezone of approximately 2.97 acres currently zoned Mixed Use District (MXD) to the proposed MXD-2 zone once created.

RECOMMENDATION:

Hold a public hearing on October 25th to consider the proposed amendments and rezone.

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Agenda Item # 2b)

MEETING DATE: October 18, 2016

- ☐ Consent Agenda
- ☐ Discussion Item
- ☐ Unfinished Business
- ☐ New Business
- ☑ Other Presentation

TITLE:

Tree Advisory Board Briefing to City Council; Center Drive Replanting

Department:	Public Works	Date of First Reading:	
Originator:	Staff	Date of Second Reading:	
Assigned to:	Gus Lim, Public Works Director	Date of Public Hearing:	

BUDGET IMPACT: Yes ☐ **No** ☑ **FUND:**

Amount Budgeted		General
Additional Required		Grant

DETAILED SUMMARY STATEMENT:

The Tree Advisory Board proposes to re-plant the medians on Center DR.

Background:

Center Drive is the main thoroughfare of the city and indeed the area that creates the first impression for visitors. The initial plantings installed nearly 20 years ago have suffered greatly due to drought and disease and are not representative of a community which has been a Tree City USA for the past seven years.

We are initiating a four-phased project, focusing initially on the most heavily trafficked areas. Our plan is to incorporate varieties which are known to do well in this climate that will also create a welcoming and pleasant experience for residents and visitors as they travel through our city.

Discussion:

The presentation will provide graphics on existing conditions and proposal of plantings.

The medians are subdivided into 15 sections. In some medians there are existing plantings and trees, while in others it is bare. This proposal is to improve segments at a time as resources are available.

RECOMMENDATION:

Staff recommends concurrence on the proposal, as resources permitted, to replant of the Center DR median to have hardy, drought/flood resistant trees; and cost effective, water conserving irrigation.

Center Drive Revitalization

Presentation to DuPont City Council

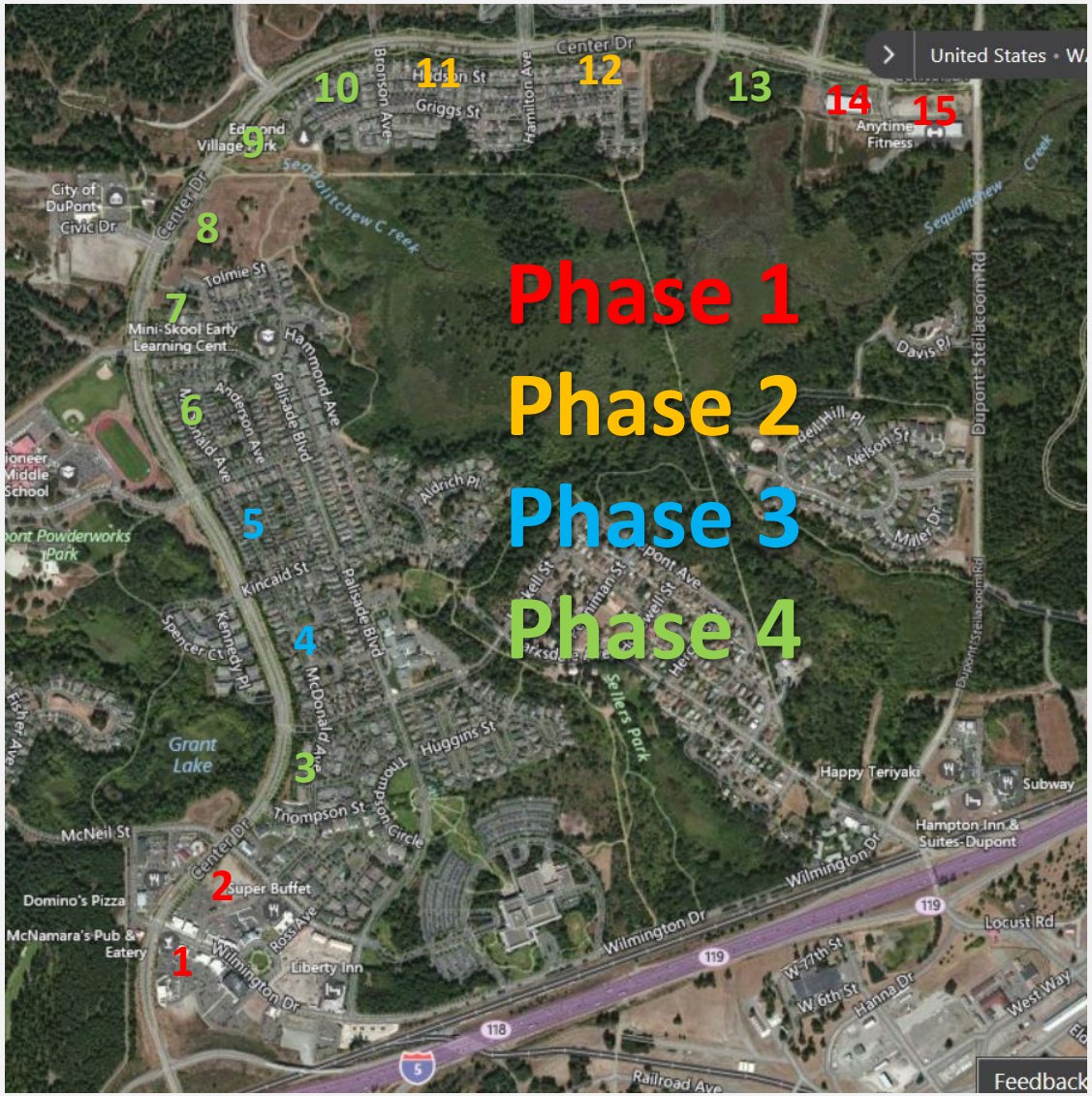
Presenter: Kyle McCreary, Tree Board Chairman

Overview

- Issue: Current state of Center Drive Planting strips not representative of a “Tree City USA” City. Does not project the desired image.
- Concept presented at City Council Meeting in November
- Four-Phased Project:
  - Phase 1: Areas 1-2, 14 and 15 “First Impression”
  - Phase 2: Areas 11-12 “Reforestation”
  - Phase 3: Areas 5-7 “Added Interest”
  - Phase 4: Area 3-4, 8-10 “General Clean-up”

