



*Environmental  
Science*

Volume 2, Issue 3, 868-883.

DOI: 10.3934/environsci.2015.3.868

Received date 18 March 2015,

Accepted date 13 September 2015,

Published date 22 September 2015

<http://www.aimspress.com/>

---

*Research article*

## **Stormwater management the American way: why no policy transfer?**

**David P. Dolowitz \***

Dept. of Politics, University of Liverpool, Roxby Building, Liverpool, UK

\* **Correspondence:** Email: [dolowitz@liv.ac.uk](mailto:dolowitz@liv.ac.uk); Tel: 01517942906.

**Abstract:** From the 1940s until the 1980s the federal government gradually extended its authority over the structure of the American stormwater management system. The goal was to improve the water quality of the nation's waterways by regulating the pollution loads entering the system, primarily through the use of gray infrastructure. However during the 1980s the Environmental Protection Agency (EPA) began to explore new approaches toward the regulation of stormwater pollution. Instead of focusing only on gray mechanisms, the EPA began developing and promoting the use of low impact development (LID) techniques as an element municipal governments could use to achieve their total maximum daily load of pollutants allowable under the National Pollutant Discharge Elimination System permit system. In light of the incentive offered by the EPA for the use of LID in the management of stormwater, it should be expected to provide a perfect area to observe policy transfer between federal, state and local governments; but it does not. This article will establish why the EPA began promoting a green approach to stormwater management and why this has not led to a widespread transfer of best management practices in the ways the literatures associated with federalism and policy transfer would suggest.

**Keywords:** policy transfer; public policy; stormwater; federalism

---

### **1. Introduction**

Prior to 1948 water management in the US tended to be confined to the realm of state oversight and decision-making. As a result, by the mid-part of the 20th century most states had experienced instances (often extreme) of polluted waterways and stormwater catchment areas. This led a range of interest groups to lobby the federal government to take action: which it did with the passage of the

---

1948 Federal Water Pollution Control Act. The 1948 Act required the federal government to protect the nation's waterways against specific industrial pollutions (point source) linked to the degradation of the ecosystems of the attendant waterways, streams and rivers. As a result of mixed success (depending on the state or local government involved), the 1948 Act went through a series of amendments. The most important, the Clean Water Act (CWA) passed in 1972. The CWA established a set of federally formulated "programs for water quality improvement that...are still being implemented by industries and municipalities" [1]. With the CWA and its subsequent amendments the federal government slowly shifted its focus from funding gray infrastructure projects towards the funding of both gray infrastructure and low impact development infrastructure projects (LID). By the mid-1990s the Environmental Protection Agency (EPA) required local governments to integrate LID projects into their stormwater management plans, if they were to obtain a storm water discharge permit. While not the primary purpose of the National Pollutant Discharge Elimination System (NPDES) it included provisions to encouraging municipalities to use LID techniques in their stormwater management plans in order to stay within their permitted total daily maximum pollution limit (TMDL). As a result the number and type of LID utilized by municipalities across the US exponential increased [2].

Based on the observed expansion of LID, it can be hypothesized that local governments should have been engaging in the transfer of green ideas, technologies and policies, as a way to jump start their own efforts to integrate LID into their stormwater management plans. This hypothesis is formed on the bases of several observations. First, the enabling legislation associated with NPDES and TMDL requires municipalities use LID in their stormwater management plans. Second, the 1972 legislation stresses the importance of using the relevant local authorities in this process:

It is the policy of the Congress to recognize, preserve, and protect the primary responsibilities and rights of States to prevent, reduce, and eliminate pollution, to plan the development and use (including restoration, preservation, and enhancement) of land and water resources, and to consult with the Administrator in the exercise of his authority under this Act. It is the policy of Congress that the States manage the construction grant program under this Act and implement the permit programs under sections 402 and 404 of this Act. It is further the policy of the Congress to support and aid research relating to the prevention, reduction, and elimination of pollution, and to provide Federal technical services and financial aid to State and interstate agencies and municipalities in connection with the prevention, reduction, and elimination of pollution [3].

Third, to aid state and local organizations, a number of federal agencies collect, disseminate, and promote the adaptation of LID stormwater BMPs being used in the US and across the globe [4].

In addition, a range of more "persuasive" devices have been developed by the EPA to foster the transfer of policies. For instance, the EPA regularly publishes data on low impact stormwater BMPs with the explicit purpose of encouraging municipalities and states to learn and borrow the best (or most appropriate) practices. There is some evidence that the idea is working. When discussing the EPA (and Federal Highway Administration) benchmarks several local political leaders stated that they often felt pressure to be seen as amongst the best rather than being "just average" in the tables. In a similar way one of our interviewees explicitly stated that they saw the tables as a way in which the federal officials were attempting to "shame poorly-performing localities into improving".

In summary, since the passage of the CWA, the US has produced over 30,000 "laboratories of

innovation”. Based on the transfer and federalism literatures it should be expected that these laboratories are offering considerable opportunities for municipal governments to learn how other municipalities are acting and then borrow accordingly. The remainder of this article will examine what is occurring relation to the movement (or otherwise) of stormwater management techniques.

