Valuation of Ecosystem Services: Lents Case Study

Jim Middaugh
City of Portland, Bureau of Environmental Services

Gillian Ockner
David Evans and Associates, Inc.

EPA SAB Committee
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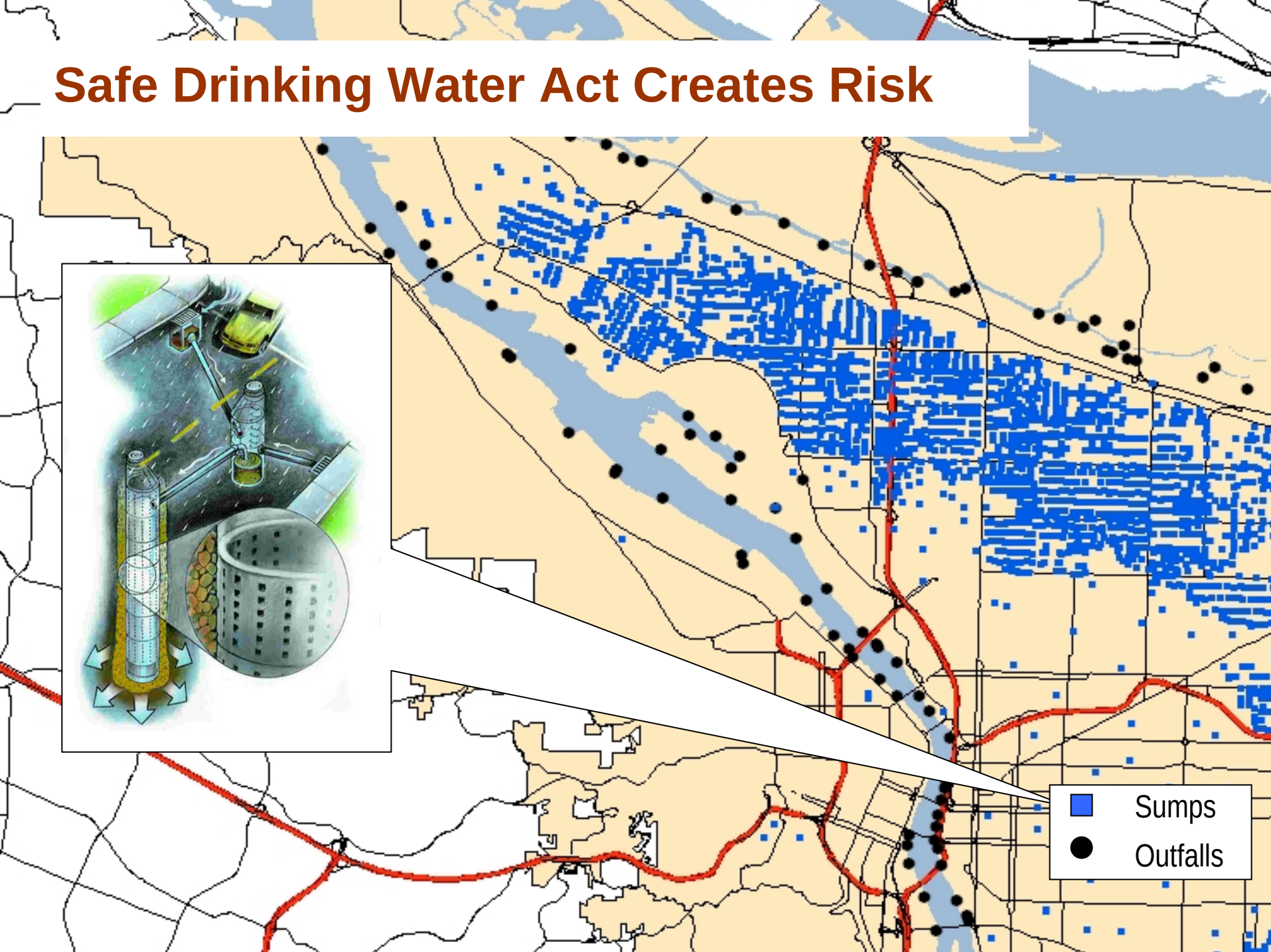
INTRODUCTION

- **What:** Understanding the value of restoring and protecting natural resources
- **Who:** City of Portland, Oregon
- **Where:** Pacific Northwest - Willamette River Basin
- **Why:** Need for better informed decision making
- **When:** Now and into the future

ENDANGERED SPECIES ACT CAUSES UNCERTAINTY

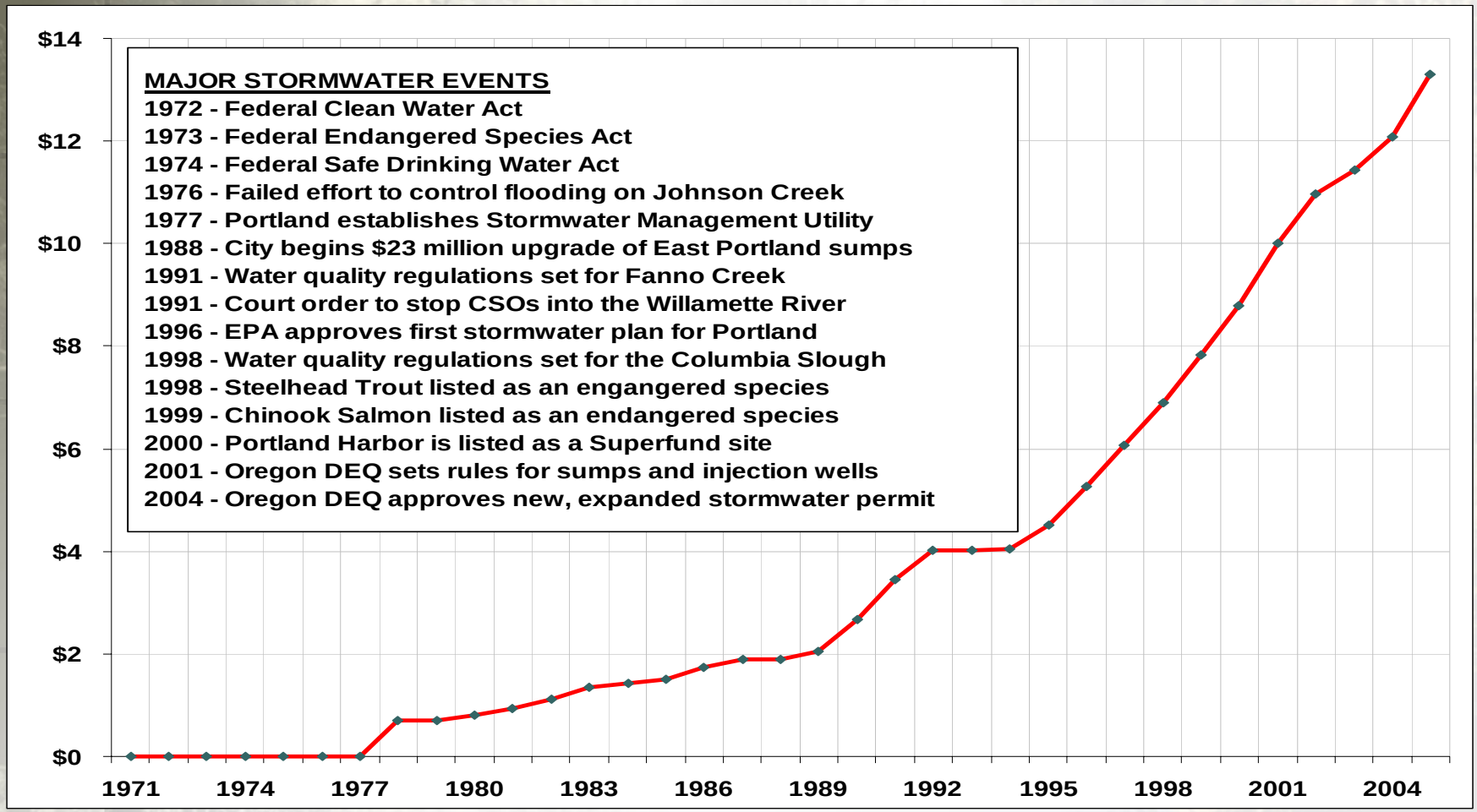
SUPERFUND CHILLS INVESTMENTS, HARMS CITY IMAGE