Areas 1-15/Phases Defined

- Phase 1: 1Q FY 17: Near total replanting/redesign
- Phase 2: 1 Q FY 18: Complete Reforestation Using Native Flora
- Phase 3: 2Q FY 18:
- Phase 4: Incremental



Phase 1 Pallette

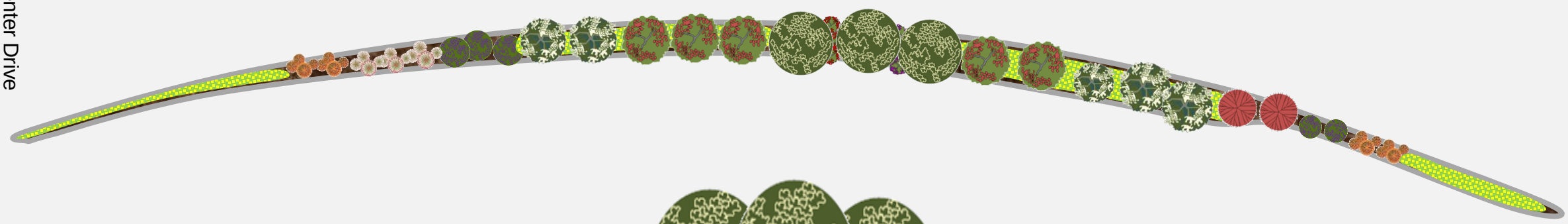
- Trees- No Cost
  - Existing Kwanzan Cherry Trees in Area 15
  - Hophornbeam, Mountain Ash, Crimson Cloud Hawthorn from the “Neighborwood” Nursery
  - Japanese Lilac left-over from initial Palisades Project

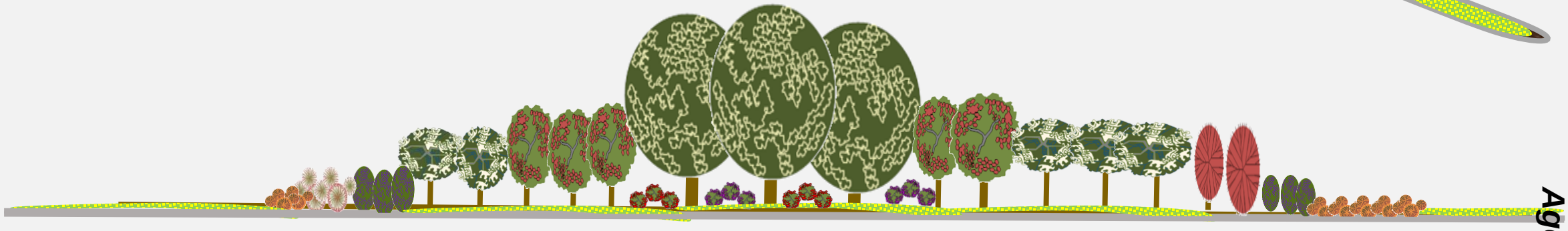
- Trees- Purchase
  - Acer Palmatum (Japanese Maple) Cultivars
  - Oakleaf Hydrangeas

Phase I Pallette

- Shrubs: Purchase
  - Ilex Crenata (Japanese Holly) X 10
  - Pieris Japonica Cultivars (Andromeda) x 40
  - Nandina (Heavenly Bamboo) X 50
  - Azalea Cultivars“Neighborwood” x 80
- Floral/Ground Cover
  - Existing Knickknick, Heather (No cost)
  - Mixed ground cover/perennials/bulbs (following page)-Purchase

AREA 1

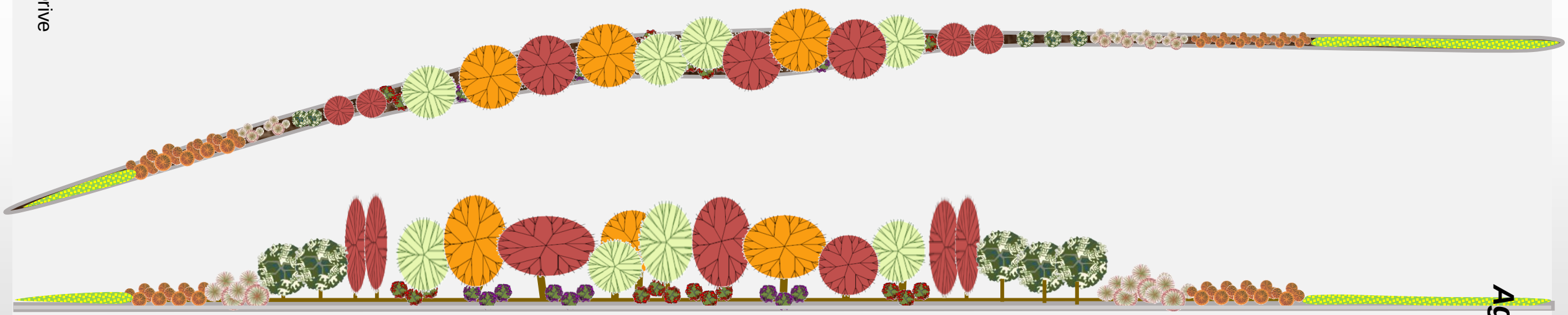




Tree Advisory Board Center Drive
Re-planting (G. Lim)

