Retrofitting:
Urban Natural Drainage and Site Design Strategies in the Puget Sound Basin

Peg Staeheli, ASLA
Tom von Schrader, PE

SvR Design Company, Seattle, WA

SvR DESIGN COMPANY

October 19, 2005

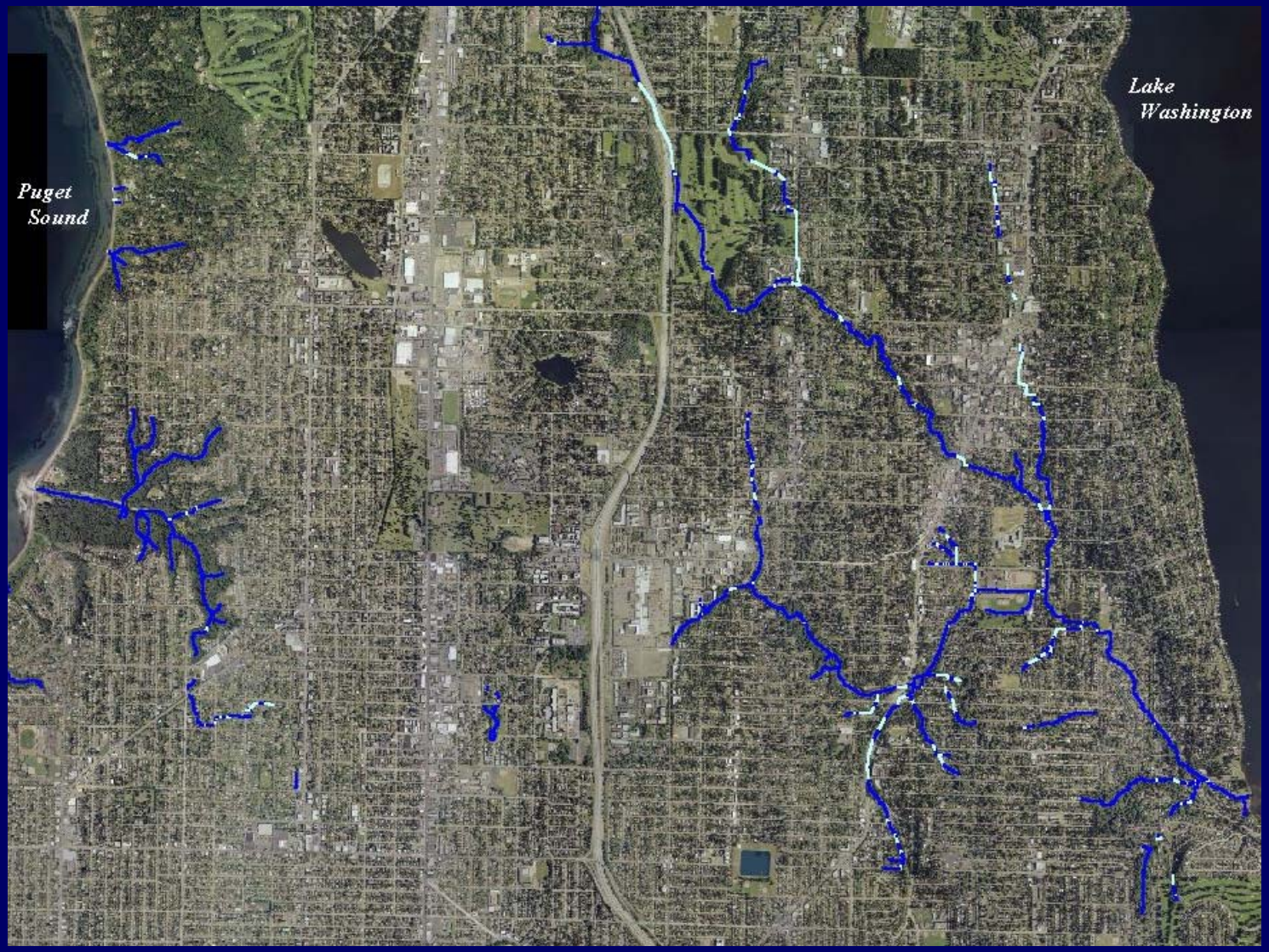
Projects in the Puget Sound Basins (Western Washington)

Seattle's Natural Drainage Program
"SEA streets"
High Point

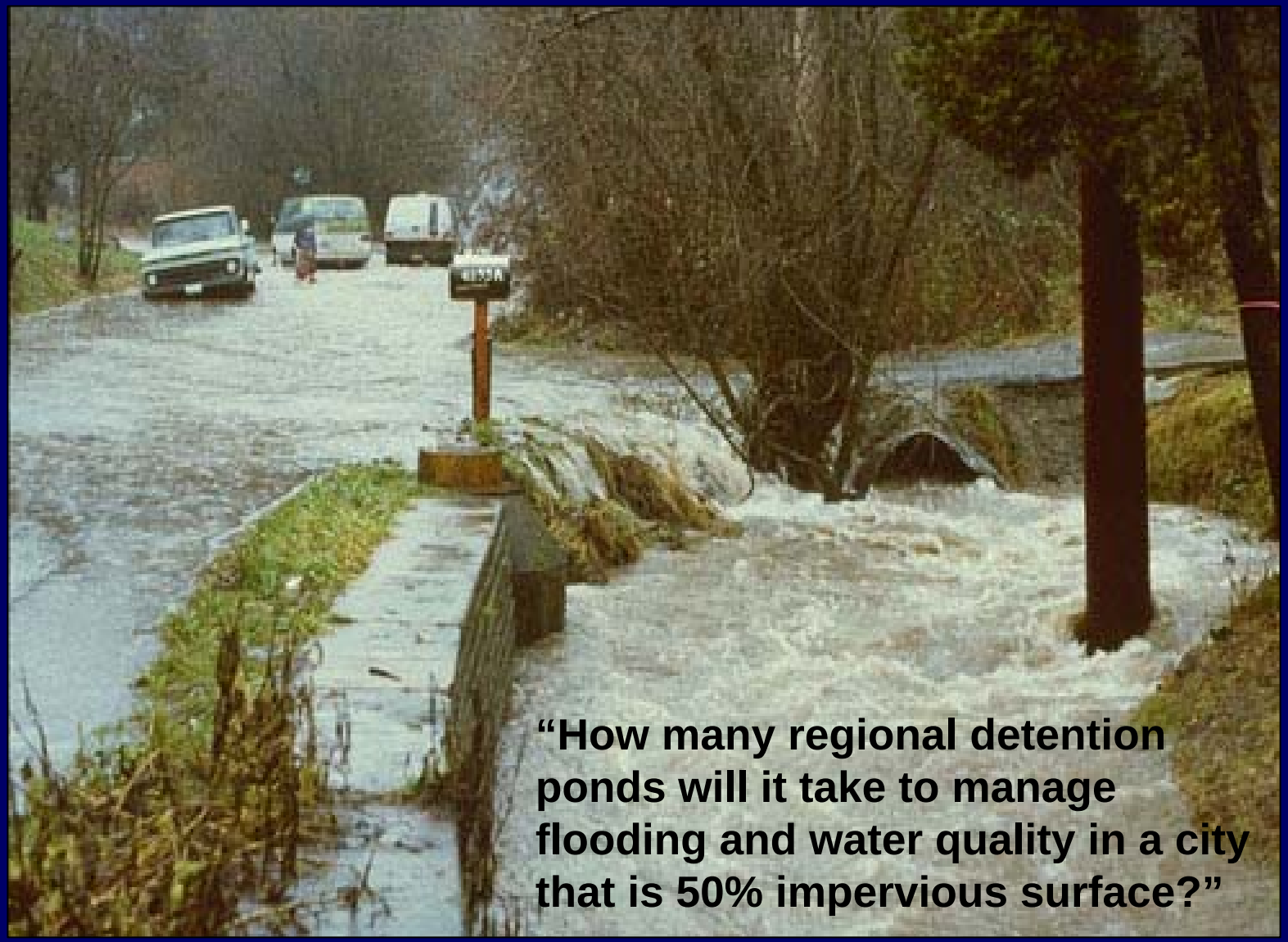
Others:

- "Growing" Vine Street
- Port Townsend- F Street
- Seattle – Terry Avenue
- Seattle – Joint Training Facility
- Seattle – City Hall and Justice Center
- Kitsap County Administration Building
- Pierce County Environmental Services
- Seattle: Denny Way Apartments
- Seattle: Mall Parking Lot Study
- Seattle: Thornton Creek Water Quality Channel

City of Seattle – Natural Drainage Systems Program



City of Seattle – Natural Drainage Systems Program



“How many regional detention ponds will it take to manage flooding and water quality in a city that is 50% impervious surface?”

