A Guide to the Standardized Framework Project for Puget Sound Stormwater System Mapping

Produced by King County with a grant from the Washington State Department of Ecology

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Preface

The Standardized Framework Project for Puget Sound Stormwater System Mapping was a collaboration facilitated by ROADMAP (Regional Operations and Maintenance Program), a consortium of municipalities that share information and ideas about the operations and maintenance of stormwater systems and about compliance with National Pollutant Discharge Elimination System (NPDES) municipal stormwater permits. Thirty-five entities from across Washington state, including thirty-three cities and counties and two state agencies contributed materials on their stormwater system mapping schemas, terms, or definitions to kick off the project. Representatives of 13 entities, including the cities of Bellevue, Burien, Covington, Everett, Maple Valley, Newcastle, Sammamish, and Tacoma, the counties of King, Pierce, and Snohomish, and the Washington State Department of Transportation (WSDOT) and the Washington State Department of Ecology (Ecology) participated in a series of meetings to develop and refine this project’s products. Ecology provided project funding through a Municipal Stormwater Grant of Regional or Statewide Significance (MSGRSS), fiscal year 2012.

King County was the recipient of Ecology’s grant and a team from the Stormwater Services Section shaped and managed the project, but the effort would not have been possible without the dedication, collaborative spirit, and donated time of all participants. The King County team offers them sincerest thanks for their ideas, time, and belief in the project. The team also thanks Ecology for supporting the project not only with funding, but also by sending a representative to
participate in the group process. And finally, a hearty thank you to the City of Federal Way, which provided space and coffee for our group process.

Background

This project is the first step toward improving the compatibility of stormwater system mapping data in the Puget Sound Region and perhaps even beyond.

Presently, there is no standard terminology used to describe the components of stormwater management systems. While the physical system components are fairly standard, without standard terminology, the terms different entities use for these components vary, sometimes even within different branches of the same entity. Not only do the terms differ, they are rarely defined. It’s almost as though different stormwater languages have sprung up in the silos of different stormwater management organizations. These organizations need standard terms for commonly used stormwater system components to enable effective collaboration.
The problem of inconsistent terms for common stormwater system elements makes it extremely challenging to share stormwater system data and create a common database. The problem is compounded by a lack of a formalized framework for thinking about stormwater systems. Without a standardized framework, individual databases are incompatible and a common database for neighboring or regional stormwater systems is impossible.

ROADMAP participants have long noted the challenges created when information about stormwater systems is fragmented by jurisdictional boundaries. They made work on a common stormwater system framework and spatial database a priority idea for possible grant funding, realizing the unlikelihood and impracticability of any one municipality taking it on with its own funding. This project takes a step towards realizing that vision long held by ROADMAP participants of creating a regional stormwater system map and shared data by creating standard terminology for stormwater systems and a standard framework for a geodatabase structure.

Goal of the Standardized Mapping Framework Project—a cohesive map of the stormwater system that transcends jurisdictional boundaries
Process

We began the process by researching the development of data structures, or ontologies. The project team reviewed many online resources. The most accessible guide, which we used to create much of our project plan, was *Ontology Building*, a presentation by Umi Laili Yuhana.

The next step in the process was the collection of available documentation for existing stormwater system terminologies. The team requested stormwater dictionaries from stormwater managers throughout Washington state. We received material from thirty-five entities, mostly in the form of ESRI (Environmental Systems Research Institute) GIS (geographic information systems) database schemas, though a handful of municipalities did provide actual dictionaries for the terms they used. Upon inquiry, we found that those municipalities were the only ones that had actual documentation for the meaning of the terms they used.

We then entered terms used in the materials we received into a spreadsheet. We hoped that by sorting the entries we could discern clusters of similar terms and from them propose a standard term. We also hoped that we could use the spreadsheet to identify synonymous terms and provide an effective thesaurus to the participating jurisdictions. What we found instead after days of trying to analyze the spreadsheet, was that even though we had years of stormwater management experience, we had no idea what many of the terms referred to and were challenged to find term clusters, unsure if similar terms were referring to the same stormwater system component. We needed to come up with a new approach.
After a break for the holidays, inspiration struck! We came up with a visual framework that described stormwater system functions and the components that performed those functions. The framework was hierarchical in nature and provided a structure that could be translated into a spatial database. It included our proposals for standardized terms for stormwater system components.

