FOREST SPOKANE

PLANT.PROTECT.APPRECIATE

Prepared By:

Alicia Powell

Project Coordinator

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Introduction and background: The Forest Spokane Initiative is an effort to decrease the gallons of stormwater runoff every year and increase the number of trees planted over the next two years in the Spokane area as a means of beautifying our twenty-seven (27) neighborhoods. The Initiatives overarching goal is to plant 10,000 trees in two years. Forest Spokane aims to coordinate these efforts through neighborhoods, City Departments and local partners invested in planting trees for the benefits they provide to our community.

Currently our urban forest consists of approximately 76,553 trees. In 2013 the City sponsored a project with the Davey Resource Group who conducted an inventory of public trees along the City's rights-of-way. The report is called, *Resource Analysis of Inventoried Street Trees*, *2013.* A team of ISA Certified Arborists mapped public tree locations using global positioning system (GPS) technology. From this information the Davey Resource group was able to identify the top most populated tree in Spokane to the least populated; they used this information to generate a host of benefits. The results of this study demonstrated the various benefits the urban forest offers as it relates to each tree species within our local urban forest. The varying categories of benefits offered by our urban forest include; decreases in energy, air, stormwater, and increases in property value. Furthermore the report included details of the current composition of our urban forest, tree conditions, species importance, total canopy cover, and relative age distribution.

The analysis estimates that Spokane's street tree population in 2013 was providing an annual benefit of $4,044,229 ($19.25 per capita). While the annual benefits produced by the urban forest can be substantial, it's important to recognize that the greatest benefits from the urban forest are derived from the benefit stream that results over a greater period of time from a mature forest where trees are well managed, healthy, and long lived.

The Forest Spokane Initiative was set forth to ensure that the community is guaranteed to continue to receive these amazing benefits provide by trees for years to come. By working directly with Neighborhoods, City Departments and invested community partners to identify and implement tree planting projects the urban forest will receive much growth in the coming years and Spokane's community will continue to reap the benefits.

Tree Benefits:

There are three major categories of benefits that trees provide; environmental, economic and social. Many of the benefits listed below are also quantifiable in that there is a cost savings associated with each healthy tree planted in our community.

Environmental:

- Planting trees address stormwater at the source by managing rainfall where it falls, reducing or eliminating the need for detention ponds and flood controls.
- Trees and LID practices reduce stormwater runoff by allowing stormwater to infiltrate underlying soils, leaf litter, and other vegetation.
- Trees intercept stormwater by absorbing it through the leaves, bark and root system. This lowers stormwater runoff, water treatment costs, reduces flooding and erosion.
- Air quality is improved in five fundamental ways
    - By absorbing pollutants such as nitrogen dioxide, sulfur dioxide, ozone and carbon dioxide produced by automobiles, power plants, and factories through leaf surfaces.
    - Interception of particulate matter such as dust, ash, dirt, pollen, and smoke
    - Reduction of emissions from power generation by reducing energy consumption
    - Increase in oxygen level through photosynthesis, and
    - Transpiration of water and shade provision, resulting in lower local air temperatures, thereby reducing ozone levels.
- Trees help to sequester carbon dioxide (a greenhouse gas) from the atmosphere in two ways:

    Directly
    - By converting and storing carbon dioxide in the form of wood. From every ton of wood produced, about 1.8 tons of carbon dioxide is removed from the air.

    Indirectly
    - By lowering the demand for heating and air conditioning, thereby reducing the emissions associated with electric power generation and natural gas consumption.
- While asphalt paving, concrete buildings and walkways absorb heat causing the “heat island effect”, shade created by trees help to keep these surfaces cool and reduce air temperatures by about 5-10 degrees Fahrenheit influencing the internal temperatures and air conditioning needs of nearby buildings. The larger the tree the greater the cooling effect.
- Trees can create a barrier to wind speed and direction. The more compact the foliage on the tree or group of trees, the more effective the windbreak. Rainfall, sleet, and hail are absorbed or slowed by trees, providing some protection for people, pets and buildings.
- Urban trees provide critical habitat for wildlife and promotes a connection to the natural world for residents.

Economic:

- Healthy urban trees increase the overall attractiveness of a community and have been proven to increase the values of local real estate by 7%-10%.
- Economic benefits of trees are both direct and indirect:
    - Direct: Energy costs are lowered by reduction in the use of air-conditioning from shading trees and heating when trees act as a windbreak.
    - Indirect: City dwellers pay lower electricity bills when power companies build fewer new facilities to meet peak demands, use reduced amounts of fossil fuel in their furnaces, and use fewer measures to control air pollution. Communities can save money by reduction the number of facilities built to control stormwater. To the individual, these savings may seem small but to the community as a whole, reductions in these expenses are often substantial.
- Trees reduce annual heating and cooling costs for residents.
- Trees and other green infrastructure vegetation help to lower levels of graffiti, property crime, and violent crimes.
- Trees reduce stormwater runoff and thus reduce treatment costs.

Social:

- Trees support a more livable community, fostering psychological health and providing residents with a greater sense of place.
- The presence of trees and other green infrastructure creates a calming effect and reduce workplace stress levels and fatigue, calm traffic, and even decrease the recovery time needed after surgery.
- Trees can be memorialized as living legacies for family members or honored by a birth.
- Tree-shaded sidewalks encourage pedestrian activity thus reducing the use of autos.
- Community trees, both public and private, soften the urban landscape by providing a green sanctuary and making Spokane a more enjoyable place to live, work, and play.

The benefits of planting trees are attained through a broad spectrum of environmental, economic and social advantages. Many benefits offer cost savings to the community at large and on an individualistic basis for each city resident. In order to understand the benefits of our urban trees an analysis of the top seven (7) most populated trees in our community was conducted for their cumulative annual stormwater and energy reductions, return on investment and an individual analysis of savings for all seven species.

Analysis of Stormwater Mitigation, Energy Reduction & Return on Investment

This analysis carefully examined cumulative stormwater reduction, energy reduction and returns on investment (ROI) of seven (7) tree species in Spokane. The tree species were chosen based on being the most prolific in population across the Spokane area as gathered from the Resource Analysis Report. Furthermore, the species were broken down into six groups of small, medium and large deciduous and coniferous tree species. The breakdown of tree species is important in that Spokane's urban forest is comprised of a diverse variety of tree species currently and there is a significant benefit to the continued practice to keep the urban forest diverse because there is less chance of disease and wide spread devastation and death associated with mono-culture crops.

The seven analyzed tree species are:

Classification	Tree Species
Broadleaf Deciduous Large (BDL)	Norway Maple
	Siberian Elm
Broadleaf Deciduous Medium (BDM)	Hornbeam
Broadleaf Deciduous Small (BDS)	Callery Pear
Conifer Evergreen Large (CEL)	Ponderosa Pine
Conifer Evergreen Medium (CEM)	White Spruce
Conifer Evergreen Small (CES)	Rocky Mountain Bristlecone Pine

Off all the benefits that trees bring to a community it became apparent that there were two benefits that stood out beyond all that could be measured. The two benefits that were analyzed include the reduction in stormwater and the reduction in energy.

The first two graphs illustrate the annual savings per year of gallons of stormwater and kilowatts of energy reduced over the course of 25 years. Both of these graphs list the seven tree species and account for the growth rate of each tree species.

