NATIONAL PERSPECTIVE ON STORMWATER QUALITY AND LID IMPLEMENTATION WITH ASSOCIATED CHALLENGES

Presenters:

Rob Anderson, President of RJR Engineering and Interim Executive Director and Chairman of the Board of EnviroCert International, Inc.

and

Alan Black, Stormwater Lead with HNTB and Director, Treasurer and Technical Chair for EnviroCert International, Inc.

TRENDS IN STORMWATER

Permits require BMP's and <u>other</u> measures under:

- Construction General Permit (CGP)
- Industrial (or Multi-Sector) General Permit (IGP)
- Municipal General Permit (MS4 etc.)

Then we encounter SUSMP, SQUIMPS, SWMP (and other alphabet soup requirements), and other local or specialized requirements from the various permits.

Evolution of Stormwater

Until recent years (depending on location) BMP’s were be implemented ONLY during construction …

At best, limited success under best conditions. As This brought about LID.

Evolution of Stormwater

303d Assessments and continued testing demonstrated the continued degradation of water quality and habitat. This brought about LID.

Ramp Up to LID

Don't worry … LID to the rescue !

Positives:

- Hydrologic mimicry
- Water reuse
- Groundwater recharge
- Multiple local or regional uses

Where did LID come from ?

Development of LID principles began with the introduction of bioretention technology in Prince George's County, Maryland, in the mid-1980s.

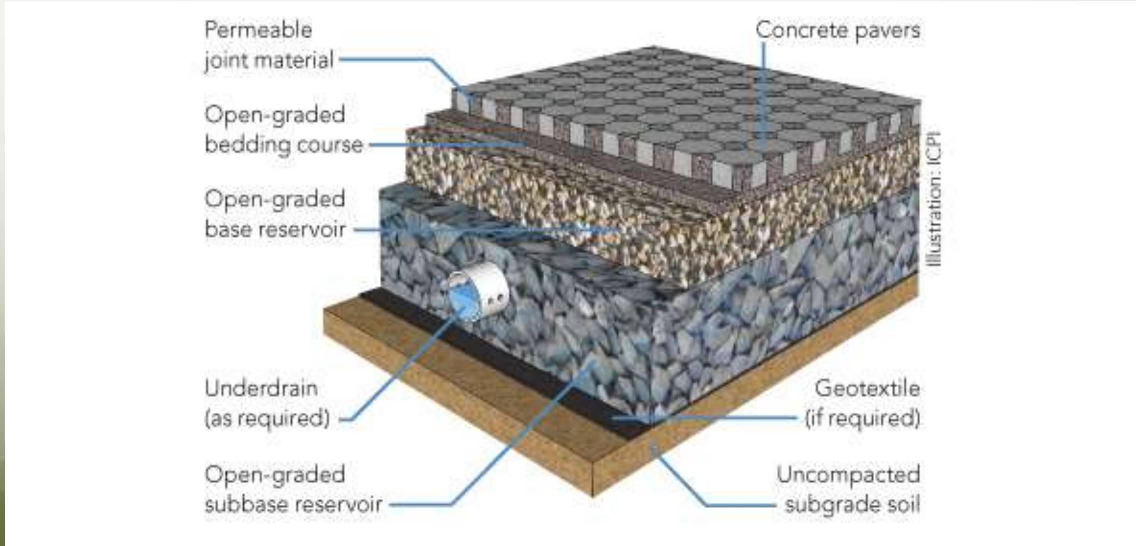
- LID was pioneered to help Prince George’s County address the growing economic and environmental limitations of conventional stormwater management practices.
- LID allows for greater development potential with less environmental impacts through the use of smarter designs and advanced technologies that achieve a better balance between conservation, growth, ecosystem protection, and public health / quality of life.

Where did LID come from ?

