



# Stormwater Drainage System Information Sources, Documentation, and Permitting

Design Manual

Chapter 4

Drainage

Originally Issued 10-29-10

This section addresses the following:

- [Drainage information sources](#),
- [Documentation](#), and
- [Permitting](#).

## Drainage Information Sources

Drainage information (contour maps, drainage areas, flooding concerns, maintenance issues, soil types, as-built plans, etc.) can be obtained from a variety of sources including state, Federal, and local offices. To facilitate the design process, obtain information commensurate with the proposed facility's complexity, risks, and costs.

### Drainage Maps

The first step in designing a roadway drainage system is to prepare a drainage map that shows the entire area (referred to as a drainage basin) the proposed improvements will drain, as well as on- and off-site areas that drain or convey stormwater to the project drainage system. Contour maps serve as excellent drainage maps when supplemented by field reconnaissance. These maps may be available from the preliminary survey crew.

### Electronic Data

Survey and Photogrammetry are the primary sources of information for the Office of Design. Refer to Table 1 for a list of files they provide.

**Table 1: Survey photogrammetry and files.**

file*	file type and information contained
<i>ProjectNumber.pho</i>	MicroStation file containing all existing features. The photogrammetry file contains both photogrammetry and survey information.
<i>Number.sur</i>	MicroStation file containing all existing features. The survey file contains only survey information.
W:\Highway\Design\CADD\Geopak\Survey\Manual\FeatureCodes\FullManual.pdf	PDF file containing feature codes with descriptions, feature code full descriptions, feature code breakdowns, and zone and color descriptions used in the .PHO and .SUR files.
<i>ProjectNumber.pho</i> , contour model	MicroStation file containing contour models made from the TIN file. (Some areas may not be accurate due to interpolation by the software.)
<i>ProjectNumber.tin</i>	Electronic file containing all the survey shots that have been interpolated to provide, when visualized, a surface model of the existing topography. (Some areas may not be accurate due to interpolation by the software.)
<i>Number.gpk</i>	GEOPAK file containing existing alignments used for existing surveying.

\* These files are in either the Photo or the Prelim Survey folder (or the SURVEY folder located in the Photo folder) located in the project directory. The names of these files often vary, but the extensions are usually the same. Contact Photogrammetry or Survey to request additional information or for help finding files.

**CADD:** See Section [4A-51](#), Creating a Survey Report, to show existing features such as bottom of well, form grade, and flow line elevations.

### Other sources

Table 2 provides additional information sources.

**Table 2: Additional sources of information for stormwater drainage system design.**

		source		
		prelim survey	city	United States Army Corps of Engineers
information	Drainage plats	Zoning Plans	Flood studies	ERMS As-Built plans
	Utility plats	Planning Maps	Other information about flood plains and flood control areas	Prelim plan and profile sheets
		Future street and storm sewer plans	Flood control plans	Prelim cross sections
		Drainage studies	Levee construction plans	LIDAR
		Plans for existing systems		USGS topographic maps
		Future construction or replacement of utilities		Contour maps
				Aerial photos



Survey drainage plats show only drainage areas within the project limits for existing systems. Designers will need to refer to other resources for drainage areas outside the project limits that drain into the existing system.

## Documentation

Good documentation is an essential component of stormwater drainage system design, construction, and operation. Documentation not only defines the design process used to determine the final design, it provides information related to construction and operation of the system. Thus, documentation is an ongoing process that starts with information gathering before the preliminary design, and continues on through the design, construction, and operation of the final system.

Documentation that is easy to understand and follow is essential for future reference purposes. A table of contents or executive summary is advised to guide designers and other personnel through the information.

Design documentation should include all the information used to justify the design. What, and how much, is documented may vary from project element to project element. It is up to the designer to make this determination. The designer must keep in mind that documentation acts as a resource for future designers when systems require updates, changes, or rehabilitation. Although documentation does not need to be voluminous, it should be thorough.

Design documentation should contain the following:

1. Table of Contents
2. Executive summary

Information from the Executive Summary will assist in the preparation of the pollution prevention plan (if required).

3. Hydrology (see Section [4A-5](#) for more information regarding hydrology)
  - Existing and Proposed Drainage Base Maps (Watershed maps) including:
    - Flow directions.
    - Watershed boundaries including delineations of off-site areas contributing runoff or contained flow to the site.