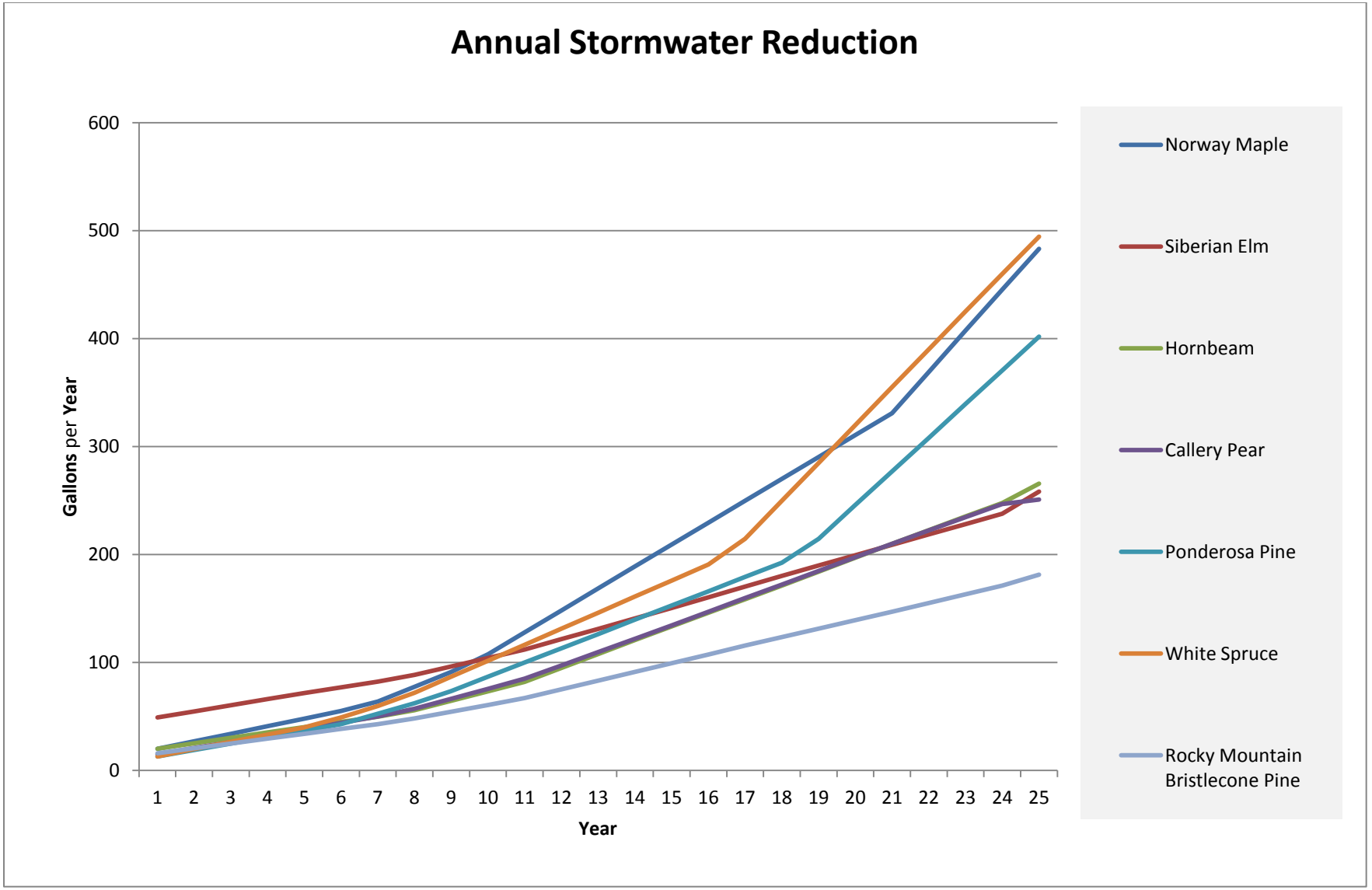
Lastly, it is important to note that each tree was calculated at a diameter at breast height (DBH) of 2 inches. This is important to note this for two reasons;

1. Each tree varies in cost at varying DBH's and
2. Trees purchased at 2 DBH were the most cost effective of any other size.

Annual Stormwater Reduction: This graph illustrates out of twenty-five (25) years of growth from each of the seven (7) tree species hundreds of gallons of stormwater is mitigated. The mitigation of stormwater happens in a number of ways including, transpoevaportation which intercepts water in two ways. One, rain water is more readily evaporated from the surface of leaves, limbs and the trunk of the tree and two, transpiration where water absorbed by the tree can transpire over time after a rain event occurs. Based on the graph below the White Spruce,

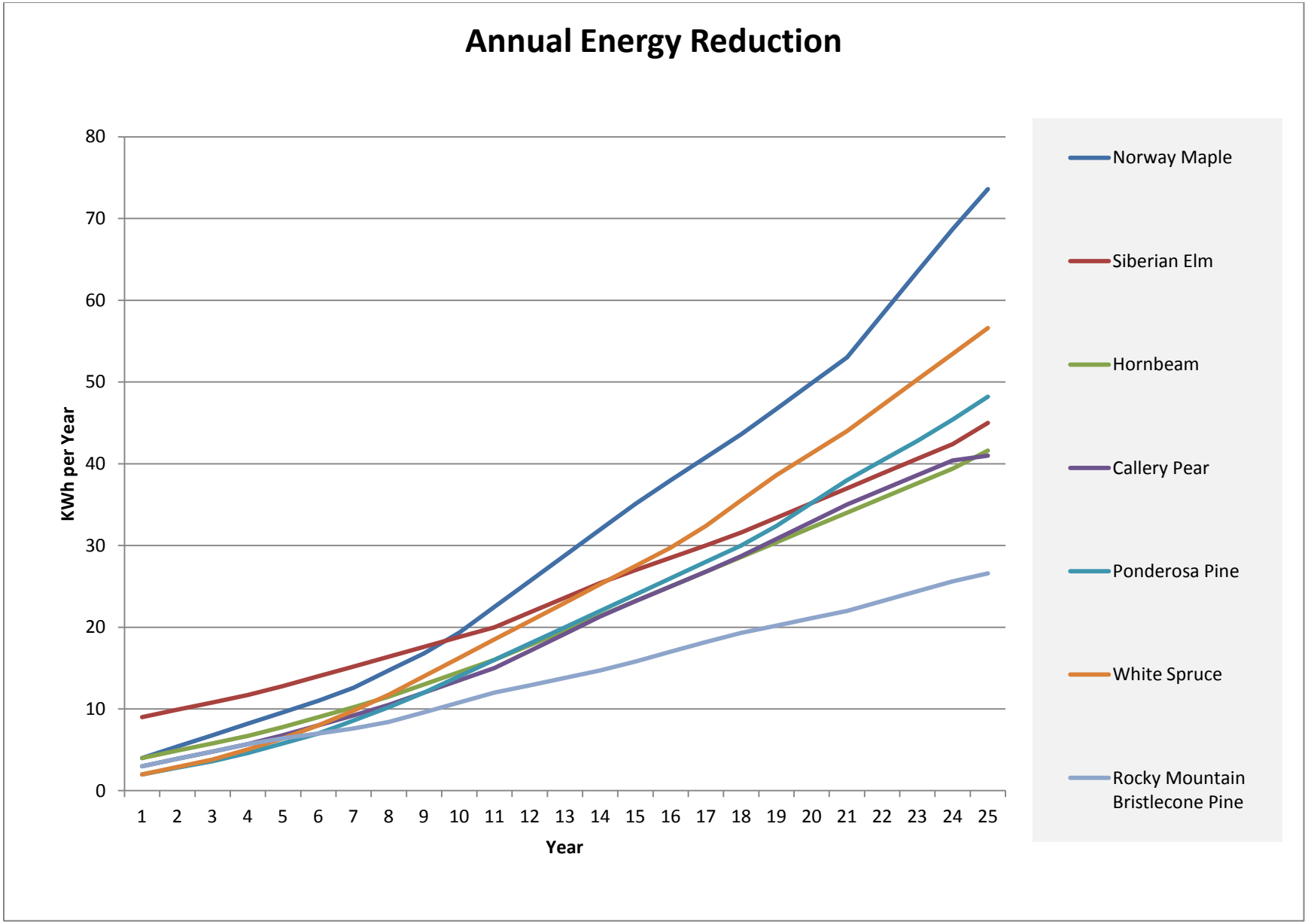
Norway Maple and Ponderosa Pine trees yield the highest reduction in annual stormwater, between 400-500 gallons, over the course of 25 years than any other tree in this analysis. Stormwater reductions not only benefits each resident but plays a significant role in reducing the astronomical costs the City pays to treat stormwater runoff. Furthermore, this reduction also relates directly to a reduction of the wear and tear of our stormwater facilities.