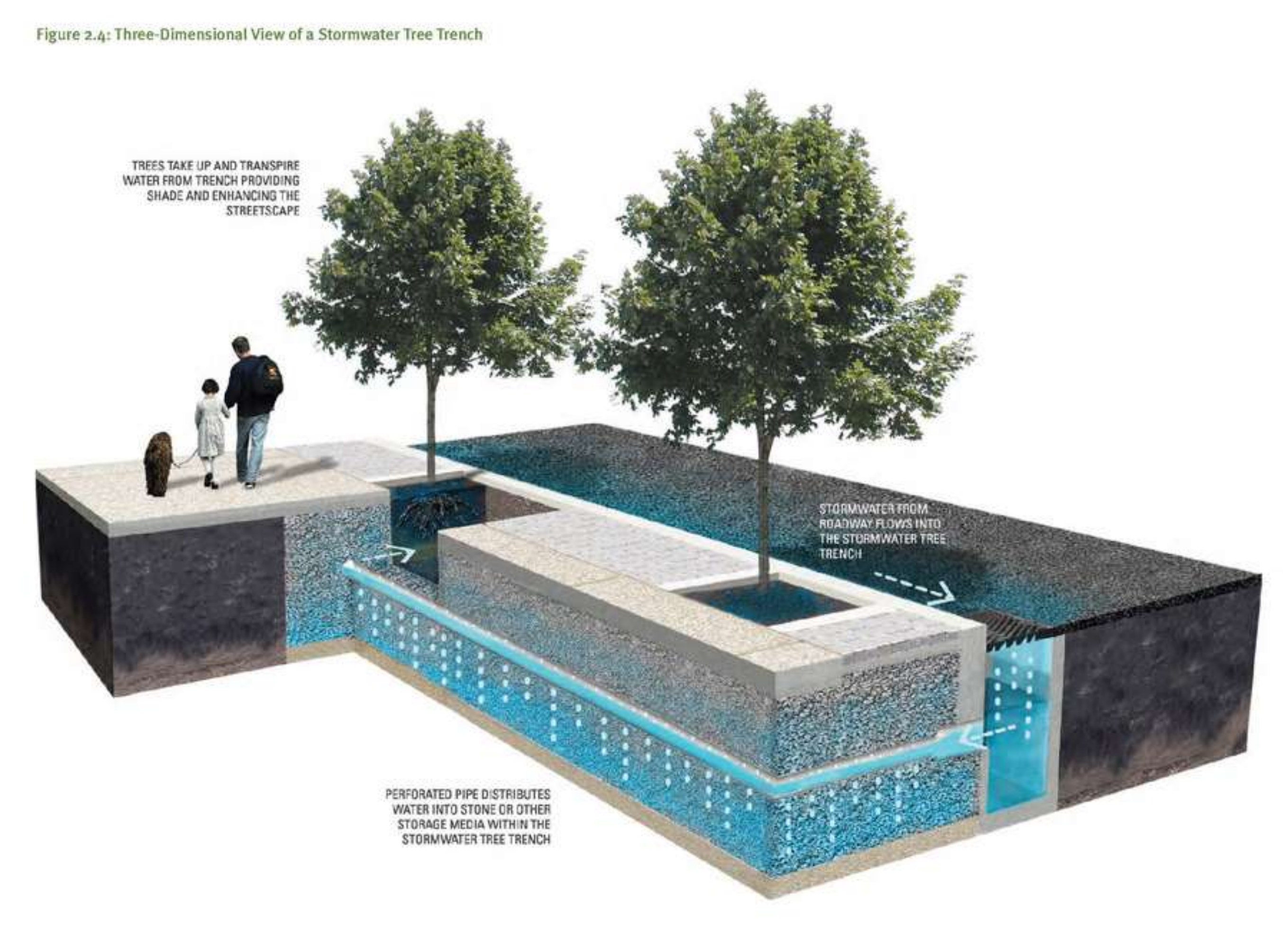
Today, when most here LID, they think: bioretention

As illustrated in your permit and SWMP, this is just one of the LID techniques available to users.

Other techniques, such as permeable pavers, tree box planters, and disconnected downspouts, are a few other measures to control pollutants, reduce runoff volume, manage runoff timing, and address a number of other ecological concerns.



What does the EPA say about LID ?



EPA Perspective on LID

U.S. Environmental Protection Agency (EPA) considers LID to be a **management approach**

The term *low impact development* (LID) refers to systems and practices that use or mimic natural processes that result in the infiltration, evapotranspiration or use of stormwater in order to protect water quality and associated aquatic habitat by reducing runoff and pollutant loadings by managing runoff as close to its source(s) as possible.

EPA Perspective on LID

LID includes overall site design approaches (holistic LID, or LID integrated management practices)

and,

individual small-scale stormwater management practices (isolated LID practices)

that:

promotes the use of natural systems for infiltration, evapotranspiration and the harvesting and use of rainwater.

For more information on LID, see **www.epa.gov/nps/lid**.

EPA Perspectives

Then … EPA paradigm shift: LID is CUTE but NOT POWERFUL ENOUGH !

DEVELOPMENTS IN STORMWATER

GREEN INFRASTRUCTURE will now save us ….

EPS Perspective on GI

Green Infrastructure is popping up everywhere:

- MS4 and TMDL Regulatory Mandate
- CSO reduction
- Rainwater Reuse
- Water Supply
- Groundwater Replenishment
- Pollution Removal
- Political Popularity
- LEED or other Ratings

EPA Perspective on GI

Green infrastructure is an:

- approach to wet weather management that is cost-effective, sustainable, and environmentally friendly.
- approaches and technologies infiltrate, evapotranspire, capture and reuse stormwater to maintain or restore natural hydrology.
- creates patchwork of natural areas that provide habitat, flood protection, cleaner air and cleaner water.

EPA Perspective on GI

Green Infrastructure (GI) has been used outside of a stormwater context to describe the creation and networking of natural ecosystems and greenway corridors (e.g., forests and floodplains). This provides ecological services and benefits ranging from:

- filtering air pollutants,
- reducing energy demands,
- mitigating urban heat islands,
- sequestering and storing carbon,
- enhancing aesthetics and property values, and
- preserving and creating natural habitat functions.
- In this context, the term may also be known as natural infrastructure

www.epa.gov/greenkit/natural_infrastructure.htm

EPA Perspective on GI

In the context of stormwater, GI refers to:

engineered-as-natural ecosystems such as green roofs, porous pavement, swales and rain gardens (which are also LID practices) that largely rely on using soil and vegetation to infiltrate, evapotranspirate, and/or harvest stormwater runoff and reduce flows to drainage collection systems.

