

# LID Practices For Stormwater in our Semi-Arid Environment

## A Regional Dialogue



# *The Evolution Clean Water to LID San Antonio TX*

*March 15, 2011*



**John Malueg, PE**  
**[John.Malueg@Stantec.com](mailto:John.Malueg@Stantec.com)**

One Team. Infinite Solutions



# USEPA



## Environmental Protection Agency

Mission - To protect human health and to safeguard the natural environment upon which life depends.

One Team. Infinite Solutions



**Stantec**

# EPA's 1969 Inspiration



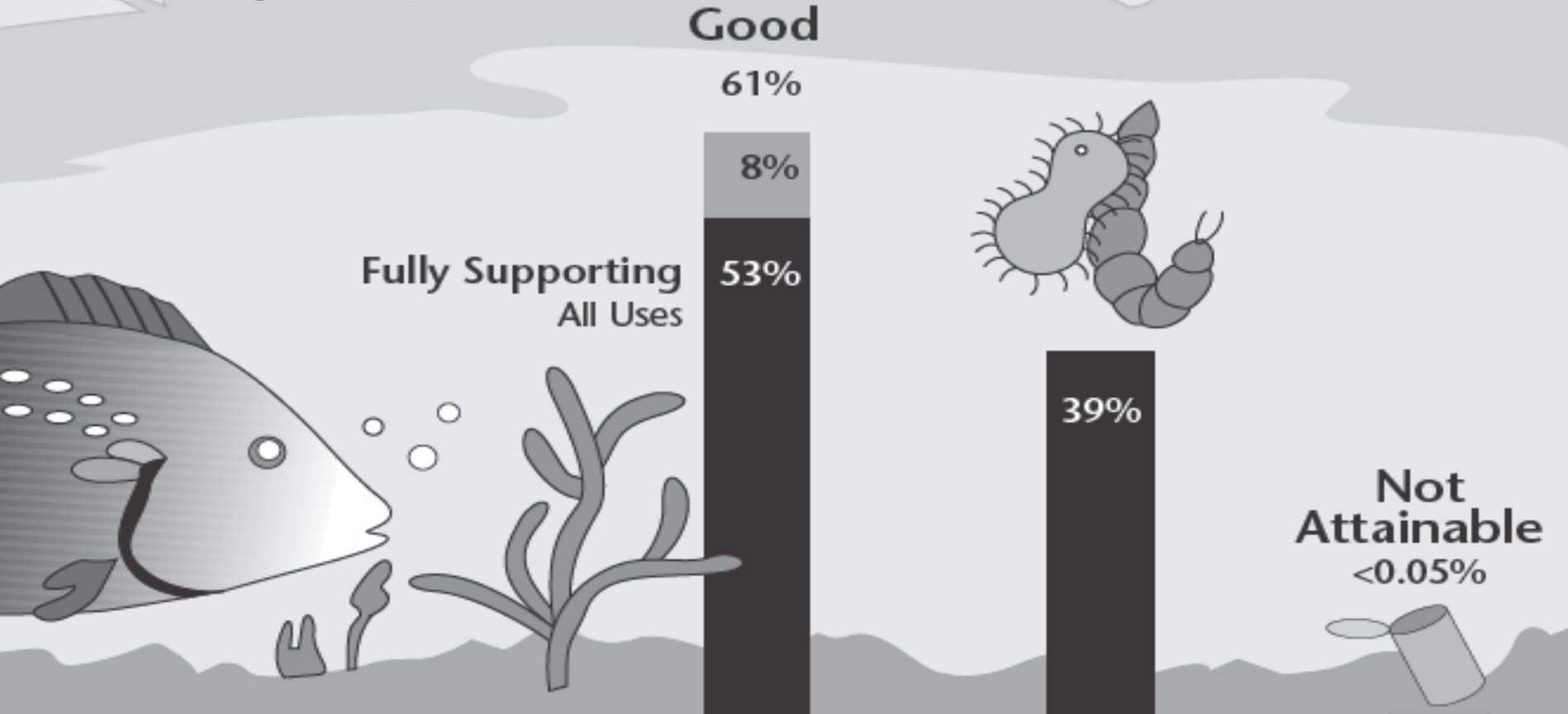
One Team. Infinite Solutions



**Stantec**

# 1972 Assessed Rivers and Streams

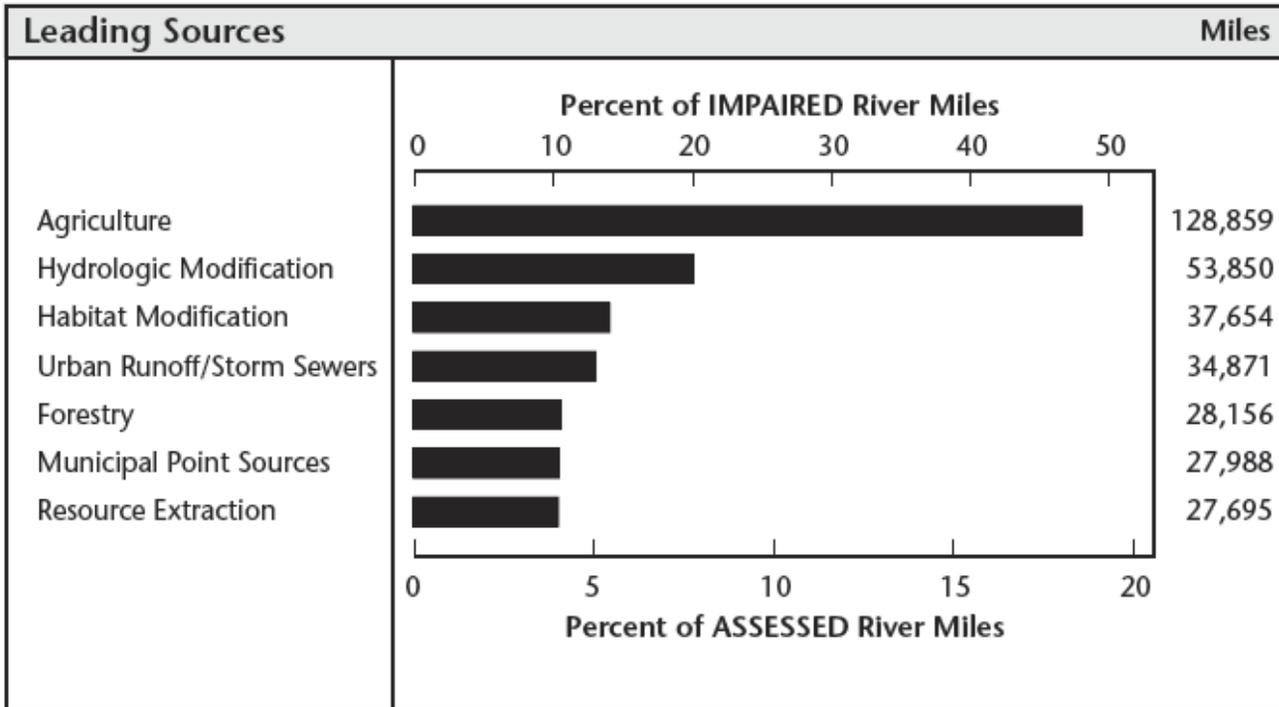
Supporting Uses (EPA 841-R-02-001)



