Draft Standards and Guidelines for Digital Drainage System Data

Summer, 2009

INTRODUCTION

The Municipal Separate Storm Sewer System (MS4) General Permit requires permittees to map certain parts of their conveyance and hydrologic systems. In addition to fulfilling this permit requirement, storm sewer maps have other potential uses, including aiding in emergency response, water quality management, and vector control.

Although regulated MS4s must map parts of their system, there is no standard approach to collecting and compiling this information. The result is that adjacent storm sewer systems often do not link to each other, even though they generally behave as a single hydrologic system.

OBJECTIVE

The purpose of this Standards and Guidelines for Digital Drainage System Data (Standard) is to standardize geospatial information for storm sewer systems. The standard should allow data transfer and linkage of maps developed by different entities. This Standard specifies the names and definitions for storm sewer system components that can be geospatially depicted as feature types with attributes.

SCOPE and APPLICABILITY

This Standard supports a wide range of potential uses, including meeting permit requirements, storm sewer system inspections and maintenance, emergency response, water quality management, vector control, project scoping and design (e.g. road expansions), and drainage permit requests. The Standard presents a recommended structure to facilitate collecting and compiling information about a storm sewer system.

DEVELOPMENT PROCESS

Following an initial meeting with the Governor's Council on Geographic Information Standards Committee (GCGISC), a multidisciplinary team representing several public and private entities was formed to draft a standard. The group met twice in spring of 2008 to discuss development of the standard. A draft standard was developed during the summer and fall of 2008.

A survey of regulated MS4s was conducted in summer of 2008 to identify existing mapping practices. Of 233 MS4s invited to take the survey 120 (51 %) responded. Information from the survey was considered in development of the standard. The survey results are summarized in Appendix A.

The draft Standard was presented to the GCGISC in early 2009. The Standard was subsequently approved by the GCGISC.

IMPLEMENTATION and MAINTENANCE

The approved standard will be distributed to regulated MS4s via electronic communication. **Need information about an outreach plan and maintenance here.**

PARTS of the STANDARD

The Standard consists of a list of definitions and two Appendices. Appendix B contains a comprehensive Feature report which is organized by Feature Type (line or point). The Feature report lists feature definitions, attributes for each feature, and attribute values for each feature. Appendix C contains an Attributes report which contains a complete listing of attributes, including attribute name, definition, and examples.

COORDINATE SYSTEM AND GEOGRAPHIC REPRESENTATION

An important goal of the Standard is to allow adjacent storm sewer maps to link. To accomplish, the following procedures should be implemented.

1. Digital data for drainage systems should be created using a standard geographic coordinate system such as the Minnesota State standard (UTM Zone 15, meters, NAD 83) or similar local standard coordinate system such as a local county coordinate system.
2. The coordinate system used for the drainage system data should be clearly documented in a metadata file that accompanies the data.
3. Sewer and open channel lines should be digitized as a single line between structures and stored in a single data layer or feature class dataset separate from the point features.
4. Structure nodes should be digitized as a point feature snapped to the endpoint of a sewer or open channel and stored in a single data layer or feature class dataset separate from the line features. These features may be symbolized as desired (e.g. circles for maintenance access holes) for cartographic production.
5. The end point of a sewer or open channel lines should be snapped to the end point of any connecting sewer or open channel as well as the intervening structure node.
6. An appropriate structure node should be digitized at every junction of two or more sewer or open channel lines.
7. Sewer and open channel lines should be digitized in the direction of physical flow starting at the upstream point and ending with the downstream point.
8. Additional cartographic flourishes, such as arrows or flared end sections should be maintained in a separate data layer.
9. **What base shape files, if any, should we specify here?**

DEFINITIONS

Feature type - definition and description of a set (class of real world phenomena) into which similar features are classified. A feature type can be a point, a line, or a polygon. Polygons are represented as points in this Standard.

Feature - real-world spatial phenomenon about which data is collected, maintained, and disseminated. Features are geospatial objects that are graphically delineated in a spatial database. Examples include pipes and ponds.

Attribute - a defined characteristic of a feature. Examples are the length of a pipe or drainage area of a pond.

