Identification of Approaches for Including Low Impact Development and Pollution Prevention in General Permits

Partners for the Connecticut Low Impact Development and Stormwater General Permit Evaluation

Connecticut

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317 Iron Horse Way, Suite 204
Providence, RI 02908

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1 Background and Purpose

The Connecticut Department of Environmental Protection (DEP) has initiated a project to explore inclusion of low impact development (LID) into its four stormwater general permits (SGPs)—construction, municipal separate storm sewer systems (MS4s), industrial, and commercial—as well as the *Soil Erosion and Sediment Control Guidelines* and the *Stormwater Quality Manual*.

As a starting point in this project, DEP is gathering information. In part this information comes from other states, experts in the field of stormwater, and literature. DEP believes this information must also come directly from its partners. This technical memorandum includes summary of the following elements of this project:

- Research on states stormwater general permit programs.
- Interviews conducted with project partners.

The approaches evaluated through this review may help to inform Connecticut's approach to incorporating LID standards. At a minimum, they represent a set of ideas and a starting point for discussion with project partners.

2 Review of Stormwater General Permits from Regulatory Agencies Outside of Connecticut

Section 2 of this technical memorandum provides a summary of information gathered from 22 regarding construction, MS4s, industrial, and commercial stormwater general permits.

2.1 Method of Collection

For this summary, we collected information using two general methods:

- **Web searches and state web page mining.** This method involved using search engines such as Google to track down basic information about each state's stormwater program. Once general permits and other basic information were collected, we reviewed the information and often drilled down further into references cited.
- **Interviewing state stormwater managers.** These interviews were conducted by telephone using an interview questionnaire (see *Appendix A*). As our primary purpose was to collect information, we did not necessarily adhere to the form exactly, but instead used it as a structural and conversational tool.

2.2 Permits Collected

Information was collected through web research and interviews of 22 states. A list of references from each state (i.e., documents that we found to contain pithy information about state stormwater programs and their use of LID) are provided at the end of each state discussion.

We focused in particular on the four basic general permits (GPs) for stormwater—construction, municipal separate storm sewer system (MS4), industrial, and commercial—and our analysis aimed to identify specific information about the inclusion of LID and pollution control standards as well as runoff volume as an indicator of environmental quality and as a proxy for pollution concentration.[1]

We included the following states in our review:

- Alaska
- Arizona
- California
- Florida
- Idaho
- Maine
- Maryland
- Massachusetts
- Minnesota
- Nevada
- New Mexico
- New Hampshire
- New York
- Oklahoma
- Oregon
- Pennsylvania
- Rhode Island
- Vermont
- Virginia
- Washington
- West Virginia
- Wisconsin

2.3 Interviews with Stormwater Managers

We conducted 15 interviews with stormwater managers by phone. We attempted to contact stormwater managers from each of the 20 states listed in *Section 1.2* above. At least two attempts were made to contact each manager. (Additional attempts were made in cases where managers returned our calls and left messages, but did not speak to us directly.) If no response was received through two contact attempts, we ceased further contact attempts.

[1] Control of certain volumes of runoff are often assumed to result in certain levels of pollution control. For example, states commonly use control of one-inch of runoff as a proxy for treatment of 80% of total suspended solids.

As indicated in *Section 1.1*, we used an interview sheet to loosely structure our conversations with state stormwater managers. The purpose of the interview sheet was to help us to collect like information from each state and to facilitate our conversations with interviewees. As we were not attempting to conduct a scientific experiment or maintain experimental integrity, we did not necessarily adhere to the interview sheet exactly. A blank interview sheet is provided in *Appendix A*. *Table 1* below summarizes points of contacts interviewed, or attempted to be interviewed, in each state. Points of contact were determined from staff listings provided on state stormwater program websites.

Table 1
Interview Contact List

State	Contact	Department	Telephone Number	Status of Interview
VT	Padraic Monks – Program Manager	Department of Environmental Conservation, Water Quality Division, Stormwater Section	802-241-1453	Interview conducted
NY	Dave Gasper	Department of Environmental Conservation	518-402-8111	Interview conducted
NM	Richard Powell – Team Leader	New Mexico Environment Department, Surface Water Quality Bureau	505-827-2798	Interview conducted
AK	William Ashton - Storm Water and Wetlands Manager	Department of Environmental Conservation, Division of Water		Point of contact could not be reached
AZ	Chris Henninger – Stormwater Technical Issues-Construction, MS4	Department of Environmental Quality	602-771-4508	Interview conducted
ID	Johnna Sandow – Water Quality Standards Specialist	Department of Environmental Quality, Water Quality Division	208-373-0163	Interview conducted
OR	Dennis Jurries Jenine Camilleri	Department of Environmental Quality, Water Quality	503-229-5937 503-229-6775	Interview conducted Interview conducted
NV	Steve McGoff	Division of Environmental Protection, Bureau of Water Pollution Control	775-687-9429	Interview conducted
NH	Jeff Andrews – Sanitary Engineer III	Department of Environmental Services	603-271-2984	Interview conducted
MA	Fred Civian	Massachusetts Department of Environmental Protection	617-292-5821	Interview conducted
WI	Jim Bertolocini – Stormwater Specialist	Department of Natural Resources	608-264-8971	Voicemail response only
ME	David Ladd	Department of Environmental Protection, Bureau of Land and Water Quality	207-287-5404	Interview conducted
WA	Ed O'Brien	Department of Ecology, Water Quality	360-407-6438	Interview conducted
WV	Sherry Wilkins	Department of Environmental Protection	304-926-0499 x1048	Interview conducted
MD	Jesse Salter – Environmental Program Manager I	Department of the Environment, Compliance Program	410-537-3570	Interview conducted
VA	Doug Fritz – MS4 Program Manager	Department of Conservation and Recreation	804-371-7330	Interview conducted
CA	John Short	Environmental Protection Agency, State Water Resources Control Board, Region 1 (North Coast)	707-576-2065	Point of contact could not be reached
FL	Eric Livingston	Department of Environmental Protection	850-245-8430	Point of contact could not be reached
MN	Dale Thompson	Pollution Control Agency	651-757-2776	Point of contact could not be reached
OK	Karen Milford	Department of Environmental Quality,	405-702-8100	Point of contact

State	Contact	Department	Telephone Number	Status of Interview
		Water Quality Division		could not be reached
PA	Barry Newman	Department of Environmental Protection	717-772-5661	Point of contact could not be reached
RI	Eric Beck	Department of Environmental Management- Water Resources	401-222-4700 x7202	Point of contact could not be reached

2.4 Findings and Analysis of Permits

Section 2.6 provides detailed state summaries of information collected from each of the 20 subject states. A general summary of data obtained is provided below.

Thirteen of the 20 subject states have LID guidance documents, which may include, but are not limited to narrative standards, prescriptive design standards, and performance standards. The following states have a LID guidance documents:

- Alaska
- California
- Idaho
- Maine
- Massachusetts
- Minnesota
- New Hampshire
- New York
- Pennsylvania
- Rhode Island
- Vermont
- Washington
- West Virginia

LID was typically referenced in GPs, regulations, or policy. The following bulleted list identifies states which have incorporated LID into their stormwater program through one of these three mechanisms, or additional mechanisms.

- California – GP encourages LID
- Maine – Regulation strongly encourages LID
- Massachusetts – LID incorporated into stormwater policy
- Minnesota – Extensive guidance; LID incorporated into pollution prevention
- New York – GP cites the state's stormwater manual, which references LID
- Rhode Island – GP cites LID
- Vermont – Towns require LID; LID encouraged in individual stormwater permits
- Washington – GPs cite LID
- West Virginia – GP cites performance standard

As suggested in the above bulleted list, some states encourage LID, but do not require it as part of their stormwater program. Alternatively, some states encourage LID while local governments within the state either require LID or encourage LID through incentives and guidance documents. This was specifically noted for Arizona and Oklahoma. Twelve of the 20 subject states encourage LID but do not require it to be used. The following list identifies states which encourage LID:

- Alaska
- Arizona
- California
- Idaho
- Maine
- Minnesota
- New Hampshire
- New York
- Oklahoma
- Pennsylvania
- Vermont
- West Virginia

It should be noted that West Virginia encourages LID in its construction activity GP, but LID is required of MS4s.

Typical performance standards used in state stormwater guidance documents, regulations, and general permits include:

- Runoff Volume (e.g., WQV – 1", 0.5", 25%)
- Pollution reduction linked to volume (e.g., 80% TSS removal, Turbidity, Nutrients, Sensitive sites)
- Performance Standards (e.g., Area set-aside for LID, imperviousness reduction)

Most states do not give LID primacy over end-of-pipe controls such as detention ponds and sand filters. However, where LID is given primacy, standards used to develop primacy of LID over end-of-pipe controls may include, but are not limited to:

- Runoff volume (e.g., percentage or fraction of WQV)
- Performance standard (e.g., Area set-aside for LID and imperviousness reduction)

2.5 Summary of Findings by State

This section provides a summary of information collected from each of the 20 subject states. In general, state-by-state summaries are structured as follows:

- Tabular summary of specific standards found in general permits
- Discussion of each general permit identified and reviewed

- Discussion of specific performance standards focusing in particular on LID standards
- Reference documents (generally, these are web-available documents)

2.5.1 Alaska

Table 2
Specific Standards Found in Alaska General Permits

Key Items	Standards
Runoff volume as an environmental indicator	Not Found
Volume control in relation to pollutant control	Not Found
Permit limits related to storm size and runoff volume	Not Found
Performance criteria	Not Found
LID	Not Found
Pollution prevention	Not Found
End of pipe	Not Found

2.5.1.1 General

The Alaska Department of Environmental Conservation (ADEC) Division of Water is responsible for administering the State's stormwater management program. The ADEC implements three GPs, those permits being for construction activity, industrial activity, and small municipal separate storm sewer systems (MS4s). Both the GP for industrial activity and for small MS4s closely follow the National Pollutant Discharge Elimination System (NPDES) Program GPs. Those GPs do not implement LID concepts. Similarly, while the ADEC has its own GP for construction activity, it does not include LID techniques.

1. <u>Construction GP</u>

- *Alaska Pollutant Discharge Elimination System General Permit for Discharges from Large and Small Construction Activities* (Permit Number AKR10000 – effective January 31, 2010)

As stated on the ADEC Division of Water website for the Construction General Permit:

> In July 2008, EPA issued its 2008 Construction General Permit (CGP) and then extended the term of the 2008 CGP by one year. Now the 2008 CGP is a three-year permit, which will expire on or before June 30, 2011. As of October 31, 2009, the Alaska Department of Environmental Conservation (DEC) is now the storm water permitting authority in Alaska. On January 31, 2010, DEC reissued the Alaska CGP which is now in effect…
>
> If your project disturbs less than one acre and is not part of the planned disturbance of a larger common plan of development or sale, no permit is required. Otherwise, you must develop and follow a stormwater pollution prevention plan (SWPPP) to manage materials, equipment, and runoff from your construction site.

2. MS4 GP

As stated on the ADEC website for Municipal Separate Storm Sewer Systems (MS4):

> Regulated small MS4s are defined as all small MS4s located in "urbanized areas" (UAs) as defined by the Bureau of the Census, and those small MS4s located outside of a UA that are designated by NPDES permitting authorities.
>
> In Alaska, the Bureau of the Census recognizes only Anchorage and Fairbanks as urbanized areas.

All operators of regulated municipal separate storm sewer systems (MS4s) are required to:

- Obtain a NPDES permit, and
- Develop a storm water management program designed to prevent harmful pollutants from being washed by storm water runoff into the MS4 (or from being dumped directly into the MS4), then discharged from the MS4 into local waterbodies.

Storm water management program should meet the standard of "reducing pollutants to the maximum extent practicable (MEP), and include measures to:

- Identify major outfalls and pollutant loadings.
- Detect and eliminate non-storm water discharges to the system.
- Reduce pollutants in runoff from industrial, commercial, and residential areas.
- Control storm water discharges from new development and redevelopment areas.

3. Multi-Sector GP

- *Alaska Pollutant Discharge Elimination System General Permit Multi-Sector General Permit for Storm Water Discharges (MSGP)* (Permit Number AKR050000 – effective February 26, 2009)

The ADEC implements the MSGP, and as previously mentioned, the ADEC utilizes the NDPES MSGP for regulating industrial activities.

2.5.1.2 Performance Standards

- *Alaska Stormwater Guide (June 2009)*

As stated on the ADEC website for the *Alaska Stormwater Guide*:

> ADEC, with the assistance of a work group and a contractor, developed the *Alaska Stormwater Guide* (hereinafter, the "Guide"). Local governments use the guide to set storm water requirements for new development and redevelopment projects. Land

> developers and development engineers use the guide to help design site plans and determine storm water infrastructure. Businesses and contractors use the guide to help design their storm water pollution prevention plans. The guide is useful for anyone needing guidance on erosion and sediment control for construction areas.

Furthermore:

> The Guide is intended to be flexible, easily updated and responsive to the needs of the Alaska storm water community. The concepts presented in this Guide are intended to be guidance for readers rather than stringent rules. The Guide embraces the concept that each storm water problem is different, so solutions will need to be customized to address this variability (Page i).

Section 3.3.5 of the Alaska Stormwater Guide addresses "Low Impact Development/Environmental Site Design." Page 3-21 of the guide states:

> LID is new to Alaska, and local communities are still determining which concepts are acceptable or applicable and when they could serve as alternatives to more conventional permanent storm water management controls. The LID concepts that have the highest potential in Alaska are the following:
>
> - Retaining existing or native vegetation
> - Reducing directly connected imperviousness
> - Reducing curb and gutter and using vegetated swales
> - Allowing on-site infiltration for high infiltration areas
> - Optimizing development to cluster structures
> - Preserve high-quality land or highly sensitive land

It should be noted that the *Alaska Stormwater Guide* is not referenced in the ADEC GPs and is therefore strictly a guidance document.

2.5.1.3 References

Alaska Department of Environmental Conservation Division of Water. Wastewater Discharge Authorization-Storm Water. http://dec.alaska.gov/water/wnpspc/stormwater/index.htm (Accessed May 10, 2010).

Alaska Department of Environmental Conservation Division of Water. June 2009. *Alaska Stormwater Guide- Chapter 3 Storm Water Design Considerations and Methods.* http://dec.alaska.gov/water/wnpspc/stormwater/docs/AKSWGuide_Chapter3.pdf

2.5.2 Arizona

Table 3
Specific Standards Found in Arizona General Permits

Key Items	Standards
Runoff volume as an environmental indicator	Not Found
Volume control in relation to pollutant control	Not Found
Permit limits related to storm size and runoff volume	Not Found
Performance criteria	Not Found
LID	Not Found
Pollution prevention	Not Found
End of pipe	Not Found

2.5.2.1 General

The Arizona Department of Environmental Quality (ADEQ) is responsible for administering the State's stormwater management program. As stated on the ADEQ's website:

> Under the Arizona Pollutant Discharge Elimination System (AZPDES) Permit Program, all facilities that discharge pollutants from any point source into waters of the United States (navigable waters) are required to obtain or seek coverage under an AZPDES permit.

LID is not currently incorporated into any of the GPs. Per a telephone interview with the stormwater and general permits unit manager, ADEQ is waiting for EPA to make changes to the NDPES program before any changes are made by Arizona.

It should be noted that guidance on stormwater best management practices and soil erosion control does not exist at the state level. These guidance documents are developed at the local level, by some municipalities. Per the telephone interview, some municipalities have incentive programs for LID.

2.5.2.2 General Permits

1. <u>Construction GP</u>

- *Arizona Pollutant Discharge Elimination System General Permit for Discharge from Construction Activity to Water of the United States* (AZPDES Construction GP) – Permit No. AZG2008-01, effective February 29, 2008.

This GP covers stormwater discharges from construction activities in Arizona, except for those construction discharges in Native American land.

2. MS4 GP

- *Arizona Pollutant Discharge Elimination System General Permit for Discharge from Small Municipal Separate Storm Sewer Systems (MS4s) to Water of the United States* (AZPDES Small MS4 GP) – Permit No. AZG2002-02, effective December 19, 2002.

As stated on Page 9, Part V.A of the AZPDES Small MS4 GP:

> Under this GP, MS4s shall develop, implement, and enforce a stormwater management plan (SWMP) designed to reduce the discharge of pollutants from a small MS4 to the maximum extent practicable to protect water quality.

The SWMP must incorporate each of the six minimum control measures.

3. Multi-Sector GP

- The Multi-Sector General Permit for Stormwater Discharges Associated with Industrial Activity (2000 MSGP) – Expired on October 30, 2005.

The multi-sector general permit (MSGP) is designed for discharges of stormwater from certain industrial sites that are of a non-construction nature.

As stated in a draft fact sheet for the AZPDES 2009 MSGP:

> EPA issued the MSGP 2000 for a five-year term commencing on October 30, 2000 (65 FR 64746). EPA subsequently corrected the MSGP 2000 on January 9, 2001 (66 FR 1675-1678) and March 23, 2001 (66 FR 16233-16237). ADEQ has had authority for implementation, compliance and enforcement of EPA's MSGP 2000 since assuming responsibility for the NPDES permitting program. The MSGP 2000 expired on October 30, 2005 but was administratively continued for facilities that were covered under the permit at the time it expired. EPA's 2008 MSGP, which does not apply in Arizona, became effective on September 29, 2008.

Arizona currently implements the expired MSGP 2000. All facilities in Arizona subject to the permit will need to apply for coverage under ADEQ's new AZPDES 2009 MSGP, which is currently in draft form.

2.5.2.3 References

Arizona Department of Environmental Quality. Stormwater Permits http://www.azdeq.gov/environ/water/permits/stormwater.html#phase (Accessed April 22, 2010)

2.5.3 California

Table 4
Specific Standards Found in California General Permits

Key Items	Standards
Runoff volume as an environmental indicator	Runoff volume is used as a proxy, but not always explicitly.
Volume control in relation to pollutant control	Technology standard requires sizing for the 5-year, 24-hour storm, 85th percentile 24-hour storm, etc.
Permit limits related to storm size and runoff volume	Construction general permit establishes pH and turbidity standards, which may be achieved by meeting technology standards.
Performance criteria:	Best available technology standard is established for application of all management practices.
LID	Strongly encouraged, but not required in most cases. San Francisco requires LID treatment for 100% of the water quality volume.
Pollution prevention	Allows use of pollution prevention to meet permit requirements.
End of pipe	

2.5.3.1 General

The California State Water Resources Control Board (SWRCB) is responsible for administering the state's stormwater management program. The SWRCB oversees nine Regional Water Resources Control Boards (RWQCB) that develop stormwater requirements for their jurisdictional areas. Municipalities and counties must comply with the requirements established by their RWQCB.

California's regulatory structure is fairly complex. At the state level, all construction sites disturbing more than one acre, many industrial sites, and all designated municipal separate storm sewer systems (MS4s) are required to obtain and meet the requirements of the National Pollution Discharge Elimination System (NPDES) permit coverage. In addition to state, regional, and local regulations, there are a number of established and proposed total maximum daily load (TMDL) requirements and special programs impacting California's watersheds.

In 2005 the SWRCB adopted sustainability as a core value to be included as part of all future policies, activities, guidelines and regulatory actions (ref. 1). LID has been designated as a sustainable stormwater approach and the SWRCB has advanced LID through general permits, training programs, 319 grants, transportation projects, partnerships, etc. LID techniques are now strongly encouraged (effectively required) by incorporation into all new MS4 permits

statewide (ref. 2). The SWRCB has provided a wide array of resources to help the RWQCBs and MS4s to develop their LID programs. Regulatory and technical assistance and guidance is funded by the SWRCB and provided through the Central Coast Water Board and LID Center (ref.3). California has one of the most progressive state LID programs in the nation.

Role of RWQCBs

The RWQCBs ensure general permit compliance. As appropriate, they review reports, require modification to SWMPs and other submissions, impose region-specific monitoring requirements, conduct inspections, take enforcement actions against violators of the general permit, and make additional designations of regulated small MS4s pursuant to the general permit. They may also issue individual permits to regulate small MS4s, and alternative general permits to categories of regulated small MS4s. Upon issuance of such permits by an RWQCB, the general permit shall no longer regulate the affected Small MS4s.

LID is strongly encouraged in the general permit, but it is up to the nine RWQCB to approve the LID scope and approach within each local MS4 program. Each RWQCB has a slightly different approach and emphasis as appropriate to meet local hydrology, geology, and receiving water goals. Therefore, the use of LID within each MS4 program will differ in its selection and emphasis of LID techniques and design strategies. This can best be seen by reviewing the LID design manuals for LA County (reference 4) and San Diego County (reference5). Other local governments such San Mateo County / City have advanced LID through the development of unique advanced LID programs for sustainable green streets providing useful tools for redevelopment of the urban infrastructure (ref. 6).

2.5.3.2 General Permits

1. **Construction General Permit (Order NO. 2009 – 0009 – DWQ - Effective July 1, 2010).** – This GP is primarily for erosion and sediment control during construction phase of the project. It requires development of SWPPP that not only address erosion and sediment controls, but must also address the post construction BMP's to be used. The permit strongly suggests the use of LID for the SWPPP and lists some LID techniques that should be used. The permit contains numeric effluent limitations for pH (6.0 to 9.0 pH Units) and turbidity (500 NTU daily average). These limits are presumed to be met using best available technology (BAT) or best conventional pollutant control technology (CBT). The design storm used for the treatment technologies is 5-year 24-hour event. Further, if a TMDL exists, the discharger may be required by a RWQCB order to implement additional BMPs, conduct additional monitoring activities, and/or comply with an applicable waste load allocation and implementation schedule for pH or turbidity. (ref. 7)

2. **MS4 General (SWRCB).** Post construction long term controls promote the use of LID and include the language "Post-construction programs are most efficient when they stress (i) low impact design; (ii) source controls; and (iii) treatment controls." The general permit also allows for the use of structural and/or non-structural BMPs. The SWRCB establishes the general stormwater management goals and requires them for

development of the local stormwater management programs. It is up to each permittee to develop a program that details how it will comply with the general permit including adopting a design guidance. (ref. 8)

3. **MS4 Permit / Order (RWQCB).** Each regional board has or is developing MS4 general permit or order for their respective local jurisdictions that specifically sets out the requirements for developing local stormwater management programs. For example, the San Francisco RWQCB has developed a Municipal Regional Stormwater Permit / Order that mandates water quality goals to be "accomplished primarily through the implementation of LID techniques." Further, the permit specifies that LID must be used for 100% of the water quality volume treatment. The San Francisco municipal permit is quite specific about the allowable types of LID practices and certain design standards. Water quality control places a preference on volume control using technology-based standards based on maximum extent practicable to protect water quality. The general permit requires regulated small MS4 to develop a stormwater program that describes the BMPs, measurable, implementation time tables to meet the six minimum control measures including control of construction and long term post construction activities (Ref. 9).

2.5.3.3 Performance Criteria

Performance criteria is technology based in order to meet water quality goals. Post-construction treatment control BMPs must incorporate either a volumetric or flow-based treatment control design standard, or both, to mitigate (infiltrate, filter or treat) storm water runoff. Volumetric measures use the 85th percentile 24-hour event to determine the volume to be controlled or treated. The formula to compute this volume is recommended in Urban Runoff Quality Management, WEF Manual of Practice No. 23/ ASCE Manual of Practice No. 87, (1998) or the volume of annual runoff based on unit basin storage water quality volume, to achieve 80 percent or more volume treatment by the method recommended in California Stormwater Best Management Practices Handbook – Industrial/ Commercial, (2003); or the volume of runoff produced from a historical-record based reference 24-hour rainfall criterion for "treatment" that achieves approximately the same reduction in pollutant loads achieved by the 85th percentile 24-hour runoff event.

Flow Based Treatment Control BMP – The SWRCB also allows for optional flow control to meet their water quality goals. The standard is to control flow from a rain event equal to at least two times the 85th percentile hourly rainfall intensity for the area or the flow of runoff produced from a rain event that will result in treatment of the same portion of runoff as treated using volumetric standards above.

2.5.3.4 References

California LID Policy Review –
http://www.waterboards.ca.gov/water_issues/programs/low_impact_development/index.shtml

LID Policy Review –
http://www.waterboards.ca.gov/water_issues/programs/low_impact_development/docs/ca_lid_policy_review.pdf

Technical and Regulatory Guidance -
http://www.swrcb.ca.gov/rwqcb3/water_issues/programs/stormwater/low_impact.shtml

County of Los Angeles LID Manual -
http://dpw.lacounty.gov/wmd/LA_County_LID_Manual.pdf

County of San Diego LID Manual - http://www.sdcounty.ca.gov/dplu/docs/LID-Handbook.pdf

San Mateo Sustainable Green Streets -
http://www.flowstobay.org/ms_sustainable_guidebook.php

SWRCB General Permit for Construction (Effective July 1 2010)-
http://www.waterboards.ca.gov/water_issues/programs/stormwater/docs/constpermits/wqo_2009_0009_complete.pdf

SWRCB Small MS4 General Permit -
http://www.swrcb.ca.gov/water_issues/programs/stormwater/docs/final_ms4_permit.pdf

San Francisco MS4 Regional Permit -
http://www.swrcb.ca.gov/sanfranciscobay/board_decisions/adopted_orders/2009/R2-2009-0074.pdf

2.5.4 Florida

Table 5
Specific Standards Found in Florida General Permits

Key Items	Standards
Runoff volume as an environmental indicator	None found
Volume control in relation to pollutant control	None found
Permit limits related to storm size and runoff volume	None found
Performance criteria	Sediment removal only
LID	None found
Pollution prevention	None found
End of pipe	None found

2.5.4.1 General

Under the Florida Water Resources Act of 1972, the Florida Department of Environmental Protection (DEP) was given responsibility for administering the state's stormwater management program. FLDEP subsequently delegated authority to the five regional water management districts (WMDs) to regulate stormwater discharges. Under the Environmental Reorganization Act of 1993 stormwater quality and stormwater quantity were combined into the Environmental Resource Permitting Program (ERP) under Part IV of Chapter 373, Florida Statutes. The DEP and WMDs share implementation of this program depending upon the type of activity that is permitted.