## 2. Methodology

The data used for this article was collected and analyzed using a standard qualitative design. It relied on triangulation of data and information collected from city planning documents, internal water district and water company documents, government legislation, EPA stormwater regulations, academic journals, interviews and a series of follow-up questionnaires. Initially eight interviewees (2 February 2012–2 June 2012) were selected as known leaders in the promotion of LID techniques in their communities, key administrative officials working for water authorities, and core business interests. The initial size of the sample interviewed was limited due to restrictions placed on the study by its project funder.<sup>1</sup> Based on results emerging from the initial study 12 more participants were interviewed (between 6 September 2012–8 January 2013). These 12 interviewees were selected based on a snowball technique employed to discover who our initial eight participants thought were key to the spread and implementation of LID techniques in their local area.

The questions for the initial set of questionnaires were developed based on the data gathered from documentary analysis of journal articles, newspaper articles, and legislation relating to stormwater management and discharge permits. These questions were supplemented with a series of questions designed to elicit information on the movement and use of information regarding LID techniques and ideas. The goal of the questionnaires and follow-up interviews was to gain an understanding of whether a municipality (or responsible organization) engaged in a search for BMPs; if they did, where was the information obtained; how much of this was assimilated by these actors; and whether the information was subsequently used in the development of their own strategies, programs and policies.

To do this, the questions combined a mix of open and closed formats in hopes of eliciting the most expansive response possible. Based on the responses to the open ended questions, a follow-up questionnaire was developed and sent to interviewees to allow respondents to clarify or expand on selected issues relating to the transfer of information associated with LID techniques.<sup>2</sup>

## 3. The changing nature of US federalism in stormwater management

The US the constitution says “little to specify the relationship between those powers (reserved to

---

<sup>1</sup> This study was supported, in part, by the EPA Office of Research and Development (ORD) and National Risk Management Research Laboratory (NRMRL), under contract EP-11-C-000067. As part of this the EPA stipulated that the initial study involved no more than eight interviewees, to prevent the study triggering the Paperwork Reduction Act. A further stipulation was that Chatham House rules needed to be followed. For this reason all identities have been removed when quoting or referring to the data provided by interviewees

<sup>2</sup> While the author acknowledges the numbers involved (twenty) are too small to make universal generalizations, the consistency in responses across government, business, NGO’s and civil servants involved is highly suggestive.

---

the federal government) and the reserved powers of the states” [5]. This left much of the relationship in the area of water management open to court interpretation and trial-and-error interactions between the different levels of governance. Until the passage of the 16th amendment (1913) the relationship was fairly non-contentious—the federal government tended to allow the states to act as they choose in the area of environmental policy. This was partially due to the lack of revenue needed to fund projects and partially due to a lack of capacity in the civil services’ ability to administer national programs. Even in the few instances where the federal government attempted to enter the realm of water management the Supreme Court tended to overrule its efforts. After the passage of the 16th Amendment the situation began to change. First, the federal government was able to fund projects and interventions in ways not possible before. Second, the results of the Pendleton Act (1883), combined with increased capacity to higher specialist, led to a dramatic improvement in the quality and capacity of the federal civil service.

While these changes helped the federal government develop, fund, and manage regulatory policies, it was a change in the way the Supreme Court interpreted the relationship between the states and federal government that truly allowed the federal government to move into the area of stormwater regulation. One of the earliest cases was *US v. Darby* (1941). In this case the Court declared “The power of Congress over interstate commerce is complete in itself, may be exercised to its utmost extent, and acknowledges no limitations other than are prescribed in the Constitution”. More importantly, it stated that Congress’ power over regulation “can neither be enlarged nor diminished by the exercise or non-exercise of state power” [6]. Once this precedent was established the Court proceeded to expand the areas accepted as falling under the commerce clause [7]. As a result stormwater management emerged as involving a:

distinctive blend of national and state authority...National authority is employed by EPA or another agency as a basis for establishing criteria, standards, and conditions to apply in program implementation. Responsibility for implementation is to be delegated to states if their programs meet national requirements. If states do not elect to participate or do not secure national approval of their programs, implementation proceeds within their borders on the basis of national authority exercised by national officials. If states do participate, implementation employs national and state authority concurrently. It should be noted that while this is the relationship that predominates the area of stormwater regulation, the type of federal-state-local relationship that dominates in other policy areas is likely to be different [8].

While some have argued that the federal government coopted stormwater regulation, for the purposes of the argument presented in this article, it is important to stress that “States retain significant leverage because the federal government...(cannot) accomplish its goals without...reliance on state implementers” [5].

#### **4. A brief history of US stormwater management**

Before looking at the role of policy transfer in the development of stormwater management in the US, it is worth briefly looking at what it is we are talking about: the watershed surrounding and interacting with our urban and rural areas and how stormwater effects this environment. Where a

watershed exists in a state of nature stormwater tends not to be a problem (Stormwater is surface water that gathers in high volumes as a result of heavy rain and/or snow melt). This is because unmodified ecosystems have the ability to absorb and filtrate stormwater by channeling excess water into natural flood plains where it is absorbed, evaporates, or naturally flows back into a water body. This hydrological process is disrupted by urbanization and the expansion of impervious surfaces (roads, buildings, parking lots, driveways, paving of front gardens, etc.). As urban centers grow and replace more of the ecosystem's natural habitat (trees, bushes, grasslands, swamplands, etc.) with impervious surfaces, watersheds become less able to function as water collectors, percolation systems or filtration systems. This leads to considerably more (and more severe) surface runoff from rain, snowmelt and major storm events [5,9-11]. One of the key problem this creates is that where stormwater flows over impervious surfaces it collects a range of pollutants, including "toxic heavy metals, acids, raw sewage, pesticides, industrial and biological wastes, oil and floatable garbage" [12].

