Urban Drainage Modeling for Storm Water Design

Using QL2 LIDAR

A Los Angeles County Case Study

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SPATIAL ANALYTIX

LOS ANGELES REGION

LAR|IAC

imagery acquisition consortium

GROUNDPOINT

TECHNOLOGIES, LLC

Use Elevation data to:

- Show the drainage network - where runoff flows over land.
- Develop catchments
- Derive metrics

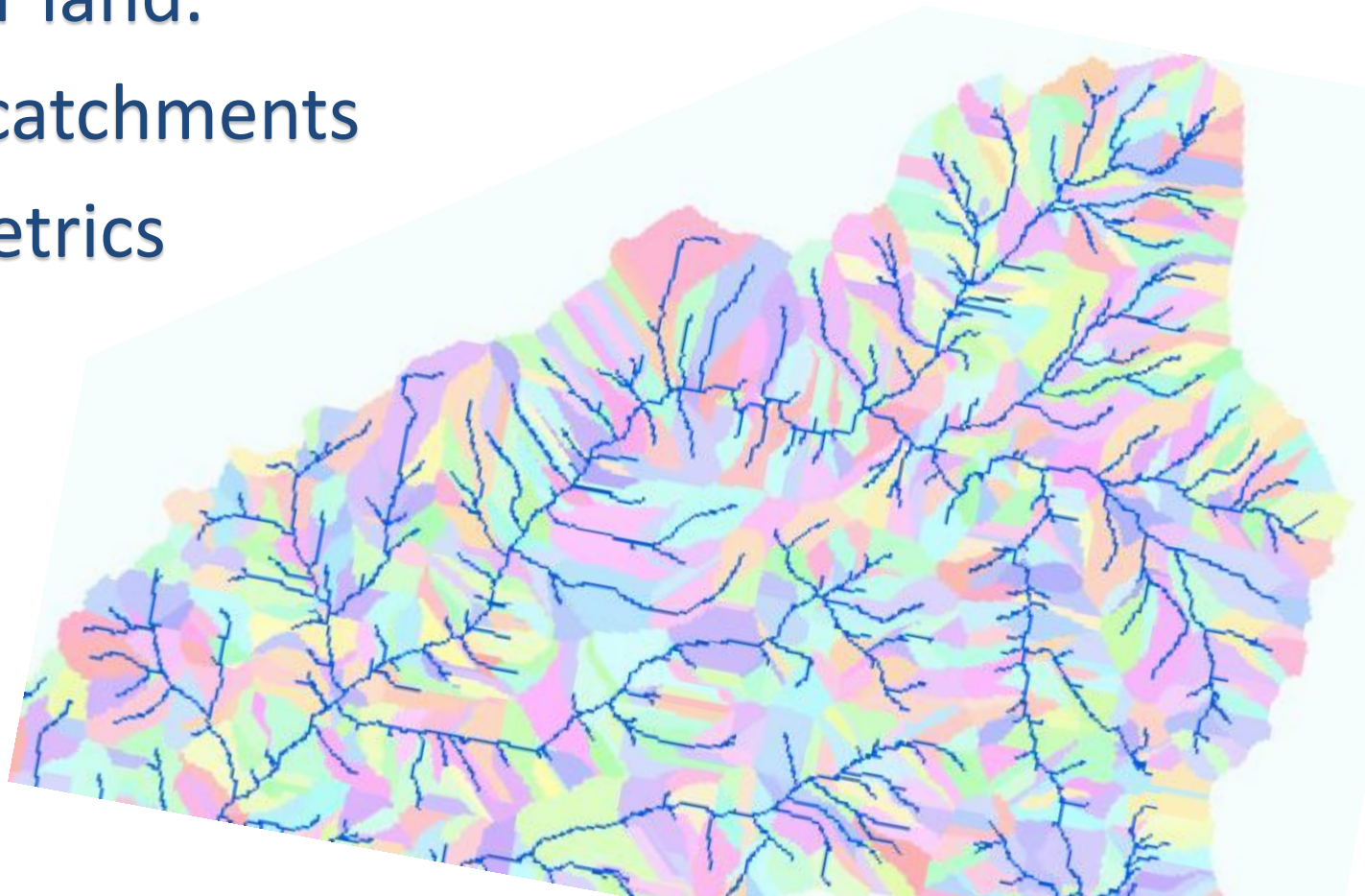


Image courtesy of hydrology.usu.edu
TauDEM 5.1 Quick Start Guide

What's the Big Deal?

- MS4 Permit Compliance
- Infrastructure design
- Flood response
- Catchment Characteristics

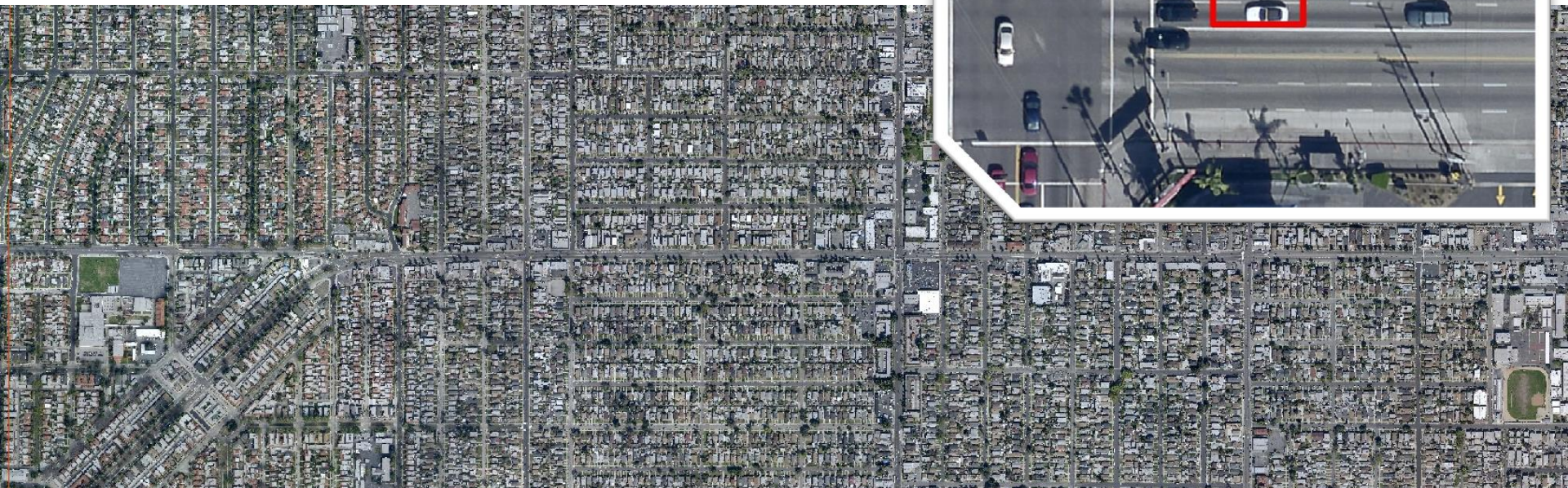
Infiltration islands in a parking lot in San Mateo, California, help reduce runoff. (Photo courtesy of John Kosco)
water.epa.gov