Regulations for water quality and quantity have been adopted largely to address the specific needs particular to the geographic and hydrologic conditions found in each WMD's jurisdiction. The WMDs have exercised their independent authority for establishing rules (Florida Administrative Code or F.A.C.). In addition to state rules, each WMD and the DEP have adopted either a design manual or handbook that describes the various BMPs and criteria for addressing water quality and quantity issues. Florida's stormwater rules apply almost exclusively to new development, while redevelopment and retrofit projects are largely permitted on a case-by-case basis. Proposed projects must meet the criteria specified in state law to obtain necessary permits.

Florida has been very slow to embraced LID principles and practices and relies for the most part on more conventional end-of-pipe practices (e.g., ponds) for new construction and temporary construction. A few local governments, Water Management Districts, Universities and environmental groups are providing some leadership to promote LID with guidance information and demonstration projects (ref. 1, 2 & 3). Some local governments do on a case-by-case basis work with developers to implement of LID projects. However, LID has not been adopted on a statewide basis nor is it promoted by DEP.

2.5.4.2 General Permits

Generic Construction Permit – This permit addresses only with the construction phase of the project and requires typical BMPs to protect water quality. The permit conditions can be found in the state code (ref.4). LID is not discussed in the permit.

Generic MS4 Permit – This permit require MS4s to develop stormwater management programs that meet EPA six minimum requirements. Guidance on compliance requires consistency with applicable state environmental resource protection requirements and EPA guidance. The MS4 code and generic permit are provided below (ref. 5&6). LID is not discussed directly in the permit.

Performance Criteria – Overall stormwater management, presumptive criteria, and best management practices are dictated by individual WMD's Environmental Resource Permit. Generally, BMP standards apply to erosion and sediment control. Erosion and sediment are to be retained onsite during construction. No discharge shall violate the state's water quality standard for turbidity. The stormwater treatment performance standard requires removal of at least 80% of the average annual pollutant load for stormwater discharges to Class III (recreational) waters. A 95% removal level was set for stormwater discharges to sensitive waters such as potable supply waters (Class I), shellfish harvesting waters (Class II), and Outstanding Florida Waters (OFWs). In addition, the WMDs have established performance standards to minimize flooding by limiting the post-development stormwater peak discharge rate and, in some cases such as closed basins, the stormwater volume. Design storm frequencies, as well as return intervals are specified by the WMDs.

2.5.4.3 References

St. John's River Water Management District LID brochure:
http://www.sjrwmd.com/publications/pdfs/fs_lowimpactdevelopment.pdf

University of Florida Barriers to LID: http://waterinstitute.ufl.edu/research/downloads/Clark-LID.pdf

Paper on Incentive for LID in Florida:
http://waterinstitute.ufl.edu/research/downloads/Clark-LID.pdf

Generic Construction Code: http://www.dep.state.fl.us/legal/Rules/shared/62-621.pdf

Generic MS4 Code: http://www.dep.state.fl.us/legal/rules/shared/62-624.pdf

Generic General MS4 Permit:
http://www.dep.state.fl.us/water/stormwater/npdes/docs/Phase_II_MS4_GP.pdf

2.5.5 Idaho

Table 6
Specific Standards Found in Idaho General Permits

Key Items	Standards
Runoff volume as an environmental indicator	Not Found
Volume control in relation to pollutant control	Not Found
Permit limits related to storm size and runoff volume	Not Found
Performance criteria	Not Found
LID	Not Found
Pollution prevention	Not Found
End of pipe	Not Found

2.5.5.1 General

The U.S. Environmental Protection Agency (EPA) is the National Pollutant Discharge Elimination System (NPDES) permitting authority for Idaho and as such is responsible for issuing NPDES stormwater permits. LID is not currently incorporated into the NPDES General Permits (GPs). Notwithstanding, the EPA indicates their promotion of LID on Page 1 of the "NPDES General Permit for Stormwater Discharges from Construction Activities Fact Sheet":

> Stormwater control measures should be designed in accordance with any requirements established by the appropriate local, state, or tribal authority. EPA also strongly encourages operators to use low impact development or green infrastructure practices that promote infiltration and reduce stormwater volumes after development. Additional information on green infrastructure practices can be found at www.epa.gov/npdes/greeninfrastructure.

The Idaho Department of Environmental Quality (DEQ) stormwater webpage indicates:

> The Idaho Department of Environmental Quality (DEQ) provides technical assistance and support for controlling stormwater in Idaho. DEQ's Catalog of Stormwater Best Management Practices includes site design techniques for controlling stormwater runoff associated with land development activities. DEQ also provides plan and specification review for facilities that control, treat, or dispose of stormwater if requested by the developer or design engineer.

2.5.5.2 Performance Standards

The DEQ has developed guidance documents pertaining to stormwater. Idaho's primary document is the *Catalog of Stormwater BMPs for Idaho Cities and Counties.* As noted on the DEQ website, this guidance document was recently updated.

The following has been adopted from the Idaho Department of Environmental Quality (DEQ) website for stormwater regarding the updated guidance document.

This document is a revision of the originally *Catalog of Stormwater BMPs for Idaho Cities and Counties* developed in 1998. Its target audience is design professionals, such as landscape architects, geologists, engineers, and soil scientists, and local public officials and staff responsible for the review and approval of development applications.

The revised catalog provides numerous ways to control erosion and sediment during and after construction. It is comprised of the following five volumes:

- **Volume 1** includes a brief discussion of stormwater runoff impacts, an overview of agencies responsible for stormwater permitting and authority in Idaho, and a step-by-step procedure for site design.
- **Volume 2** contains construction BMPs to control erosion and sediment.
- **Volume 3** covers low-impact development and provides techniques that can minimize changes to the hydrology of development sites.
- **Volume 4** contains post-construction/permanent BMPs.
- **Volume 5** provides source control BMPs for industrial, commercial, and residential land use activities.

As described in the bulleted list above, Volume 3 pertains to LID. This volume includes discussion of many LID BMPs, including but not limited to: protect natural site functions, minimize directly connected impervious areas, narrow roadways, and bioretention. A full list of BMPs is provided in the table of contents for volume three. A web link for the document is provided at the end of this summary in the references section. Volume 3 relies heavily on narrative standards to introduce LID techniques. While design standards are discussed for selective BMPs, these are not enforceable, but rather recommended guidelines for implementing the particular LID technique.

2.5.5.3 References

Idaho Department of Environmental Quality. Stormwater in Idaho: Overview. http://www.deq.idaho.gov/water/prog_issues/storm_water/overview.cfm (Accessed May 10, 2010).

Idaho Department of Environmental Quality. Stormwater: Catalog of Stormwater BMPs for Idaho Cities and Counties. http://www.deq.state.id.us/water/data_reports/storm_water/catalog/index.cfm (Accessed May 10, 2010).

2.5.6 Maine

Table 7
Specific Standards Found in Maine General Permits

Key Items	Standards
Runoff volume as an environmental indicator	Not found
Volume control in relation to pollutant control	Not found
Permit limits related to storm size and runoff volume	Not found
Performance criteria	Not found
LID	Not found
Pollution prevention	Not found
End of pipe	Not found

Maine's general permits do not directly establish runoff volume standards or performance criteria; however, Maine does establish specific stormwater requirements under its Stormwater Code Chapter 500. This code requires permitting under MRSA title 38, chapter 3, section 420-D, which states:

A person may not construct, or cause to be constructed, a project that includes one acre or more of disturbed area without prior approval from the department. A person proposing a project shall apply to the department for a permit using an application provided by the department and may not begin construction until approval is received. This section applies to a project or any portion of a project that is located within an organized area of this State.

Standards under Stormwater Code Chapter 500 include volumetric standards and performance criteria for LID, pollution prevention and other BMPs.

2.5.6.1 General

The Maine Department of Environmental Protection (DEP) is responsible for administering the state's stormwater management program. Maine's program establishes permitting requirements for construction sites disturbing more than one acre, industrial sites, and MS4s. The state's program is governed by Stormwater Code Chapter 500 (ref.1). The code establishes the narrative standards and technology / BMP based controls for new development and redevelopment. There are several categories of stormwater standards including basic, general, phosphorus, flooding and urban impaired stream. More than one standard may apply to a project depending on site conditions and location.

LID is highly encouraged by DEP and mentioned in the state law and the MS4 permits. Technical guidance for LID is provided in their BMP design manual (Volume I, chapter 3) (ref. 2) and further detailed in a separate LID design manual (ref. 3). To determine when BMPs are required DEP uses total area disturbed (1 to 5 acres) and impervious thresholds (2000 square feet to 20,000 square feet) that vary depending on the watershed, receiving water goals and applicable TMDL's.

2.5.6.2 General permits

1. **General Construction Permit** - The permit provides guidance on erosion and sediment control requirements for construction activities. State code and the design manuals provide the narrative antidegradation specifications, thresholds (1 acre) and guidance on appropriate BMPs for erosion and sediment control. Further, if a stormwater permit is required the construction permit cannot be approved until the stormwater permit is approved. This ensures that LID techniques are considered in the development of the sediment and erosion control plan provide they are part of the post construction BMPs (ref 4).

2. **Small MS4 General Permit –** The permit establishes the current State stormwater law governs all projects requiring a permit for pre- and postconstruction, and redevelopment activities. The MS4 permit requires that regulated communities implement EPA's six minimum standards. Under these standards the permittee is required to develop a comprehensive stormwater program that includes managing construction permits and postconstruction program. The permit suggests the MS4 operator "should also consider the adoption and implementation of low impact development techniques through an ordinance or other regulatory mechanism" (ref.5).

3. **Performance Standards** - State Stormwater Code Chapter 500 establishes many of the stormwater standards that apply to projects disturbing one acre or more, or to a modification of any size. Thresholds of total area and impervious area vary depending on location, impaired waters and type of development. DEP has some latitude to determine which standards should apply and the appropriate mix BMPs. The standards include the following categories:

   a. **Basic standards.** In general a project disturbing one acre or more must provide appropriate BMPs for construction activities such as erosion and sedimentation control, inspection and maintenance, and housekeeping, respectively.

   b. **General standards.** General standards project requiring long-term postconstruction BMPs. This includes new development and some redevelopment projects. Conventional BMPs are allowed and volume controls are provided for ponds and infiltration devices. The volume controlled equals to 1.0 inches over the area of impervious area, plus 0.4 inches over areas of landscaping. LID BMPs are highly encouraged and specific guidance is provided in the design manuals. As per this note in the State law:
   NOTE: The department strongly encourages applicants to incorporate low-impact development (LID) measures where practicable. LID addresses avoidance of stormwater impacts by minimizing developed and impervious areas on the project site. LID project design considers the location of any protected natural resources, and maintaining natural drainage patterns and pre-construction time of concentration. If practicable, LID incorporates runoff storage dispersed uniformly.

   c. **Phosphorus standards.** The phosphorus standards apply only in lake watersheds. A project disturbing one acre or more and resulting in any of the

following is required to meet the phosphorus standards. Permittees must follow specific design guidance is provided in the design manual for determining a lakes phosphorus budget and load reduction allocation for the site.

d. **Urban impaired stream standard.** If required, the urban impaired stream standard applies in addition to the basic standards, general standards and phosphorus standards.

e. **Flooding standard.** If required, the flooding standard applies in addition to the basic standards, general standards, phosphorus standards and urban impaired stream standards. Stormwater management systems for these projects must detain, retain, or result in the infiltration of stormwater from 24-hour storms of the 2-year, 10-year, and 25-year frequencies such that the peak flows of stormwater from the project site do not exceed the peak flows of stormwater prior to undertaking the project.

f. **Easements and covenants.** If projects require off-site areas for the control, disposal, or treatment of stormwater runoff, then these areas must be protected from alteration through easements or covenants.

2.5.6.3 References

Stormwater Code Chapter 500:
http://www.maine.gov/dep/blwq/rules/stormwater/2006/ch500.pdf

LID Guidance, Vol. I Chapter 3, BMP Manual:
http://www.maine.gov/dep/blwq/docstand/stormwater/stormwaterbmps/vol1/chapter3.pdf

LID Guidance Manual for Maine Communities, 2007:
http://www.maine.gov/dep/blwq/docwatershed/materials/LID_guidance/manual.pdf

Construction General permit:
http://www.maine.gov/dep/blwq/docstand/stormwater/2006mcgptext.pdf

Small MS4 General Permit:
http://www.maine.gov/dep/blwq/docstand/stormwater/ms4/final_2008_ms4_gp.pdf

MRSA Title 38, Section 420-D: http://www.mainelegislature.org/legis/statutes/38/title38sec420-D.htm

2.5.7 Massachusetts

Table 8
Specific Standards Found in Massachusetts General Permits

Key Items	Standards
Runoff volume as an environmental indicator	None found
Volume control in relation to pollutant control	None found
Permit limits related to storm size and runoff volume	None found
Performance criteria	None found
LID	None found
Pollution prevention	None found
End of pipe	None found

Although LID is not explicitly discussed in the stormwater general permits used by Massachusetts, LID, pollution prevention, runoff volume as an environmental indicator, etc. are incorporated into state regulations and guidance. Thus many of these standards are in effect required.

2.5.7.1 General

The U.S. Environmental Protection Agency (EPA) is the National Pollutant Discharge Elimination System (NPDES) permitting authority for Massachusetts and as such is responsible for issuing NPDES stormwater permits. LID is not currently incorporated into the NPDES General Permits (GPs). Notwithstanding, the EPA indicates their promotion of LID on Page 1 of a NPDES General Permit for Stormwater Discharges From Construction Activities Fact Sheet:

> Stormwater control measures should be designed in accordance with any requirements established by the appropriate local, state, or tribal authority. EPA also strongly encourages operators to use low impact development or green infrastructure practices that promote infiltration and reduce stormwater volumes after development. Additional information on green infrastructure practices can be found at www.epa.gov/npdes/greeninfrastructure

Massachusetts is not currently delegated by EPA to issue NPDES permits, but the Massachusetts Department of Environmental Protection (MassDEP) is initiating the process to develop a stormwater management program in accordance with NPDES and the Clean Water Act. As stated on the MassDEP website for regulations and standards:

> MassDEP has proposed new regulations implementing a stormwater management program in Massachusetts in accordance with state and federal clean water laws. The proposed 314 CMR 21.00 would confer on MassDEP the authority to issue individual and general surface water discharge permits.

According to the *Amendments to the Wetland Protection Act Regulations and 401 Water Quality Certification Regulations* document provided on the MassDEP website:

> In 1996, the Massachusetts MassDEP issued the "Stormwater Policy" that established Stormwater management standards aimed at encouraging recharge and preventing stormwater discharges from causing or contributing to the pollution of the surface waters and ground waters of the Commonwealth. MassDEP also issued the *Massachusetts Stormwater Handbook* that included detailed information on how to apply the Stormwater Management Standards.
>
> Since that time, MassDEP has applied the Stormwater Management Standards pursuant to its authority under the Wetlands Protection Act, M.G.L.c. 131, §40, and the Wetlands Protection Act Regulations, 310, CMR 10.00, when reviewing projects subject to jurisdiction under the Act. Mass DEP also applied the *Stormwater Management Regulations* when reviewing projects that require a water quality certification pursuant to 314 CMR 9.00. MassDEP has incorporated the Stormwater Management Standards into both 310 CMR 10.00 and 314 CMR 9.00, thereby eliminating the need for the Stormwater Policy.

2.5.7.2 Performance Standards

The *Massachusetts Erosion and Sediment Control Guidelines for Urban and Suburban areas: A Guide for Planners, Designers, and Municipal Officials*, reprinted in May 2003, does not include implementation of LID techniques. However, the *Massachusetts Stormwater Handbook* incorporates the use of LID throughout the manual. LID techniques do not take primacy of end-of-pipe technologies, at the state level; however, local jurisdictions may require LID in lieu of end-of-pipe stormwater solutions. Determination of LID versus end-of-pipe technologies is determined through the local regulatory processes.

The table presented at the beginning of this summary details performance standards provided in the Stormwater Manual.

2.5.7.3 References

Massachusetts Stormwater Handbook
http://www.mass.gov/dep/water/laws/policies.htm#storm

Massachusetts Department of Environmental Protection. Standards and Regulations.
http://www.mass.gov/dep/water/laws/regulati.htm **(Accessed May 18, 2010).**

2.5.8 Minnesota

Table 9
Specific Standards Found in Minnesota General Permits

Key Items	Standards
Runoff volume as an environmental indicator	0.5-inch water quality volume (WQV). 1.0 inch WQV is required in sensitive areas.
Volume control in relation to pollutant control	WQV is intended as a proxy for 80% TSS removal
Permit limits related to storm size and runoff volume	Not found
Performance criteria	80% TSS removal
LID	Not found
Pollution prevention	Section F of the Construction General Permit makes specific pollution prevention requirements
End of pipe	Not found

2.5.8.1 General

The Minnesota Pollution Control Agency (MPCA) is responsible for administering the state's stormwater management program. The program relies on a technology base standards where BMPs are designed to meet and MEP standard. Permittees are allowed flexibility to choose appropriate BMPs to meet local conditions and receiving-water requirements. However, for impaired waters, the state and local authorities reserve the right to impose numeric standards if necessary. For example, Minneapolis/St Paul stormwater program has watershed specific phosphorus removal requirements typically ranging from 20-42% removal of total phosphorus.

1. **Construction Stormwater Permitting Program**: The permit only covers construction activities up to site stabilization. A SWPPP is required that incorporates the specific construction BMPs and describes the postconstruction long-term BMPs applicable to their site. Postconstruction stormwater controls may require a separate permit. Permits are required construction related activity disturbing one acre or more of land. In some cases, smaller sites may require permit coverage if they are part of a larger common plan for development. The permit places a preference on the use of infiltration practices for construction and post construction BMPs but provides numerous options of varying site conditions. DNR provides design manuals and other design resources for BMP design (ref.1).

2. **Municipal Stormwater Permitting Program**: MS4s are required permittees to develop stormwater pollution prevention plan SWPPP or comprehensive stormwater management plan that must include EPA's six minimum measures including

construction and post construction programs to reduce impact to the maximum extent possible. The permit allows MCPA to establish stricter requires under certain conditions to ensure water quality standards are met, e.g. TMDL's and impaired waters. The SWPPP must include a mix of structural and nonstructural measures.

Extensive and comprehensive guidance is provided by MCPA to assist and guide MS4 in the development of all aspects of their programs (2). Included in the guidance is a comprehensive BMP design manual and LID program resources including: ordinances, design manuals and specifications (3 & 4). MPCA has one of the most comprehensive set design resources available. Since the selection of BMPs is up to the judgment of the MS4 the state has provided a thorough list of BMP options for both construction and postconstruction controls.

2.5.8.2 Performance Criteria

MPCA uses a water quality volume of 0.5 inches for the design of construction and post construction retention, detention and infiltration BMPs. Filtration BMPs should achieve 80% TSS removal on an annual basis.

2.5.8.3 References

General Construction Permit: http://www.pca.state.mn.us/water/stormwater/stormwater-c.html#spermit

MS4 general Permit: http://www.pca.state.mn.us/publications/wq-strm4-51.pdf

Low impact Design Resources: http://www.pca.state.mn.us/water/stormwater/stormwater-lid.html

Minnesota Design Manual and other BMP Resources: http://www.pca.state.mn.us/water/stormwater/stormwater-manual.html

2.5.9 Nevada

Table 10
Specific Standards Found in Nevada General Permits

Key Items	Standards
Runoff volume as an environmental indicator	None found
Volume control in relation to pollutant control	None found
Permit limits related to storm size and runoff volume	None found
Performance criteria	None found
LID	None found
Pollution prevention	None found
End of pipe	None found

2.5.9.1 General

The Nevada Division of Environmental Protection is responsible for administering the state's stormwater management program. Like many states, the NDEP implements GPs pertaining to construction activity, industrial activity, and municipal separate storm sewer systems (MS4s). LID is not currently incorporated into the GPs.

Stormwater design manuals and LID implementation manuals are developed through local permitting programs. However, as discussed in the sections below, the NDEP has developed a Best Management Practice Field Guide to be used as recommendations for stormwater control practices.

As noted during a telephone interview with the NDEP stormwater coordinator, it is difficult to implement LID within the state due to lack of precipitation. BMP controls such as rain gardens and green roofs are, therefore, not necessarily practical given precipitation history. Not withstanding, the state is looking to implement other aspects of LID. The State works closely with local permitees and encourages LID wherever possible.

2.5.9.2 General Permits

1. **Construction GP**
   - *Stormwater General Permit NVR100000* – effective September 16, 2007

   According to NDEP's website pertaining to stormwater discharge permits:

   NDEP requires owner/operators to obtain a Construction Stormwater Permit if the project will disturb more than one (1) acres, or will disturb less than one (1) acre but is part of a larger common plan for development or sale that will ultimately disturb one (1) or more acres. If the construction site will disturb less than five (5) acres and meets certain criteria, the site may be eligible for a construction stormwater permit waiver.

   If NDEP determines that a project less than one (1) acre in size will impact receiving waters or its tributaries within a 1/4-mile radius of the project, the owner/operator of the project will also be required to obtain a construction stormwater permit.

2. **Small MS4 GP**
   - *National Pollutant Discharge Elimination System General Permit for Discharges from Small Municipal Separate Storm Sewer Systems (Small MS4 GP)* – Permit No. NVS040000, expired in December 2007.

This GP originally expired in December 2007, but has been extended to remain in effect until reissuance. Coverage obtained under the existing permits will continue under the reissued permits.

3. **Multi Sector GP**
   - *General Permit for Stormwater Discharges Associated with Industrial Activity to Waters of the United States* – Permit No. NVR05000, effective September 22, 2008.

This GP is modeled closely after the Environmental Protection Agency (EPA) multi-sector GP and applies to 11 industrial facility categories. Operators having and industrial classification code falling within any of these 11 categories must obtain coverage under the GP.

2.5.9.3 Performance Criteria

- *Nevada Contractors Field Guide for Construction Site Best Management Practices (BMP Field Guide)* – June 2008

This document is focused on the appropriate installation of soil erosion and sediment controls. However, this document does reference some common LID practices.

According to the NDEP website:

> The Nevada BMP Guide is the result of funding provided by the Nevada Division of Environmental Protection (NDEP), the Truckee Meadows Storm Water Coordinating Committee (TMSWPCC), the Washoe County Regional Water Planning Commission, and the Clark County Regional Flood Control District.
>
> The technical review and development process involved representatives from: the NDEP, the TMSWPCC, the Las Vegas Valley Stormwater Quality Management Committee, the Associated General Contractors of America, the Builders Association of Northern Nevada and other interested members of the public.

The Preface on Page i of the BMP Field Guide indicates:

> The regional policies and procedures presented in the Nevada BMP Field Guide are recommendations unless adopted by ordinance or code by the local entity. If the language in this field guide and the adopted ordinance differ, the ordinance language shall take precedence.

Chapter 1, Preconstruction Planning, includes discussion of minimizing impervious surfaces and including LID practices as part of preconstruction planning. This section provides narrative standards for keeping the amount of directly connected roof area, driveways, roads, and parking lots to a minimum.

The Nevada BMP Field Guide also provides narrative description to promote infiltration in project design in Chapter 1, on page 4. A short narrative discussion on disconnecting impervious surfaces is also provided in Chapter 1 on pages 85 and 86.

2.5.9.4 Additional Information

- Draft Individual MS4 Permit for Trucking Mills (Permit No. NVS000001)

This draft individual permit only authorizes the City of Reno, the City of Sparks and Washoe County (i.e., Truckee Meadows) to discharge municipal stormwater runoff to the Truckee River, its tributaries, and other waters of the United States in accordance with the conditions and requirements of the GP.

Item IV.F.3.a.ii on page 9 of the draft permit, regarding Post-Construction Stormwater Management Program For New Development and Significant Redevelopment Projects, requires permittees to "Describe how the Permittees will promote the use of low-impact development ("LID") measures that will remain in effect after construction is complete and are effective and appropriate for the Truckee Meadows and its environment".

- *The Truckee Meadows Regional Stormwater Quality Management Program Low Impact Development Handbook* (LID Handbook) dated August 2007.

This handbook was created for the Truckee Meadows region. As stated in Section 1.0 on Page 1 of the LID Handbook:

> The purpose of the Truckee Meadows Low Impact Development Handbook (the LID Handbook) is to provide regional planning policies, procedures and general guidance on site design techniques for improving the quality and reducing the quantity of storm water runoff from new development and significant redevelopment, to predevelopment conditions, to the Maximum Extent Practicable (MEP). The LID Handbook has primarily been developed to assist planners, developers, architects, landscape professionals, city and county community development and public works staff, and others with the selection and design of features and practices that mimic natural hydrologic functions. As described in this document, LID Handbook should be the first guidance document referenced during the development planning process.