The Norway Maple and Ponderosa Pine are both categorized as large species in the broadleaf deciduous and conifer evergreen classifications while the White Spruce is classified as a medium conifer evergreen. It should be mentioned here that as the analysis continues and as research has show larger tree species yield much high benefit outcomes than do trees that fall within the “small” classification for both broadleaf deciduous and conifer evergreens.


Annual Stormwater Reduction
600
500
400
300
200
100
0
Gallons per Year
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
Year
Norway Maple
Siberian Elm
Hornbeam
Callery Pear
Ponderosa Pine
White Spruce
Rocky Mountain Bristlecone Pine

Annual Energy Reductions:

In this graph it is illustrated that the Norway Maple, White Spruce and Ponderosa Pine also take the lead in reducing energy consumption. At a mature age of twenty-five years these top three trees reduce between 48-75 kilowatts (KWh) per hour. Though it is important to keep in mind that many of the trees planted will between 2-5 years old the benefits associated with tree plantings perpetuates year after year.

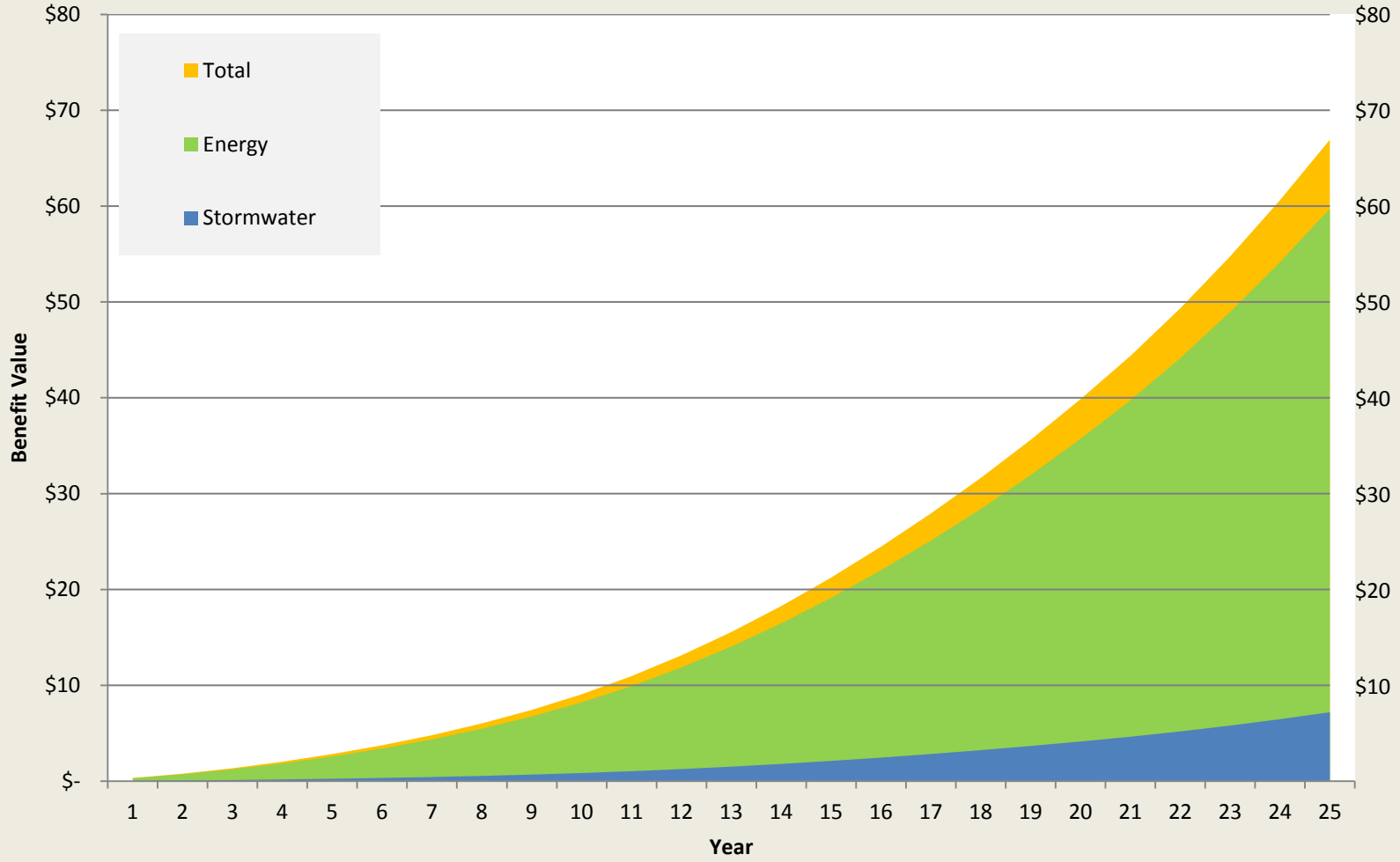

Annual Energy Reduction
KWh per Year
80
70
60
50
40
30
20
10
0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
Year
Norway Maple
Siberian Elm
Hornbeam
Callery Pear
Ponderosa Pine
White Spruce
Rocky Mountain Bristlecone Pine