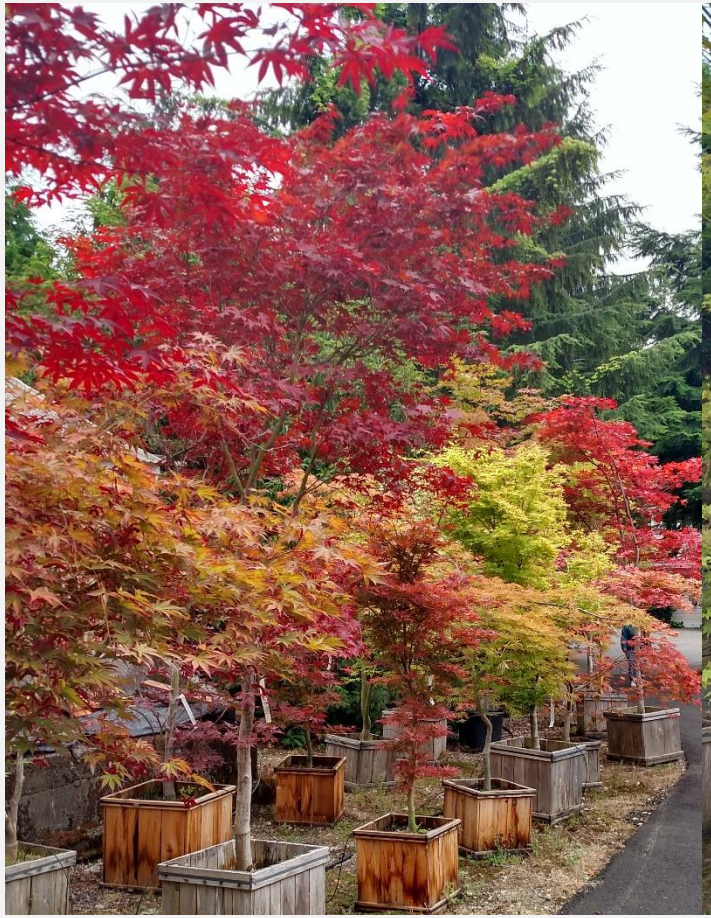
AREA 2

Tree Advisory Board Center Drive
Re-planting (G. Lim);

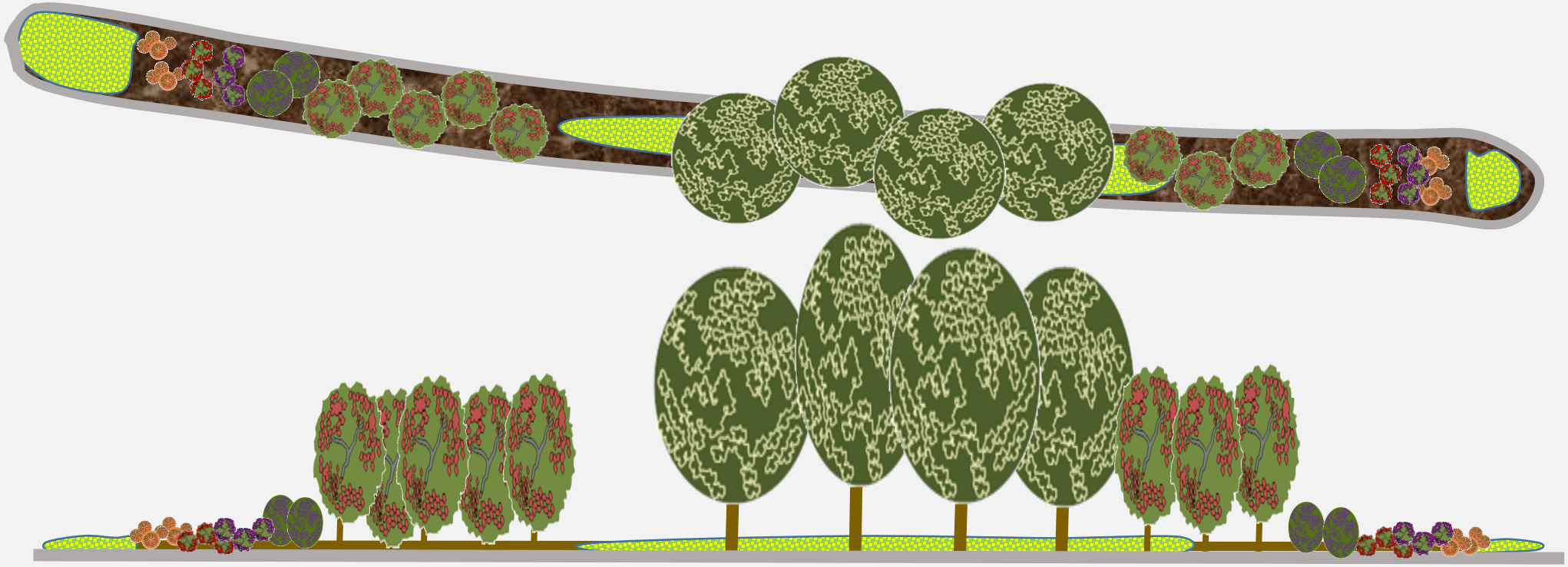


Nandina	Oak Leaf Hydrangea	Mixed Azalea	Mixed Acer Palmatum Cultivars	A.P. “Sentinel”	Pieris	Mixed Floral/GC
HT: 2’	10’	2’	16-22’	18’	4-5”	12”

Japanese Maple Cultivars



AREA 14



Mixed Floral/GC
HT: 12”

Japanese Holly
3’-4”

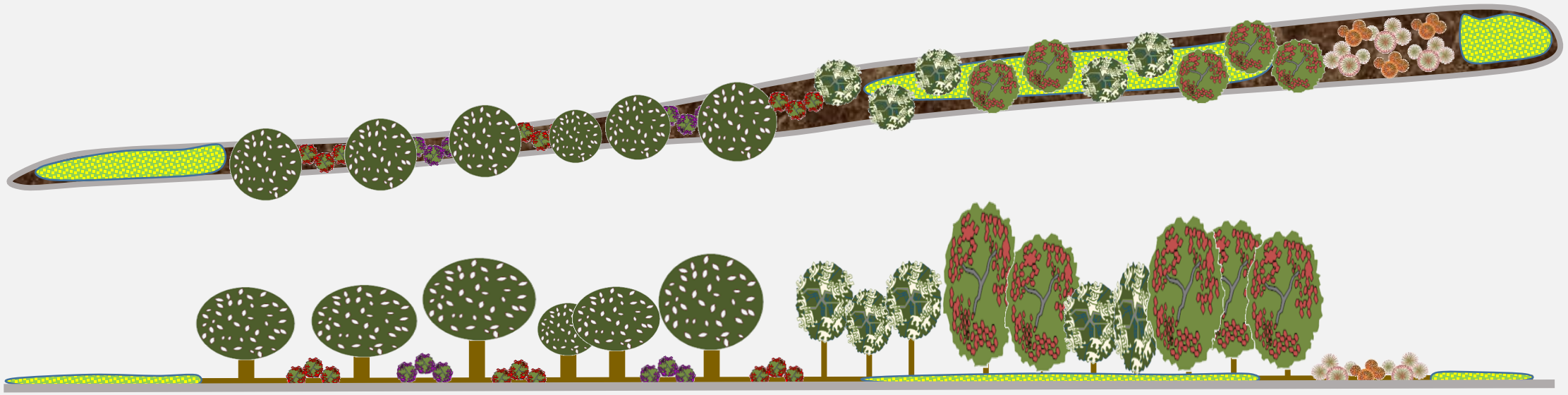
Mountain Ash
20’

