Economics in the Watershed

CALFED Watershed Partnership Seminar
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Economics in the Watershed.

I. Economists View of the Watershed.

II. What Economics Is.

III. Analytical tools of Economics.

IV. Creating Markets-Cap and Trade.

V. Incentives. Vs. Creating Markets.

VI. Benefits and Costs-Parcel Level Infiltration.

Challenges Facing Watershed Managers.

Statewide pressure on water supplies.

- Population Growth and Urbanization.
- Climate Change.
- Increased Environmental Demands.
- TMDL Regulation.
- Public Pressure.

Water Quality Concerns

Integration with other priorities.

- Open Space.
- Housing, etc.

The Toolbox for Confronting these Challenges is Limited.

Education

- Relies on voluntary actions.
- Difficult to measure effectiveness.

Public Projects

- Financing.
- Treating symptoms?

Regulation and Enforcement

- Better suited to a few big problems.
- Politically difficult.

Economics can expand the toolbox.

Economics is the Study of the Optimal Use of Scarce Resources.

What Economics is not:	Running a business
	Magical money tree.
	Pro-government or pro-business.
Best use of resources:	Fulfill pre-determined goal=Cost-Effectiveness.
	Greatest benefit to society=Optimality.
Individual decision making:	Are individual incentives aligned with policy goals?
	Can policies change individual decision making.

Getting the most from what you have.

Cost-Effectiveness v. Get the Job Done Now.

Public Projects	Do more with less. Builds support. Learning for the future.
Regulation	Decrease opposition. Easier enforcement.

Economist's Eye on the Watershed.

Economists sees unpriced runoff

Economists sees underpriced water

Problems can be traced to lack of correct economic incentives

Economics often Examines Decentralized, Incentive-Based Solutions.

Markets

- Water Markets
- Water Quality tradable permits.
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Prices

- Marginal cost water pricing.
- Pollution charges
- Subsidies for pollution control.

The goal is to solve the problem by altering the incentives for individual actions

Policy Analysis.

Project Cost-Effectiveness	• Marginal contributions to the goal. • System-wide optimization.
Regulation	• Unintended consequences. • Effectiveness.
Voluntary action.	• When might it be effective?

Marginal Analysis and individual incentive key to any policy decision.

Problem: Sediment Runoff

Think Marginal.

Solution 1: New Irrigation.
1 ton reduction.
$100,000

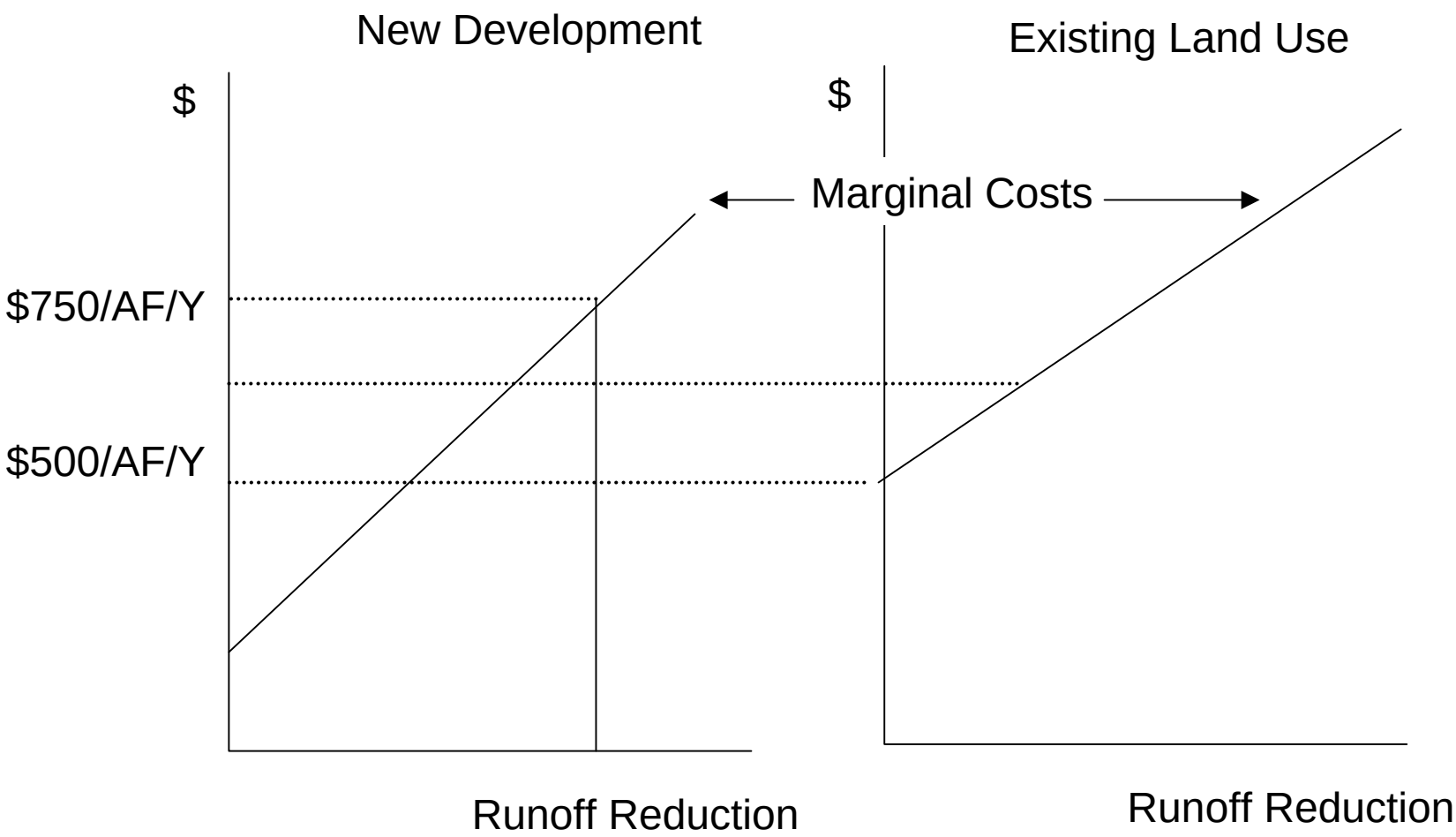
Solution 2: Wet Pond
1 additional ton reduction
$ 400,000