In this context, it is often used interchangeably with Green Stormwater Infrastructure or Wet Weather Green Infrastructure.

EPA Perspective on GI

Considered collectively,

GI is an integrated system of natural elements and LID practices that provide broad environmental benefits.

For many, GI is becoming an umbrella term under which other terms (such as LID), fit.

EPA Perspective on LID/GI

Terms you will hear:

Reference:

Terminology of Low Impact Development Distinguishing LID from other Techniques that Address Community Growth Issues; EPA March 2012.

EPA Perspective on GI

Other GI terms include:

Green Stormwater Infrastructure or Wet Weather Green Infrastructure emphasizes approaches that rely on natural or engineered-as-natural ecosystems to specifically control and manage stormwater runoff

See www.epa.gov/greeninfrastructure for more information.

Conservation Design seeks to protect the natural environment with open space landscapes, along with high quality wildlife habitats and existing farmland and rural communities.

EPA Perspective on GI

EPA Perspective on GI

Other GI terms include:

Sustainable Stormwater Management: focuses on natural solutions to restore or maintain a predevelopment water balance (holistic LID).

Better Site Design: Key principles of this approach include reducing impervious cover, increasing the amount of natural lands set aside for conservation, and better integrating stormwater treatment systems on-site.

EPA Perspective on GI

Other GI terms include:

Smart Growth refers to a range of development and conservation strategies intended to preserve and protect the natural environment while simultaneously making communities more attractive, economically stronger and more socially diverse.

Smart growth relies on ten key principles, such as taking advantage of compact building design and increasing density to prevent sprawl and preserve more undisturbed natural areas, mixing land uses to reduce transportation needs and improve quality of life, creating walkable neighborhoods, providing a variety of transportation choices.

For more information on smart growth, see www.epa.gov/smartgrowth

EPA Perspective on GI

Other GI terms include:

New Urbanism is closely related to Smart Growth and for many can be used interchangeably. It focuses on traditional neighborhood design, provides improved connectivity through traditional street grids, promotes a strong sense of place and local identity, and minimizes dependency on cars.

Light Imprint Design is a term that grew out of the New Urbanist movement that seeks to integrate Low Impact Development with New Urbanism. It encourages sustainable, compact, mixed-use community development and walkable communities. Placement of stormwater and other green practices strive to encourage interaction between people and the environment, not block it. For example, communities not only preserve natural areas, but also include access paths.

EPA Goals for LID

1. Improved Water Quality.
2. Reduced Number of Costly Flooding Events.
3. Restored Aquatic Habitat.
4. Improved Groundwater Recharge.
5. Enhanced Neighborhood Beauty.

So when managing your reporting from a regulatory point of view, please keep these big picture themes and goals in mind.

LID EPA Summary

EPA publications often list the following LID benefits:

- **mitigate the urban heat island effect** (by in filtrating water running off hot pavements and shading and minimizing impervious surfaces),
- **mitigate climate change** (by sequestering carbon in plants),
- **save energy** (from green roofs, tree shading, and reduced/ avoided water treatment costs),
- **reduce air pollution** (by avoiding power plant emissions and reducing ground-level ozone),
- **increase property values** (by improving neighborhood aesthetics and connecting the built and natural environments), and **increase**
- **groundwater recharge**, potentially slowing or reversing land and well field subsidence.

GI/LID – GENERALLY ACCEPTED BENEFITS

- Preserve and protect wetlands, surface waters, streams, flood prone areas and sensitive water bodies
- Minimize land disturbance
- Reduce stormwater runoff and stream bank erosion
- Promote infiltration and evapotranspiration
- Promote groundwater recharge
- Maintain stream base flow
- Maximize vegetated and natural conveyances
- Minimize or reduce imperviousness.

GI/LID – GENERALLY ACCEPTED BENEFITS

- Conserve natural areas and open spaces
- Disperse stormwater control measures into the landscape and manage stormwater runoff at or near the sources of the runoff thus provides flexibility and alternatives to a centralized stormwater control measure (this can vary)
- Improve aesthetics (this can vary)
- Reduce infrastructure, thus reducing capital expenses, maintenance cost, and operating cost (mixed results)
- · Increase value (big debate)

GI/LID – GENERALLY ACCEPTED PROBLEMS

- Emergency and waste management services that insist on wider and wider access roads to accommodate larger and larger equipment.
- Local ordinances with requirements for parking, curb and gutter, street widths and lengths, cul- de-sac requirements, side walk and drive ways, setback and frontage, etc.
- Federal and State standards do not always provide the flexibility
- Parking “needs” are often mandated, often through lease agreements, by commercial and retail businesses.