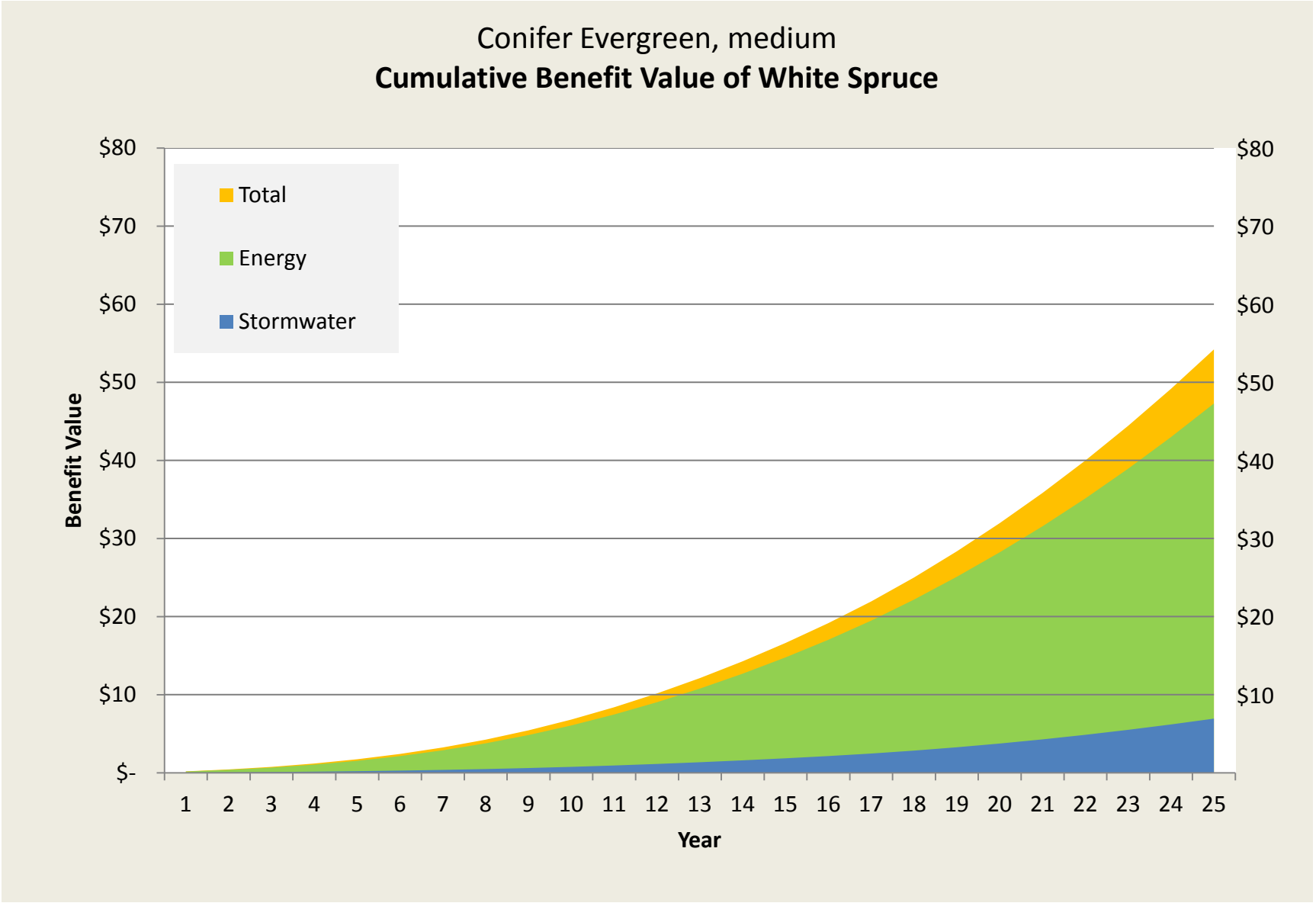
Cumulative Benefit Value:

The following seven graphs illustrate the cumulative benefits in the reduction of stormwater and energy per each tree species analyzed. The calculations were again based on the tree DBH at 2 inches, took into account each trees specific growth rates and were projected over the course of 25 years. The graphs are in order of the species that provides the highest cumulative benefit value.

Broadleaf Deciduous, large

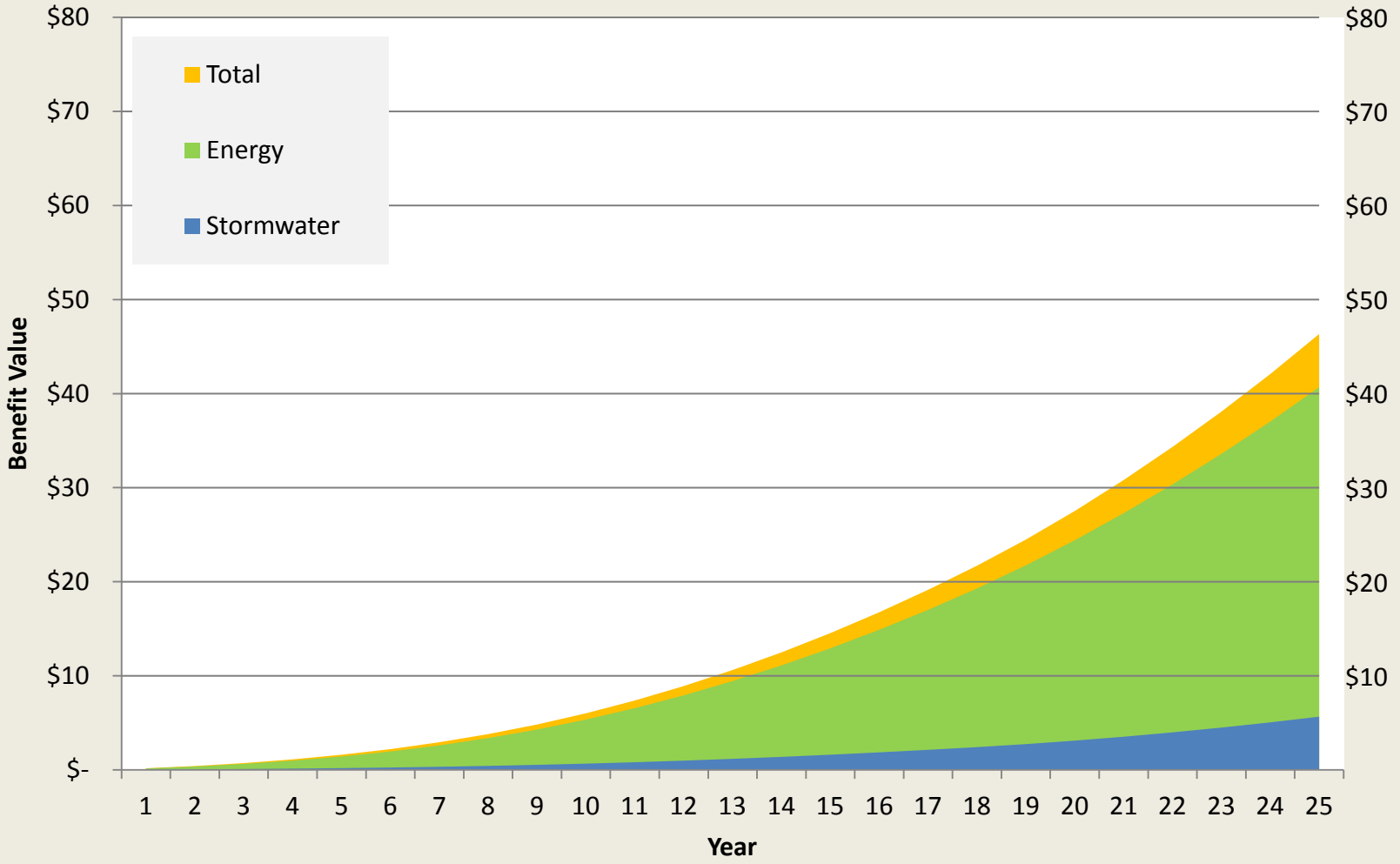
Cumulative Benefit Value of Norway Maple