Average Cost:
$250,000/Ton

Alternative BMP:
$200,000 Ton

Incremental Costs:
1st ton: $100,000
2nd ton: $200,000

Thinking on the Margin and Incentive-Based Solutions.



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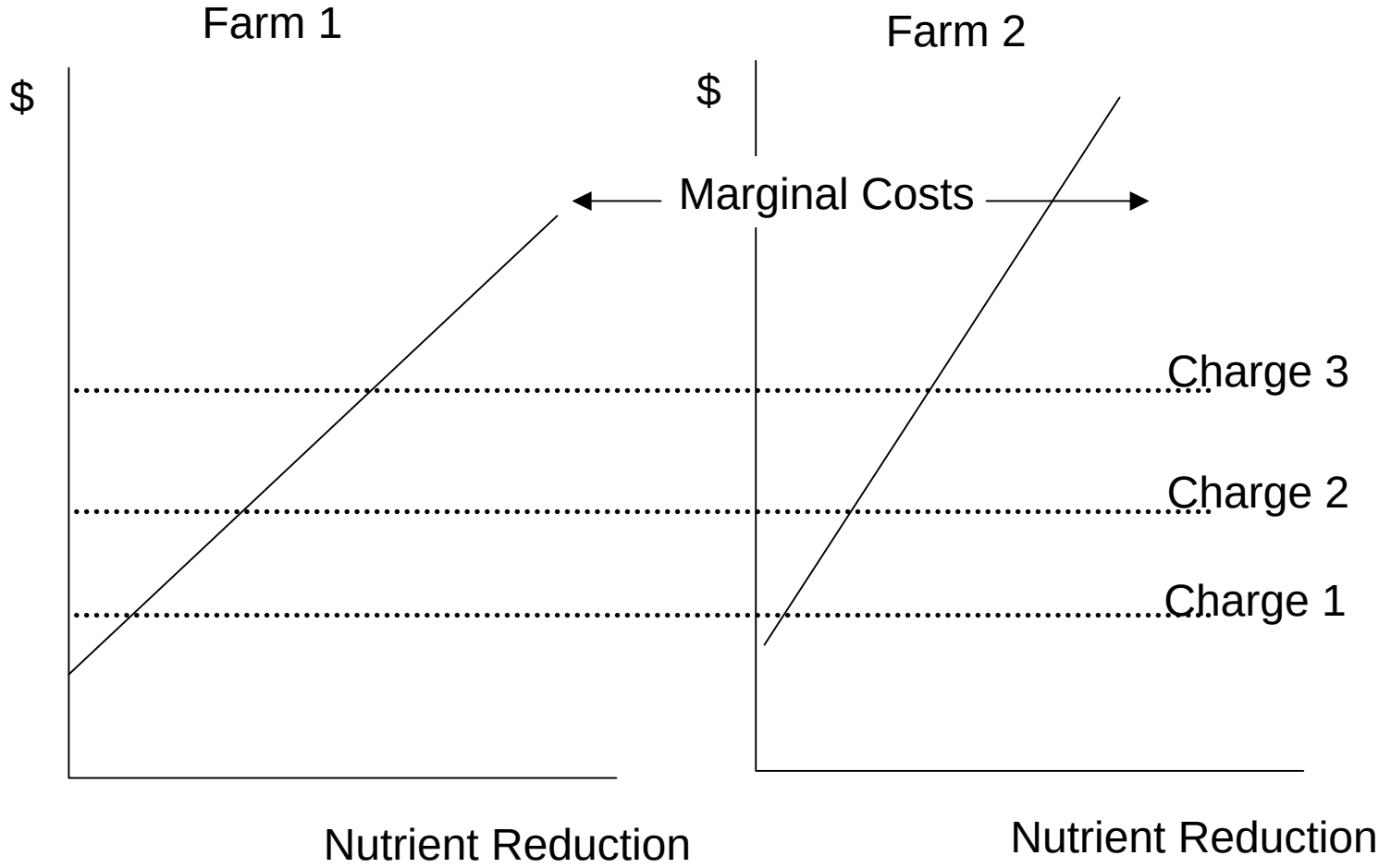
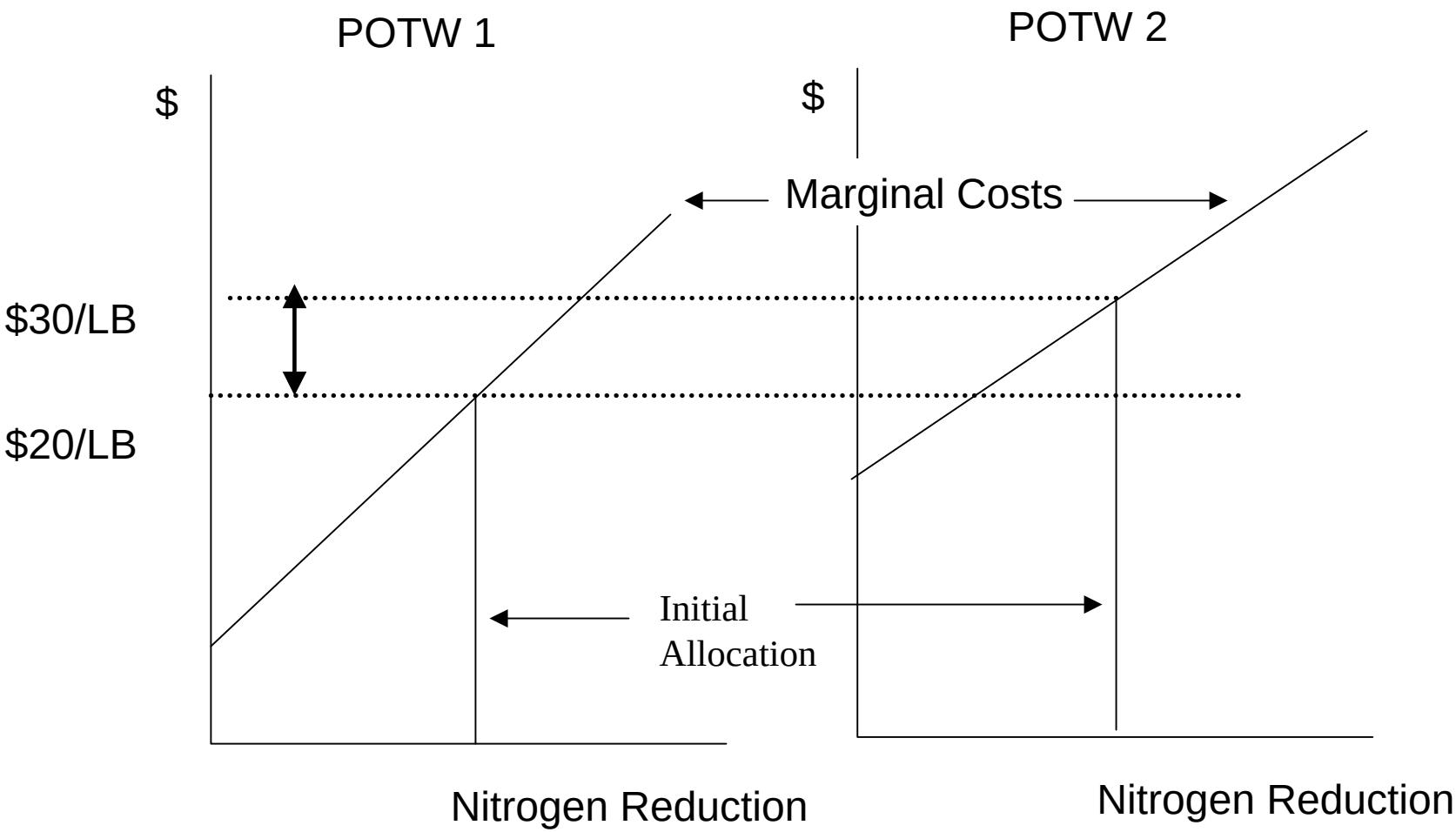
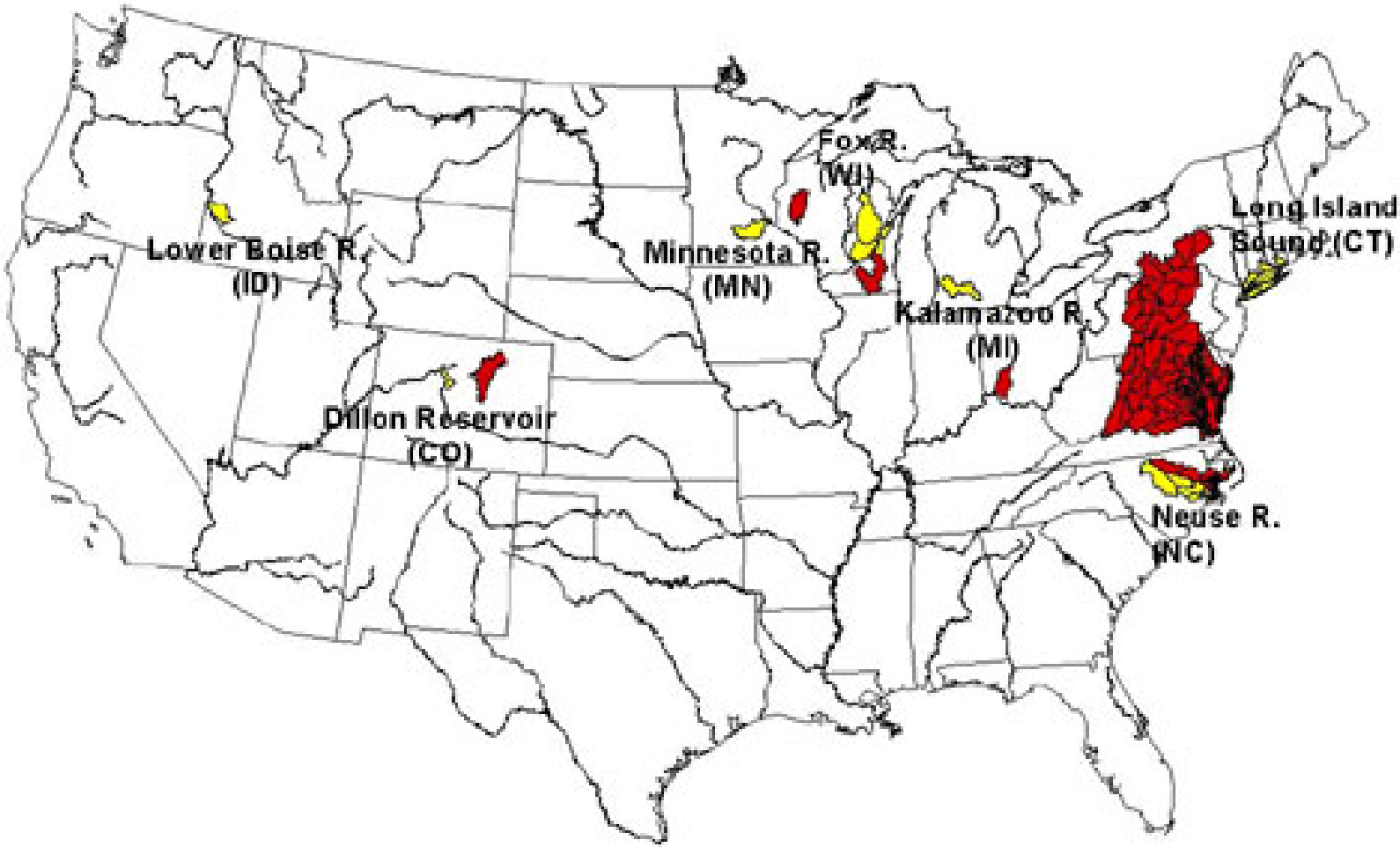


