Water Quality Improvement Plan:

A GIS Approach for Stream Restoration Site Selection

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Agenda

- ***Project***
- ***Data***
- ***Stream Model***
- ***Way Ahead***

Project Overview

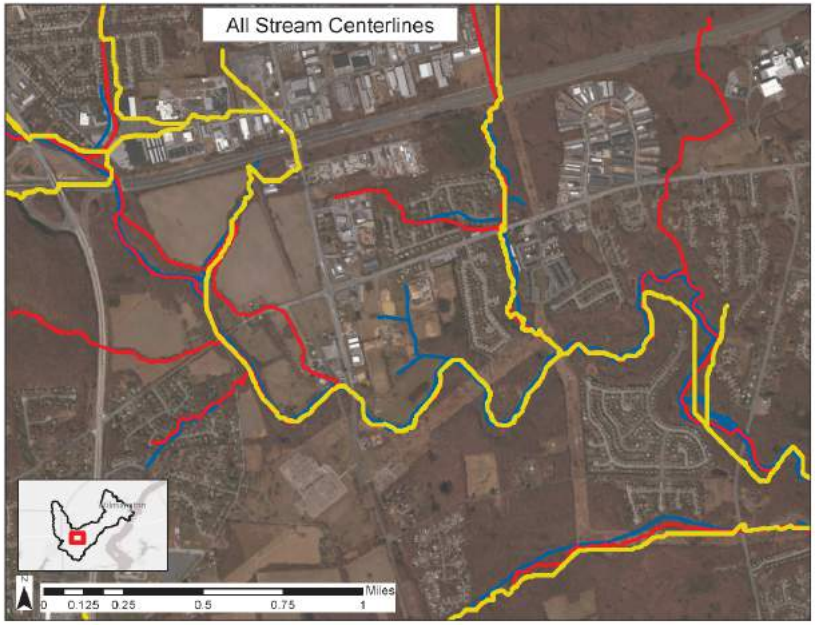
- ***Client:*** Delaware Department of Transportation (DelDOT)
- ***Location:*** New Castle County, DE
- ***Study Areas:*** Christina River / Dragon Run Watersheds
- ***Purpose:*** 3% reduction of Effective Impervious Area (EIA) / support Total Maximum Daily Load (TMDL) allocations through SWM Retrofit and Stream Restoration