Safe Drinking Water Act Creates Risk



THE CLEAN WATER ACT DOMINATES CAPITAL RESOURCES

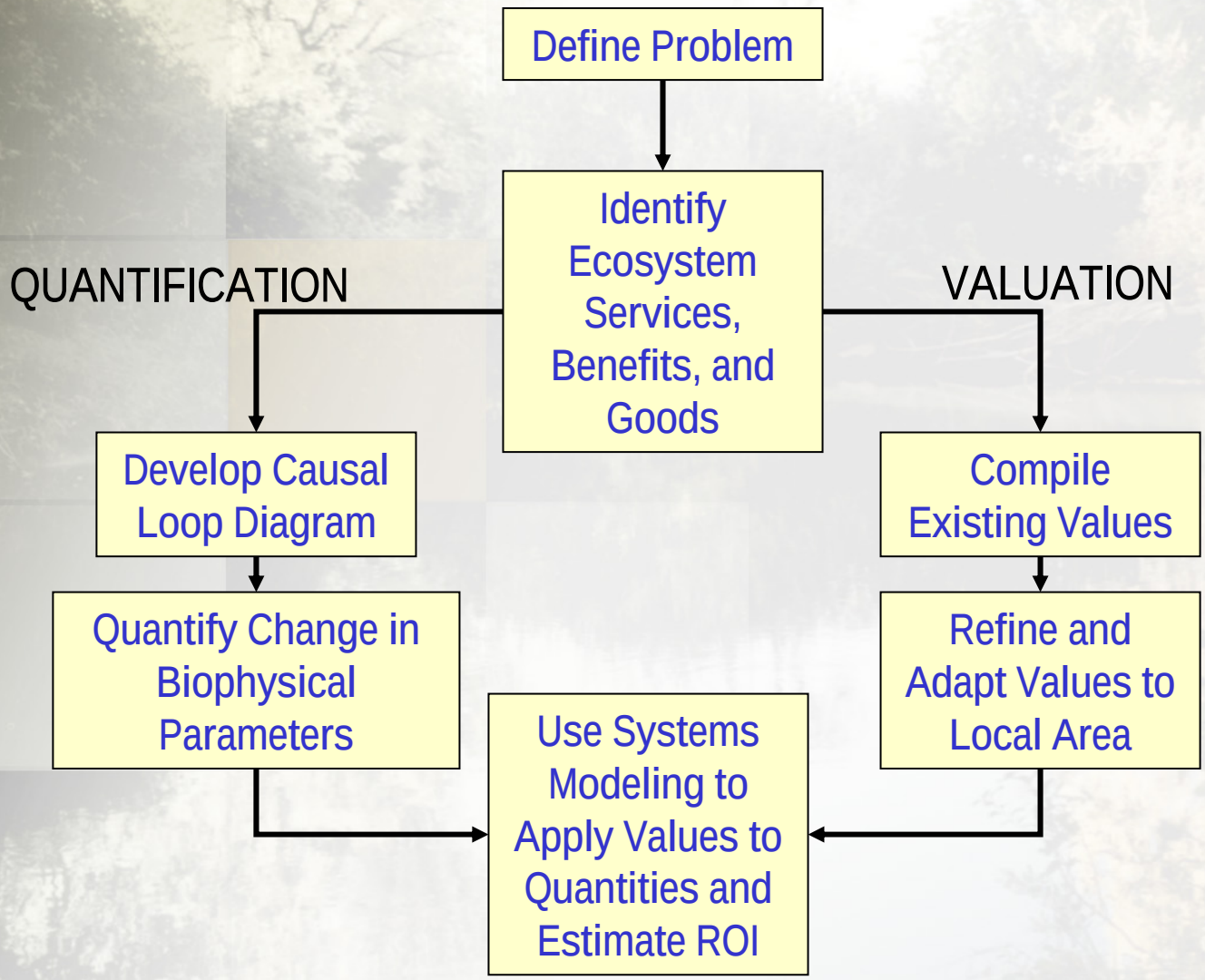
CUMULATIVE EFFECT ON RESIDENTIAL STORMWATER CHARGES



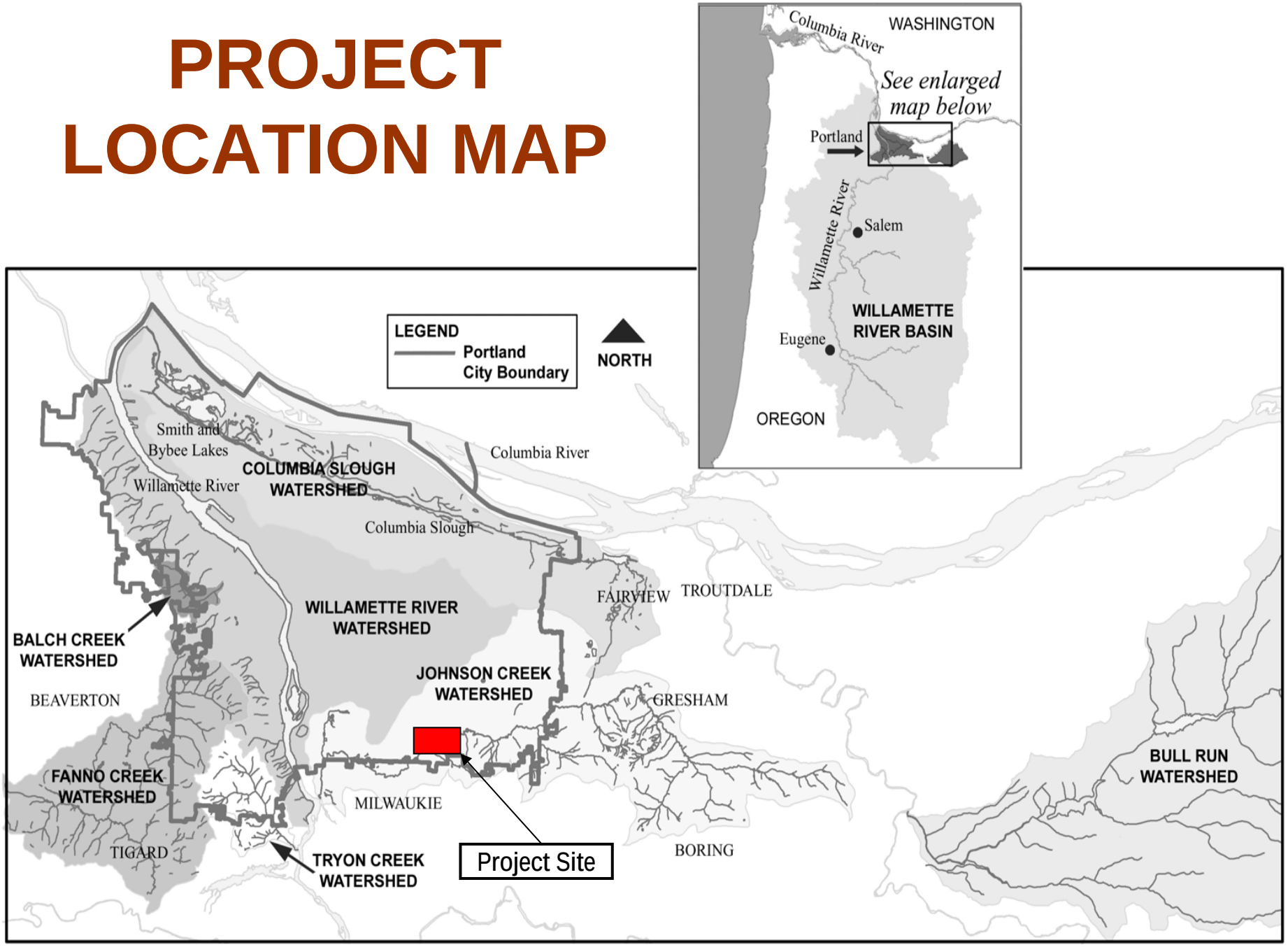
PURPOSE AND NEED FOR VALUATION TOOL

- Identify actions that create the most benefit for meeting long term, multiple objectives (greatest return on investment).
- Provide a quantifiable basis for changing regulatory environment to be more receptive to multi-objective, cost-effective approaches.