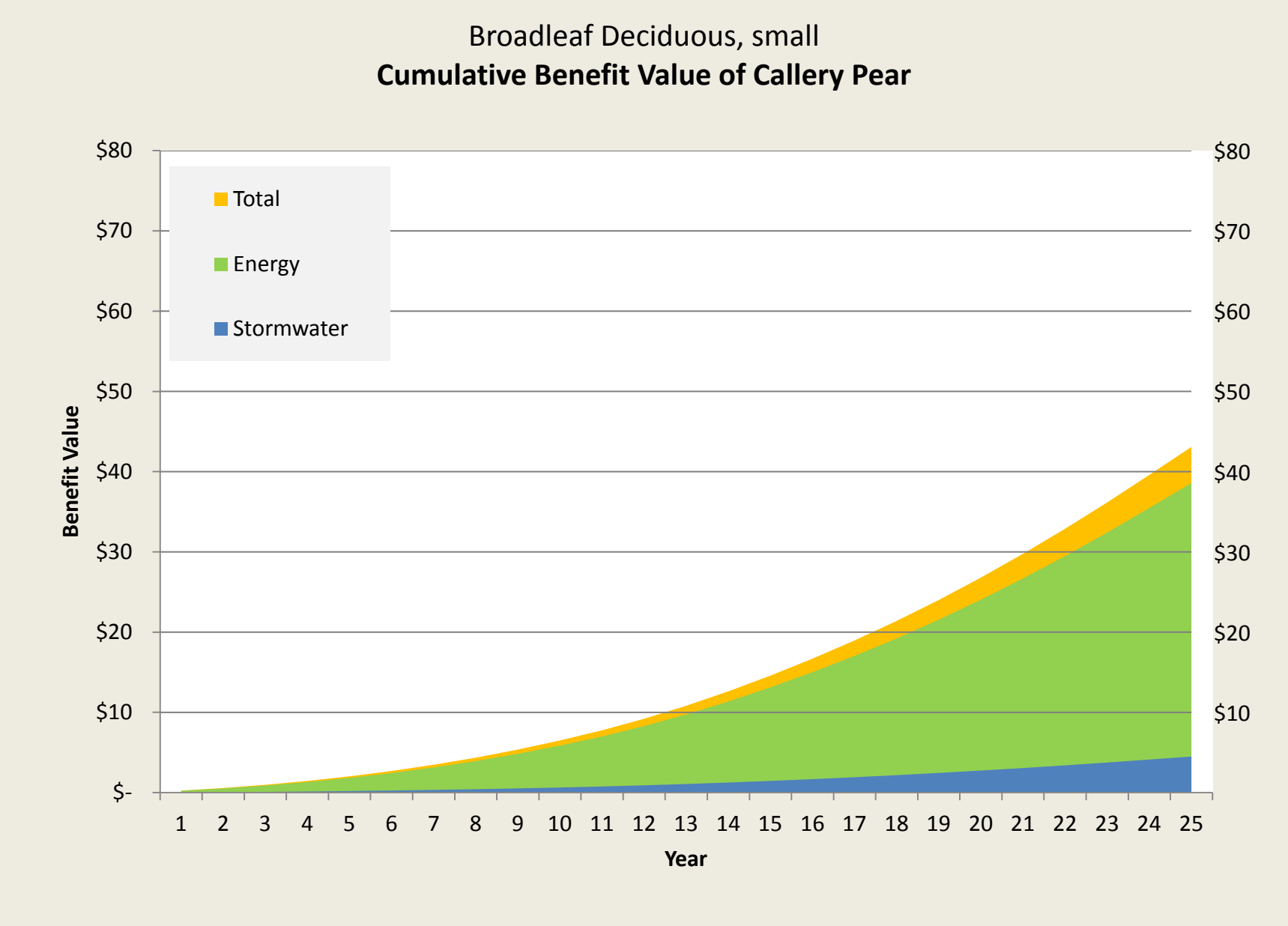



Conifer Evergreen, medium
Cumulative Benefit Value of White Spruce
Total
Energy
Stormwater
Benefit Value
$80
$70
$60
$50
$40
$30
$20
$10
$-
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
Year

Conifer Evergreen, large

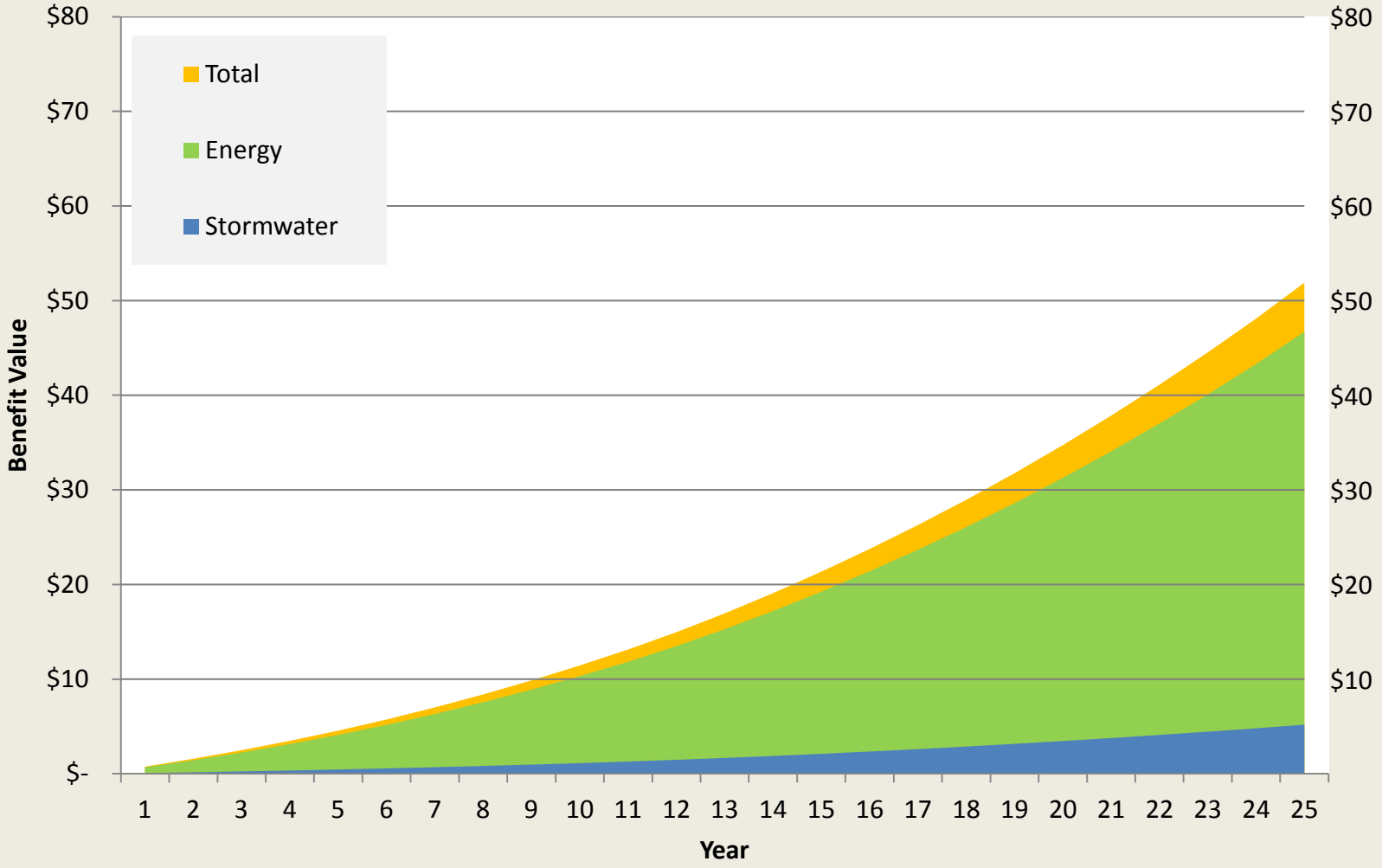
Cumulative Benefit Value of Ponderosa Pine

