

Appendix 2-F

Drainage Study Task List

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If you require assistance accessing this information or require it in an alternative format, contact the Michigan Department of Transportation's (MDOT) Americans with disabilities Act (ADA) coordinator at [Michigan.gov/MDOT-ADA](https://www.michigan.gov/MDOT-ADA).

Drainage Study Outline

The purpose of the Drainage Study is to provide supporting calculations and analysis for the stormwater design included in the final plans for drainage areas less than 2 square miles.

The following information may be required in the Drainage Study (Planisware Task 3522):

1. Drainage Study Introduction
 - A. Purpose of project
 - B. General overview of the existing drainage system
 - C. Description of the proposed system improvements
 - D. Describe outlet capacity and condition (county drain, natural rivers/streams, storm sewers, etc.)
 - E. Describe geotechnical investigations (locations and scope)
 - F. Groundwater elevation
 - G. Drainage criteria
 - H. When pipe materials are specified in the plans for culverts or storm sewers, document the pipe material used and why that material is used
2. Hydrologic Analysis (Refer to Chapter 3)
 - A. Selection of Hydrology Method
 - 1) Rational Method
 - 2) TR-55
 - 3) EGLE-NRCS method
 - B. Rational Method
 - 1) Contributing area map
 - 2) Overland flow path
 - 3) Time of concentration
 - 4) Intensity selection (Refer to Appendix 3-B)
 - 5) Runoff coefficient, C
 - 6) Results
 - C. TR-55 or EGLE-NRSC method
 - 1) Contributing area map
 - 2) Overland flow path
 - 3) Time of concentration

- 4) Land use, soil types and RCN
- 5) Ponding areas for ponding percentage
- 6) Results

3. Hydraulic Analysis

A. Storm Sewers/Inlets (Refer to Chapter 7)

- 1) Inlet spacing analysis
- 2) Storm sewer sizing analysis
- 3) Hydraulic and energy grade line
- 4) Energy dissipation and outlet protection, if required
- 5) Calculation method
 - a. Spread:
 - 1. Hand calculations / spreadsheet
 - 2. FHWA Hydraulic Toolbox for inlet spread or energy dissipation
 - 3. OpenRoads Designer Drainage and Utilities (except for valley gutter spread calculations)
 - b. Preliminary Pipe Sizing
 - 1. Hand calculations / spreadsheet (include link)
 - c. Final Pipe Sizing and Hydraulic Grade Line Calculations
 - 1. OpenRoads Designer Drainage and Utilities
 - 2. Other approved software for Local Agency Projects

B. Culverts (Refer to Chapter 5)

- 1) Design conditions
 - a. Tailwater assumptions and elevations
 - b. Manning's Coefficient, n
 - c. Height of cover
 - d. Inlet configuration
 - e. Culvert recess
- 2) Calculation method
 - a. Hand calculations / spreadsheet
 - b. HY-8
 - c. HEC-RAS
- 3) SMS (2D hydraulic modeling)
 - a. Riprap/revetment calculations

C. Storage Facilities for Flood Control (Refer to Chapter 8)

- 1) Design conditions
 - a. Allowable discharge rates and maximum storage elevation
 - b. Outlet type (weir or riser pipe)
 - c. Weir and/or orifice coefficient(s)
 - d. Groundwater elevations and infiltration rates, if applicable
 - e. Site information
 - 1. Bottom of basin slope
 - 2. Side slopes
- 2) Stage vs. storage curve and calculations

- 3) Stage vs. discharge curve and calculations
 - 4) Reservoir routing calculations
 - 5) Calculation method
 - a. Hand calculations / spreadsheet
 - b. FHWA Hydraulic Toolbox
- D. Ditches (Refer to Chapter 4)
- 1) Design conditions
 - a. Side slopes, longitudinal slope
 - b. Slope and grade stabilization
 - c. HGL
 - 2) Calculation method
 - a. Hand calculations/spreadsheet
 - b. HEC-RAS
- E. Post Construction Stormwater Control Measures (PC-SCMs) (Refer to [MDOT Stormwater Treatment Manual](#))
- 1) Include the following information in the hydraulic report to document MS4 compliance
 - a. Aerial view showing the location of all PC-SCMs
 - b. 10-digit HUC watershed(s) that the project is in and how PC-SCMs will be distributed on projects that span multiple watersheds
 - c. Increase/decrease in imperviousness of the site
 - d. Drainage system changes that increase or decrease contributing watershed area(s) to outfalls
 - e. Latitude/longitude of all outfalls and points of discharge within the project limits
 - f. Latitude/longitude of all new (not replacement) outfalls to a water of the state
 - g. Latitude/longitude of all new (not replacement) points of discharge to a municipal stormwater conveyance system
 - h. Latitude/longitude of all PC-SCM locations
 - i. Discussion on site constraints that prohibit treatment goal compliance, if necessary
 - j. A harmful interference check for a range of flows up to the 100-year, 24-hour storm event for proposed storage facilities
 - 2) Specific information included in the hydraulic report for water quality and channel protection is as follows:
 - a. Water quality
 - 1. Calculations of required water quality treatment volume and water quality treatment provided
 - b. Channel protection
 - 1. Pre- and post-project runoff discharge rates and volumes for the 2-year, 24-hour storm event
 - 2. A discussion on soil infiltration capacity - Provide calculations showing infiltration rates and volumes when using infiltration to meet channel protection requirements

3. Routing calculations for the 2-year, 24-hour storm event when detention is used instead of infiltration
- F. Pump stations (Refer to Chapter 10)
 - 1) Inflow hydrograph
 - 2) Wet well/inline storage calculations
 - 3) System head curve
 - 4) Recommended pump curves and duty point
 - 5) Allowable discharge rate
 - 6) Maximum upstream HGL
4. Appendices
 - A. Drainage/vicinity maps with supporting GIS files and other digital files
 - B. Photos
 - C. Hydraulic software report/output
 - D. Electronic copies of calculations (e.g. Excel, Hydraulic Toolbox, HY-8, HEC-RAS, ORD Drainage and Utilities, etc.)
 - E. Geotechnical information not contained in a Geotechnical Report
5. Report Reference Documents
 - A. Project Plans
 - B. Geotechnical Report including soil borings