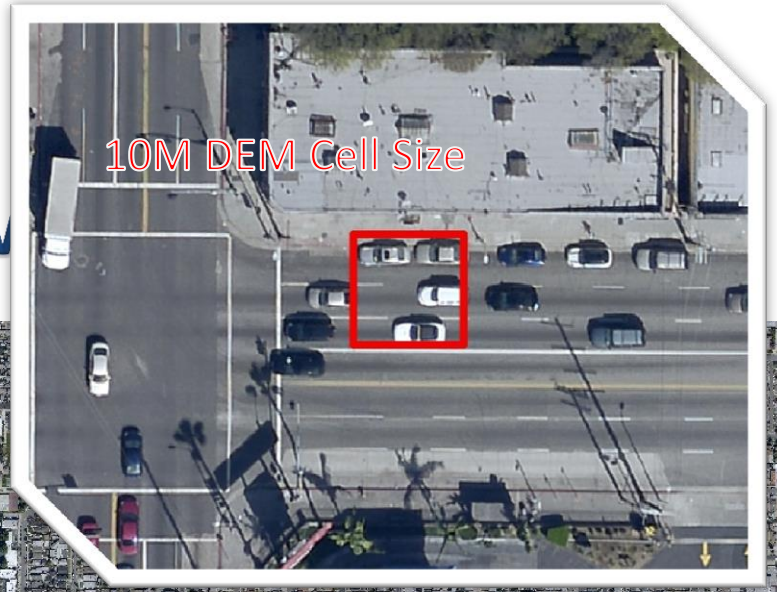
What's the Big Deal?

- Currently a very slow, labor intensive process.
  - Estimate: **~30 Years** to complete with current methodology

LA Pilot Area- Characteristics

- **FLAT**
- **No streams or ditches**
- **Gutter flow**
- **6” curbs often define flow**
- **Extensive storm drain netw**





Target Deliverables

- **Acceptable Lidar Point Resolution**
- **Final Surface Model**
- **Artificial Stream Network**
- **Catchment area polygons for:**
  - **Catch Basins (known)**
  - **Collection Points (theoretical)**
  - **MS4 Outfalls (regulatory- also known)**

Point Cloud Resolution

Table 1. Point Cloud Resolution/DEM Matrix

DEM	35cm	70cm	1.4m
1ft		n/a	n/a
3ft			n/a
5ft			

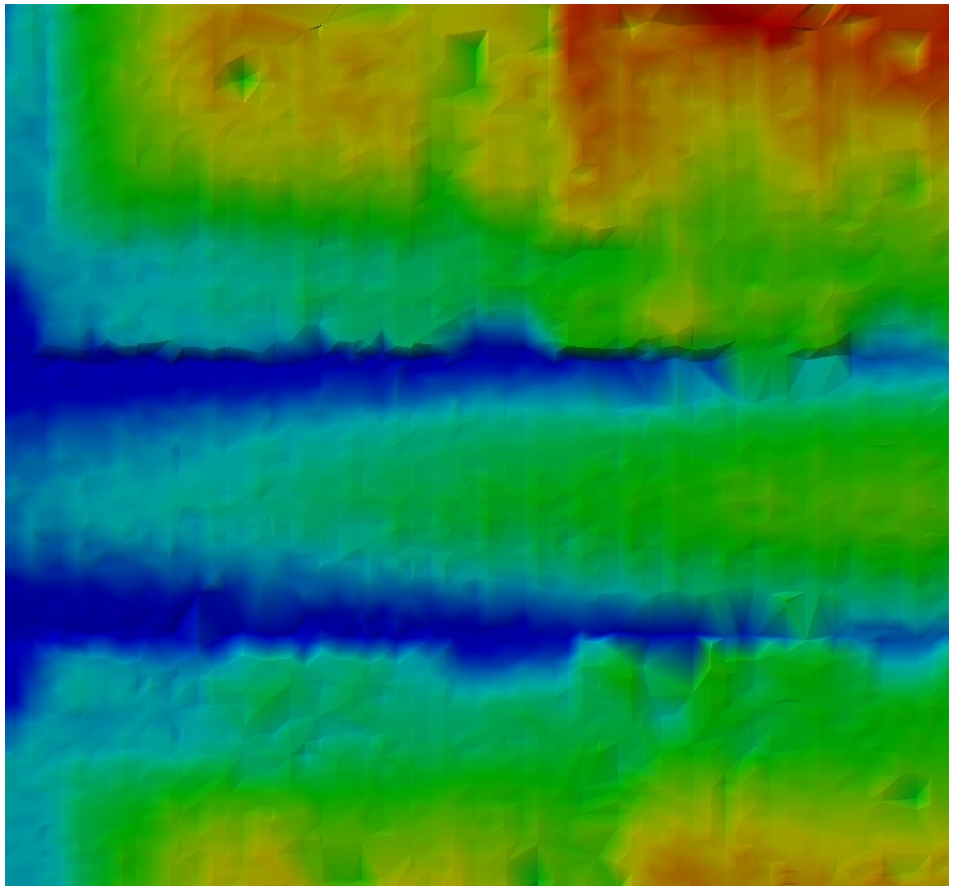
RED is the default standard for 1ft contour development