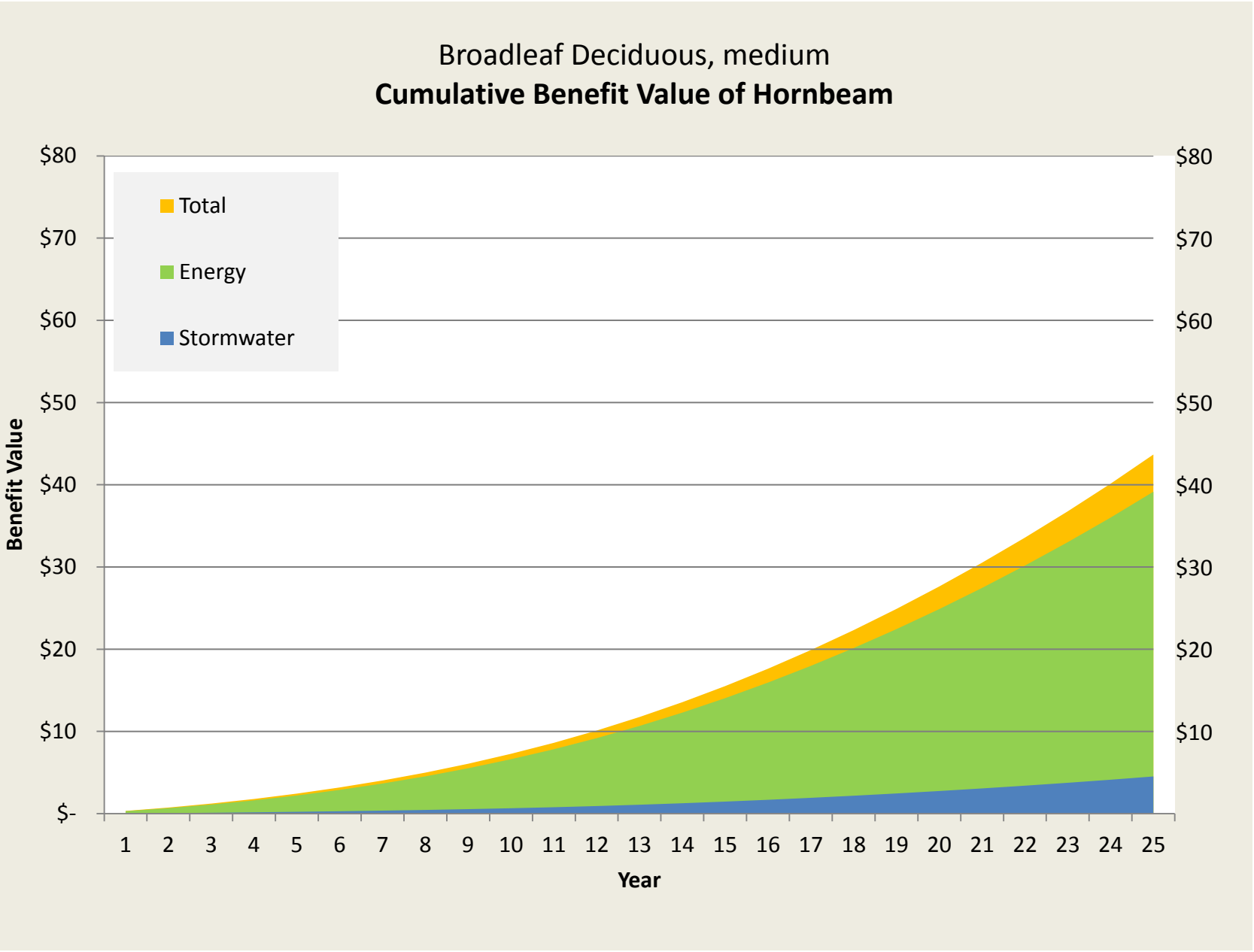



Broadleaf Deciduous, small
Cumulative Benefit Value of Callery Pear
Total
Energy
Stormwater
Benefit Value
$80
$70
$60
$50
$40
$30
$20
$10
$-
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
Year

Broadleaf Deciduous, large

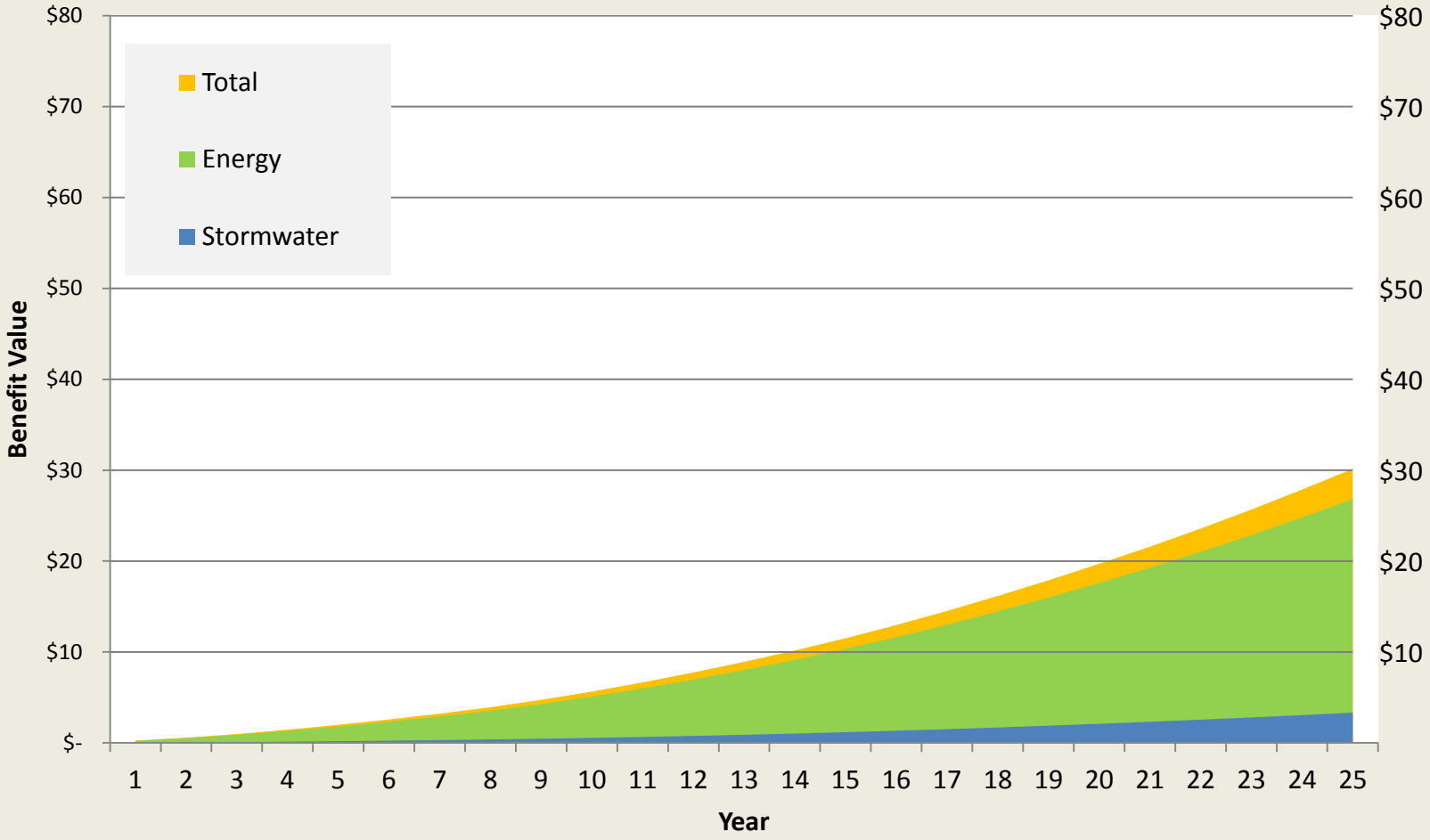
Cumulative Benefit Value of Siberian Elm