GI/LID – GENERALLY ACCEPTED PROBLEMS

- **Uncertainty in performance and cost**. There is a general lack of education for home builders, realtors, lenders, regulators, legislators, home owners, and developers. Many do not understand LID. Questions that impede LID include, "Can you get a state permit for LID? What is LID? What does it cost? Is it going to take longer to get a permit and complete the construction? Does it provide equal or better water quality controls? Will it control the larger storm events? Is it only for projects with good soils and where will we infiltration? Is LID is merely an alternative to traditional stormwater control measures?
- **The cost to set up an HOA for O&M.**
- **Resistance to change**. Developers know what will work. They aren't so sure about LID and cannot accurately predict for a proforma

GI/LID – GENERALLY ACCEPTED PROBLEMS

- **Uncertainty of LID and flood control channels**. LID treatment not effective (or little data to support) with large events. Liability for Developers and liability for Flood Control Departments.
- Note: More local governments allowing variances if the Developer can show there will be not be an impact on flooding,
- **Consumers (as well as many in the industry) do not demand LID nor do they understand.**
- **Responsibilities for implementing stormwater requirements are fragmented.** In addition to state and Federal requirements, each local government has unique 1) ordinances, 2) flood control requirements, 3) project review and permitting processes, etc. Further the various elements of design and build are fragmented, i.e. developers, designers and engineers, those responsible for stormwater, landscape companies, builders, local and state regulators, etc.

GI/LID – GENERALLY ACCEPTED PROBLEMS

- **Guidance and technical questions**. Can soils with low infiltration rates reliable infiltrate, over time, the design storms? Do tight soils seal up? What effect does compaction have on infiltration? Is the required two feet (some States up to 10 feet) separation from the water table necessary?
- **Design standards**, i.e., the requirement for two feet above the seasonal high water table may impede LID and the requirement have a minimum hydraulic conductivity of 0.50 inches (some as low as 0.35 inches per hour) per hour may impede LID.
- **Lack of innovative designs**. No record or history. A designer cannot be sure of published materials and the national database info.
- **Design requirements**. Need to customize for local conditions and then establish a long-term measure of success and adjust accordingly.

GI/LID – GENERALLY ACCEPTED PROBLEMS

- **Access to private property to inspect and maintain stormwater control measures**, i.e., code enforcement would be a nightmare, deed restrictions, and operation and maintenance concerns, higher perpetual inspection requirements.
- **Not always cost effective and/or provide stormwater quality improvements**

EPA Perspective on LID/GI

So what does all of this mean to you and how should you approach as a regulator and/or a design ?

…. And any approach is up for a lot of debate.

EPA Perspective on LID/GI

Maybe the real question is:

As Regulators and Designers with a Permit and SWMP, what are you really interested in ?

How should you quantify the effectiveness of various LID BMPs and the resulting improvement in receiving water quality ?

EPA Perspective on LID/GI

Permit Conformance to fend off Stakeholder lawsuits or are we really addressing water quality ?

Overall Perspectives

Perspective 1: Continue to look to other programs across the country but adapt to the local resources and conditions. Do not make the same mistakes other municipalities make.

Consider:

- Local resources
- Climate and other conditions
- Water conservation

Overall Perspectives

Perspective 2: EDUCATION and TRAINING !

- Most professionals and the public do not know what they do not know.
- Look to California and others for training examples.

* Important: "Professional" Certifications for broad knowledge and local educational training for local practices

Overall Perspectives

Education Continued:

- Need to better integrate Engineering (both Civil and Geotechnical Engineering into the process.

Overall Perspectives

Education Continued:

- Long term maintenance challenges
  - Changes in ownership
  - Weather
  - Lack of Enforcement
- Need for long term monitoring and testing
  - Long term results lacking
  - National database flaws
- Public outreach and social indicators

Overall Perspectives

Perspective 3: State Local but think Larger Picture

- Implement requirements but consider the entire watershed.

Overall Perspectives

Couple Points

1. Despite significant advances in alternative "integrated urban stormwater management" techniques and processes over the last 20 years, wide-scale implementation has been limited. By in large the, while there have been notable successes, stormwater quality and other resources have continued to decline !

2. The public administration of urban stormwater inherently privileges and perpetuates traditional stormwater management practices at implementation …. Why ?

Lack of institutional knowledge, history, expertise, and leadership pose impediments to change and evolution.

Trend towards Watershed Management

Watershed Management Approach

- Section 303(d) of the Clean Water Act (CWA) requires that each State “shall identify those waters within its boundaries for which the effluent limitations are not stringent enough to implement any water quality objective applicable to such waters.” The CWA also requires states to establish a priority ranking for waters on the 303(d) list of impaired waters and establish TMDLs for such waters.