Value - a specific quality or quantity assigned to an attribute for a specific feature. Examples are the units of height for a pipe or units of area for a pond.

Geospatial data - data with implicit or explicit reference to a location relative to the earth.

Appendix A – Results from a storm sewer survey distributed to regulated MS4s

Do you represent a:[1]		Number	Percent
	Uncorrected		
	Designated MS4	51	42.5
	Mandatory city	51	42.5
	Township	6	5.0
	County	7	5.8
	Watershed district	4	3.3
	More than one of the above	1	1.7
	Corrected		
	Designated MS4	38	31.7
	Mandatory city	61	50.8
	Township	6	5.0
	County	7	5.8
	Watershed district	4	3.3
	Nontraditional	2	1.7
	Phase 1	1	0.8
	More than one of the above	1	0.8
Does your organization own or maintain storm sewers?			
	Yes	114	95.0
	No	6	5.0
Are the storm sewers mapped?			
	Yes	110	96.5
	No	4	3.5
What format are your maps in?[2]			
	CADD - Microstation	6	5.3
	AutoCADD	49	43.0
	Other	8	7.0
	GIS – Shapefile	44	38.6

[1] Several respondents answered this question incorrectly. To the best of our ability, we corrected the responses. Both corrected and uncorrected data are show.

[2] The cumulative percent does not add up to 100 because some MS4s utilize more than one format.

	GIS - Geodatabase	33	28.9
	GIS - 3rd party database	7	6.1
	Other	9	7.9
	Don't know	6	5.3
What features do you map?[3]			
	Pipes (24" and over)	99	86.8
	Pipes (under 24")	97	85.1
	Ponds, streams, lakes, wetlands	82	71.9
	Outfalls	96	84.2
	Structural pollution control devices	72	63.2
	Constructed ponds wetlands	77	67.5
	Other surface waters	45	39.5
	Catch basin	96	84.2
	Storm sewer inlets	91	79.8
How often do you update your mapping system?			
	Monthly	4	3.5
	Quarterly	3	2.6
	Annually	37	32.5
	When needed	67	58.8
Are your maps publicly available?			
	Yes	43	37.7
	No	71	59.6
In what form are your maps?[4]			
	Paper maps available at city hall	37	86.0
	Noninteractive web-based	12	27.9
	Interactive web-based	2	4.7
Does your mapping interface with other applications?			
	Yes	48	42.1
	No	63	55.3

[3] The percent represents the percent of 114 respondents for each of the structural devices.
[4] The cumulative percent does not add up to 100 because some MS4s utilize more than one format.

	No answer	3	2.6
Are you interested in any of the following opportunities?[5]			
	Kept up to date on progress of group	82	71.9
	Participate in pilot study	23	20.2
	Not interested at this time	20	17.5

[5] The cumulative percent does not add up to 100 because some MS4s utilize more than one format.

Appendix B – Feature Report

FEATURE TYPE: **Line**

FEATURE: **Pipe**
DEFINITION: **A connecting device used to carry a substance from location to location**
ATTRIBUTES:
- ID
- Shape
  - Value: Round, Arch, Box, Elliptical, Tunnel, Other
- Material
  - Value: Concrete, Plastic, Steel, Aluminum, Brick/Masonry, Other
- Height
  - Value: Inches
- Width
  - Value: Inches
- Length
  - Value: Feet
- Data Accuracy: 0.5-2 meter, 2-5 meter, 5-10 meter, < 0.5 meter, > 10 meter,
  - Unknown **What does accuracy refer to here and in other places in the document, and are the units consistent with other features and attributes?**
- Flow Direction **Is there a value associated with this attribute?**
- Ownership
- Maintenance Responsibility

FEATURE: **Ditch** **Does this include swales?**
DEFINITION: **an open constructed channel used to carry a substance from location to location**
ATTRIBUTES:
- ID
- Flow Direction
- Ownership
- Maintenance Responsibility

FEATURE: **Stream**
DEFINITION: **an open non-constructed channel used to carry a substance from location to location**
ATTRIBUTES:
- ID
- Flow Direction
- Ownership
- Maintenance Responsibility