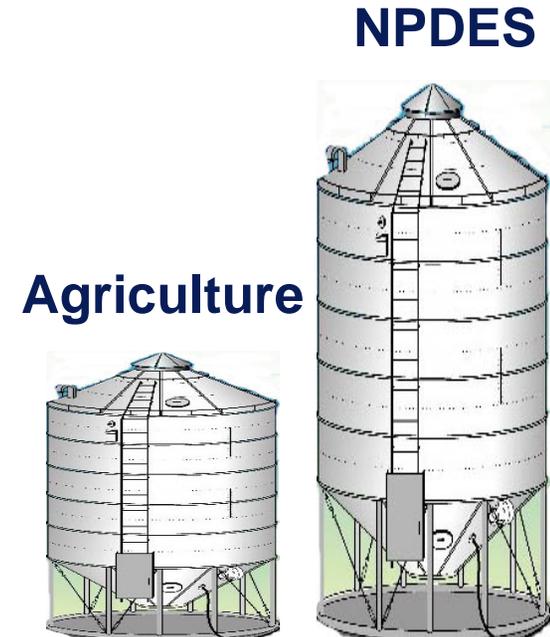
One Team. Infinite Solutions



# EPA's 1972 Water Quality Baseline



Sources of Impairment (%)



EPA's Clean Water Act Authority to Address

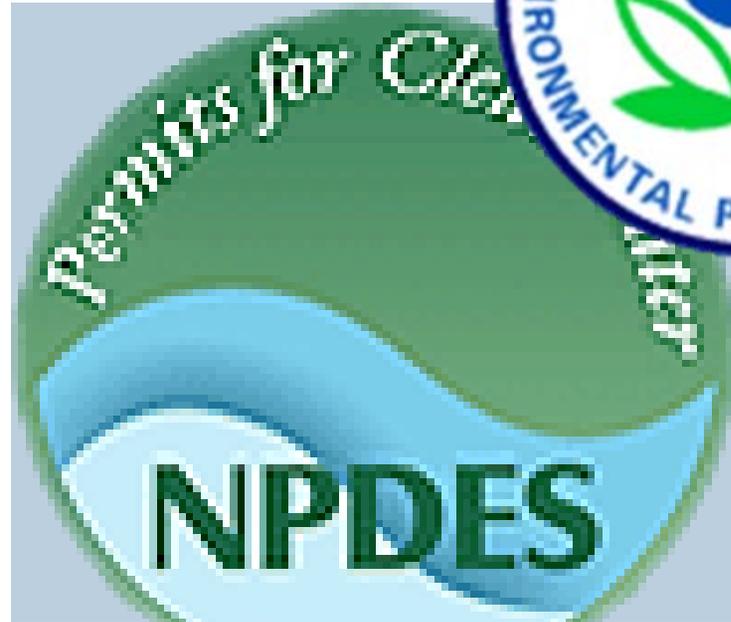
One Team. Infinite Solutions



# EPA's 1972 Clean Water Act

## Quality of Life

- Fishable
- Swimmable



One Team. Infinite Solutions



# EPA's 1972 Strategy

## Watershed - Based

### A. Point Source Pollution

#### 1. Wastewater

### B. Non-Point Source Pollution

#### 1. Storm Water

### C. Comprehensive Watershed Mgmt

#### 1. TMDL's

## Water Quality Baseline

### A. Anti-degradation

### B. Streams Designated Use



One Team. Infinite Solutions



Stantec

# EPA's 1972 Strategy

## Watershed - Based

### A. Point Source Pollution

#### 1. Wastewater

### B. Non-Point Source Pollution

#### 1. Storm Water

### C. Comprehensive Watershed Mgmt

#### 1. TMDL's

## Water Quality Baseline

### A. Anti-degradation

### B. Streams Designated Use



One Team. Infinite Solutions



**Stantec**

# EPA's 1972 Strategy

## Watershed - Based

### A. Point Source Pollution

#### 1. Wastewater

### B. Non-Point Source Pollution

#### 1. Storm Water

### C. Comprehensive Watershed Mgmt

#### 1. TMDL's

## Water Quality Baseline

### A. Anti-degradation

### B. Streams Designated Use



One Team. Infinite Solutions



**Stantec**

# EPA's Strategy

## A. Point Source Pollution

### 1. Wastewater – 1972 EPA Grants

#### a. Primary Treatment

- Floatable Solids / Disinfection

#### b. Secondary Treatment

- Biological Oxygen Demand (BOD)
- Total Suspended Solids (TSS)

#### c. Tertiary Treatment

- Nutrients (Nitrification / De-nitrification)