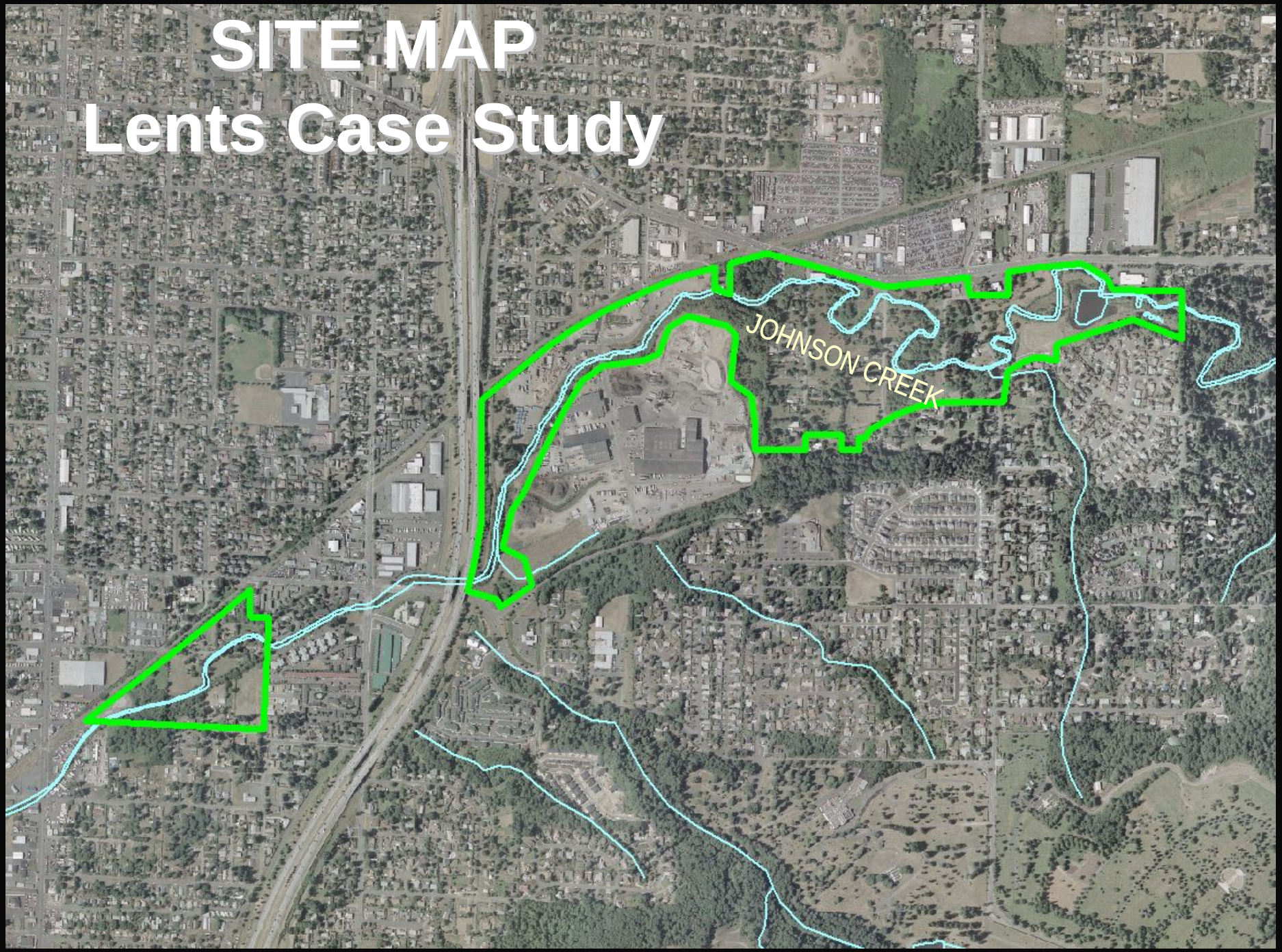
HOW DOES ANALYSIS WORK?



PROJECT LOCATION MAP



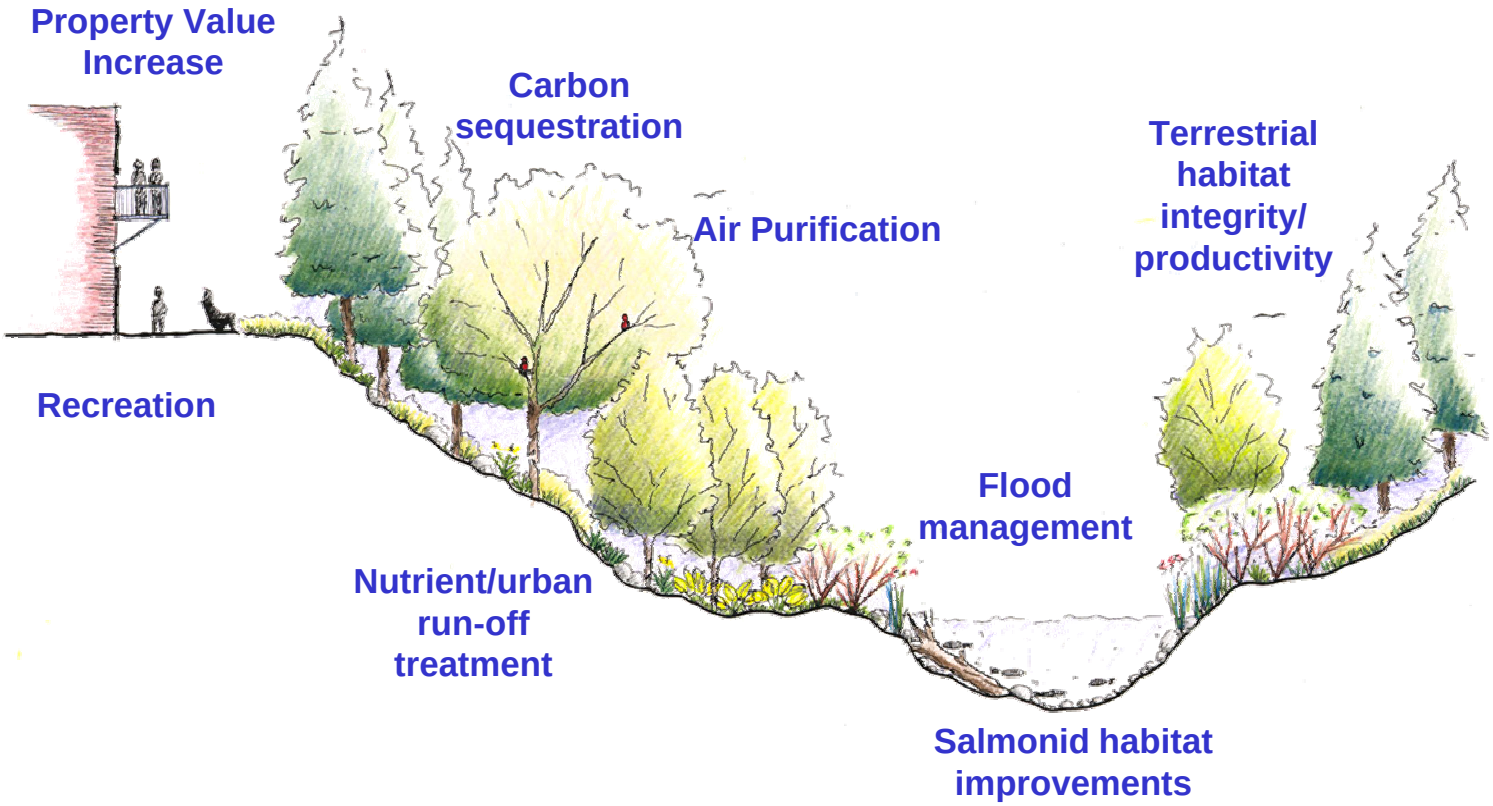
SITE MAP
Lents Case Study



DEFINE PROBLEM

- Symptoms
  - Flooded homes, businesses, and roads
  - Degraded water quality
  - Threatened fish
  - Human health concerns
- Why?
  - Markets not accurately reflecting costs of removal of wetlands, riparian areas, forested areas
  - Increasing impervious surface and increasing demand for buildable lands