Hophornbeam
40’

Mixed Azaleas
2’

Nandina
2’’

AREA 15


Mixed Floral/G.C
(HT: 12”
Existing Tree
20’
Mixed Azaleas
2’
Japanese Lilac
20’
Hawthorn
25’
Pieris
5’
Nandina
3’

Budget

Item	Vendor/Source	Cost
Hophornbeam, Japanese Lilac, Crimson Cloud Hawthorn, Mountain Ash	Neighborwood Nursery	0.00
Japanese Maple Cultivars	Yang's Nursery, Gig Harbor	$3,000.00
Oakleaf Hydrangeas,	J.F. Schmidt, Portland	$300.00
Bushes, Shrubs	Various	$2,500.00
Floral/Ground Covers	Various	$2,000.00

Total: $7,800.00
Requested: $10,000.00
Buffer: $2,200.000

Center Drive Revitalization

Questions/Concerns/Public Comment

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Agenda Item # 2c)

MEETING DATE: October 18, 2016

- ☐ Consent Agenda
- ☐ Discussion Item
- ☐ Unfinished Business
- ☐ New Business
- ☑ Other Presentation

TITLE:

Street Trees and Sidewalk Damage; Update from Summer Pilot Projects and Proposal on Repair Solution

Department: Public Works	Date of First Reading:
Originator: Staff	Date of Second Reading:
Assigned to: Gus Lim, Public Works Director	Date of Public Hearing:

BUDGET IMPACT: Yes ☐ **No** ☑ **FUND:**

Amount Budgeted		
Additional Required		

DETAILED SUMMARY STATEMENT:

1. Background:
   a. Root Crown Survey 2,317 "Mature" Street trees in Palisade Village, DuPont Station, and about 1/3 of Yehle Park Village. The survey is to identify which trees can survive root pruning and can be saved.
   b. 5 sites with a total of 15 trees will receive root barrier installation, and soil improvements in the planting strip. This to develop a future production rate applied over the 4K+ street trees (located in front of private property) for future work.
2. Project Cost Estimate: $49,815
   a. Survey: $38,350
   b. Root Barrier and Planting Strip Improvement: $10,465
   c. Minor Changes as needed: $1,000
3. Use of Sidewalk Sucker to repair sidewalk defects at O'Neil Court, Palisade Village.

Attachments:
1. Arborist Report on Root Pruning, Root Barrier, and Soil Improvements
2. Arborist Report on Root Crown Survey
3. Presentation on arborist work and Sidewalk Sucker work
4. Summary of proposed sidewalk defects work

RECOMMENDATION:

Staff recommends pursuing repairs to sidewalk defects through the use of the Sidewalk Sucker and installation of root barrier.

STREET TREES AND SIDEWALK DAMAGE; UPDATE FROM SUMMER PILOT PROJECTS AND PROPOSAL ON REPAIR SOLUTION

Gus Lim
City of DuPont, Washington

October 18, 2016 Mayor and City Council Members in Workshop

Purpose and Action

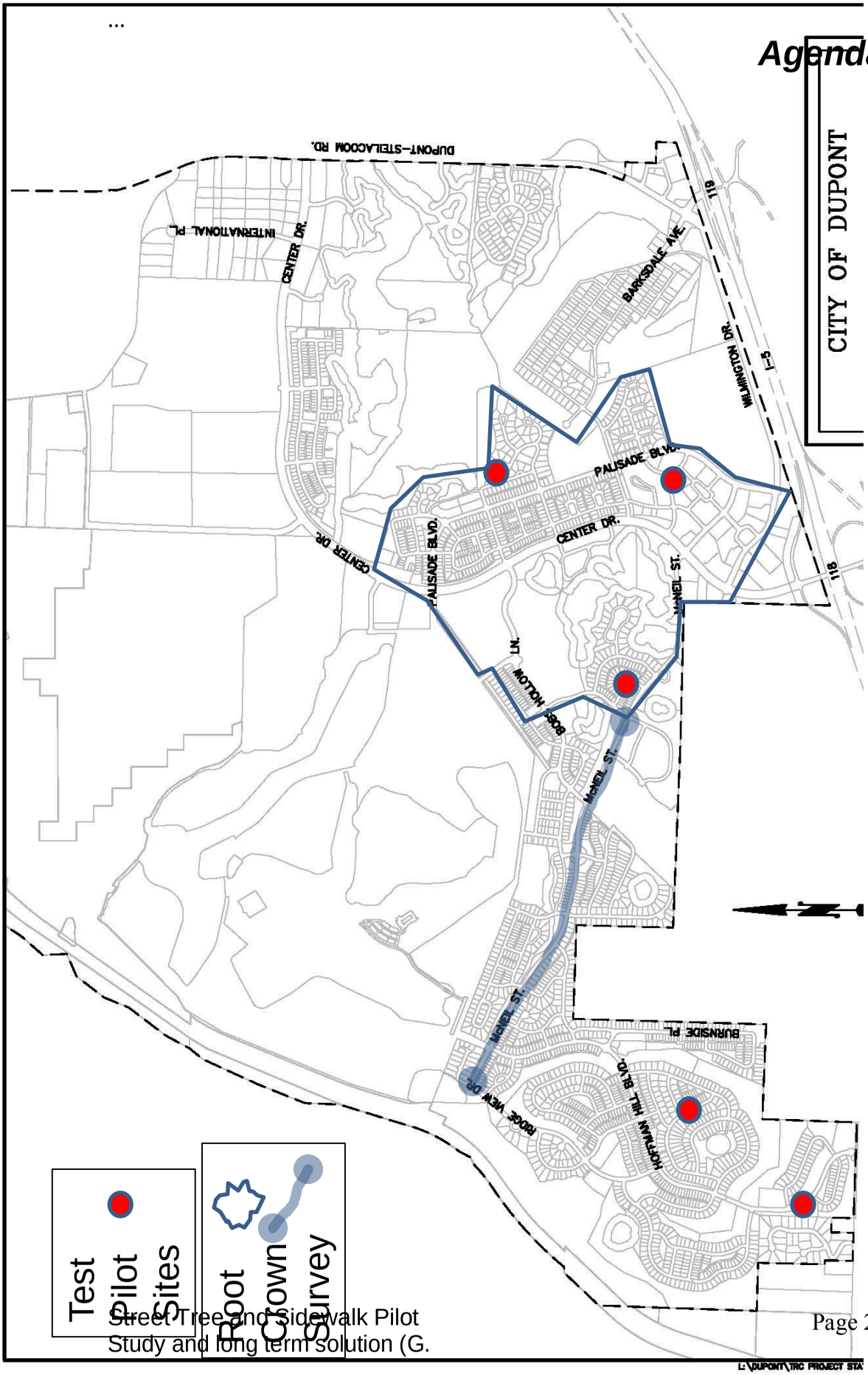
- This is an informational briefing on the test pilot sites for root barrier installation, root crown survey, and sidewalk damage repair using the Sidewalk Sucker.