**EPA Grants**  
**\$85 Billion**  
**55% Fed Share**

One Team. Infinite Solutions



# EPA's Strategy (Cont.)

## B. Non-Point Source Pollution

### 1. Storm Water – 1987 SRF

#### a. 1990 Phase I

- Cities Pop > 100,000

#### b. 1998 Phase II

- City Pop. > 10,000
- Plus Adjoining Urban Areas

**Indicator Pollutant: TSS 80% Removal**



**EPA State  
Revolving Fund  
\$33 Billion**

One Team. Infinite Solutions



# Phase II Stormwater Regulations



## Six Minimum Controls

1. Public Education & Outreach
2. Public Involvement and Participation
3. Illicit Discharge Detection and Elimination
4. Construction Site Storm Water Runoff Control
5. **Post-Construction Runoff Management**
6. Pollution Prevention/Good Housekeeping For Municipal

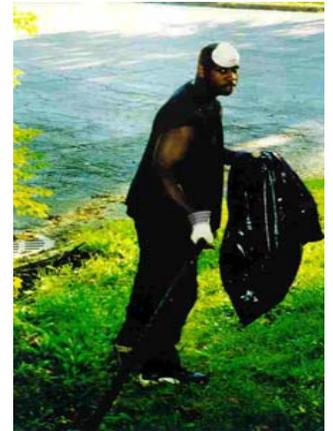
One Team. Infinite Solutions



# Phase II Stormwater Regulations

## “Good Regulations”

- ◆ Program Can Represent Community’s Priorities
- ◆ Unique Success Strategies:
  - Louisville KY: I/I Reduction
  - Austin TX: Street Sweeping
  - Greensboro NC: Loose Leaf Collection
  - Madison WI: Riparian Greenways / Trails



IF....

One Team. Infinite Solutions



# EPA's Strategy (Cont.)



## **C. Total Maximum Daily Limits (TMDL)**

### **1. 1972 - 303(d) List Impaired Waters List**

**a. Required for ALL Impaired Streams**

**b. Defines Stream's Assimilation Capacity**

**c. Requires Identification of ALL Sources**

- Watershed-based**
- Includes Agriculture**

**One Team. Infinite Solutions**



# EPA's Strategy (Cont.)



## D. Currently Under Development

### 1. New Prescriptive MS4 Regulations

- Hard Linked to TMDLs

### 2. Numerical Limits w/ Non-Point Sources

- Construction Activities (turbidity limits)
- Urban Development (TSS, BOD, Bacterial)

### 3. New In-stream Water Quality Criteria

- New Nutrient Criteria: Phosphorus

One Team. Infinite Solutions



# USACE – Civil Works Strategic Plan for Fiscal Years 2005-2010



- “ ... presents a bold initiative for the Corps to manage our Nation's public water resources in collaboration with others through a watershed approach.”
- “The Corps of Engineers advocates taking a holistic view to find sustainable water resources solutions in partnership with other Federal agencies.”

One Team. Infinite Solutions



# FEMA RiskMap – Preparing for FY09 and Beyond



- “FY09 will mark the beginning of significantly improved integrated flood risk management approach ... by weaving in watershed-based risk assessments...”

One Team. Infinite Solutions



# EPA.gov / watershed



- ◆ “A watershed approach is the most effective framework to address today's water resource challenges.”
- ◆ “EPA’s 4 Pillars of Sustainable Infrastructure  
4. Watershed approaches to protection”

One Team. Infinite Solutions



# Role of Watersheds w/ Urban Water Resources Sustainability

- ◆ USACE
  - ◆ Collaboration / Partnerships
  - ◆ Holistic / Sustainable Solutions
- ◆ FEMA - Integrated Management
- ◆ EPA
  - ◆ Most Effective Framework
  - ◆ Pillar of Sustainable Infrastructure