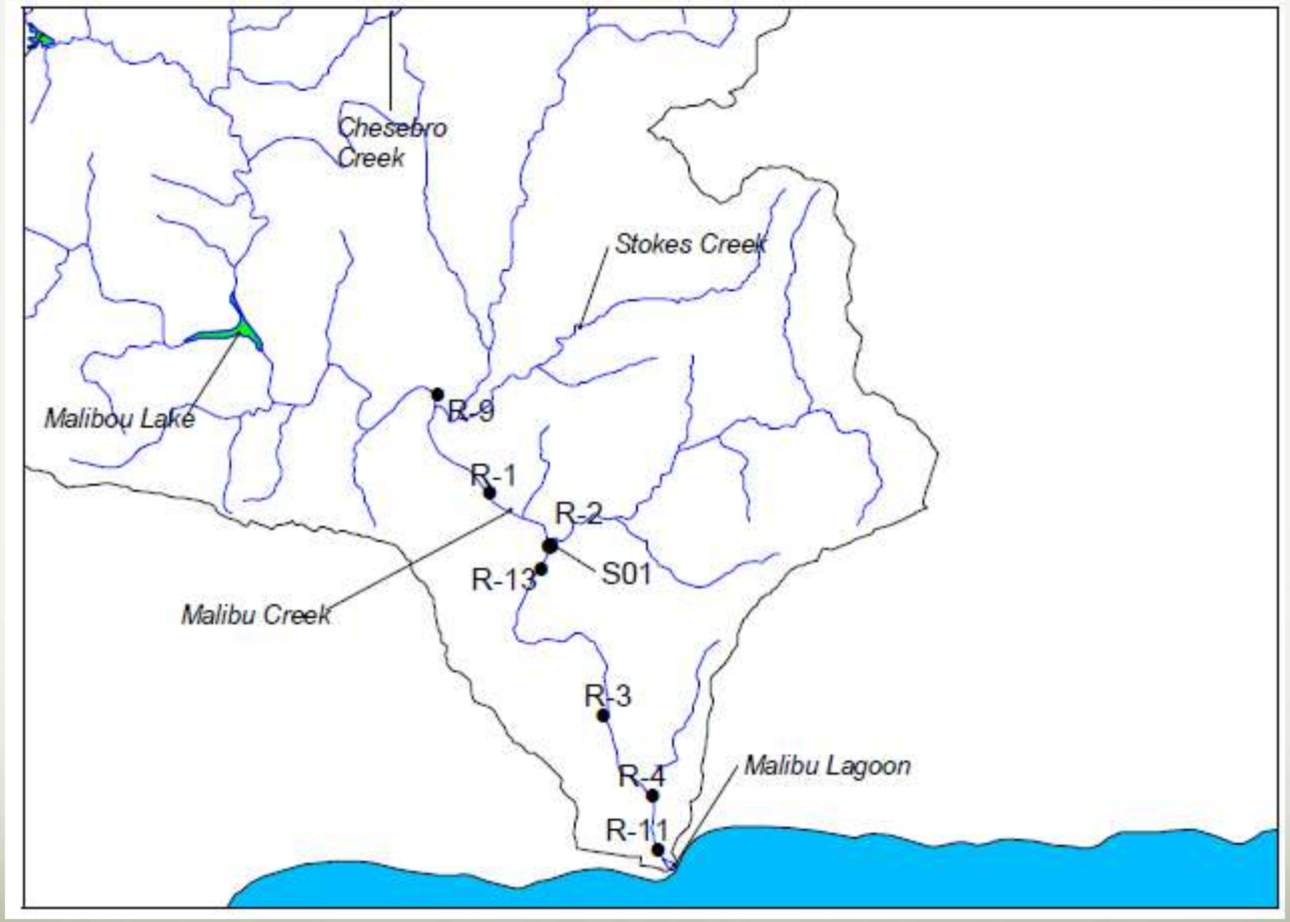
- The elements of a TMDL are described in 40 Code of Federal Regulations (CFR) 130.2 and 130.7 and Section 303(d) of the CWA, as well as in the USEPA Region IX’s Guidance for Developing TMDLs in California (USEPA, 2000e). A TMDL is defined as the “sum of the individual waste load allocations for point sources and load allocations for nonpoint sources and natural background” (40 CFR 130.2) such that the capacity of the waterbody to assimilate pollutant loads (the loading capacity) is not exceeded. A TMDL is also required to account for seasonal variations and include a margin of safety to address uncertainty in the analysis (CWA 303(d)(1)(C) (USEPA, 2000e).

- States must develop water quality management plans to implement the TMDL (40 CFR 130.6)