Agenda

- Background: Locations and Map
- Before and After Photos; Project Photos
- Lessons Learned
- Proposed Repair Solution

Locations

Site #	Address	Property Owner	Village	Tree Species	Number of Trees	Work Dates
1	1907 Braget	K. Preston	Yehle Park	Maple	4	7/26 – 7/27
2a	3086 Sheaser	J. & C. Benge	Hoffman Hill	Hornbeam	1	7/27 – 7/28
2b	3088 Sheaser	J. & X. Howard	Hoffman Hill	Hornbeam	1	7/27 – 7/28
2c	3092 Sheaser	H. & J. Nauth	Hoffman Hill	Hornbeam	1	7/27 – 7/28
3	Ross AVE & Thompson CIR; Near Post Office	Clock Tower Apts; Madrona Ridge Res.	DuPont Station	Maple	4	7/25
4	1292 O'Neil	A. & A. Thapa	Palisade	Linden	4	7/25 – 7/26
5	Hoffman Hill Park	City of DuPont	Hoffman Hill	Linden	2	7/27 – 7/28



Street Tree and Sidewalk Pilot Study and long term solution (G.

Site 1 Before: 1907 Braget

Street Tree and Sidewalk Pilot Study and long term solution (G.

Site 1 After: 1907 Braget

Street Tree and Sidewalk Pilot Study and long term solution (G.

Site 5 Before: Hoffman Hill Park

Street Tree and Sidewalk Pilot Study and long term solution (G.

Site 5 After: Hoffman Hill Park

Street Tree and Sidewalk Pilot Study and long term solution (G.

Typical Work area

Typical Work Area

Street Tree and Sidewalk Pilot Study and long term solution (G.

Exposed Roots: Sheaser and Braget

Root Barrier Installed

18 inches depth

Lessons Learned

- Use of air tools expedited excavation and exposed tree roots and irrigation w/o damage.
- Use of water for dust control. Access to water.
- Irrigation system impacts.
- Root pruned were shallow. 18” root barrier. Possible shallower installation
- Root Crown Survey complete. 2,317 trees surveyed.
- 230 trees need removal: Palisade Village/DuPont Station

Sidewalk Repairs

- Sidewalk Sucker: 9/26 – 9/30
- O'Neil CT 3 PW Staff
- 8 tree sites
- Rental equipment, small tools, and sand

Street Tree and Sidewalk Pilot
Study and long term Solution (G.

Street Tree and Sidewalk Pilot Study and long term solution (G.

A traditional repair (before)

A traditional repair (aft

The root removal (during)

Non-traditional repair (before)

Non-traditional repair with original panels re-installed and new concrete panel (after)

Non-traditional repair with roots removed and leveling (during)

Lessons Learned

- Precast 5 ft X 5 ft sections to replace panels too damaged to be re-used.
- Shaved panels can be cut 18” and save remaining 42” panel. Cast in place afterwards.
- Curved panels needs to be cast in place.
- Min. crew size is 3 people.
- Outfit all tools in a dedicated trailer for on site work.
- Arborist survey critical to root pruning.

QUESTIONS?

Gus Lim
253.912.5380 or glim@dupontwa.gov

October 18, 2016

Summary Repair Solution

Phase 1: Sidewalk Defect Repairs	$611,758
Phase 1: Equipment	$143,000
Phase 1: Materials	$10,350
Phase 1 Subtotal Cost	$765,108
Phase 1: Time (Years)	2.3
Phase 2: Contracted Tree Removal and Replacement	$397,440
Phase 3: Preventative Work / Root Barrier Only	$721,372
Phase 3: Materials	$5,380
Phase 3: Subtotal Cost	$726,752
Phase 3: Time (Years)	2.7
Grand Total Cost	$1,889,300
Grand Total Time (Years)	5.0

Phase 1: Repairs

Village Name	Number of Trees	Mature/Immature	Sidewalk Defects	Work Hours: Sidewalk Repair 10 ft panel and Root Barrier	Subtotal CREW Work Hours	CREW (3) Burdened Rate	Subtotal Labor Cost	Arborist Consultation: 2 hours per week	Arborist Rate	Arborist Consultation Subtotal
Bell Hill	163	Immature	6	2.5	15	$ 128.58	$ 1,928.76	0.75	$110.00	$82.50
DuPont Station	399	Mature	208	2.5	520	$ 128.58	$ 66,863.69	26	$110.00	$2,860.00
Edmond	220	Immature	12	2.5	30	$ 128.58	$ 3,857.52	1.5	$110.00	$165.00
Hoffman Hill	1363	Immature	150	2.5	375	$ 128.58	$ 48,219.00	18.75	$110.00	$2,062.50
Palisade	1328	Mature	1270	2.5	3175	$ 128.58	$ 408,254.24	158.75	$110.00	$17,462.50
Yehle Park	261	Mature	179	2.5	447.5	$ 128.58	$ 57,541.35	22.375	$110.00	$2,461.25
Yehle Park	782	Immature	0	2.5	0	$ 128.58	$ -	0	$110.00	$0.00
Total	**4515**		**1825**		4562.5		$ 586,664.55	228.125		$25,093.75
Center DR	1223	N/A	152							
El Rancho Madrona	0	N/A	0							
Historic	42	N/A	430							
Manufac Research Ind	45	N/A	0							
Total	**1310**		582							