2.5.9.5 References

City of Reno, Nevada. Regional Stormwater Quality Management Program. http://www.reno.gov/index.aspx?page=366 (Accessed April 27, 2010)

Kennedy/Jenks Consultants.*The Truckee Meadows Regional Stormwater Quality Management Program Low Impact Development Handbook*. August 2007. http://www.reno.gov/index.aspx?page=366

Kennedy/Jenks Consultants. *Nevada Contractors Field Guide for Construction Site Best Management Practices* (June 2008). http://ndep.nv.gov/bwqp/bmp05.htm

State of Nevada Division of Environmental Protection Bureau of Water Pollution Control. Stormwater Discharge Permits. http://ndep.nv.gov/BWPC/storm01.htm (Accessed April 27, 2010)

2.5.10 New Mexico

Table 11
Specific Standards Found in New Mexico General Permits

Key Items	Standards
Runoff volume as an environmental indicator	Not Found
Volume control in relation to pollutant control	Not Found
Permit limits related to storm size and runoff volume	Not Found
Performance criteria	Not Found
LID	Not Found
Pollution prevention	Not Found
End of pipe	Not Found

2.5.10.1 General

The U.S. Environmental Protection Agency (EPA) is the National Pollutant Discharge Elimination System (NPDES) permitting authority for New Mexico and as such is responsible for issuing NPDES stormwater permits. LID is not currently incorporated into the NPDES General Permits (GPs). Notwithstanding, the EPA indicates their promotion of LID on Page 1 of a NPDES General Permit for Stormwater Discharges From Construction Activities Fact Sheet:

> Stormwater control measures should be designed in accordance with any requirements established by the appropriate local, state, or tribal authority. EPA also strongly encourages operators to use low impact development or green infrastructure practices that promote infiltration and reduce stormwater volumes after development. Additional information on green infrastructure practices can be found at www.epa.gov/npdes/greeninfrastructure.

The New Mexico Environment Department Surface Water Quality Bureau (SWQB) assists EPA in regulation of storm water discharges by performing inspections on behalf of EPA and by serving as a local point of contact for providing information to operators and other agencies regarding this federal regulatory program.

2.5.10.2 Performance Criteria

It does not appear that New Mexico offers technical guidance on LID at the state level, or any other stormwater BMPs. Rather, the SWQB directs permitees and interested parties to other resources for implementation of BMPs. Sources include:

- EPA's National Menu of Best Management Practices
- International Stormwater BMP Database
- Measurable Goals Guidance for Phase II Small MS4s
- Stormwater Center
- Stormwater Authority

- Construction Industry Compliance Assistance Center

2.5.10.3 References

New Mexico Environment Department Surface Water Quality Bureau. The NPDES Stormwater Program. http://www.nmenv.state.nm.us/swqb/StormWater/index.html (Accessed April 27, 2010).

2.5.11 New Hampshire

Table 12
Specific Standards Found in New Hampshire General Permits

Key Items	Standards
Runoff volume as an environmental indicator	Not Found
Volume control in relation to pollutant control	Not Found
Permit limits related to storm size and runoff volume	Not Found
Performance criteria	Not Found
LID	Not Found
Pollution prevention	Not Found
End of pipe	Not allowed under the Alteration of Terrain permit (see below)

2.5.11.1 General

The U.S. Environmental Protection Agency (EPA) is the National Pollutant Discharge Elimination System (NPDES) permitting authority for New Hampshire and as such is responsible for issuing NPDES stormwater permits. LID is not currently incorporated into the NPDES General Permits (GPs). Notwithstanding, the EPA indicates their promotion of LID on Page 1 of a NPDES General Permit for Stormwater Discharges From Construction Activities Fact Sheet:

> Stormwater control measures should be designed in accordance with any requirements established by the appropriate local, state, or tribal authority. EPA also strongly encourages operators to use low impact development or green infrastructure practices that promote infiltration and reduce stormwater volumes after development. Additional information on green infrastructure practices can be found at:
>
> www.epa.gov/npdes/greeninfrastructure

2.5.11.2 Alteration of Terrain (AoT) Permit

New Hampshire implements an alteration of terrain (AoT) GP. As stated on the NHDES website:

New Hampshire Alteration of Terrain permits are issued by the DES Alteration of Terrain (AoT) Program. This permit protects New Hampshire surface waters, drinking water supplies and groundwater by controlling soil erosion and managing stormwater runoff from developed areas. An AoT permit is required whenever a project proposes to disturb more than 100,000 square feet of contiguous terrain (50,000 square feet, if any portion of the project is within the protected shoreland), or disturbs an area having a grade of 25 percent or greater within 50 feet of any surface water. In addition to these larger disturbances, the AoT Permit by Rule applies to smaller sites.

This permitting program applies to earth moving operations, such as industrial, commercial, and residential developments as well as sand pits, gravel pits, and rock quarries. Permits are issued by DES after a technical review of the application, which includes the project plans and supporting documents.

Per telephone interview with Jeff Andrews as the NHDES, hard piping management techniques cannot be used under the AoT permitting regulations.

2.5.11.3 Performance Standards

- ***New Hampshire Stormwater Manual***, December 2008

According to the New Hampshire Department of Environmental Services (NHDES) website:

> The New Hampshire Stormwater Manual was developed as a planning and design tool for the communities, developers, designers and members of regulatory boards, commissions, and agencies involved in stormwater programs in New Hampshire.
>
> The manual is intended to be a "living" document and will be updated as new information becomes available. The revision number of the most recent version is included on the title page and the footer on each left-hand page.

The manual is presented in three volumes and is currently in the process of being updated. Below is a summary of LID related topics covered in the New Hampshire Stormwater Manual.

- Volume 1, Chapter 6 – Non Structural Site Design Techniques
  - Minimize disturbed areas
  - Maintain natural buffers
  - Disconnect impervious cover
  - Minimize soil compaction
  - Alternative pavement
  - Impervious surface disconnection methods
- Volume 2, Chapter 4, Section 4.1 – LID "Interception Practices)

2.5.11.4 References

New Hampshire Department of Environmental Services. Alteration of Terrain Program. http://des.nh.gov/organization/divisions/water/aot/ (Accessed May 6, 2010).

New Hampshire Department of Envionrmental Services. Stormwater. http://des.nh.gov/organization/divisions/water/stormwater/index.htm (Accessed May 6, 2010).

2.5.12 New York

Table 13
Specific Standards Found in New York General Permits

Key Items	Standards
Runoff volume as an environmental indicator	Reference to *New York State Stormwater Management Design Manual*
Volume control in relation to pollutant control	
Permit limits related to storm size and runoff volume	
Performance criteria	Reference to *New York State Stormwater Management Design Manual*
LID	
Pollution prevention	
End of pipe	

2.5.12.1 General

The New York State Department of Environmental Conservation (NYDEC) is responsible for administering the state's stormwater management program.

2.5.12.2 General Permits

1. Construction GP

- *New York State Department of Environmental Conservation SPDES General Permit for Stormwater Discharges from Construction Activity* (NYDEC Construction GP) – Permit No. GP-O-IO-00I, effective January 29, 2010.

This GP addresses construction activity and post-construction best management practices. Under the GP, a permitee is required to develop a SWPPP. The SWPPP must meet requirements to address soil erosion and sediment control practices as well as postconstruction practices.

LID is not directly addressed within this GP. However, the GP does reference the *New York State Stormwater Management Design Manual* (Design Manual), which addresses the use of LID techniques. References to the Design Manual occur in the following sections of the NYDEC Construction GP):

- Part III.B.2
- Part III.B.3

- Appendix C

2. Small MS4 GP

- *New York State Department of Environmental Conservation SPDES General Permit for Stormwater Discharges from Small Municipal Separate Storm Sewer Systems (*NYDEC Small MS4 GP) – Permit No. GP-0-08-002, effective May 1, 2008

Under the NYDEC Small MS4 GP, permitees must develop, implement, and enforce a SWMP designed to reduce the discharge of pollutants from small MS4s to the maximum extent practicable (MEP). Six minimum control measures must be met in development of the SWMP. Further, New York State separates MS4's into three categories, those being traditional land use control MS4s, traditional non-land-use control MS4s, and nontraditional MS4s. Six minimum control measures for each of the three categories are described in the GP.

Use of LID is referenced within this GP under minimum control measure five for each aforementioned category. As stated in Part VII.A.5.a.iv on page 33 and in Part VIII.A.5.a.iv on page 51 of the NYDEC MS4 GP, the stormwater program shall include:

> …a combination of structural management practices (including, but not limited to practices from the NYS Stormwater Management Design Manual or equivalent) and / or non-structural management practices (including, but not limited to comprehensive plans, open space preservation programs, *LID*, Better Site Design (BSD) and other *Green Infrastructure* practices, land use regulations) appropriate for the *permittee* that will reduce the *discharge* of pollutants to the MEP.

It should also be noted that in the same aforementioned sections of the Small MS4 GP:

> Permittees are encouraged to implement *Green Infrastructure* practices at a site level and to review, and revise where appropriate, local codes and laws that include provisions that preclude construction that minimizes or reduces pollutant loadings.
> (page 33)

3. Multi Sector GP

- *SPDES Multi-Sector General Permit for Stormwater Discharges Associated with Industrial Activity* – Permit No. GP-0-06-002 , effective March 28, 2007.

LID is not directly addressed within this GP. However, the GP does reference the Design Manual, which addresses the use of LID techniques. Part 2 on Page VIII.L-1 states:

> A comprehensive SWPPP addressing the storm water run-on and run-off control systems needed during the landfill's construction, operation and closure phases must be prepared prior to the commencement of any construction activity that will result in a land disturbance of one or more acres of land. The plan must be prepared in accordance with the New York Standards and Specifications for Erosion and Sediment Control, dated August 2005; and the New York State Stormwater Management Design Manual.

Sector L, Part 6 on Page VIII.L-4 also states:

> The design, construction and maintenance of all post-construction stormwater management controls shall conform to the New York State Stormwater Management Design Manual.

2.5.12.3 Performance Criteria

New York State Stormwater Management Design Manual (Prepared August 2003, Updated April 2008)

As adopted from the NYDEC website:

> The current New York State Stormwater Management Design Manual provides designers with a general overview on how to size, design, select, and locate stormwater management practices at a development site to comply with State stormwater performance standards. This manual is a key component of the Phase II State Pollution Discharge Elimination System (SPDES) general permit for stormwater runoff from construction activities from all sizes of disturbance.

The NYDEC is in the process of updating the Design Manual, and the draft is currently under public review. The draft Design Manual now has chapters specifically dedicated to green infrastructure and stormwater management planning. The following list summarizes topics discussed in each chapter. Standards within the Design Manual are summarized in the above table.

Chapter 5 – Green Infrastructure Practices

- 5.1 Preservation of Natural Features and Conservation Design – Narrative Standards
- 5.2 Reduction of Impervious Cover – Narrative and prescriptive design standards
- 5.3 Green Infrastructure Techniques
  - Runoff reduction by area
  - Runoff reduction by volume (The practices in this section may be combined with runoff reduction by area and standard water quality practices to achieve distributed runoff control)

2.5.12.4 References

State of New York Department of Environmental Conservation. Stormwater. http://www.dec.ny.gov/chemical/8468.html (Accessed April 27, 2010)

Center for Watershed Protection. New York State Stormwater Management Design Manual (April 2008). http://www.dec.ny.gov/chemical/29072.html

State of New York Department of Environemntal Conservation. New York State Stormwater Management Design. Chapter 5. Green Infrastructure. Practices (DRAFT). Manualhttp://www.dec.ny.gov/docs/water_pdf/greeninfra.pdf

2.5.13 Oklahoma

Table 14
Specific Standards Found in Oklahoma General Permits

Key Items	Standards
Runoff volume as an environmental indicator	Not Found
Volume control in relation to pollutant control	Not Found
Permit limits related to storm size and runoff volume	Not Found
Performance criteria	Not Found
LID	Not Found
Pollution prevention	Not Found
End of pipe	Not Found

2.5.13.1 General

The Oklahoma Department of Environmental Quality (DEQ) is responsible for administering the state's stormwater management program with the exception of Native American lands, which are regulated by EPA Region 6. Oklahoma's stormwater program is closely modeled after the federal NPDES program minimum standards, which requires stormwater be treated to the maximum extent practicable. Numeric treatment requirements specific to stormwater have not been established at the state level, but water quality parameters can be established by local governments and the Water Quality Control Board on a site-by-site basis when the risk of contamination is present.

DEQ's program establishes permitting requirements for construction sites disturbing more than one acre, industrial sites, and MS4s. Each permitted MS4 is responsible for establishing a SWMP either under the Phase I or Phase II of the NPDES stormwater regulations. Additional permitting requirements may be imposed at the county and municipal level.

The regulations do not specifically promote LID but are flexible enough to allow MS4's to adopt LID programs if desired. LID is being promoted at the local level and by various organizations in watershed where surface water protection and restoration is important especially to protect drinking water sources (ref.1& 2).

2.5.13.2 General Permits

1. **General Construction Permit** - The permit only covers construction activities up to final stabilization of the site. A stormwater pollution prevention plan (SWP3) is required with appropriate sediment and erosion controls and that must describe the post construction BMPs to be used. The permit describes the type of post construction BMP allowed including: storm water detention structures (including wet ponds); storm water retention structures; flow attenuation by use of open vegetated swales and natural depressions; infiltration of runoff onsite; and sequential systems (that combine several practices). The SWP3 must also include an explanation of the technical basis used to select the practices to

control pollution where flows exceed predevelopment levels. Post-construction storm water BMPs that discharge pollutants from point sources once construction is completed, may in themselves need authorization under a separate permit (ref. 3).

2. **MS4 General permits** - Requires MS4s to develop, implement, and enforce a comprehensive stormwater program that include construction activities that result in a land disturbance of greater than or equal to one acre. MS4s must develop a post construction stormwater program for new development and redevelopment that follows the EPA six minimum standards with the goal of preventing or minimizing water quality impacts. BMPs must include both structural and nonstructural techniques that are appropriate for the MS4's local conditions. The permit allows for the use of several LID techniques including: filtration practices such as grassed swales, bioretention cells, sand filters and filter strips and infiltration practices such as infiltration basins and infiltration trenches (ref. 4).

2.5.13.3 Performance Criteria

Numeric treatment requirements specific to stormwater have not been established at the state level, but water quality parameters are established on a site-by-site basis when the risk of contamination is present. Narrative standards generally use MEP to protect water quality and the designated receiving water uses and water quality standards established by the *Oklahoma Water Quality Board*. Specific volume and flow controls are establish at the local level with a focus on flood control.

2.5.13.4 References

OK State University LID Program / Guidance: http://lid.okstate.edu/

American Rivers LID Program for Lower Maumee and Ottawa Rivers: http://www.americanrivers.org/assets/pdfs/reports-and-publications/low-impact-development-manual.pdf

Construction General Permit - http://www.deq.state.ok.us/WQDnew/stormwater/construction/okr10_final_permit_2009-09-03.pdf

Small MS4 General Permit Permit - http://www.deq.state.ok.us/WQDnew/stormwater/ms4/phase_ii_small_ms4_final_permit_8_feb_2005.pdf

2.5.14 Oregon

Table 15
Specific Standards Found in Oregon General Permits

Key Items	Standards
Runoff volume as an environmental indicator	Not found
Volume control in relation to pollutant control	Not found
Permit limits related to storm size and runoff volume	Not found
Performance criteria	Not found
LID	Not found
Pollution prevention	Not found
End of pipe	Not found

2.5.14.1 General

The Oregon Department of Environmental Quality (DEQ) Water Quality Division is responsible for administering the State's stormwater management program. The DEQ is currently in the process of updating each of their general permits; those permits being for construction activity, industrial activity, and small MS4s. The GPs, as they currently exist, do not incorporate implementation of LID policy. At least for the renewal of the GP associated with construction activity, LID will not be incorporated into the permit due to the quick timeline proposed for establishing the permit.

2.5.14.2 General Permits

1. <u>Construction GP</u>

- *General Permit National Pollutant Discharge Elimination System Stormwater Discharge Permit* (Permit Number 1200-C, issued December 28, 2005)

As stated on the cover page of this permit, sources covered by the permit include:

> Construction activities including clearing, grading, excavation, and stockpiling that will disturb one or more acres and may discharge to surface waters or conveyance systems leading to surface waters of the state. Also included are activities that disturb less than one acre that are part of a common plan of development or sale if the larger common plan of development or sale will ultimately disturb one acre or more and may discharge to surface waters or conveyance systems leading to surface waters of the state.

2. Small MS4s

Small MS4s are permitted through individual permits. Though individual permit numbers are assigned to each MS4, the contents of the permits remains consistent. As indicated on Page 1 of a fact sheet for Oregon's Phase II Municipal Stormwater Program:

The proposed permits require communities to implement a stormwater management program and to develop measurable goals to evaluate**.**
Individual communities have the flexibility to determine the practices and measurable goals that are most appropriate for their system. The chosen practices and measurable goals, submitted to DEQ as part of the permit application, become the required stormwater management program.

3. Multi-Sector GPs

As stated on the DEQ website for NPDES Stormwater Discharge Permits –Industrial Activities:

> As part of its efforts to protect and improve Oregon's water quality, DEQ issues stormwater discharge permits to industries that discharge stormwater into rivers, lakes and streams from pipes, outfalls or other point sources at a site. Based on federal regulations, National Pollutant Discharge Elimination System (NPDES) permit coverage is required for industrial facilities that discharge stormwater from their industrial areas to surface waters of the state, or to storm drains that discharge to surface waters.

The Oregon DEQ issues three industrial activity GPs.

- *General Permit National Pollutant Discharge Elimination System Storm Water Discharge Permit* (Permit Number 1200-A, issued December 28, 2005)
- *General Permit National Pollutant Discharge Elimination System Storm Water Discharge Permit* (Permit Number 1200-Z, issued July 1, 2007)
- *General Permit National Pollutant Discharge Elimination System Storm Water Discharge Permit* (Permit Number 1200-COLS, issued September 1, 2006)

2.5.14.3 Performance Criteria

The GPs reviewed do not discuss performance criteria.

2.5.14.4 References

Oregon Department of Environmental Quality. Water Quality Permit Program –NPDES Stormwater Discharge Permits http://www.deq.state.or.us/wq/stormwater/stormwater.htm (Accessed May 7, 2010).

Oregon Department of Environmental Quality. Water Quality Permit Program –NPDES Stormwater Discharge Permits – Industrial Activities.

http://www.deq.state.or.us/wq/stormwater/industrial.htm (Accessed May 7, 2010).

State of Oregon Department of Environmental Quality Water Quality Division. Fact Sheet: Oregon's Phase II Municipal Stormwater Program. Updated November 27, 2006. http://www.deq.state.or.us/wq/pubs/factsheets/stormwater/ph2munistmprg.pdf (Accessed May 7, 2010).

2.5.15 Pennsylvania

Table 16
Specific Standards Found in Pennsylvania General Permits

Key Items	Standards
Runoff volume as an environmental indicator	Not Found
Volume control in relation to pollutant control	Not Found
Permit limits related to storm size and runoff volume	Not Found
Performance criteria	Not Found
LID	Not Found
Pollution prevention	Not Found
End of pipe	Not Found

2.5.15.1 General

The Pennsylvania Department of Environmental Protection (DEP) is responsible for administering the state's stormwater management program. Pennsylvania's stormwater program is closely modeled after the federal NPDES program, which requires stormwater be treated to the maximum extent practicable. Pennsylvania's NPDES stormwater program establishes permitting requirements for construction sites disturbing more than one acre, industrial sites, and MS4s.

MS4s are responsible for developing comprehensive stormwater management programs that meet the minimum program EPA requirements, Pennsylvania code and general permit. DEP provides suggested specific guidance for BMP design, volume controls, model ordinances, etc. The guidance includes details on the use of LID principles and practices for the control of new development and provided as reference only. The state design manual is very comprehensive and provides a wide range of BMP options for conventional and LID techniques (ref. 3). In Pennsylvania, most NPDES permits are administered by county conservation districts through delegation agreements with the Pennsylvania Department of Environmental Protection (DEP). Conservation districts process and authorize the permit applications, conduct site inspections, respond to complaints, and in certain circumstances, conduct enforcement actions.

2.5.15.2 General Permits

1. Construction General Permit – Construction site greater than 1 ac are required to obtain an approved erosion and sediment control plan. Of particular importance is the requirement for a post construction stormwater management plan (PCSM) that must employ stormwater management BMPs to control the volume, rate, and water quality of the post construction stormwater runoff to protect and maintain the chemical, physical,

biological properties and existing/designated uses of the waters the commonwealth. (ref. 1).

2. MS4 General Permit – Permittees must develop a stomwater management program that meets EPA six minimum requirements. The state uses a technology based standard to meet a MEP standard. The state provides comprehensive programmatic and BMP guidance for permittee to use. The BMP guidance is not part of the requirements but only reference as guidance (ref. 2).

2.5.15.3 Performance Criteria

Many of the standards are narrative such as: maintain the existing water balance in all watersheds and protect and restore natural hydrologic characteristics. These criteria are established in municipal ordinances, as supported by the watershed stormwater management plan. In general, these stormwater management techniques will ensure that post-development runoff rates throughout the watershed do not exceed pre-development levels.
Example Performance Standards Chesterfield County (ref. 4 & 5)

Structural and non-structural stormwater management practices that provide, promote or otherwise make best possible use of infiltration on-site shall be considered first and foremost in all site designs.

Water quality management shall be provided through the use of structural and/or non-structural stormwater management practices. Water quality stormwater management practices shall be designed to reduce or eliminate solids, sediment, nutrients, and other potential pollutants from the site.

Stormwater quality management practices shall be designed to capture and treat stormwater runoff generated by the one-inch rainfall event.

Reduce the total impervious cover on the site by at least twenty percent (20%), based on a comparison of existing impervious cover to proposed impervious cover**; or** achieve a ten percent (10%) reduction in the total volume of runoff generated and discharged from the site by a 2-year storm event. Runoff calculations shall be based on a comparison of existing site conditions to post development site conditions; **or** reduce the post development peak discharge rates to ninety percent (90%) of the predevelopment peak discharge rates for the 2-year, 10- year, 25-year, 50-year and 100-year 24-hour storm events based on a comparison of existing ground cover to post development site conditions.

The one (1) inch storm event represents 80% of the total volume of rainfall and 95% of all rainfall events that occur in a typical year.

2.5.15.4 References

General Construction Permit fact Sheet:
http://www.buckinghampa.org/inc/documents/3/Fact-Sheet-NPDES-Permits.pdf

Draft General Municipal Permit: http://www.elibrary.dep.state.pa.us/dsweb/Get/Document-75300/3930-PM-WM0100%20DRAFT_PAG13%20for%20posting%20to%20eLibrary.pdf

Stormwater BMP Manual: http://www.elibrary.dep.state.pa.us/dsweb/View/Collection-8305

Chester County Example local model ordinance:
http://www.stormwaterauthority.org/assets/swmordinance.pdf

Low Impact Development: The Village At Springbrook Farms
Lebanon County PA Case Study: http://www.stormwaterpa.org/low-impact-development.htm

2.5.16 Rhode Island

Table 17
Specific Standards Found in Rhode Island General Permits

Key Items	Standards
Runoff volume as an environmental indicator	Via reference to the Stormwater Manual both water quality volume and peak flows.
Volume control in relation to pollutant control	Via reference to the Stormwater Manual; 80% TSS.
Permit limits related to storm size and runoff volume	
Performance criteria	
LID	Via reference to the Stormwater Manual. The draft Stormwater Manual employs a credit based system.
Pollution prevention	Via reference to the Stormwater Manual
End of pipe	Via reference to the Stormwater Manual

2.5.16.1 General

The Rhode Island Department of Environmental Management (RIDEM) is responsible for administering the State's stormwater management program, the Rhode Island Pollutant Discharge Elimination System (RIPDES). RIDEM implements general permits to enforce RIDPES regulations, including GPs for construction activity, industrial activity, and for small MS4s. Each of the three GPs are described below.

In general, Rhode Island has incorporated LID into their stormwater program via references to LID requirements in the *Rhode Island Stormwater Design and Installation Standards Manual* (Final Draft April 2010) (Stormwater Manual), as discussed below. Through the Stormwater Manual, Rhode Island requires the use of LID techniques for site design in order to reduce the

generation of the water runoff volume for both new and redevelopment projects. *Rhode Island implements the Stormwater Design and Installation Standards Manual* as a *de facto* regulation, although applicants are technically allowed to propose alternative standards that are "equivalent." Rhode Island is in the latter stages of adopting revisions to the Stormwater Manual, which was originally drafted in 1993. RIDEM will accept permit applications using the 2010 draft of the Stormwater Manual. RIDEM intends to promulgate the 2010 revisions.

1. **Construction GP**

- *General Permit Rhode Island Pollutant Discharge Elimination System Stormwater Discharge Associated with Construction Activity* (Effective September 26, 2008)

This GP does not directly address LID. However, the GP does reference the *State of Rhode Island Storm Water Design and Installation Standards Manual* (Stormwater Manual), which does address LID in the final draft (available on line). Section III.A.11 on page 7 indicates that:

> Signed certification by a Registered Professional Engineer, a Certified Professional in Erosion and Sediment Control (CPESC), a Certified Professional in Storm Water Quality (CPSWQ), or a Registered Landscape Architect, that the SWPPP has been developed in accordance to the requirements of this permit as well as all applicable guidelines of the *Soil Erosion and Sediment Control Handbook* and the *Storm Water Design and Installation Standards Manual.*

Further discussion of the Stormwater Manual is provided at the end of this summary.

2. **MS4 GP**

- *General Permit Rhode Island Pollutant Discharge Elimination System Storm Water Discharge from Small Municipal Separate Storm Sewer Systems and from Industrial Activity at Eligible Facilities Operated by Regulated Small MS4s* (Permit Number RIR040000, effective November 14, 2003).

Like the Construction GP, the MS4 GP requires LID via document reference to the Stormwater Manual (as revised). Permittees are also required to consider and incorporate LID as part of drainage projects. Progress toward meeting this requirement must be reported out on an annual basis. As stated in Section G.1 of the Small MS4 GP, on Page 33, "the operator must submit an annual report for each year after the permit is issued by March 10th. The reports must contain information regarding activities of the previous calendar year."

Further Section G.2.j on Page 34 indicates the following must be contained in the annual report:

> Planned municipal construction projects and opportunities to incorporate water quality BMPs, low impact development as well as activities to promote infiltration and recharge.

Applicants to municipalities are also required to address LID through the MS4 GP. Section IV.B.5.a.3 on Page 19 indicates the postconstruction program must include:

> Procedures for site plan review to ensure that design of controls to address post-construction runoff are consistent with the State of Rhode Island Stormwater Design and Installation Manual (as amended).