City of Seattle – Natural Drainage Systems Program

The challenge is to try to make this…

…function like this

City of Seattle – Natural Drainage Systems Program

The City of Seattle's **Natural Drainage Systems Program** is an alternative stormwater management approach that delivers higher levels of protection for receiving waters at a lower cost than traditional street and drainage improvements.

City of Seattle – Natural Drainage Systems Program

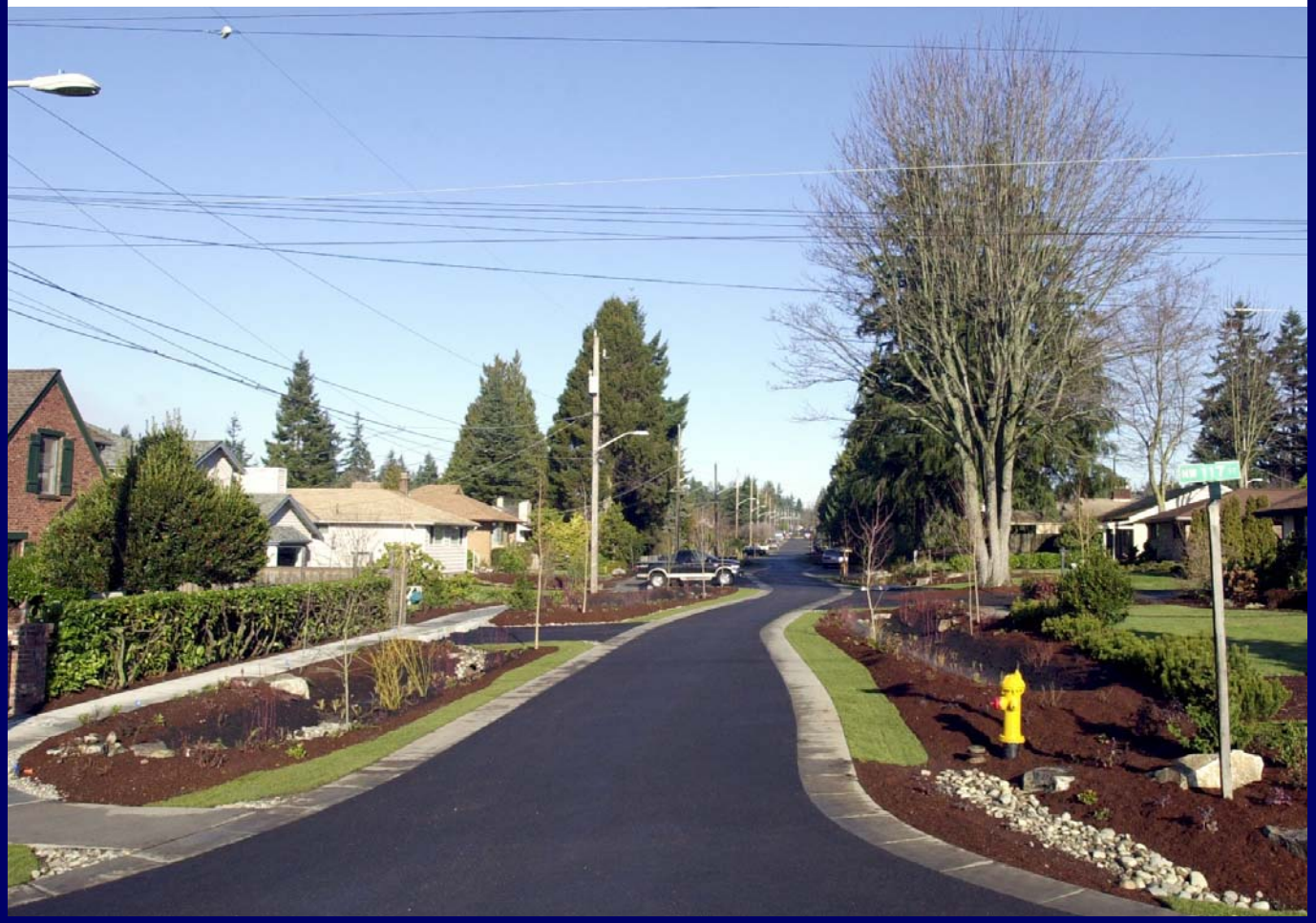
SEA Street - Before

City of Seattle – Natural Drainage Systems Program

SEA Street - Construction

City of Seattle – Natural Drainage Systems Program

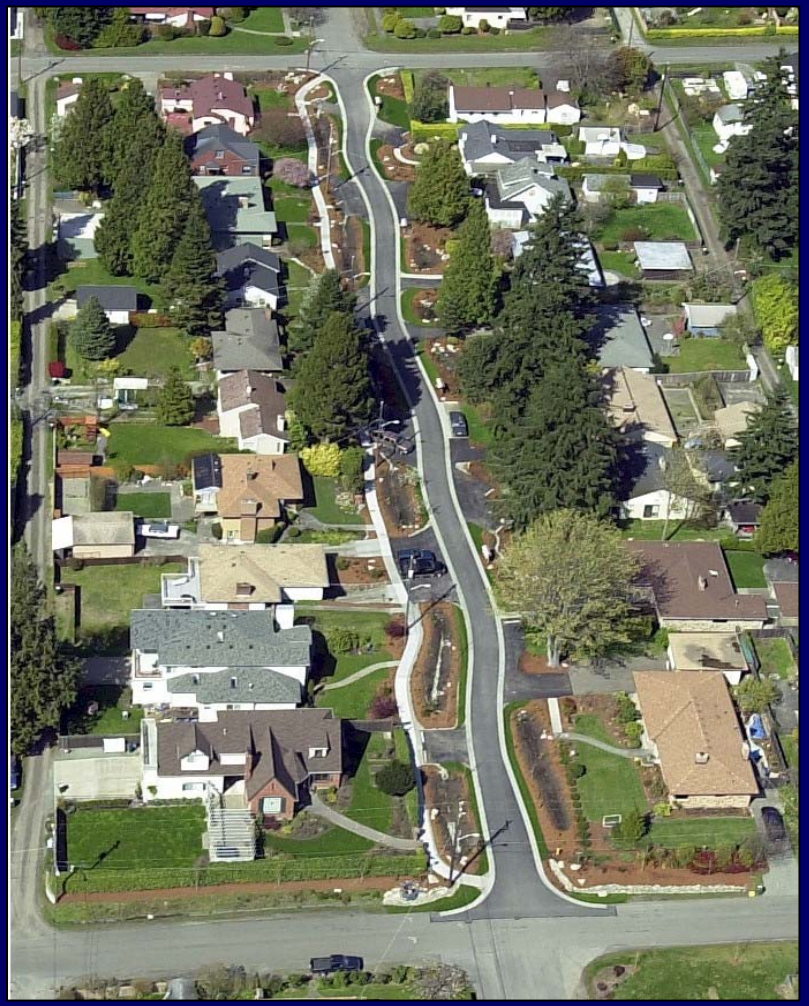
SEA Street - After



City of Seattle – Natural Drainage Systems Program

SEA Street - After

City of Seattle – Natural Drainage Systems Program