Data – Overview

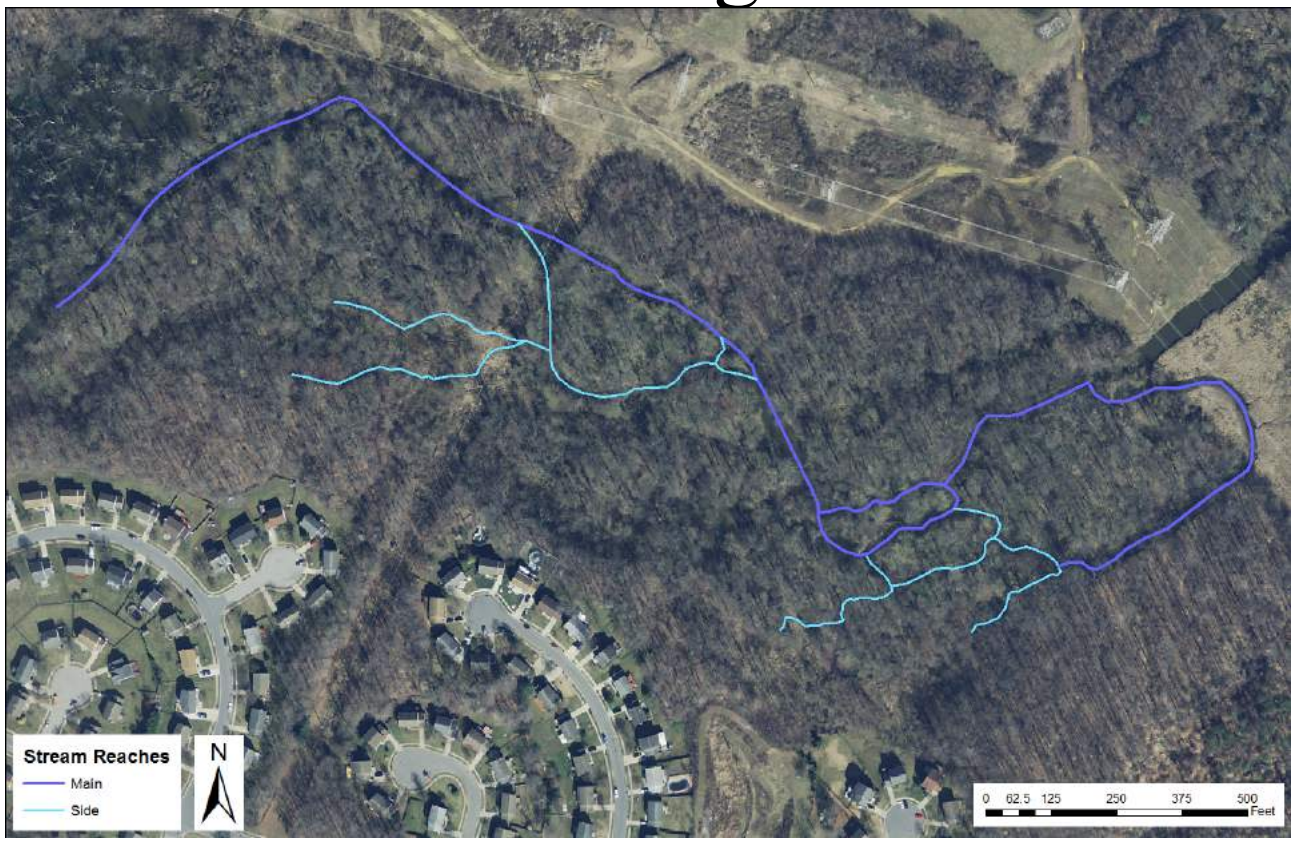
- ***Boundaries:***
  - County / Municipal Boundaries - NCC
- ***Elevation:***
  - 2m LiDAR (2007) - NCC
- ***Hydrology:***
  - NFHL – FEMA
  - HUC-8 / HUC-12 Watersheds - USDA
  - National Hydrology Dataset (NHD) – USGS
- ***Imagery***
  - .3 meter Imagery (2012) – DEMAC
- ***Planning:***
  - Land Use / Land Cover (2012) - First Map
  - Parcels with Ownership - NCC
- ***Transportation:***
  - Bridge Points – DE FirstMap
  - Road Centerlines – DE FirstMap

Data – Pre-Processing

- ***DEM:***
  - Global Mapper
  - Generated from LAS at 2m
- ***Stream Centerlines:***
  - USGS – NHD (Red)
  - FEMA – NFHL (Blue)
  - DEM-Generated (Yellow):
    - Filling Sinks
    - Flow Direction
    - Flow Accumulation
    - Set Threshold (via Map Algebra / CON)
    - Stream Order
    - Stream To Feature

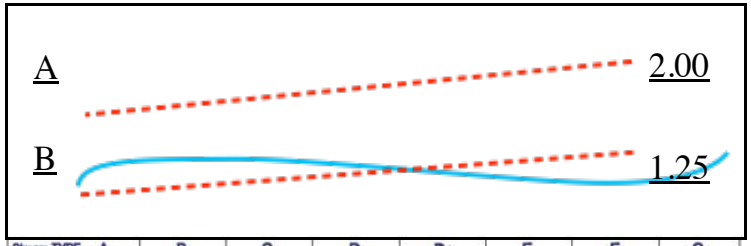


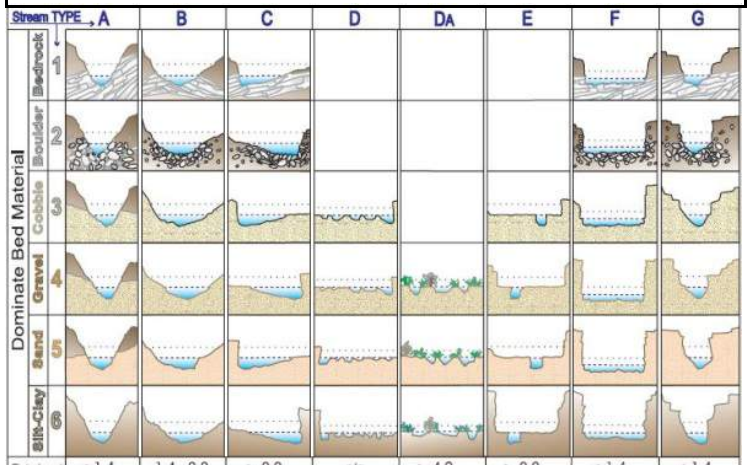
Data – Pre-Processing



Stream Model – Overview

- ***Goals:***
  - Stream Reach Sinuosity
  - Stream Channel Entrenchment
  - Prioritize via Overlays / Queries
  - Identify Suitable Sites
- ***Processed Datasets:***
  - DEM
  - Streams
- ***Overlay / Reference Datasets:***
  - Land Use Land Cover
  - Parcels (NCC)

