

Integrating Urban Trees & Stormwater Management

or

A Reason for Public Works Engineers to Hug Trees



Randy Neprash, PE
February 8, 2013

One Team. Infinite Solutions.



Why Stormwater and Trees?



Minnesota Cities Stormwater Coalition

Municipal stormwater professionals
working together for clean water

- **Some challenges of urban stormwater management**
 - **Densely-developed urban areas – MS4 stormwater permits**
 - **TMDLs, nondeg, volume reduction regs**
 - **Controlling dissolved phosphorus runoff & other contaminants**

Number of MS4s

- In Minnesota – 162 cities
- In U.S. – 6,613 MS4s (before the 2010 Census)
 - 761 large MS4s
 - 5,862 small & medium-sized MS4s



Basic Questions

- **Why are we growing short-lived, stunted urban trees instead of long-lived, large trees**
- **Why aren't we using the biomass of trees?**
- **Why aren't we using the proven volume reduction capacity of our tree canopy?**
- **Can we redesign streets, parking lots, and streetscapes around trees and stormwater?**
- **Is there an existing model for integrating trees into stormwater management?**

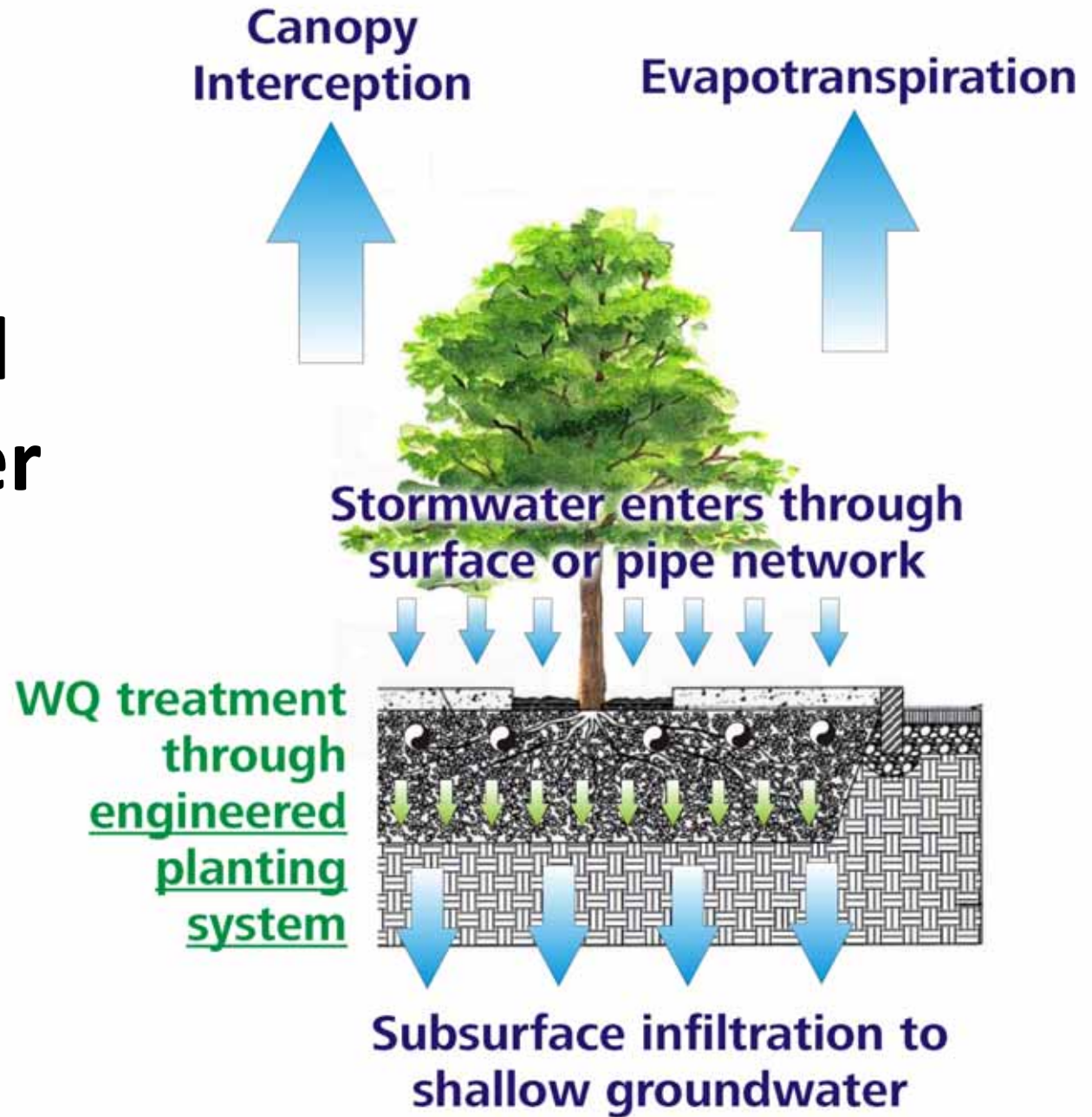
NURP Ponds – A Precedent

- National Urban Runoff Program
- Study by the USEPA
 - 1977 to 1983
- One result was the wide-spread use of stormwater ponds
 - Public and private projects

