An Introduction to Strategically Planning and Assessing Stormwater Programs

CASQA Webinar
June 22, 2015

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Instructions for Today

- Participants will be muted
- Asking questions – send via chat
Topics

- Background
- Key Concepts
- Introduction to Outcome Types
- Introduction to Strategic Planning for Stormwater Programs
- Case Studies
Background
A Brief History of Recent Effectiveness Assessment Work

https://www.casqa.org/effectiveness_assessment
Proposition 84 – Web Portal Project

- Task 3 - CASQA Guidance Manual Update
- Task 4 - Assessment of Existing Practices and User Needs
- Task 5 - Education and Outreach
- Task 6 - Project Evaluation
Proposition 84 – Web Portal Project

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- Task 4 - Assessment of Existing Practices and User Needs
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- Task 6 - Project Evaluation
Next Steps

Task 4
Assessment of Existing Practices and User Needs

Task 5
Education and Outreach

Task 6
Project Evaluation

Jan
Mar
May
July
Sep
Nov
Jan
Mar
May
July
Sep
Nov
Jan
2014
2015
2016
Questions?
Key Concepts
Effectiveness assessment consists of the methods and activities that managers use to evaluate how well their programs are working and to identify modifications necessary to improve results.
A Strategic Approach to Planning and Assessing Municipal Stormwater Management Programs

Table of Contents

Executive Summary ....................................................................................................................... ii

Section 1.0 Introduction and Purpose .......................................................................................... 1-1

Section 2.0 Stormwater Management Approach ......................................................................... 2-1

Section 3.0 Introduction to Strategic Planning for Stormwater Management Programs ........... 3-1

Section 4.0 Source and Impact Strategies .................................................................................... 4-1

Section 5.0 Target Audience Strategies ...................................................................................... 5-1

Section 6.0 Program Implementation Strategies .......................................................................... 6-1

Section 7.0 Assessment Tools and Strategies .............................................................................. 7-1

Section 8.0 Interpretation and Use of Results ............................................................................ 8-1

Attachments .................................................................................................................................

A  Glossary of Acronyms and Terms .......................................................................................... A-1
B  Source Profiles ....................................................................................................................... B-1
C  Pollutant Profile Sheets ......................................................................................................... C-1
The Relationship of Planning and Assessment

- Planning provides a road map for assessment
- Assessing “after-the-fact” limits managers’ ability to evaluate
- Assessment measures and methods should be identified during planning
- Programs that “plan to assess” increase measurability and effectiveness
**Outcomes** are measurable endpoints associated with programs, people, and physical systems.

**Physical Systems**
- **Level 6**: Receiving Water Conditions
- **Level 5**: MS4 Conditions
- **Level 4**: Source Contributions

**People**
- **Level 3**: Target Audience Actions
- **Level 2**: Barriers & Bridges to Action

**Programs**
- **Level 1**: Stormwater Program Activities

**Receiving Water Conditions**

**MS4 Conditions**

**Source Contributions**

**Target Audience Actions**

**Barriers & Bridges to Action**

**Stormwater Program Activities**

17
Outcomes are Interrelated
Core Steps in a Structured Planning Process

Characterizing Problems

Step A

Targeting Outcomes

Step B

Documenting Knowledge and Data Gaps

Step C
Key Concept 2
Problem conditions are "causally" linked

2. Barriers and Bridges to Action
   - Lack of knowledge in site workers

3. Target Audience Actions
   - Ineffective sediment control practices

4. Source Contributions
   - Sediment loadings from construction sites

5. MS4 Contributions
   - Discharges of sediment from MS4 outfalls

6. Receiving Water Conditions
   - WQO exceedances for total suspended solids (TSS)

Cause → Effect

Cause → Effect

Cause → Effect
Key Concept 3

Relationships between conditions resemble webs more than chains

- Bacteria Exceed Objective in RW
- Over-irrigation
- Washing Activities
- Bacteria > Action Level in Dry Weather Flows -MS4
- Multiple Potential Sources in Watershed
- Biofilms in MS4
- Birds
- Re-growth
Key Concept 1
Prioritization is Essential to Strategic Planning
Key Concept 4
Linkages and Relationships exist in different stages of certainty

<table>
<thead>
<tr>
<th>Problem 1</th>
<th>Hypothesis -- Co-occurrence -- Correlation -- Causation</th>
</tr>
</thead>
<tbody>
<tr>
<td>“cause”</td>
<td>➤ Increasing strength of relationship ➤</td>
</tr>
</tbody>
</table>

Problem 2
“effect”
Questions?
Introduction to Outcome Types
Three Planning and Assessment Elements

First Element

- **Level 6**: Receiving Water Conditions
- **Level 5**: MS4 Contributions
- **Level 4**: Source Contributions

Second Element

- **Level 3**: Target Audience Actions
- **Level 2**: Barriers & Bridges to Action

Third Element

- **Level 1**: Stormwater Program Activities

Sources and Impacts
(Section 4.0)

Target Audiences
(Section 5.0)

Stormwater Programs
(Section 6.0)
First Element
Source & Impact Strategies

Level 6
Receiving Water Conditions
- Receiving water quality
- Hydromodification
- Beneficial use protection

Level 5
MS4 Contributions
- Urban runoff quality
- Urban runoff hydrology
- MS4 conditions

Level 4
Source Contributions
- Source pollutant loads
- Site/source hydrology
- Site/source conditions
### Table 4.2: General Types and Examples of Receiving Water Conditions