MS4 operators must document the decision process for the development of a postconstruction storm water management program. This involves development of a rationale statement.

Section IV.B.5.b.2, on Page 20, states that the permittee's rational statement must include:

> Description of how the program is consistent with the State of Rhode Island Stormwater Design and Installation Manual (as amended) and how the program will be specifically tailored for the local community or facility, will minimize water quality impacts, and will work to maintain pre-development runoff conditions considering opportunities for groundwater recharge.

3. **Multi-Sector GP**

- *Multi-Sector General Permit Rhode Island Pollutant Discharge Elimination System Storm Water Discharge Associated with Industrial Activity (excluding Construction Activity)* (Permit Number RIR500000, effective May 1st, 2006).

2.5.16.2 Performance Standards

- *Rhode Island Stormwater Design and Installation Standards Manual* (Final Draft April 2010).

As stated on the RIDEM website for Stormwater Guidance, "The R.I. design standards for handling and treating stormwater runoff are being updated and revised jointly by the RIDEM and CRMC." Additionally:

> The existing 1993 *State of Rhode Island Storm Water Design and Installation Standards Manual*, developed by RIDEM and RICRMC, is in effect until the new manual is officially adopted. Notwithstanding, both agencies have been accepting similar, improved stormwater methods and practices on a case-by-case basis where agency reviewers agreed that greater water quality benefits would result.

The 1993 Stormwater Design and Installation Standards Manual does not reference LID techniques. However the April 2010 Draft Stormwater Manual begins to incorporate LID concepts into BMP design.

Chapter 4.0 of the Draft Stormwater Manual addresses LID site planning and design strategies. As stated on Page 4-1 of the Stormwater Manual:

> This chapter presents a suite of LID methods that designers and developers can choose from to treat, infiltrate, and reduce the stormwater runoff at a site. The LID site

> planning process is required to meet Minimum Standard 1, and an LID Credit is available that helps project applicants meet the recharge and treatment requirements of Minimum Standards 2 and 3.

Section 3.2 of the Draft Stormwater Manual addresses the minimum standards referenced above. Standard 1 is LID Site Planning and Design. According to this standard on Page 3-2 of the Draft Stormwater Manual:

> LID site planning and design strategies must be used to the maximum extent practicable1 in order to reduce the generation of the water runoff volume for both new and redevelopment projects. All development proposals must include a completed Stormwater Management Plan checklist (Appendix A) and Stormwater Management Plan for review by the approving agency that shows compliance with this standard. If full compliance is not provided, an applicant must document why key steps in the process could not be met and what is proposed as mitigation. The objective of the LID Site Planning and Design Strategies standard is to provide a process by which LID is considered at an early stage in the planning process such that stormwater impacts are prevented rather than mitigated.

2.5.16.3 References

State of Rhode Island Department of Environmental Management Office of Water Resources. RIPDES Stormwater Program. http://www.dem.ri.gov/programs/benviron/water/permits/ripdes/stwater/index.htm (Accessed May 10, 2010).

State of Rhode Island Department of Environmental Management Office of Water Resources. Stormwater Guidance. http://www.dem.ri.gov/programs/benviron/water/permits/ripdes/stwater/t4guide/desman.htm (Accessed May 10, 2010).

2.5.17 Vermont

Table18
Specific Standards Found in Vermont General Permits

Key Items	Standards
Runoff volume as an environmental indicator	Not found
Volume control in relation to pollutant control	Not found
Permit limits related to storm size and runoff volume	Not found
Performance criteria	
LID	No perform criteria were found; however, LID must be included in municipal policy. Stormwater "credits" are used as a proxy for treatment volume.
Pollution prevention	Not found
End of pipe	Not found

2.5.17.1 General

The Vermont Department of Environmental Conservation (VDEC) Water Quality Division is responsible for administering the state's stormwater management program. The program includes implementation of individual and general permits (GP) as well as utilization of guidance manuals. The VDEC implements additional regulations, and requires additional permit coverage, from federal regulations. The following is a list of all general permits carried out under the VDEC stormwater management program. However, this summary only focuses on the construction, multi-sector, and small MS4 GPs.

- New Development and Redevelopment Discharges to Waters that are Not Principally Impaired by Collected Stormwater Runoff
- Previously Permitted Discharges to Waters that are Not Principally Impaired by Collected Stormwater Runoff
- Designated Discharges to Bartlett, Centennial, Englesby, Morehouse, and Potash Brooks

As will be discussed below, only the draft MS4 GP references the use of LID. Notwithstanding, the VDEC incorporates LID into some state guidance manuals. While LID does not take primacy over end-of-pipe practices, LID is encouraged. Although not in the regulations, permitees can receive credit in the form of reduced treatment volume requirement for disconnection.

VDEC publishes the following guidance manuals:

The Vermont Standards and Specifications for Erosion Prevention & Sediment Control, 2006
The Vermont Stormwater Management Manual; Volume I - Stormwater Treatment Standards, 5th printing. April 2002.

The *Vermont Stormwater Management Manual* (Stormwater Manual) does contain low impact develop related techniques, as discussed below in this summary.

2.5.17.2 General Permits

1. **Construction GP**

- *State of Vermont Agency of Natural Resources Department of Environmental Conservation General Permit 3-9020 (2006) for Stormwater Runoff from Construction Sites* – effective September 13, 2006.

The current construction GP does not incorporate LID into State regulations. Notwithstanding, the original version of 3-9020 permit was issued in September 2006. An amended permit was issued in February 2008. The following language has been adopted from the VDEC website pertaining to stormwater permits:

Construction General Permit 3-9020 authorizes permittees to discharge stormwater runoff from construction activities provided the project is in compliance with the requirements of the permit. The permitting requirements for projects authorized under this general permit depend upon the risk of having a discharge of sediment in the stormwater runoff from the construction site. There are two risk categories authorized by the general permit--low risk and moderate risk. Projects that pose a higher risk are ineligible to use the general permit, and must file an application for an individual permit.

Projects that qualify as low risk do so because of favorable site conditions, use of vegetated buffers on water bodies, and the use of prompt stabilization and phased earthwork. For these projects, applicants will need to file a notice of intent that certifies that they will employ the erosion prevention and sediment control measures contained in the *Low Risk Site Handbook for Erosion Prevention and Sediment Control*. A complete application for a low-risk eligible project will be automatically authorized following a 10-day public comment period provided no comments are received.

Projects that are qualify as moderate risk require the development of a site specific Erosion Prevention and Sediment Control (EPSC) Plan that meets the requirements of the general permit and conforms to the *Vermont Standards and Specifications for Erosion Prevention and Sediment Control (2006)*. Moderate risk projects require design by an individual familiar with the principles of erosion prevention and sediment control.

2. **Multi-Sector GP**

- *Vermont Multi-Sector General Permits for Stormwater Discharges Associated with Industrial Activity MSGP 3-9003, NPDES Number* – Effective August 18, 2006

The current multi-sector GP (MSGP) does not incorporate LID into State regulations. The MSGP is a federally mandated National Pollutant Discharge Elimination System (NPDES) permit that covers new and existing discharges of stormwater from industrial facilities. Industrial facilities conduct activities and use materials that have the potential to impact the quality of Vermont's waters. The permit requires facilities to examine potential sources of pollution, implement measures to reduce the risk of stormwater contamination, and test stormwater discharges for sources of pollution. Permit coverage is required by private and municipal industries identified on the MSGP Standard Industrial Classification (SIC) code list.

3. **Small MS4 GP**

- *Draft State of Vermont Agency of Natural Resources Department of Environmental Conservation National Pollutant Discharge Elimination System (NPDES) General Permit 3-9014 (2010) for Stormwater Discharges from Small Municipal Separate Storm Sewer Systems*

In November 1999 the EPA issued new federal stormwater regulations for the census defined metropolitan areas of less than 100,000 people called the Phase II Stormwater Rule. In Vermont eight municipalities with MS4 are required to come into compliance with this rule. The Vermont Department of Environmental Conservation (VTDEC) is in the process of reissuing the MS4 Permit to replace the current version. A draft of the permit was released on January 22, 2010 for public comment and has yet to be finalized as of the writing of this summary document.

The small MS4 GP incorporates LID into its regulations for discharges to impaired waters with an approved TMDL. Section IV.C.1.d.2.d states that "For those MS4s that discharge to stormwater-impaired waters with EPA-approved stormwater TMDLs, the permittee shall comply with the following requirements:

> Each MS4 permittee, in consultation with the Agency, shall work cooperatively with any other MS4 permittees that discharge into the same stormwater impaired watershed to develop and submit a single, comprehensive FRP for the stormwater-impaired watershed… The FRP shall contain…a regulatory analysis that identifies and describes what, if any, additional regulatory authorities, including but not limited to the authority to require low impact development BMPs, the permittee will need in order for the permittee to implement the FRP.
> (pg 11).

Section IV.C.1.d.7 also states:

> Beginning in the second year following issuance of this permit, or designation as a regulated MS4, the permittee shall develop a program to identify opportunities for and provide assistance to landowners in the implementation of LID BMPs such as maximizing disconnection, maximizing infiltration of stormwater runoff, preventing and eliminating soil erosion, and preventing and eliminating the delivery of pollutants to stormwater conveyances.

Additionally, the small MS4 GP incorporates LID into minimum control measures four and five. Section IV.G.4.a.5 states:

> In conjunction with the review required by Subpart IV.G.5.b., the permittee shall review existing policies; planning, zoning and subdivision regulations; and ordinances to determine their effectiveness in managing construction-related erosion and sediment and controlling waste such as discarded building materials, concrete truck washout, chemicals, litter, and sanitary waste at construction sites that may cause adverse impacts to water quality. The policies, regulations, and ordinances must also be reviewed for their consistency with the requirements of the Secretary's general permits for stormwater runoff from large and small construction sites and construction erosion guidelines for low impact development. The permittee may adopt requirements that complement or are more stringent than the requirements of the Secretary (Pg 23).

Section IV.G.5.d states:

> For stormwater runoff that discharges into the small MS4 from new development and redevelopment projects that disturb greater than or equal to one acre (including projects less than one acre that are part of a larger common plan of development or sale) and that are not subject to regulation under the Agency's post-construction stormwater management permit program the permittee must adopt, if it has not already done so, an ordinance, planning, zoning and subdivision regulation, or other regulatory mechanism, or if the permittee is a nontraditional MS4, a policy that utilizes a combination of structural, non-structural and low impact BMPs, which are appropriate for the

> community and meet, at a minimum, requirements in the Agency's 2002 Vermont State Stormwater Management Manual (and any amendments thereto); and (Pg 25).

2.5.17.3 Performance Standards

- The Vermont Stormwater Management Manual; Volume I - Stormwater Treatment Standards, 5th printing. April 2002.

Section 3 of the Stormwater Manual discusses voluntary stormwater management credits. As stated in the introduction of the Stormwater Manual:

> This section provides six groups of nonstructural practices that can be used to gain stormwater credits that will significantly reduce the cost and size of the stormwater treatment practices at a site. The key benefit of these non-structural practices is that they reduce the generation of stormwater runoff at a site, thereby resulting in decreased treatment and storage volumes. These nonstructural practices are completely voluntary and need not be used by a permit applicant.

Stormwater credits can be obtained through the use of the following six groups of non-structural practices:

- Credit 1. Natural Area Conservation
- Credit 2. Disconnection of Rooftop Runoff
- Credit 3. Disconnection of Non-Rooftop Runoff
- Credit 4. Stream Buffers
- Credit 5. Grass Channels
- Credit 6. Environmentally Sensitive Rural Development

Performance standards provided in the Stormwater Manual are summarized in the above table.

2.5.17.4 References

Vermont Department of Environmental Conservation Water Quality Division. Welcome to the Stormwater Section. http://www.anr.state.vt.us/dec//waterq/stormwater.htm (Accessed May 6, 2010).

Vermont Agency of Natural Resources. The Vermont Stormwater Management Manual; Volume I - Stormwater Treatment Standards, 5th printing. April 2002. http://www.anr.state.vt.us/dec//waterq/stormwater/docs/sw_manual-vol1.pdf

2.5.18 Washington

Table 19
Specific Standards Found in Washington General Permits

Key Items	Standards
Runoff volume as an environmental indicator	Washington applies a water quality volume and peak runoff standard
Volume control in relation to pollutant control	Pollution control standards for turbidity and pH are assumed to be met if the 12 minimum control measures are met under the Construction GP
Permit limits related to storm size and runoff volume	The peak runoff standard is graduated for the 6-month, 2-, 10-, and 50-year storms
Performance criteria	Not Found
LID	Not Found
Pollution prevention	Required by narrative standard
End of pipe	Not Found

2.5.18.1 General

The Washington State Department Ecology (DOE) is responsible for administering the state stormwater management program. The DOE establishes permitting requirements for construction sites disturbing more than one acre, industrial sites, and MS4s. Each permitted MS4 is responsible for establishing a SWMP to address construction, development and new development activities. The Phase II MS4 jurisdictions are required to include LID as part of their SWMP. Further, LID specific technical design guidance is provided by the state and other stakeholder organizations such as the Puget Sound Partners (ref. 1).

In 2008 the Washington State Pollution Control Hearings Board order the Department of Ecology that it must require mandatory use of LID for the Phase I communities and to work towards mandatory requirements. The board specifically directed DOE to amend the Phase I permits to 1) require the identification and elimination of barriers to implementing LID, 2) require the identification of LID practices that can be implemented immediately, 3) require the establishment of goals and metrics to "identify, promote, and measure" LID use, including schedules by which Phase II jurisdictions will require such techniques. DOE is currently working with stakeholders to develop LID guidelines and implementation time tables (ref. 2).

To meet water quality goals DOE uses a technology based approach and provides detailed technical BMP design guidance in separate manuals for the Western and Eastern parts of the state. Western and Eastern Washington have different hydrology, geology and receiving water goals. Eastern Washington is a high plains desert climate with half the rainfall as Western Washington. The Western Washington stormwater program is more applicable to that of Connecticut so only Western Washington examples are provided (ref. 3).

2.5.18.2 General Permits

1. **Construction General Permit** Construction projects greater than five acres must apply for coverage under the General Permit for Construction activities. Other projects must apply to the local government for plan approval and if in the Puget Sound basin are subject to the Puget Sound Water Quality Management Plan goals (PSWQMP) or other requirement for TMDLs. Generally, the PSWQMP requirements are more stringent with lower impervious thresholds for controls. The general permit only covers the construction phase up to final stabilization and does not address postconstruction BMPs (ref 4).

2. **MS4 General Permits Phase I and II** - Under a current court order the Phase I MS4 permits will be revised to require mandatory use of LID. Under the current permit for Phase II MS4s LID is required as part of the minimum stormwater program requirements for new development and redevelopment. LID use is also required as part of the educational program for homeowners. Clear guidance on LID BMP's is provided in the Volume III of the Western Washington design manual as well as technical guidance provided by the Puget Sound Partnership (ref. 1 & 3).

2.5.18.3 Performance Criteria

1. For construction activities water quality action levels standards are: a) Turbidity: shall not exceed 5 NTU turbidity units over background turbidity when the background turbidity is 50 NTU or less, or have more than a 10 percent increase in turbidity when the background turbidity is more than 50 NTU. b) PH: shall be within the range of 6.5 to 8.5 (freshwater) or 7.0 to 8.5 (marine water) with a human-caused variation within a range of less than 0.2 units. For Class A and lower water classifications, the permissible induced increase is 0.5 units. Although there is no specific surface or ground water quality standard for petroleum products, the narrative surface water quality criteria prohibits any visible sheen in a discharge to surface water. It is presumed that if you apply the 12 minimum control elements required in the general construction permit and detailed in the design manual these standards will be met. All of the technical requirements are detailed in Volume I of the stormwater design manual (ref. 3).

2. For development and redevelopment BMPs in western Washington must be designed to remove 80% of the total suspended solids (TSS) load during the peak of the 6-month, 24-hour storm. In addition, all stormwater treatment devices must be designed so that peak discharges from the 2-, 10-, and 50-year, 24-hour storm do not exceed predevelopment rates. Additional treatment requirements exist in many of the counties and municipalities in Western Washington for metals, phosphorus bacteria and oil and grease.

3. BMPs for long-term management of stormwater at developed sites are divided into three main categories (1) BMPs addressing the volume and timing of stormwater flows (2) BMPs addressing prevention of pollution from potential sources; and (3) BMPs addressing treatment of runoff to remove sediment and other pollutants. For the purpose of designing most types of runoff treatment BMPs, a calibrated continuous

simulation hydrologic model based on the EPA's HSPF (Hydrologic Simulation Program-Fortran) program, or an approved equivalent model, must be used to calculate runoff and determine the water quality design flow rates and volumes. The flow rate at or below which 91% of the runoff volume, as estimated by an approved continuous runoff model, will be treated. Design criteria for treatment facilities are assigned to achieve the applicable performance goal at the water quality design flow rate (e.g., 80% TSS removal).

2.5.18.4 References

Puget Sound Partnership - http://www.psparchives.com/our_work/stormwater/lid.htm

Pollution Control Hearing Board Ruling - http://www.earthjustice.org/library/legal_docs/phase-ii-final-order.pdf

Stormwater Management Manual for Western Washington - http://www.ecy.wa.gov/programs/wq/stormwater/manual.html#How_to_Find_the_Stormwater_Manual_on_the

Construction General Stormwater Permit - http://www.ecy.wa.gov/programs/wq/stormwater/construction/constructionfinalpermit.pdf

2.5.19 West Virginia

Table 20
Specific Standards Found in West Virginia General Permits

Key Items	Standards
Runoff volume as an environmental indicator	One-inch of runoff must be managed using LID and pollution prevention
Volume control in relation to pollutant control	Not specified
Permit limits related to storm size and runoff volume	Not specified
Performance criteria	
LID	One-inch of runoff must be managed using LID
Pollution prevention	Narrative standard in the GP
End of pipe	End-of-pipe BMPs may be used once LID and pollution prevention options are exhausted; however, a performance standard is not provided.

2.5.19.1 General

The West Virginia Department of Environmental Protection (DEP) is responsible for administering the state's National Pollution Discharge Elimination System (NPDES) stormwater management program. West Virginia's stormwater program is modeled after the federal NPDES program, which requires stormwater be treated to the maximum extent practicable. LID is encouraged in the general construction permit as part of the required description of post construction BMPs. LID elements are required in the MS4 permit that include a variety of watershed site planning / design techniques and onsite BMP controls to address flow, volume and temperature mitigation requirements. Each permitted MS4 is responsible for establishing a SWMP that includes managing construction permits and development of an LID program. Technical guidance provided is generally from EPA sources (ref.1).

1. **Construction General Permit** – Disturbance of one acre or more requires an approved SWPPP with appropriate BMPs to meet state water quality standards for construction activities to control erosion and sediment. A groundwater protection plan (GPP) is required to protect source waters. The SWPPP must include a description of the postconstruction BMPs. Permittee "should consider," but is not required to use LID for site development and long term postconstruction controls (Ref. 2 & 3).

2. **MS4 Permit** – Regulated communities must develop stormwater management programs that meet EPA minimum standards (e.g., six minimum control measures). This includes the development of a comprehensive stormwater management program to control flow, volume and temperature of runoff from new and redevelopment sites. The stormwater program minimum requirements are numerous and quite specific including:

   - Modification of all policy and plans documents such as master land use plans, zoning, subdivision ordinances to reduce impervious surfaces and increase conservation.
   - Utilization of practices to include dry swales, bioretention, rain tanks and cisterns, soil amendments, roof top disconnections, permeable pavement, porous concrete, permeable pavers, reforestation, grass channels, green roofs and other practices that alone or combined to capture the first one inch of rainfall runoff volume.
   - Preserve, protect, create and restore ecologically sensitive areas that provide water quality benefits and serve critical watershed functions (including riparian corridors, headwaters, floodplains and wetlands).

   Where the water quality goals cannot be met using these techniques alternative measure are allowed including off site mitigation and fee-in-lieu. (ref. 4).

2.5.19.2 Performance Criteria

The MS4 permit requires management measures in combination or alone, keep and manage on site the first one inch of rainfall from a 24-hour storm preceded by 48 hours of no measurable precipitation. Runoff volume reduction can be achieved by canopy interception, soil

amendments, evaporation, rainfall harvesting, engineered infiltration, extended filtration and/or evapotranspiration and any combination of the aforementioned practices. This first one inch of rainfall must be 100% managed with no discharge to surface waters, except when the permittee chooses either site mitigation or fee in lieu as an alternatives. Management of the runoff be achieved through on site practices including: dry swales, bioretention, rain tanks and cisterns, soil amendments, roof top disconnections, permeable pavement, porous concrete, permeable pavers, reforestation, grass channels, green roofs and other practices that alone or combined will capture the first one inch of rainfall runoff volume. Extended filtration practices that are designed to capture and retain up to one inch of rainfall may discharge volume in excess of the first inch through an under drain system.

2.5.19.3 References

EPA LID / Green Infrastructure Guidance - http://www.epa.gov/nps/lid/

WV General Construction Permit 2007-
http://www.dep.wv.gov/WWE/Programs/stormwater/csw/Documents/2007%20Construction%20Stormwater%20General%20Permit.pdf

WV General Construction Permit (2010 Modifications) -
http://www.dep.wv.gov/WWE/Programs/stormwater/csw/Documents/WV0115924%20Modification.pdf

WV MS4 General Permit -
http://www.dep.wv.gov/WWE/Programs/stormwater/MS4/permits/Documents/WV%20MS4%202009%20General%20Permit.pdf

2.5.20 Wisconsin

Table 21
Specific Standards Found in Wisconsin General Permits

Key Items	Standards
Runoff volume as an environmental indicator	Not Found
Volume control in relation to pollutant control	80% TSS standard
Permit limits related to storm size and runoff volume	Not Found
Performance criteria	Not Found
LID	1 – 2% of the site area must be set aside for infiltration (not specifically a LID standard)
Pollution prevention	Not Found
End of pipe	Not Found

2.5.20.1 General

The stormwater program is administered by the Department of Natural Resources. The requirement, standards and basic design goals for managing construction site and postconstruction runoff are described in Wisconsin's Administrative Code for stormwater management (1). The program attempts to meet water quality standards through use of technology based standards and provides specific design guidance manual on pre- and postconstruction BMPs. DNR does not specifically promote LID, but they embrace many LID principles and techniques such as avoidance of impacts and use heavy reliance on infiltration practices (trenches, bioretention and swales) to protect water quality. Compared to California, Washington or Maine, Wisconsin's program is fairly conventional.

2.5.20.2 General Permits

1. **State Code Chapter NR 151**- The state code provides the overarching pollution performance criteria to achieve required water quality standards for construction and postconstruction activities. For construction activities, a plan is required for all sites over 1 ac that must use BMPs to achieve appropriate BMP design and sizing guidance is provided in the Wisconsin Erosion and Sediment Control Manual. (1)

2. **Construction permit** – Requirements are described in state code and BMP guidance is provided in the design manual. The design manual is adopted by reference in the code. The code provides a clear update and approval process for modifications to the manual. (1)

3. **MS4 permits**- Requirements are described in the state code and BMP guidance is provided in the design manual. The DNR design manual is adopted by reference in the code. The permit identifies communities that are regulated by the MS4 permit and requires them to implement a stormwater program that follows EPA's six minimum requirements, provides for consistency with the state stormwater code and includes a construction site control program. (2)

4. **Performance Standards** - The general performance standard of 80% TSS removal on an average annual basis compared to no controls to protect water quality. The same performance standard is used for postconstruction and redevelopment. Further, for postconstruction when infiltration is used a volume equal to 90% of the predevelopment infiltration volume must be used. No more than 1% of the site may be used for infiltration purposes for residential sties and 2% for industrial sites. Detailed guidance on BMP sizing to meet the standards is provided in the state design manual (3).

2.5.20.3 References

WI Code Chapter NR 216 Storm Water Discharge Permits:
http://www.legis.state.wi.us/rsb/code/nr/nr216.pdf

MS4 General permit - http://dnr.wi.gov/runoff/pdf/stormwater/permits/S050075-1%20_municipal_permit.pdf

Website address to purchase all design manuals: http://learningstore.uwex.edu/Wisconsin-Storm-Water-Manual-P603C0.aspx

3 Partner Recommendations

3.1 Informing and Engaging Partners

DEP is using a variety of media and methods to engage partners. Partners were initially made aware of the Low-Impact Development and Stormwater General Permit Evaluation initiative through a letter and email sent on May 12, 2010. This letter is provided in *Appendix B* of this document. In particular, the letter announces an initiation meeting. Four other meetings are also planned for this project and will be announced through email and a project webpage. We intend to use the May 26 meeting to set the schedule for the four additional meetings.

DEP has established a project webpage, which may be accessed at:

http://www.ct.gov/dep/cwp/view.asp?a=2719&q=459488&depNav_GID=1654

This webpage is being used to provide important project information, such as:

- Workshop agendas and summaries
- Workshop presentations
- Project reports and other related materials

Beyond the workshops, webpage, and project announcements, DEP intends to engage partners through one-on-one interaction. While this sort of interaction can occur at workshops, individual conversations provide a more personalized opportunity for direct feedback. Therefore, as a starting point to the project, telephone interviews are being conducted for the specific purpose of requesting partner ideas on how to best develop and implement LID policy. The remainder of this report addresses the use and results of these telephone interviews.

3.2 Telephone Interviews

This section of the report discusses 27 telephone interviews with project partners, which were conducted between May 14 and July 1, 2010. It details:

- The structure of the interview process
- Interview questionnaire and conversation
- Findings from the interviews

3.2.1 Interview Process

Interviews with partners were conducted following the dissemination of an invitation, sent both by post and email on May 12, 2010, requesting that partners attend a project initiation meeting on May 26, 2010 at Connecticut Department of Environmental Protection headquarters at 79 Elm Street in Hartford. In part the letter also stated:

> Fuss & O'Neill, contractor for the project, will be contacting you in advance of the May 26 partner workshop to begin the discussion of LID and SGP amendment process. Your ideas will also be used to guide activities at the workshop.