Phase 3: Preventative Work

Village Name	Work Hours: Preventative Root Barrier 10 ft panel	Subtotal CREW Hours	CREW (3) Burdened Rate	Subtotal Labor Cost	Arborist Consulatation: 2 hours per week	Arborist Rate	Arborist Consultation Subtotal
Bell Hill	2	314	$ 128.58	$ 40,375.38	16	$ 110.00	$ 1,727.00
DuPont Station	2	382	$ 128.58	$ 49,119.09	19	$ 110.00	$ 2,101.00
Edmond	2	416	$ 128.58	$ 53,490.95	21	$ 110.00	$ 2,288.00
Hoffman Hill	2	2,426	$ 128.58	$ 311,944.81	121	$ 110.00	$ 13,343.00
Palisade	2	116	$ 128.58	$ 14,915.75	6	$ 110.00	$ 638.00
Yehle Park	2	163	$ 128.58	$ 20,959.19	8	$ 110.00	$ 896.50
Yehle Park	2	1,563	$ 128.58	$ 200,976.81	78	$ 110.00	$ 8,596.50
Total		5,380	0	$ 691,781.98	269		$ 29,590.00

Phase 2: Tree Removal and Replacement

Village	Trees	Replace	Total Saved	Unit Replacement Cost	Tree Replacement Cost
Palisade/Dupont Station	1727	227	1500	$1,728	$392,256
Yehle Park Mature	260.5	3	257.5	$1,728	$5,184
Yehle Park Immature	781.5	0	781.5	0	0
Bell Hill/ Edmond/Hoffman Hill	1746	0	1746	0	0
	4515	230	4285		$397,440

Equipment Costs

Item	Cost
Sidewalk Sucker	$8,000
Bobcat Compact Excavator E45	$75,000
Crew Truck	$34,000
Trailer (2)	$23,000
Small Tools	$3,000
Total	**$143,000**

Labor

Trade	Wage (burdended)
Equipment Operator	$ 41.20
Concrete Mason	$ 41.20
Concrete Mason Lead	$ 46.18
Crew Total	$ 128.58

Material

Item	Unit Cost	Qty (Each or Cubic Yards)	Subtotal
Pre Fab Concrete Panels 5ft X 10ft X 4 inches	$50	100	$5,000
Sand	$55	10	$550
Crushed Rock	$75	10	$750
Expansion Joint	$2	200	$400
Root Barrier Ph 1	$2	1825	$3,650
Root Barrier Ph 3	$2	2690	$5,380
	Total		**$15,730**

ROOT CAUSE, LLC
7490 85th Avenue SE
Mercer Island, WA 98040

Brian D. Holers
I.S.A. Certified Arborist #PN1185

(206) 799-9837
brianholers1@gmail.com

CITY OF DUPONT
ROOT BARRIER PILOT PROJECT

The city of DuPont is considering placing rigid root barrier between street trees and sidewalks, for as many as 5,000 trees of different species, ages and sizes. For this reason, as part of a pilot project, during the week of July 25 through 29, 2016, Root Cause LLC installed a series of rigid root barriers between 15 different types of street trees and DuPont city-owned sidewalks to aid in identifying and determining the costs and feasibility of the proposed project. The purpose of the pilot project was to assist DuPont in determining the specific steps, cost and feasibility of implementing the project on a larger scale.

In addition to placing root barrier, Root Cause removed existing turf in a ten foot area and the width of each planting strip. This made soil remediation and improvement possible by creating new rooting space, and offered a partial counterbalance to trees where roots were removed or severed.

OVERVIEW

Several critical steps in the soil remediation and root barrier placement process require air excavation. Air excavation, in its application to arboriculture, uses a 185 CFM air compressor and tool called an “Air Knife” or “Air Spade,” with special formulated nozzles that allow movement of soil without damage to tree roots. Air excavation allowed Root Cause to:

- remove turfgrass from root zones;
- incorporate compost amendment into the soil;
- expose roots to enable root pruning and removal; and
- expose hazards, in particular irrigation lines and heads.

The single most important element to effective air excavation is access to water. Conditioning the soil to field capacity allows for easier separation of turfgrass roots. Air excavation softens soil to enables breakdown into smaller units so organic material (compost) can be added. Most importantly, water keeps down dust, a real hazard if not managed properly.

The greatest complication Root Cause experienced during implementation of the pilot project was the presence and location of irrigation lines and heads. In some instances, such as the site on O'Neil Court, supply lines run along the edge of sidewalks, and are completely intertwined and fused with tree roots. In other places, such as Hoffman Hill park, irrigation lines appear to run down the middle of the planting strip and send heads to the edges along sidewalk via flexible pipe. Air excavation to expose irrigation lines and heads is a crucial component of implementing a larger project. In many cases, placing root barrier will necessitate the unavoidable removal and replacement of irrigation lines.

SELECTION CRITERIA FOR TEST PILOT SITES

See attached report from Gus Lim, Public Works Director, describing test sites and selection criteria.

MATERIAL REQUIREMENTS AND COSTS

The proposed project requires placement of a 5 foot root barrier along the sidewalk, on center of each tree, for a total amount of 10 feet of root barrier per tree. Although the entire sidewalk could be placed with a continuous root barrier. I recommend 10 feet per tree as a more affordable solution to nearly all tree/sidewalk conflicts.

Materials required per tree:

- 10 feet of DeepRoot interlocking barrier, 18" deep, cost approximately $40;
- Average of 6 cubic feet of compost, 10 feet long by 5 foot strip width by 1.5 inches deep, cost approximately $10;
- Average of 6 cubic feet of surface mulch by same calculations, cost approximately $10;
- Water from fire hydrants;
- Root pruning tools—loppers, reciprocating saws and blades. As this type of work is especially dirty and difficult, many tools and blades break and wear out quickly, at a conservative estimate of $10 per tree to maintain and replace root pruning tools;
- For the air excavation itself, a 185 CFM compressor, lengths of air hose and an Air Knife or Spade are required; and
- fuel and compressor maintenance costs—guesstimate of $7-10 per tree.