If stormwater is not diverted into sewer and treatment facilities it can enter the drinking and recreational water systems. When this happens, biological and chemical contamination places the wildlife and human populations at risk of disease and poisoning [13]. The reason for this is that when sewer systems become overwhelmed stormwater overflows onto roadways, into backyards, basements, nearby rivers and creeks, etc., allowing untreated water to potentially damage human health, the underlying flora and fauna, impair biodiversity, increases the water temperature of receiving water bodies, ultimately leading to the decline in the health the entire ecosystem [14,15]. The problem is that even 40-years after the passage of the CWA the "law has done little to rein in pollution that is generated not just by heavy industry but also by individuals: the dirt and contaminants from city streets lots, houses and lawns that flow into lakes, beaches, bays and rivers when rain sends water rushing across the landscape" [16]. In fact, non-point source stormwater is now seen as the leading source of toxins and pollutants in many major watersheds across the country [16].

## 5. Federal intervention

The first major effort to engage the states in the protection of the nation's waterways came with the passage of the 1948 Water Pollution Control Act. This Act required the Surgeon General "in cooperation with other Federal, state and local entities, to prepare comprehensive programs for eliminating or reducing the pollution of *interstate* waters and tributaries and improving the sanitary condition of surface and underground waters" [17]. This law also required *all concerned governing units* to give due regard to the specific ways they could act to improve and conserve "waters for public water supplies, propagation of fish and aquatic life, recreational purposes, and agricultural and industrial uses" [17]. The requirement that all concerned governing units give due regard to improving waters started the process by which states and federal authorities began *working together* to reduce the amount of water pollution being carried *across state boundaries*.

While providing the framework for learning and transfer the Act proved ineffective. The primary reason for this was that the 1948 Act linked federal assistance not to the development of LID technologies but to large-scale gray projects, including the construction of sewer systems, drainage tunnels and "treatment plants to prevent discharges of inadequately treated sewage and other wastes into interstate waters or tributaries" [17]. In response to some of the perceived inadequacies of the

1948 Act, Congress amended it with the Federal Water Pollution Control Act of 1956, Federal Water Pollution Control Act of 1961, the Water Quality Act of 1965 and the Water Quality Improvement Act of 1971. All of these were directed at using gray infrastructure and regulations to better control point source pollutants.<sup>3</sup> While these alterations extended the role of the federal government's authority in regulating the quality of surface water, states and local governments remained slow, reluctant, and in some instances nonresponsive towards the use of LID projects and technologies in their stormwater management plans [17]. This (and the image of rivers catching fire as a result of their pollution loads) led Congress to pass the 1972 Clean Water Act (CWA). At the core of the CWA is a requirement for the EPA to create a set of technology based effluent limitations. These were to be implemented through National Pollution Discharge Elimination System (NPDES) permits. NPDES permits allowed the federal government to require "local governments to mitigate negative environmental impacts of urban stormwater runoff by developing and implementing best management practices" (BMP). Congress and the EPA turned to the NPDES system because, despite improvement seen in point source water pollution, there was a "consensus that nonpoint source pollutants, particularly those contained in stormwater, are a continuing threat to the nations water quality"(See Box 1) [18].

**Box 1. Difference between point source and nonpoint source pollutants [19].**

The term "nonpoint source" is defined to mean any source of water pollution that does not meet the legal definition of "point source" in section 502(14) of the Clean Water Act:

The term "point source" means any discernible, confined and discrete conveyance, including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, or vessel or other floating craft, from which pollutants are or may be discharged. This term does not include agricultural storm water discharges and return flows from irrigated agriculture.

NPS pollution is caused by rainfall or snowmelt moving over and through the ground. As the runoff moves, it picks up and carries away natural and human-made pollutants, finally depositing them into lakes, rivers, wetlands, coastal waters and ground waters.

While the NPDES system covers a range of issues beyond LID, it is generally accepted that in many states the NPDES system has been the "only effort for, solving the nation's non-point source water quality problem" though LID techniques. The reason new efforts are necessary can be found in

<sup>3</sup> Some of the more important legal rules include: Continued authority to develop comprehensive programs for water pollution control, to provide grants to States and interstate agencies to assist in developing such programs and to construct treatment facilities, and to establish enforcement measures for pollution of interstate waters (Ch. 518; P.L. 660); Redefinition of eligible entities to include the 50 States and the District of Columbia (P.L. 86-624); Increase in the authorization level for the National Study Commission (P.L. 94-238); Establishment of a related municipal public works capital development and investment program (P.L. 94-369); Authorization for a loan guarantee program for construction of treatment works (P.L. 94-558); Modification of effluent limitations relating to biochemical oxygen demand and pH (P.L. 97-440).