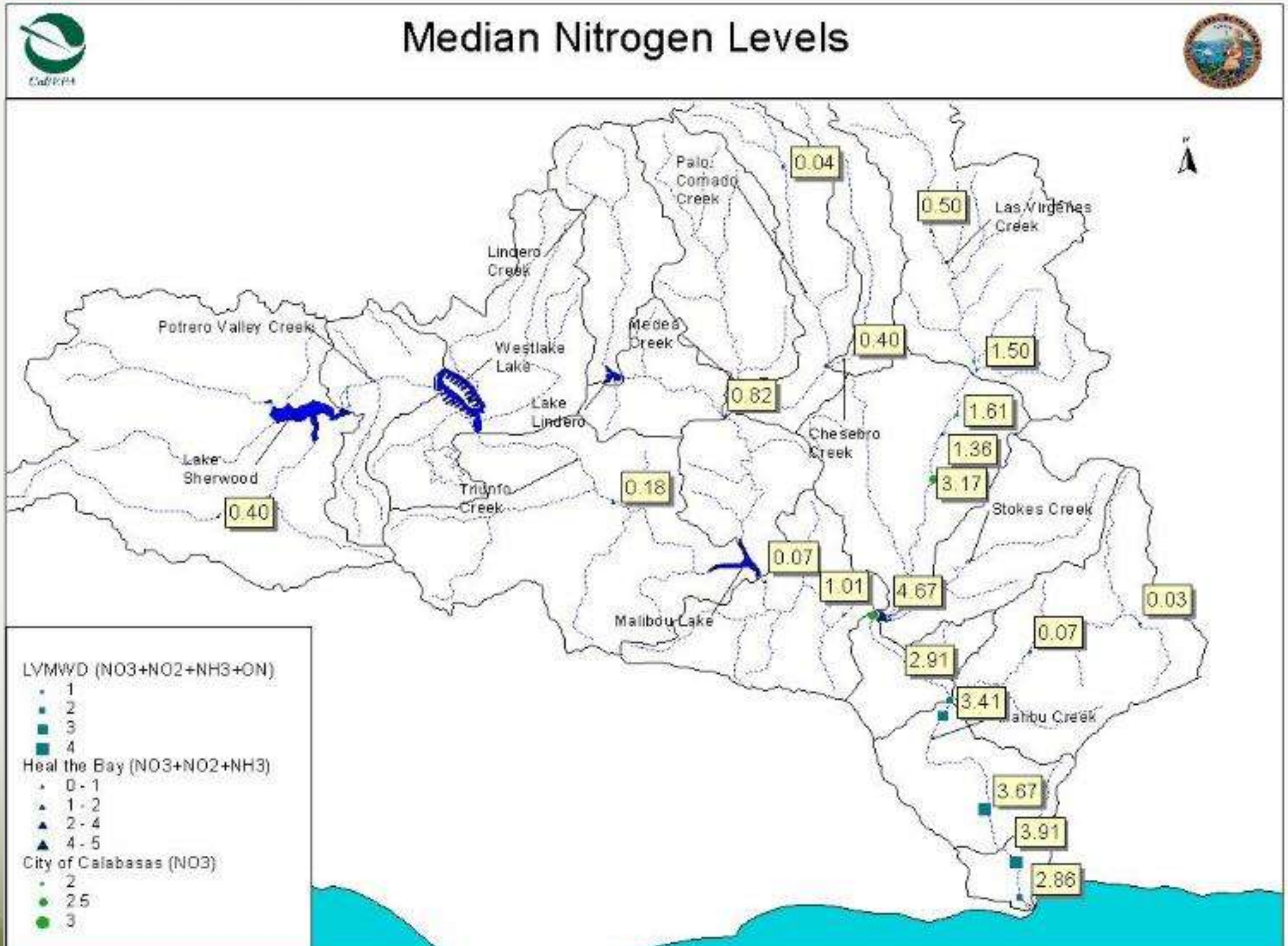
Trends toward Watershed Management

These approaches can allow the various agencies to evaluate on a watershed scale and implement green streets, retrofits, and other BMP mitigations.