Broadleaf Deciduous, medium
Cumulative Benefit Value of Hornbeam
Total
Energy
Stormwater
Benefit Value
$80
$70
$60
$50
$40
$30
$20
$10
$-
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
Year

Conifer Evergreen, small

Cumulative Benefit Value of Rocky Mountain Bristlecone Pine

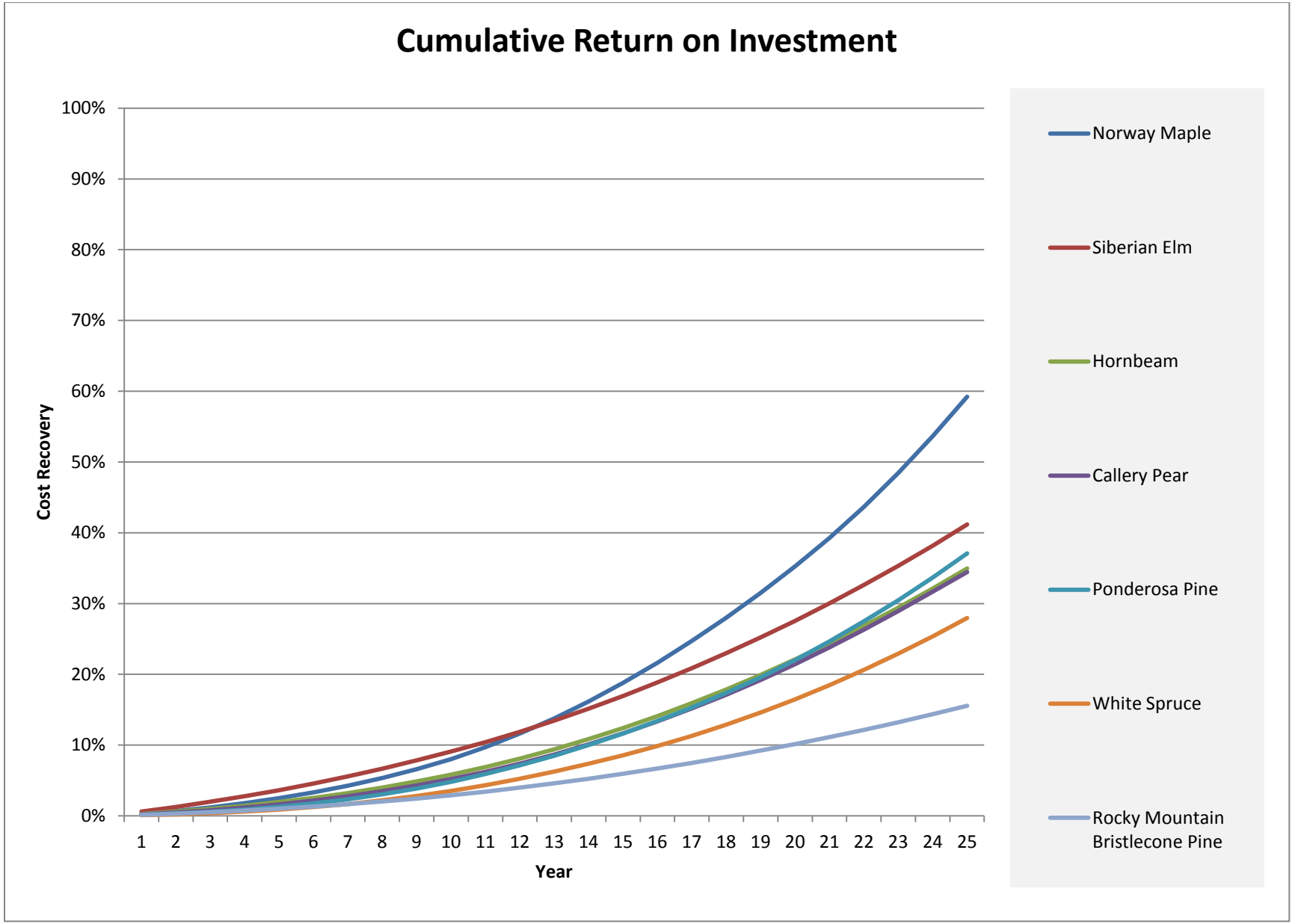


Cumulative Return on Investment (ROI):

After gathering information on the reductions of stormwater and energy of the seven tree species the analysis was then able to use this information to calculate cumulative return on investment (ROI) over the course of 25 years.

All calculations take into account the cost to purchase each tree at a two (2) inch diameter at breast height (DBH). With the exception of the Ponderosa Pine, this is sold at one standard rate. The reason for analyzing each tree at a 2 inch DBH is because at this DBH the trees yield the highest ROI when taking into consideration the initial cost to plant the tree. In addition growth rates were taken into account for each tree species because there are significant benefits yielded from each tree year after year. Mature trees and large canopy trees yield the highest ROI. The increase in benefits mature trees offer over the course of their lifetime is exponential. Each tree purchased at a 2 inch DBH cost anywhere from $113 to $194.

The top three species that had the greatest ROI over the course of 25 years was the Norway Maple, Siberian Elm and Ponderosa Pine. The Ponderosa Pine's has the third highest ROI of all seven species. The initial cost to purchase this tree is approximately $125, at 25 years of age there is a 36% ROI. The Siberian Elm has the second highest ROI. The initial cost to purchase this tree species is $126, at 25 years of age the ROI is 41%. The Norway Maple has the highest ROI of all seven species analyzed, the ROI is 59.5% ROI after 25 years.