---

EPA statistics indicating that over 45 percent of all lakes and 39 percent of all rivers (that they assessed) are polluted with agricultural and urban non-point source pollutants [20]. As a result the EPA is using provisions in the CWA to force state and municipal governments to cleanup the nation's waterways. They are able to do this because the act "more forcefully target the nation's storm water problems at the state and local levels...Section 402(p)...directly regulates *municipal* separate storm sewer systems (MSRs)" [12]. Section 319 directs states to "develop and implement nonpoint pollution management programs". As part of this, "Federal financial assistance was authorized to support demonstration projects and actual control activities" that utilize LID technologies and techniques [1]. To operate the new measures, the EPA devised a two-phase implementation process. Phase I applied to all municipalities with populations over 100,000 operating separate storm sewer system (MS4).<sup>4</sup> Phase II extended these regulations to urban areas with populations under 100,000. To comply with the Phase II permit all regulated areas are required to submit a Notice of Intent (NOI) as to how they propose to comply with the appropriate EPA (or EPA approved and authorized state level regulatory agency) Minimum Control Measures (MCMs). As part of the MCM process the EPA developed a detailed set of guidelines and information sources related to each of the MCMs and the types of BMPs (i.e. LID) that could be used [21]. It should be stressed that the NPDES permit program was extended to Combined Sewer Systems (CSS) in an effort to help reduce the amount of Combined Sewer Overflow (CSO) that occurred during storm events because during CSO events so much pressure is placed on a treatment plant that it is forced to (or the system automatically) discharge untreated water into the environment (for more information on the final rules and the Nine Minimum Control Measures all localities have to comply with see EPA 832-B-95-003 [22]). The goal was to: "devise a permit system capable of reducing the conveyance of stormwater discharges with pollutants to streams, rivers, and creeks...So that now all municipalities with urban conglomerates must actively eliminate point and non-point source stormwater runoff" [23].

## 6. What is going on today?

In light of the CWA (and its subsequent amendments) it could be predicted that municipalities would want to learn from each other in order to shortcut the need to invent entirely new responses to the increasingly strict EPA guidelines relating to waterway pollution loads. The prediction of transfer is boosted when it is realized that to help facilitate the learning process at the municipal level the EPA has (for over a decade) been conducting everything from workshops to the compilation and publication of what it considers the best BMPs from around the nation (and world). In addition to these efforts, the EPA has also created (and regularly updates) a BMP website. This site has been specifically designed to facilitate the transfer of information about LID techniques and what the most innovative municipalities are doing [21]. Complementing the efforts of federal agencies in spreading information on BMPs, over the past decade a plethora of websites have been created by state and local governments

---

4 While the constitution leaves local governing arrangements to the states, it is the local level where sewer systems are developed and operate. When this is combined with zoning laws that are at the discretion of the local government—the NPDES has a considerable amount of influence at the local level. Creating the framework for potential learning and transfer across the realm of water management.

---

to directly publicize what they are doing in the area of LID and stormwater management.

Not only are governments involved in the publication of data relating to their LID programs but the EPA also established a “minimum standards regime” as part of the NPDES permit system. The minimum standard regime was in part designed by the EPA to encourage states and localities to look to each other for ideas on how best to meet federally established minimum standard. Combined, these activities should provide state and local water districts, administrators, legislatures, and executives a number of opportunities and reasons for engaging in the learning and transfer processes.

### *Why LID?*

A second set of reasons to hypothesize that LID should offer a perfect platform for policy transfer is that many LID techniques and technologies are based on small-scale schemes. Because of this a range of LID techniques are amiable to use across different types soils, rainfall patterns, watersheds, municipal designs and governing regimes. In addition, many LID techniques are applicable to a range of different property types (from single dweller houses or individual apartment block to large-scale multi-business complexes, or even large scale parking structures and areas). Combined, these make LID amiable to use in “ultra” urban environments with aging gray infrastructure, little green space, and low (and declining) tax bases.

While this article sees the small-scale adaptability of LID as a positive, the use of LID on individual parcels could be seen as a hindrance to the transfer process. The logic here is that while techniques such as rain barrels and rain gardens would appear to be simple solutions, both require the individual landholder to maintain the LID. In addition, many of the LID techniques available to low income ultra urban areas require individuals to adjust their thinking and practices towards water use and disposal. Any technique that requires top-down enforcement and/or voluntary acceptance and maintenance might be perceived as more of a hindrance to progress than the use of more traditional gray infrastructure solutions.

A third set of reasons to believe LID should be a prime target for policy transfer is that on average LID techniques tend to cost less than more traditional gray infrastructure solutions. This is particularly true in ultra urban areas where there is little to no natural drainage remaining and the costs of rebuilding the CSO would be prohibitive. For instance, according to *American Rivers* and the *Midwest Environmental Advocates*, of the options available for complying with the NTSD permit system, “the most cost effective are associated with Low Impact Development...[They] help minimize impervious surfaces, absorb stormwater, and mimic the natural water cycle” [24]. More importantly, because LID technologies mimic the natural environment, they have an added advantage of adding to property value and improved amenities in an area where they are used. Recall, the goal of LID is to “mimic the functions of the natural environment...to offset the impacts of urbanization and imperviousness... (in ways that) minimize, capture, and treat stormwater at the location at which it is created and before it has the opportunity to reach the collection system” [25].

Illustrations of LID techniques that have been implemented by municipal authorities and other responsible bodies (Water Companies, Sewer Districts) include; permeable pavements, pocket wetlands, rain barrels and cisterns, downspout disconnection, green roofs, curb-and-gutter removal, curb-and-gutter alterations, vegetated swales, green parking lots, the introduction of urban tree boxes



---

and vegetated strips, bio-retention cells, retention ponds, filtration ponds, French drains, and in several localities the day-lighting and greening of culverted watercourses.