One Team. Infinite Solutions



# So What's The Problem?

## Limits to Achieving Urban WR Sustainability

- ◆ If its so Simple:
  - Connect the Dots
  - Umbrella

One Team. Infinite Solutions



# So What's The Problem?

## Limits to Achieving Urban WR Sustainability

- ┌ People
  - Organizations
    - Policies
      - Bureaucratic Processes
        - Funding

One Team. Infinite Solutions

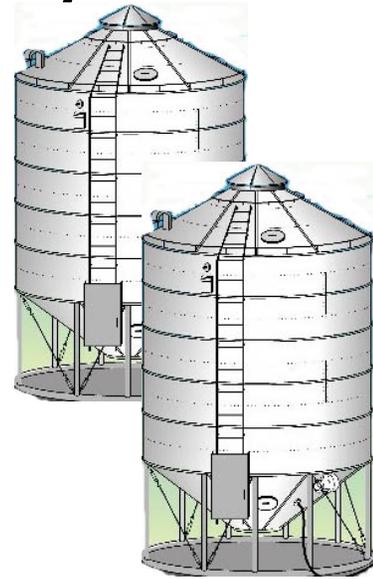


# So What's The Problem?

## Limits to Achieving Urban WR Sustainability

It's hard to break down Silos!

- ◆ Stormwater vs. Wastewater
- ◆ Point vs. Non-Point Pollution
- ◆ Water Quantity vs. Water Quality
- ◇ Engineering vs. Science
- ◆ Soft vs. Hard Solutions



One Team. Infinite Solutions



# So What's The Problem?

## Limits to Achieving Urban WR Sustainability

- ◆ Benefits not well:
  - Understood
  - Communicated
- ◆ Cannot be scared of the TRUTH

# To Achieve Urban WR Sustainability...

Must Answer - “What's in it for Me...?”

- ◆ Protected Environment
- ◆ Enhanced Public Safety
- ◆ Economic Prosperity
- ◆ Improved Quality of Life

**Improved WQ can be Hard Sell!**



One Team. Infinite Solutions

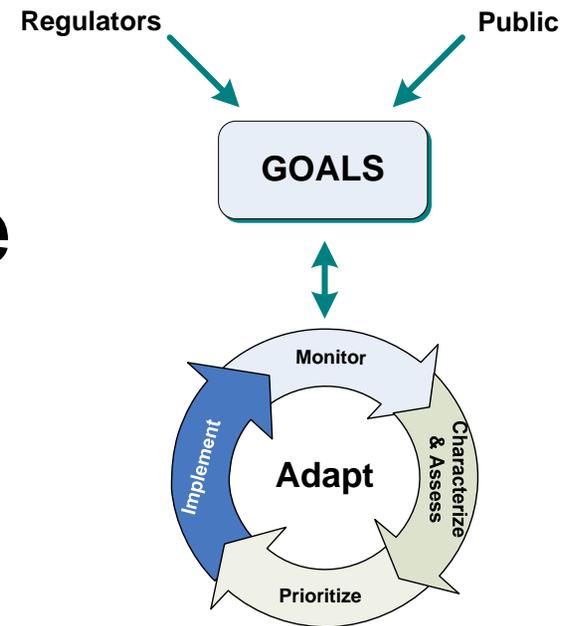


**Stantec**

# To Achieve Urban WR Sustainability...

Must shift strategy:  
Prescriptive to Adaptive

- ◆ Prescriptive
  - ◆ Compliant / Non-Compliant
- ◆ Adaptive
  - ◆ Measure, Assess, Adjust