ECOSYSTEM PROCESSES



IDENTIFY ECOSYSTEM SERVICE VALUES

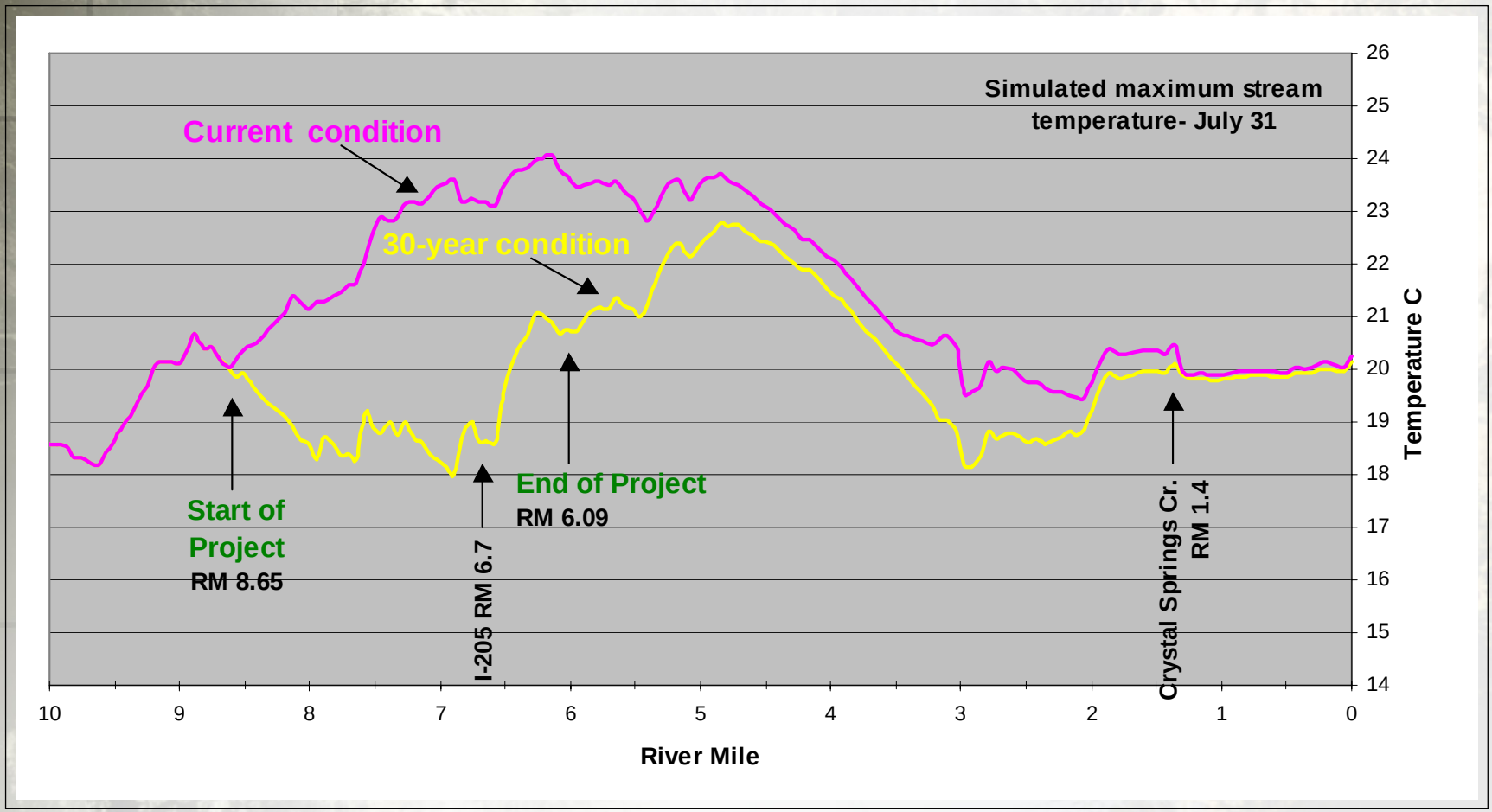
Ecosystem Services (condition or process)	Water Purification
Benefits (enhance well-being)	• Clean water for recreation • Aquatic species population stabilization • Potable water
Goods (yield economic utility or satisfy an economic want)	• Avoided CWA & ESA compliance costs • Avoided water treatment costs • Increased recreation
Values (monetary worth)	• $$$

ANALYTICAL STEPS

- Systems thinking - understand types of relationships (does water temperature decrease as shading increases?)
- Biophysical modeling - quantify change in *biophysical conditions* from current condition to potential impacted or restored condition
- Economic modeling - quantify change in *economic conditions*