<table>
<thead>
<tr>
<th>Type of Condition</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Chemical Conditions</strong></td>
<td></td>
</tr>
<tr>
<td>Constituents in flows (wet, dry, and ambient)</td>
<td>Chemical constituent concentrations or loads (metals, pesticides, nutrients, etc.)</td>
</tr>
<tr>
<td>Constituents in sediments</td>
<td>Metals, pesticides, nutrients, etc.</td>
</tr>
<tr>
<td><strong>Toxicological Conditions</strong></td>
<td></td>
</tr>
<tr>
<td>Toxicity from chemical constituents</td>
<td>Metals, pesticides, nutrients, etc.</td>
</tr>
<tr>
<td>Toxicity from other stressors</td>
<td>Temperature, turbidity, etc.</td>
</tr>
<tr>
<td><strong>Biological Conditions</strong></td>
<td></td>
</tr>
<tr>
<td>Pathogens and indicators</td>
<td>Bacterial indicators in wet and dry weather flows</td>
</tr>
<tr>
<td></td>
<td>Pathogens (bacteria, viruses, protozoa, etc.) in wet and dry weather flows</td>
</tr>
<tr>
<td>Habitat and communities</td>
<td>Macro-invertebrate community integrity</td>
</tr>
<tr>
<td></td>
<td>Biodiversity</td>
</tr>
<tr>
<td></td>
<td>Algal abundance and diversity</td>
</tr>
<tr>
<td></td>
<td>Habitat integrity (wetlands, riparian cover, etc.)</td>
</tr>
<tr>
<td><strong>Physical Conditions</strong></td>
<td></td>
</tr>
<tr>
<td>Physical condition of channels and banks</td>
<td>Geomorphic conditions</td>
</tr>
<tr>
<td></td>
<td>Erosion and sedimentation</td>
</tr>
<tr>
<td></td>
<td>Hydromodification</td>
</tr>
<tr>
<td></td>
<td>Extent and amount of trash</td>
</tr>
<tr>
<td>Flow conditions within channels</td>
<td>Presence or absence of flow or ponded water</td>
</tr>
<tr>
<td></td>
<td>Volume, velocities, and durations of flows</td>
</tr>
<tr>
<td>Other</td>
<td>pH, temperature, conductivity, dissolved oxygen, turbidity</td>
</tr>
<tr>
<td><strong>Municipal and Domestic Supply (MUN)</strong></td>
<td>Uses of water for community, military, or individual water supply systems including, but not limited to, drinking water supply.</td>
</tr>
<tr>
<td><strong>Agricultural Supply (AGR)</strong></td>
<td>Uses of water for farming, horticulture, or ranching including, but not limited to, irrigation, stock watering, or support of vegetation for range grazing.</td>
</tr>
<tr>
<td><strong>Industrial Process Supply (PROC)</strong></td>
<td>Uses of water for industrial activities that depend primarily on water quality.</td>
</tr>
<tr>
<td><strong>Industrial Service Supply (IND)</strong></td>
<td>Uses of water for industrial activities that do not depend primarily on water quality including, but not limited to, mining, cooling water supply, hydraulic conveyance, gravel washing, fire protection, or oil well repressurization.</td>
</tr>
<tr>
<td><strong>Ground Water Recharge (GWR)</strong></td>
<td>Uses of water for natural or artificial recharge of ground water for purposes of future extraction, maintenance of water quality, or halting of saltwater intrusion into freshwater aquifers.</td>
</tr>
<tr>
<td><strong>Freshwater Replenishment (FRSH)</strong></td>
<td>Uses of water for natural or artificial maintenance of surface water quantity or quality (e.g., salinity).</td>
</tr>
<tr>
<td><strong>Navigation (NAV)</strong></td>
<td>Uses of water for shipping, travel, or other transportation by private, military, or commercial vessels.</td>
</tr>
<tr>
<td><strong>Hydropower Generation (POW)</strong></td>
<td>Uses of water for hydropower generation.</td>
</tr>
<tr>
<td><strong>Water Contact Recreation (REC-1)</strong></td>
<td>Uses of water for recreational activities involving body contact with water, where ingestion of water is reasonably possible. These uses include, but are not</td>
</tr>
<tr>
<td><strong>Cold Freshwater Habitat (COLD)</strong></td>
<td>Uses of water that support cold freshwater ecosystems including, but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish, or wildlife, including invertebrates.</td>
</tr>
<tr>
<td><strong>Inland Saline Water Habitat (SAL)</strong></td>
<td>Uses of water that support saline water ecosystems including, but not limited to, preservation or enhancement of aquatic saline habitats, vegetation, fish, or wildlife, including invertebrates.</td>
</tr>
<tr>
<td><strong>Estuarine Habitat (EST)</strong></td>
<td>Uses of water that support estuarine ecosystems including, but not limited to, preservation or enhancement of estuarine habitats, vegetation, fish, shellfish, wildlife (e.g., estuarine mammals, waterfowl, shorebirds).</td>
</tr>
<tr>
<td><strong>Wetland Habitat (WET)</strong></td>
<td>Uses of water that support wetland ecosystems, including, but not limited to, preservation or enhancement of wetland habitats, vegetation, fish, shellfish, wildlife, and other unique wetland functions which enhance water quality, such as providing flood and erosion control, stream bank stabilization, and filtration and purification of naturally occurring contaminants.</td>
</tr>
<tr>
<td><strong>Marine Habitat (MAR)</strong></td>
<td>Uses of water that support marine ecosystems including, but not limited to, preservation or enhancement of marine habitats, vegetation such as kelp, fish, shellfish, or wildlife (e.g., marine mammals, shorebirds).</td>
</tr>
<tr>
<td><strong>Wildlife Habitat (WILD)</strong></td>
<td>Uses of water that support terrestrial ecosystems including, but not limited to, preservation and enhancement of terrestrial habitats, vegetation, wildlife (e.g., mammals, birds, reptiles, amphibians, invertebrates), or wildlife and food sources.</td>
</tr>
</tbody>
</table>
### Table 4.10: General Types and Examples of MS4 Conditions

<table>
<thead>
<tr>
<th>Type of Condition</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Chemical Conditions</strong></td>
<td></td>
</tr>
<tr>
<td>Constituents in flows (wet, dry, and</td>
<td>• Chemical constituent concentrations or loads (metals, pesticides,</td>
</tr>
<tr>
<td>ambient)</td>
<td>nutrients, etc.)</td>
</tr>
<tr>
<td><strong>Biological Conditions</strong></td>
<td></td>
</tr>
<tr>
<td>Pathogens and indicators</td>
<td>• Bacterial indicators in wet and dry weather flows</td>
</tr>
<tr>
<td></td>
<td>• Pathogens (bacteria, viruses, protozoa, etc.) in wet and dry weather</td>
</tr>
<tr>
<td></td>
<td>flows</td>
</tr>
<tr>
<td><strong>Toxicological Conditions</strong></td>
<td></td>
</tr>
<tr>
<td>Toxicity of discharges from MS4 outfalls</td>
<td>• Metals, pesticides, nutrients, etc.</td>
</tr>
<tr>
<td><strong>Physical Conditions</strong></td>
<td></td>
</tr>
<tr>
<td>Physical condition of MS4 facilities</td>
<td>• Geomorphic conditions</td>
</tr>
<tr>
<td>(channels, streets, roads, inlets,</td>
<td>• Erosion and sedimentation</td>
</tr>
<tr>
<td>outlets, etc.)</td>
<td>• Structural integrity</td>
</tr>
<tr>
<td></td>
<td>• Extent and amount of trash</td>
</tr>
<tr>
<td>**Flow conditions within the MS4 and</td>
<td>• Presence or absence, volume, velocities, and durations of flows</td>
</tr>
<tr>
<td>from outfalls**</td>
<td></td>
</tr>
<tr>
<td><strong>Other</strong></td>
<td>• pH, temperature, conductivity, dissolved oxygen, turbidity</td>
</tr>
</tbody>
</table>
# Level 4 Outcomes