Interviews were initiated through telephone calls placed by Fuss & O'Neill staff. If staff was unsuccessful in directly reaching a partner (i.e., potential interviewee) a message was left. Follow-up calls were made on subsequent days. In some cases, partners also returned calls, in which case interviews were conducted at that time.

Interviews were based on an interview sheet, which is discussed further in *Section 3.2.2* below.

3.2.2 Interview Questionnaire and Conversation

We used an interview sheet or "questionnaire" to structure our conversations with partners and gather their ideas for incorporating LID into state policy. The purpose of the interview sheet was to help us to collect similar and consistent information from each partner. The structure also helped to facilitate our conversations with interviewees. As we were not attempting to conduct a scientific experiment or maintain experimental integrity, we did not necessarily adhere to the interview sheet exactly. A blank interview questionnaire is provided in *Appendix C*.

The interview sheet includes an introductory statement and a series of questions. The statement makes two key points. It notes:

- DEP's intent to update the four general permits, Stormwater Quality Manual, and Soil Erosion Control Guidelines to include LID.
- DEP's intent to make this initiative partner driven and that DEP is asking partners to define their role in the process.

The interview sheet includes seven questions. Some of the questions are compound. That is to say that they may include more than one actual request for information around a specific thought or idea. *Section 3.2.3 Findings* addresses general interview responses to each of the seven questions.

3.2.3 Findings

To date, Fuss & O'Neill has conducted interviews with 27 partners. Although not all of the 50 plus partners have been interviewed, the 27 interviews conducted to date do provide a representative cross-section of partners including municipalities, trade organizations, federal, regional, and state government, utility companies, and environmental organizations.

This section of the summary follows the structure of questions in the interview form. Specifically, each question from the interview sheet is written in italics text followed by a general discussion of the responses received from interviewees.

3.2.3.1 Are you Familiar with LID Practices?

1. *Are you familiar with LID practices? (If not, interviewer should provide some description. Also this is an opportunity to discuss aspects of LID that the interviewee may not be considering)*

We included this as a first question for two primary reasons. First, the question serves to orient interviewees on LID. A number of the questions that follow are relatively complex and require interviewees to express philosophical views about the use of regulations, government intervention, and policy. By contrast, this is a very concrete question and generally generates a "yes" or "no" response.

Secondly, this question reveals a basic level of understanding of the subject matter and gives the interviewee the permission to say "no, I'm not familiar with LID"; or "my organization is interested in this topic, but you should really be speaking to [name of other person]." The interviewer can then gage the approach to further questioning to facilitate answers from the interviewee and to avoid asking questions of the interviewee that, frankly, he or she may not be prepared to answer.

Most interviewees answered the question in the affirmative (25 of 27); however, three respondents answered "a little" or "yes, somewhat"; and two respondents answered in the negative.

3.2.3.2 Have you been Involved in the Application of LID?

2. *Have you been involved in their application on a project or in policy?*

The table below provides a basic breakdown of responses to question two.

Table 22
Interviewee Reports of Experience with LID

Type of LID Experience	Number of Responses	Percentage of Responses
At Least Some Experience	19	70%
Policy or Advocacy Only	6	22%
Project Experience Only	2	7%
Both Project and Policy	11	41%
Neither	5	19%

Like Question 1, Question 2 is fairly concrete and tends to generate straight-forward responses; although Question 2 does allow respondents to provide some description of the type of projects they worked on and how LID has been applied. This was also helpful in preparation for later questions.

3.2.3.3 How Should LID be Incorporated into DEP Policy?

3. *How do you think they* [LID practices] *should be incorporated into DEP policy?*
    a. *By reference to a document*
    b. *Specific standards*
        i. *Narrative standard*
        ii. *Prescriptive design standard*
        iii. *Numeric standard*
        iv. *Performance standard*
    c. *Other methods*

Question 3 represents the first in a series of "open" questions. That is to say that Question 3 is not a question that lends itself to a simple "yes" or "no" response. To encourage open responses the interviewer tended to present the question as follows:

> This is a bit more of an open question. How do you think LID should be incorporated into DEP policy? And I'm going to give you a few suggestions here, but you should not feel a need to limit your response:
>
> By reference to a document?
> Specific standards? Such as:
>
> Narrative standards;
> Prescriptive design standards;
> Numeric standards; or
> Performance standard (not that the other standards couldn't be performance standards); or
>
> You could suggest other methods

Table 3 (below) provides a summary of responses received. Responses to this question provide no clear consensus on an implementation approach. In fact, many respondents specifically stated that they were unsure, unqualified to answer, or needed to give the matter further consideration.

In reviewing responses as a whole, it is important to consider some apparent—but not generally real—contradictions in terms. For example, some respondents were interested in using combined approaches and specifically suggested the use of flexible, performance-based guidance as well as LID requirements in general permits.

Respondents typically suggested incentive-based approaches in place of regulatory approaches. One respondent stated "[LID] should be a suggestion, not required. Use [of LID] should be incentivized." Other respondents who suggested use of incentives were less specific about whether or not to regulate. Suggestion to use incentive-based approaches should be viewed as significant as it was not suggested in the interview sheet.

Table 23
Interviewee's Preference for Type of LID Standard

Type of LID Standard	Number of Responses[1]	Percentage of Responses
Guidance	7	26%
No Regulation	5	19%
Incentive-Based Approach	2	7%
Regulation	6	22%
Performance Standard	7	26%
Not sure or no response	3	11%

Note:
1 Total number of responses do not sum to 17 as several respondents suggested use of a combination of approaches.

3.2.3.4 Should LID be the BMP of Choice?

4. *Should LID be the BMPs of choice over end-of-pipe management practices such as detention ponds? If so, how?*

Table 4 provides an overview of responses. It is important to note that many affirmative responses came with qualification such as "yes, but allow flexibility based on site conditions," or "yes, but use demonstration projects to encourage [LID] use." Interestingly, no respondents answered "no" directly. Those respondents who did not answer "yes" or "no" suggested "flexibility" or implementation on a "case-by-case" basis. Generally, respondents appear to favor LID, but may have reservations about using LID as the BMP of choice without consideration of site conditions.

Table 24
Interviewee's Response to the Question
"Should LID be the BMP of Choice?"

Should LID be the BMP of Choice?	Number of Responses	Percentage of Responses
Yes no Qualification	4	15%
Yes with Qualification	14	52%
No Response	2	7%
Other Approach Suggested	4	15%
No	0	0%

3.2.3.5 What Standards Should we use to Demonstrate the use of LID in Projects?

5. *What sort of standards should we use as a way to demonstrate the incorporation of LID?*
    i. *Runoff volume*
    ii. *Graduated permit limits for differently sized storms and runoff volumes*
    iii. *Pollutant levels based on runoff volumes*
    iv. *Performance criteria*

When asking this question, the interviewer generally stated it conversationally, but essentially verbatim with an addition after "performance criteria" stating "or you can suggest an approach."

Table 5 provides an overview of responses to the question "how should we demonstrate LID?" As can be seen by reviewing the responses, no strong consensus emerges for a method to demonstrate the use of LID on projects, although "runoff volume" and "performance criteria" were the most frequently mentioned. Several respondents made a point of suggesting that regardless of the approach taken, it should be simple and allow for flexibility. Several respondents suggested targeting/graduating implementation to a specific industry (e.g., residential development) or through special requirements for geographic areas.

Table 25
Interviewee's Response to the Question
"How Should LID be Demonstrated?"

How Should LID be Demonstrated?	Number of Responses	Percentage of Responses
Runoff Volume	7	26%
Graduated Permit Limits	1	4%
Pollutant Levels Based on Runoff Volume	1	4%
Performance Criteria	5	19%
No Response or Not Sure	6	22%
Suggested "Flexibility" in Response	2	7%
Suggested "Simplicity" in Response	1	4%
Other Approach Suggested	4	15%

3.2.3.6 Should we use Stormwater Utility Districts as a Regulatory Device?

6. *In some states stormwater utility districts charge a fee for service to oversee BMP design review, installation, operation and maintenance. What do you think of the ideas of using stormwater utility districts as a regulatory device?*
    a. *Do you see stormwater utility districts playing a role in permitting?*

i. *Do you think they could reasonably be delegated regulatory functions?*
ii. *Do you think they could reasonably function as qualified local programs? That is programs that are allowed by DEP to implement the Phase II General Permit on behalf of MS4 operators.*
iii. *Do you think they could otherwise be used to facilitate compliance?*

b. *What advantages do you see available through stormwater utility districts?*

This question presented some challenges for use in the interview. Interviewees had varying levels of familiarity with the concept of stormwater utilities. This may have biased some responses and in at least two interviews led to responses of "unsure" or "no response." When respondents appeared unfamiliar with stormwater utilities, the interviewer explained their application. Another issue with this question, which may have led to less than clear responses, is the fact that most people, who are familiar with utilities, are familiar with them as revenue generating devices, not regulatory devices. A number of respondents answered the question with a statement such as "I've never considered using utility districts in that way."

Table 6 presents a summary of interviewee responses to the idea of using stormwater utility districts as regulatory devices. Virtually all interviewee responses were qualified in some way. This included all the "yes" responses, all but two "maybe" responses, and all but one "no" response. One respondent noted that there was specific interest for implementation of a utility district in that respondent's region, but that actual implementation was unlikely due to political issues.

Table 26
Interviewee's Response to the Question
"Should we use Stormwater Utility Districts as a Regulatory Device?"

Should we use Utility Districts as a Regulatory Device?	Number of Responses	Percentage of Responses
Yes	5	19%
Maybe, Not Sure, etc.	5	19%
No	7	26%
Politically Unlikely	6	22%
Unnecessary Government	8	30%

3.2.3.7 What would you like your Role to be in Implementing LID?

7. *What would you like your role to be in implementing LID as part of the SGP?*
   a. *Developing and reviewing technical standards*
   b. *Developing policy*
   c. *Engaging the involvement of a constituency*
   d. *Public education*
   e. *Training*
   f. *As a qualified local program*

g. *Implementation of a stormwater utility district*
h. *Other*
i. *Are you willing to participate as a partner in this project by attending partner meetings and reviewing work products?*
    i. *Are you the appropriate contact person for this project?*
    ii. *Provide contact information*

In order to facilitate responses, this question was asked by grouping role opportunities as follows:

- Technical standards and policy.
- Engaging involvement of a constituency.
- Education and training of other.
- Qualified local programs and utility districts.
- Participation as a partner.

Interviewees generally responded positively to the opportunity to participate and indicated that either they or another representative of their organization would participate as partner and/or other capacities.

Table 7 provides a summary of responses.

Table 27
Interviewee's Response to the Question
"What Role would you like to Play?"

What Role would you like to Play?	Number of Affirmative Responses	Percent of Affirmative Responses
Develop and/or Review Policy and Standards	20	74%
Engage a Constituency	20	74%
Education and Training of Others	22	81%
Qualified Local Program and Utility Districts	11	41%
Participation as a Partner	26	96%

4 Input from Workshops 1 and 2

On May 26 and July 1, 2010 workshops were conducted with the project partners. In part, the workshops included card storming sessions and a carousel activity. The following sections describe the input received from the workshops and how this information can be used to help identify implementation alternatives.

4.1 Workshop 1 and 2 Card Storming

On May 26 and July 1, 2010, workshops were conducted with the project partners, which in part included a card storming session. The session was initiated with the following aims:

Rational aim:	"*Identify criteria*" for selection of approaches to incorporate LID into state stormwater policy.
Experiential aim:	"*Identify similarities*" in the approaches recommended by different partners in the group.

Card storming was initiated with the following question to the partners: "What are the features of good LID policy?" The card storming question and aim were posted on blue cards for the group of participants to consider during the session.

The card storming process worked as follows:

- Participants spent five minutes individually identifying five 3 to 5 word answers to the card storming question (What are the features of good LID policy?). Each answer was written on a 5" x 8" half-sheet of paper (card).

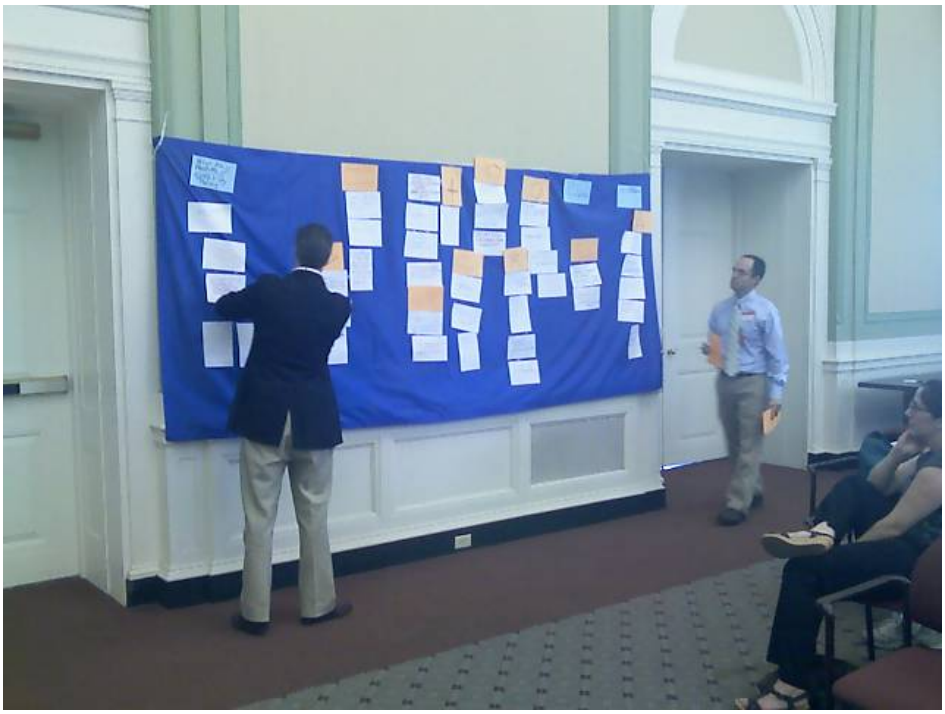
- Participants were asked to pair up with one other person to review their cards and select the clearest answer from the 10 reviewed. The card with that answer was then posted on an adhesive clothe (sticky wall) hung on the wall of the auditorium.

- The group was then asked to identify pairs of answers (e.g., if one pair of participants posted "flexibility" and another posted "flexible implementation" the group might identify these two postings as a pair). The **Photograph 1** (below) shows the sticky wall after the first round of postings and pairing exercise. During this exercise the group identified two pairs and two triplets. Triplets are not typical; however, in this particular case there were two natural groups of three.

Photograph 1—Sticky Wall after first round of postings and pairing. The card storming question and aims are posted on blue half-sheets of paper in the upper right and left corners of the Sticky Wall.

- Participant pairs were then asked to revisit their answers to the card storming question and identify two more ideas which had not been posted during the first round.

- Participants were then asked to review the posting to identify and group like answers to the card storming question. This part of the exercise is referred to as "clustering." Once clusters were developed a shape card (i.e., orange half-sheet of paper with a shape (e.g., star, square, circle, etc.) drawn on it) was assigned to each group (see **Photograph 2**, below). Participants also began a process of assigning names to each cluster.



Photograph 2—Groups or "clusters" of card storming answers being assigned shapes.

- Participants were asked to review their card storming answers one final time and to identify any answers, which were not yet represented on the Sticky Wall.

At this point, the exercise was suspended due to time constraints. On July 1, the card storming was reinitiated as part of Workshop 2. Final results of this process can be found in the meeting summary for Workshop 2, which is provided in *Appendix D*.

Results of the card storming suggest potential alternatives for implementation as well as the characteristics that alternatives should embody. This information can be used to inform both the development of alternatives and the process for selecting alternatives. For the purposes of this technical memorandum, we are primarily developing alternatives. A process for selecting alternatives for implementation will be developed as part of Technical Memorandum 3.

As a starting point in identifying alternatives, we have selected elements from the results of the card storming that we believe translate more readily to alternatives and shown them in blue text (see next page).

ATTACHMENT 1
RESULTS OF CARD STORMING FROM JULY 1, 2010 (WORKSHOP 2)

Card Storming Question:
What are the features of good LID policy?

Objective Card Storming Aim:
Identify criteria [for determining alternatives]

Experiential Card Storming Aim:
Identify similarities [in participants ideas of good LID policy]

Economic Market Viability

- Cost effective options, not regulations
- Enough incentive to achieve success
- Recognize market demands for different development types (LID may not be for all
- Funding for implementation
- Market/demand sensitivity
- Effectiveness can be verified and maintenance is not cost prohibitive

Education

- Education component
- Knowledgeable design engineers training, train
- Use good science and knowledgeable people to make decisions
- Public acceptance—meaning willingness to act a local/residential scale
- Greatest behavior change Promote policies (regulatory and/or voluntary) that result in greatest behavior change

Clear and Understandable

- Clarity
- Uniform statewide (standardized)
- Make any guidance and/or standards simple. Make process certain.
- LID policy at the local level to adopt, enforce, implement

Practicability-Flexibility

- Practical to implement and maintain
- Not burdensome to individuals, easy to comply with
- Maintenance required
- Flexible
  - Consider site constraints
  - Consider project type
- Flexible
- Room for innovation
- Performance based (about objective, not technique)
- Bottom-up site specific approach, not top down.

Legal Administrable

- Easy to administer
- Aligning municipal zoning subdivision regulations (with LID)
- Encouragement TPZ, cons[ervation] subdivision regulations
- Available support structure mechanism for contractors/homeowners implementing LID
- Compatible with other regulations and goals that are necessary i.e., ADA, mosquito control, public safety, public health
- Legal
- Oversight from local and state agencies
- Enforceability
- Treats stormwater runoff with the same strict criteria that are required of on-site septic systems
- Quantifiable-measurable for other permit requirements that might duplicate
- Should be expected and standard operating procedure not as the exception

Environmental Benefit

- Manages soil erosion
- Reduction of impervious materials
- Remediates already built areas
- Promotes GW recharge
- Water quality & water quantity (groundwater recharge) (in-stream flow techniques)
- Reduces runoff
- Minimize impervious cover
- Fix impairment
- Resource based design (e.g., soils)
- Allow soil microorganisms to work
- Shift focus from engineering to conservation

From this information, we conclude that alternatives for implementation should in part include consideration of the following elements:

- Incentives
- Market-based approaches
- Funding for implementation
- A process for verifying effectiveness
- An education component
- A training component
- A component focused on behavior change
- A uniform statewide standard
- Local-based policy
- Maintenance requirement
- A process for considering innovation
- A site specific approach
- Support structure for the regulated community
- A quantifiable-measurable approach to translate management across multiple permitting programs
- Soil erosion management
- Impervious cover reduction
- Remediation of built areas and impairments
- Groundwater recharge
- Water quality
- Runoff reduction

4.2 Workshop 2 Carousel Activity

On July 1, 2010 a workshop was conducted with the project partners, which in part included a carousel activity. The carousel activity focused on participant identification of strengths, weaknesses, benefits, and dangers; but also included an opportunity for participants to identify alternatives for implementation. Prior to the carousel activity a list of potential (i.e., example) implementation alternatives was provided and discussed briefly. The list is provided below:

1. **Regulation (e.g., write low impact development (LID) into general permits (GPs) or another regulation)**
   Example suggestions:
   - Require use of LID at 100% of sites
   - Require LID at some sites (these options are not necessarily exclusive of each other)
   - No regulatory/legal requirement for LID

2. **Nonregulatory**
   Example suggestions:
   - Guidance with LID standards

- Training/Education
- Incentives for using LID
- Demonstration projects

3. **Performance standards for LID by guidance or regulation**
   Example suggestions:
   - Set one or more required standards (e.g., runoff volume/flow rate, pollution removal, etc.)
   - Set interchangeable bench marks/performance standards (this requires determination of equivalency between standards)
   - Allow designers to select from a menu of options (WQV, infiltration set-aside, impervious surface disconnection/reduction)

4. **Set a pollution reduction standard in guidance or regulation**
   Example suggestions:
   - General standard (e.g., 80% TSS reduction)
   - Sensitive site standard(s)
   - Based on monitoring
   - Based on design and assumed pollution reduction rate

5. **Stormwater utility districts**
   Example suggestions:
   - Do nothing/don't clarify statutory issues
   - Make statutory revisions

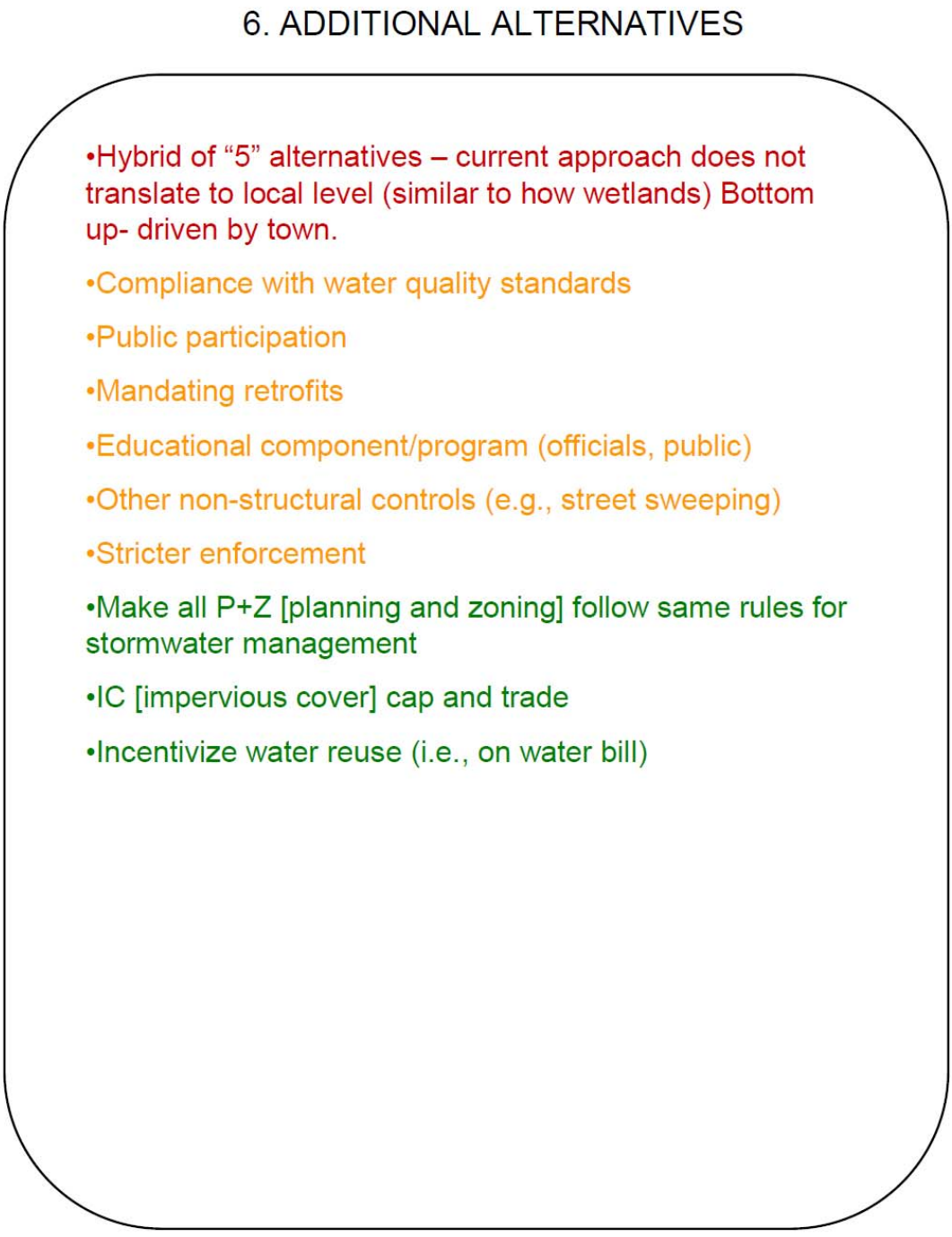
Six carousel stations, including a flip chart and set of colored markers, were set up in separate parts of the meeting room. Five of the stations were used to represent each of the five alternatives listed above. A sixth station was set up to create an opportunity for participants to add new alternatives. The carousel activity was conducted as follows:

- At their seats at the start of the carousel activity, participants were given 12 minutes to list five pros and five cons for each of the five alternatives. Participants were also asked to list three alternatives that had not yet been considered.
- Participants then split up randomly into six groups and each group was asked to pick a "reporter."
- The participant groups were allowed five minutes at each station to:
  - List five strengths, five weaknesses, five benefits, and five dangers of each of the five alternatives
  - List alternatives that had not yet been recommended at Station 6,

- At the end of the carousel, reporters were asked to present the full set of findings (2 minutes for each reporter) at the last alternative the reporter visited.

Photographs 3 - 6—Carousel workshop in process.

Final results of this process can be found in the meeting summary for Workshop 2, which is provided in Appendix D. The list of alternatives from Station 6 of the carousel activity is provided below:



This list adds several alternatives to the list provided in Section 4.1 of this technical memorandum. Specifically, the additional alternatives include:

- Education for public officials
- Nonstructural controls (e.g., street sweeping)
- Impervious cover cap and trade
- Incentives for water reuse

5 Applications in Connecticut

The following subsections discuss potential approaches that could be used to incorporate low impact development and pollution prevention into Connecticut's general permits for stormwater. These potential applications are based on the information gathered during:

- Research on state programs.
- Partner interviews.
- Activities conducted during workshops 1 and 2.

This is not intended to be an exhaustive list, but rather a starting point for further discussion.

5.1 Performance Goals and Criteria for LID/Pollution Prevention

The following descriptive list is intended to provide a starting point for consideration of establishing performance goals and criteria for management practices common to LID/pollution prevention and SGP implementation.