One Team. Infinite Solutions



# SARA - Broadway/Hildebrand Green Infrastructure Initiative



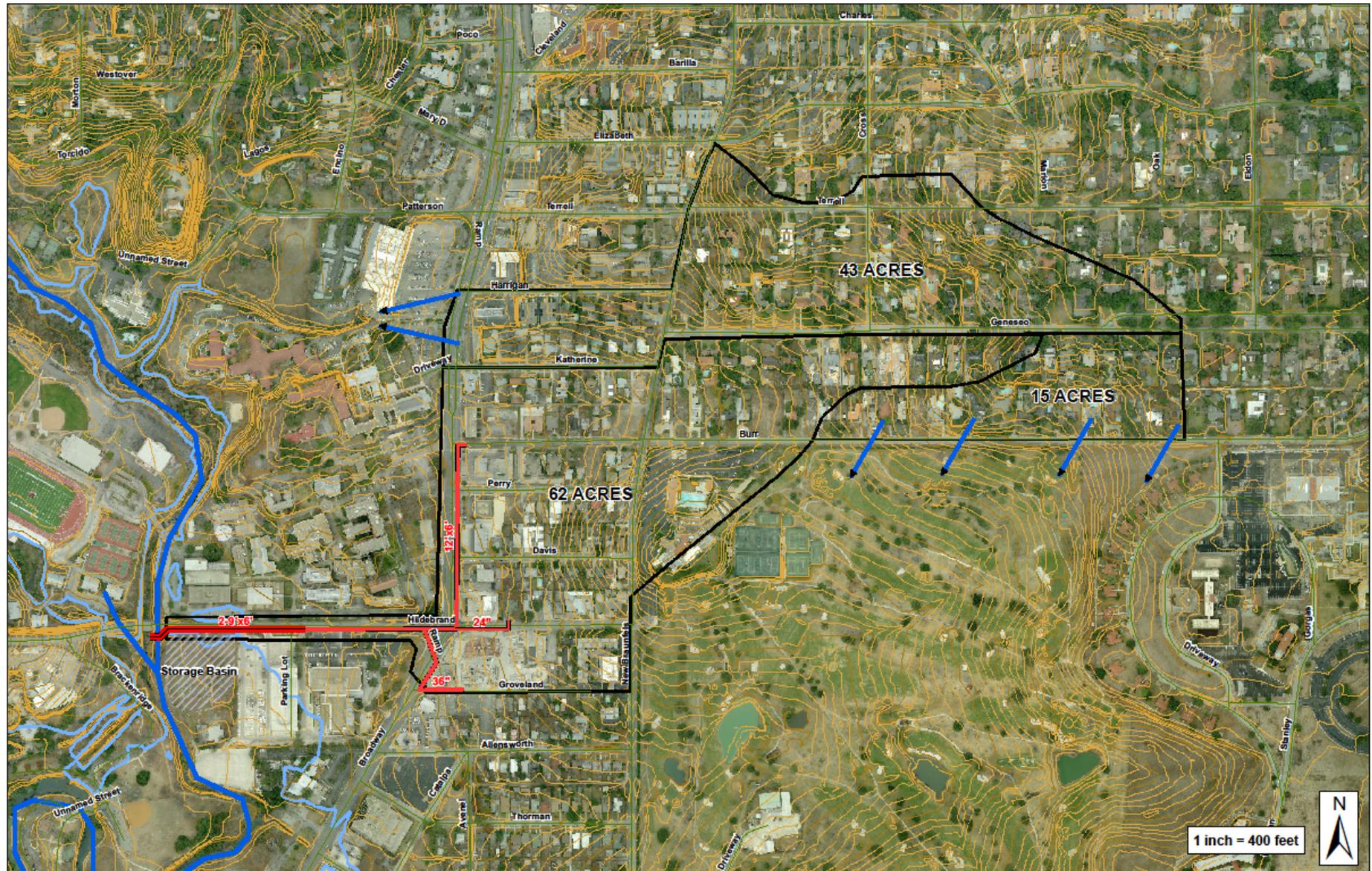
## I. General Project Information

- A. Total drainage area ~120 acres
- B. Calculated flows to San Antonio River
  - 100 year flow ~ 580 cfs
  - First flush flow (1/2 inch) ~ 10 cfs
- c. Proposed pipes transition from one 12'x6' RCB (Broadway/Hildebrand) to two 9'x6' RCB (Hildebrand)