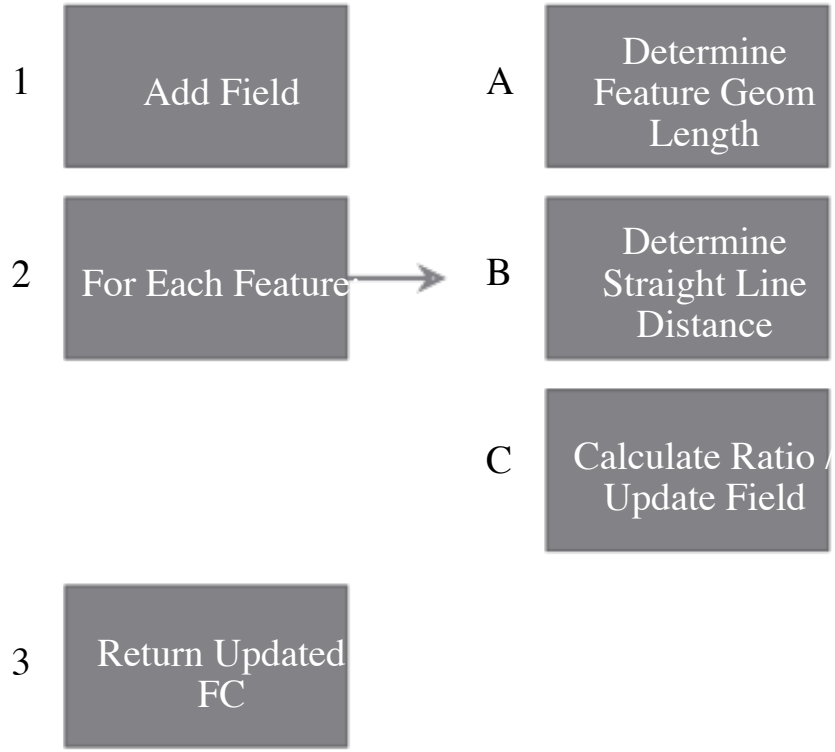




Stream TYPE	A	B	C	D	DA	E	F	G
Entrchmnt	< 1.4	1.4 - 2.2	> 2.2	n/a	> 4.0	> 2.2	< 1.4	< 1.4
W/D Ratio	< 12	> 12	> 12	> 40	< 40	< 12	> 12	< 12
Sinuosity	1 - 1.2	> 1.2	> 1.2	n/a	variable	> 1.5	> 1.2	> 1.2
H.0 Slope	.04-.099	.02-.039	< .02	< .04	<.005	< .02	< .02	.02-.039