With Cap and Trade, Financial Burden is Decreased.



Trading Programs.



Taking Cap and Trade to Watersheds is Complex.

Multiple Pollutants

- Phosphorous and Nitrogen
- Trading ratio between them?
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Hot Spots

- Trading can concentrate pollution.
- Modeled and Prohibited.

Non-Point and Point sources.

- Point Sources POTWs easy to monitor
- Non-point control cheap?
- Hard to “Cap” non-point.

Spatial relationship

- Dissipation from discharge point.
- Model Equivalent Credits

Long Island Sound Experience is a Success.

Participants	• 78 POTWs.
Tradable Permit Allocation	• Reduction in excess of permits.
Pollutants	• Nitrogen only
Hot Spots	• Must still meet local waterbody standards.
Spatial relationship	• Nitrogen credit allocation based on distance to sound.
Savings	• About $200 Million of an estimated $1 Billion.

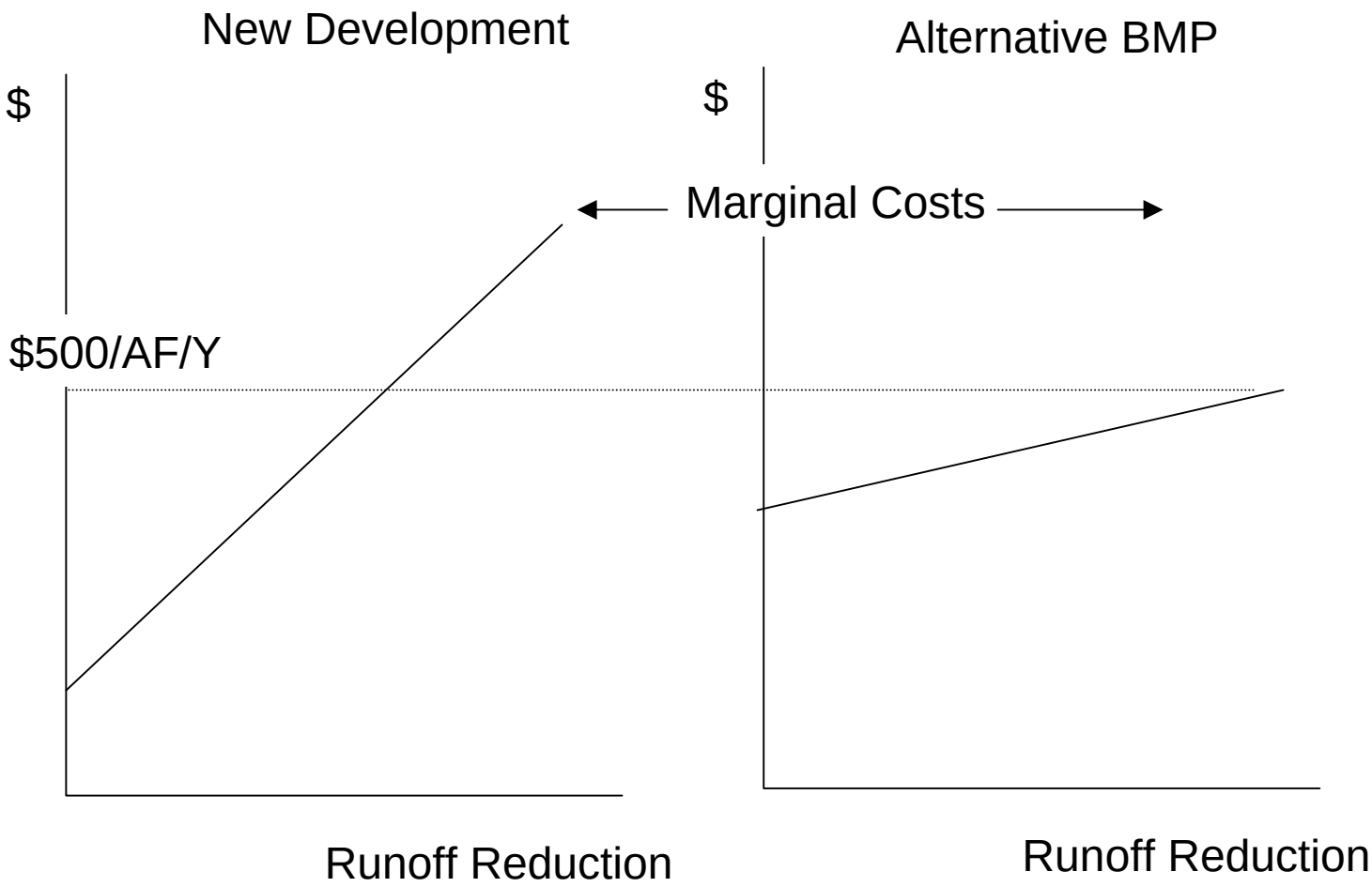
More complex designs have not worked well.

Incentives instead of Trading?

Charge and Rebate Systems	• Fees on polluters • Reductions on fees for BMPs
In-Lieu Fees	• Applies to parties subject to regulation • Allow exemption from part of regulation for a fee.
Subsidies	• Direct payments for runoff/pollutant reduction.
Auctions	• Landowners bid to accept compensation for installing BMPs.

The goal is to avoid high marginal costs and find low marginal costs.

In-Lieu Fees Can Avoid the Highest Costs.