## General Source Categories

<table>
<thead>
<tr>
<th>Municipal Sources</th>
<th>Residential Sources</th>
<th>Industrial/Commercial Sources</th>
<th>Construction Sources</th>
<th>Development &amp; Redevelopment Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Solid waste facilities</td>
<td>• Single family housing</td>
<td>• Restaurants</td>
<td>• Commercial and industrial development</td>
<td>• Commercial and industrial development</td>
</tr>
<tr>
<td>• Wastewater operations</td>
<td>• Multiple family housing</td>
<td>• Automotive maintenance</td>
<td>• Single family homes</td>
<td>• Single family homes</td>
</tr>
<tr>
<td>• Streets and roads</td>
<td>• Apartments</td>
<td>• Nurseries</td>
<td>• Major subdivisions</td>
<td>• Major subdivisions</td>
</tr>
<tr>
<td>• MS4s</td>
<td>• Mobile homes</td>
<td>• Horse stables</td>
<td>• Capital improvement projects</td>
<td>• Capital improvement projects</td>
</tr>
<tr>
<td>• Parks</td>
<td>• Rural residential areas</td>
<td>• Mobile operations (landscaping, pool care, pest control, etc.)</td>
<td>• Redevelopment projects</td>
<td>• Redevelopment projects</td>
</tr>
<tr>
<td>• Office buildings</td>
<td>• Inner city neighborhoods</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Types of Source Contributions

<table>
<thead>
<tr>
<th>Type of Contribution</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Materials and Wastes</strong></td>
<td>• Fertilizers</td>
</tr>
<tr>
<td></td>
<td>• Yard waste</td>
</tr>
<tr>
<td></td>
<td>• Paint</td>
</tr>
<tr>
<td></td>
<td>• Automotive fluids (motor oil, brake fluid, etc.)</td>
</tr>
<tr>
<td></td>
<td>• Trash and debris</td>
</tr>
<tr>
<td><strong>Pollutants</strong></td>
<td></td>
</tr>
<tr>
<td>Chemical Constituents</td>
<td>• Metals (e.g., Cd, Cu, Cr, Pb, Ni, Ag, Zn)</td>
</tr>
<tr>
<td></td>
<td>• Pesticides (e.g., organophosphates, pyrethroids)</td>
</tr>
<tr>
<td></td>
<td>• Nutrients (e.g., nitrates, phosphates)</td>
</tr>
<tr>
<td>Biological Constituents</td>
<td>• Bacterial indictors (total and fecal coliform, enterococcus, etc.)</td>
</tr>
<tr>
<td></td>
<td>• Pathogens (bacteria, viruses, protozoa, etc.)</td>
</tr>
<tr>
<td>Physical Constituents</td>
<td>• Sediment</td>
</tr>
<tr>
<td></td>
<td>• Floatables</td>
</tr>
<tr>
<td></td>
<td>• Temperature</td>
</tr>
<tr>
<td>Flows</td>
<td>• Stormwater flows (volume, velocities, and durations)</td>
</tr>
<tr>
<td></td>
<td>• Non-stormwater flows (presence or absence, volume, velocities, and durations)</td>
</tr>
</tbody>
</table>
Drainage Areas
Drainage Area Attributes

Land Area Characteristics
- Geographic boundaries
- Land uses (residential, industrial, transportation, etc.)
- Zoning classifications (residential, commercial, mixed use, etc.)

Sources of Pollutants and Flow
- Areas of pollutant and flow generation (area-wide, land use-specific, etc.)
- Source locations (industrial areas, facility locations, etc.)

Population Characteristics
- Demographics (ethnicity, gender, age, etc.)
- Population distribution (density, communities, etc.)

Physical Characteristics
- Locations of receiving waters and MS4s
- Patterns of precipitation and runoff
- Topography, soil types, and vegetation
- Areas of imperviousness, open space, or infiltration
Constituent-based organizational approaches (start at Levels 5 and 6)
Source-based organizational approaches (start at Level 4)
Questions?
Second Element
Target Audience Strategies

- Pollutant-generating Activities (PGAs)
- Best Management Practices (BMPs)
- Supporting behaviors
- Target audience characteristics

- Knowledge and awareness
- Other behavioral determinants
## Level 3 Outcomes

### Potential Target Audiences by Source Category

<table>
<thead>
<tr>
<th>Residential Sources</th>
<th>Source Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do-it-yourselfers (e.g., gardening and yard care; home improvement; power washing; vehicle washing, maintenance, and repair)</td>
<td>Pet owners</td>
</tr>
<tr>
<td>Service providers (commercial operations corresponding to same activities as above)</td>
<td>Livestock owners</td>
</tr>
<tr>
<td></td>
<td>Smokers</td>
</tr>
<tr>
<td></td>
<td>Recreational water users (swimmers, surfers, etc.)</td>
</tr>
<tr>
<td></td>
<td>Schoolchildren</td>
</tr>
<tr>
<td></td>
<td>Hotline callers</td>
</tr>
<tr>
<td>Municipal Sources</td>
<td></td>
</tr>
<tr>
<td>Garbage collectors</td>
<td>Waste water collection and water distribution maintenance staff</td>
</tr>
<tr>
<td>Street maintenance staff</td>
<td>Animal control staff</td>
</tr>
<tr>
<td>Park and grounds maintenance staff</td>
<td>Law enforcement staff</td>
</tr>
<tr>
<td>Building maintenance staff</td>
<td>Flood control or reclamation district maintenance staff</td>
</tr>
<tr>
<td>Grading plan or permit reviewers</td>
<td>Hazardous materials inspectors</td>
</tr>
<tr>
<td>Grading or construction inspectors</td>
<td></td>
</tr>
<tr>
<td>Industrial and commercial business inspectors</td>
<td></td>
</tr>
<tr>
<td>Owners</td>
<td>Mobile operators</td>
</tr>
<tr>
<td>Managers and supervisors</td>
<td>Contractors (landscaping, parking lot sweeping, etc.)</td>
</tr>
<tr>
<td>Employees (skilled workers and laborers)</td>
<td>Industry associations</td>
</tr>
<tr>
<td></td>
<td>Employee unions</td>
</tr>
<tr>
<td>Construction Sources</td>
<td></td>
</tr>
<tr>
<td>Owners</td>
<td>Contractors (plumbing, etc.)</td>
</tr>
<tr>
<td>Developers</td>
<td>Skilled workers</td>
</tr>
<tr>
<td>Planning groups</td>
<td>Laborers</td>
</tr>
<tr>
<td>New Development and Redevelopment Sources</td>
<td></td>
</tr>
<tr>
<td>Engineers and architects</td>
<td>Developers</td>
</tr>
<tr>
<td>Landscape architects</td>
<td>Housing authorities</td>
</tr>
<tr>
<td>Urban planners</td>
<td>Flood control or reclamation district planners</td>
</tr>
<tr>
<td>Engineers</td>
<td></td>
</tr>
</tbody>
</table>
General Types of Target Audience Actions

Pollutant-generating activities (PGAs) are behaviors that contribute pollutants or increase flows to runoff. In this illustration, a woman is using a hose to clean up an outdoor area. If other precautions are not taken to prevent flows and pollutants from leaving the site, this action is likely to be a PGA.

Best management practices (BMPs) are practices designed to prevent, reduce, or eliminate discharges of pollutants and flow. Here the woman has instead chosen to use a broom for cleaning up. Dry sweeping methods are an excellent example of choosing a BMP over a PGA.