STREAM TEMPERATURE QUANTIFICATION

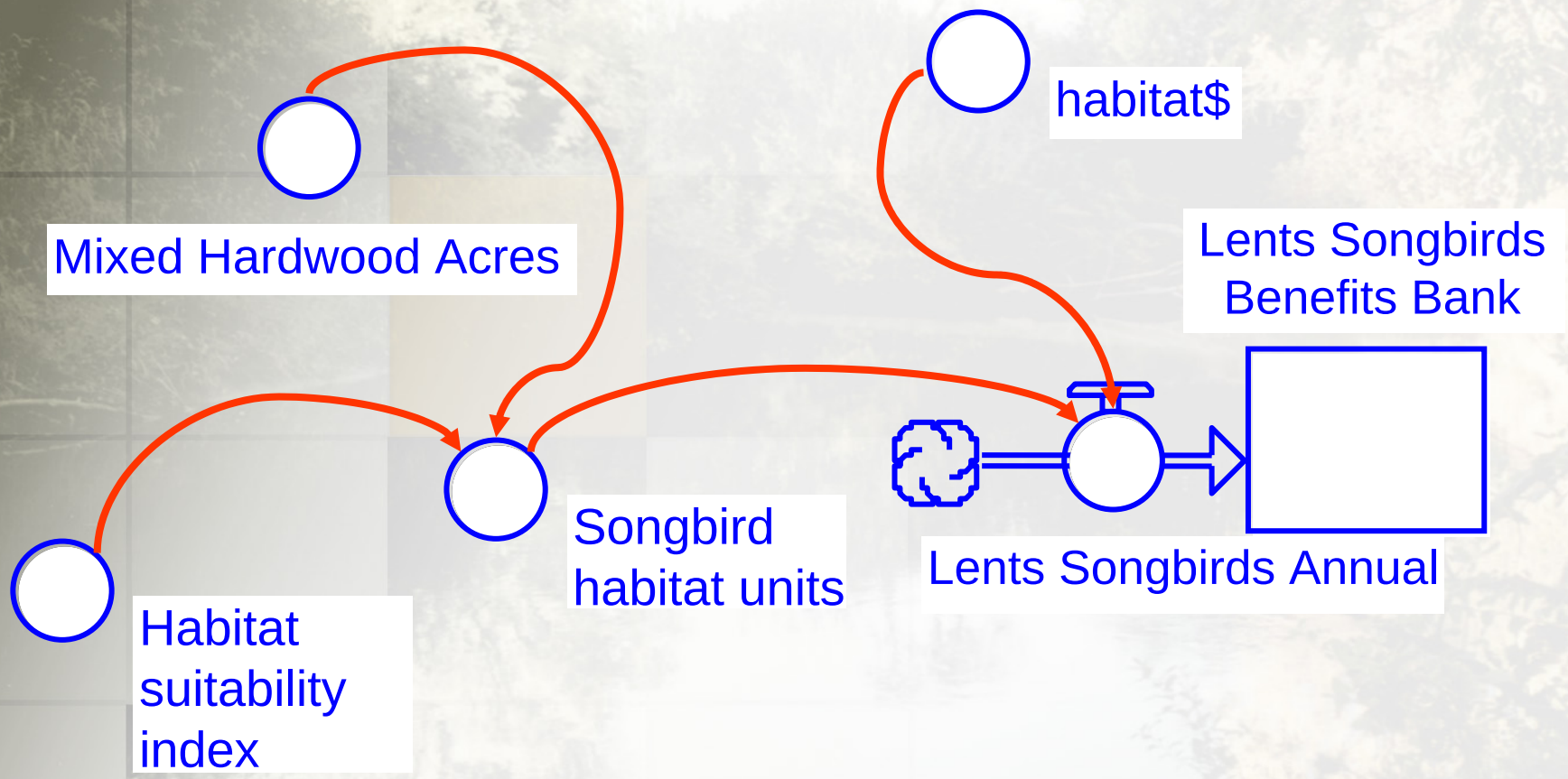
DEQ's Heat Source 6.5.1 model



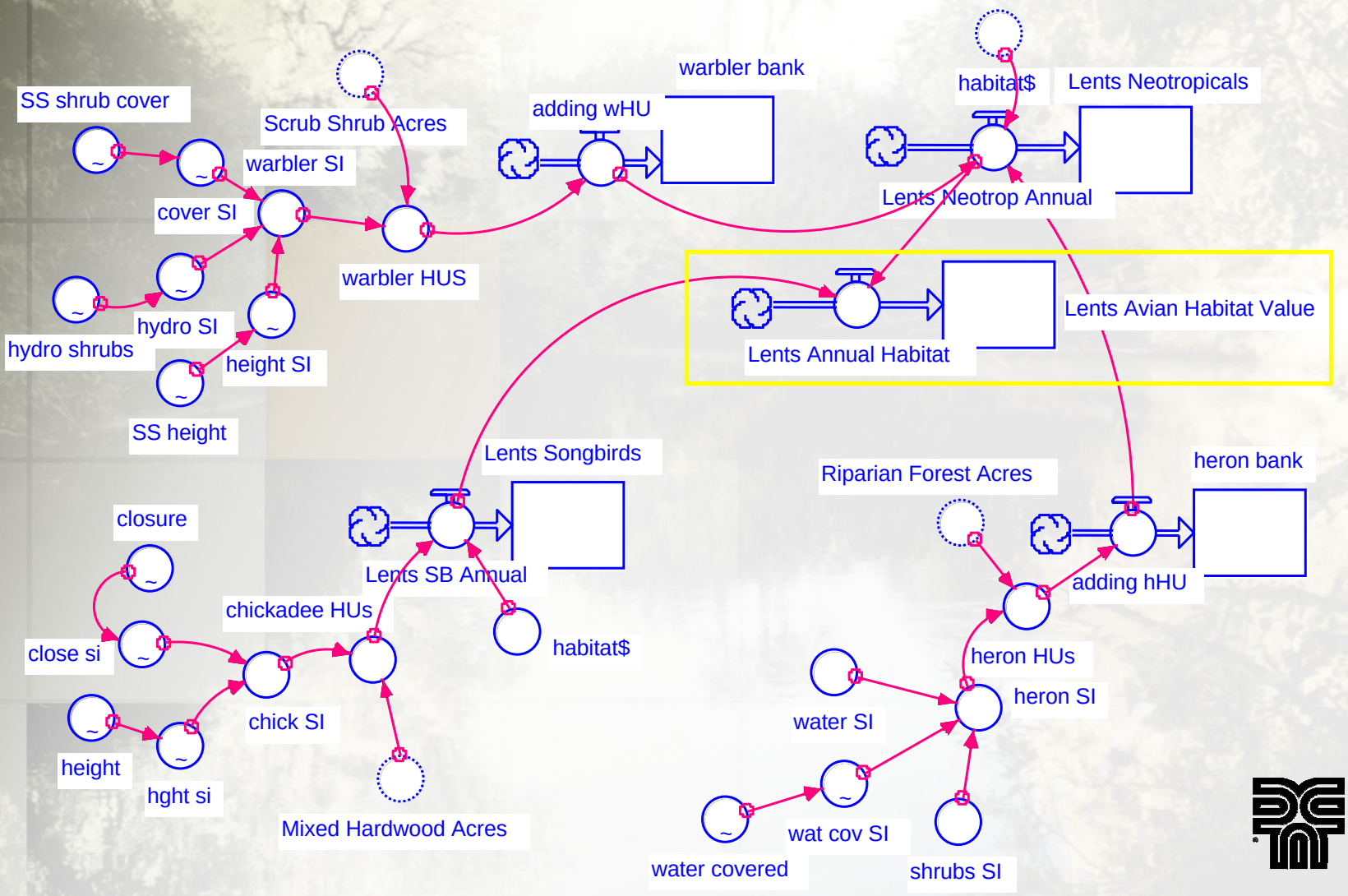
ECONOMIC VALUES OF ECOSYSTEM SERVICES

- Salmon recovery (Helvoigt & Montgomery 2003)
- Water quality (Woodward & Wui 2001)
- Property values (Lutzenhiser & Netusil 2001)
- Air quality (American Forests, US OMB, CA Energy Com.)

BUILDING THE MODEL



HABITAT SUITABILITY MODEL



RUNNING THE MODEL

Slider bars help engage stakeholders, use value ranges, and run different scenarios