Economic Incentives for On-site Residential Stormwater Control

Hale W. Thurston, William Shuster, Allison Roy, Matthew Claggett, Joshua Templeton, and Heriberto Cabezas

Office of Research and Development
National Risk Management Research Laboratory
Sustainable Technologies Division
Sustainable Environments Branch

Shepherd Creek Pilot Project

Objective:

We will test the legal and economic feasibility of installing on-lot stormwater BMPs in an existing subdivision and the hydrologic and ecological response to these BMPs

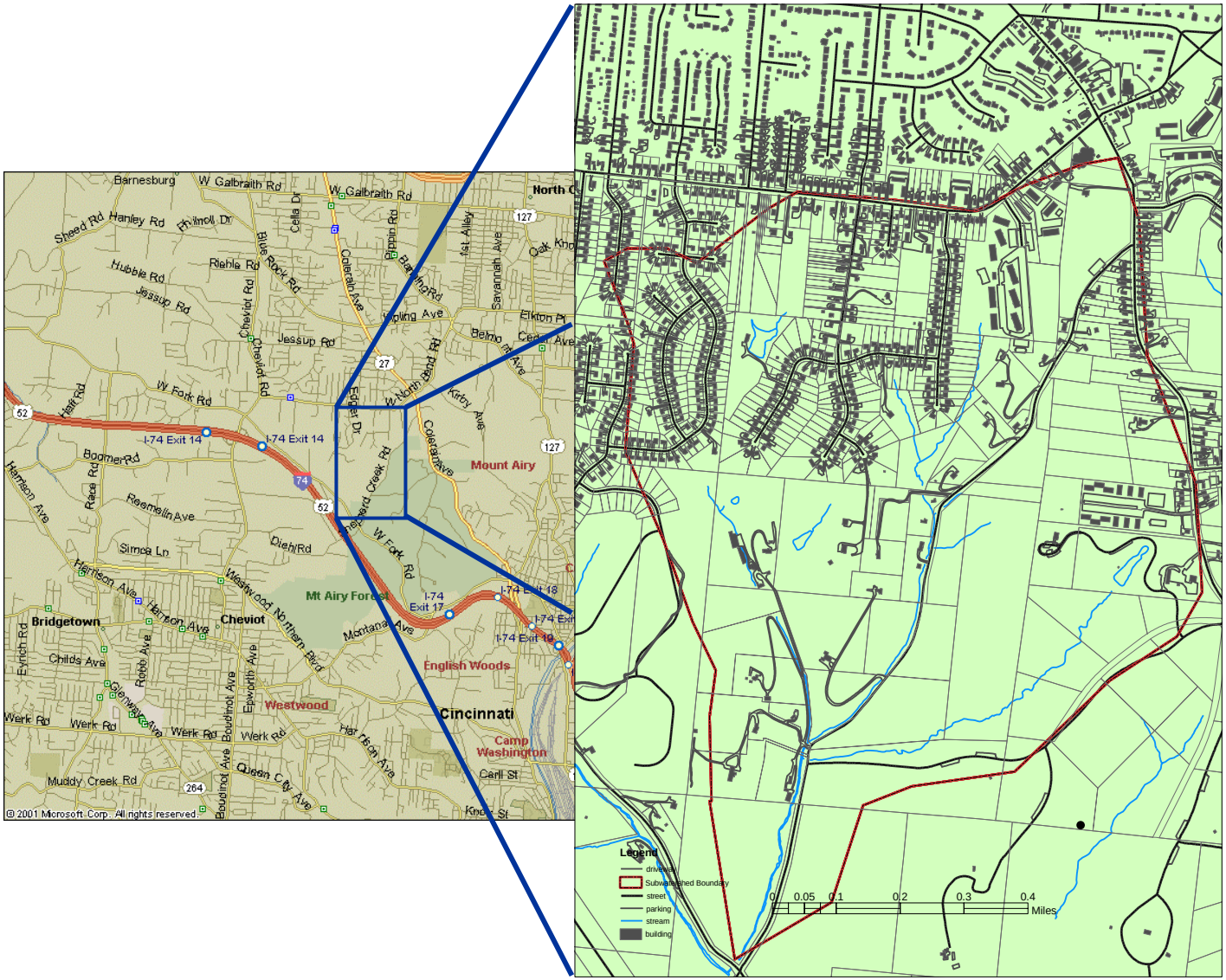
Research Questions:

1) Can a market-based mechanism provide appropriate incentives to install on-lot BMPs throughout this small watershed?

2) Will the incentives induce the placement of an adequate number of BMPs such that significant hydrologic and ecological improvements are realized in this watershed?