## 7. Does LID transfer?

### 7.1. Knowledge of others LID programs

In line with the existing literature on states as “laboratories of democracy” when asked whether they were aware of other jurisdictions using LID practices to address EPA regulations all respondents said yes. Not only were participants aware that other jurisdictions were developing LID projects but there was some awareness of which jurisdictions were considered to be the most advanced and innovative in the use and construction of LID stormwater management techniques. Of these, the most commonly mentioned were Portland, Oregon and Seattle, Washington. A typical response comes from Foxtrot, who noted that: “Portland and Seattle offered the best models for helping in the development and implementation of stormwater management practices (BMPs), to meet NPDES and TMDL requirements”. While discussed, as being the leaders in the field, Portland and Seattle were not alone, respondents were also aware of what was occurring in: Chicago, Illinois; Austin, Texas; Fairfax, Virginia; and Madison, Wisconsin. Of note, none of the respondents made reference to cities such as Boston, Massachusetts; Pittsburgh, Pennsylvania; or Los Angeles, California, even though each of these cities have well-developed and publicized programs.

While a fairly small number of cities appear to be attracting considerable attention, unlike what might be predicted, cities seen as being the most advanced or innovative in their use of LID for stormwater management do not appear to be being used as models. Rather, leaders in LID appeared to be being used as reference points for what could be done. Alpha stated it best, “While there is much to like about what is going on in Portland, I just do not see how we could use it.” In a similar way Foxtrot stated, “West Coast models could not work.” Strangely, many of the same respondents who reported not being able to utilize Seattle and Portland (or any of the other of the cities they discussed) went on to say that they saw many elements in their programs “as being worth transferring”.

Even though Seattle and Portland were not seen as offering useable models by many of our interviewees, the chief proponents of the use of green technologies in the area of stormwater management and water pollution alleviation, such as *Clean Rivers Cooperative*, the *EPA* and *American Rivers*, argue otherwise. Each of these organizations has champion Seattle and/or Portland in their literature, at conferences and workshop, and during individual presentations as useful and usable models for other cities.

Although it might appear that the reluctance to utilize models developed by acknowledged leaders is an incongruity that neither the federalism nor the policy transfer literatures can account for, upon further investigation this study discovered a partial explanation: there is a strong preferences for municipalities to look for ideas from what was referred to as the “menu of activities going on in municipalities *within* their state” (Golf). According to Golf, the reason for this was that if the municipality “was to look outside the state for ideas to much effort would be needed to adapt them” to the local economic, legal, social and political system. Every interviewee operating within a state institution believed that to get a new LID technique put into practice “it would have to be scrutinized

by too many actors to make out of state models relevant” (Alpha). Some of the reasons given for not engaging in transfer included: the belief that any out of state LID would have to pass through the local planning commission, comply with local zoning codes (e.g. minimum street width, house setback requirements), be capable of being integrated into the structure of the existing sewer system and its minimum load requirements, health districts (particularly their codes and practices relating to waterborne pathogens), make its way through the local legislative process, and be capable of surviving legal challenges by those negatively impacted by the new technique (road builders and construction companies who will have to integrate the new LID technologies, households who may have to disconnect their downspouts and install rain barrels, or where house owners who may have to re-build parking lots or add green roofs). Ultimately fear about the local conditions resulted in a widespread pre-determined belief that “The examples we have found most helpful have been in neighboring jurisdictions that are under similar regulatory systems” (Beta).

Beta brings up an important point. The relatively low level of active cross-jurisdictional transfer does not indicate that LID policies are not appearing across the nation. First, it is clear that within the states involved in this study municipal governments are engaged in at least soft emulation of other municipalities within their state. Second, even municipal governments who are not transferring policies and models are required to adopt at least some of the EPA established BMPs (or explain how they will meet their TMDL without their adoption). As such, while LID might not be an example of active policy transfer, and may even be little more than a “niche” in an administrator’s stormwater toolkit, LID techniques are appearing across the nation in practice (and in law) inline with EPA recommendations and regulations.

While the overall pattern was to stay close to home, one municipality did follow the expected pattern of borrowing from a cross-state municipality. The key difference appeared to be that they represented a municipality of over a million people. In this municipality the interviewee discussed the importance of looking around for ideas. However, they were able to limit their search to what they considered to be a clear competitor city of similar size and development. While this goes against the strategy of smaller municipalities it has internal logic since the range of problems and resources ultra large urban catchments encounter are more likely to be reflected by similar municipalities than smaller municipalities in the same state.

## 7.2. *Where was information gathered?*

Municipalities wishing to *learn* from the experience of others have a large number of models to choose from [26]. One of the best ways to engage in the learning process, at a deeper level of understanding (outside learning-by-doing), has been shown to involve actively engaging in face-to-face contact with those involved in the development and implementation of a program. As such, it should be expected that those interested in learning about another jurisdictions LID techniques (particularly within a state) would be seeking opportunities to engage in site visits or administrative exchanges. This was not the case. Only one of our interviewees had engaged in site visits with other cities within their state. While expected, one of the reasons brought to light when discussing why site visits were not conducted was that ‘budgets were not sufficient’ for such exchanges. Interestingly, many of the interviewees brought up the issue of trust. They felt that there needed to be a degree of

trust and honesty as to what worked and what did not work or why a given BMP that was in use might not work elsewhere. One interview went so far as to state that they felt that site visits were too orchestrated to provide useful information. Thus, not only is the cost of a site visit important for explaining the lack of take-up, but also the need to develop trust before a site visit may be partially responsible for the lack of visits.