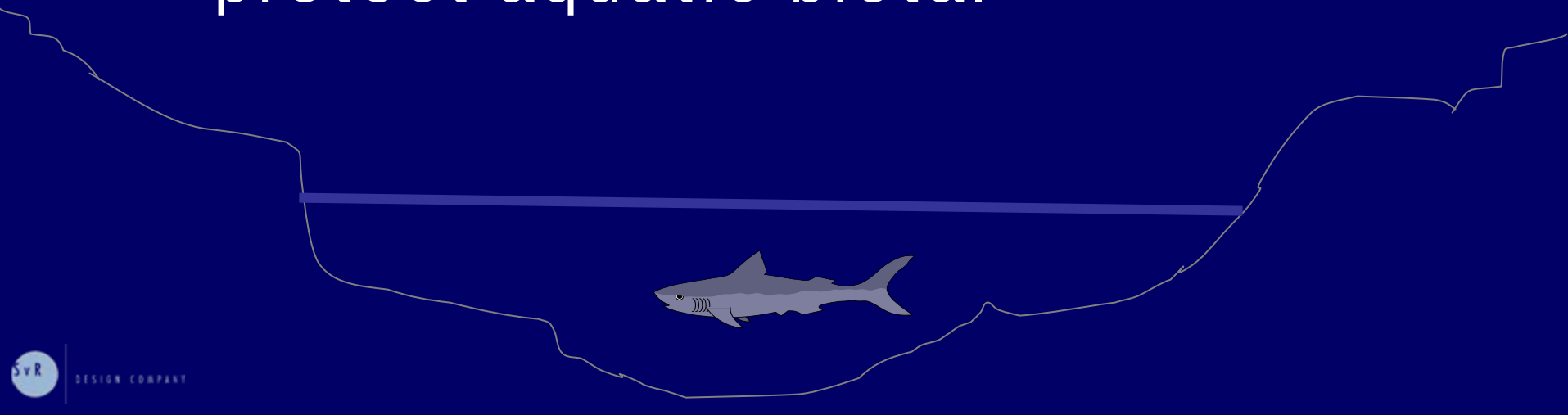
SEA Street monitoring results for two years:

98%

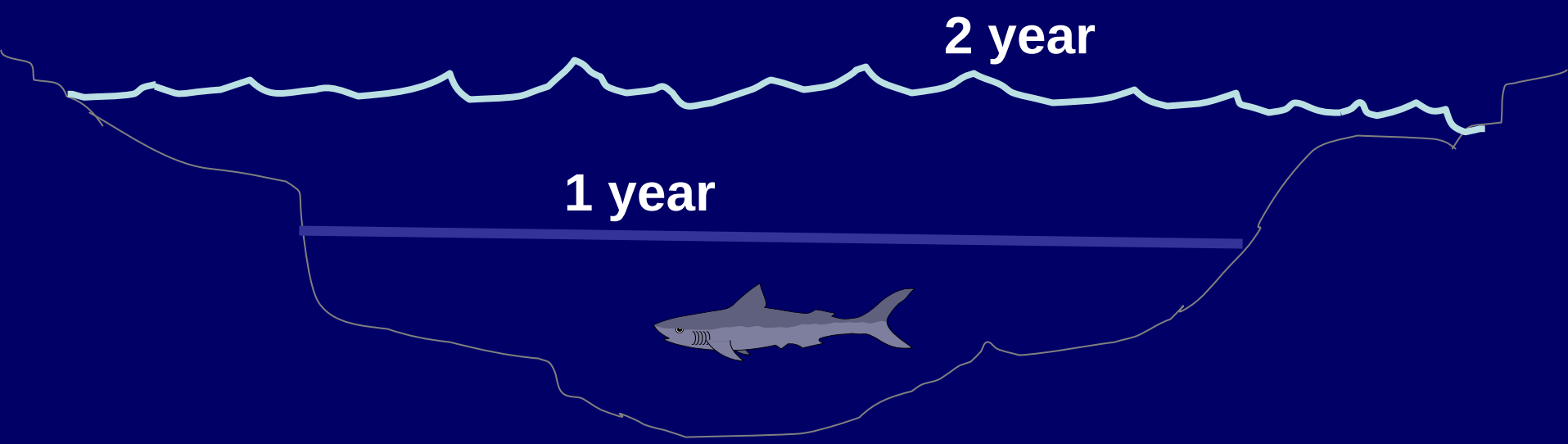
reduction in total runoff volume

95% of total annual rainfall in Seattle = 1 year storm

Goal #1: Control small storms to protect aquatic biota.



Goal #2: Control 1 to 2 year storms to prevent channel erosion.



Goal #3: Higher water quality protection.

Monitoring:

- **petroleum hydrocarbons,**
- **metals (copper, lead, zinc),**
- **fecal coliform,**
- **pesticides & herbicides**
- **nitrogen**
- **water temperature,**
- **pH**

City of Seattle – Natural Drainage Systems Program

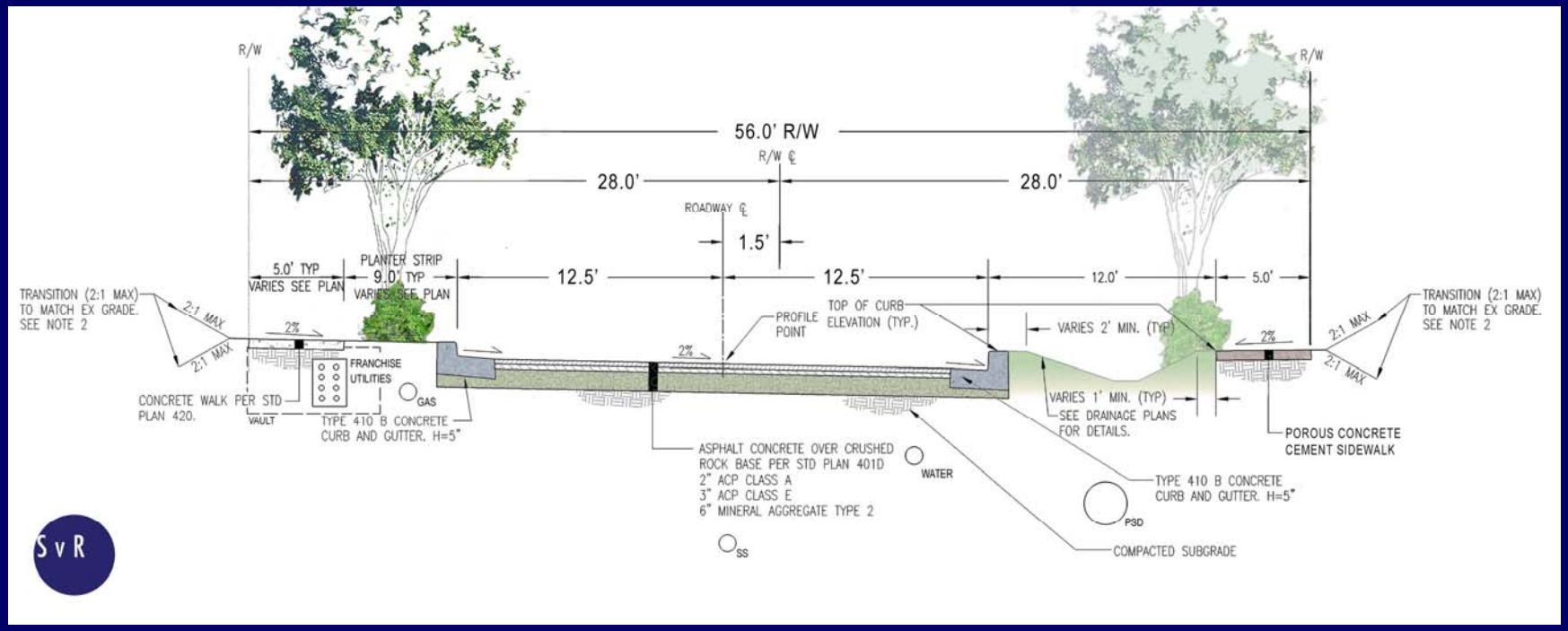
www.seattle.gov/util/naturalsystems

High Point Revitalization Project
Seattle Housing Authority and Seattle Public Utilities