- Water Quality Volume (WQV) – Most states use WQV as a method to measure stormwater treatment effectiveness. States that have incorporated LID typically link treatment provided by LID to WQV either directly or indirectly (e.g., through a "credit" system). When asked how LID should be demonstrated, partners expressed a difference of opinion on the most appropriate methods; however, more partners expressed a preference for the use of WQV than any other method of performance demonstration. A common method used by other states to demonstrate incorporation of LID is to require that a fraction or percentage of the WQV is managed with LID. For example, the San Francisco Regional Water Quality Control Board (RWQCB) has developed a municipal regional stormwater Permit / Order that mandates water quality goals to be "accomplished primarily through the implementation of low impact development (LID) techniques." The permit specifies that LID must be used for 100% of the water quality volume treatment. Connecticut could establish a LID-incorporation standard, which could be set between 1 – 100%. Setting of the standard could be based on a variety of factors such as economics, site-specific environmental concerns, general ability of the regulated community to implement, etc.

- Impervious Cover Cap and Trade– Impervious cover cap and trade was suggested during the carousel activity of Workshop 2. Based on our research it has not been implemented in other Phase 2 Stormwater jurisdictions; however, it is an approach used to govern air emissions. To implement the approach, Connecticut could place a cap on

the amount of impervious cover allowed in a regulated area or industrial sector and apportion units of impervious surface to entities (i.e., land owners) within the area or sector. The state could set a unit value (e.g., $50,000 an impervious acre) or allow the market to self-set a unit value through trading. Trading could be allowed between entities with oversight provided by the state. Adding to the approach, the state could allow applicants to "purchase" additional units of impervious surface based on the market value. Proceeds could be deposited in a stormwater quality remediation bank.

- Set-Aside for LID – Wisconsin has established a set-aside requirement for infiltration. Under this approach 1 - 2% of any land included in a development project must be reserved for infiltration practices. A similar approach could be established in Connecticut for LID.

5.2 Incorporating Performance Goals and Criteria in General Permits

This section discusses how performance goals and criteria can be effectively incorporated into Connecticut's SGP to meet permit limits and conditions. As described in *Section 3.2.3.3* (above), during each of our interviews with partners, we asked:

How do you think they [LID practices] *should be incorporated into DEP policy?*

a. *By reference to a document*
b. *Specific standards*
    i. *Narrative standard*
    ii. *Prescriptive design standard*
    iii. *Numeric standard*
    iv. *Performance standard*
c. *Other methods*

Responses to this question provide no clear consensus on an implementation approach. In fact, many respondents specifically stated that they were unsure, unqualified to answer, or needed to give the matter further consideration; however, generally speaking, interviewees that provided a specific response seemed to be calling for flexibility by indicating preference for guidance (26% of respondents) and performance standards (26%). Responses were essentially split on whether or not to regulate, with no regulation being preferred by five respondents and regulation being preferred by six respondents.

We would expect this sentiment to be common in other states as most states that include LID in regulation have established hybrid approaches that involve flexible regulation, guidance and performance standards. Findings from state reviews indicate other regulatory agencies use one or a combination of these methods.

- A LID manual established as guidance only. In Connecticut, a LID stormwater document could lay out a LID process as well as discuss best management practices and performance criteria for implementation. State GPs could reference the LID manual as a guidance document.

- As an alternative to the method discussed above, Connecticut could develop a LID manual but opt to not reference it in the State GPs.
- Incorporate LID directly into State GPs or into regulation or policy. Performance goals and criteria could be established in the State GPs or regulation. Flexibility could be incorporated into this method by either requiring or encouraging LID. Several states have taken similar approaches in combination with a design manual.

As part of developing new standards, partners have stated that the standard should be a uniform, statewide policy that is adopted at both the state and local levels and that standards implemented should translate across multiple permitting programs. Additional features of such policy should include:

- Water quality standards.
- Soil erosion standards.
- Groundwater recharge standards.
- Runoff reduction standards.
- Impervious area reduction standards.
- Maintenance requirements.
- Process for verifying effectiveness.
- Process for considering innovation.

5.3 Giving LID Priority Attention

In the interviews we conducted with partners, most interviewees (18 of 27) expressed a desire to include LID as BMPs of choice versus end-of-pipe BMPs. A number of respondents pointed out that such a requirement should include flexibility to address situational issues.

As discussed in *Section 2.4* (above), standards used by other states to develop primacy of LID over end-of-pipe controls include

- Requiring that a percentage of runoff volume is managed using LID.
- Requiring set-aside of an area of a site for LID (e.g., Using a related approach, Wisconsin requires set-aside of 5% of each development site for infiltration).

Existing impervious surface area reduction requirements could be used at redevelopment sites to reduce the need for end-of-pipe BMPs. This approach is currently being used in Rhode Island. The standards could be written to address other situational issues such as soil type and specific water quality concerns.

5.4 Additional Suggestions for Elements of a LID Program

- Permitting Process that Includes Flexibility – A number of partners have stated the need for flexibility in stormwater and LID policy. Connecticut could use the general permit to provide significant flexibility for projects that meet certain criteria and achieve

certain performance standards. For example, applicants could be allowed to use a general permit for all projects that incorporate a certain fraction of LID as part of their water quality treatment provided that the designer is properly trained. Permitting for such projects could be limited to a notice of intent. Other projects, because they have potential to present a great risk to the environment, could be required to obtain individual permits.

- Training, Education and Behavior Change– Training, education, and behavior change were raised as important aspects of implementation during both the partner interviews and through workshop activities. These elements of implementation could be included in both regulatory and nonregulatory aspects of LID incorporation. For example, Connecticut could establish a LID designer licensing or certification process for design professionals and developers. This certification would have to be renewed periodically. Training could be offered through an institute of higher learning such as the University of Connecticut. Essentially, a continuing education process such as this would allow stormwater program managers to ensure the appropriateness of information provided to developers using LID in Connecticut. Such a program could be incentivized by allowing certified/licensed designers to submit designs under a GP that provides extra flexibility and limits regulatory oversight. Behavior change (i.e., the appropriate use of LID in designs) could be measured before and after the implementation of the training program.

- Approach to Enable Stormwater Utilities – DEP has included consideration of stormwater utilities as part of this project to evaluate the incorporation of LID in general permits. Stormwater utilities were addressed in partner interviews. Specifically stormwater utilities could provide a revenue stream at the local level and could allow for stormwater management on a regional (e.g., watershed) basis. A full discussion on the potential use of stormwater utilities in Connecticut is being developed for this project as part of a technical memorandum.

- Financial Incentives--Grant Programs for LID – During the partner interviews and workshops 1 and 2, several participants specifically identified incentives, funding and other support for the regulated community as important elements of implementation of LID policy. Previously, Connecticut has offered some grants for LID projects (e.g., Farmington River Enhancement Grant Municipal Land Use Evaluation Project for Village Center and Low Impact Development Guidelines and Regulations). Connecticut could structure LID grants to create a pilot program for statewide LID implementation. Additional incentives for LID implementation at the local level could include technical assistance, delegation of authority, and reduced regulatory oversight.

- Remediation of Built Areas and Impairments—During the workshop activities and partner interviews, several partners suggested that LID policy should include remediation of water quality issues in built areas as well as restoration of impaired waters. Phase II stormwater policy includes a mandate to address stormwater load reductions required pursuant to total maximum daily load (impaired water) studies. To further this, DEP could include consideration of LID as part of new TMDLs. Some state stormwater manuals also include requirements to reduce impervious surface as part

of the redevelopment of currently developed properties. When developing such policies, consideration should be given to their effect on the development community and urban renewal.

Appendix A

State Interview Questionnaire

FUSS & O'NEILL

Questionnaire
Stormwater Program Managers from Other States
March 2010

The purpose is to inform CTDEP's LID and SGP approach. These questions are expected to be asked in conversation; therefore, the results should not be considered "experimentally valid." To the extent that it is available, we will review each state's stormwater policy in advance of interviewing.

Introduction
The State of Connecticut is conducting a project that will begin the process of including low-impact develop, or LID, into the following policy and guidance documents:

- General permits (MS4, construction, industrial, commercial)
- Stormwater quality manual
- Soil erosion control guidelines

We're calling other states to explore approaches they may have used to incorporate LID into their stormwater policy and, in particular, their general permits.

1. Have you incorporated LID into the following policy and guidance documents? (LID practices may include minimizing site disturbance, working with site hydrology, minimizing and disconnecting impervious surface, and applying small-scale BMPs.)

    a. General permits (MS4, construction, industrial, commercial)
    b. Stormwater design guidance materials
    c. Soil erosion design guidance materials

2. How was this done?

    a. By reference to a document
    b. Specific standards
        i. Narrative standard
        ii. Prescriptive design standard
        iii. Numeric standard
        iv. Performance standard

    c. Other methods

    d. Giving LID primacy over end-of-pipe

    e. Do you use any of the following standards as a way to demonstrate the incorporation of LID?

        i. Runoff volume
        ii. Graduated permit limits for differently sized storms and runoff volumes
        iii. Pollutant levels based on runoff volumes
        iv. Performance criteria

3. Do you allow stormwater utility districts?

    a. Do stormwater utility districts play a role in permitting?
        i. Are they delegated regulatory functions?
        ii. Do they function as qualified local programs?
        iii. Are they otherwise used to facilitate compliance?

    b. What advantages do you see available through stormwater utility districts?

4. Lessons learned? Have you had experience implementing these measures and how would you do it differently to improve compliance and success with LID provisions?

Appendix B

Letter to Partners

STATE OF CONNECTICUT
DEPARTMENT OF ENVIRONMENTAL PROTECTION

May 12, 2010

[redacted]

The Connecticut Department of Environmental Protection (DEP) has initiated a project to explore opportunities to add low impact development (LID) concepts and planning into four stormwater general permits (SGPs)—construction, municipal separate storm sewer systems (MS4s), industrial, and commercial. The project will also make recommendations for modifications of the *Soil Erosion and Sediment Control Guidelines* and the *Stormwater Quality Manual* to better incorporate LID principles. DEP intends for this to be a partner-driven process. A stakeholder group is being formed that will participate in the review of current DEP policies and standards and offer strategies to incorporate LID into DEP's programs.

We will hold a workshop at our 79 Elm Street Offices in the Phoenix Auditorium on May 26, 2010 from 9:15 to 11:45 a.m. to begin the process. You are invited and an agenda for the meeting is attached. This meeting will be the first in a series of five meetings to be held over the course of the next eight months. Fuss & O'Neill, contractor for the project, will be contacting you in advance of the May 26 partner workshop to begin the discussion of LID and the SGP amendment process. Your ideas will also be used to guide activities at the workshop.

Using American Reinvestment and Recovery Act funding, DEP entered into a contract with Fuss & O'Neill Consultants, who assisted us with the most recent update to the *Stormwater Quality Manual*. They will conduct a study of general permits around the country, LID policy, and the potential for stormwater utility districts. This information will be provided to you to form the basis for your decision making on this project. The Fuss & O'Neill team will include Larry Coffman, who originated the LID method in Prince George's County, MD and authored *Low-Impact Development Design Strategies* (2000), which was the very first LID manual.

A web page has been created on DEP's web site at:
http://www.ct.gov/dep/cwp/view.asp?a=2719&q=459488&depNav_GID=1654

The website represents a node of communication for this project and will efficiently put project materials at your fingertips while avoiding unnecessary printouts, mailings, etc. It will include project materials such as workshop agendas, workshop summaries, and technical reports.

Why are we making this partner driven? We recognize that whatever policy is established will ultimately be implemented at the ground level by Connecticut's regulated sector and community organizations. Thus, the approach we take to regulation must be practicable for everyone. DEP hopes everyone will be fully engaged in implementation.

We very much look forward to working with you on this important project and look forward to seeing you May 26.

Sincerely,

Paul E. Stacey
Director
Bureau of Water Protection and Land Reuse
Planning and Standards Division

Appendix C

Partner Interview Questionnaire

FUSS & O'NEILL

Questionnaire
Project Partners
March 2010

The purpose of using this questionnaire is to gather data to inform CTDEP's LID and SGP approach. These questions are expected to be asked in conversation; therefore, the results should not be considered "experimentally valid."

Introduction
DEP is conducting a project that will begin the process of including low-impact development, or LID, into the following policy and guidance documents:

- General permits (MS4, construction, industrial, commercial)
- Stormwater Quality Manual
- Soil Erosion Control Guidelines

The project will be partner driven. That is to say, members of the regulated community, non-governmental organizations, as well as representatives of regulatory agencies (the partners) are being asked to provide direction to the DEP to initiate the development of LID guidance and regulatory policy through workshops and review of work products. Partners will also be given the opportunity to help implement policy by developing and participating in an implementation work plan. In other words, DEP is asking you to define your own role in the process.

Questions
Fuss & O'Neill, as the consultant assisting the DEP, is contacting you for two reasons—to request your participation in the partnership and to discuss your initial ideas about how to build LID into DEP policy. This is intended to be a starting point so that we can plan a first partner workshop.

1. Are you familiar with LID practices? (If not, interviewer should provide some description. Also this is an opportunity to discuss aspects of LID that the interviewee may not be considering)

2. Have you been involved in their application on a project or in policy?

3. How do you think they should be incorporated into DEP policy?
    a. By reference to a document
    b. Specific standards
        i. Narrative standard
        ii. Prescriptive design standard
        iii. Numeric standard
        iv. Performance standard
    c. Other methods

4. Should LID be the BMPs of choice over end-of-pipe management practices such as detention ponds? If so, how?

5. What sort of standards should we use as a way to demonstrate the incorporation of LID?
    i. Runoff volume
    ii. Graduated permit limits for differently sized storms and runoff volumes
    iii. Pollutant levels based on runoff volumes
    iv. Performance criteria

6. In some states stormwater utility districts charge a fee for service to oversee BMP design review, installation, operation and maintenance. What do you think of the ideas of using stormwater utility districts as a regulatory device?

    a. Do you see stormwater utility districts playing a role in permitting?

        i. Do you think they could reasonably be delegated regulatory functions?
        ii. Do you think they could reasonably function as qualified local programs? That is programs that are allowed by DEP to implement the Phase II General Permit on behalf of MS4 operators.
        iii. Do you think they could otherwise be used to facilitate compliance?

    b. What advantages do you see available through stormwater utility districts?

7. What would you like your role to be in implementing LID as part of the SGP?

    a. Developing and review technical standards
    b. Developing policy
    c. Engaging the involvement of a constituency
    d. Public education
    e. Training
    f. As a qualified local program
    g. Implementation of a stormwater utility district
    h. Other
    i. Are you willing to participate as a partner in this project by attending partner meetings and reviewing work products?

        i. Are you the appropriate contact person for this project?
        ii. Provide contact information

Appendix D

Summaries of Workshop 1 with Attachment 6 only and Workshop 2 with all Attachments

FUSS & O'NEILL

MEETING SUMMARY NOTES
EVALUATION OF STORMWATER GENERAL PERMIT AND LID
WORKSHOP 1—MAY 26, 2010; PHOENIX AUDITORIUM

DISTRIBUTION: Attendees and Other Project Partners
DATE: June 9, 2010

The following discussion summarizes the May 26, 2010 Workshop for the Evaluation of Stormwater General Permit and Low-Impact Development held at the Department of Environmental Protection Offices (79 Elm Street, Hartford, CT) in the Phoenix Auditorium.

A list of **workshop attendees** is provided at the end of this summary.

INTRODUCTIONS

Opening Remarks
MaryAnn Nusom Haverstock and Paul Stacey opened the meeting. Paul discussed the nature of the need for improved stormwater management and low-impact development (LID). He then turned the agenda over to Fuss & O'Neill.

Introductions around the Table
Jim Riordan of Fuss & O'Neill gave a PowerPoint Presentation, entitled "Introductions, Meetings, and the Web Page." A PDF copy is provided as **Attachment 1**.

Jim led the group in introductions. Each attendee gave their name, affiliation and a few words describing what they hoped for as a result of the project. At the conclusion, Jim asked that participants keep in mind the hoped-for result they had just described. A list of partners invited to participate in the project, which includes attendees and others invited, has been included as an attachment to this summary.

Future Meeting Dates and Locations
Jim recommended week timeframes for the next four meetings and meeting dates were selected as follows:

Project Meeting Dates

Workshop Title	**Date to be Held**
Partner Workshop 2	Thursday, July 1, 2010
Partner Workshop 3	Tuesday, August 31, 2010
Partner Workshop 4	Wednesday, October 20, 2010
Partner Workshop 5	Wednesday, December 15, 2010

Note:
All meetings will be held from 9:15 a.m. – 11:45 a.m. in the Phoenix Auditorium at the Hartford, CT DEP Offices.

Web Page
Jim introduced the project web page on DEP's website:

http://www.ct.gov/dep/cwp/view.asp?a=2719&q=459488&depNav_GID=1654

The web page will be used to provide project partners and other interested parties with general project information, schedules, and deliverables.

During the presentation, the following questions were raised:

- A question was asked about which general permits are being considered for revision under this project. Jim explained that four general permits are being reviewed—municipal separate storm sewer system (MS4), construction, industrial, and commercial. The MS4 permit and construction permit are the highest priority for examination.

- A follow-up question was asked regarding how these were chosen as priorities (i.e., was there a scientific reason behind this decision). Jim explained that the MS4 and construction general permits lend themselves to the use of LID because of the nature of the activities that they regulate including new development, operation and maintenance of management practices, and potential retrofit opportunities.

PROJECT OVERVIEW

Jim gave a PowerPoint presentation entitled "Project Overview," a copy of which is attached as a PDF (**Attachment 2**).

OVERVIEW OF LOW IMPACT DEVELOPMENT (LID) AND STORMWATER GENERAL PERMITS (SGP)

What's LID?
Jim gave a PowerPoint presentation entitled "Overview of LID," a copy of which is attached as a PDF (**Attachment 3**).

Summary of Other States
Phil Moreschi gave a PowerPoint presentation entitled "Summary of US State General Permitting Programs," a copy of which is attached as a PDF (**Attachment 4**).

Several issues and questions arose during this presentation:

- The states of Virginia and Maryland should be included in the summary. Larry Coffman (subcontractor to Fuss & O'Neill on the project) may be able to assist in this regard as he is from Maryland.

- Questions about the specific incentives and the reasoning behind them were raised. Phil and Jim pointed out that two types of incentive are commonly used. One type having to do with water quality treatment "credit" for the use of LID on a specific project. The other type of incentive involves grants to municipalities and project proponents that wish to implement LID. Some regulatory agencies also fast-track permitting of projects that implement LID.

- Does Connecticut have statutory authority to require the implementation of LID within the general permits through the Federal Clean Water Act? It was pointed out by one participant that the Connecticut Attorney General's Office had researched a very similar issue previously and determined that authority exists at the state level under title 22A, chapter 40-30; therefore, the question of federal authority appears not critical for Connecticut.

Summary of Interviews with Partners
Jim gave a PowerPoint presentation entitled "Summary of Partner Interviews," a copy of which is attached as a PDF (**Attachment 5**).

IDENTIFYING ALTERNATIVES AND CRITERIA AND PARTNER INVOLVEMENT IN IMPLEMENTATION

Jim facilitated a card storming and consensus-building session. The session was initiated with the following aims:

Rational aim:	"*Identify criteria*" for selection of approaches to incorporate LID into state stormwater policy.
Experiential aim:	"*Identify similarities*" in the approaches recommended by different partners in the group.

Card storming was initiated with the following question to the partners: "What are the features of good LID policy?" The card storming question and aim were posted on blue cards for the group of participants to consider during the session.

The card storming process worked as follows:

- Participants spent five minutes individually identifying five 3 to 5 word answers to the card storming question (What are the features of good LID policy?). Each answer was written on a 5" x 8" half-sheet of paper (card).

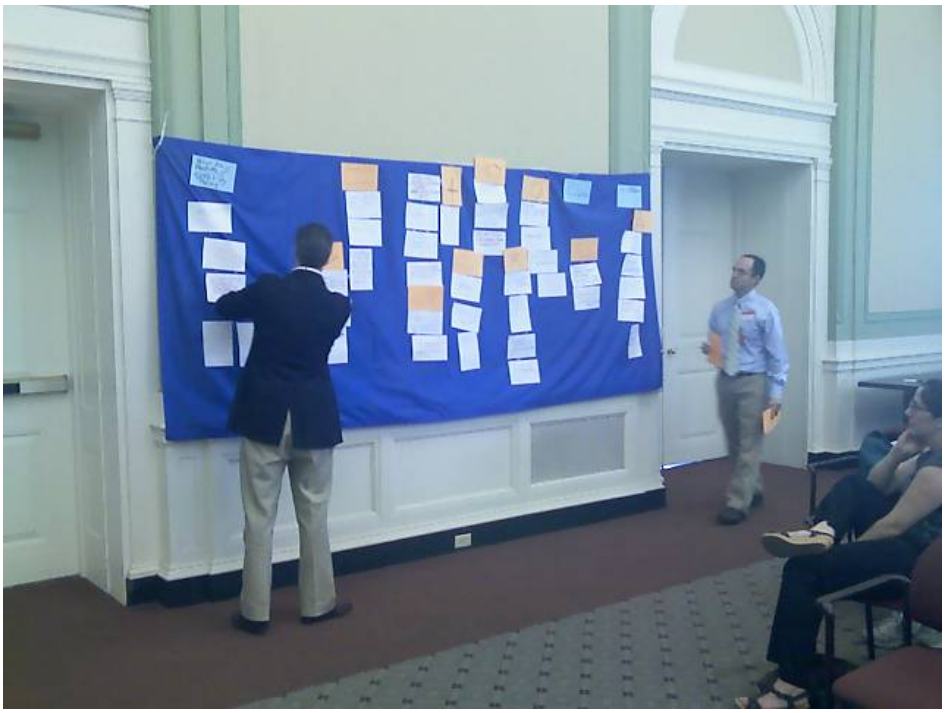
- Participants were asked to pair up with one other person to review their cards and select the clearest answer from the 10 reviewed. The card with that answer was then posted on an adhesive clothe (sticky wall) hung on the wall of the auditorium.

- The group was then asked to identify pairs of answers (e.g., if one pair of participants posted "flexibility" and another posted "flexible implementation" the group might identify these two postings as a pair). The **Photograph 1** (below) shows the sticky wall after the first round of postings and pairing exercise. During this exercise the group identified two pairs and two triplets. Triplets are not typical; however, in this particular case there were two natural groups of three.

Photograph 1—Sticky Wall after first round of postings and pairing. The card storming question and aims are posted on blue half-sheets of paper in the upper right and left corners of the Sticky Wall.

- Participant pairs were then asked to revisit their answers to the card storming question and identify two more ideas which had not been posted during the first round.

- Participants were then asked to review the posting to identify and group like answers to the card storming question. This part of the exercise is referred to as "clustering." Once clusters were developed a shape card (i.e., orange half-sheet of paper with a shape (e.g., star, square, circle, etc.) drawn on it) was assigned to each group (see **Photograph 2**, below). Participants also began a process of assigning names to each cluster.



Photograph 2—Groups or "clusters" of card storming answers being assigned shapes.

- Participants were asked to review their card storming answers one final time and to identify any answers, which were not yet represented on the Sticky Wall.

At this point, the exercise was suspended due to time constraints. **Attachment 6** provides a summary of the sticky wall layout of the card storming exercise to this point. At the next workshop, participants will be asked to review the results of the card storming and clustering. Next steps will involve completion of assigning one- to two-word names in place of the shape cards and continued identification of similarities amongst the answers to the card storming question (what are the features of good LID policy?). Participants will also be asked to discuss their observations about the results of the exercise. We intend to use these results and observations to help to develop consensus during the next workshop about our continued approach to the project.

NEXT STEPS

The next workshop will be held on **July 1 in the Phoenix Auditorium from 9:15 to 11:45 a.m.** This meeting will involve continued development of consensus on "what are good features of LID policy?" as well as alternatives for implementation. The meeting will also be used to explore the potential role of stormwater utility districts in implementation of LID policy and the stormwater general permits. In preparation for the meeting Fuss & O'Neill will continue to conduct partner interviews and will develop a summary of the potential role of stormwater utility districts based on literature and research.

ATTENDEES

Attendees of the May 26 workshop are listed below in alphabetical order by affiliation.

Attendee	Affiliation
John Stelmokas	Advanced Drainage Systems
Rob Lemire	Advanced Drainage Systems
Brian Roach	Aquarion Water Co.
Eric Brown	CBIA
John Pagini	CCAPA
Melon Wedick	CCRPA
Virginia Mason	Council of Governments Central Naugatuck Valley
Faith Gavin Kuhn	Connecticut Associated Builders & Contractors
Jim Langlois	Connecticut Concrete
Matthew Hallssey	Connecticut Construction Industries
Jessica Morgan	Connecticut Department of Environmental Protection
Paul Stacey	Connecticut Department of Environmental Protection
Mary-Beth Hart	Connecticut Department of Environmental Protection OLISP
Chris Malik	Connecticut Department of Environmental Protection/NPS Program
MaryAnn Nusom Haverstock	Connecticut Department of Environmental Protection/NPS Program
Rob Hust	Connecticut Department of Environmental Protection-Water & Permitting
Chris Stone	Connecticut Department of Environmental Protection-Water Permitting
Nisha Patel	Connecticut Department of Environmental Protection-Water Permitting
Kimberly Lesay	Connecticut Department of Transportation
Roger Reynolds	Connecticut Fund for the Environment
Judy Rondeau	ECCD
Beth Edwards	EPA Region 1
Johanna Hunter	EPA Region 1

Steve Winnett	EPA Region 1
Anne Leiby	EPA Region 1 Boston
William Hurley	Fairfield Engineering
Erik Mas	Fuss & O'Neill
Jim Riordan	Fuss & O'Neill
Phil Moreschi	Fuss & O'Neill
Bill Ethier	Home Builders Association of Connecticut
Craig Scott	MDC
Becky Meyer	Milone & MacBroom Inc.
Greg Sharp	Murtha Cullina, LLP
Sean Hayden	Northwest Conservation District
Paul Balavender	O & G Industries, Inc.
John Hudak	Regional Water Authority
Kenneth Wieland	Rivers Alliance
Martha Mador	Rivers Alliance, Sierra
Leah Schmalz	Save The Sound/CPE
Nicole Davis	South Western Regional Planning Agency
Shelley Green	The Nature Conservancy
Denise Savageau	Town of Greenwich

AGENDA

Stormwater General Permits and Incorporation of Low Impact Development Evaluation

May 26, 2010; 9:15 – 11:45 am

CTDEP—79 Elm Street, Hartford; Phoenix Auditorium

1. Introductions
    a. Opening Remarks
    b. Introductions Around the Table
    c. Future Meeting Dates and Locations
    d. Web Page: (http://www.ct.gov/dep/cwp/view.asp?a=2719&q=459488&depNav_GID=1654)

2. Project Overview
    a. Project Objectives
    b. Points of Contact
    c. Deliverables and Schedule
    d. Partners

3. Overview of Low Impact Development (LID) and Stormwater General Permits (SGP)
    a. What's LID?
    b. Summary of Other States
    c. Summary of Interviews with Partners

4. Identifying Alternatives and Criteria

5. Partner Involvement in Implementation

6. Next Steps

Card Storming Question:
What are the features of good LID policy?