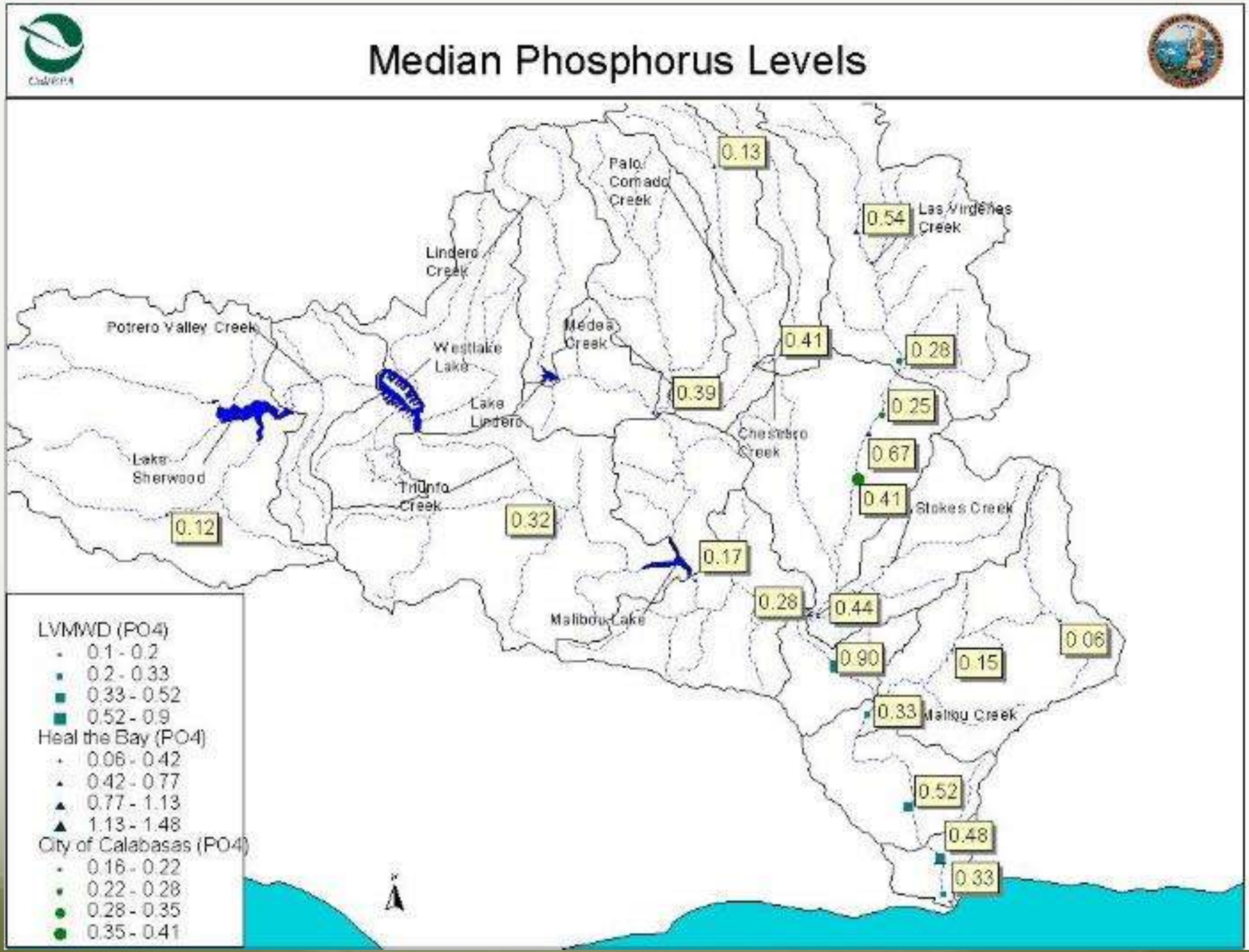
Trends Nationally



TRENDS IN STORMWATER



Trends Nationally



Watershed Approach

Approach:

1. Compile existing control measures, including minimum control measures, and BMP programs already in effect
2. Determine which MCMs could potentially be modified, how to modify MCMs, identify MCMs that can be implemented by multi-permittees for cost efficiency and information that may be necessary to support the modifications
3. Evaluate existing facilities for retrofit, including multiple benefits and support beneficial reuse, recycling, or recharge of treated stormwater in addition to opportunities to incorporate habitat recreational, and open space.

Watershed Approach

4. Evaluate for new opportunities for non-structural and structural measures.

5. Regional and local LID Measures
   - Constructed or reconstructed wetlands;
   - Infiltration/spreading basins or trenches;
   - Vegetated swales or strips;
   - Bioretention areas;
   - Extended detention basins;
   - Green Streets;
   - A combination or hybrid of the before-mentioned facilities.

2016 SWMP vs EPA

- What are the elements?
- What does EPA say about monitoring/reporting effectiveness?

2016 SWMP

Public Education and Outreach Program Assessment

- INCREASE Public Support, Interest, Knowledge, and Awareness
- INCREASE Event Participation
- INCREASE Public Support, Interest, Knowledge, and Awareness

Post-Construction Storm Water Management in New Development and Redevelopment Program Assessment

- INCREASE LID Utilization Outcome Level(s) Assessment Measures SWMPP Reference: 5.2, 5.3, and 5.5

2016 SWMP Measures

Confirmation:

- Verify submittal of a SWQC for both Priority A and Priority B projects.
- Record post-construction BMPs record in database and GIS.
- Confirm educational materials including manuals, guides, templates and worksheets are available on the City website and permitting offices.

Tabulation:

- Number of projects using LID vs. non-LID BMPs.
- Number of projects using LID specific for the pollutants onsite.
- The drainage area of new and redevelopment treated each year by LID BMPs.
- Analysis on reasons for infeasibility exempt criteria for projects using non-LID BMPs

Three EPA References

Incorporating Environmentally Sensitive Development Into Municipal Stormwater Programs, EPA 833-F-07-011, January 2008 (Updated January 2009) – Northeast (Region III)

Enhancing Sustainable Communities with Green Infrastructure, A Guide to Helping Communities Better Manage Stormwater While Achieving Other Environmental, Public Health, Social, and Economic Benefits, EPA 100-R-14-006, October 2014, www.epa.gov/smartgrowth

Incorporating Green Infrastructure into TMDLs, *EPA, Oct 2008*

Incorporation LID into Program

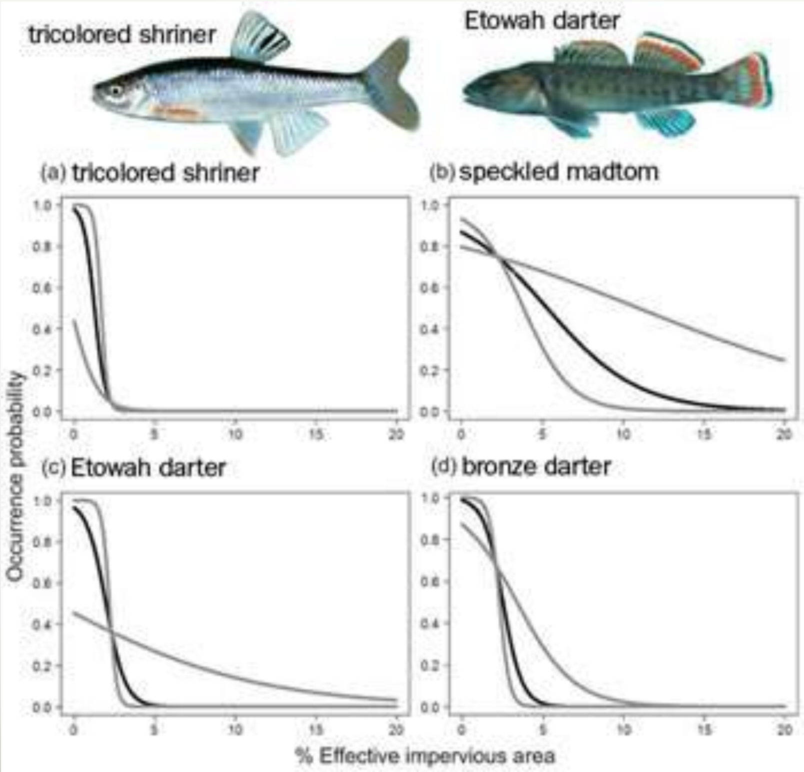
EPA’s TMDL Guideline for implementing LID – provides references on tracking connected impervious area

