



**King County**

**Barton, Murray, Magnolia, and North Beach**



**Murray CSO  
Citizen's Advisory Group  
August 3, 2010**

**CSO Facilities**

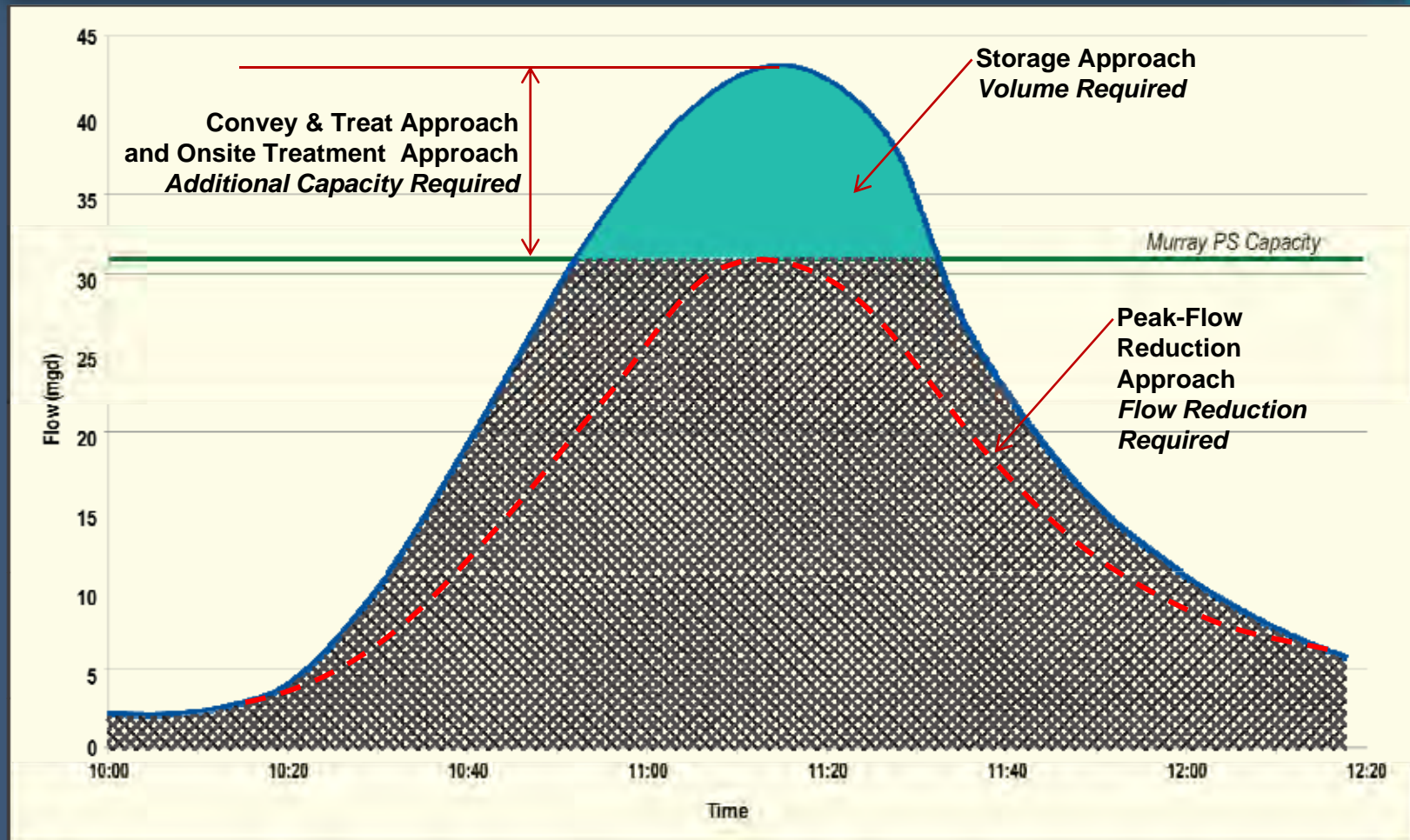
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# CSO Control Needs Determined From Hydrograph





# Alternatives Developed to Meet Basin Requirements

- What's required for a workable alternative:
  - Sufficient room to site and construct the facility?
  - Feasible to construct?
  - Will the alternative capture sufficient peak flow?