FEATURE: **Connector**
DEFINITION:
ATTRIBUTES:

ID:
Type
Value: Lake, Pond, Wetland **Are these the only connectors? Lift Stations?**
Flow Direction
Ownership
Maintenance Responsibility

FEATURE TYPE: **Point**

FEATURE: **Pond** **Does this encompass catch basins? If not, is a catch basin a feature or an attribute of pond? Does this encompass lakes?**
DEFINITION: A small body of water that essentially lacks a horizontal flow component. Ponds can be constructed or natural. Ponds can have a significant vertical flow component if constructed for temporary storage.
ATTRIBUTES:
ID
Type
Value: Wet, Dry, Unknown **How these are defined may differ for different entities. For example, what about a dry pond that isn't performing and allows for breeding of mosquitoes?**
Area
Value: Acres
Mean Depth
Value: Feet
Contributing Drainage Area
Value: Acres
Constructed
Value: Yes or No
Data Accuracy: 0.5-2 meter, 2-5 meter, 5-10 meter, < 0.5 meter, > 10 meter, Unknown **What does accuracy refer to here and in other places in the document, and are the units consistent with other features and attributes?**
Ownership
Maintenance Responsibility

FEATURE: **Structural Pollution Control Device** **Is SPCD a type of structure, or is it a feature?**
DEFINITION: A constructed device used to treat stormwater runoff
ATTRIBUTES:
ID
Type
Value: Grit Chamber, Sump Manhole, Skimmer, Separator, Filter, Infiltration Device, Other
Length
Value: Feet
Width
Value: Feet
Invert Elevation of Outlet

Value: Feet above MSL
Bottom Elevation
Value: Feet above MSL
Contributing Drainage Area
Value: Acres
Infiltration Rate (if applicable)
Value: **in/hr**
Data Accuracy: 0.5-2 meter, 2-5 meter, 5-10 meter, < 0.5 meter, > 10 meter, Unknown **What does accuracy refer to here and in other places in the document, and are the units consistent with other features and attributes?**
Ownership
Maintenance Responsibility

FEATURE: **Structure**
DEFINITION: A constructed device that does not treat stormwater
ATTRIBUTES:
ID:
Type
Value: Manhole, Catch Basin, Drop Inlet
Height
Value: feet
Data Accuracy: 0.5-2 meter, 2-5 meter, 5-10 meter, < 0.5 meter, > 10 meter, Unknown **What does accuracy refer to here and in other places in the document, and are the units consistent with other features and attributes?**
Ownership
Maintenance Responsibility

FEATURE: **Outfall**
DEFINITION: The place where effluent is discharged into receiving waters
ATTRIBUTES:
ID
Type
Value: Pipe, Ditch, Apron
Ownership
Maintenance Responsibility

Appendix C – Attribute Report

Area: The overall surface area of a feature. An example is an area of 10 acres for a pond.
Bottom Elevation:
Contributing Drainage Area: The overall surface area draining to a feature. An example is 300 acres draining to a wet pond.
Data Accuracy
Flow Direction: The direction of flow within a line feature.
Height: The overall height of a feature, measured from inside faces. An example is a pipe that has a 20 inch height (inside diameter of 20 inches).
ID: A unique numerical identifier given to a feature. An example is a dry pond located at the intersection of 1st Street and 1st Avenue and given a unique ID of 1001.
Infiltration Rate:
Invert Elevation of Outlet:
Length: The overall length of a feature, measured between connecting points or a connecting point and an outfall. An example is a ditch that is 2000 feet in length and connected by two ponds.
Maintenance Responsibility: Entity responsible for maintaining a feature. Examples include entities that manage ditches or swales along roads, such as a city, county, or the Minnesota Department of Transportation.
Material
Mean Depth: The average depth for a feature
Ownership: Entity that owns a feature. Examples include entities that manage ditches or swales along roads, such as a city, county, or the Minnesota Department of Transportation.
Shape
Type
Width: The overall width of a feature, measured from inside faces. An example is a pipe that is 20 inches in width (20 inch inside diameter).