One Team. Infinite Solutions



# SARA - Broadway/Hildebrand Green Infrastructure



# SARA - Broadway/Hildebrand Green Infrastructure Initiative

## II. Package 1 – Water Quantity

### A. Watershed Diversion / *Flow Diversion and Reuse*

1. Diversion to San Antonio Country Club
  - 15 of 120 ACRES (~13%)
  - Contributing ~ 80 cfs
  - Golf course irrigation / Water Feature
2. Diversion to University of Incarnate Word
  - 43 of 120 ACRES (~36%)
  - Contributing ~ 230 cfs
  - Flow diverted through existing channel
  - Natural channel design

# SARA - Broadway/Hildebrand Green Infrastructure Initiative

## III. Package 2 – Water Quality

### A. Headwaters (Residential Area) *Level 3*

*Keys: Attenuation, polish, management of the source*

1. Road Inlet Modification
2. Streetscapes
3. Rain Barrels
4. SW Retention – schools / public areas / ROW



One Team. Infinite Solutions



# SARA - Broadway/Hildebrand Green Infrastructure Initiative



## III. Package 2 – Water Quality

### B. Mid-Watershed (Commercial Area)

Keys: Management of larger flows with storage and treatment

1. Vortex Separator/Screening
  - Collects solids / Allows high flows to by-pass
2. Underground Storage/Stand Pipes
3. Inlet Modification
4. Streetscapes

One Team. Infinite Solutions



# SARA - Broadway/Hildebrand Green Infrastructure Initiative

## III. Package 2 – Water Quality

### C. Lower-Watershed (river floodplain)

*Keys: Final treatment of first flush*

#### 1. Screen/Separator

#### 2. First flush water quality basin at Mira Flores Park

- Controlled by first flush pipe/weir system
- Allows for ~ 1.3 acre-ft of storage / contain first flush