While site visits were seldom performed, interview data found that our participants often used in-house probes of the Internet and/or the use of a preferred consultancy firm (used for a variety of different consultations). Unfortunately for any long-term impact, this information tends to convey secondary and tertiary information and views. Worse, several of the participants admitted to relying on “non-verifiable online sources” for the majority of their information. While not as widely mentioned, conference and workshop presentations were another source of information used by many of our participants. It is interesting to note that the majority of individuals interviewed reported that when they attended a conference they tended to rely “solely on PowerPoint presentations for information” (Foxtrot). Almost no one, even after being prompted, mentioned face-to-face discussions (whether formal or informal). For the diffusion of LID techniques from one locality to another the problem with an over reliance on PowerPoint is that studies have shown that most PowerPoint presentations tends to convey little hard information and, if not properly used, can actually lead some individuals to learn less than they would have if PowerPoint had not been used [27-30]. By relying on secondary sources for information many actors appear to be limiting their understanding (and subsequent use) of other models. An issue that arises from this is that when poorly understood or incomplete information is subsequently presented to potential policymakers in a new system it is likely to prove less inspiring as a model; which might help explain why less transfer appears to be occurring than the existing literatures on federalism and transfer would suggest should be occurring in the area of stormwater management.

All told what appears to be occurring is that when information is collected it is done in a more augmented fashion than the policy transfer literature suggests or participants realize. As part of this, it is worth mentioning that while most of the individuals interviewed discussed using the Internet to conduct “extensive and comprehensive” (Alpha) reviews of what was occurring elsewhere, on further discussion many disclosed this comprehensive review was based on a single review or one website. This was not seen as a disadvantage to learning or transfer since “there is little need to go beyond it (the Internet) as a source of information because there were sites available that offered comprehensive information” (Foxtrot). Not a single site-visit or personnel exchange was mentioned as having occurred by individuals describing their understanding of another municipalities LID program as comprehensive. Just as interesting, when asked what they were looking for, there was tendency to seek information on benchmark measures and league table positions. While league tables and benchmarks have their purposes it is not really an appropriate source of information for anyone wanting to learn how another system operates. Rather, they point to where others should look for BMPs or ideas. However, when asked directly about whether a search of a league table or benchmark led to further investigation into a more highly positioned system, none of the participants replied in the affirmative.

---

### 7.3. *Why was transfer so limited in nature?*

It appears that in the municipalities studied, the efforts of the federal government to foster cross boundary transfer are not as easy as leading a horse to water. Rather it is more like leading a horse to water and then trying to find a way to make it drink (or realize there is water to be drunk). Why is this the case? One reason emerges out of the governing structures created in the US Constitution. By allowing each state to establish its own governing system, legal codes, local governing patterns and powers the Constitution made it possible for a range of different legal and governing regimes to emerge across the US. This has led to a situation where it is difficult for actors to directly transfer a BMP from one municipality to another (especially when the models must travel across state or national lines or enter a system where it faces a “hostile” political/social culture). Issues as small as the states designation of a body of water can impact what can be transferred or adapted once transferred. This is multiplied exponentially when it is realized that most building and zoning codes are established at the local level (making it almost impossible to simply copy a model from one municipality to another). Added to this, a plethora of local and state legal systems operate in the realm of water management. This has a dramatic impact on the type and kinds of LID technologies that can be integrated into existing local and state legal codes. In fact, even the way sewer networks are funded has an impact on what can and cannot be accomplished with LID technologies.

In light of this, it should come as little surprise that the US political system may offer the opportunity to act as a laboratory of democracy, but once disaggregated to the local level, this laboratory is less capable operating as a transfer platform than federal efforts and beliefs would aspire to. In other words, the “lack of unified policies and legislation regarding integrated water resource management make one model (inadequate)...when seen across multiple municipal boundaries or watersheds even BMP models used elsewhere are not transferrable” (Indigo).

While the federal structure is a source of innovative ideas and practices, the ability of state and local entities to develop their own legal and regulatory codes and practices hinders the transfer process, even when promoted and mediated through the EPA. As a result of variations in codes and practices, many local agents only engage in cursory searches, which imposes a natural barrier to the learning and transfer processes offered by the federal system. A culture emerges that says we are too unique to learn from others; and, when the culture says that looking close to home is safe—it may not provide the variation in policies and techniques needed to reassess the way one is developing their own LID infrastructure. Similarly while the Internet and Power Point can convey a range of data, the data is unlikely to provide detailed information needed to see what it is about a local setting that provides for success or failure. Relying on presentations neglects the fact that few organizations are going to openly or fully discuss failures or difficulties at conferences and workshops [31]. Without this information it is unlikely that the type of understanding needed to establish if any given technique might be appropriate if adopted will emerge.