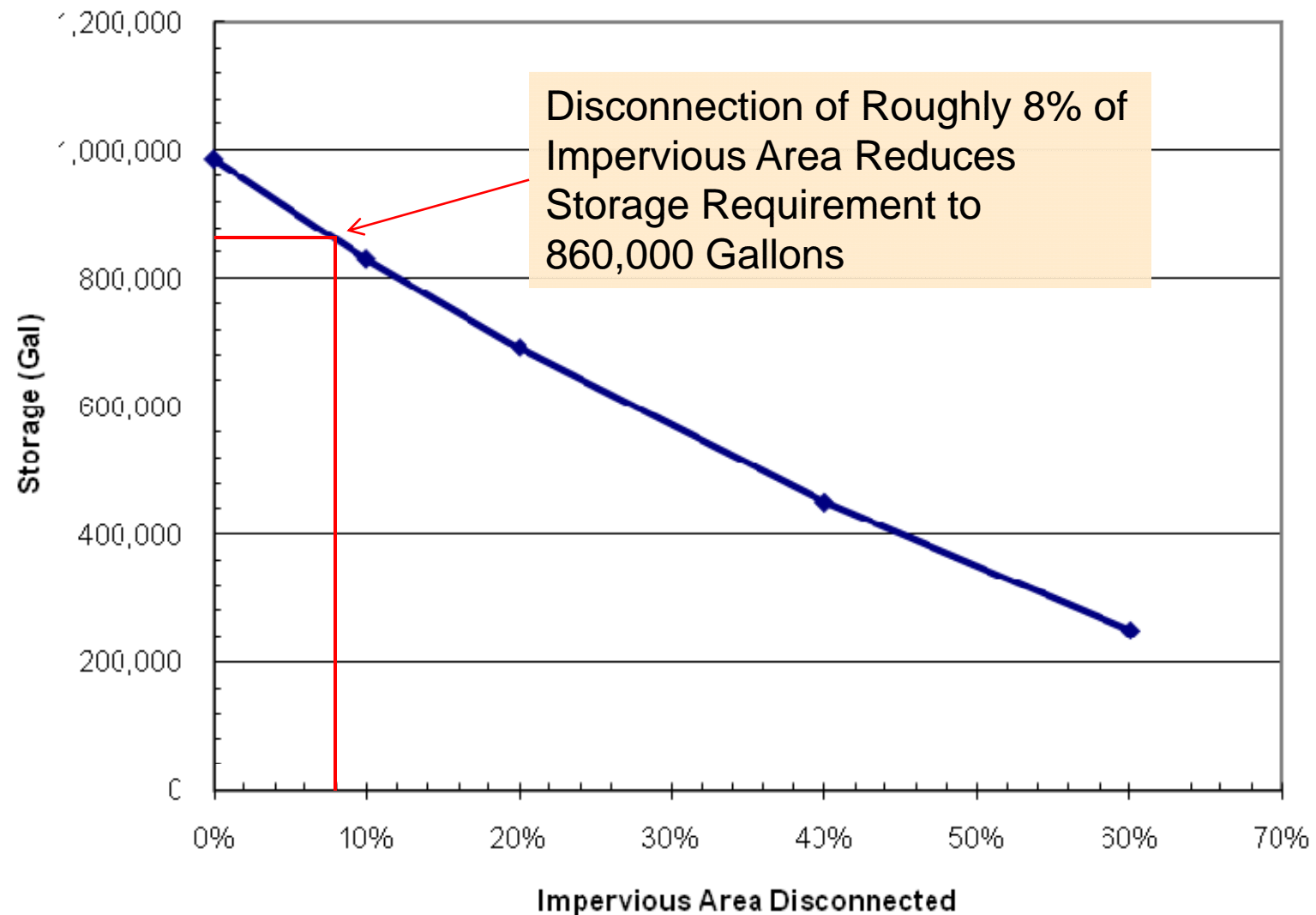


# 5A: Peak Flow Reduction Combined with Storage

- Characteristics:
  - Disconnect 10 acres of roof drains and street runoff in upper basin through traditional separation
  - Included re-routing of flows to new storm drain pipeline
  - Still required 0.86 MG of pipe storage along Beach Dr.