Point Density

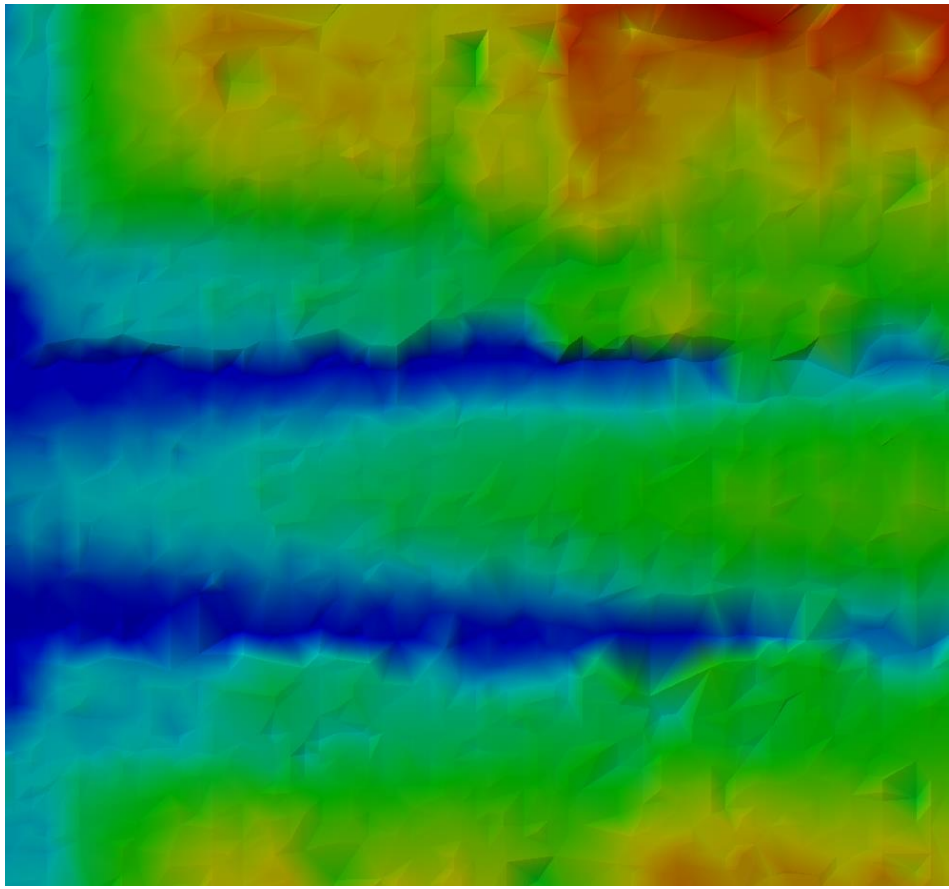
35cm Point spacing

70cm Point spacing

TIN Surface Model

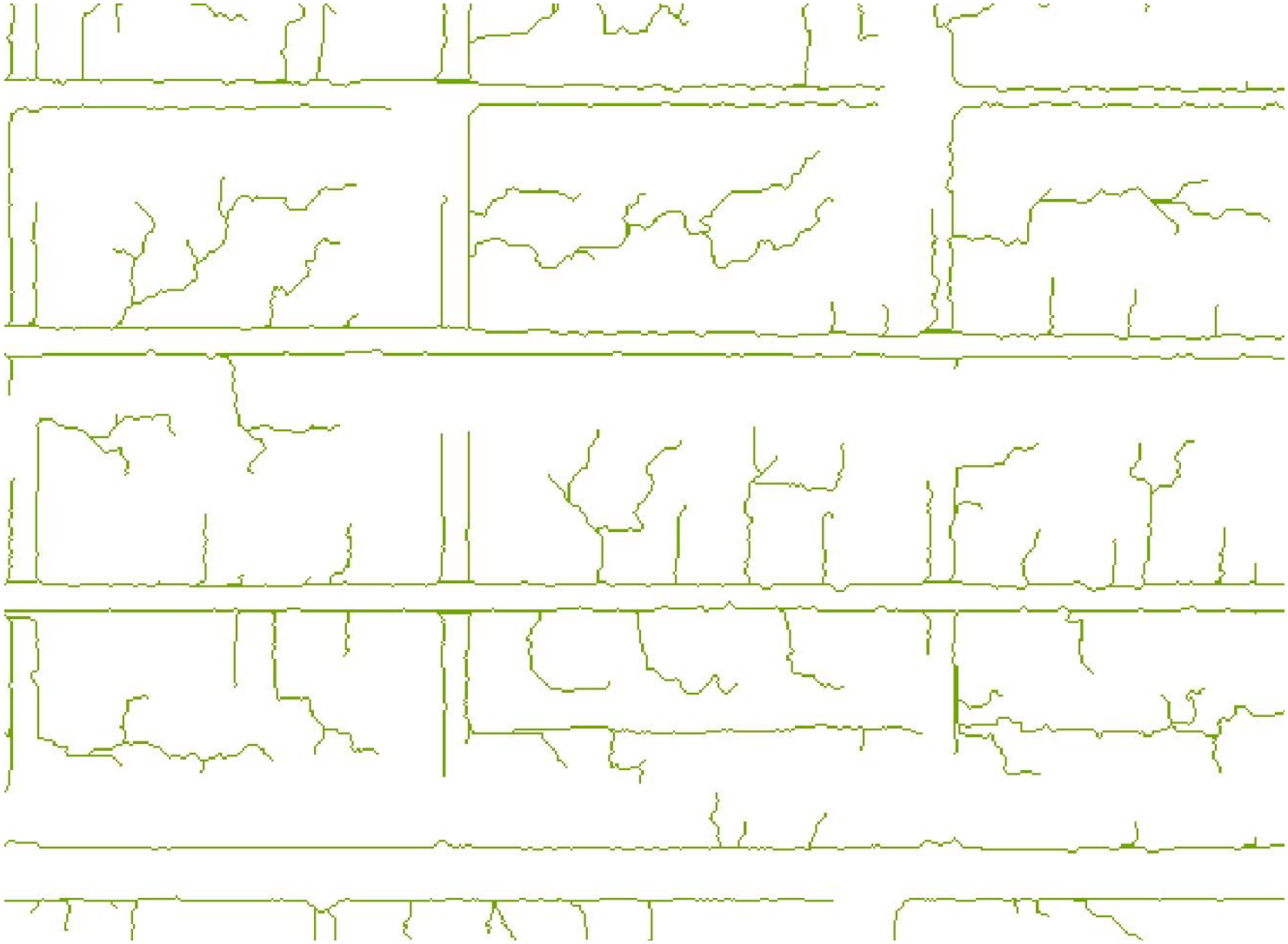


35cm Point spacing



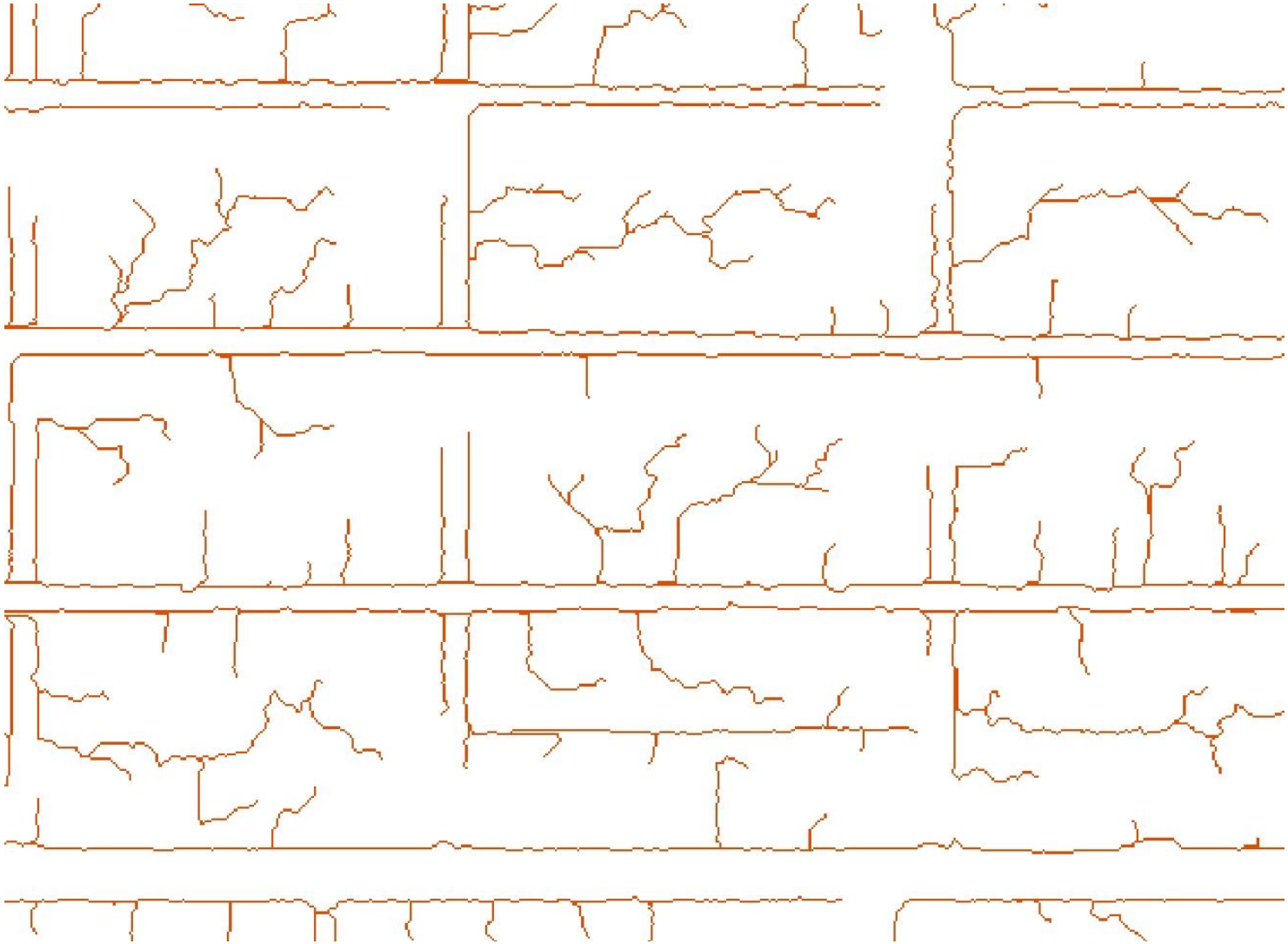
70cm Point spacing

Drainage Network Analysis



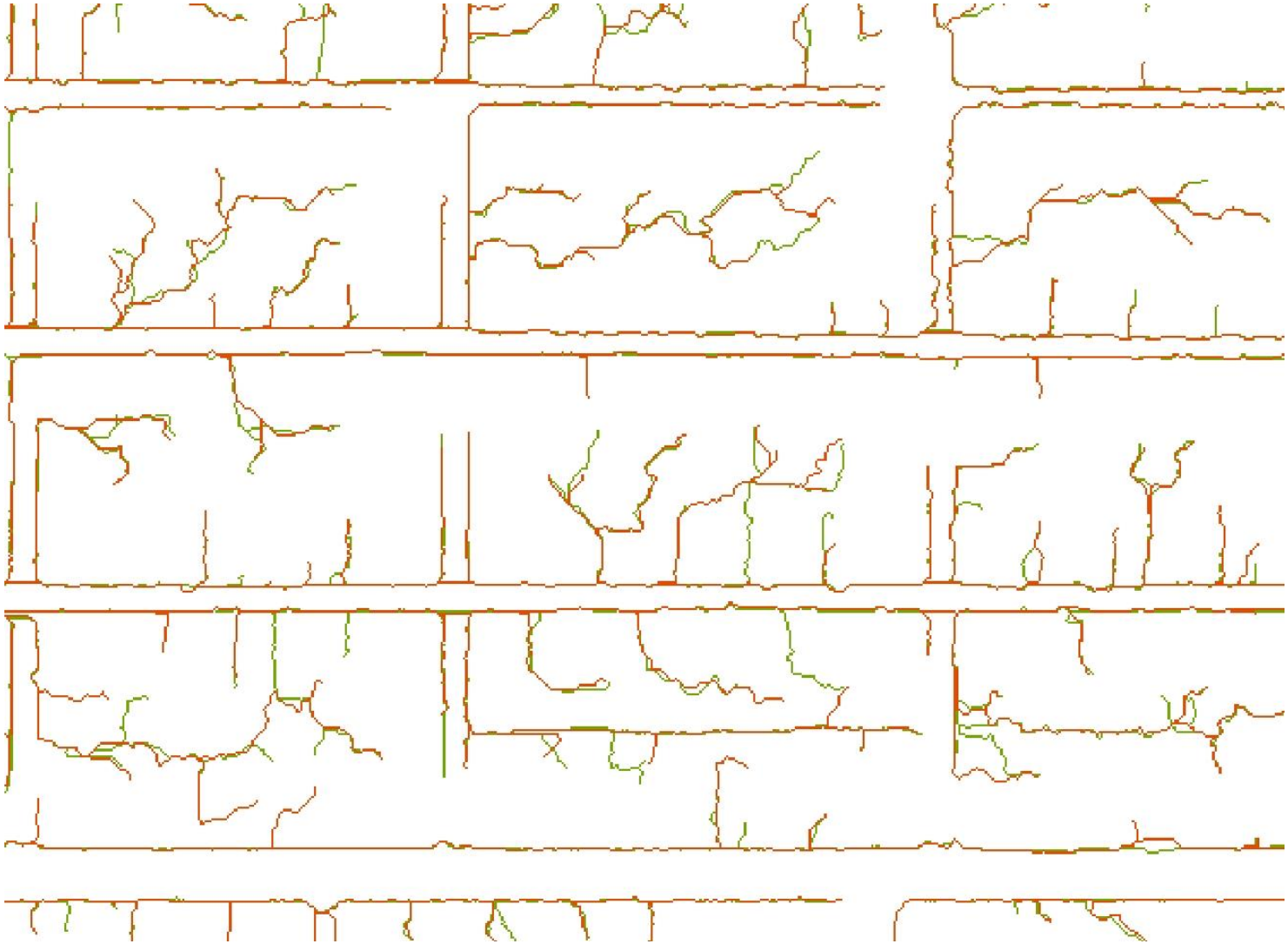