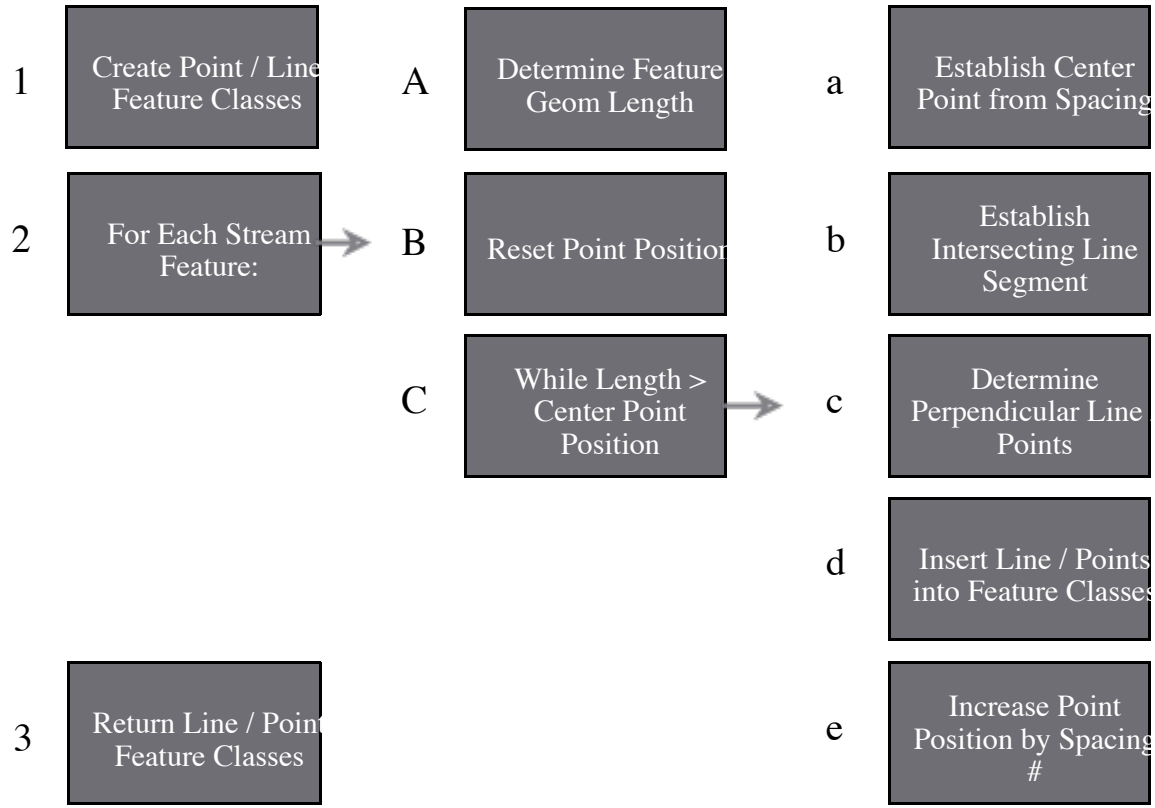
Stream Model – Sinuosity

- ***Inputs:***
  - Workspace (FGDB)
  - Line Feature Class
- ***Tools:***
  - Add Field
  - Update Cursor
  - Feature Geometry:
    - Length
    - First Point
    - Last Point
  - Distance Formula**
- ***Limitation:***
  - Arbitrary Reach Lengths