The limit of initial searches was magnified by a general lack of post-search evaluation. This led to a widespread, though undoubtedly incorrect, belief that most of the LID techniques seen as BMP by the EPA and others could not be used (or adapted) to a particular locality if transferred. In the words of Alpha, their jurisdiction “had to be the trailblazers, nothing we found in the À la Carte approaches of other communities would be enough to help us”. While this might be true, Alpha went on to

described their search and evaluation as being “online and of an ‘elementary’ nature... a simple examination of performance benchmarks”. While in the mind of the individual they may have gathered a comprehensive understanding of what was occurring elsewhere from performance benchmarks, however it is hard to believe that there was nothing “out their” worthy of transferring given the fairly limited amount of information gathered and evaluated.

Before concluding it is worth mentioning that part of the explanation for the lack of transfer observed in this study may have to do with the nature of LID. For instance, policymakers interested in models that integrate LID on individual land parcels will have to find ways that they can gain the compliance and acceptance of the residents. Thus, it is possible that some of our participants found a model they liked but as a result of practical operational issues they were prevented from transferring or adopting it. In a similar way, some LID technologies will be rejected (regardless of its applicability) due to the number of authorities involved in the development and implementation of LID in any given municipal area. By way of illustration, in areas where the water authority is different from the tax authority, whom is different from the sewer provider, it could be that a perfectly viable LID program could be desired by the water authority, but they have no ability to fund the project (particularly in municipalities relying on public sector water authorities rather than private sector authorities). Even matters as simple as technologically advance LID techniques, requiring specialist skills to install and maintain, may prove impossible to transfer to smaller municipalities. Thus, while this study focused on the characteristics of the municipal there are a number of other possible (contributory) reasons that municipalities may not engage in policy transfer when developing LID in response to NPDES requirements [32].

All told, local governments maybe “laboratories of democracy” however, it appears that these laboratories are not very good at transferring their experiments to others. This preference for not engaging in transfer or doing so by “staying-close-to-home” remained true even amongst the 12 participants who accepted in follow-up interviews that the “EPA’s information on BMP offered a range of more appropriate models” than they thought “were being used by other jurisdictions in their state” (Tango).

## 8. Conclusion

Over the past 30-years a natural experiment has emerged in the area of stormwater management. As states and localities respond to the CWA and integrate a range of LID programs and technologies into their stormwater programs, LID policies and technologies should be spreading around the nation. The networks that developed around stormwater management and the EPA’s efforts to promote BMP further support this hypothesis. However, while not arguing that no transfer has taken place, the outcome of widespread transfer does not appear to be occurring. Not only have acknowledged leaders not acted as models, but after conducting “searches” for solutions, local municipalities appear to be rejecting even the most tired-and-tested LID technologies due to fairly surface level searches of online documentation and benchmarking measurements.

The lack of transfer observed in this study was not only due to the lack of concerted examination of what was occurring in other jurisdictions but also a range of beliefs surrounding the uniqueness of one’s own legal, economic and political systems. While it is true that states and local governments

have developed a cornucopia of different environmental, building and legal codes, social systems and local governing patterns, it is questionable as to whether these impose as much an impediment to transfer as discussed by participants. It is clearly not true that none of the LID techniques being used in Seattle or Portland could be successfully transferred to the North East as was suggested in some of our interviews. Just consider; tree boxes, French drains and permeable pavements have been successfully integrated into the stormwater programs around the globe: including Seattle and Portland.

The poor uptake of BMPs appeared to be truer for jurisdictions where actors were motivated by political or ideological factors. For instance, four of our interviewees specifically mentioned that one of the problems faced was that “the potential users of their information [the policymakers] were not motivated to use the ideas they offered” (Golf). As such, one of the hidden problems discovered was that often the needs of technocrats involved in the day-to-day delivery of the EPA’s program were different from the needs of elected officials. So while, one set of actors may be very interested in learning and transferring ideas and information, another set that must become involved in the process not only block movement but even the desire to engage in a process that is seen as futile.

All told, while federalism should be leading to the cross-fertilization of ideas and models across the nation, this is not the case. What seems to be occurring in the area of stormwater management is a balkanization, where many localities appear to be re-inventing the wheel rather than learning from each other.

### Conflict of Interest

The author declares no conflicts of interest in this paper.

### References

1. Copeland C (2010) Clean Water Act. Washington DC: Congressional Research Service; ii.
2. National Pollution Discharge Permit System. Washington DC: EPA, 2015. Available from: <http://water.epa.gov/polwaste/npdes/stormwater/index.cfm>
3. Federal Water Pollution Control Act, Washington DC: US Senate. 2015. Available from: <http://www.epw.senate.gov/water.pdf>
4. Department of Transportation, Washington DC. 2015. Available from: <http://environment.fhwa.dot.gov/ecosystems/ultraurb/index.asp>; <http://water.epa.gov>
5. Fischman R (2005) Cooperative Federalism and Natural Resources Law. *New York Univ Environ Law J* 14: 182-188.
6. US v. DARBY, 312 US 100 (1941). Available from: <https://www.law.cornell.edu/supremecourt/text/312/100>
7. Daniel v. Paul. 395 US 298 (1969); Heart of Atlanta Motel, Inc. v. US. 379 US 241 (1964); Perez v. US. 420 US 146 (1971); Wickard v. Filburn. 317 US 111 (1942). All available from: <https://www.law.cornell.edu>
8. Welborn D (1988) Conjoint Federalism and Environmental Regulations in the US. *Publius* 18: 27-43.