Objective Card Storming Aim:
Identify criteria [for determining alternatives]

Experiential Card Storming Aim:
Identify similarities [in participants ideas of good LID policy]

Economic Viability

- Enough incentive to achieve success
- Market/demand sensitivity
- Cost effective options, not regulations
- Recognize market demands for different development types (LID may not be for all
- Funding for implementation
- Effectiveness can be verified and maintenance is not cost prohibitive

+

- Clarity
- Uniform statewide (standardized)
- Make any guidance and/or standards simple. Make process certain.
- Should be expected and standard operating procedure not as the exception
- LID policy at the local level to adopt, enforce, implement

Legal Administrable

- Easy to administer
- Aligning municipal zoning subdivision regulations (with LID)
- Encouragement TPZ, cons[ervation] subdivision regulations
- Available support structure mechanism for contractors/homeowners implementing LID
- Compatible with other regulations and goals that are necessary i.e., ADA, mosquito control, public safety, public health
- Legal

Flexibility

- Flexible
  - Consider site constraints
  - Consider project type
- Flexible
- Room for innovation
- Performance based (about objective, not technique)
- Bottom-up site specific approach, <u>not</u> top down.

Conservation

- Resource based design (e.g., soils)
- Allow soil microorganisms to work
- Shift focus from engineering to conservation

- Practical to implement and maintain
- Not burdensome to individuals, easy to comply with
- Maintenance required

Education

- Education component
- Knowledgeable design engineers training, <u>train</u>
- Use good science and knowledgeable people to make decisions
- Public acceptance—meaning willingness to act a local/residential scale
- <u>Greatest behavior change</u> Promote policies (regulatory and/or voluntary) that result in greatest behavior change

Environmental Benefit

- Manages soil erosion
- Reduction of impervious materials
- Remediates already built areas
- Promotes GW recharge
- Water quality & water quantity (groundwater recharge) (in-stream flow techniques)
- Reduces runoff
- Minimize impervious cover
- Fix impairment

Regulatory

- Oversight from local and state agencies
- Enforceability
- Treats stormwater runoff with the same strict criteria that are required of on-site septic systems

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MEETING SUMMARY NOTES
EVALUATION OF STORMWATER GENERAL PERMIT AND LID
(Contract # PS2010-10172)
WORKSHOP 2—JULY 1, 2010; PHOENIX AUDITORIUM

DISTRIBUTION: Attendees and Other Project Partners
DATE: July 12, 2010

The following discussion summarizes the July 1, 2010 Workshop for the Evaluation of Stormwater General Permit and Low-Impact Development held at the Department of Environmental Protection Offices (79 Elm Street, Hartford, CT) in the Phoenix Auditorium.

A list of workshop attendees is provided at the end of this summary.

INTRODUCTIONS

Opening Remarks
MaryAnn Nusom Haverstock opened the meeting. During her opening, she pointed out that the issue of legal authority to require low impact development (LID) as part of the stormwater general permits had been vetted between the Environmental Protection Agency—New England (EPA) and Connecticut Department of Environmental Protection (DEP) and such authority is clearly present in existing state law. MaryAnn asked attendees to introduce themselves around the table. She then turned the agenda over to Fuss & O'Neill.

Introductions around the Table
Jim Riordan of Fuss & O'Neill gave a PowerPoint Presentation, entitled "Introductions, Meetings, and the Web Page." The presentation is available on:

http://www.ct.gov/dep/cwp/view.asp?a=2719&q=459488&depNav_GID=1654

Future Meeting Dates and Locations
Jim reconfirmed the next three meetings and meeting dates, which were set during Workshop 1 (May 26). The dates are as follows:

Project Meeting Dates

Workshop Title	Date to be Held
Partner Workshop 3	Tuesday, August 31, 2010
Partner Workshop 4	Wednesday, October 20, 2010
Partner Workshop 5	Wednesday, December 15, 2010

Note:
All meetings will be held from 9:15 a.m. – 11:45 a.m. in the Phoenix Auditorium at the Hartford, CT DEP Offices.

Web Page
Jim reintroduced the project web page on DEP's website:

http://www.ct.gov/dep/cwp/view.asp?a=2719&q=459488&depNav_GID=1654

The web page will be used to provide project partners and other interested parties with general project information, schedules, and deliverables.

IDENTIFYING ALTERNATIVES AND CRITERIA AND PARTNER INVOLVEMENT IN IMPLEMENTATION (continued)

At the May 26 workshop, a card storming and consensus-building session was facilitated. The session was partially completed. Therefore, the July 1 workshop involved a continuation of the session. Jim led meeting attendees in this continuation (see Photograph 1). Results included recombination of several of the card storming clusters formed during the May 26 workshop and naming of the resulting clusters.

Photograph 1—Results during the July 1 workshop included rearrangement of clustered cards as well as naming of the clusters.

Some of the specific changes included:

- Combining "Practical" and "Flexibility" into "Practicability-Flexibility."
- Moving "Conservation" into "Environmental Benefit."
- Placing "Legal Administrable" into the parking lot.[1]
- Moving "Regulation" into "Administrable."
- Changing "Economic Viability" to "Economic Market Viability."
- Naming the cards under the "+" symbol "Clear and Understandable."

A discussion point was raised about whether the flow management capacity of LID BMPs would be quantifiable and, therefore, could be used to achieve peak flow attenuation requirements. A card was added under the topic of "administrable":

- Quantifiable-measurable for other permit requirements that might duplicate.

During this session, a point was raised that some of cards and clusters were more closely related to implementation than the actual workshop question of "what are features of good LID policy?" Jim offered to the group that one solution would be to change the workshop

[1] The "parking lot" refers to holding further discussion for now in order to continue forward on other issues in the workshop. Some discussion occurred over the issue of whether or not DEP has legal authority to require LID. DEP has established this authority and intends to document it. DEP intends to document their legal authority. The topic of "administrable" was retained in place of "Legal Administrable."

question to include implementation. Ultimately, the group decided to leave the workshop question, cards, and clusters without change.

Results of the card storming exercise are shown in Photograph 2 and type written in Attachment 2. Six named clustered resulted:

- Economic Market Viability
- Clear and Understandable
- Practicable Flexibility
- Administrable
- Education
- Environmental Benefit

Photograph 2—Complete results of card storming conducted during May 26 and July 1 workshops.

STORMWATER UTILITY DISTRICTS

Jim gave a PowerPoint presentation regarding the potential role of stormwater utility districts in the implementation of LID. The presentation is available on:

http://www.ct.gov/dep/cwp/view.asp?a=2719&q=459488&depNav_GID=1654

CAROUSEL WORKSHOP

Jim introduced the carousel workshop with a PowerPoint presentation, which included a brief discussion of five implementation alternatives. The presentation is available on:

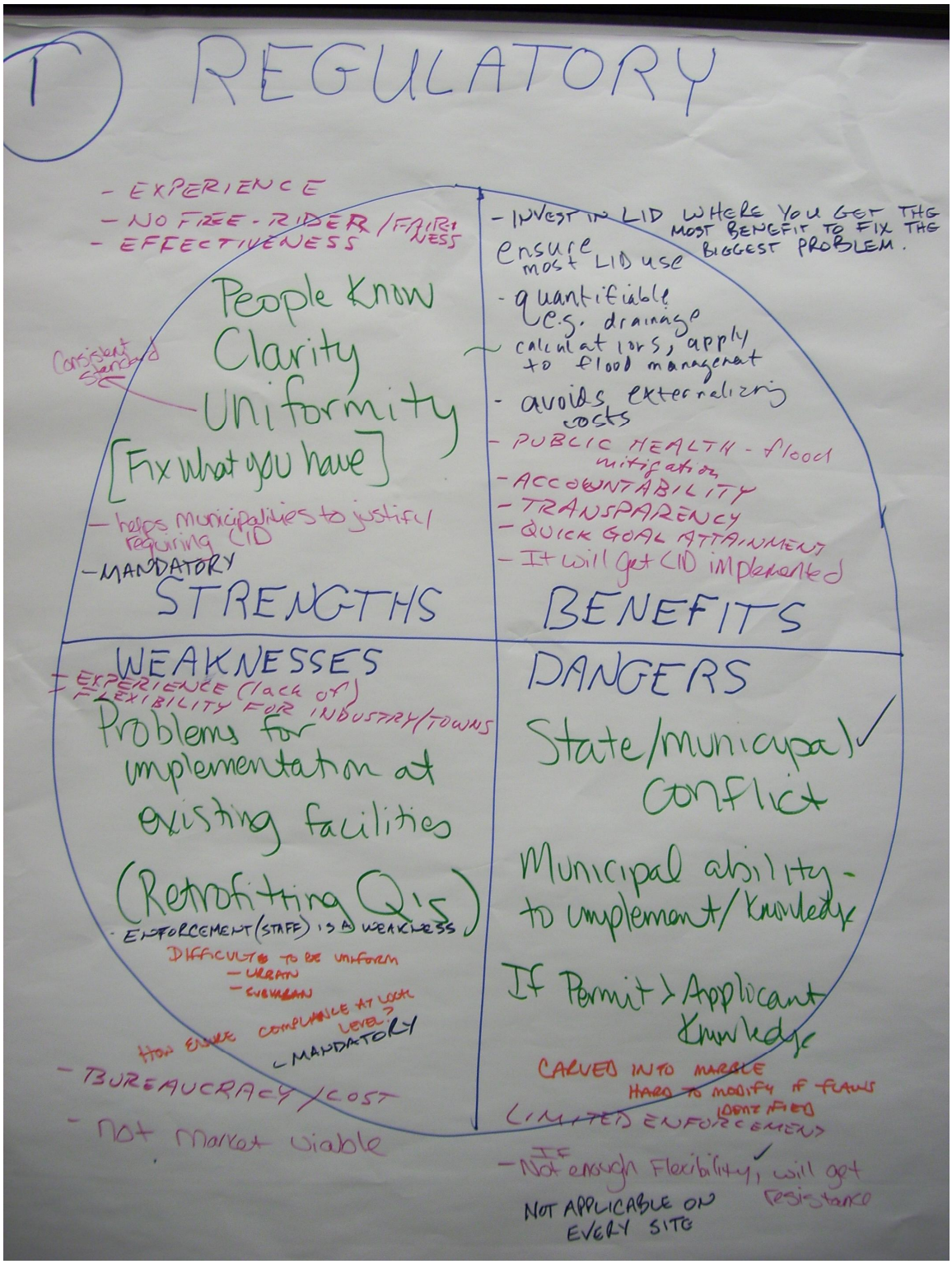
http://www.ct.gov/dep/cwp/view.asp?a=2719&q=459488&depNav_GID=1654

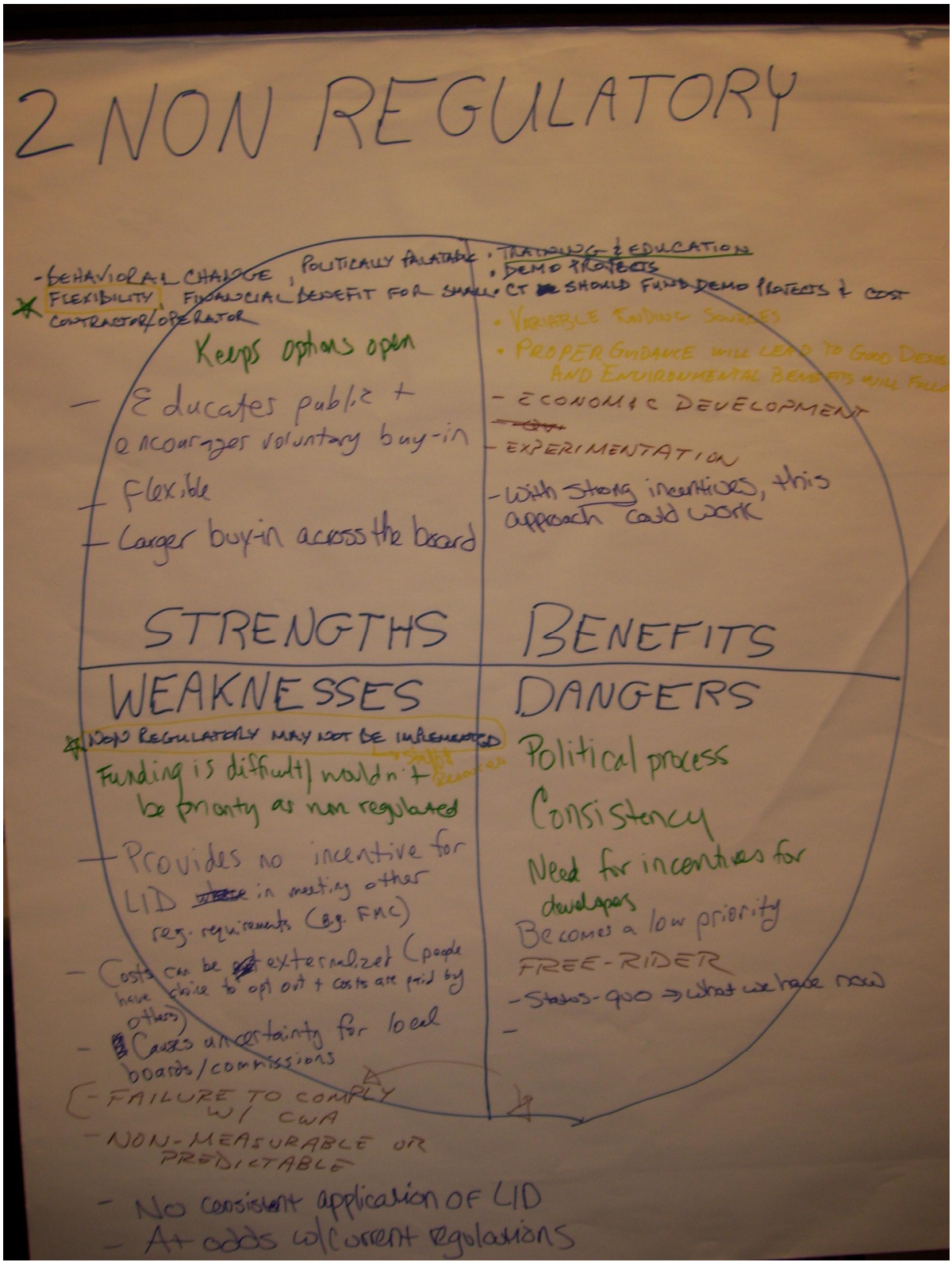
This included the following:

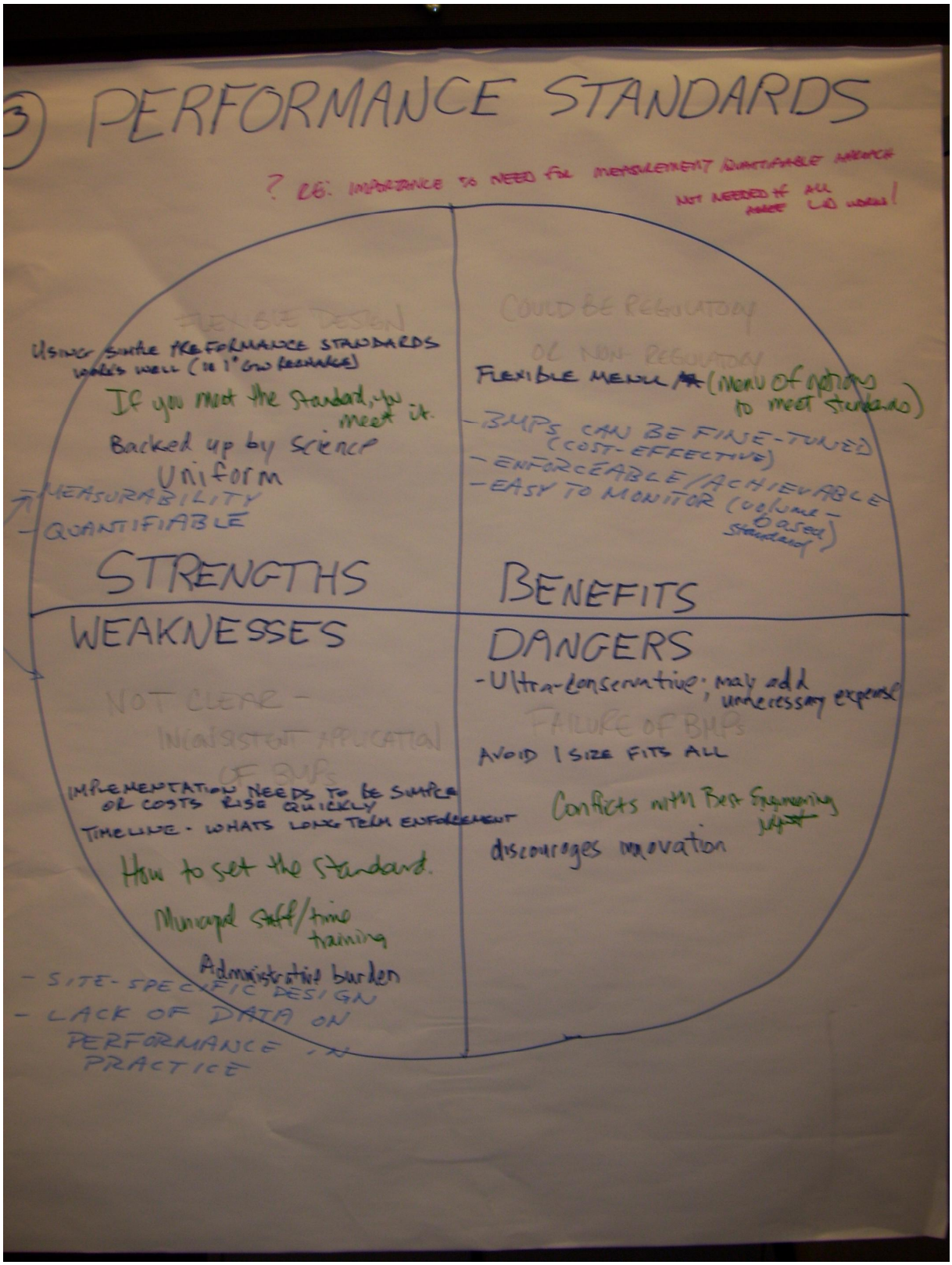
- 12 minutes each participant lists 5 pros & 5 cons for each of the 5 alternatives and 3 alternatives that haven't been considered.
- Split up into 6 groups and pick a "reporter."
- 5 minutes at each station:
  - List 5 strengths, 5 weaknesses, 5 benefits, and 5 dangers of each of the 5 alternatives
  - At Station 6, list alternatives that haven't been recommended
- Repeat process at other 5 alternatives. You can star or emphasize items you see as critical.
- Reporter presents findings (2 minutes for each reporter) at your group's last alternative.

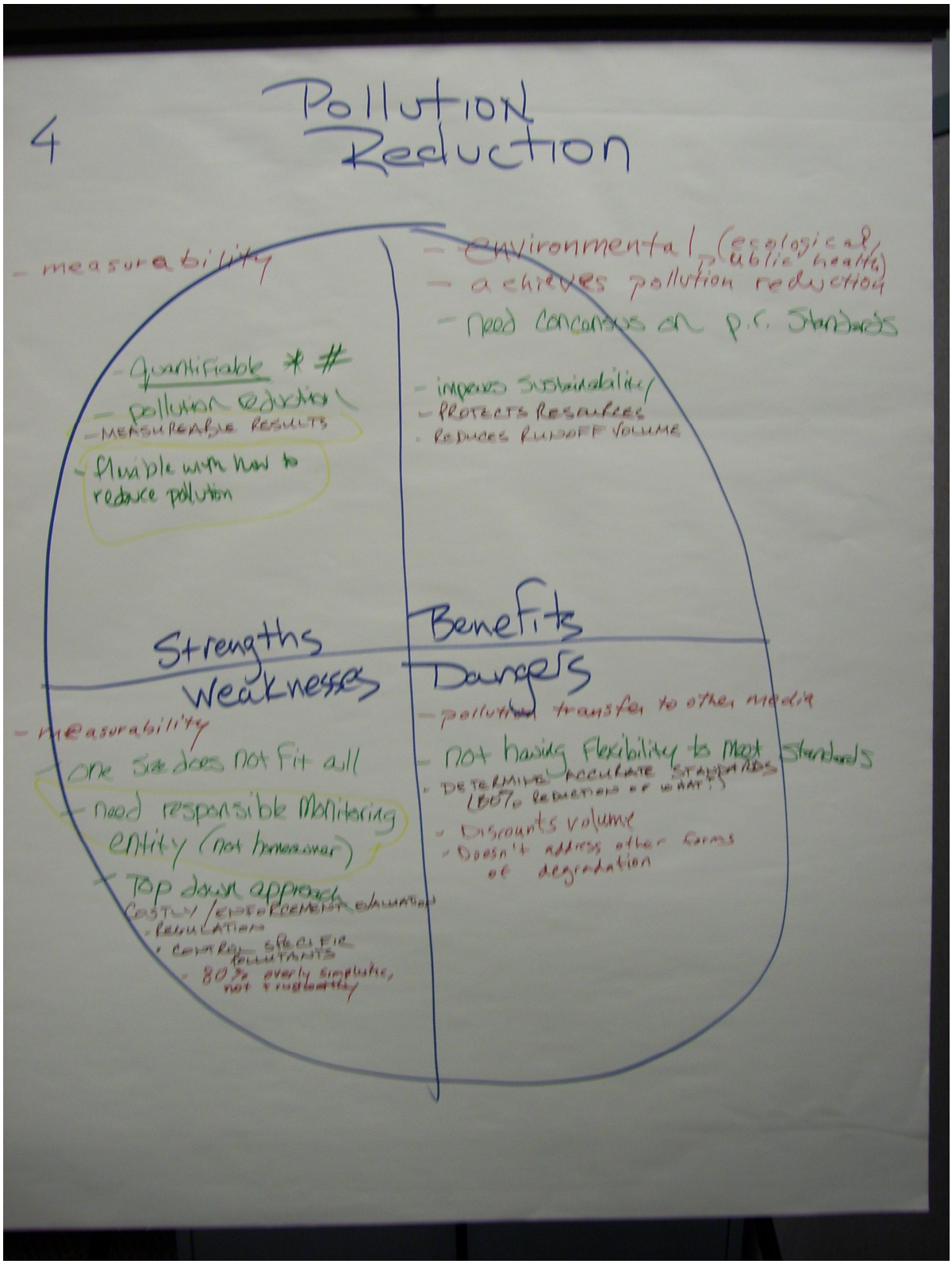
Photographs 3 - 6—Carousel workshop in process.