Drainage Network – 35cm post spacing

Drainage Network Analysis



Drainage Network – 70cm post spacing

Drainage Network Analysis



Drainage Network – 35cm green
70cm orange

Software Tools?

ArcGIS Resources

Home | Communities | Help

Arc Hydro Overview

Communities / Hydrology / Surface Water

data models and tools that operates within ArcGIS to support geospatial and temporal data analyses.

SCALABLE ALGORITHMICS

technology | solutions | company

> introduction | desktop | analysis | live

Turning big terrain data into knowledge.

UtahState UNIVERSITY

Hydrology Research Group

David Tarboton

System-Wide Water Resources Program SWWRP

Hydrologic terrain analysis with parallel processing developed with support from the US Army Corps of Engineers, System Wide Water Resources Program

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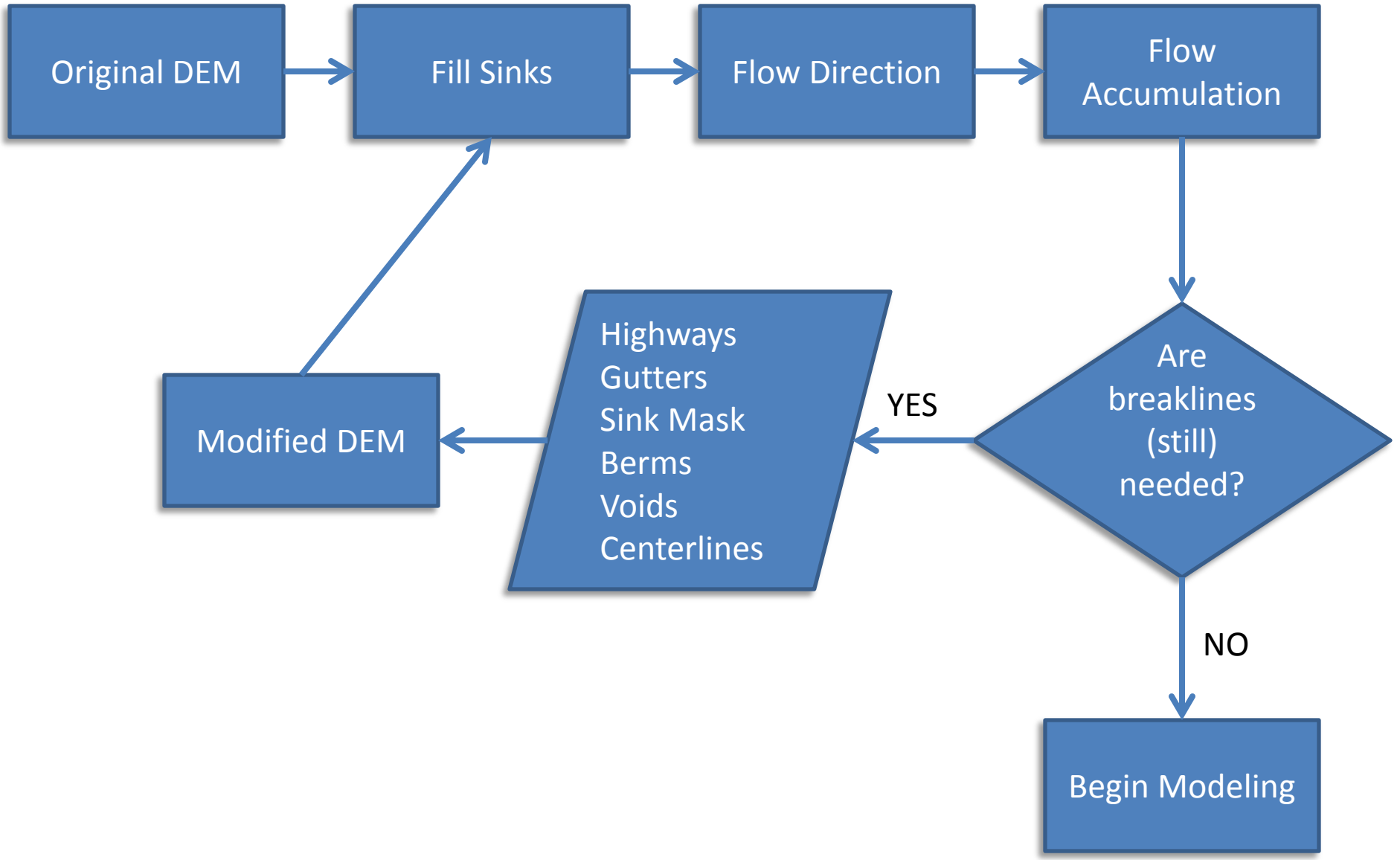
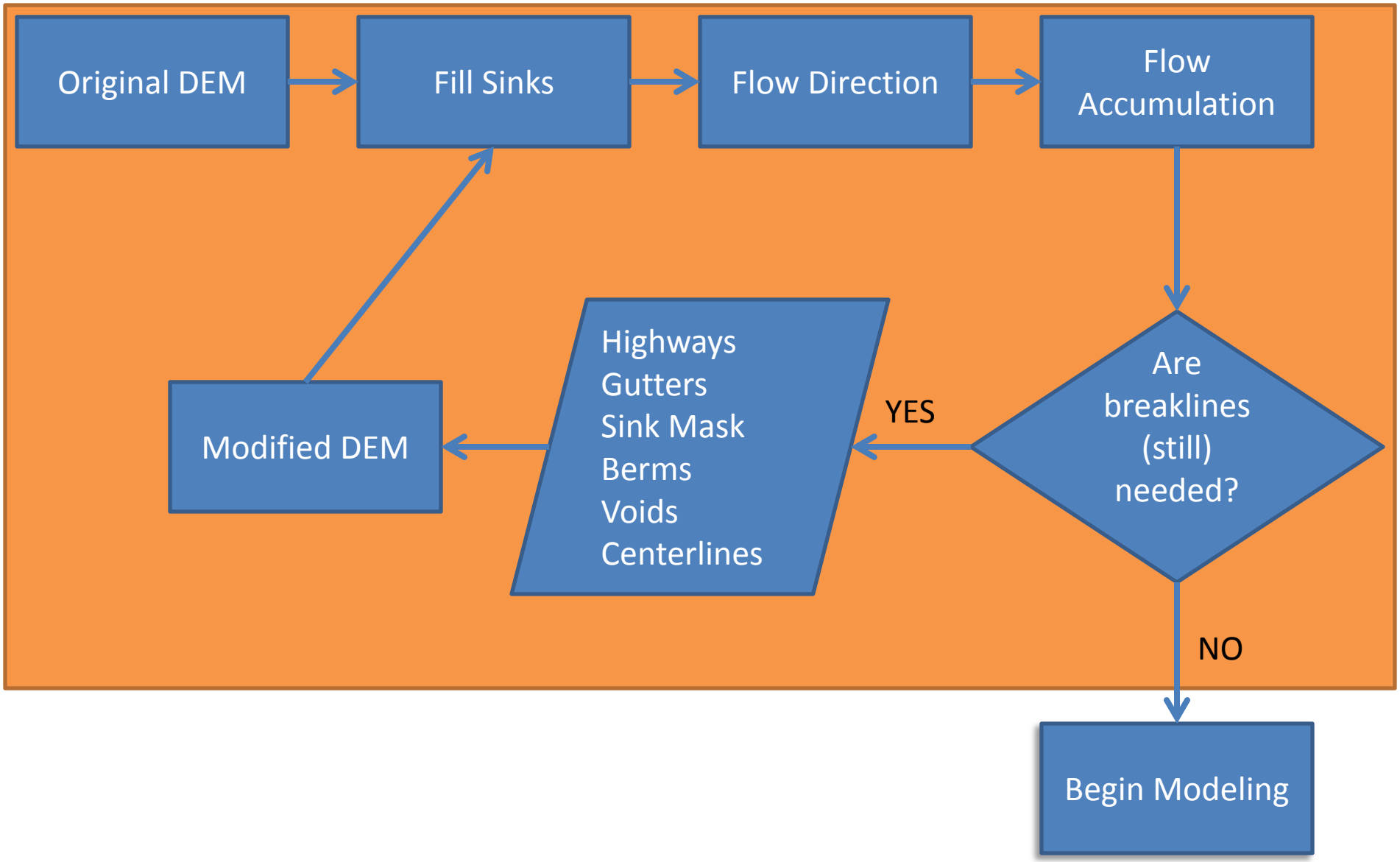
TERRAIN ANALYSIS USING DIGITAL ELEVATION MODELS (TAUDEM)