# Storage Reduction from Alternative 5A Impervious Area Disconnection



# Why Use Green Stormwater Infrastructure?

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- Green Stormwater Infrastructure (GSI)
- Considerable challenges with using GSI
- King County and SPU worked together to integrate GSI into CSO planning
  - Reduce size of gray infrastructure project
  - Reduce costs of CSO program implementation
  - Reduce stormwater volume over time
  - Adapt to unknown future conditions



# GSI Evaluation

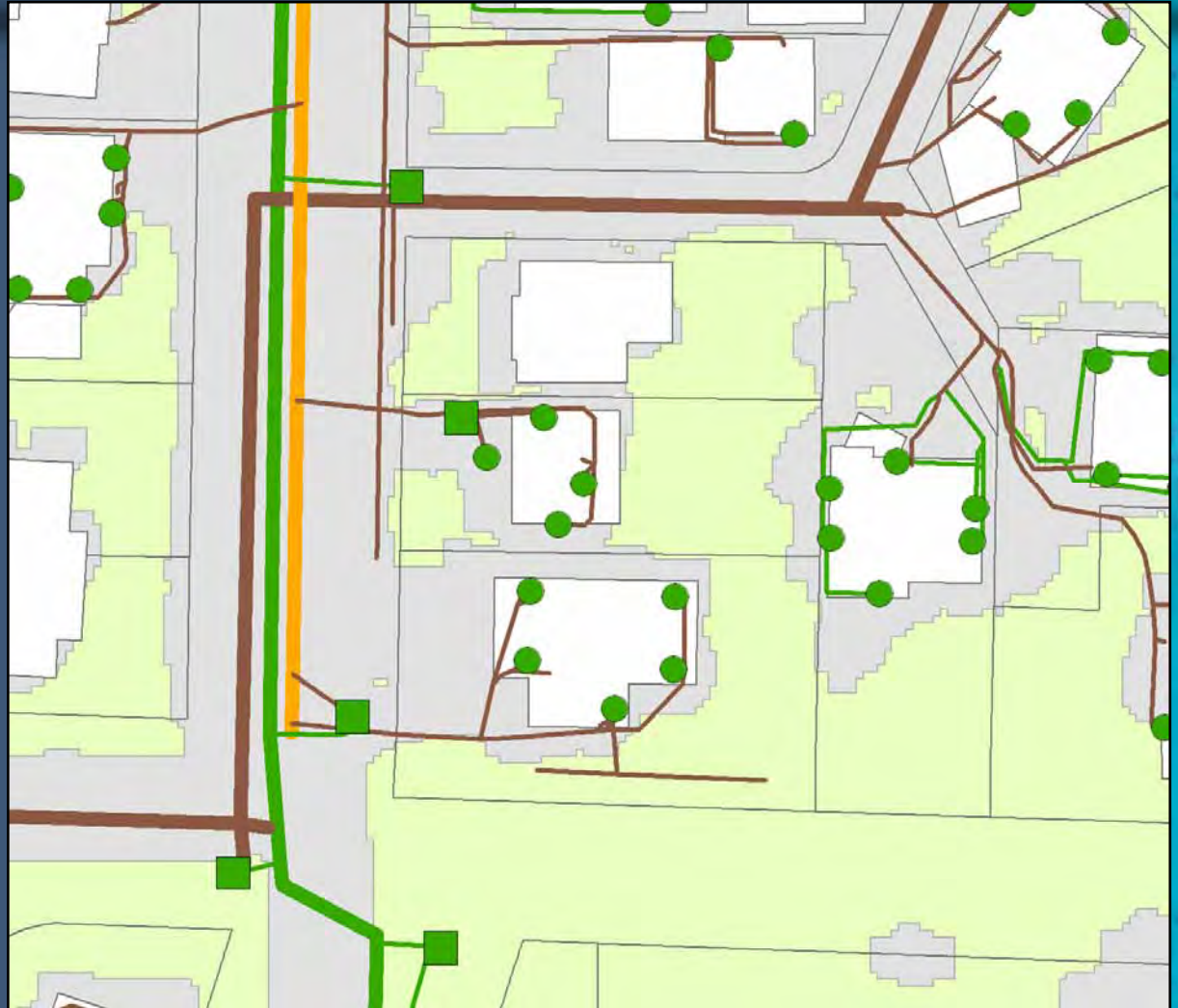
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- Where does the flow come from and where is it going?