FLOOD COST ESTIMATES

Foster Road Closure Costs/Vehicle

30.0 — 35.0 — ? — 32.2

Residential Flooding Costs

60000 — 80000 — 67000

Business Flooding Costs

400000 — 520000 — ? — 460000

COP Flooding Costs

4000 — 6000 — ? — 5000

Utility Line Flooding Costs

9100 — 11900 — ? — 10500

Flood Duration

0 — 24 — ? — 10

Motorist Delay Time

0.0 — 3.0 — ? — 1.0

RECREATION VALUE ESTIMATES

Annual Park Visitation Estimate

0.00 — 1.00 — ? — 0.02 x 10^6

Recreation Value per Visitor

3.0 — 8.0 — ? — 4.0

AIR QUALITY VALUE ESTIMATES

Carbon Monoxide $/lb removed

0.00 — 1.00 — ? — 0.44

Carbon $/ton removed

8.5000 — 10.5000 — ? — 9.5000

Particulate Matter(10) $/lb removed

1.0500 — 3.0500 — ? — 2.0500

Sulfur Dioxide $/lb removed

0.2500 — 1.2500 — ? — 0.7500

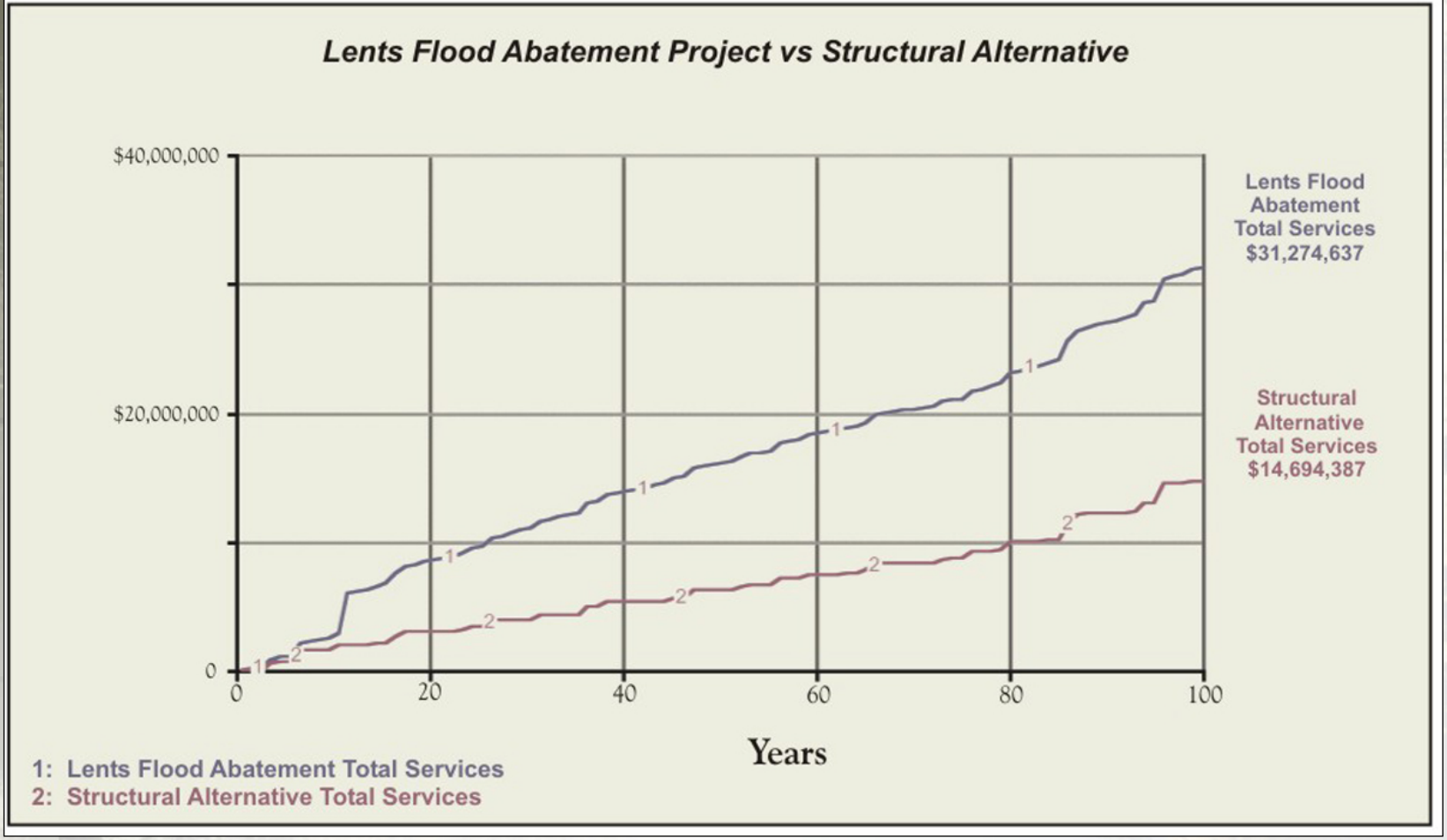
Ozone $/lb removed

2.0700 — 4.0700 — ? — 3.0700

RESULTS

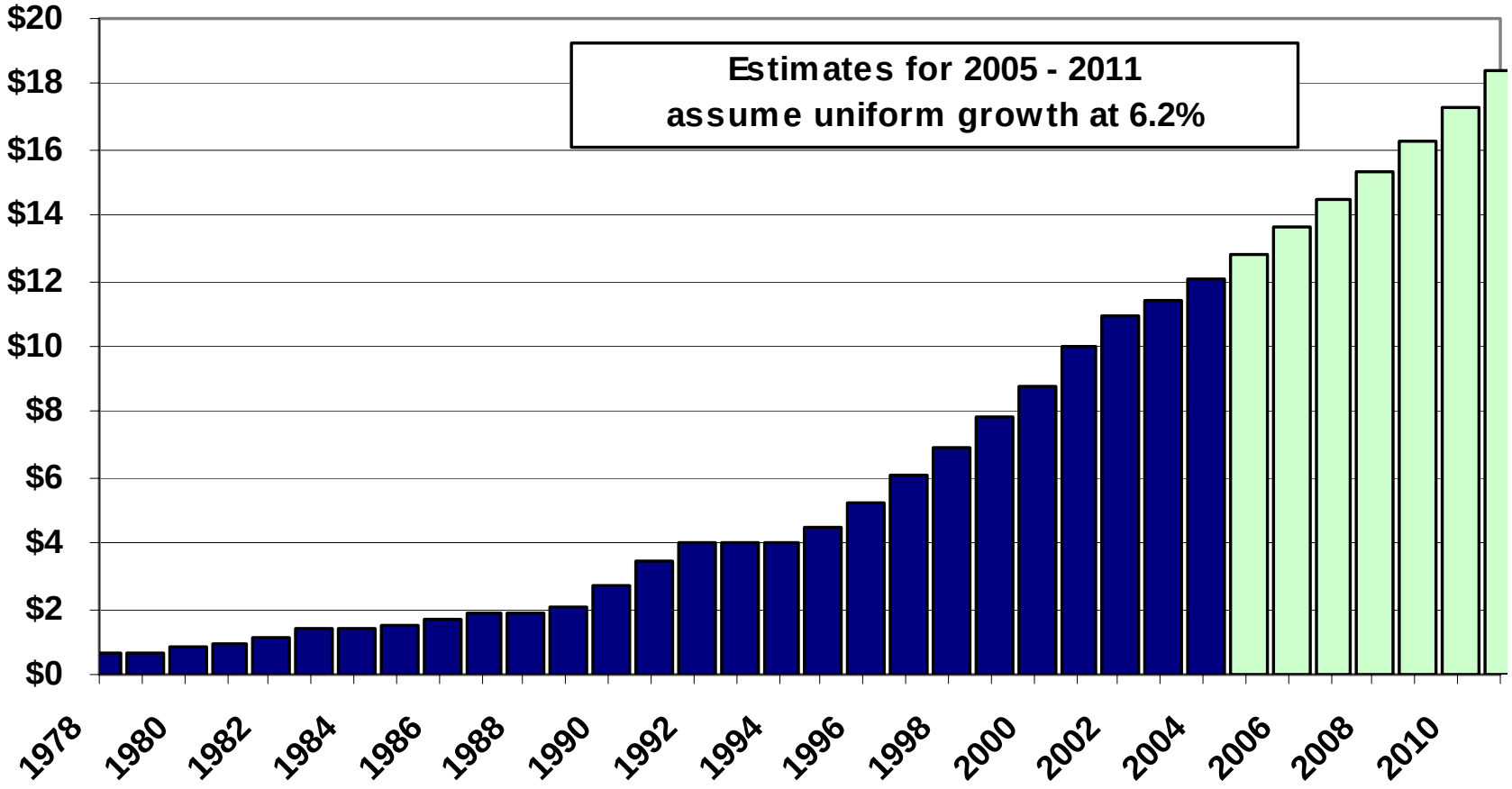
Ecosystem Services	Value accrued over 100 years (reported in 2002 $)	Percent of Long-Term Value
Bird Habitat	$ 1,600,461	5%
Salmonid Habitat	$ 4,105,603	13%
Avoided Flooding	$14,694,387	47%
Air Pollution Removal	$ 2,544,635	8%
Water Quality Improvement	$ 2,388,982	8%
Increased Property Value	$ 2,832,346	9%
Recreational Opportunities	$ 3,108,225	10%
Gross Benefits	**$31,274,639**	**100%**