Supporting behaviors are actions that encourage or facilitate BMP implementation. Supporting behaviors can be initiated by virtually anyone; in some cases, by dischargers (facility self-inspections, staff training, etc.) and in others by interested parties (pollution reporting, joining an environmental advocacy group, etc.).
Level 3 Outcomes

PGA-BMP Packages

**PGA**
Application of insecticides for ant control

**BMP Option 1**
Use less toxic products

**BMP Option 2**
Change timing of application

**BMP Option 3**
State and federal source control regulation

---

**PGA**
Runoff from vehicle washing

**BMP Option 1**
Use controllable spray nozzles

**BMP Option 2**
Wash over a permeable surface

**BMP Option 3**
Use “dry washing” techniques
Behaviors are Distributed within Target Audience Populations
Level 2 Outcomes

Barriers + Bridges = Influencing Factors
## Personal Factors

<table>
<thead>
<tr>
<th>Knowledge</th>
<th>Pesticide Use</th>
<th>Vehicle Washing</th>
<th>Disposal of Reusables</th>
<th>Sediment Discharge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pesticides should be applied according to label instructions</td>
<td>Controllable spray nozzles can significantly reduce runoff</td>
<td>Compost piles should be turned at least weekly</td>
<td>Silt fences should not be used at the base of a slope</td>
<td></td>
</tr>
</tbody>
</table>

### Awareness

| My pesticides can harm aquatic life | Commercial car washes minimize runoff | Training on composting is locally available | Discharges can be reported to a local hotline |

### Attitudes

| Healthy plants are more important than environmental protection | People have a right to wash their cars on the street | Composting is too messy to bother with | Construction will be completed long before anyone notices our runoff |
## External Factors

<table>
<thead>
<tr>
<th>Regulatory factors</th>
<th>Pesticide Use</th>
<th>Vehicle Washing</th>
<th>Disposal of Reusables</th>
<th>Sediment Discharges</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Some pesticides can be applied only by licensed pest control applicators; others are freely available</td>
<td>A program prohibits discharges from businesses, but not at residences</td>
<td>Re-use of materials is encouraged rather than legally required</td>
<td>Ordinances prohibit discharges, but do not require prevention through erosion control practices</td>
</tr>
<tr>
<td>Economic factors</td>
<td>Many pesticides are inexpensive or cheaper in large quantities</td>
<td>Washing in a driveway is cheaper than using a car wash</td>
<td>Changes in practices may require upfront investments (e.g., composting bins)</td>
<td>Materials needed for stabilization projects can be expensive</td>
</tr>
<tr>
<td>Technological factors</td>
<td>Effective alternatives do not exist for a particular use (e.g., ant control)</td>
<td>Controllable spray nozzles are widely available</td>
<td>Technologies are not widely available for recycling of &quot;higher numbered&quot; materials</td>
<td>A variety of products are available for effectively managing discharges</td>
</tr>
<tr>
<td>Structural factors</td>
<td>Site safety issues limit the use of pesticide alternatives</td>
<td>A nearby parking lot with a pervious surface could facilitate environmentally friendly car washing</td>
<td>A community garden provides residents access to composting bins</td>
<td>Site topography or space limitations inhibit the use of sediment control practices</td>
</tr>
<tr>
<td>Organizational factors</td>
<td>A business lacks a policy or procedures on pesticide use</td>
<td>A company has an offsite vehicle washing policy</td>
<td>Employees are actively encouraged to recycle and reuse</td>
<td>Site maintenance is not an organizational priority</td>
</tr>
<tr>
<td>Societal factors</td>
<td>Green lawns are valued as part of a community’s identity</td>
<td>Washing soapy water onto streets is considered “low class”</td>
<td>Composting is valued by the community</td>
<td>Sediment discharges onto public streets are considered unsightly</td>
</tr>
<tr>
<td>Communication factors</td>
<td>Residents lack information on pesticide alternatives</td>
<td>Information on “dry washing” techniques is widely available</td>
<td>Recycling and reuse policy is not communicated to employees</td>
<td>Information on effective erosion control practices is not widely available</td>
</tr>
</tbody>
</table>
Questions?
Third Element

Target Audience Strategies

- Facilitation activities
- Direct implementation of treatment control BMPs
- Administrative activities
- Data collection activities
Level 1 Outcomes

**Step 1 - A**  
Program Implementation Activities

(i) Facilitation Activities

(ii) Direct Implementation of Structural BMPs

(iii) Administrative Activities (support i and ii)

Behavioral change in target audiences

- PGAs

+ BMPs

Targeted Source Reductions
Facilitation Activities

- Replacing Barriers with Bridges
- Reducing Existing Barriers
- Increasing Existing Bridges
Facilitation Activities

Priority PGAs & BMPs

- Encouragement
- Incentive
- Requirement
- Supporting implementation

- Discouragement
- Disincentive
- Prohibition
- Opposing implementation
Example: Monthly insecticide spraying around the house

**Priority Behaviors**

- **BMP Option 1**: Use less toxic products
- **BMP Option 2**: Change timing of application
- **BMP Option 3**: State and federal source control regulation

**Potential Barriers**

- Lack of knowledge
- Increase in costs
- Resistance of users to change practices
- Products not widely available
- Products less effective

- Lack of knowledge
- Difficulty remembering
- Difficulty of predicting rainfall
- Industry opposition
- Lack of adequate data
- Registration review cycle

**Potential Facilitation Activities**

- Education
- Rebate program
- Licensing
- Enforcement

- Education
- Industry training
- Enforcement

- Advocacy for changes to pesticide label requirements
- Advocacy for restrictions on licensed applications
Questions?
Introduction to Strategic Planning for Stormwater Programs
Overview of Structured Planning Process
Step A: Characterizing Problems

Task 1: Evaluating existing conditions
- What are current conditions?
- How are conditions changing over time?

Task 2: Defining problem conditions
- Is the condition causally linked to a known or suspected higher outcome level problem?
- Is there independent evidence for designating the condition as a problem?

Task 3: Prioritizing problem conditions
- Is priority influenced by regulatory requirements?
- Is the problem significant, certain, and controllable?
- Is priority influenced by economic and social considerations?
Step A Task 1 Key Questions
Evaluating Existing Conditions

<table>
<thead>
<tr>
<th>Inputs</th>
<th>Key Questions</th>
<th>Outputs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Available Data, Information, and Results</td>
<td><strong>Question 1:</strong> What are current conditions?</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Question 2:</strong> How are conditions changing over time?</td>
<td>Existing Conditions</td>
</tr>
</tbody>
</table>

- Sweetwater River
- Tijuana River

- Significant Trend
- Upper and Lower 90% Confidence Interval
- Water Quality Benchmark
### Step A Task 2 Key Questions
#### Defining Problem Conditions

<table>
<thead>
<tr>
<th>Inputs</th>
<th>Key Questions</th>
<th>Outputs</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Existing Conditions</strong></td>
<td><strong>Question 1:</strong> Is the condition causally linked to a known or suspected higher outcome level problem?</td>
<td><strong>Problem Conditions</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Question 2:</strong> Is there independent evidence for designating the condition as a problem?</td>
<td></td>
</tr>
</tbody>
</table>
Multiple Problem Conditions Require Prioritization

- Bacterial indicators exceed Rec-1 indicators
- Hydromodification in creek
- Low DO levels in estuary
- Bifenthrin toxicity
- Wet weather TSS above benchmarks
- Benthic impairment
Task 3 Prioritizing Problem Conditions

Step A Task 3 Key Questions
Prioritizing Problem Conditions

**Inputs**
- Problem Conditions

**Key Questions**
- **Question 1:** What is the priority rating of each problem condition?
- **Question 2:** What is the relative importance of each problem condition?