Mithun Architects + Planners

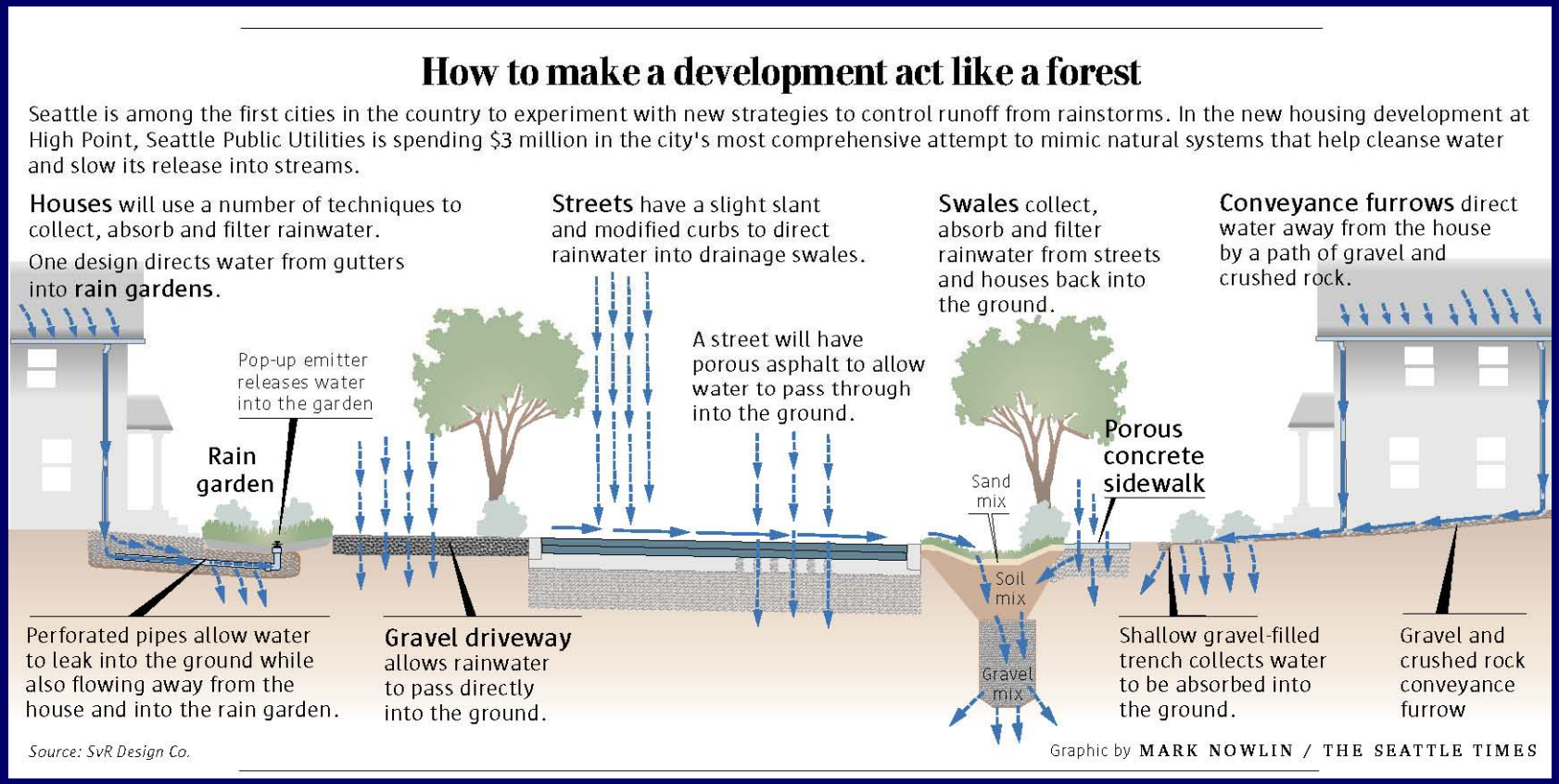
- 120-acre mixed income housing redevelopment
- New Urbanist principles
- Master plan designed prior to decision to do natural drainage systems
- 34 blocks of new streets with new utilities, street trees, sidewalks, parks and open space
- 1,600 housing units, neighborhood center, library, and mixed-use block
- Density ranges from 16 units/acre to 30 units/acre of ground-related housing

Seattle: High Point Streets
An example of compromise

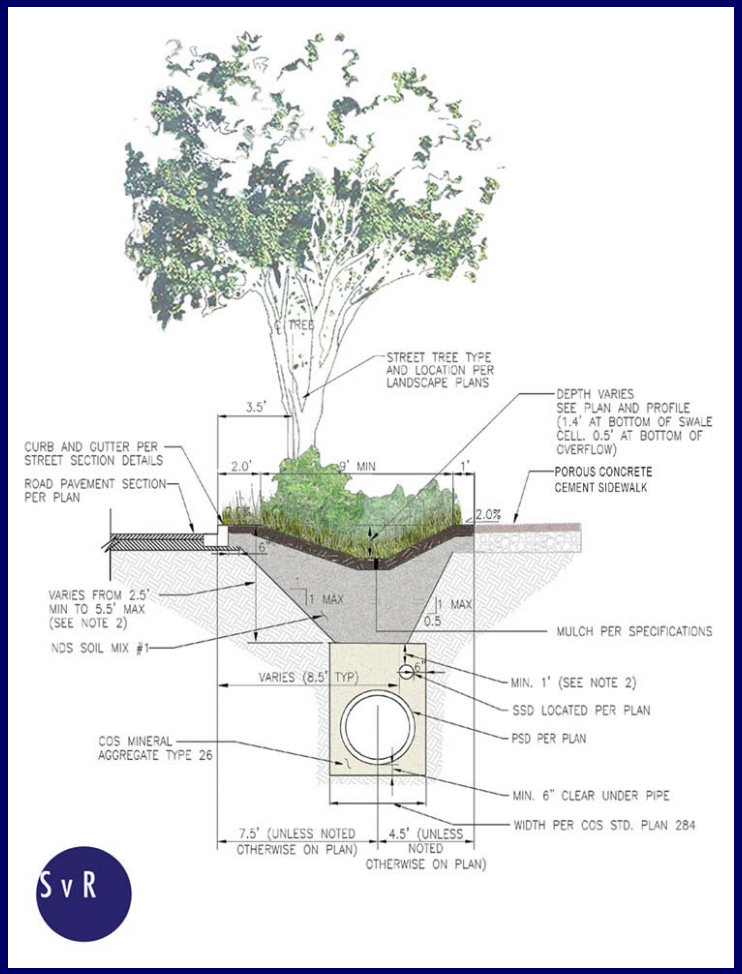


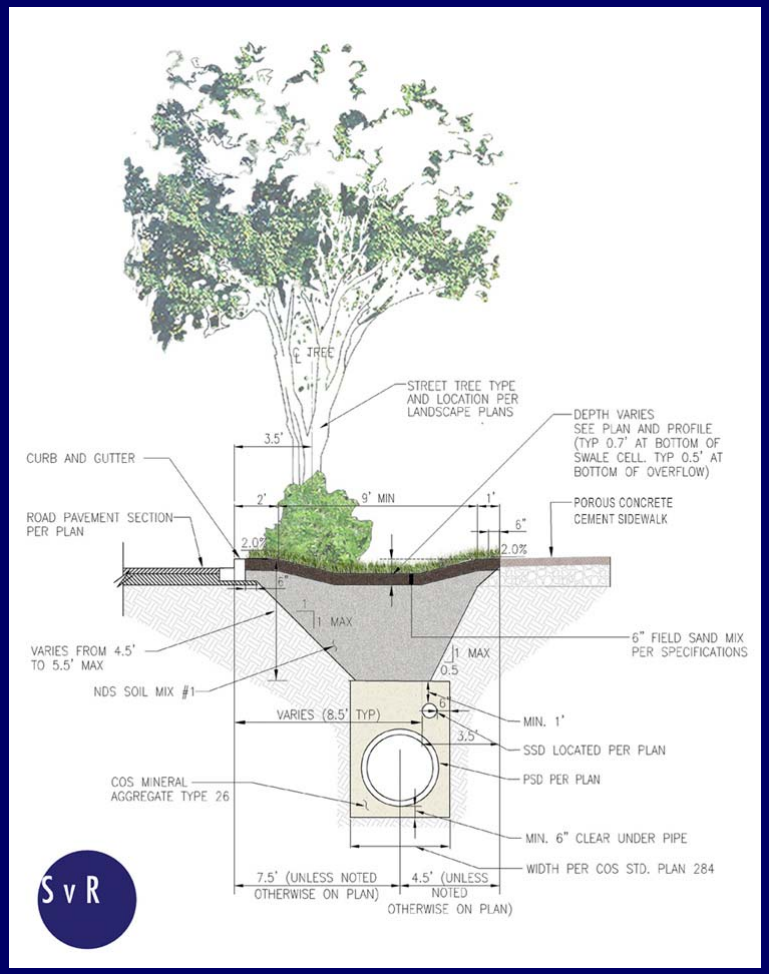
- Right of Way width (56’ versus 60’)
- Street width (25’ versus 28’)
- Utility placement and separation (storm drain under planter)
- Traditional curb, gutter and sidewalks both sides
- Curb height and curb cuts (5” versus 6”; curb cuts versus catch basins)
- Thrown street (versus crown)
- Planting strips with swales (versus level grass)

