San Diego Flow Tracing Web Application

Visualizing Surface Runoff and Stormwater Network Flow via Web Application

Garrett Boucher
woodplc.com
Outline

Rationale
• Background
• Motivation
• Significance

Design
• Task and Specifications
• Workflow
• Implementation and Architecture
• Challenges

Impact
• Use Cases
• Future Functionality
• Expansion possibilities
Rationale
• Availability of spatial stormwater infrastructure data is increasing
• Leveraging data is the next step
• Stormwater management can inform floodplain management – and vice versa
• Interactive web applications have potential for displaying dynamic and real-time information
Motivation

- Illicit discharge detection and elimination (IDDE)
- Water pollution response
- Utilizing newly developed data
  - Watershed Master Plan (WMP)

“Illicit Discharges”, Think Blue City of San Diego Storm Water Fact Sheet, 2016

“Aviso - Advisory-Closure_Explanations”, City of San Diego
Significance

• Regulation/Permitting Compliance
• Responsible preservation of the environment
• Serve the community
Design
Task

- Create a web mapping application
- Trace surface (overland) flow and network flow
- Process dynamically based on user-defined input
- Provide functionality for both upstream and downstream operations
Application

Chollas Creek Watershed, San Diego
HUC 12: 180703041201
Data Foundation

- WMP existing assets stormwater network
  - Junctions, outfalls, conduits, and channels
Data Foundation

- WMP existing assets dataset also includes:
  - Subwatersheds
  - Subcatchments
Data Initialization

• Build ESRI geometric network with stormwater data
  – Ensures correct topology
  – Provides tracing abilities

• Encode points of entry to the network on the elevation raster
  – USGS 1-Meter Digital Elevation Model (DEM)
Workflow: Pre-processing

- Two methods of DEM preprocessing:
  - Enforce subcatchment boundaries on DEM
  - Use “raw” DEM data

- Current tool determines which workflow to use based on location of user input

- Develop Flow Direction raster
Workflow: Downstream Trace

• Validate the user input point
  – Within the watershed
  – Determine which raster datasets to use

• Trace the flow direction raster downstream
  – Output line representing flow from user input to the appropriate network entry point

• Trace the geometric network downstream
  – Output the subset of stormwater infrastructure assets downstream of the network entry point
Validation the user input point
- Within a tolerance (10m) of a stormwater asset

Trace the geometric network upstream
- Output the subset of stormwater infrastructure assets upstream of the user input

Highlight contributing subcatchments
- Output the subcatchment polygons corresponding to the selected network entry points
Implementation

• Delivery format
  – Desktop toolbar for ArcMap
  – Online web application

• Execution format
  – ArcGIS ModelBuilder
  – Python script
Architecture

- Python scripts within toolbox
- ArcGIS Enterprise (Portal, Server)
- ArcGIS Web AppBuilder
- Widgets access published scripts as GP Services
- Data lives locally on the server
- Developed internally, delivered for external deployment
Demonstration: Downstream Trace

A presentation by Wood. Visualizing Surface Runoff and Stormwater Network Flow via Web Application
Demonstration: Upstream Trace
• Online GIS data
Output Formats

- Downloaded, offline GIS data
Output Formats

- PDF maps
Challenges

- Geometric Network development
- Conditioning DEM to pre-modeled subcatchments
- Initial data assumptions not necessarily consistent through entire dataset
Solution

• Dual workflows: determine which workflow to use based on location of user input

• Tool will execute in nonvalidated subcatchment areas, but may not respect the previously modeled boundaries
Impact
Use Cases

• Illicit discharge detection and elimination
• Water pollution response
• Desktop preparation for fieldwork
Future Possibilities

• Kentucky: availability of LiDAR data
• Integration with existing systems
  – Water quality monitoring
  – Asset management
  – Crowd-sourced discharge detection
• Dynamic delineation of contributing areas for network entry points
• Reporting travel times through the network
• Initial step for more complicated modeling systems

Photo by Lance Cpl. Jason Jimenez
Helpful Links

- http://www.sdbeachinfo.com/
Garrett Boucher
GIS Analyst

615.577.7058
garrett.boucher@woodplc.com