Cumulative Return on Investment
Cost Recovery
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
Year
Norway Maple
Siberian Elm
Hornbeam
Callery Pear
Ponderosa Pine
White Spruce
Rocky Mountain Bristlecone Pine

Program Scope:

This program is housed in the Neighborhood Services Department because there is a strong component for Neighborhood outreach, engagement and implementation. The development and implementation of Forest Spokane aim's to work with neighborhood councils, residents, community stakeholders and City Departments to identify tree planting locations.

Identification of planting opportunities include, public right-of-way land, city owned vacant land, planting strips wider than 3' across, residential property, the Spokane River gorge, Spokane City Parks, and Capital Improvement Projects to name a few. In addition to physical development, effective project identification, implementation and management of the urban forest require the development of programs and policies.

The efforts and success of the programs and policies that develop from this initiative will require the attention and coordination of each of the stakeholder groups; neighborhoods, City Departments and non-profit and other organizations.

The following table summarizes the current stake holder group:

City Stakeholders		
Last Name	**Name**	**Department**
Powell	Alicia	Neighborhood Services
Taylor	Mike	Engineering
Robb	Hannah	Engineering
Werner	Mike	Asset Management
Davis	Marcia	Public Works
Spell	Angel	Parks & Recreation
Coddington	Brian	Communications
Kegley	Dan	Water
Schenk	Andy	Streets
Piccolo	Mike	Legal
Dahl	George	Community, Housing & Human Services (CHHS)
Community Stakeholders		
Last Name	**Name**	**Organization/Committee**
Nunberg	Marla	Downtown Spokane Partnership
Fitzpatrick	Erik	AHBL
MacKerrow	Nancy	Susie's Forest
Parrish	Amanda	The Lands Council
Davis	Garth	Spokane County Conservation District
Stone	Larry	Spokane Ponderosa
Brady	Patrish	Spokane Ponderosa
*TBD	*TBD	Community Assembly Representative
*TBD	*TBD	Spokane River Keepers
Fitterer	Korissa, *Chair*	Building Stronger Neighborhoods

* To be determined.

Goal: The Forest Spokane Initiative will focus on planting 10,000 trees within the City of Spokane in two years as an integrated approach to mitigate stormwater by implementing green infrastructure such as tree and other low impact design principles by engaging the community, city departments, and invested external partners.

In order to do this the Forest Spokane Initiative is targeting two larger goals; Project Integration & Planning and Policy.

Project Integration & Planning: This goal aims to work with current projects and planning efforts that focus on City infrastructure improvements, community oriented projects and building relationships with our community partners.

Policy: This goal focuses on developing and/or improving policies that directly affect the Cities approach in encouraging ongoing stewardship of our current urban forest. The policies identified in this section help to engage the community in understanding the value and cost savings trees and LID projects provide through Commercial Stormwater Charge Discounts and Spokane's LID Ordinance.

Under each goal three (3) strategies were devised in order to focus each objective towards the attainment of the original goal.

Strategies: The key objective of Forest Spokane is to engage neighborhoods, City departments, and community stakeholder groups as a means to integrate tree planting projects and low impact development designs across the City of Spokane.

The Forest Spokane Initiative has identified (3) principal strategies as a means of developing strategic objectives.

Strategy 1: Community: Engage the community in a variety of options to reduce storm water while improving neighborhoods.

Strategy 2: City: By working together through principles of integrated planning, incorporate additional green space and reduce impermeable services in planned capital project. Coordinate work through a combined effort between multiple City Departments.

Strategy 3: Partners: Collaborate with corporate and community partners to drive investment in the development and maintenance of Spokane's urban forestry.

The following table lists the goals, strategies and objectives. The table demonstrates how each relates and builds upon one another.

Goal: Project Integration & Planning			
Strategy	**Stakeholder Group**	**Objectives**	**Approximate # of Trees (2014)**
Strategy 1	ONS, Urban Forestry, CHHS	Utilize a mini-grant program where neighborhoods may actively identify and apply to implement greening projects. Includes award certificate for best project and funding for an additional project.	210
Strategy 1 & 3	ONS, Urban Forestry	Work with local nursery's and home improvement businesses to create a partnership that aims to implement a Residential Tree Planting Program. Include educational activities for the public regarding urban forest health, proper planting and care of trees.	2,000
Strategy 1, 2, & 3	City Departments, Neighborhoods, Partners	Implement large scale seedling plantings that focus on engaging partnerships with City Departments, Neighborhoods and external stakeholder groups.	2,000
Strategy 1 & 2	Community Development Block Grant (CDBG) Projects		
	CHHS, Urban Forestry, ONS, Engineering	Integrate street tree plantings with applicable CDBG designated sidewalk repairs.	200
		Work directly with neighborhoods to implement tree plantings using Street Tree designated CDBG funding and/or flagged Street Tree funding when applicable.	225

		Coordinate efforts with neighborhoods to include trees in all streetscape designs via CDBG funding or other.	100+/-
		Work with Parks Department to integrate tree replacement and new tree installation using Parks Improvement designated funding.	100+/-
	Urban Forestry, ONS, Engineering	Coordinate with Engineering to identify tree plantings that may occur in conjunction with Capital Improvement Projects. Includes; streets, sidewalks, trails, Combine Sewer Overflow locations (CSO), schools and parks, etc.	2,000
	Project Coordinator, Urban Forestry, Parks	Coordinate tree plantings throughout City parks; 2014-2016	50
	ONS, Urban Forestry	Work with Urban Forestry staff to implement public outreach for parks projects, street trees, neighborhood and residential plantings.	500

	Spokane City Parks & Urban Forestry	Work with Urban Forestry staff to coordinate tree planting efforts with Avista on public right-of-way property.	500
Strategy 2	Project Coordinator, Asset Management, Urban Forestry	Facilitate neighborhood efforts to plant on City owned vacant property as projects are identified by neighborhoods.	n/a
Strategy 2 & 3	Community Partners, ONS, Urban Forestry	Partner with local non-profits and other organizations who seek to increase trees within our cities urban forest.	2,000
Goal: Policy			
Strategy	**Stakeholder Group**	**Objectives**	
Strategy 2	Project Coordinator, Engineering, Public Works, Urban Forestry	Create a policy standard which enables the continued integration of tree plantings, tree replacement, green infrastructure options, LID guidelines, and addressed tree maintenance concerns.	
	Project Coordinator, Urban Forestry	Work with Urban Forestry to develop a robust Urban Forest Management Plan.	

Strategy 2 & 3	Business & Developer Services, Public Works, Urban Forestry, Engineering, Project Coordinator	Develop incentives for tree plantings, replacement of dead trees in our City center, removal of impermeable surfaces, and implementation of the Low Impact Development (LID) Ordinance No. C35021 as a means to increase awareness and participation within our business community.
		Identify locations and businesses who qualify for the "Commercial Stormwater Charge Discounts" as classified by SMC 13.03.1137. Work with Building & Development Services to approach businesses for implementation.
		Generate list of commercial buildings that are registered under commercial user/stormwater user charge and develop tree planting incentives or discounts for these businesses to plant street trees. Create media, outreach and education material for this purpose.
	Project Coordinator, Urban Forestry	Create ordinance that aims to resolve conflicts between property owner disputes that result when trees block views or sunlight.

Total Trees: 9,885

Resource: Resource Analysis of Inventoried Street Trees, 2013