Seattle: High Point Streets- Natural Drainage Approach



Seattle: High Point Swale Cross Section & Length





- Vegetated swale
- Soil conductivity 2” per hour
- 16” deep/ 10” ponding

- Grass-lined swale
- Walkable
- 8” deep/ 2” ponding

Seattle: High Point Streets- Natural Drainage Approach

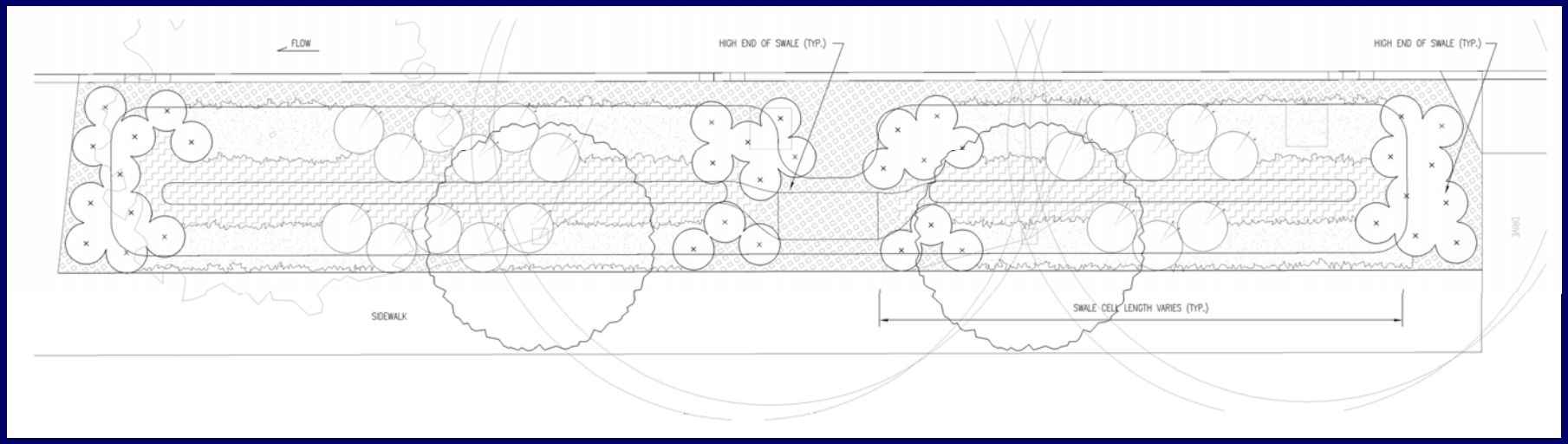
Concept

Under construction
Porous walks, curb cuts and swales

Seattle: 32nd Avenue SW
First Porous Concrete Public Street in Seattle

High Point Swales

High Point Swale Detail



Swale Bottom:

Carex/Sedge mix:
Carex deweyana/Dewey's Sedge
Carex obnupta/Slough Sedge
Carex Montana/Mountain Sedge

Swale Sides:

Cornus sericea 'Kelseyi'/Kelsey Dogwood

Upper Swale:

Helictotrichon sempervirens/Blue Oat Grass

Small trees:

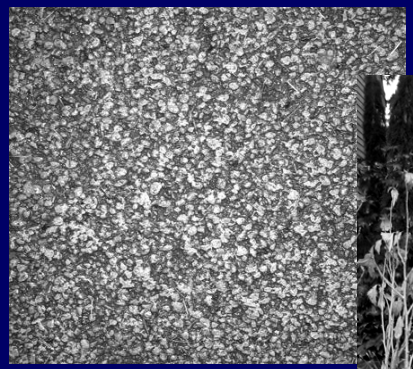
Amelanchier x. grandiflora 'Autumn Brilliance'/Serviceberry

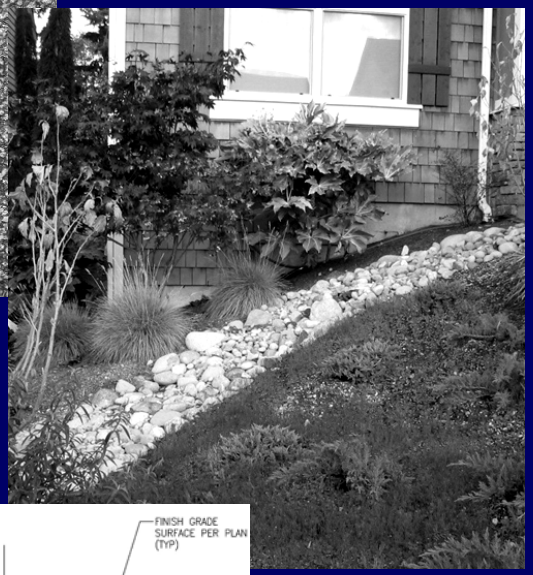
High Point

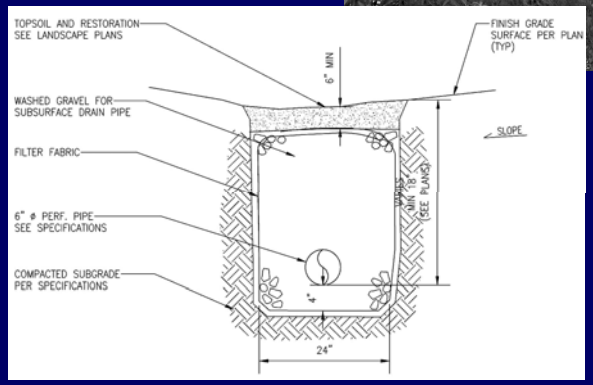
Cascade /weirs

- Stormwater Pond 16 ac ft

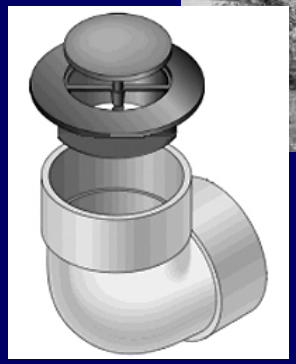
High Point Natural Drainage Strategies
Housing: Block-level Design







- Porous pavements
- Conveyance furrow
- Dispersal trench
- Rain garden
- Pop-up emitter



High Point Natural Drainage Strategies
Housing: Block-level Design

Pop Up Emitter

Gravel Pave

Splash blocks

High Point: Tree Protection

Trees 229 and 289

- Arborist evaluation
- Valuation posted
- Critical root zone fencing
- Contractor education/ incentive
- Utility boring

High Point: Tree Protection - The Exceptional Tree

Tree 784

Tree Protection – Critical Root Zone

Tree#1 Sequoia

High Point: Tree Protection- A long term enforcement

Trees 234 & 237

Seattle: Growing Vine Street

- Urban Drainage
- Cascade of Pools
- Cleans Stormwater Runoff
- Educate
- Art integration
- Pea Patch