PROCEDURE

Placement of root barrier along the sidewalk requires the following steps:

1. Cut along line about 8” inside sidewalk to break up the surface layer of roots. We used a diamond blade cutoff saw.

2. Begin to wet turf area around tree so water begins to soak in. This can take some time so the earlier one starts this process the better. In dry periods, one worker can even water turf areas the day before air excavation begins.

3. After the initial layer of cut roots is removed, water an 8” wide area along the sidewalk.

4. Place protective barrier around watered area to guard against flying debris. Sheets of plywood will usually work if dust is properly controlled.

5. Use air knife to expose roots and remove soil to create a trench. Cut roots as needed and identify and plan for irrigation depending on the status of irrigation once the soil is removed.

6. After proper watering, use air knife to subsume or remove area turf.

7. Interlock sections of root barrier and place along sidewalk when trench is 18” deep.

8. Backfill trench.

9. Place compost on exposed area where turf was removed and incorporate into soil with air.

10. Finish area with surface mulch.

LABOR

The single greatest cost of root barrier placement is labor. In general, the larger and more established the tree, the more time and labor intensive the pruning of its roots, digging a trench and placement of root barrier. Labor hours required to place barrier along 15 trees in five pilot project areas was as follows:

ROSS AVENUE AT THOMPSON STREET
3 mature red maple, #1903-1905
20 worker hours for an average of 6.67 labor hours per tree

O'NEIL COURT[1]
3 mature linden, #7263-7265
11 actual worker hours; best estimate is 15 worker hours for an average of 5 hours per tree.

BRAGET STREET
3 mature linden, #3098-3100
15 worker hours for an average of 5 hours per tree.

SHEASER AVENUE
3 immature hornbeams, #3680-3682
9 worker hours for an average of 3 hours per tree.

HOFFMAN HILL PARK
3 immature lindens, #4052-54
9 worker hours for an average of 3 hours per tree.

COST SUMMARY

In summary, the estimated cost for undertaking this project is several hundred dollars per tree. Materials average approximately $100 and labor worker hours at 3-7 hours per tree, dependent on complexity.

CONSIDERATIONS AND RECOMMENDATIONS

As anticipated, the greatest impediment to the excavation required prior to placement of a rigid vertical root barrier, is the existing hard and rocky soil throughout the proposed area. Once Root Cause penetrated the surface to expose the initial layer of roots, we encountered soil consisting of abundant cobble and gravel. Nonetheless, there is sufficient soil, and we found that application of the right amount of water, in order to condition the soil to field capacity, helped break the soil apart to make digging easier and keep hazardous dust down. Application of compressed air also helped separate the different sized rocks and made digging them out to place barrier significantly easier.

In addition to breaking apart soil and rocks, compressed air helps expose tree roots that are currently and/or potentially damaging to sidewalks. Exposure of the root system allows for careful and informed selection and effective severance of surface layer roots, and causes the least damage to tree health. Although the majority of roots pruned during the pilot project were found in the top few inches of soil, industry standard for this application requires digging to 18" deep, in order to successfully divert roots that would eventually damage sidewalks. When roots are forced downward and have to grow under

[1] Root Cause was unable to place root barrier due to intertwinement of the irrigation and root systems and our ability to cut roots to a depth of 4 inches only. Labor hours are therefore a good faith estimate utilizing industry standards of 18 inches.

barriers, they are unlikely to cause damage even if they grow back to surface on the other side of the barrier.

Another significant consideration to the project is the existing irrigation components. Air excavation helps expose irrigation and root systems, and determine the best cost and time effective way to approach barrier placement, and causes minimal damage, if any, to the tree. On larger projects, such as proposed by DuPont, air excavation for evaluation purposes is essential; with roots intertwined and fused with irrigation lines in all directions at many of the sites, the barrier work will move faster and cost less if the irrigation lines and heads are simply cut, replaced, and/or repositioned.

Although removal or severance of tree roots is never ideal, I have found trees generally tolerate well removal of up to 30 percent of their root system. In our pilot project, we severed, at best, 20 percent of a given tree's roots, and anticipate no significant impact on tree health.

After we applied ample water, we used air excavation to remove turf and begin to dig trench for root barrier

Air exposes roots at edge of sidewalk to help dig trench for root barrier

Root barrier in place

Typical amount of roots cut per mature tree

Brian Holers
Root Cause LLC

DUPONT SUB-GRADE INVENTORY

In July of 2016, my company, Root Cause LLC, was contracted to assess and advise on the condition of approximately 2,300 street trees in the city of DuPont, Washington. After much discussion and pre-assessment, it was decided that collecting pieces of data about said trees, and recording them in an Excel database, would allow us to make the most informed decisions about the conditions of, and prognosis for, these trees.

Gus Lim, Public Works director for the city of DuPont, originally contacted me to help DuPont figure out how to address its increasing tree and sidewalk conflicts. Per a traditional tree inventory taken in 2012, we knew DuPont had approximately 4,800 street trees planted between street and sidewalk. Of these, over half fell into the category of "immature," which meant they were too small to cause conflicts yet. But of the remaining, trees planted between 15 and 25 years ago, a number were beginning to cause conflicts, and certainly many more possibly would over time.

My company created a specialized database which allowed us to collect several pieces of data on all the trees in the "mature" category. We assessed the trees in the field using a combination of visual inspection, subsurface probing, and manual excavation. My assistant and I walked and individually assessed over 2,300 trees. I probed, dug and inspected, and my assistant recorded bits of data on a hand-held Microsoft Surface device. All of the trees in Palisade Village and DuPont Station were surveyed as these were considered as mature trees with sizable growth. Yehle Park Village was partially surveyed as this was the transition from mature to immature trees. Yehle Park Village was surveyed along McNeil Street and the areas surrounded by Garry Oaks Avenue and Bob's Hollow Lane

The purpose of collecting the data was to help determine which trees would withstand the solution my company recommended. In order to significantly impede tree roots from damaging sidewalks, I recommended an 18 inch deep rigid barrier be placed between tree and sidewalk, for a total of 10 linear feet per tree. Placing this barrier will require manually excavating trenches 18 inches deep along sidewalks, and will require removing many tree roots from the area. The question our data helps answer is, will this tree survive the root pruning needed to place the barrier?

PROBLEM

The ongoing problem of tree and sidewalk conflicts is one the city of DuPont shares with nearly every municipality in the United States. Many private companies, as well as millions of homeowners, face this problem as well. Trees planted in the vicinity of sidewalks are well intentioned, important to property values and to the beauty and functionality of spaces, and often, for many years after planting, only add value to streets and open areas.