# Three Sources of Flow to the Combined Sewer System

- Roofs
- Impervious areas
- Pervious areas





# Field Verification



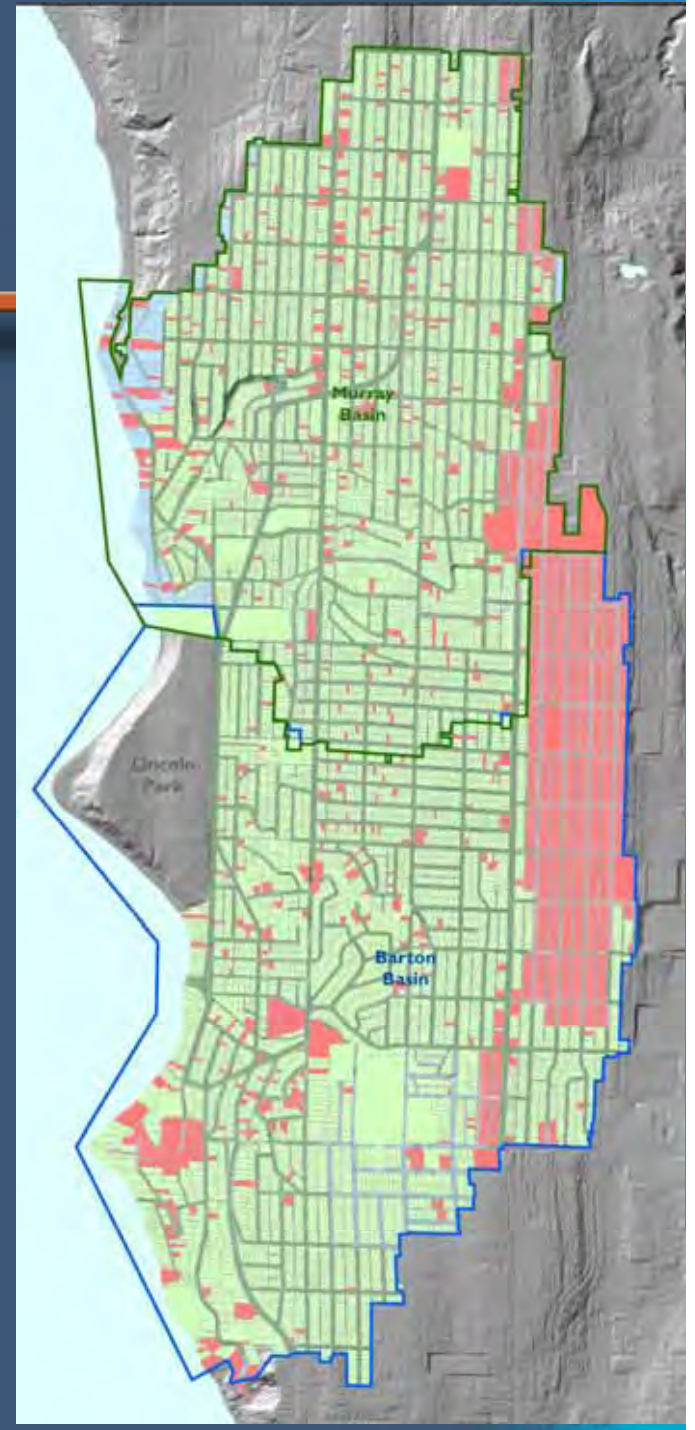
# GSI Spatial Analysis

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- Identify five GSI techniques
  - Ecoroofs/Green Roofs
  - Roof Disconnection
  - Street Trees
  - Bioretention (i.e. Rain Gardens)
  - Permeable Pavement
- Use a set of criteria to identify suitable locations

# Results of Analysis

- Maps of connected areas
- Estimation of amount of impervious and pervious areas connected to the combined sewer system
- Feasible area for green techniques





# GSI Project in Barton

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- Identified Barton basin as having highest feasibility for most green techniques
- Identified large area of streets connected to combined sewer system
- Opportunity to explore a project similar to SPU's Ballard Roadside Rain Gardens project
- Allow SPU and King County to evaluate design, construction and performance of GSI in combined sewer basins

# Examples of Streets with GSI



Seattle



Port Townsend



# Examples of Streets with GSI

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Seattle



Portland



# Changes to Streetscape with GSI

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- Parking
- Walkability
- Landscape Treatment
- Private Property
- Maintenance