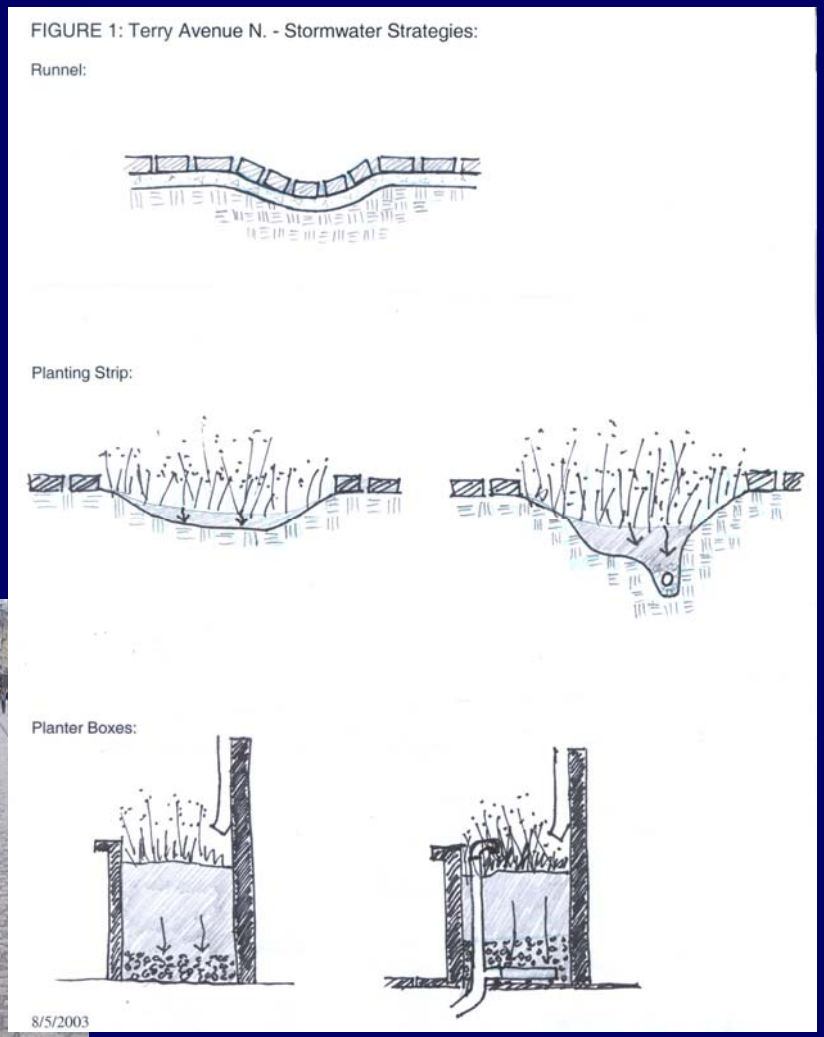
Port Townsend: F Street: Right of Way as Public Space