**Outputs**
- Priority Problem Conditions
First Prioritization Step
Rating Problem Conditions

Tier 1
- Regulatory Requirements + Regulatory Constraints → Regulatory Rating

Tier 2
- Significance + Certainty + Controllability → Technical Rating

Tier 3
- Economic Rating + Social Rating → Sustainability Rating(s)
  - H, M, L, U + H, M, L, U → H, M, L, U
Second Prioritization Step
Ranking Problem Conditions

<table>
<thead>
<tr>
<th>RANKED ORDER EXAMPLE</th>
<th>GROUPED RANKING EXAMPLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Bacterial indicators exceed REC-1 standards</td>
<td></td>
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<td>2. Low DO levels in estuary</td>
<td></td>
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<tr>
<td>3. Wet weather TSS above benchmarks</td>
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<td>4. Hydromodification in creek</td>
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</tr>
<tr>
<td>5. Benthic impairment</td>
<td></td>
</tr>
<tr>
<td>6. Bifenthrin toxicity</td>
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</tr>
<tr>
<td><strong>GROUP A (Moderate)</strong></td>
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</tr>
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<td>• Bacterial indicators exceed REC-1 standards</td>
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<td>• Wet weather TSS above benchmarks</td>
<td></td>
</tr>
<tr>
<td>• Hydromodification in creek</td>
<td></td>
</tr>
<tr>
<td><strong>GROUP B (Low)</strong></td>
<td></td>
</tr>
<tr>
<td>• Benthic impairment</td>
<td></td>
</tr>
<tr>
<td>• Bifenthrin toxicity</td>
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</tbody>
</table>
Prioritized Problem Conditions Can Be Targeted for Change

<table>
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</tbody>
</table>
**Step B: Targeting Outcomes**

**Task 1**
- Identifying end-state targets
  - What is the end-state for the problem condition?
  - When should the end-state condition be achieved?

**Task 2**
- Establishing interim targets
  - What interim targets are needed to evaluate progress toward the end-state condition?
  - When will interim targets be achieved?

**Task 3**
- Identifying data requirements
  - What metrics will be used?
  - What data collection methods will be used?
  - What data analysis methods will be used?
### Step B Task 1 Key Questions
Identifying End-state Targets

<table>
<thead>
<tr>
<th>Inputs</th>
<th>Key Questions</th>
<th>Outputs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Priority Problem Conditions</td>
<td><strong>Question 1:</strong> What is the end-state for the problem condition?</td>
<td><strong>End-state Targets</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Question 2:</strong> When should the end-state condition be achieved?</td>
<td></td>
</tr>
</tbody>
</table>
Establishing End-state Targets

- Targeting to Regulatory Requirements
- Targeting to Higher Outcome Levels
- Targeting to Resources
- Targeting to Learn and Adapt
Timelines for Achieving Targeted Outcomes

- Complexity
- Cost
- Scale
- Metrics and methods of measurement
- Variability
Step C: Documenting Knowledge and Data Gaps

- **Task 1**: Compiling Step A Knowledge and Data Gaps
- **Task 2**: Compiling Step B Knowledge and Data Gaps
- **Task 3**: Consolidating the Knowledge and Data Gap List
Examples of Potential Knowledge and Data Gaps (Level 4)

- Understanding of drainage area contributions (EMCs, monitoring data, methodologies, etc.)
- Understanding of drainage area attributes (land uses, areas of pollutant and flow generation, population distribution, etc.; see also Table 4.14)
- Understanding of source contributions (potential or actual wet and dry weather discharges of pollutants or flows)
- Understanding of source attributes (number, size and types of sites or facilities; activities and practices; operations conducted; materials and wastes; see also Table 4.15)
- Adequacy of facility or other monitoring data (sample size, representative sampling, etc.)
- Knowledge of target audience attributes
- Knowledge of economic and social factors affecting drainage areas and sources
74
Questions?
Case Studies
Case Studies

- Case 1- Outcome Levels 6 through 1
  - Receiving water and MS4 water quality data available
  - Constituent based approach
  - Potential sources have been identified

- Case 2- Begins at Level 4
  - Source based approached
  - Limited water quality data
Case Study 1: Assessment of Levels 6 through 1
What are the priority receiving waters?
- Estuary, listed segments of creek upstream of estuary

What are priority problems for each priority receiving water?
Case Study 1: Assessment of Levels 6 – Receiving Water

Total Nitrogen and Phosphorus Concentrations exceed water quality objectives in Creek dry weather flows.

Algae Blooms, Low DO and Sediment Deposition in Estuary.

Evidence of Hydromodification in Local Streams.

Biological Impairment in Creek based on Bioassessment Data.
What Changes will be targeted for the receiving water?

- Improvement in Water Quality – Reduce nutrient load from dry weather watershed flows
- Changes in Physical Characteristics – Reduce peak volume storm flows resulting in hydromodification in creek
When and how will targeted changes be measured?

- **Long-term Trend (5-10 years) measurements of:**
  - Improvement in Water Quality – nutrient concentration and flows (load) from dry weather watershed flows
  - Reduction of peak storm flow volume
General Timelines Needed for Achieving Targeted Outcomes

- Program activities (Level 1)
- Target audiences and sources (Levels 2 - 4)
- MS4s and Receiving waters (Levels 5 & 6)

<table>
<thead>
<tr>
<th>Months</th>
<th>Years</th>
<th>Decades</th>
</tr>
</thead>
</table>

84
### Targeting Change - Spatial

<table>
<thead>
<tr>
<th>Level/Spatial Area</th>
<th>Site</th>
<th>Drainage Area</th>
<th>Hydrologic Unit</th>
<th>Watershed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 6 – Receiving Water</td>
<td>% Reduction in Nutrient Load</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Level 5 – Urban Runoff/MS 4</td>
<td>% Reduction in Nutrient Load</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Level 4 - Sources</td>
<td>% Conversion of High Fertilizer Use Landscaping</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Complexity (depends) and Cost to Measure Targeted Change**

[Step B: Targeting Outcomes]
What data is still needed for characterization and targeting outcomes?