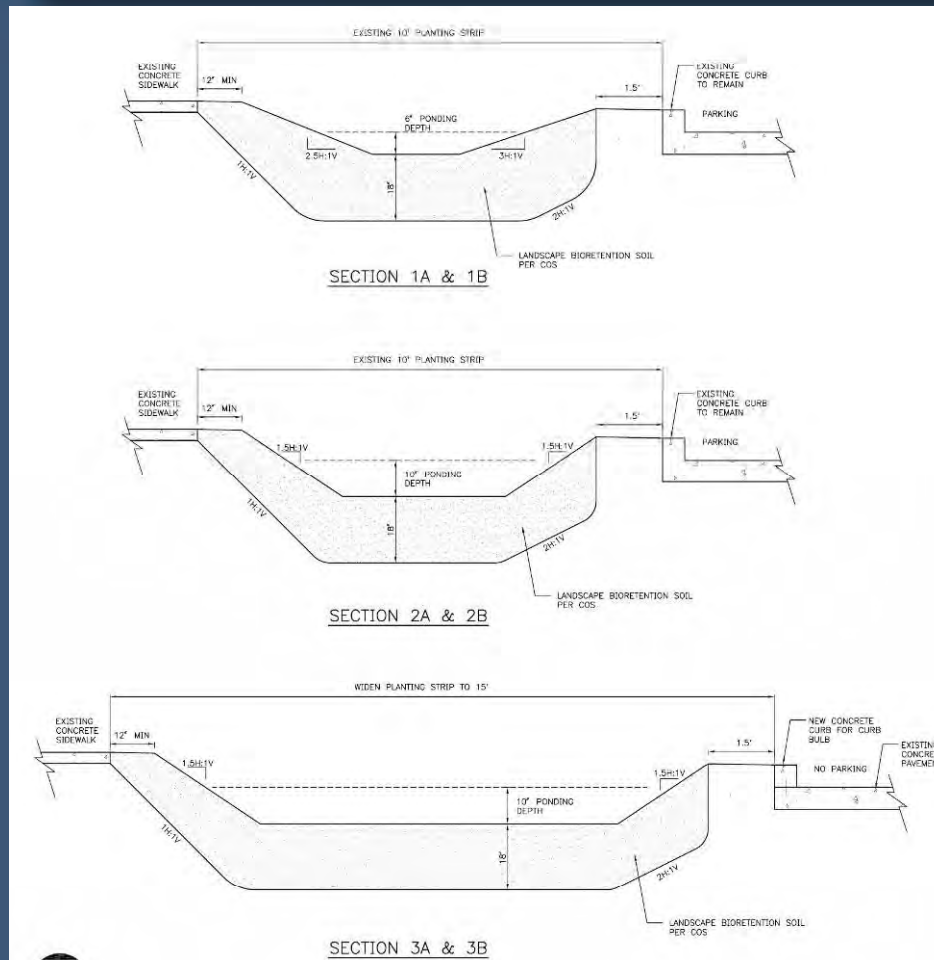
# Concept Street with GSI Before and After





# Barton Subbasin 416

## Street Cross-Section Options





# Components of Barton GSI Alternative

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- 66+/- modified blocks with green stormwater infrastructure
- Private parcel adaptations through SPU's Rainwise Program and other King County Programs
  - Cisterns
  - Bioretention – (i.e. rain gardens)
  - Permeable pavements
  - Infiltration
  - Vegetation