- Multi-Modal Travel
- Traffic Calming
- Context Sensitive Design

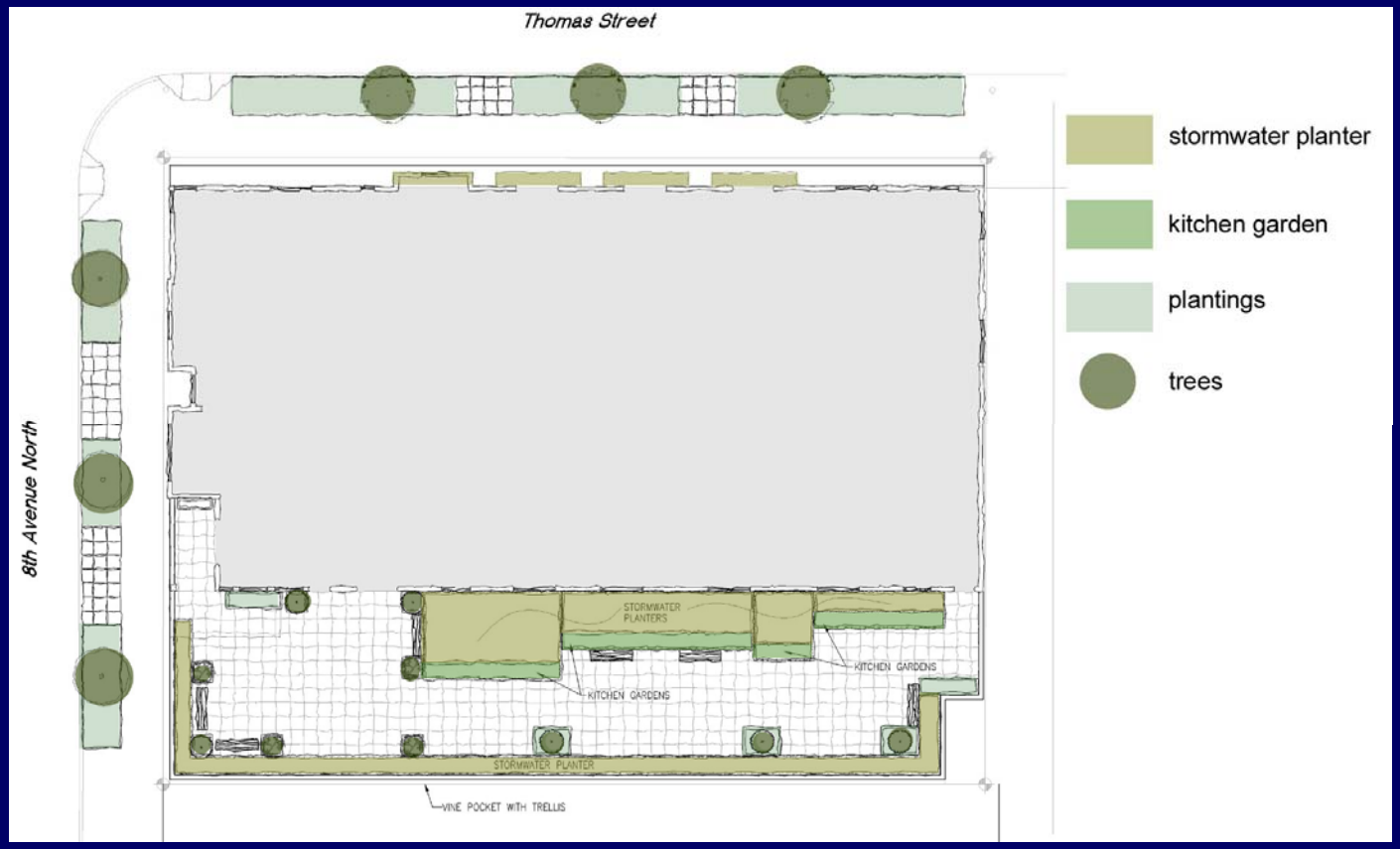
Port Townsend: F Street

- Critical Area Drainage
- Cleans Stormwater Runoff
- Art

Seattle: Terry Avenue N: Right of Way as Public Space

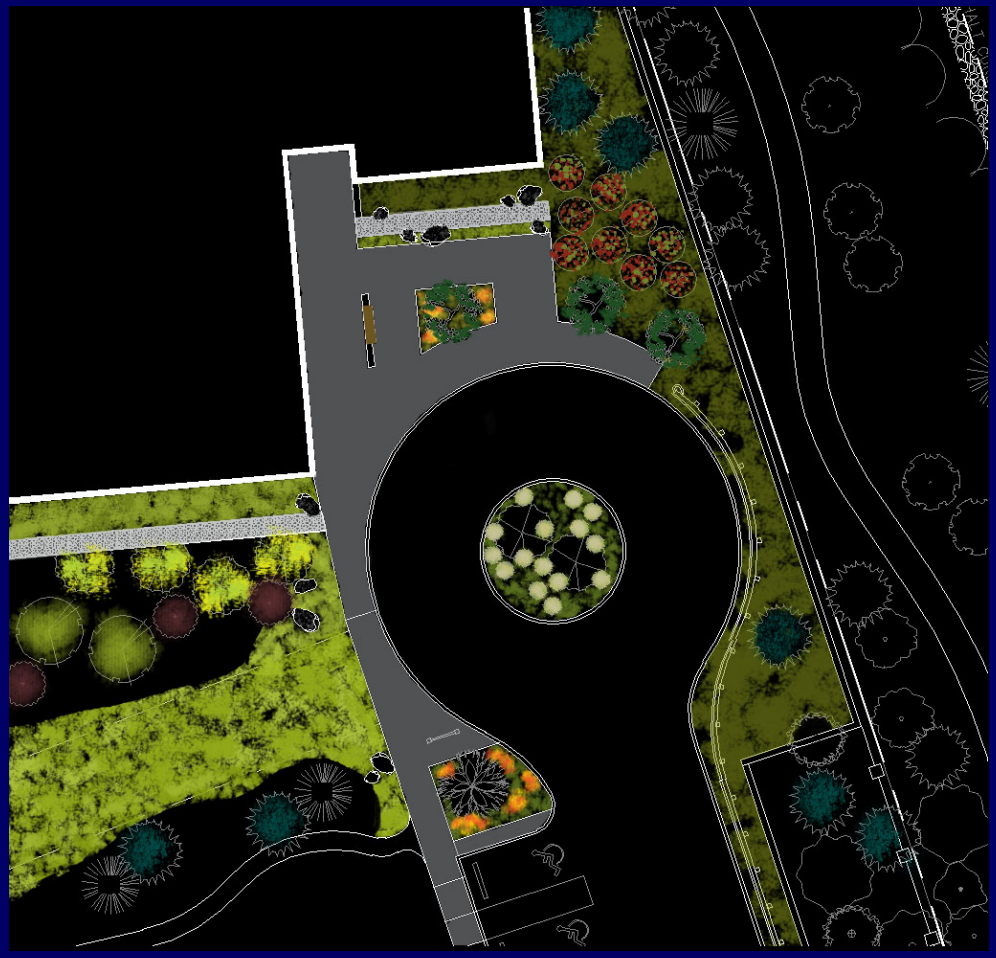


Seattle:
Denny Way Apartments



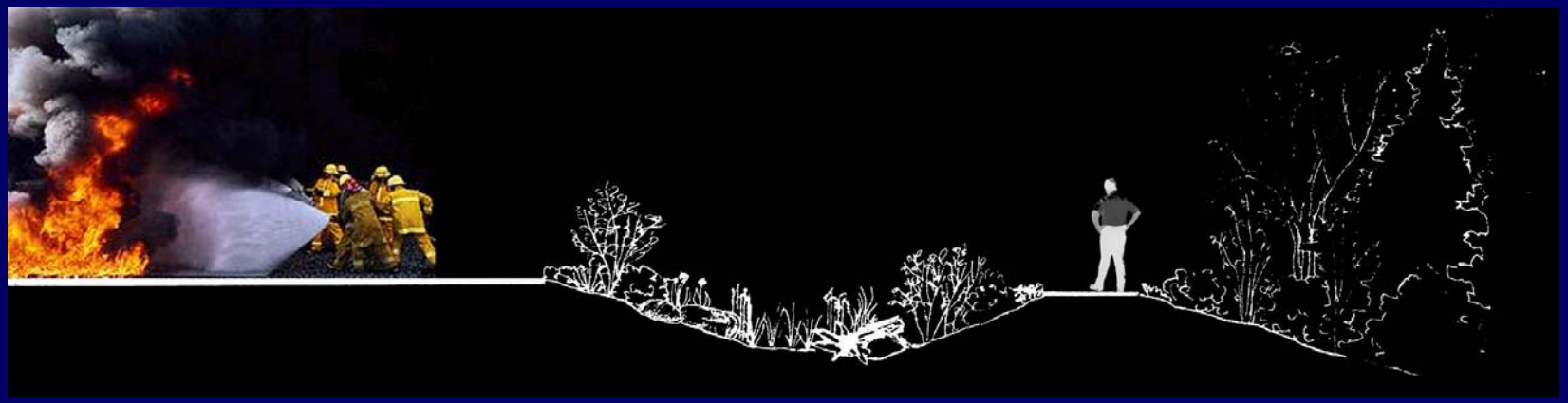
- Stormwater planter prototype for runoff control
- Amended soils to attenuate runoff

Seattle: Joint Training Facility



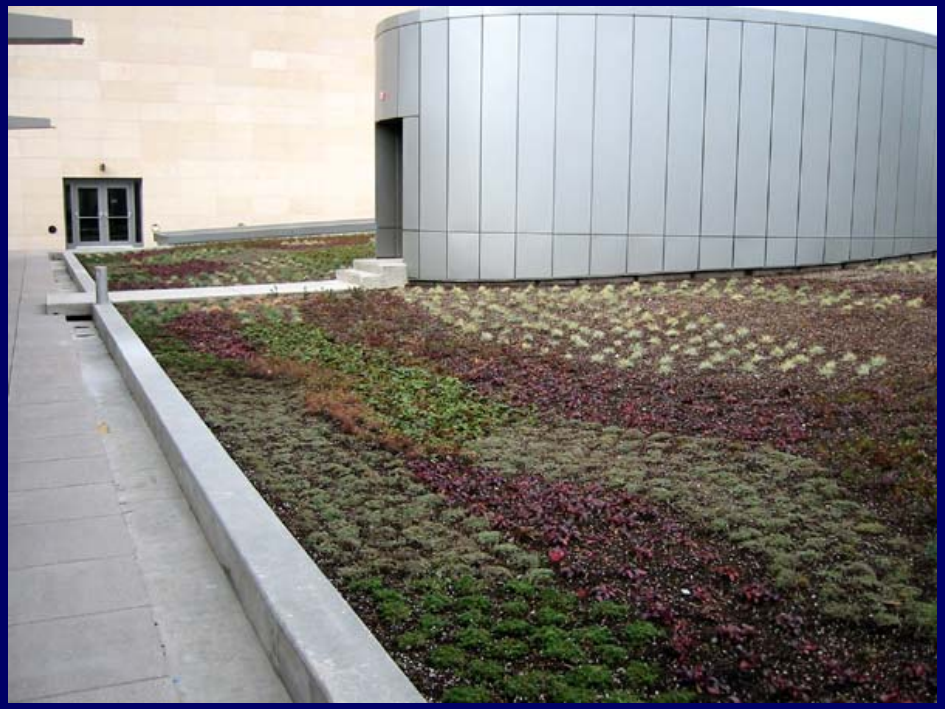
- Mine Reclamation
- Creek Restoration
- Closed Hydraulic System