NURP Ponds – A Precedent

- Essential elements of NURP
 - Good research – conclusions supported by science and study
 - Specific design standards for stormwater ponds – suitable for any engineer or designer
 - Quantification of benefits – build according to the design and you get specific reduction credit
 - Complete integration into every level of stormwater regulation
- Result
 - estimated 20,000 stormwater ponds in the Twin Cities metro area
 - *A significant change to the American landscape*

Tree-based Stormwater BMP



Basic Principles

- **Volume reduction and WQ treatment**
- **What works for trees can work for stormwater**
 - **Uncompacted soil for roots**
 - **Sufficient depth and volume for roots**
 - **Support large, long-lived urban trees**
- **Kill two birds with one stone**
 - **Use budget and land for both stormwater management and urban forestry**
 - **Meet the goals of both public works and urban forestry**

Real Budget Results

City of Vancouver

URBAN FORESTRY PROGRAM

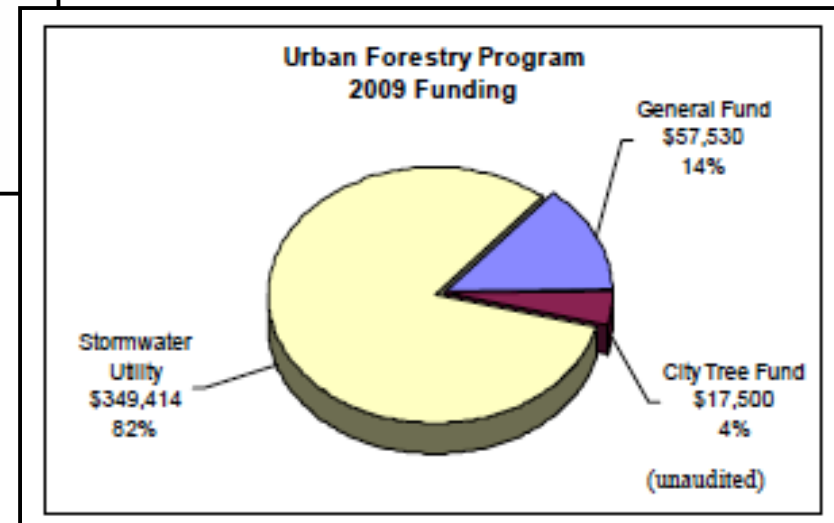
ANNUAL REPORT
2009

\$424,444 budget

SW utility – 82%

General Fund – 14%

City Tree Fund – 4%



Green Infrastructure – Trees and Rain Gardens

- **Similarities – bioretention BMPs**
 - Deep root systems
 - Significant biomass – active microbial communities
 - Infiltration and filtration capacity
 - Evapotranspiration is a factor
 - Habitat value
 - Aesthetic value



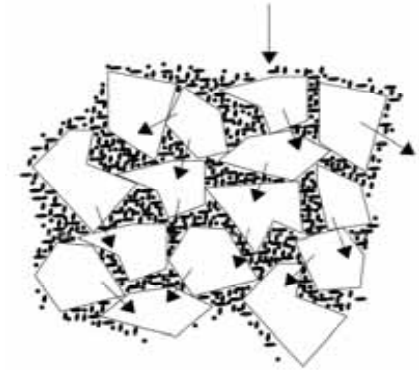
Green Infrastructure – Trees and Rain Gardens

- **Advantages of trees**
 - **Greater evapotranspiration**
 - **Unique relationship to ground**
 - **We already have lots of them**
 - **We know how to manage them**
 - **Everyone likes them**
 - **Extra benefits – ecological services**



Interesting Planting Systems

- Structural soils
 - CU Structural Soil[®], Swedish Soil, others
- Suspended pavement systems
 - Silva Cells[®], Strata Cells[®], others
- Support large, long-lived trees in urban settings
- Allow paving over the root zone without compaction



Applications

- **Response to TMDL load allocation**
 - Increase tree canopy
 - Reduce runoff volume
 - Improve water quality
 - Regional or city-wide
 - Reduce Combined Sewer Overflow (CSO)