Pilot Project Area: Shepherd Creek

Figure 1. Impervious Surface in Shepherd Creek



Shepherd Creek Pilot Project

- **Challenge – no regulatory "stick."**
  - Water quantity not regulated under CWA (1972)
  - Can't use "cap and trade" in established neighborhoods like originally theorized
    - But could be used in new developments
- **Potential solution: use reverse auction to provide a "carrot" in the form of economic incentives**
  - Stormwater fees not tightly tied to excess runoff
  - BMPs will be distributed via a **voluntary economic auction**
  - Control runoff without necessitating a legal mandate
- **Bids will reflect landowner's willingness to accept BMPs while considering:**
  - construction and maintenance costs (included),
  - opportunity cost of land
  - non-market values

Combining Benefits and Costs
Parcel Level Infiltration in Los Angeles.

Bowman Cutter
Autumn Dewoody

Water Augmentation Study Sites.

Runoff captured from many impervious areas and infiltrated

Parcel-Level Infiltration Cost-Effectiveness in Southern California

Infiltration Benefits

- Infiltration $400-$900 benefit per Acre-Foot.
- Stormwater control avoided costs.

Cost of Infiltration BMPs

- Economies of Scale.
- Implicit land costs.

Evaluation of BMP strategies from specific sites

- Sites built by LASGRWC.
- Costs from project documentation.
- Constructed infiltration model.

Average Costs of Infiltration BMPs

Comparison is on void space equivalent

Depression Basins	• $1.00 - $3.00 per gallon. • Large surface area • ($10-$40 per square foot range.)
Porous Concrete	• $3.00-$5.00 per gallon • No land costs.
Infiltration Pits/ Biofilters	• $3.00-$5.50 per gallon. • Medium surface area.
Infiltration Leachfields	• $20 or more small BMPs (<6000 gallons) $10 for larger BMPs • No land cost even with large capacities.

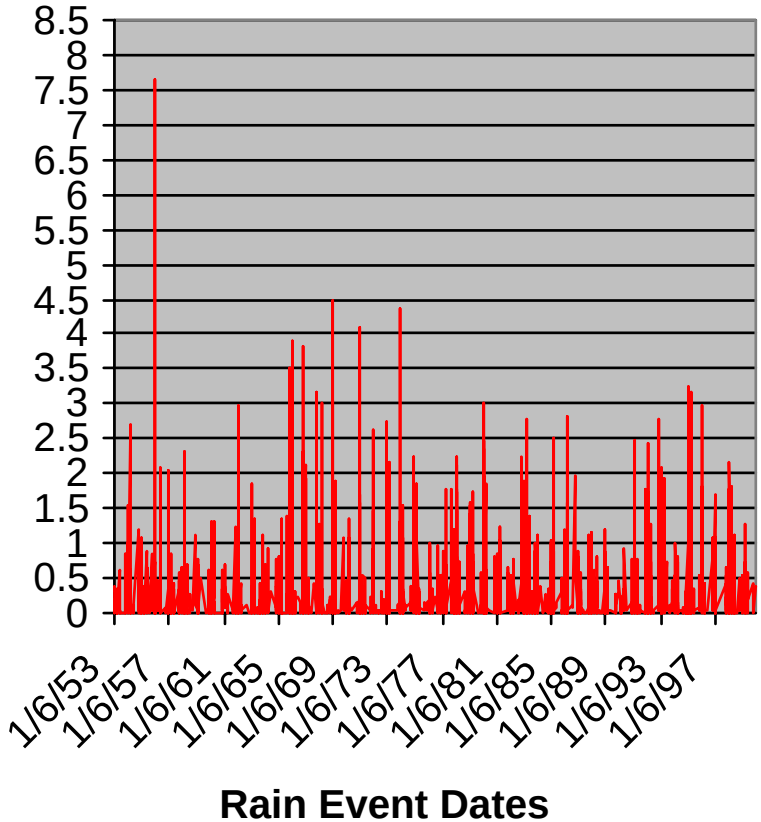
Stormwater control, not BMP size, is the target.

Los Angeles Rainfall Data, 1953-1999

- 46 years, 2,670 rain events
- Average depth: 0.26 inch
- Median depth: 0.07 inch
- Average duration: 3 hours