COMPARISON

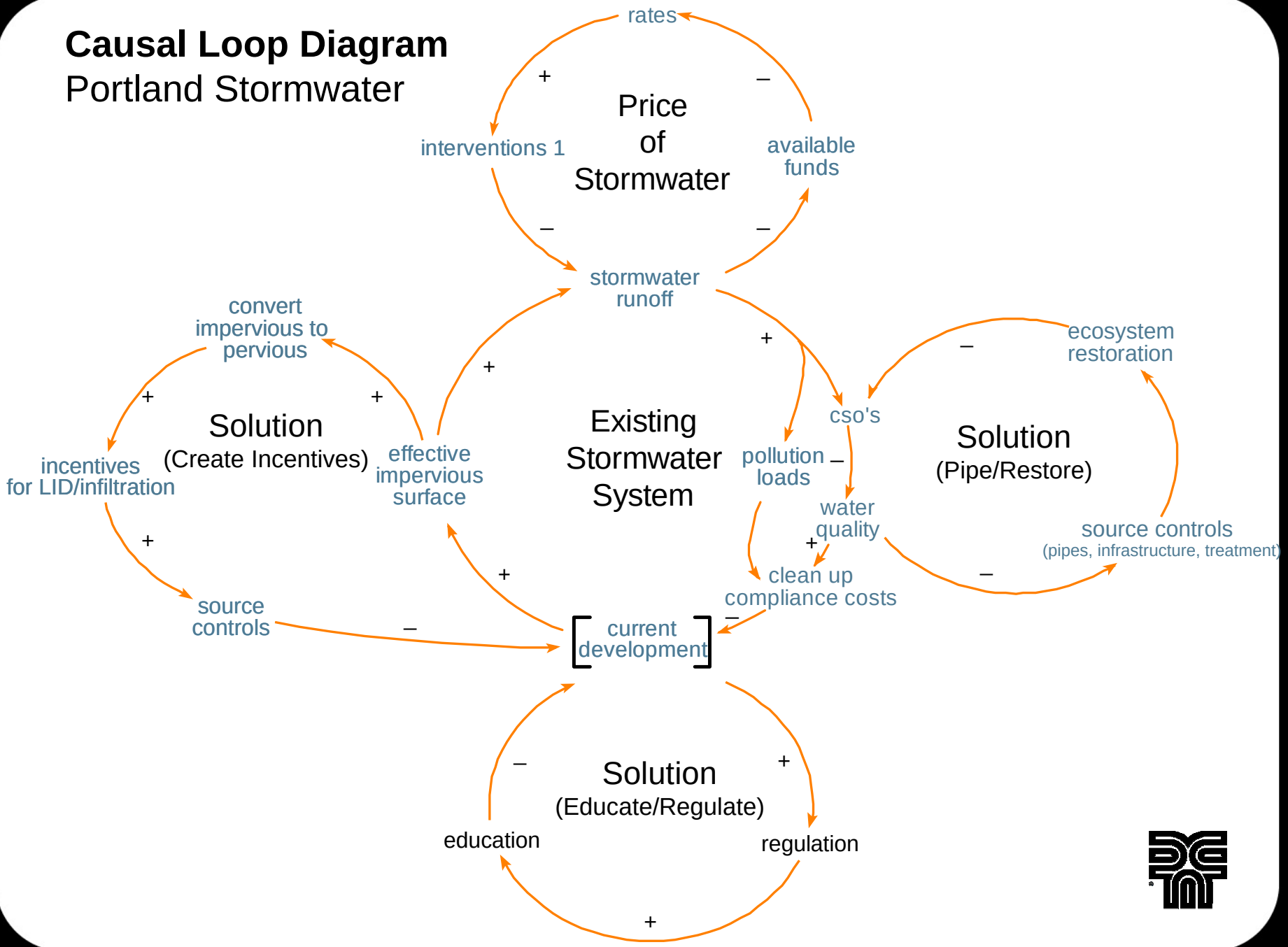

Lents Flood Abatement Project vs Structural Alternative
$40,000,000
$20,000,000
0
0
20
40
60
80
100
Years
Lents Flood Abatement Total Services $31,274,637
Structural Alternative Total Services $14,694,387
1: Lents Flood Abatement Total Services
2: Structural Alternative Total Services

NEXT STEPS

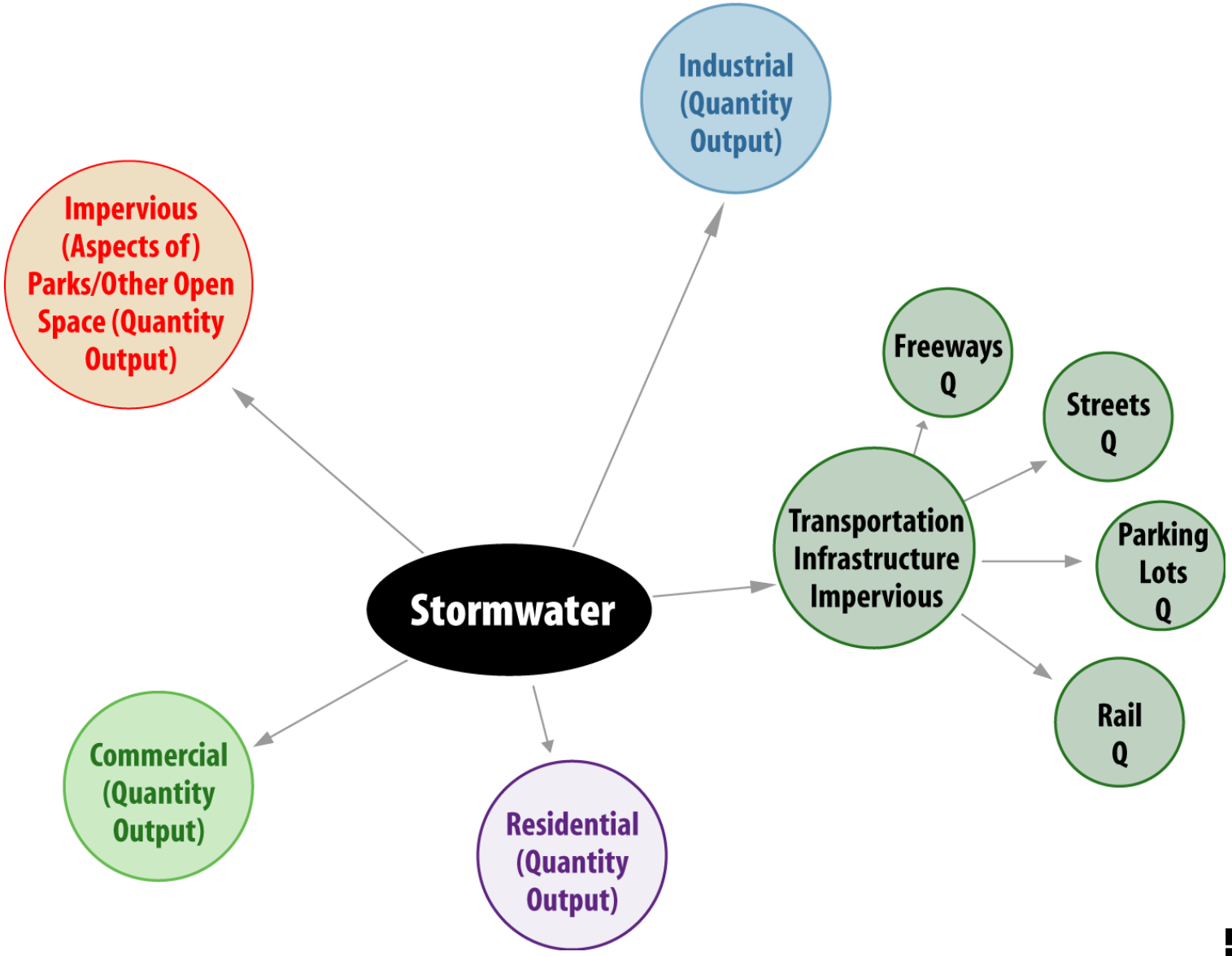
- Identify the costs and the value of stormwater
- Create a market-based approach to stormwater management


Average Monthly Residential Charges
Sanitary Sewer, Stormwater and Account Service
Estimates for 2005 - 2011
assume uniform growth at 6.2%
$20
$18
$16
$14
$12
$10
$8
$6
$4
$2
$0
1978
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010