- Adequacy and quality of the water quality data?
- How are nutrient concentrations impacting biological resources of creek and estuary?
- What are priority drainage areas that contribute to creek erosion due to hydromod?
Questions?
Case Study 1: Assessment of Level 5- MS4 Contributions

Nutrient Concentrations highest in runoff from Upstream Agricultural Land Use

Peak Flows from MS4 Outfalls linked to downstream evidence of extensive erosion of Local Streams

MS4 Outfalls with highest dry weather flows also contribute largest Nutrient loads
Which MS4 facilities convey flows to priority receiving waters?

Which facilities or portions of the MS4 are the highest priorities?

- MS4s discharging to listed segment of creek that have highest dry weather flows and/or nutrient concentrations
- MS4s discharging to segment of creek with greatest erosion and increase in peak flow
What Changes in MS4 conditions will be targeted and how will they be measured?

- Reductions in priority MS4s dry weather flows and/or nutrient concentrations
  - Annual flow monitoring and 2-5 yr. random sampling
- Reductions in priority MS4s storm flow volumes
  - Storm event flow monitoring
What data is still needed for characterization and targeting outcomes?

- Have baseline flows been measured in priority MS4 outfalls to assess change (adequacy)?
- What contribution does groundwater have in nutrient loading to receiving water compared to MS4?
- What contribution does runoff from agricultural areas compared to MS4 outfalls?
Case Study 1: Assessment of Level 4- Sources

Upstream Agricultural Land Use has measured higher Nutrient Concentrations in runoff

Priority Drainage Areas that contain older development linked to downstream evidence of extensive erosion of Local Streams

Residential and Commercial Landscaped areas in Priority Drainage Area with highest dry weather flows contribute largest Nutrient loads
Apply to Single or Set of Priority MS4 Outfalls

- Which drainage areas contribute priority flows or pollutants to the receiving water?
- Which portions of identified drainage areas are the highest priority?
- What are priority sources of pollutants or flow within drainage area?
# Case 1: Source and Impacts – Step A

## Characterizing Problems

| Level 6 – Receiving Water | • **Water Quality** - Eutrophication of Estuary - Excess Algae and Low DO in Summer  
|                          | • **Bio-indicators** – Benthic impairment in creek  
|                          | • **Physical Evidence** of Hydromod. in creek |
| Level 5 – Urban Runoff   | • **Water Quality** - Nutrient Loading from MS4  
|                          | • **Physical Evidence** of Erosion at and downstream of outfalls |
| Level 4 - Sources        | Likely **Water Quality** Sources:  
|                          | • Upstream Agricultural Runoff  
|                          | • Fertilized Landscape in Residential Comm.  
|                          | • Landscape and Organic Debris in MS4  
|                          | • Groundwater  
|                          | • Air Deposition  
|                          | • Natural Sources of Nutrients  
|                          | • **Physical** - Concentrated Higher Peak Flows from Urbanized Areas |
What changes will be targeted for each priority source and how will it be measured?

- Reductions in nutrient loading in priority areas.
  - Reduce yard waste in MS4
  - Conversion to zero or minimal fertilized landscapes
  - Measured reductions of dry weather flows
- Reduction in peak storm flows from priority drainage areas from older developed areas
What data is still needed for characterization and targeting outcomes?

- Is there baseline data on nutrient contributions from residential and commercial landscaped areas and yard waste in MS4? (complex)
- What baseline data is available on dry weather flows from targeted land uses?
- What are contributions from other potential sources and how do they compare to targeted sources?
Questions?
Case Study 1: Assessment of Level 3- Target Audience Actions

Upstream Agricultural Land Use has measured higher Nutrient Concentrations in runoff

Older development owners and HOAs with no stormwater retention on-site

Residential and Commercial Owners with Landscaped Areas in Priority Drainage Areas and Landscape Contractors – over-use of fertilizer, over-irigation and poor management of yard waste
Who are the target audience responsible for each source contribution?

What specific behaviors are contributing to priority source contribution?

- Commercial/Residential Property owners – High fertilizer use and over-irrigation in landscaped areas
- Landscape Contractors – Overuse of fertilizer, poor maintenance of irrigation systems and improper disposal of yard waste
What behavioral changes will be targeted to reduce or eliminate priority source contributions?

- Decrease in pollutant generating activities – over-use of fertilizer, over-irrigation and improper disposal of yard waste
- Implementation of BMP – *non-structural* – change over-use of fertilizer and disposal practices of yard waste by residential and landscape contractors – *structural* – turf replacement
## Case 1: Targeted Change – Metrics

<table>
<thead>
<tr>
<th>Level</th>
<th>Interim Targeted Change</th>
<th>5 Year Timeline - Measurement of Targeted Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 – Rec. Water</td>
<td>• Decreasing trend in nutrient concen.</td>
<td>• Monitor Nutrients, DO &amp; Algae – 1X/5 years</td>
</tr>
<tr>
<td>5 – Urban Runoff</td>
<td>• % Reduction of Nutrient Load</td>
<td>• Conduct Random Sampling of MS4 outfalls – 2-5 year intervals • Annual Flow measurements</td>
</tr>
<tr>
<td>4 – Sources</td>
<td>• Achieve % increase in converted lawns • Reductions at priority sites</td>
<td>• Count % of residences &amp; commercial sites converted to lower fertilizer use landscape • Conduct Runoff Monitoring of Selected Sites- converted landscapes</td>
</tr>
<tr>
<td>3- Target Audience</td>
<td>• Reduce % occurrence of high fertilizer use and improper disposal of yard waste</td>
<td>• Count % occurrence of activities by target audience with higher nutrient loading potential - compare with baseline year</td>
</tr>
</tbody>
</table>
### Level 3 Outcomes

#### Potential Target Audiences by Source Category

<table>
<thead>
<tr>
<th>Residential Sources</th>
<th>Municipal Sources</th>
<th>Industrial and Commercial Sources</th>
<th>Construction Sources</th>
<th>New Development and Redevelopment Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do-it-yourselfers (e.g., gardening and yard care; home improvement; power washing; vehicle washing, maintenance, and repair)</td>
<td>Garbage collectors</td>
<td>Owners</td>
<td>Owners</td>
<td>Engineers and architects</td>
</tr>
<tr>
<td>Service providers (commercial operations corresponding to same activities as above)</td>
<td>Street maintenance staff</td>
<td>Managers and supervisors</td>
<td>Developers</td>
<td>Landscape architects</td>
</tr>
<tr>
<td>Pet owners</td>
<td>Park and grounds maintenance staff</td>
<td>Employees (skilled workers and laborers)</td>
<td>Planning groups</td>
<td>Urban planners</td>
</tr>
<tr>
<td>Livestock owners</td>
<td>Building maintenance staff</td>
<td>Mobile operators</td>
<td>Contractors (plumbing, etc.)</td>
<td>Engineers</td>
</tr>
<tr>
<td>Smokers</td>
<td>Grading plan or permit reviewers</td>
<td>Contractors (landscaping, parking lot sweeping, etc.)</td>
<td>Skilled workers</td>
<td>Developers</td>
</tr>
<tr>
<td>Recreational water users (swimmers, surfers, etc.)</td>
<td>Grading or construction inspectors</td>
<td>Industry associations</td>
<td>Laborers</td>
<td>Housing authorities</td>
</tr>
<tr>
<td>Schoolchildren</td>
<td>Industrial and commercial business inspectors</td>
<td>Employee unions</td>
<td>Flood control or reclamation district planners</td>
<td></td>
</tr>
</tbody>
</table>
Tools to Measure Targeted Change – Targeted Sources & PGAs – Shorter Timeline