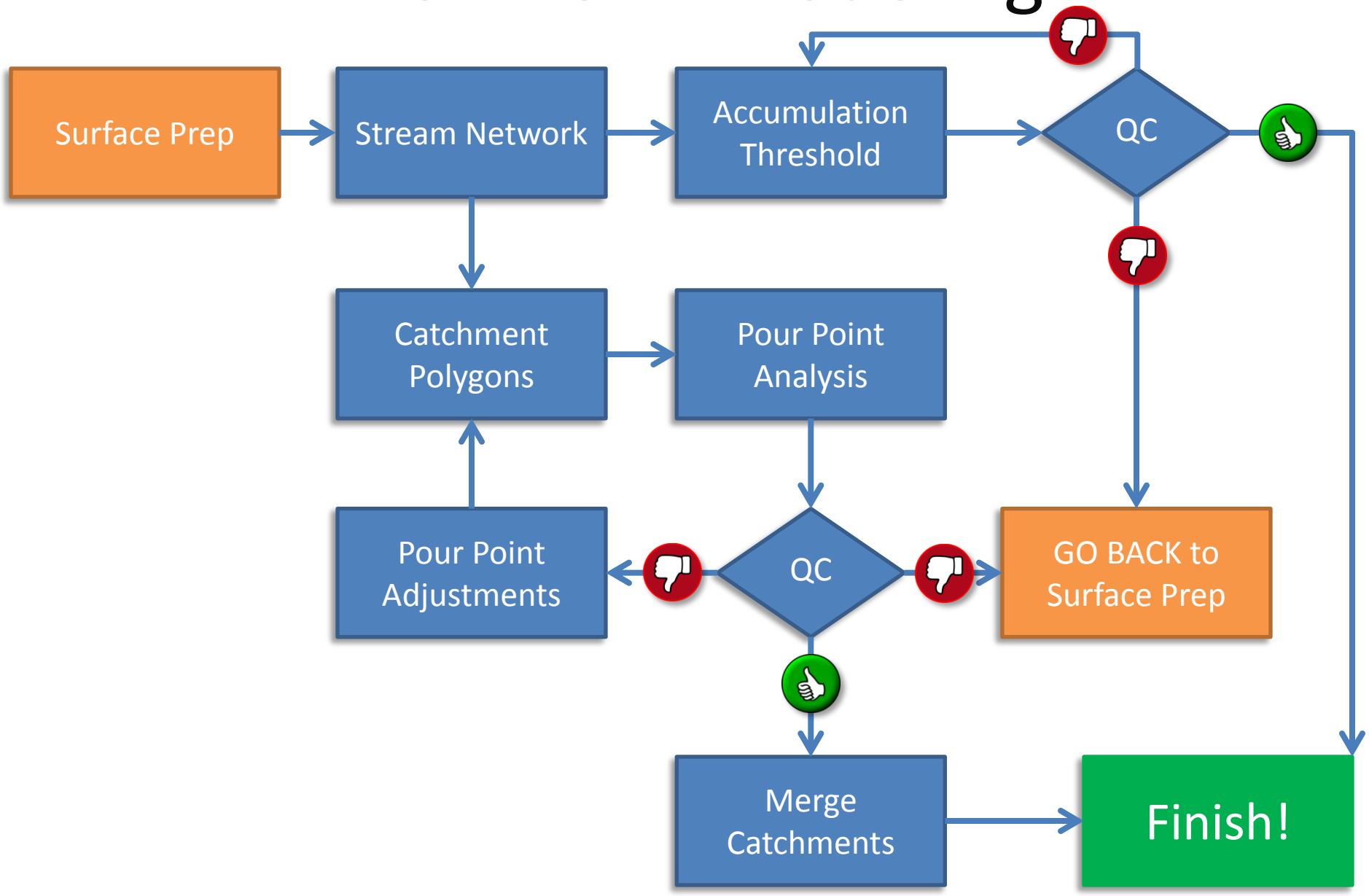
Workflow- Surface Prep



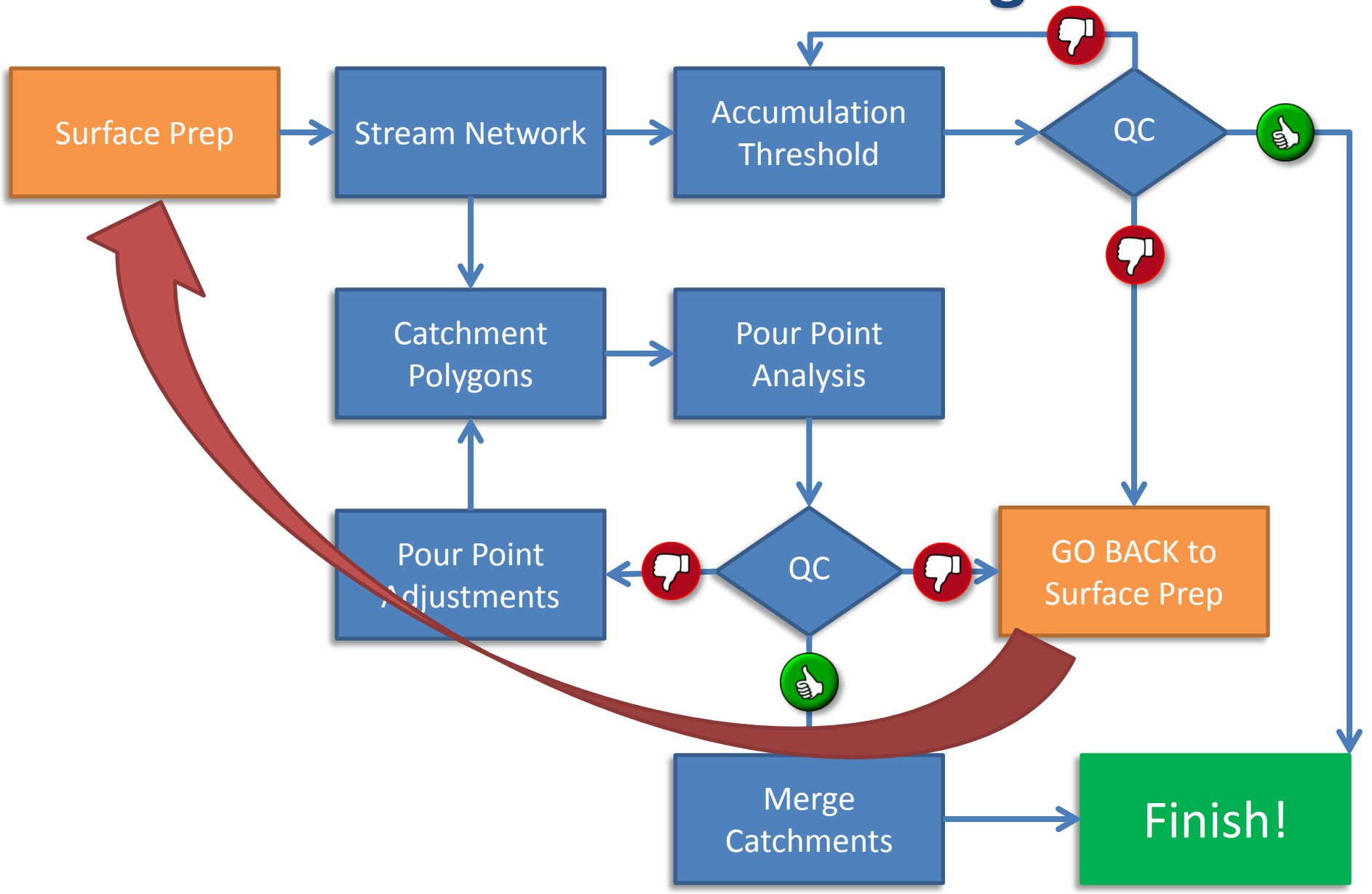
Workflow- Surface Prep