9. Xian G, Crane M, Su J (2007) An analysis of urban development and its environmental impact on the Tampa Bay watershed. *J Environ Manage* 85: 965-967.
10. Gaffield S, Goo R, Richards L, et al. (2003) Public Health Effects of Inadequately Managed Stormwater Runoff: *Am J Public Health* 93: 1527-1533;
11. Gilbert J, Clausen J (2006) Stormwater runoff quality and the quantity from asphalt, paver, and stone driveways in Connecticut. *Water Res* 40: 826-832.
12. Dargie C (2004) Finding the Ways Through the Phase II Maze: Coastal Cold Weather MS4s and the EPA's New Stormwater Regulatory Program. *Oceans Coastal Law J* 10: 81-116.
13. Alimo Water Softeners, Why is Water Quality Important? 2012. Available from: <http://alamowatersofteners.com/water-quality-important> .
14. Saegrov S, Saegrov J, Thorolfsson M. Urban Drainage in Cold Climates, UNESCO: Paris. 2000. Available from: <http://unesdoc.unesco.org/images/0012/001225/122599eo.pdf>
15. Hueiwang A, Englande A, Bakeer R, et al. (2005) Impact of urban stormwater runoff on estuarine environmental quality. *Estuar Coast Shelf Sci* 63: 513-526.
16. Ostrander M, Loving the Puget Sound to death; The Nation. 2015. Available from: <http://www.thenation.com/article/loving-puget-sound-death>.
17. Digest of Federal Resource Laws of Interest to the U.S. Fish and Wildlife Service. Federal Water Pollution Control Act (Clean Water Act), Federal Register: Washington DC. 2012. Available from: <http://www.fws.gov/laws/lawsdigest/FWATRPO.HTML>
18. White S, Boswell M (2006) Planning for Water Quality. *J Environ Plann Man* 49: 141-160.
19. EPA: Washington DC. 2015. Available from: <http://water.epa.gov/polwaste/nps/whatis.cfm>
20. EPA (2000) National Water Quality Inventory Report (EPA-841-R-02-001), Washington, DC: USEPA Office of Water; EPA (2002), Water Quality Conditions in the United States (EPA-841-F-02-003), Washington, DC: USEPA Office of Water.
21. EPA. MPDES Home. Washington DC: EPA. 2014. Available from: <http://cfpub.epa.gov/npdes/index.cfm>.
22. USEPA. Combined Sewer Overflows, EPA 832-B-95-003. 1995. Available from: <http://nepis.epa.gov/Exe/ZyNET.exe/200041XP.TXT?ZyActionD=ZyDocument&Client=EPA&Index=1995+Thru+1999&Docs=&Query=&Time=&EndTime=&SearchMethod=1&TocRestrict=&Toc=&TocEntry=&QField=&QFieldYear=&QFieldMonth=&QFieldDay=&IntQFieldOp=0&ExtQFieldOp=0&XmlQuery=&File=D%3A%5Czyfiles%5CIndex%20Data%5C95thru99%5Ctxt%5C00000002%5C200041XP.txt&User=ANONYMOUS&Password=anonymous&SortMethod=h%7C-&MaximumDocuments=1&FuzzyDegree=0&ImageQuality=r75g8/r75g8/x150y150g16/i425&Display=p%7Cf&DefSeekPage=x&SearchBack=ZyActionL&Back=ZyActionS&BackDesc=Results%20page&MaximumPages=1&ZyEntry=1&SeekPage=x&ZyPURL>
23. Lower Towamensing, Stormwater Management MS4 Permit. Carbon County Pennsylvania: Township Supervisors. 2015. Available from: [http://www.lowertowtp.com/index.php?option=com\\_content&view=article&id=78&Itemid=56](http://www.lowertowtp.com/index.php?option=com_content&view=article&id=78&Itemid=56)
24. Denzin B, Local Water Policy Innovation. Madison, Wisconsin: American Rivers & Midwest Environmental Advocates. 2008. Available from: [http://water.epa.gov/infrastructure/greeninfrastructure/upload/gi\\_localwaterinnovation.pdf](http://water.epa.gov/infrastructure/greeninfrastructure/upload/gi_localwaterinnovation.pdf)

25. Kloss C, Calarusse C (2008) Rooftops to Rivers. New York: National Resource Defense Council; 8.
26. EPA, Smart Growth. Washington DC: EPA. 2012. Available from:  
<http://www.epa.gov/smartgrowth>
27. Tufte E, The cognitive style of PowerPoint. 2011. Available from:  
<http://www.edwardtufte.com/tufte/powerpoint>
28. Norvig P (2004) PowerPoint: shot with its own bullets. *Lancet* 362: 343-344;
29. Pidwirny M, Jones Scott. The Natural Spheres: The Hydrologic Cycle. British Columbia: PhysicalGeography.Net. 2012. Available from  
[http://www.physicalgeography.net/fundamentals/5c\\_1.html](http://www.physicalgeography.net/fundamentals/5c_1.html)
30. McKendrick J, Is PowerPoint dumbing down our decisions? 2010. Available from  
<http://www.smartplanet.com/business/blog/business-brains/is-powerpoint-dumbing-downour-decisions/1709>
31. Sears DO, Freedman JL (1967) Selective exposure to information: A critical review. *Public Opin Q* 31: 194-213.
32. Rogers E (2003) Diffusion of Innovations. 5th rev. ed. New York: Free Press.



AIMS Press

© 2015 David P. Dolowitz, licensee AIMS Press. This is an open access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>)