We presented our work to ROADMAP at its March meeting and on April 10 began, with a self-selected group of ROADMAP representatives, a series of workshops focused on refining the framework, agreeing on standard terms, and creating a dictionary for those terms. Unfortunately, we did not have time within the window of grant funding to finish work on the framework and dictionary. While we did identify and define most of the terms for stormwater system components are, we noted, but did not define, terms for regulatory constructs like UICs (underground injection controls) and outfalls. These terms are of interest to this mapping-related project because, while they would ideally be identified using a data analysis, in the absence of a fully mapped stormwater system, regulatory language demands that a way must be found to map them in the field. In addition to these conceptual stormwater system components, the group ran out of time before it was able to agree upon and define standard terms for attributes of the physical system components.

As an aide to the definition process, the team developed a spreadsheet comparing the definitions from a variety of entities for some of the terms we selected.
Concurrently with the workshops and continuing after they were through, the team began to translate the definitions into a tabular format as preparation for work on a field application. The Washington Stormwater Center graciously consented to host our materials on their website. They can be found by following the Technical Tools link under Municipal Resource Program on the [homepage](http://www.wastormwatercenter.org/standardized-mapping-framework/).

**About the Framework**

The framework we have created for stormwater system mapping provides context for stormwater system terms by relating them to system Functions, named Convey, Control, and Connect. A fourth Function, Concept, was identified as a location for regulatory terms used in stormwater permits and codes. These terms are not necessarily part of the physical infrastructure, but represent defined circumstances that have a locational element and must be mapped when insufficient data exists in a stormwater system database to locate them through data analysis.

The Functions are the highest tier in what is a hierarchical framework. The next tier is characterized as Function Type, and further characterizes the use of stormwater system elements, named in the third tier, Components. The fourth tier, Component Types, distinguishes among the variants of each Component. A fifth tier, Descriptors, is intended to capture the attributes of Components that are commonly tracked by municipalities. Examples include size, material, condition, etc. By the end of the group process, most of the terms in the first four tiers had been agreed upon and defined.
This framework is not a rigid set of hierarchical rules; rather, it is a guideline for understanding how a stormwater system works, thus providing context for stormwater system terms. We had expected to identify standard terms at the beginning of the project and use these to create the framework. What we found was that we needed the framework in order to identify, and agree upon, appropriate terms.

**About the Dictionary**

The definitions we created for the standard terms used in the Hierarchical Framework contain two parts, a functional definition and a structural definition. Several terms in the dictionary may share the same functional definition, but no two terms should ever share the same functional and the same structural definition. For example, many catch basin types share the same functional definition, but their structural definitions vary.

This dictionary is designed to be widely used and the effort to make it readily translatable among entities with different stormwater system languages has resulted in broader definitions. Assuming the terms we have selected for the framework become more widely used and accepted, we expect refinement of the definitions, with increased precision.

An example of the tendency of the process to choose broad terms involves the Component “Vault/Pond.” Within the timeframe of the grant, the workshop participants could not agree upon a way to distinguish between the term “vault” and the term “pond.” Finally, to avoid an impasse and move the project along, the group decided to combine the separate terms into one.
Continued refinement of this dictionary will reveal whether “Vault/Pond” persists as a combined term, is subsumed within another broader term, or is broken out again into two separate terms.

The future of the work

We have identified the following list of ways to move this work along on the path to creating a shared geodatabase for stormwater system mapping information in the Puget Sound Region, and perhaps beyond.

- Further refine and develop the Standardized Framework and terminology. While most of the elements in the Framework have been named and defined, work is still needed on terms for the descriptive information that is gathered.
- Provide for vetting of the Framework and dictionary in a larger community of stormwater managers.
- Expand the comparison of external definitions for the standard terms.
- Create a geodatabase using the standard terms.
- Develop a mechanism for populating the geodatabase with data from the region’s stormwater system managers.
- Use the geodatabase to create an online map.
- Expand the geographic area of the database.
- Finish the Stormwater Field Mapping Application. This objective would provide a tool to standardize data collection. Entities that have not already developed their own data structure could choose to use this tool for data collection, and to then migrate the data via
a programmed process after field collection. King County plans to pilot this idea, creating a test geodatabase based upon the Framework.

- Secure a funding source or sources to support the tasks above. Potential sources include the following:
  
  i. Future Washington State Department of Ecology Municipal Stormwater Grant of Regional or Statewide Significance grants
  
  ii. ESRI (Environmental Systems Research Institute) grants
  
  iii. FGDC (Federal Geographic Data Committee) grants