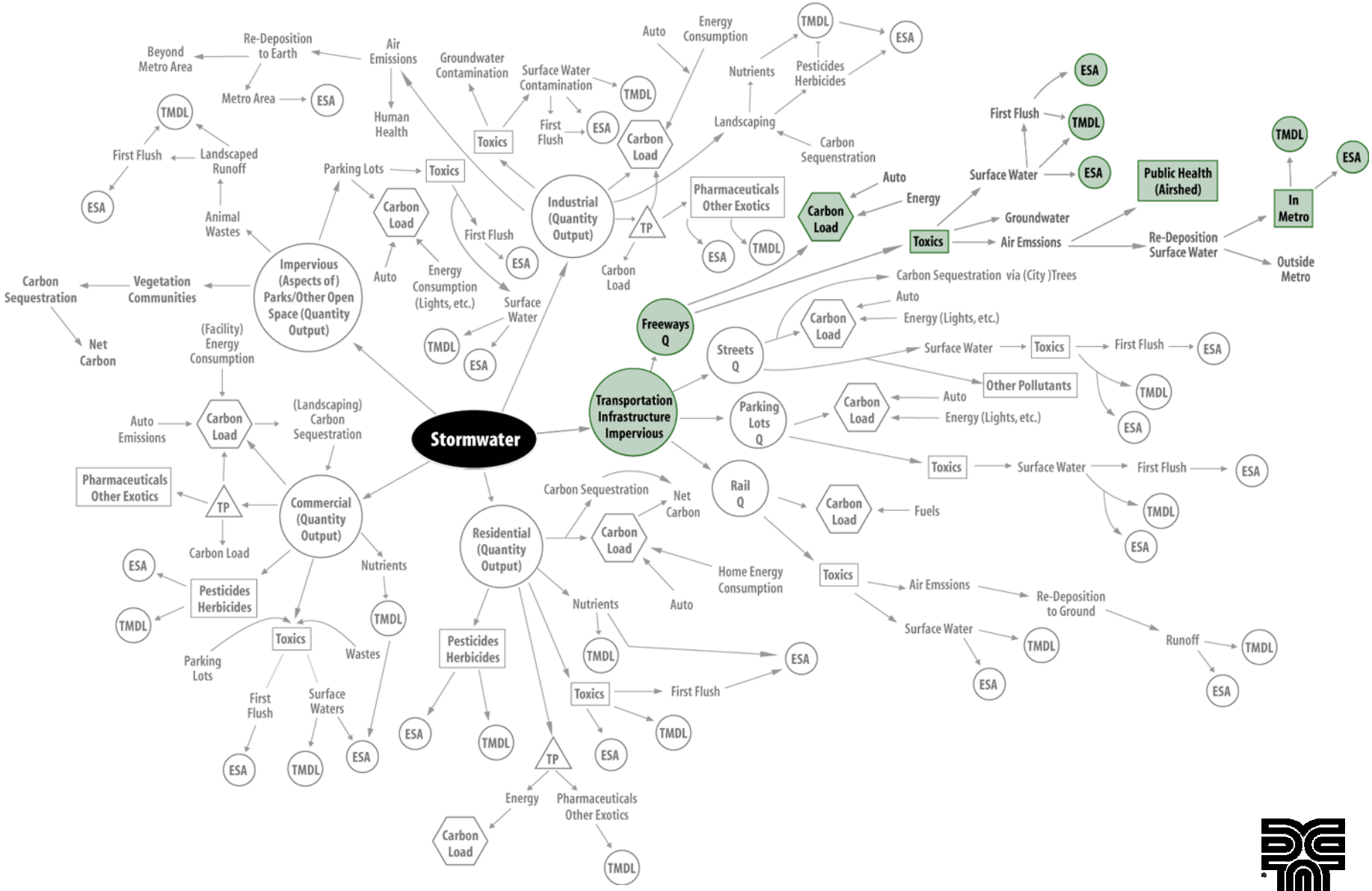
Causal Loop Diagram
Portland Stormwater



Stormwater Pathways

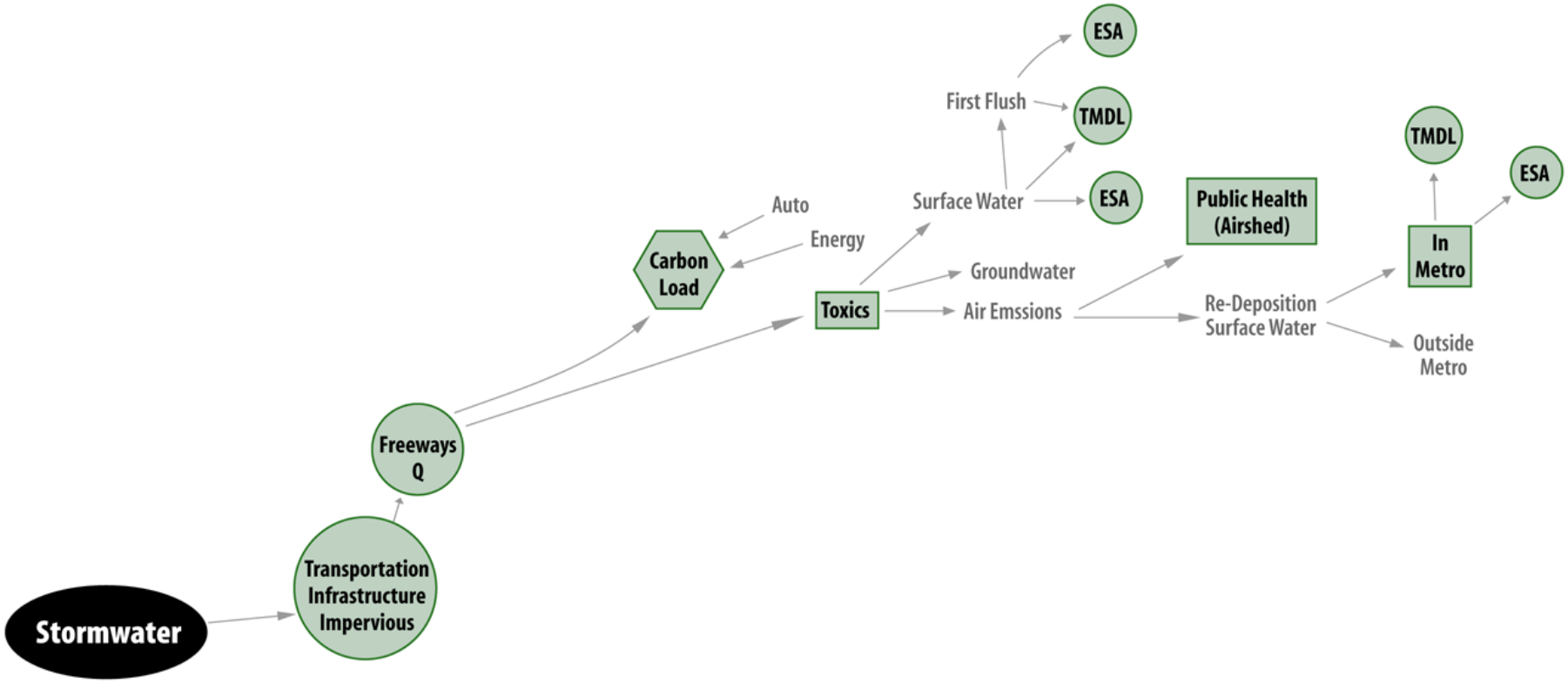


Systems Map



Stormwater
Transportation Infrastructure Impervious
Freeways Q
Streets Q
Parking Lots Q
Rail Q
Industrial (Quantity Output)
Impervious (Aspects of) Parks/Other Open Space (Quantity Output)
Commercial (Quantity Output)
Residential (Quantity Output)
Carbon Load
Toxics
TP
Public Health (Airshed)
In Metro
Pharmaceuticals Other Exotics
Other Pollutants
Pesticides Herbicides
Air Emissions
Re-Deposition to Earth
Beyond Metro Area
Metro Area
Human Health
Groundwater Contamination
Surface Water Contamination
First Flush
Landscaped Runoff
Animal Wastes
Parking Lots
Energy Consumption (Lights, etc.)
Surface Water
Vegetation Communities
Carbon Sequestration
Net Carbon
(Facility) Energy Consumption
Auto Emissions
(Landscaping) Carbon Sequestration
Nutrients
Wastes
Surface Waters
Energy
Pharmaceuticals Other Exotics
Auto
Energy Consumption
Landscaping
Carbon Sequenstration
Pesticides Herbicides
Carbon Sequestration via (City)Trees
Energy (Lights, etc.)
Fuels
Home Energy Consumption
Air Emssions
Re-Deposition to Ground
Runoff
Groundwater
Outside Metro
Re-Deposition Surface Water
ESA
TMDL

Stormwater Fate & Costing



City of Portland, Bureau of Environmental Services
www.cleanrivers-pdx.org/
Jim Middaugh, JimM@bes.ci.portland.or.us
503-823-7032

David Evans and Associates, Inc.
www.deainc.com
Gillian Ockner, gcf@deainc.com
503-223-6663

ECONorthwest
www.econw.com
Ed Whitelaw, whitelaw@eugene.econw.com
541-687-0051