Iowa Department of Transportation
Office of Design

Introduction to <u>Geopak Drainage</u>

<u>Geopak Drainage</u> is the software the Office of Design uses to assist with stormwater drainage system design and analysis. It is also used to create pipe profile view layouts in MicroStation. To use <u>Geopak Drainage</u> effectively, designers must have background knowledge of stormwater drainage system design. Sections 4A-1 to 4A-10 explain the process and provide examples along with other resources.

Geopak Drainage is an effective design tool if used properly. However, in order to determine if a system is appropriately designed, designers need to be able to properly analyze the results <u>Geopak Drainage</u> produces. To do this, designers need to know how the results are obtained. Therefore, designers should be familiar with Sections 4A-1 to 4A-10 before using <u>Geopak Drainage</u>, and keep in mind its primary function is to automate processes with which designers are already familiar. Additionally, designers shouldn't rely on <u>Geopak Drainage</u> alone to perform storm sewer design. Constraints may require designers to perform the part of the design and manually input the information.

Resources to use with <u>Geopak Drainage</u>

To use <u>Geopak Drainage</u>, designers will need at a minimum:

- MicroStation Design File (DGN or DRN) – used to visualize the project and define drainage features.

- Geopak Drainage File (GDF) – stores hydraulic information the designer has entered for the project.

- Drainage Library File (DLB) – contains tables and settings specific to Iowa DOT, e.g. rainfall intensity, land use, node and link (structure and pipe) library items, and spread sections.

- Drainage Cell Library (CEL) – contains plan views of cells (intakes, manholes, junctions, and aprons) to which the nodes in the Drainage Library refer.

- Design and Computation Manager Database (DDB) – allows designers to calculate quantities based on MicroStation level symbology.

Other files that will be helpful include:

- Superelevation Shapes File

- Original Ground TIN File

- Design Surface TIN File

Designers will need several tables from Sections 4A-4 to 4A-10. In addition, designers will need survey information and, if applicable, As-Builts showing existing conditions.

Stormwater Drainage System Design Process using <u>Geopak Drainage</u>

The process begins by starting a new project file and setting preferences (see Section 4A-52). Then the process of building the network can begin.

1. Select a node location and type for the furthest upstream intake.

2. Define the drainage area to the node (size, slope, ground cover, etc.).

3. Check spread at, and efficiency of, the node. Adjust node location and/or type if necessary.

4. Select the node location and type for the next downstream intake and define the drainage area to it.

5. Check spread at, and efficiency of, the node and make necessary adjustments.

6. Continue this process until all pavement runoff is captured by intake nodes.

7. Select the node location for the outlet.

8. Include nodes for manholes where needed (see Section 4A-4).

9. Connect the nodes together with links (pipe segments).

10. Validate the network and perform calculations.

11. Evaluate results checking items such as:

    • Spread at intakes.

    • Minimum and maximum pipe velocities.

    • Minimum pipe cover and intake well depths.

    • Hydraulic grade line (HGL) results.

> **Note:** Perform calculations for 5-year, 10-year, 50-year, and 100-year storms. Since runoff coefficients are different for each of the storm events (see Section 4A-5), separate .gdf files will need to be created for the different storm events.

Several iterations may be needed to design a system that satisfies all of the system requirements.

Geopak Drainage Results and Hand Calculations

Geopak Drainage results should be spot checked with hand calculations. This helps to ensure input data has been entered correctly and the software is doing what the designer expects it to do. Sources of error can include problems such as, but are not limited to:

• Improperly entering data, e.g. entering the wrong runoff coefficient or entering spread criteria in the wrong order.

• Choosing the wrong design storm, e.g. choosing a 5-year instead of 10-year storm.

• Choosing the wrong structure, e.g. choosing an SW-508 when an SW-510 should have been chosen.

• Checking a dialogue box that shouldn't be checked, failing to check a dialogue box, or checking the wrong dialogue box.

• Failing to click on "Apply" after entering or updating data.

• Placing a pipe incorrectly when attaching it to an intake.

• A corrupted drainage library file or drainage cell library.

• Errors in the MicroStation design file.

Geopak Drainage results and hand calculations will typically differ slightly as a result of rounding errors and some of the computational processes Geopak Drainage uses.

> **Note:** Geopak Drainage uses backwater calculations when calculating conduit flow. This can result in fairly significant differences between hand calculations and Geopak Drainage results for pipe flow velocity and time of concentration. Designers will need to draw on experience to determine if a significant difference is the result of improperly inputting data, improper design, or differences in computational processes.

Even if Geopak Drainage results and hand calculations match closely, there is no guarantee the design is correct. The designer needs to examine the results carefully to determine if they make sense and are reasonable.

Chronology of Changes to Design Manual Section:

004a-050   Introduction to Geopak Drainage

7/29/2011   NEW

New