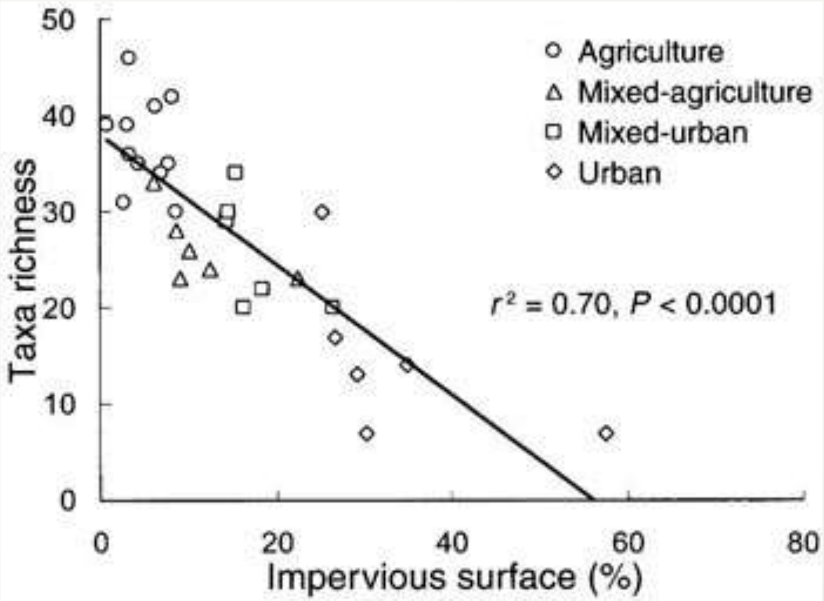
Percentage of connected impervious – probably the best measure of the overall program from engaging the community, controlling new growth, and inspiring change for all; of the options that we listed.

Two examples:

Set percent connected impervious as a measurable goal

Connected Impervious





EPA The Causal Analysis/Diagnosis Decision Information System

CADDIS Volume 2: Sources, Stressors & Responses

EPA Example from TMDLs

A future growth allocation for stormwater will typically reflect at least two factors:

- The extent of new development (future growth), i.e., how much land area will convert from open space or agricultural uses to more intensive land uses.
- The design of the new development areas -- will conventional development practices be implemented, or will GI/LID practices be widely implemented?

EPA Case Studies from TMDLs

- Olentangy River, Ohio and Barberry Creek, Maine. Implementation of GI/LID practices as new development takes place and retrofits of existing areas to build in GI/LID practices and reduce the functional imperviousness of the drainage area.
- Barberry Creek, located just south of Portland, Maine Estimated at 23% Impervious cover. The TMDL sets a target of 12% to guide implementation efforts. The TMDL also identified pollutant-specific loadings of Pb and Zn as surrogates for numerous metals found in stormwater runof

City of Kirkland, WA

- Watershed Plan for Juanita Creek, by King County DNR
- Studied watershed for salmon recovery
- Tested many flow control options to achieve favorable hydrology
- Found 80% implementation as minimum for IBI rating to fall into the right range for salmon recovery
- This level could not be reached by new and redevelopment projects alone.

EPA Case Studies from CSOs

Northeast Ohio Regional Sewer District monitors co-benefits:

- Life-cycle costs
- Ecological benefits and ecosystem services
- Socioeconomic and/or quality of life benefits to low-income population
- Provision of recreational benefits, Climate change-related effects, including change in carbon footprint
- Energy savings
- Air quality benefits
- Jobs
- Property value

EPA Case Studies from CSOs

City of Grand Rapids, Michigan, created a series of targets :

- Achieve 100% compliance with water quality permits annually.
- Eliminate three of the remaining seven CSO discharges.
- Protect and restore at least three properties identified in the Plan
- Increase the number and square footage of green roofs
- Increase the percentage of city tree canopy to at least 35.7%
- Achieve 5% pervious pavement in new roads
- Increase on-street bike lanes to100 miles
- Increase the number of people living within ¼ mile of a park or open space by 10%
- Ensure 100% compliance with stream protection ordinance

EPA National Guideline

- Current 2016 SWMP Program measures are on target
- For the full picture of the LID Program, add
  - Focus on reducing or disconnecting impervious cover to stream habitat areas
  - Set some more refined goals that can be measured
  - Get creative in tracking all of the other benefits

QUESTIONS ?