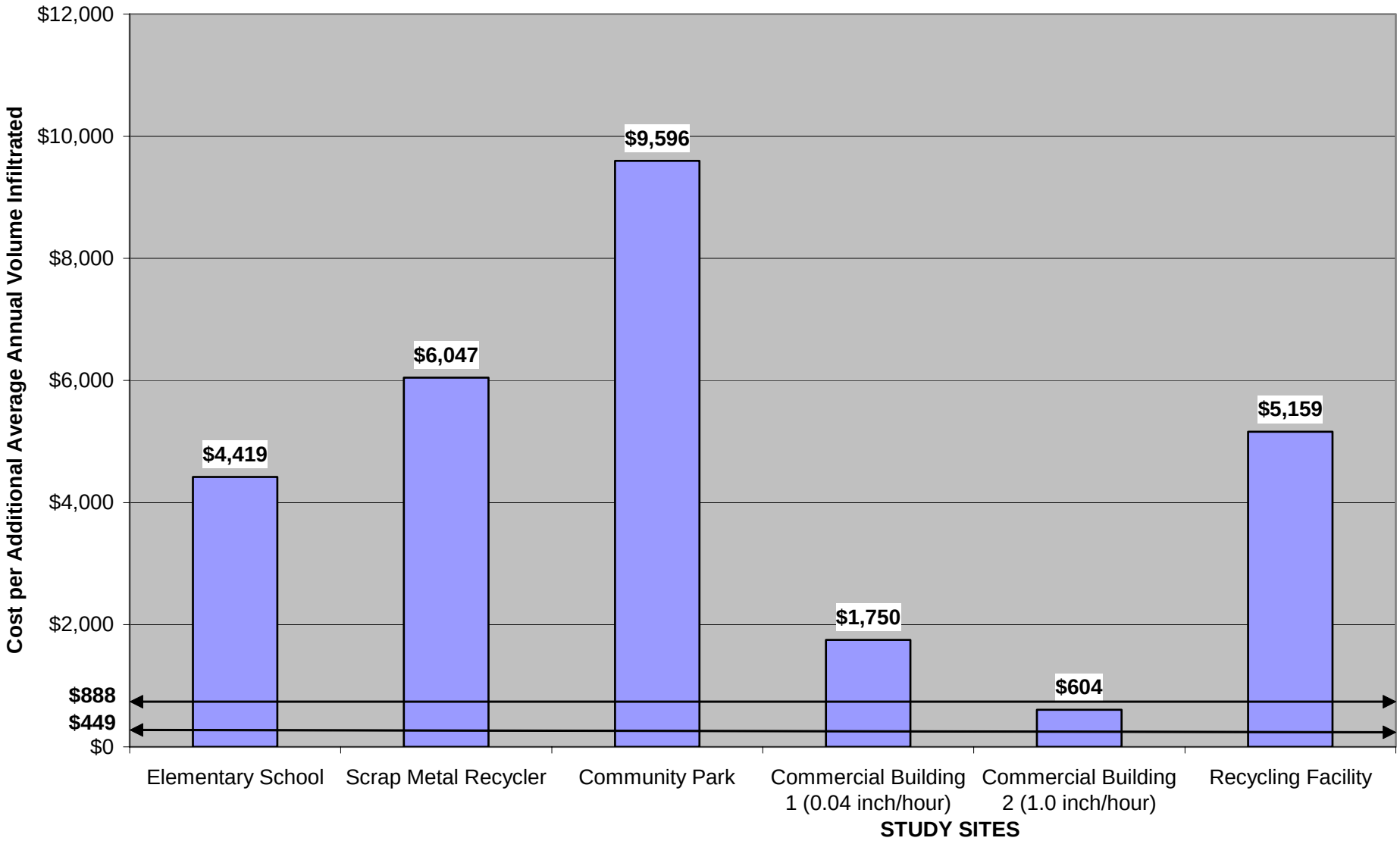
- **94% of events less than 1.0 inch**

- Smaller rain events of shorter duration occur most frequently!



→*Does it make sense to design for rare large storms.?*

Cost of Infiltrated Runoff



→ *Benefit of infiltrating 1 AF is estimated by Cutter (2007), $888 and DWP, $449.*

Conclusions.

- **Economics is about the best use of resources**
- **Thinking on the margin saves money.**
- **Economics tools aim to equalize marginal costs.**
- **Tradable permits and pollution charges original tools.**
- **Deposit/rebate, in-lieu fee, subsidies may be more workable.**
- **EPA examining pilot subsidy scheme for economic and ecological reasons.**
- **Parcel-level infiltration research indicates small storm design will be more cost-effective.**

Further reading

- Dewoody, A., Cutter W.B., Crohn D. 2006. Costs and Benefits of the Watershed Augmentation Study Sites. Policy Paper for the Los Angeles San Gabriel Rivers Watershed Council's Water Augmentation Study. (http://www.lasgrwc.org/WAS.htm)

- Roy, Allison H., Heriberto Cabezas, Matthew P. Clagett, N. Theresa Hoagland, Audrey L. Mayer, Matthew A. Morrison, William D. Shuster, Joshua J. Templeton, and Hale W. Thurston (2006) "Retrofit Stormwater Management," Stormwater, vol. 7, no. 3. pp. 16-29.

- Thurston, Hale W. (2006) "Opportunity Costs of Residential Best Management Practices for Stormwater Runoff Control," Journal of Water Resource Planning and Management, vol. 132, no. 2, pp. 89-96.

- Cutter, W.B. 2007 (In-Press). "Valuing Groundwater Recharge in an Urban Context." Land Economics. Accepted April 2006.