- Watershed areas, time of concentration flowage paths.
  - Natural storage areas (ponds, wetlands, areas with potholes).
  - Delineations of other hydraulic features such as karst topography, etc.
  - Photographs documenting features and supporting selection of coefficients.
  - Delineations of flood hazard mapping elements (FEMA 100- and 500-year floodplains, etc.).
  - Land use mapping along with anticipated upstream watershed development over the anticipated life of the stormwater drainage system.
  - Historical information related to drainage concerns.
    - Flood histories, elevations, estimated flows (including open channel ditch and stream water elevation determinations or knowledge with respect to how they may impact the stormsewer profile grade line).
    - Ponding issues
    - Performance of existing structures
  - Features that may affect drainage such as ditch checks, dikes, levees, high banks (such as “spoil banks” along drainage ditches), downstream roadways (driveways) and culverts, low-head dams, etc.
  - Design probabilities chosen and decision for the probabilities selected (including minor design storm and major (flood) check storm values).
  - Hydrologic method chosen and decision for the method chosen.
  - Selected existing, interim construction, and proposed future design coefficients and parameters.
  - Calculations for existing, proposed, and interim construction. Individuals responsible for performing and checking calculations should sign and date the calculations.
4. Storm Drainage System (see Sections [4A-7](#), [4A-8](#), and [4A-10](#) for more information regarding intakes and pipes)
- Information regarding the existing drainage system including, pipes, structures, outfall locations and upstream and downstream open channels.
    - Existing drainage area map with delineated sub-basins draining to each inlet.
    - Layout including designated overland flow routes for major design storms.
    - Detailed list of items including their types, sizes, shapes, materials, invert elevations, age, and condition.
    - Available design information such as existing system design area, time of concentration, design flows, hydraulic grade line, etc.
    - Performance information for the system such as known or expected bottlenecks, known ponding, etc.
    - Assumptions
  - Information regarding the proposed drainage system including pipes, structures, outfall locations, and upstream and downstream channels.
    - Proposed drainage area map with delineated sub-basins draining to each inlet.
    - Layout of the stormwater drainage system including designated overland flow routes for major design storm.
    - Calculations for drainage areas for minor and major storm events, including proposed time of concentration and flows.

- Calculations for spacing and sizing intakes, including width of spread for minor and major storm events along with discussion of overland flow path considerations and evaluations once curb or street crown are overtopped.
  - Calculations for sizing pipes, including energy grade line results for minor and major storm events.
  - Storm drainage outlet evaluation and downstream analysis. Location where runoff drains from the site should be same as existing conditions unless drainage easements are proposed and other drainage impacts are evaluated.
  - Staged construction considerations.
  - Assumptions
  - Maintenance authority utility length cleaning limitations.
5. Open Channels.
    - Stage discharge curves.
    - Cross-sections used to calculate design water surface elevations.
    - Roughness coefficients (“n” values) for existing, interim construction, and completed design.
    - Methods and equations used for existing, proposed and interim construction evaluations.
    - Design considerations of channel and bank erosion including interim construction evaluations required for the PPP.
    - Discussion on evaluation of adequate overland relief with proper easements for major design storm
  6. Local ordinances if more restrictive than the criteria in this chapter.
  7. Local, state and Federal permitting documentation.
  8. Other information to consider adding to documentation files includes, but is not limited to:
    - Aerial photographs.
    - Existing and proposed contour maps.
    - Survey and As-Built plans and data including existing profiles (roadway and driveways, and if necessary, channels).
    - Soil maps.
    - Field trip reports including photographs, videos, and written analysis.
    - Reports or other documentation from Federal, state, or local agencies, newspapers, and abutting property owners.
    - Interviews with local residents, adjacent property owners, and maintenance forces regarding high water marks, street flooding, drainage concerns and past problems, inlet plugging, etc.
    - Design plans and plan revisions (for proposed construction).
    - Periodic inspections and maintenance reports.
    - Utility plans
    - Existing right-of-way information
  9. References including manuals, published reports, letters, etc.
  10. List (and short description if required) of files included.

## Permitting

Refer to Section [10D-1](#) for Storm Water Discharge Permit requirements and the Pollution Prevention Plan (PPP).

# Chronology of Changes to Design Manual Section:

**004A-002**

## **Stormwater Drainage System Information Sources ...**

10/29/2010 NEW

New section. Material in old 4A-2 moved to 4A-3