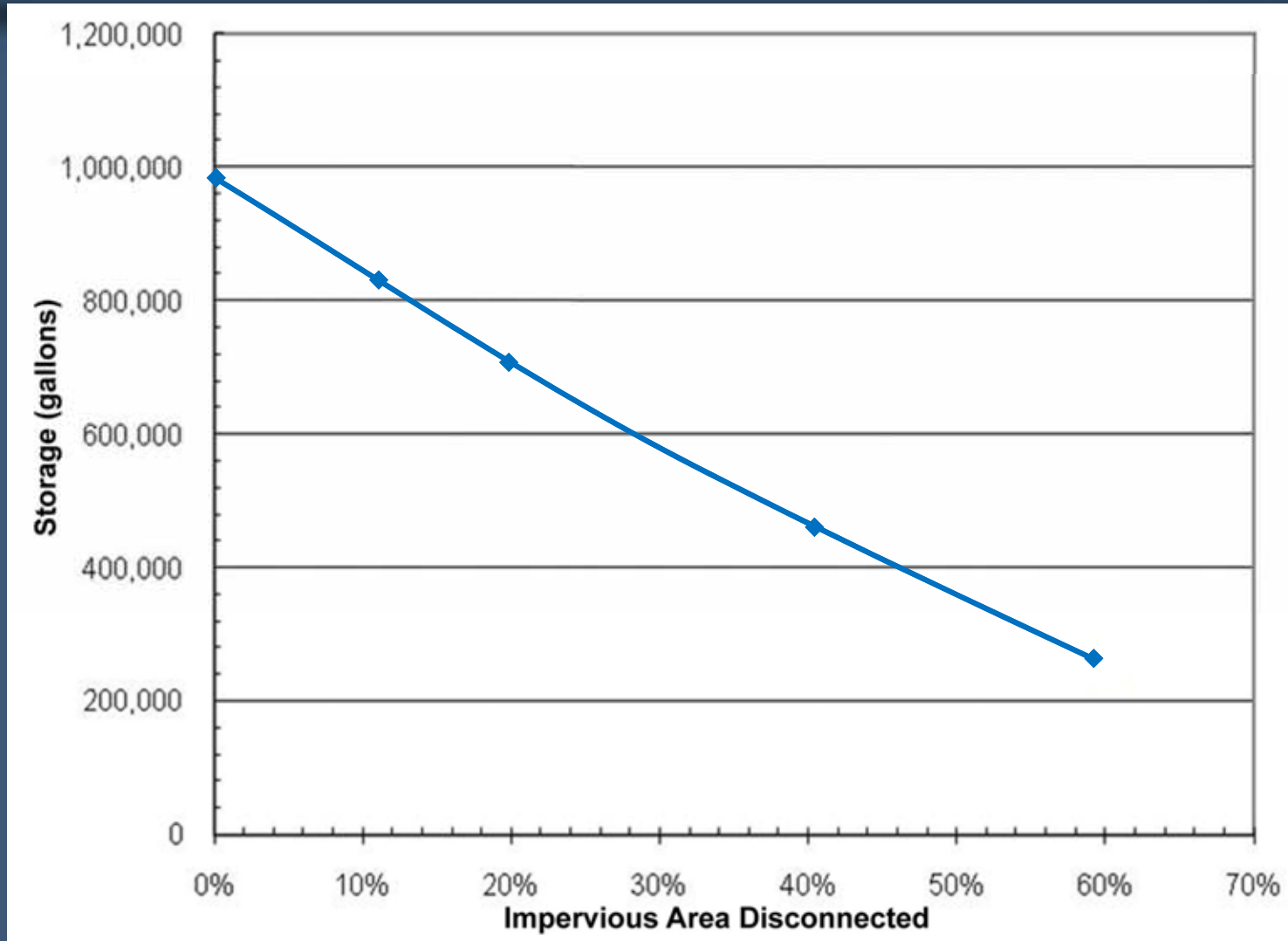
# Goal of Barton GSI Alternative

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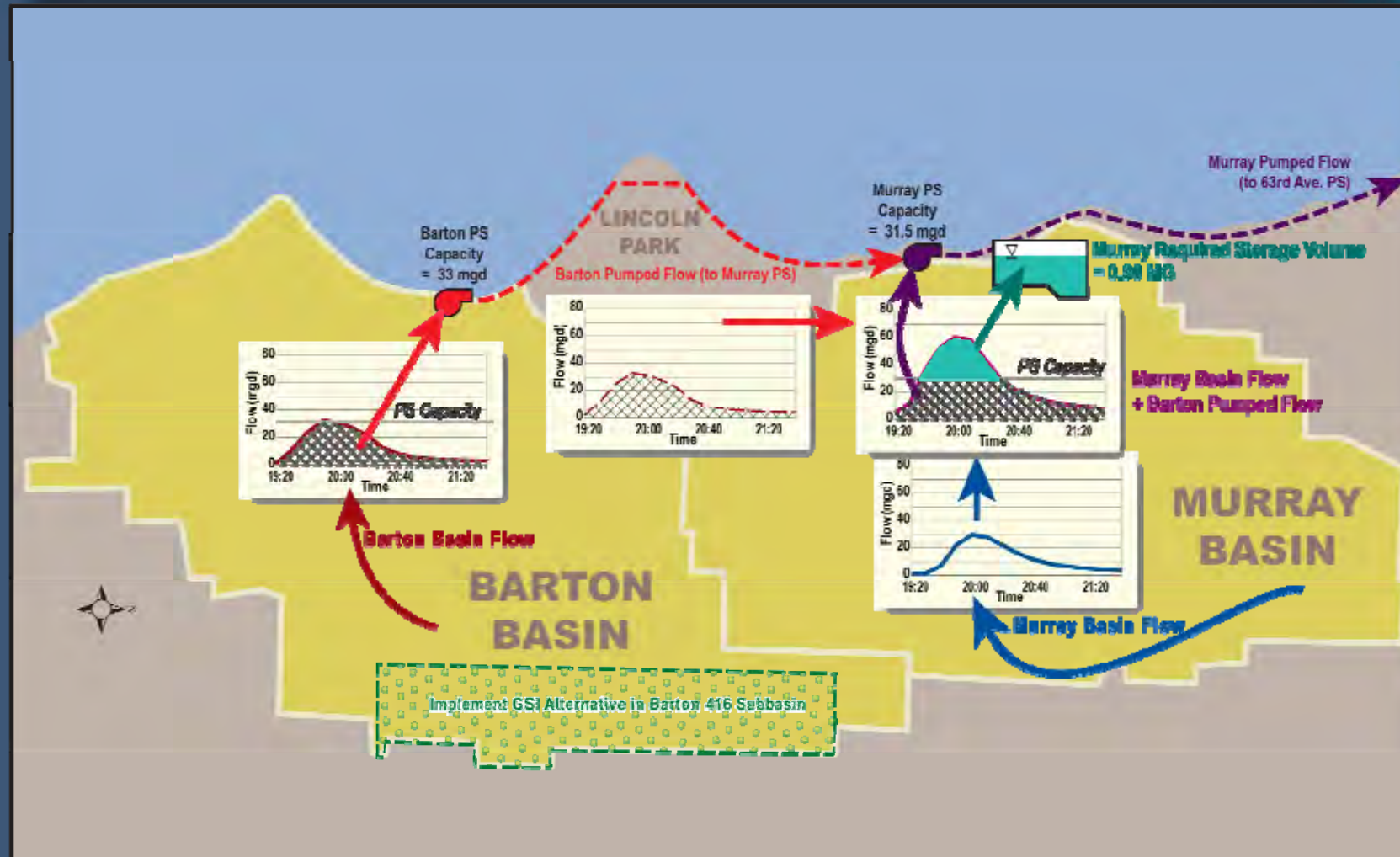
- Goal of alternative is to eliminate the storage requirement in Barton basin



# Murray Storage Reduction from GSI Implementation in Barton



# How Implementation of Barton GSI Affects Murray Requirements





# Initial GSI Analysis In Murray Basin

- Initially investigated GSI following development of Murray Alternative 5A
- Initial estimates concentrated on disconnection of residential roof runoff through Residential RainWise program
- Initially estimated maximum storage reduction of 148,000 gallons in basin
  - Considered properties away from steep slopes
  - Required participation of 435 parcels
  - Assumed 40% participation of properties



# Green Stormwater Infrastructure (GSI) in Murray

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- Re-evaluation considered the following:
  - Voluntary GSI on private property
    - Rain gardens away from steep slopes
    - Cisterns within steep slope buffers
    - Assumed 50% participation
  - Disconnection of non-residential areas
    - Assumed 50% participation
  - Disconnection of available street right-of-way



# GIS Evaluation for Green Stormwater Infrastructure in Murray

- Connected areas established through geographic information system evaluation



# Impervious Areas Connected to Combined Sewer System in Murray

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Source	Acres
Residential Roof Area	48
Residential Impervious	16
Non-Residential Roof	16
Non-Residential Impervious	20
CSS ROW (Streets)	11
TOTAL	111

# How Far Can We Go With GSI in the Murray Basin

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- Possible to reduce storage volume
- Challenges
  - Unproven criteria and assumptions
  - Implementation requires voluntary participation
  - Enough storage to contain peak CSO
  - Buy-in from regulators



# Murray CAG Alternatives for GSI

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- GSI & Storage in Barton
  - Proposed alternative for GSI in ROW
  - Additional roof disconnections
  - Mostly residential
- GSI in Murray
  - Roof disconnection
  - Mixed between residential & non-residential