Eventually, however, the problems endemic to the way we have traditionally managed trees overcomes all the positives contributed by right-of-way trees.

The first problem is soil condition. Trees planted in a right of way, the strip of land between street and sidewalk, are asked to live in an unsuitably harsh environment. After utilities are buried in the right of way, soils—which likely as not are completely devoid of organic material—are compacted with machinery to create a subgrade which will support the concrete poured on top for sidewalks. This hard, nutrient free environment in which trees are planted and asked to live doesn't suitably percolate rainwater, doesn't hold the elements trees need to take up through their roots, and thwarts the tree's attempt to establish itself.

The second problem is space. Land is valuable. To maximize the privately managed portion of municipal lots, and to save room for code-compliant sidewalks, planting strips are squeezed. In many cases, the area between curb and sidewalk is as little as 4 feet.

The third problem is species selection. Municipal arborists have tried many different species of trees in planting strips over the decades, and trial and error is often required to find trees that work well in the substandard soils and insufficient space we give them. The general rule we have learned over the years is that many species of trees are not suitable for small planting strips next to sidewalks.

When all of these problems, and certainly others, are combined—the result is broken sidewalks. Tree roots have to grow somewhere. When the soil is too hard to push down through it, and there's no water or organic material anyway, large roots tend to stay near the surface, and particularly like to exploit the void space immediately under sidewalks. When large roots become established under sidewalks, and the trees attached to the roots move in winds, even slightly, a 4-inch concrete panel is no competition. The sidewalk will lose the battle, and will crack, nearly every time.

DATA COLLECTION

We used the previously done traditional inventory as the basis of our data collection. We kept the previously given inventory numbers intact, and in many cases updated the corresponding street address as many noted street addresses were as much as a block away from the numbered trees. Additionally, the species of each tree was previously recorded, so we kept that data available in a column.

For each tree, we recorded the date of observation.

The pieces of data we collected for each tree were

1. Width of planting strip.
2. Distance from center of tree to edge of sidewalk.
3. Angle of strongest root(s) relative to sidewalk. A zero degree angle represented a root perpendicular to the sidewalk.
4. Distance from center of tree to nearest sidewalk joint.
5. Percentage root loss likely to occur from placing root barrier.
6. Visually assessed condition of tree.
7. Visually and manually assessed condition of root crown.

Width of planting strip

The total distance between curb and the inside edge of sidewalk, where roots begin to cause damage. Generally the smaller the planting strip, the more likely trees will cause damage.

Distance from tree to sidewalk

This distance is measured from center of tree and is generally half the measurement of the planting strip. Generally the closer the tree is to the sidewalk, the more likely there will be damage.

Angle of roots to sidewalk

When tree roots grow under sidewalks, particularly when they grow against the bottom of the sidewalk, they can break concrete panels when trees move, even slightly, in winds. The straighter the angle into the sidewalk, the more potential for damage. We used the measurement of zero degrees to designate the straightest possible angle.

Distance from concrete seam

The seam in poured concrete is the weak spot, most likely to break. Generally the closer the tree is to a seam, the more potential for a break at that seam.

Crown condition

While our focus was the underground conditions that made sidewalk damage likely, we did take a few minutes at each tree to assess if above ground conditions made removal of the tree necessary.

Percentage root loss

This represented my best estimate of the percentage of buttress roots that would need to be cut in order to place barrier between tree and sidewalk. In general, the greater the percentage, the more likely the tree will not survive the root pruning needed to place the barrier that will keep roots from growing under and damaging sidewalk.

Root crown assessment

While we didn't have time to excavate and expose the root crown of each tree, where other conditions made it seem likely, we did uncover root crowns to look for girdling roots or other defects that could make a tree a likely candidate for removal.

TREES RECOMMENDED FOR REMOVAL

Collecting data via Excel spreadsheet allows us to easily combine the data in a variety of ways, using predetermined thresholds to make decisions about the viability of different species, of an acceptable percentage of root loss in different species and in different ground conditions (e.g., width of planting strip), and other minor factors.

The fundamental question the survey set out to answer is, which trees can be saved if the city of DuPont implements the recommended solution to its tree and sidewalk conflicts? Where such action won't cause undue hardship or hazard, trees should be retained; as with those accused of crimes, they should remain innocent until proven guilty.

Some of the data we collected may not be useful to inform decisions about tree retention. As we had not performed a survey of this size and nature before, nor had any other organization I was able to find, I simply organized the database to allow us to collect info on all the factors I have seen that lead to sidewalk damage from tree roots. But ultimately, because the trees are so close to sidewalks, and tree roots in tight spaces are exponentially stronger than concrete panels, the angle relative to sidewalk, or proximity to the weak spot or seam, are less important considerations than simply the size of the trees in given planting strips, and the size of root plates.

Placing root barrier along the inside edge of sidewalks involves cutting a percentage of existing roots. In general, smaller, younger trees require less root pruning, and are more likely to survive root pruning. While larger, older trees of aggressive species are less likely to safely withstand the root pruning.

There are many species of street trees in DuPont. The two most aggressive species are also the most common species. Red maple (acer rubrum) and sweetgum (liquidambar styraciflua) have been top choices for street trees among municipal arborists for the last twenty to thirty years. They are hardy trees which establish easily, and are relatively unlikely to fail and cause injury or damage.

However, these two species are perfect examples of the fact that we have consistently failed to consider the landscape below ground, and have to pay the price now.

My recommendations for removal are as follows:

42 trees tagged for removal due to crown conditions, crown defects that may lead to failure, or root conditions that may lead to failure or death

191 trees that live in 4 – 4.5 foot wide planting strips and will experience a 25% or greater root loss

36 trees that live in 5 foot or wider planting strips and will experience a 30% or greater root loss

The above tree numbers have duplicates in multiple categories. The total number of trees for removal is 230. Palisade Village has 192, DuPont Station has 35, and Yehle Park Village has 3.

The great majority—over 90% of the surveyed trees should be retained. Almost all of the "immature" trees, which we did not survey, should be retained. Certainly in the process of installing barrier, other conditions may arise which indicate a given tree should be removed. Root Cause will remain available to consult on this.