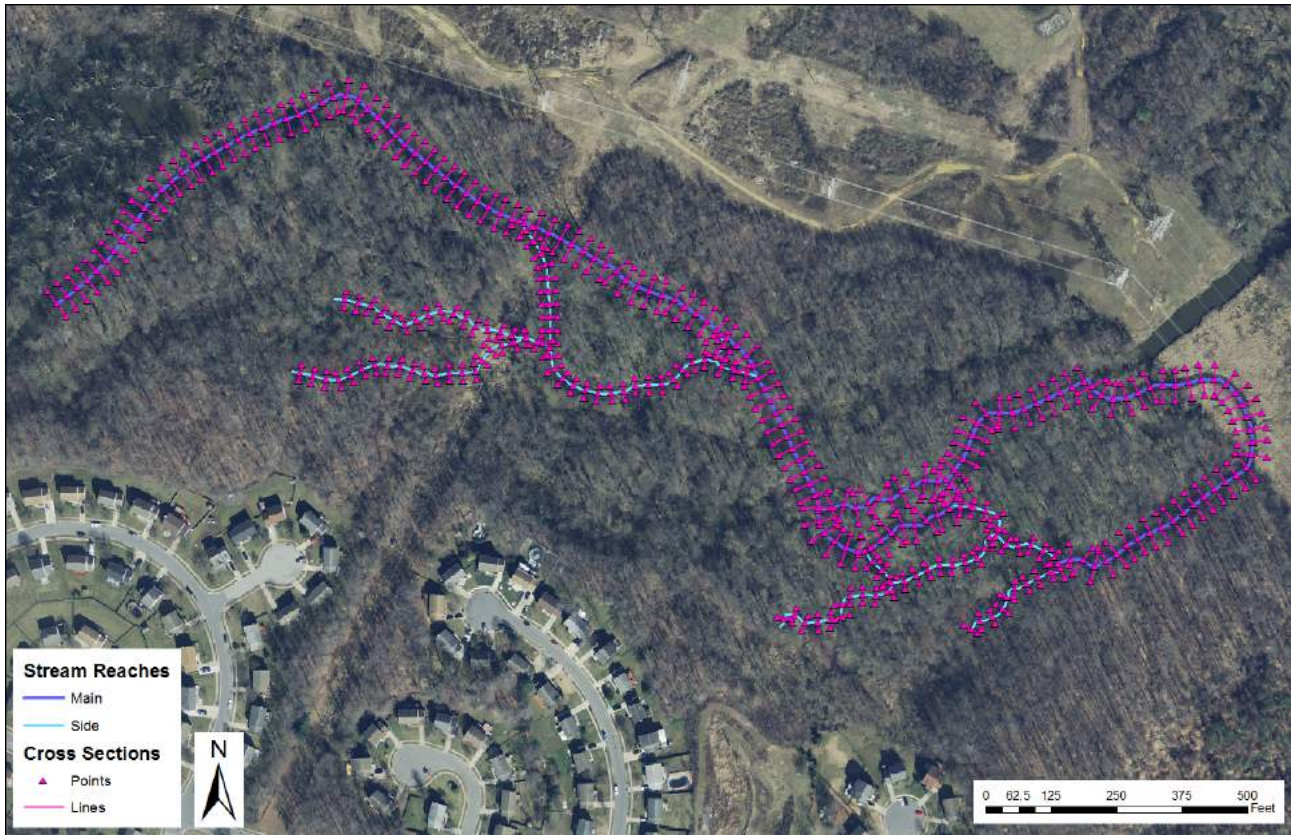


Stream Model – Cross Sections

- ***Inputs:***
  - Workspace (FGDB)
  - Line Feature Class (Streams)
  - Category Field (Stream Order)
  - Unique ID Field for Streams
  - Point Spacing Value (in feet)
  - Line Distance (in feet)
- ***Tools:***
  - SearchCursor
  - Feature Geometry:
    - Length
    - PositionAlongLine
    - First Point
    - Last Point
    - Within
    - Touches
  - Slope Formula**