Increased Potential Nutrient Load Reduction
Questions?
Apply to each priority behavior

- Who are the factors that favor the implementation of pollutant generating activities (PGA)?
- Which of these barriers is contributing to priority PGA’s?
## Personal Factors

### Table 5.11: Examples of Personal Factors that Can Affect Behaviors

<table>
<thead>
<tr>
<th></th>
<th>Pesticide Use</th>
<th>Vehicle Washing</th>
<th>Disposal of Reusables</th>
<th>Sediment Discharge</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Knowledge</strong></td>
<td>Pesticides should be applied according to label instructions</td>
<td>Controllable spray nozzles can significantly reduce runoff</td>
<td>Compost piles should be turned at least weekly</td>
<td>Silt fences should not be used at the base of a slope</td>
</tr>
<tr>
<td><strong>Awareness</strong></td>
<td>My pesticides can harm aquatic life</td>
<td>Commercial car washes minimize runoff</td>
<td>Training on composting is locally available</td>
<td>Discharges can be reported to a local hotline</td>
</tr>
<tr>
<td><strong>Attitudes</strong></td>
<td>Healthy plants are more important than environmental protection</td>
<td>People have a right to wash their cars on the street</td>
<td>Composting is too messy to bother with</td>
<td>Construction will be completed long before anyone notices our runoff</td>
</tr>
</tbody>
</table>
### External Factors

#### Table 5.12: Examples of How External Factors Can Influence Behavior

<table>
<thead>
<tr>
<th>Factor</th>
<th>Pesticide Use</th>
<th>Vehicle Washing</th>
<th>Disposal of Reusables</th>
<th>Sediment Discharges</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regulatory factors</td>
<td>Some pesticides can be applied only by licensed pest control applicators; others are freely available</td>
<td>A program prohibits discharges from businesses, but not at residences</td>
<td>Re-use of materials is encouraged rather than legally required</td>
<td>Ordinances prohibit discharges, but do not require prevention through erosion control practices</td>
</tr>
<tr>
<td>Economic factors</td>
<td>Many pesticides are inexpensive or cheaper in large quantities</td>
<td>Washing in a driveway is cheaper than using a car wash</td>
<td>Changes in practices may require upfront investments (e.g., composting bins)</td>
<td>Materials needed for stabilization projects can be expensive</td>
</tr>
<tr>
<td>Technological factors</td>
<td>Effective alternatives do not exist for a particular use (e.g., ant control)</td>
<td>Controllable spray nozzles are widely available</td>
<td>Technologies are not widely available for recycling of &quot;higher numbered&quot; materials</td>
<td>A variety of products are available for effectively managing discharges</td>
</tr>
<tr>
<td>Structural factors</td>
<td>Site safety issues limit the use of pesticide alternatives</td>
<td>A nearby parking lot with a pervious surface could facilitate environmentally friendly car washing</td>
<td>A community garden provides residents access to composting bins</td>
<td>Site topography or space limitations inhibit the use of sediment control practices</td>
</tr>
<tr>
<td>Organizational factors</td>
<td>A business lacks a policy or procedures on pesticide use</td>
<td>A company has an offsite vehicle washing policy</td>
<td>Employees are actively encouraged to recycle and reuse</td>
<td>Site maintenance is not an organizational priority</td>
</tr>
<tr>
<td>Societal factors</td>
<td>Green lawns are valued as part of a community’s identity</td>
<td>Washing soapy water onto streets is considered “low class”</td>
<td>Composting is valued by the community</td>
<td>Sediment discharges onto public streets are considered unsightly</td>
</tr>
<tr>
<td>Communication factors</td>
<td>Residents lack information on pesticide alternatives</td>
<td>Information on &quot;dry washing&quot; techniques is widely available</td>
<td>Recycling and reuse policy is not communicated to employees</td>
<td>Information on effective erosion control practices is not widely available</td>
</tr>
</tbody>
</table>
## Case 1: Target Audiences/ Barriers and Bridges

| Level 4 – Sources | • Upstream Agricultural Runoff  
| | • Fertilized Landscape in Residential Comm.  
| | • Landscape and Organic Debris in MS4  |
| Level 3 – Target Audiences | • Agricultural Community  
| | • Residences  
| | • Landscapers  
| | • Landscape Contractors  
| | • Municipal O&M - Street/Catchment  
| | • Over-irrigation  |
| Level 2 - Barriers & Bridges | Personal Factors (awareness, knowledge, attitudes)  
| | • Lack of knowledge of over-use of fertilizer link to WQ  
| | • Indifference to changing fertilization use or irrigation practices  
| External Factors (regulatory, financial, social) | • Agricultural community – under waiver  |
Apply to each priority behavior

- What bridges are necessary to address priority source contributions?
  - Change in regulatory regime to address agricultural waiver; training to increase knowledge of workers; training and education to change awareness and incentives to change old practices.
- What are the metrics to measure success?
<table>
<thead>
<tr>
<th>Level</th>
<th>Interim Targeted Change</th>
<th>5 Year Timeline- Measurement of Targeted Change</th>
</tr>
</thead>
</table>
| 3 – Target Audience | • % of highest priority agricultural properties implement BMPs  
• % of Residences for target are that use trained landscapers  
• Number of residences that use more efficient irrigation system | • Survey highest priority sites for pollutant generating activities (PGA) modified per nutrient reduction plan  
• Based on survey of residences within target area that have changed to trained landscaper  
• Based on applications for rebates for smart irrigation systems, turf replacement, drip irrigation upgrades |
| 2 – Bridges & Barriers | • Change awareness and knowledge of residences & landscape contractors, on PGAs and the BMPs to reduce over-use of fertilizer, over-irrigation & yard waste disposal. | • Surveys and interviews with residences and landscape contractors in target areas |
What data is still needed for characterization and targeting outcomes?

- Is the targeted audience that is surveyed for change in awareness and knowledge consistent or is there high turn-over reducing effectiveness?
- Are there other behaviors and barriers that contribute to greater source contributions that have not been identified, prioritized and targeted?
What facilitation activities will be targeted to reduce or eliminate priority PGAs in target audience?