One Team. Infinite Solutions



# SARA - Broadway/Hildebrand Green Infrastructure Initiative

## III. Package 2 – Water Quality

### D. Outfall (San Antonio River)

*Keys: Diffuse Flow / Environmental Restoration*

1. Diffusion of Flow
2. Stream bank stabilization



One Team. Infinite Solutions



# SARA – Storm Water Evolution

## IV. Package 3 – Implementation

### A. Education and Training

1. Case Studies

### B. Standards and Guidance

1. LID Best Management Practice Manuals

### C. Authority

1. Ordinance and Regulations

- Plan Review / Enforcement Authority

2. Organization – Expand

3. Sustainable Funding Source

- Level of Service / Cost of Service Analysis
- Gain revenue



# Real Benefits Case Study:

## Muskingum Watershed

- Ohio's Largest
- 8040 sq. miles
- 18 counties



One Team. Infinite Solutions

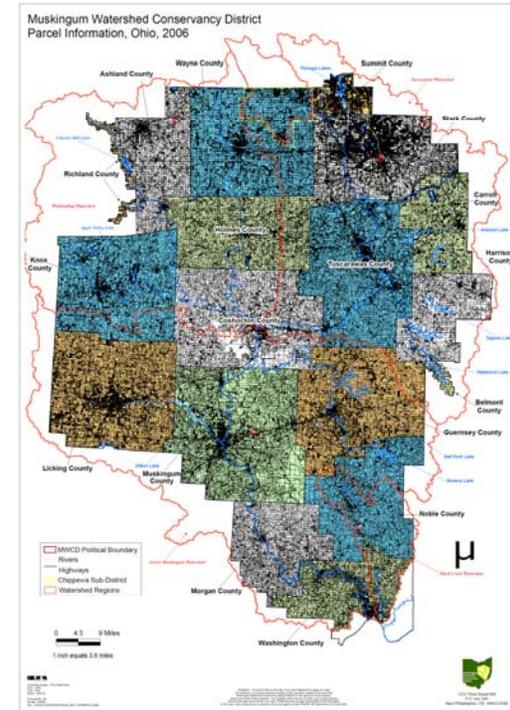


Stantec

# Real Challenges – Muskingum Watershed

## Watershed-based Challenges

- ◆ Economic Down Turn
- ◆ Degrading Environment
- ◆ Restricted Recreation



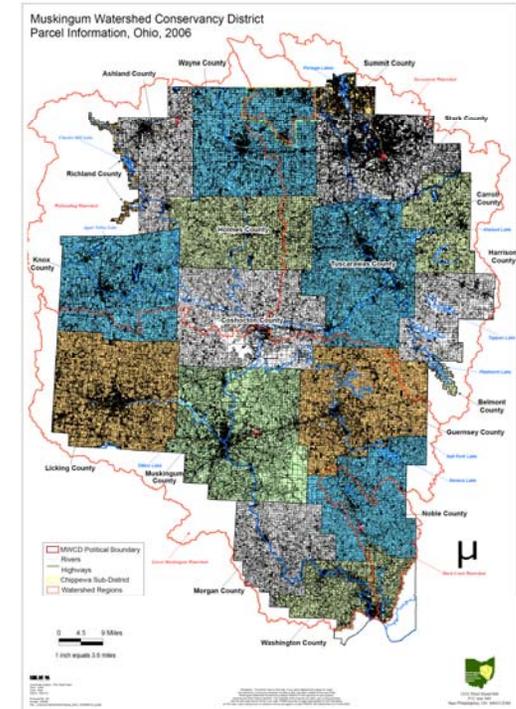
One Team. Infinite Solutions



Stantec

# Real Challenges – Muskingum Watershed

- ◆ Watershed-based Challenges
  - ◆ Aging Infrastructure
  - ◆ Reservoir Sedimentation
  - ◆ Failing Sewer Systems
  - ◆ Public Safety Concerns
  - ◆ Increased risk of flooding
  - ◆ Threatened Water Supplies



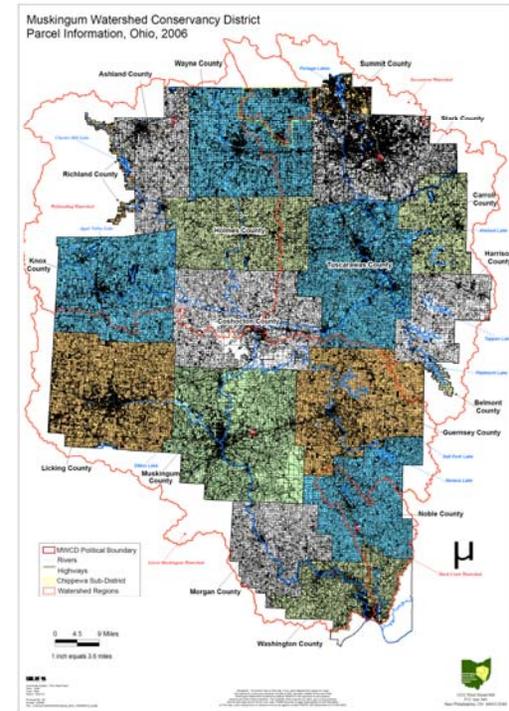
One Team. Infinite Solutions



# Real Solutions – Muskingum Watershed

## Watershed-based Solution

- Watershed Utility
  - \$ 10,000,000 Annual Revenue
  - \$12 per year / ERU
  - 18 Counties
  - 709,000 parcels
- Watershed Partnerships
  - Federal, state, county, townships
  - Universities
  - Community Groups



One Team. Infinite Solutions



# Real Benefits – Muskingum Watershed

## Watershed-based Benefits

- Federal \$\$\$ for Infrastructure
- Eco-system Restoration
- Improved Public Safety
- Reliable Water Supply
- Expanded Recreation / Tourism



One Team. Infinite Solutions



# Real Benefits – Muskingum Watershed

## Watershed-based Benefits

- Dam Infrastructure Improv.
- Low Head Dam Removals
- Stream Restoration
- WWTP Upgrades
- On-site Treatment Replacements
- Public Support and Involvement



One Team. Infinite Solutions



# THANK YOU

## Comments and Questions

John Malueg, PE

**Stantec**

502.212.5000

[jmalueg@stantec.com](mailto:jmalueg@stantec.com)



**Stantec**