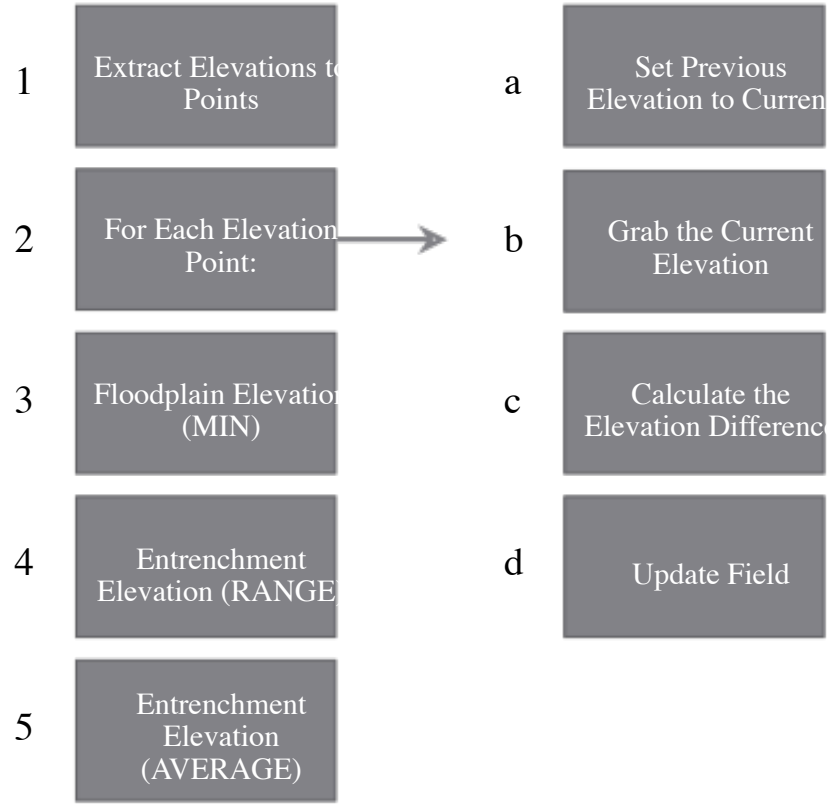


Stream Model – Cross Sections



Stream Model – Entrenchment

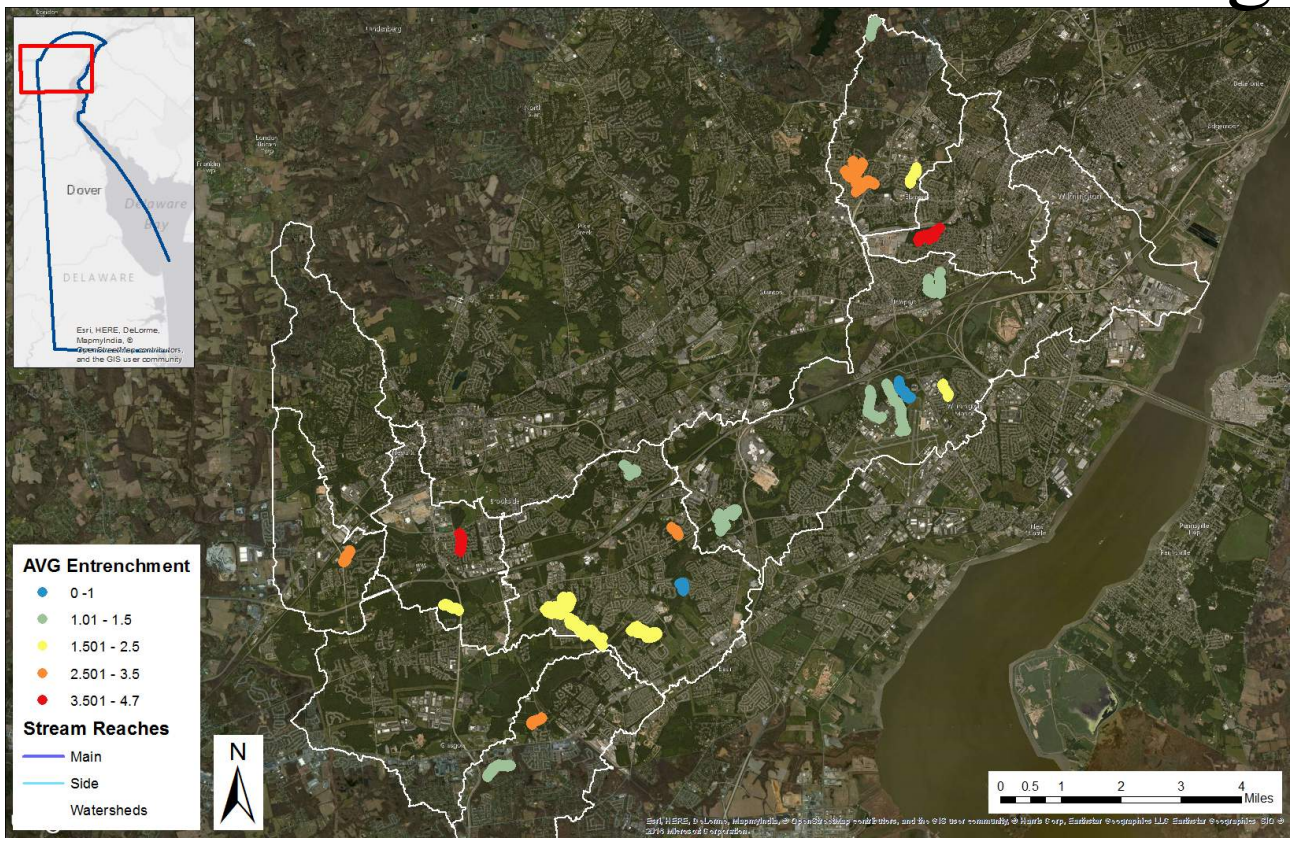
- ***Issues with Definitions***
  - Top of Bank
  - Stream Channel
- ***Inputs:***
  - Workspace (FGDB)
  - Point Feature Class
  - DEM
  - Stream ID
- ***Tools:***
  - Extract Values To Points***
  - Add Field
  - Alter Field
  - Update Cursor
  - Dissolve



Stream Model – Entrenchment

Stream Model – Entrenchment

Stream Model – Entrenchment Avg.



Way Ahead

- Field Verify Results
- Cross Section Generator Speed Enhancement

Questions?

- Stream Centerline Generation:
  - http://gis.stackexchange.com/questions/20855/arcgis10-create-perpendicular-transects-to-stream-at-specified-intervals
- Stream Delineation:
  - Explanation - https://web.ics.purdue.edu/~vmerwade/education/hydrology.pdf
  - Esri Video - http://video.esri.com/watch/1954/creating-watersheds-and-stream-networks
  - ArcSWAT - http://swat.tamu.edu/software/arcswat/