- Cooperation Agreement with Agricultural Community
- Development of Nutrient Reduction Plans – BMPs
- Training Programs for Ag. Workers and Landscapers
- Establishment of Rebate System to incentivize residents to convert landscaping & irrigation system

What program data collection, management and reporting is needed?
### Case 1:

#### Step B: Targeting Outcomes

<table>
<thead>
<tr>
<th>Level</th>
<th>Interim Targeted Change</th>
<th>5 Year Timeline - Measurement of Targeted Change</th>
</tr>
</thead>
</table>
| 1 – Stormwater Program Activities | • Obtain cooperation agreements with % of priority agricultural sources  
• Institute training for agricultural workers, & landscape contractors on BMPs  
• Establish rebate program | • Number of agricultural properties that sign up for cooperation agreement on nutrient reduction plan  
• Record number of agricultural workers trained and use BMPs  
• Number of rebates given for irrigation BMPs and number installed |
Questions?
Case Study 2: Levels 4 through 1

**Sources** of MS4 Non-Storm Flows from Stormwater IC/ID Inspection and Enforcement Program:
- Over-irrigation
- Broken/leaking irrigation valves
- Vehicle Washing
- Hard Surface Washing
- Pool Maintenance
- Dewatering

MS4 Permit requires non-storm water flows from MS4 to be eliminated

Stormwater Program has **limited MS4 Water Quality Data**

Stormwater Program has **limited Water Quality Receiving Water Data**
Apply to Single or Set of Priority MS4 Outfalls

- Which drainage areas contribute to greatest sources of non-storm flows?
  - MS4 flow data or use inspection program data
- Which portions of identified drainage areas are the highest priority?
- What are priority sources of non-storm flows within drainage area?
What changes will be targeted for each priority source and how will it be measured?

- Reductions in non storm flows in priority drainage areas.
  - Measured reductions of dry weather flows from residential and commercial land uses within high priority areas
What data is still needed for characterization and targeting outcomes?

- What baseline data is available on dry weather flows from targeted land uses?
- What non-storm flow data is needed from MS4 outfall monitoring to better prioritize drainage areas?
- What are contributions from other potential sources and how do they compare to targeted sources?
Who are the target audience responsible for each source contribution?

What specific behaviors are contributing to priority source contribution?

- Commercial/Residential Property owners – Over-irrigation in landscaped areas
- Landscape Contractors – Poor maintenance of irrigation systems
- Residences & Commercial Operators - vehicle and hardscape washing
Case Study 2: Assessment of Level 3 - Target Audience Actions

Target Audience Behaviors:
- Over-irrigation
- Maintenance of Broken/leaking irrigation valves
- Vehicle Washing
- Hard Surface Washing
- Pool Maintenance
- Dewatering

Target Audience:
- **Residences** with Landscaped Areas requiring irrigation
- **Commercial** owners with Landscaped Areas requiring irrigation
- **Landscape Contractors** providing irrigation system maintenance
What behavioral changes will be targeted to reduce or eliminate priority source contributions?

- Decrease in pollutant generating activities – over-irrigation, poor maintenance of irrigation system, vehicle washing
- Implementation of BMP – non-structural – enforcement of non storm flow prohibition – structural – drip irrigation, smart irrigation systems, leak detection
Tools to Measure Targeted Change – Targeted Sources & PGAs

Decrease in Non-Storm Flows

- Commercial PropertiesConverted to Drip Irrigation
- HOAs Converted to Smart Irrigation System
- Residential Properties Converting >50% Turf Replacement
- Commercial Properties Converted to Low Irrigation Landscapes

First Year
Second Year
Third Year
Apply to each priority behavior

- What are the factors that favor the implementation of pollutant generating activities (PGA)?
- Which of these barriers is contributing to priority PGA’s?
# Case 1: Target Audiences/ Barriers and Bridges

## Level 3 – Target Audiences and Behaviors

<table>
<thead>
<tr>
<th>Residences</th>
<th>Commercial Property Owners</th>
<th>Landscape Contractors</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Over-irrigation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Maintenance of Broken/leaking irrigation valves</td>
<td></td>
<td></td>
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<td>• Dewatering</td>
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</tr>
</tbody>
</table>

## Level 2 - Barriers & Bridges

<table>
<thead>
<tr>
<th>Personal Factors (awareness, knowledge, attitudes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Barrier - Lack of knowledge of over irrigation</td>
</tr>
<tr>
<td>• Barrier - Indifference to changing irrigation practices</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>External Factors (regulatory, financial, social)</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Barrier – Cost of replacing irrigation system</td>
</tr>
<tr>
<td>• Bridge – Drought awareness &amp; rising cost of water</td>
</tr>
<tr>
<td>• Bridge - Non-Storm Water Prohibition</td>
</tr>
</tbody>
</table>
Apply to each priority behavior

- What bridges are necessary to address priority source contributions? PGA – over-irrigation
  - Drought Awareness – education - connection to over-irrigation
  - Rising cost of water – education - connection to over-irrigation
  - Non storm flow prohibition in MS4 Permit – enforcement of PGA
  - Rebates for More Efficient Irrigation System or Turf Replacement - Incentives

- What are the metrics to measure success?
<table>
<thead>
<tr>
<th>Level</th>
<th>Interim Targeted Change</th>
<th>5 Year Timeline- Measurement of Targeted Change</th>
</tr>
</thead>
</table>
| 3 – Target Audience | • % of Residences for target area that implement turf replacement  
• Number of residences that use more efficient irrigation system | • Based on number of application for residential turf replacement  
• Number of commercial properties that have applied for green business program that provides rebates for more efficient irrigation systems  
• Based on applications for rebates for smart irrigation systems, turf replacement, drip irrigation upgrades |
| 4 – Bridges & Barriers | • Increased in awareness of connection between drought and over-irrigation  
• Increase knowledge of non-storm water prohibition | • Surveys of residences in targeted areas on awareness of connection between drought and over-irrigation  
• Surveys of commercial properties knowledgeable about non-storm flow prohibition and enforcement actions  
• Number of enforcement actions that have been cited and addressed. |
What data is still needed for characterization and targeting outcomes?

- What bridges are most effective in changing behavior in over-irrigation?
- Are there other behaviors and barriers that contribute to over-irrigation and other PGS that have not been identified, prioritized and targeted?
What facilitation activities will be targeted to reduce or eliminate priority PGAs in target audience?

- Establishment of Rebate System to incentivize residents and commercial properties to convert landscaping & irrigation system
- Expand Education and Outreach to increase awareness of non-storm flow prohibition, enforcement program and rebate incentive program.
- Increase Enforcement and Fines for Over-irrigation

What program data collection, management and reporting is needed?
Level 1 Outcomes

Step 1 - A Program Implementation Activities

(i) Facilitation Activities

Behavioral change in target audiences

- PGAs

+ BMPs

(ii) Direct Implementation of Structural BMPs

(iii) Administrative Activities (support i and ii)

+ BMPs

Targeted Source Reductions
Case 2: Importance of Program Effectiveness Assessment

- Allows program managers to assess effectiveness of programs at multiple outcome levels – different metrics, timelines, interlinked outcomes
- What’s more successful: education, enforcement or incentives? Or is it the combination that is most effective?
- What structural BMPs will ultimately be needed where more cost effective non-structural hits limitations? Most successful runoff reduction program will be 30-50% effective.
Questions?
Thank you!

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