Seattle: Joint Training Facility



- Water Reuse
- Closed Hydrologic System

Seattle
City Hall / Justice Center Complex

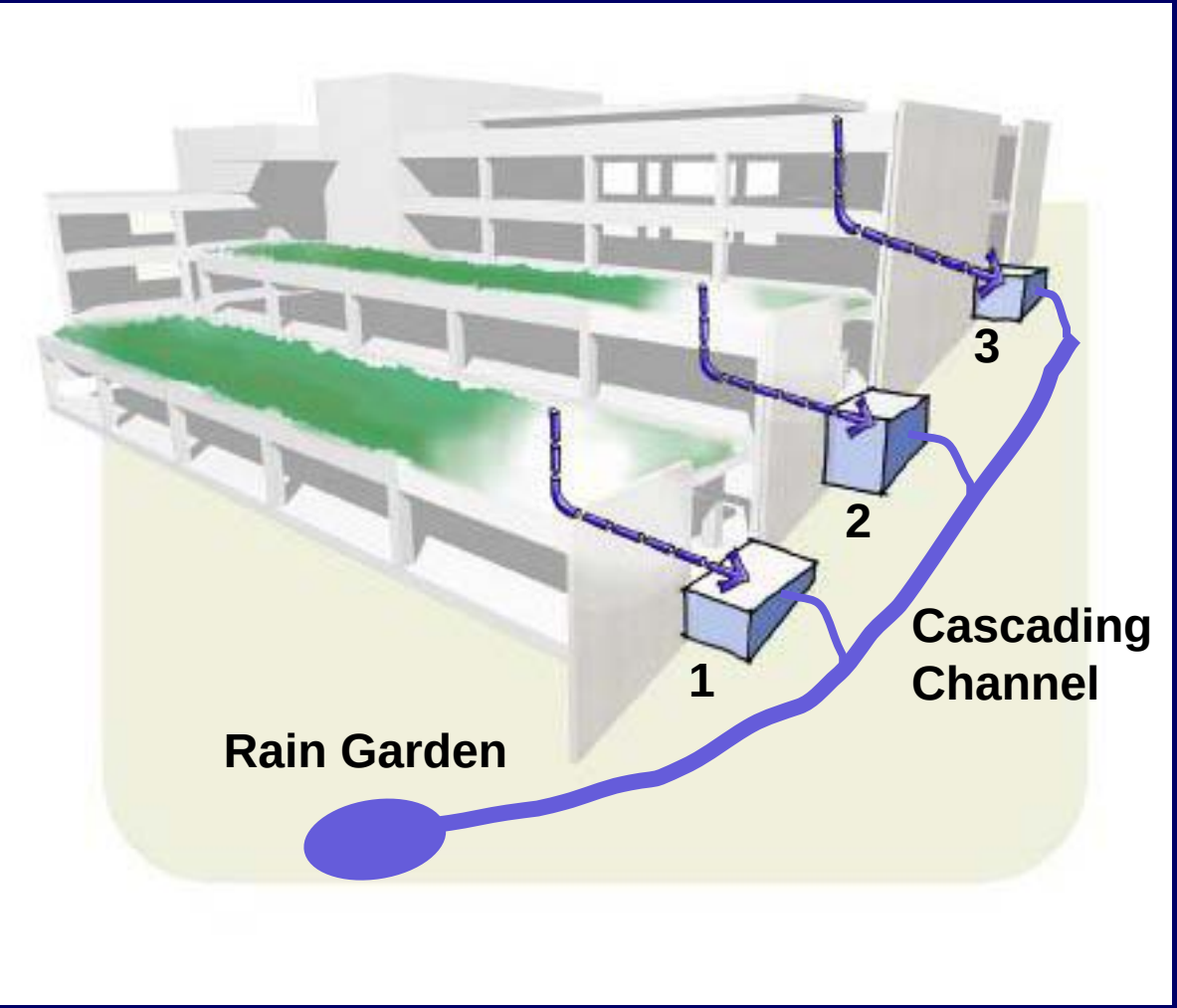


- 2002 Prototype
- Lessons learned
- Adaptive reuse of the former basement for rainwater cistern. Stormwater Used for toliet flushing, irrigation and fountains

Kitsap County Administration Building, Port Orchard

Drawing courtesy of Miller|Hull

Kitsap County Administration Building



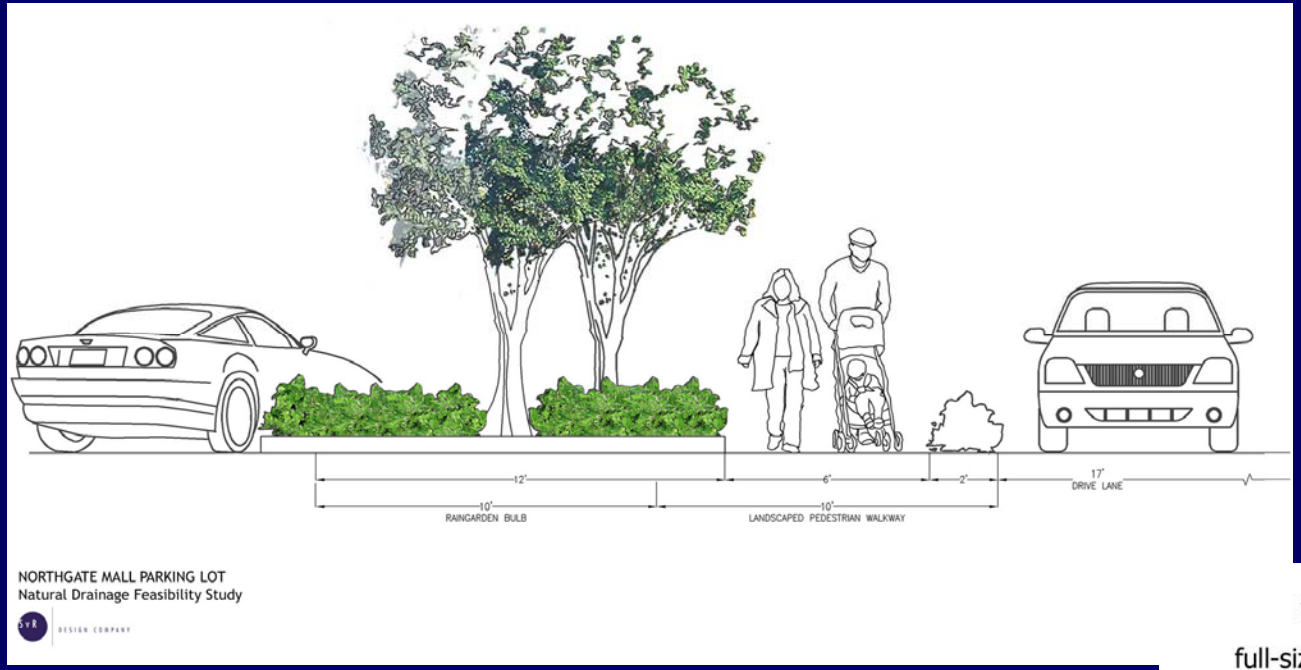
- Urban Redevelopment
- Green roofs for runoff control
- Cisterns
- Rainwater harvesting for landscape irrigation

Pierce County Environmental Services Building

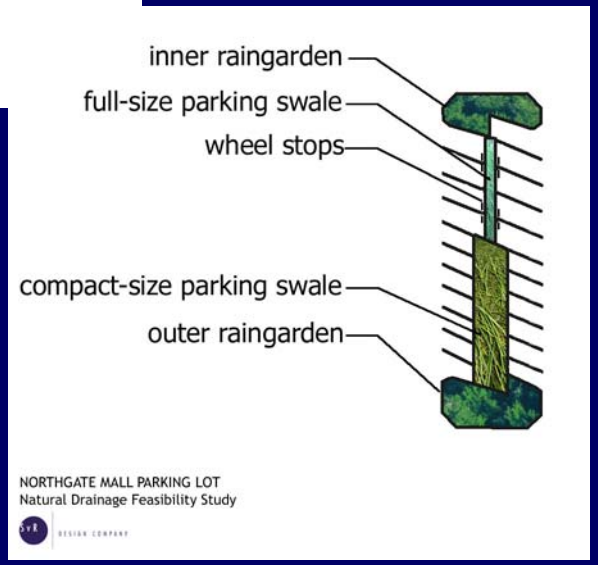
- Techniques for Developers
- Rainwater harvesting (roof)
- Infiltration
- Porous pavement
- Treatment options (valves)

SvR DESIGN COMPANY

Seattle: Northgate Mall Parking Lot Natural Drainage Feasibility Study



- Compare and contrast rain gardens with traditional system
- Enhanced landscape
- Retained Parking Count
- Bottom line =$competitive for natural systems



Seattle: Thornton Creek Water Quality Channel

- Creek protection
- Urban Redevelopment
- Public / Private partnership
- Public Education

existing conditions

Semantics / Lessons Learned

disperse porous filtration convey integration
discharge
perforated swale gravel trench
absorb

- Words mean different things to engineers, landscape architects, planners, architects, regulatory staff, contractors, owners, developers, builders and real estate agents
- Semantics caused iterative discussions on **what these terms actually mean**
- When meanings affect construction bid prices and property values, these are not minor considerations

Natural Drainage Strategies
Lessons Learned

- Learning curve for both designers and permitting agencies
- Owner/Developer understanding of differing site constraints
- Broad tool kit necessary for site plan treatments
- Contractor information
- Fine grading for site contractors
- Expect to answer questions- (Why are you doing this?)
- Expect to make adjustments

Why Retrofit for Natural Drainage?

- Practical
- Demonstrated results
- Installed examples now common place
- Accepted practice with many jurisdictions
- Accepted treatment by the public
- Value added

Recognition:

City of Seattle
Seattle Public Utilities
Washington State Department of Ecology
Seattle Housing Authority
Kitsap County
Pierce County
Low Income Housing Institute
City of Port Townsend

SvR DESIGN COMPANY