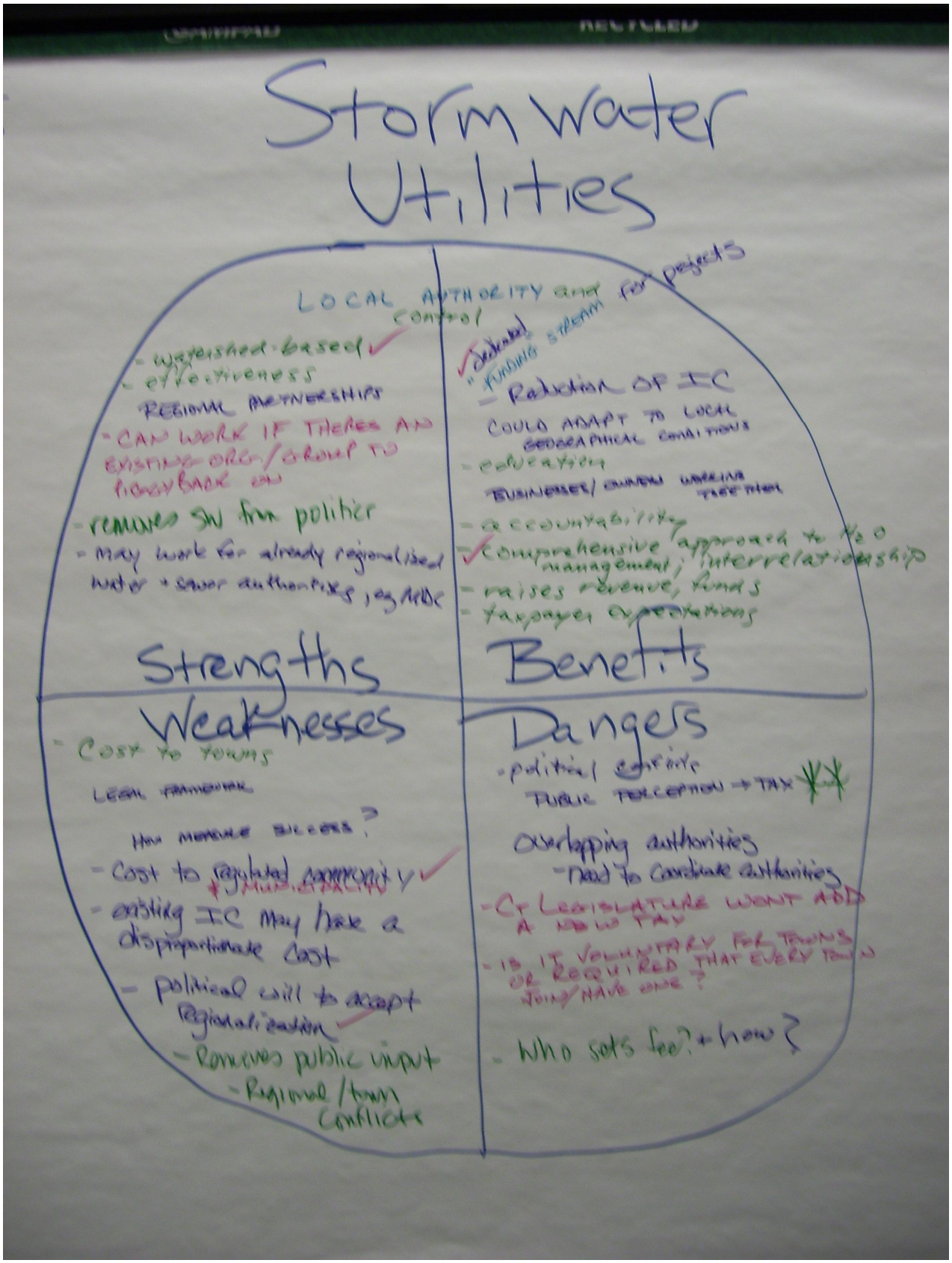
The results of the carousel workshop are shown in Photograph 2 and type written in Attachment 2.

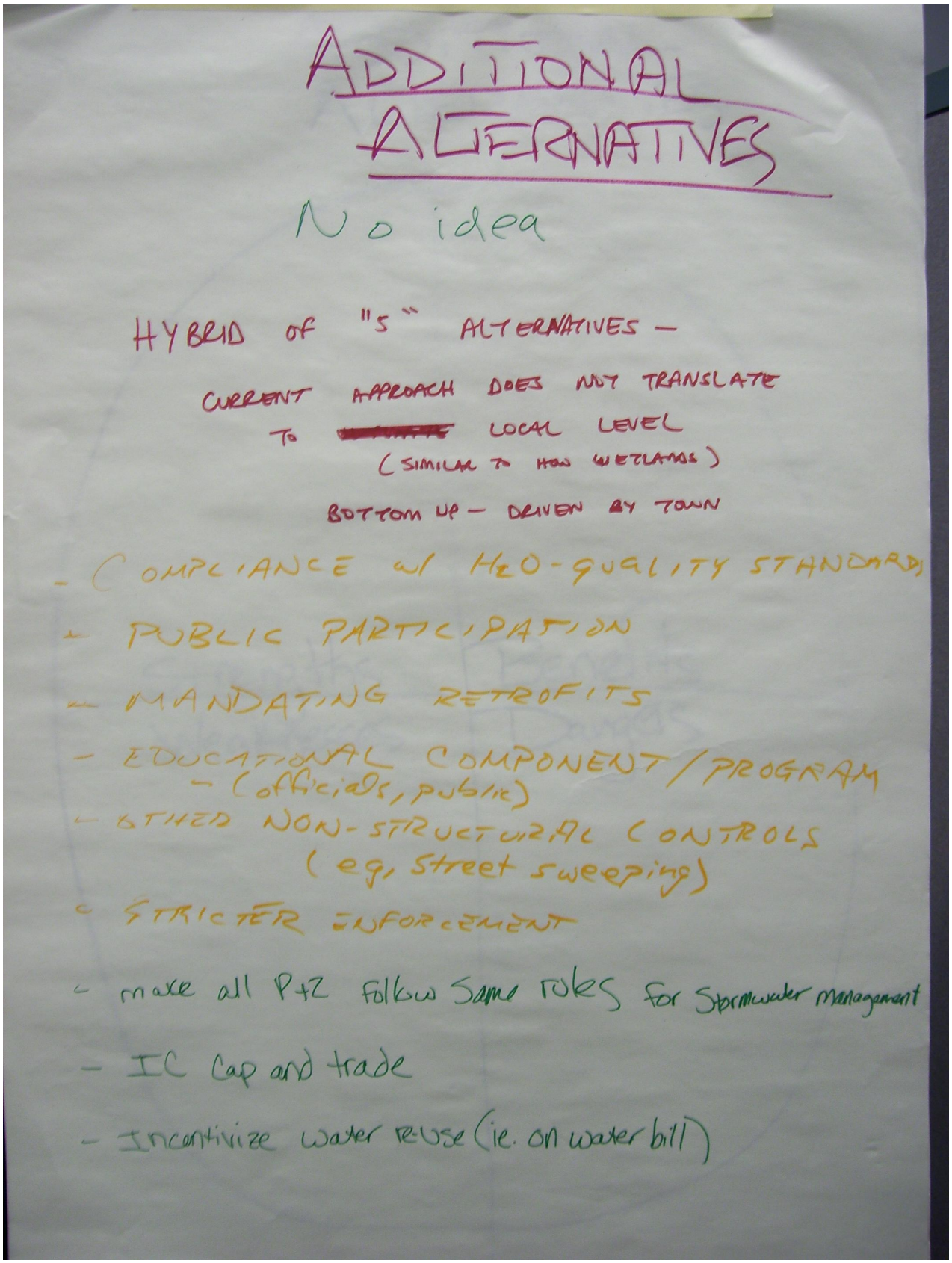



2 NON REGULATORY
- BEHAVIORAL CHANGE, POLITICALLY PALATABLE
FLEXIBILITY, FINANCIAL BENEFIT FOR SMALL
CONTRACTOR/OPERATOR
• TRAINING & EDUCATION
• DEMO PROJECTS
• CT SHOULD FUND DEMO PROJECTS & COST
• VARIABLE FUNDING SOURCES
• PROPER GUIDANCE WILL LEAD TO GOOD DESIGN AND ENVIRONMENTAL BENEFITS WILL FOLLOW
Keeps options open
- Educates public + encourages voluntary buy-in
- Flexible
- Larger buy-in across the board
- ECONOMIC DEVELOPMENT
- EXPERIMENTATION
- With strong incentives, this approach could work
STRENGTHS
BENEFITS
WEAKNESSES
DANGERS
NON REGULATORY MAY NOT BE IMPLEMENTED
Funding is difficult/ wouldn't be priority as non regulated
- Provides no incentive for LID in meeting other reg. requirements (e.g. FMC)
- Costs can be externalized (people have choice to opt out + costs are paid by others)
- Causes uncertainty for local boards/commissions
- FAILURE TO COMPLY W/ CWA
- NON-MEASURABLE OR PREDICTABLE
- No consistent application of LID
- At odds w/ current regulations
Political process
Consistency
Need for incentives for developers
Becomes a low priority
FREE-RIDER
- Status-quo ⇒ what we have now
-


3) PERFORMANCE STANDARDS
? EG: IMPORTANCE TO NEED FOR MEASUREMENT QUANTIFIABLE IMPACT
NOT NEEDED IF ALL MEET LID WORKS!
USING SIMPLE PERFORMANCE STANDARDS WORKS WELL (IE 1" GW RECHARGE)
If you meet the standard, you meet it.
Backed up by science
Uniform
- MEASURABILITY
- QUANTIFIABLE
STRENGTHS
FLEXIBLE MENU (MENU OF OPTIONS TO MEET STANDARDS)
- BMPS CAN BE FINE-TUNED (COST-EFFECTIVE)
- ENFORCEABLE/ACHIEVABLE
- EASY TO MONITOR (VOLUME-BASED STANDARD)
BENEFITS
WEAKNESSES
IMPLEMENTATION NEEDS TO BE SIMPLE OR COSTS RISE QUICKLY
TIMELINE - WHATS LONG TERM ENFORCEMENT
How to set the standard.
Municipal staff/time training
Administrative burden
- SITE-SPECIFIC DESIGN
- LACK OF DATA ON PERFORMANCE IN PRACTICE
DANGERS
- Ultra-conservative; may add unnecessary expense
AVOID 1 SIZE FITS ALL
Conflicts with Best Engineering Judgment
discourages innovation


4
Pollution Reduction
- measurability
- quantifiable * #
- pollution reduction
- MEASUREABLE RESULTS
- flexible with how to reduce pollution
- environmental (ecological, public health)
- achieves pollution reduction
- need concentrations on p.c. standards
- improves sustainability
- PROTECTS RESOURCES
- REDUCES RUNOFF VOLUME
Strengths
Weaknesses
Benefits
Dangers
- measurability
- one size does not fit all
- need responsible monitoring entity (not homeowner)
- top down approach
COSTLY / ENFORCEMENT EVALUATION
- REGULATION
- CONTROL SPECIFIC POLLUTANTS
- 80% overly simplistic, not troublesome
- pollution transfer to other media
- not having flexibility to meet standards
- DETERMINE ACCURATE STANDARDS (100% REDUCTION OF WHAT?)
- Discounts volume
- Doesn't address other forms of degradation


Storm water Utilities
LOCAL AUTHORITY and control
- watershed-based
- effectiveness
REGIONAL PARTNERSHIPS
- CAN WORK IF THERES AN EXISTING ORG/GROUP TO PIGGYBACK ON
- removes SW from politics
- may work for already regionalized water + sewer authorities, eg MDC
Strengths
Benefits
- Reduction of IC
COULD ADAPT TO LOCAL GEOGRAPHICAL CONDITIONS
- equitable
BUSINESSES/OWNERS UNDER/IN TREE ZONE
- accountability
- comprehensive approach to H2O management/interrelationship
- raises revenue, funds
- taxpayer expectations
Weaknesses
- Cost to towns
LEGAL FRAMEWORK
How measure success?
- Cost to regulated community
- existing IC may have a disproportionate cost
- political will to accept Regionalization
- Removes public input
- Regional/town conflicts
Dangers
- political agenda
PUBLIC PERCEPTION → TAX
overlapping authorities
- Need to Coordinate authorities
- CT LEGISLATURE WONT ADD A NEW TAX
- IS IT VOLUNTARY FOR TOWNS OR REQUIRED THAT EVERY TOWN JOIN/HAVE ONE?
- Who sets fee? + how?



ADDITIONAL ALTERNATIVES

No idea

HYBRID OF "5" ALTERNATIVES –

CURRENT APPROACH DOES NOT TRANSLATE TO [redacted] LOCAL LEVEL
(SIMILAR TO HOW WETLANDS)

BOTTOM UP – DRIVEN BY TOWN

- COMPLIANCE w/ H_2O-QUALITY STANDARDS
- PUBLIC PARTICIPATION
- MANDATING RETROFITS
- EDUCATIONAL COMPONENT/PROGRAM – (officials, public)
- OTHER NON-STRUCTURAL CONTROLS (eg, Street sweeping)
- STRICTER ENFORCEMENT
- make all P+Z follow same rules for Stormwater Management
- IC Cap and trade
- Incentivize water reuse (ie. on water bill)

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NEXT STEPS

The next workshop will be held on August 31 in the Phoenix Auditorium from 9:15 to 11:45 a.m. This meeting will focus on alternatives for implementation. In preparation for the meeting Fuss & O'Neill will develop two technical memoranda regarding: (a) information gathered from partner interviews and other states; (b) the role of stormwater utilities. Fuss & O'Neill will also develop a summary document of alternatives for LID implementation and criteria for selection based on workshops 1 and 2.

ATTENDEES

Attendees of the July 1 workshop are listed below in alphabetical order by affiliation.

Attendee	Affiliation
Eric Brown	CBIA
Virginia Mason	Council of Governments Central Naugatuck Valley
Jim Langlois	Connecticut Concrete
Matthew Hallssey	Connecticut Construction Industries
Jessica Morgan	Connecticut Department of Environmental Protection
Mary-Beth Hart	Connecticut Department of Environmental Protection OLISP
Chris Malik	Connecticut Department of Environmental Protection / NPS Program
MaryAnn Nusom Haverstock	Connecticut Department of Environmental Protection / NPS Program
Chris Stone	Connecticut Department of Environmental Protection-Water Permitting
Nisha Patel	Connecticut Department of Environmental Protection-Water Permitting
Eric McPhee	Connecticut Department of Public Health
Paul Corrente	Connecticut Department of Transportation—Environmental Planning
Roger Reynolds	Connecticut Fund for the Environment
John Carrier	Connecticut Home Builders
Mike Girard	Connecticut Home Builders
Darin Overton	Connecticut Home Builders

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Bruce Wittchen	Connecticut Office of Policy and Management
Judy Rondeau	ECCD
Johanna Hunter	EPA Region 1
Jim Riordan	Fuss & O'Neill
Phil Moreschi	Fuss & O'Neill
Bill Ethier	Home Builders Association of Connecticut
Terrance Gallagher	Luchs
Greg Sharp	Murtha Cullina, LLP
John Hudak	Regional Water Authority
Kenneth Wieland	Rivers Alliance
Michael Dietz	University of Connecticut—Nonpoint Education for Municipal Officials

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ATTACHMENT 1
RESULTS OF CARD STORMING FROM JULY 1, 2010 (WORKSHOP 2)

Card Storming Question:
What are the features of good LID policy?

Objective Card Storming Aim:
Identify criteria [for determining alternatives]

Experiential Card Storming Aim:
Identify similarities [in participants ideas of good LID policy]

Economic Market Viability

- Cost effective options, not regulations
- Enough incentive to achieve success
- Recognize market demands for different development types (LID may not be for all
- Funding for implementation
- Market/demand sensitivity
- Effectiveness can be verified and maintenance is not cost prohibitive

Education

- Education component
- Knowledgeable design engineers training, <u>train</u>
- Use good science and knowledgeable people to make decisions
- Public acceptance—meaning willingness to act a local/residential scale
- <u>Greatest behavior change</u> Promote policies (regulatory and/or voluntary) that result in greatest behavior change

Clear and Understandable

- Clarity
- Uniform statewide (standardized)
- Make any guidance and/or standards simple. Make process certain.
- LID policy at the local level to adopt, enforce, implement

Practicability-Flexibility

- Practical to implement and maintain
- Not burdensome to individuals, easy to comply with
- Maintenance required
- Flexible
  - Consider site constraints
  - Consider project type
- Flexible
- Room for innovation
- Performance based (about objective, not technique)
- Bottom-up site specific approach, <u>not</u> top down.

Legal Administrable

- Easy to administer
- Aligning municipal zoning subdivision regulations (with LID)
- Encouragement TPZ, cons[ervation] subdivision regulations
- Available support structure mechanism for contractors/homeowners implementing LID
- Compatible with other regulations and goals that are necessary i.e., ADA, mosquito control, public safety, public health
- Legal
- Oversight from local and state agencies
- Enforceability
- Treats stormwater runoff with the same strict criteria that are required of on-site septic systems
- Quantifiable-measurable for other permit requirements that might duplicate
- Should be expected and standard operating procedure not as the exception

Environmental Benefit

- Manages soil erosion
- Reduction of impervious materials
- Remediates already built areas
- Promotes GW recharge
- Water quality & water quantity (groundwater (in-stream recharge) flow techniques)
- Reduces runoff
- Minimize impervious cover
- Fix impairment
- Resource based design (e.g., soils)
- Allow soil microorganisms to work
- Shift focus from engineering to conservation

Low Impact Development and Stormwater General Permit Evaluation

1. REGULATORY

STRENGTHS
- Experience
- No free-rider/fairness
- Effectiveness
- People know clarity/uniformity (consistent standard) [Fix what you have]
- Helps municipalities to justify requiring LID
- Mandatory

BENEFITS
- Invest in LID where you get the most benefit to fix the biggest problem
- Ensure most LID use
- --Quantifiable (e.g., drainage calculations, apply to flood management
- Avoids externalizing costs
- Public health – flood mitigation
- Accountability
- Transparency
- Quick goal attainment
- It will get LID implemented

WEAKNESSES
- Lack of experience
- Flexibility for industry/towns
- Problems for implementation at existing facilities (Retrofitting Q's)
- Enforcement (staff) is a weakness
- Difficult to be uniform – urban, suburban
- How ensure compliance at local level?
- Mandatory
- Bureaucracy/cost
- Not market viable

DANGERS
- State/municipal conflict ✓
- Municipal ability to implement/knowledge
- If permit – applicant knowledge
- Carved into marble
- Hard to modify if flaws identified
- Limited enforcement
- If not enough flexibility, will get resistance✓
- Not applicable on every site

2. NON REGULATORY

STRENGTHS
- Behavioral change
- Politically palatable
- Flexibility*, Financial Benefit for small contractor/operator
- Keeps options open
- Educates public and encourages voluntary buy-in
- Flexible
- Larger buy-in across the board

BENEFITS
- Training and education
- Demo projects
- CT should fund demo projects and cost
- Variable funding sources
- Proper guidance will lead to good design and environmental benefits will follow
- Economic development
- Experimentation
- With strong incentives, this approach could work

WEAKNESSES
- Non regulatory may not be implemented (Staff and resources)
- Funding is difficult/wouldn't be priority as non regulated
- Provides no incentive for LID in meeting other regulatory requirements (e.g., FMC)
- Costs can be externalized (people have choice to opt out and costs are paid by others)
- Causes uncertainty for local boards/commissions
- Failure to comply with CWA
- Non-measureable or predictable
- No consistent application of LID
- At odds with current regulations

DANGERS
- Political process
- Consistency
- Need for incentives for developers
- Becomes a low priority
- Free-rider
- Status quo – what we have now
- Failure to comply

3. PERFORMANCE STANDARDS

STRENGTHS
- Flexible design
- Using simple performance standards works well (i.e., 1" GW recharge)
- If you met the standard, you meet it
- Backed up by science
- Uniform
- Measurability
- Quantifiable

BENEFITS
- Could be regulatory or non-regulatory
- Flexible menu ** (menu of options to meet standards)
- BMPs can be fine-tuned (cost-effective)
- Enforceable/achievable
- Easy to monitor (volume-based standard)

WEAKNESSES
- Not clear - Inconsistent application of BMPs
- Implementation needs to be simple or costs rise quickly
- Timeline – What's long term enforcement
- How to set the standard
- Municipal staff/time training
- Administrative burden
- Site-specific design
- Lack of data on performance in practice
- Measurability

DANGERS
- Ultra-conservative; may add unnecessary expense
- Failure of BMPs
- Avoid one size fits all
- Conflicts with best engineering judgment
- Discourages innovation

4. POLLUTION REDUCTION

STRENGTHS
- Measurability
- Quantifiable *#
- Pollution reduction
- Measureable results
- Flexible with how to reduce pollution

BENEFITS
- Environmental (ecological/public health)
- Achieves pollution reduction
- Need consensus on p.r. [pollution reduction] standards
- Improves sustainability
- Protects resources
- Reduces runoff volume

WEAKNESSES
- Measurability
- One size does not fit all
- Need responsible monitoring entity (not homeowner)
- Top down approach
- Costly/enforcement evaluation – regulation
- Control specific pollutants
- 80% overly simplistic, not trustworthy

DANGERS
- Pollution transfer to other media
- Not having flexibility to meet standards
- Determine accurate standards (80% reduction of what?)
- Discounts volume
- Doesn't address other forms of degradation

5. STORMWATER UTILITIES

STRENGTHS
Local authority and control
- Watershed based ✓
- Effectiveness
- Regional partnerships
- Can work if there's an existing organization/group to piggyback on
- Removes stormwater from politics
- May work for already regionalized water and sewer authorities , e.g., MDC

BENEFITS
- ✓Dedicated "funding" stream for projects
- Reduction of IC [impervious cover]
- Could adapt to local geographical conditions
- Education
- Businesses/owners working together
- Accountability
- ✓Comprehensive approach to water management; interrelationship
- Raises revue, funds
- Taxpayer expectations

WEAKNESSES
- Cost to towns
- Legal framework
- How measure success?
- Cost to regulated community✓ and municipality
- Existing IC may have a disproportionate cost
- Political will to accept regionalization✓
- Removes public input
- Regional/town conflicts

DANGERS
- Political conflicts
- Public perception – tax**
- Overlapping authorities – Need to coordinate authorities
- CT legislature won't add a new tax
- Is it voluntary for towns or required that every town join/have one?
- Who sets fee and how?

6. ADDITIONAL ALTERNATIVES

- Hybrid of "5" alternatives – current approach does not translate to local level (similar to how wetlands) Bottom up- driven by town.
- Compliance with water quality standards
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- Incentivize water reuse (i.e., on water bill)

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1. REGULATORY

STRENGTHS

- Experience
- No free-rider/fairness
- Effectiveness
- People know clarity/uniformity (consistent standard) [Fix what you have]
- Helps municipalities to justify requiring LID
- Mandatory

BENEFITS

- Invest in LID where you get the most benefit to fix the biggest problem
- Ensure most LID use
- ~Quantifiable (e.g., drainage calculations, apply to flood management
- Avoids externalizing costs
- Public health – flood mitigation
- Accountability
- Transparency
- Quick goal attainment
- It will get LID implemented

WEAKNESSES

- Lack of experience
- Flexibility for industry/towns
- Problems for implementation at existing facilities (Retrofitting Q's)
- Enforcement (staff) is a weakness
- Difficult to be uniform – urban, suburban
- How ensure compliance at local level?
- Mandatory
- Bureaucracy/cost
- Not market viable

DANGERS

- State/municipal conflict ✓
- Municipal ability to implement/knowledge
- If permit – applicant knowledge
- Carved into marble
- Hard to modify if flaws identified
- Limited enforcement
- If not enough flexibility, will get resistance✓
- Not applicable on every site

2. NON REGULATORY

STRENGTHS

- •Behavioral change
- •Politically palatable
- •Flexibility*, Financial Benefit for small contractor/operator
- •Keeps options open
- •Educates public and encourages voluntary buy-in
- •Flexible
- •Larger buy-in across the board

BENEFITS

- •Training and education
- •Demo projects
- •CT should fund demo projects and cost
- •Variable funding sources
- •Proper guidance will lead to good design and environmental benefits will follow
- •Economic development
- •Experimentation
- •With strong incentives, this approach could work

WEAKNESSES

- •*Non regulatory may not be implemented (Staff and resources)
- •Funding is difficult/wouldn't be priority as non regulated
- •Provides no incentive for LID in meeting other regulatory requirements (e.g., FMC)
- •Costs can be externalized (people have choice to opt out and costs are paid by others)
- •Causes uncertainty for local boards/commissions
- •Failure to comply with CWA
- •Non-measureable or predictable
- •No consistent application of LID
- •At odds with current regulations

DANGERS

- •Political process
- •Consistency
- •Need for incentives for developers
- •Becomes a low priority
- •Free-rider
- •Status quo – what we have now
- •Failure to comply

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3. PERFORMANCE STANDARDS

STRENGTHS

- Flexible design
- Using simple performance standards works well (i.e., 1" GW recharge)
- If you met the standard, you meet it
- Backed up by science
- Uniform
- Measurability
- Quantifiable

BENEFITS

- Could be regulatory or non-regulatory
- Flexible menu ** (menu of options to meet standards)
- BMPs can be fine-tuned (cost-effective)
- Enforceable/achievable
- Easy to monitor (volume-based standard)

WEAKNESSES

- Not clear - Inconsistent application of BMPs
- Implementation needs to be simple or costs rise quickly
- Timeline – What's long term enforcement
- How to set the standard
- Municipal staff/time training
- Administrative burden
- Site-specific design
- Lack of data on performance in practice
- Measurability

DANGERS

- Ultra-conservative; may add unnecessary expense
- Failure of BMPs
- Avoid one size fits all
- Conflicts with best engineering judgment
- Discourages innovation

4. POLLUTION REDUCTION

STRENGTHS

- Measurability
- Quantifiable *#
- Pollution reduction
- Measureable results
- Flexible with how to reduce pollution

BENEFITS

- Environmental (ecological/public health)
- Achieves pollution reduction
- Need consensus on p.r. [pollution reduction] standards
- Improves sustainability
- Protects resources
- Reduces runoff volume

WEAKNESSES

- Measurability
- One size does not fit all
- Need responsible monitoring entity (not homeowner)
- Top down approach
- Costly/enforcement evaluation – regulation
- Control specific pollutants
- 80% overly simplistic, not trustworthy

DANGERS

- Pollution transfer to other media
- Not having flexibility to meet standards
- Determine accurate standards (80% reduction of what?)
- Discounts volume
- Doesn't address other forms of degradation

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5. STORMWATER UTILITIES

STRENGTHS

- Watershed based ✓
- Effectiveness
- Regional partnerships
- Can work if there's an existing organization/group to piggyback on
- Removes stormwater from politics
- May work for already regionalized water and sewer authorities , e.g., MDC

BENEFITS

Local authority and control

- ✓Dedicated "funding" stream for projects
- Reduction of IC [impervious cover]
- Could adapt to local geographical conditions
- Education
- Businesses/owners working together
- Accountability
- ✓Comprehensive approach to water management; interrelationship
- Raises revue, funds
- Taxpayer expectations

WEAKNESSES

- Cost to towns
- Legal framework
- How measure success?
- Cost to regulated community✓ and municipality
- Existing IC may have a disproportionate cost
- Political will to accept regionalization✓
- Removes public input
- Regional/town conflicts

DANGERS

- Political conflicts
- Public perception – tax**
- Overlapping authorities – Need to coordinate authorities
- CT legislature won't add a new tax
- Is it voluntary for towns or required that every town join/have one?
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