Applications

Streetscapes

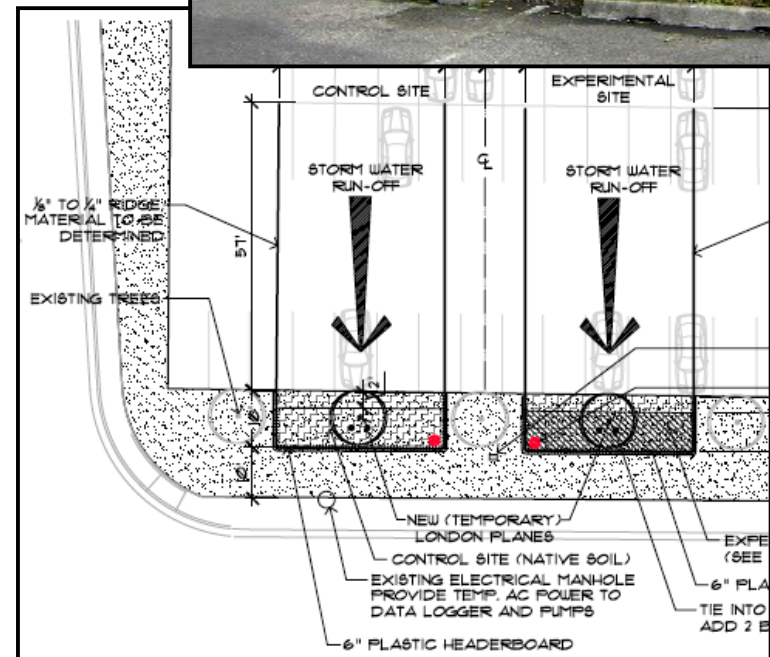


Applications

Parking lots

- Can we change how parking lots are built?
- Benefits for pavement, shopping, stormwater

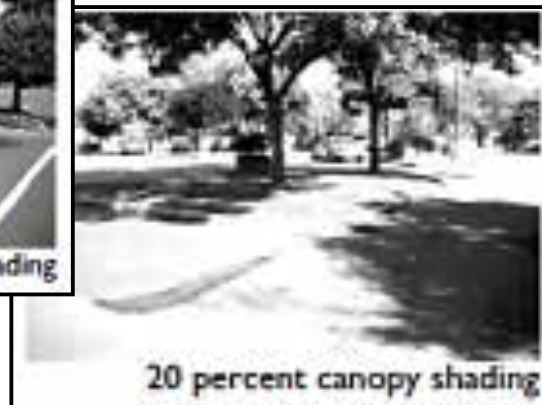
Dr. Greg McPherson
 U.S.F.S.
 Univ. California Davis



Parameter	Nutrients	Metals	Organic Carbon	Solids
Load Reduction	95.3%	86.7%	95.5%	95.5%

Applications

- **Tree canopy requirements for parking lots**
 - 30%, 40%, 50% canopy cover
 - Route runoff to the root zones
 - Volume reduction & water quality improvement



Kathleen Wolf, Ph.D.
Univ. of Washington

Applications

- **Public plaza**
 - Large area, large root zone volume



Stockholm, Sweden



9/11 Memorial – New York City



Applications

Boulevard trees



Central Corridor Light Rail Project Minneapolis to Saint Paul

- 6- mile-long stormwater management tree trench
- Both sides of University Avenue
- Cornell Structural Soil®
- \$8 million
- Stormwater “credits” only for infiltration



Minnesota - MIDS Project

- **Minimal Impact Design Standards**
- **Extend the work on stormwater ponds to the wide range of new types of BMPs**
 - A higher clean water performance goal for new development and redevelopment.
 - New modeling methods and credit calculations
 - Design standards
 - A credits system and ordinance package

Revisions to the MN Stormwater Manual

- **Development of technical information on design standards for urban forestry tree planting, tree quality, and soil quality and volume for tree plantings**
- **Development of standards for installation and construction of urban forestry best management practices (BMPs)**
- **Development of guidance for monitoring, and operation and maintenance of urban forestry BMPs for stormwater management**
- **Development of recommendations on course content for an accreditation or certification program in support of urban foresters and public works professionals**
- **Development of credit information for urban forestry practices, consistent with the MIDS calculator**
- **Compilation of general information concerning use of urban forestry and trees for stormwater management.**

Green Infrastructure & Urban Trees have “grown up”

- **New York City - \$2.4 billion over 18 years**
- **Philadelphia & EPA agreement - \$2 billion over 25 years**
- **Washington, DC MS4 Permit – 4,150 new trees planted each year**

Green Infrastructure & Urban Trees have “grown up”

White House Conference On Green Infrastructure



White House Conference on
Green Infrastructure
September 2012



Green Infrastructure & Urban Trees have “grown up”

THE NATIONAL ACADEMIES
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Support provided by:



February 25 & 26, 2013

The National Academy of Sciences is pleased to announce a participatory workshop:

Urban Forestry: Toward an Ecosystem Services Research Agenda.

The purpose of the workshop is to bring the science community together with practitioners and end users to examine the current capabilities for quantifying ecosystem services (and disservices) associated with the urban forest. Participants will discuss the tools and metrics currently available to decision makers, and identify key research needs and advancements that are necessary to support effective urban forestry management practices and sustainable urban development strategies.

Significant Questions and Issues

- **Selection of best tree species**
- **Phosphorus management – street cleaning**
 - Bannerman's work shows increased P runoff to streets with greater tree canopy
- **Viability of routing stormwater to tree roots**
 - Water regime
 - Chemicals – road pollution, deicers (salt)
- **Demonstrate and quantify benefits**
- **Long-term infiltration capacity and tree health**
- **Understand phytoremediation**

Any questions?



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