**Culvert Cost WIG on the Road to Drainage Asset Management**

**HydInfra - MnDOT’s Culvert and Storm Drain Inventory and Inspection System**

It all began in 1996 when Hydraulics/WRE engineers created HydInfra to improve drainage design and maintenance work. HydInfra was built with GIS tools designed so that people new to ArcMap could query for drainage features, make a map and export the data to a spreadsheet. HydInfra’s simple condition rating codes based on explicit criteria for different materials, and flags to record defects make it a versatile framework to build asset management on.

**Research on Pipes and Materials**

Research focusing on the projected lifespan of steel pipe is underway. The map below shows roadside pH overlaid on NRCS pH data. Acidity, or low pH, is a factor in steel pipe deterioration rates. The research is being done by Barbara Burkholder Heitkamp, U of M.

**Culvert Cost WIG**

Maintenance crews repair or replace culverts and record the labor, equipment and materials in a mobile app based on ArcGIS Collector software. Repair data can be entered in the Culvert Cost app while in the field on an iPad, or in the office on a PC. Repair data is available immediately in web-based reports that repair crews can access from the repair site. You can find Culvert Cost Reports by searching IHUB for “Culvert Cost”.

The map shows repairs, cleanings and new installations of culverts recorded in the first season of data collection.

**HazMat Spills Response Utility Locations and MS4 Water Quality**

MnWRE and Maintenance partners on MS4 water quality requirements.

Storm drain networking and “Georilla” map service improve response times for hazardous spill capture.

Storm-drain networks are also used for Gopher State Line utility locations.

**Project Scoping and Predesign**

GIS layers from many sources give context to drainage design work. DN-3 layers for Public Waters illustrate areas that need environmental permits. HydInfra layers with drainage feature data help speed scoping and predesign tasks, especially in winter.

**Big Storm + bad pipes = wrecked road**

Research on pipes and materials focuses on the projected lifespan of steel pipe in drainage design work. HydInfra data is used in research to look at materials, and their failure modes. In this chart, the depth of fill above the pipe is correlated to specific pipe defects.

**Drainage Performance Measure**

In 2008, Maintenance Operations chose HydInfra to track their Drainage Performance Measure for Highway culvert inventory and inspection. Soon after, the Inventory was completed and highway culverts are now inspected on a regular schedule.

**Extreme rainfall and floods cause damage to culverts.**

**Repair data is available in web-based reports that repair crews can access from the repair site.**

**Cost effective drainage system repair requires coordination with road construction and paving contracts. HydInfra’s “Pipe Suggested Repair Method” layer helps prioritize repairs.**

**The Road Ahead to Drainage Lifecycle Cost Analysis**

1. Capture construction costs for drainage features from projects by contractors, along with as-built details about the drainage features.
2. Get an Enterprise Asset Management software solution that includes GIS, to merge HydInfra and Culvert Cost databases and to integrate data from MnDOT’s many other parts, like Pavement, Traffic and Maintenance Operations’ many responsibilities.
3. Inventory and inspect storm drain networks, ponds and other water quality devices and all those other features that are part of the drainage system.
4. Research pipe materials to improve service life predictions.
5. Project Lifecycle Performance to get the most bang for the buck.

**Map shows scheduled paving projects overlaid on “Pipe Suggested Repair Method” layer from HydInfra Reports.**

Cost effective drainage system repair requires coordination with road construction and paving contracts. HydInfra’s “Pipe Suggested Repair Method” layer helps prioritize repairs.