Workflow- Modeling

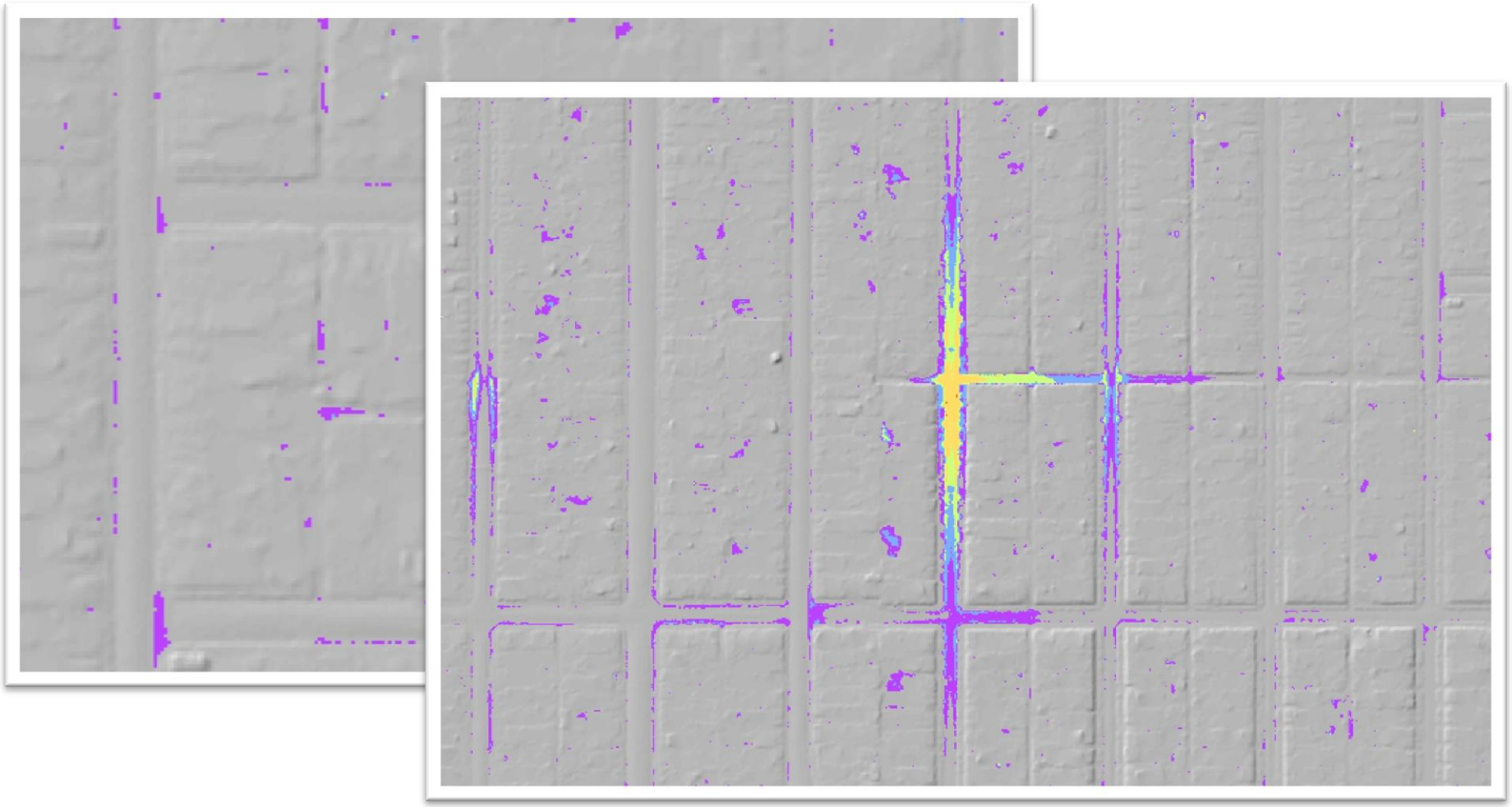


Workflow- Modeling

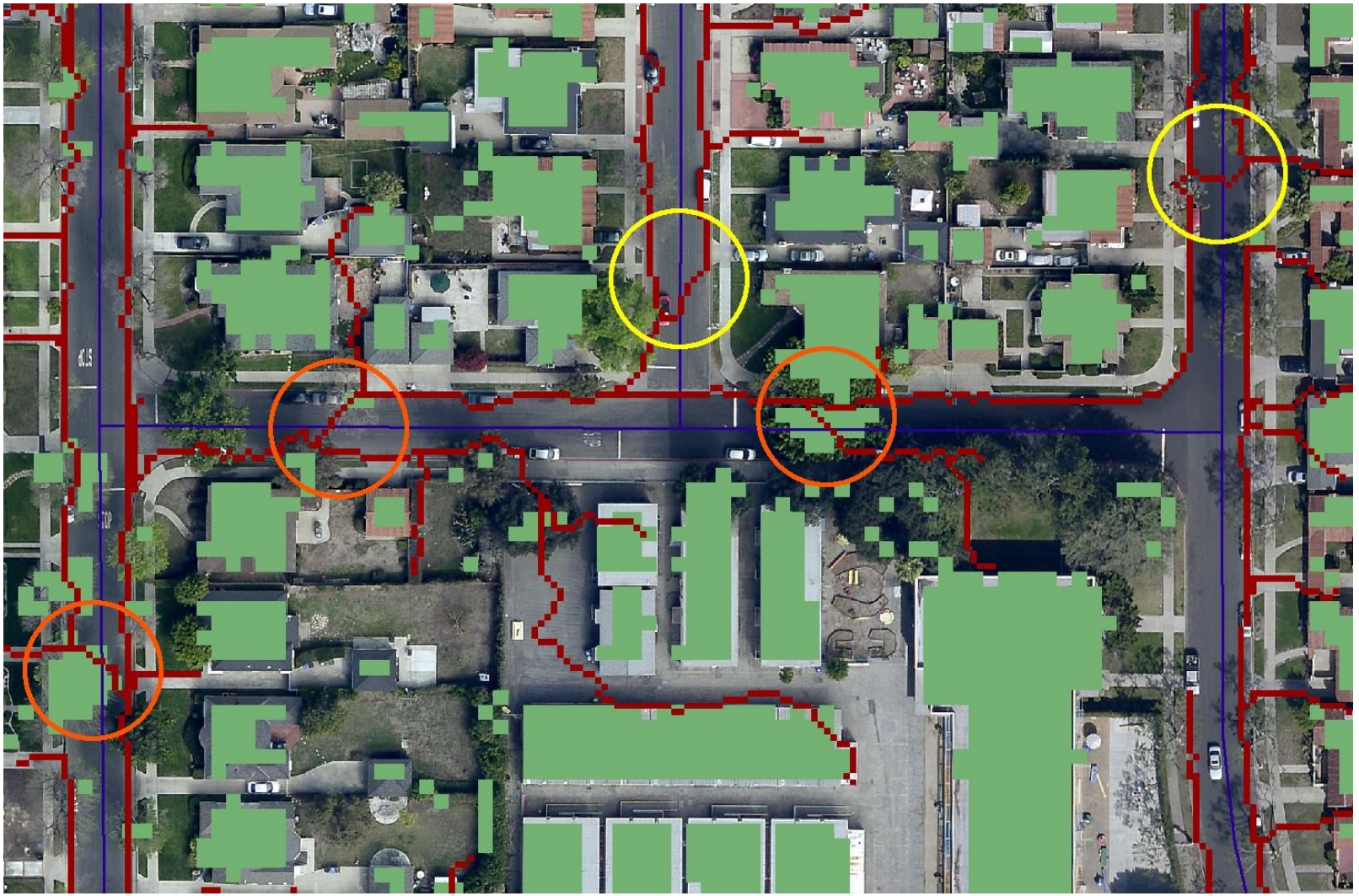


Workflow- Surface Prep

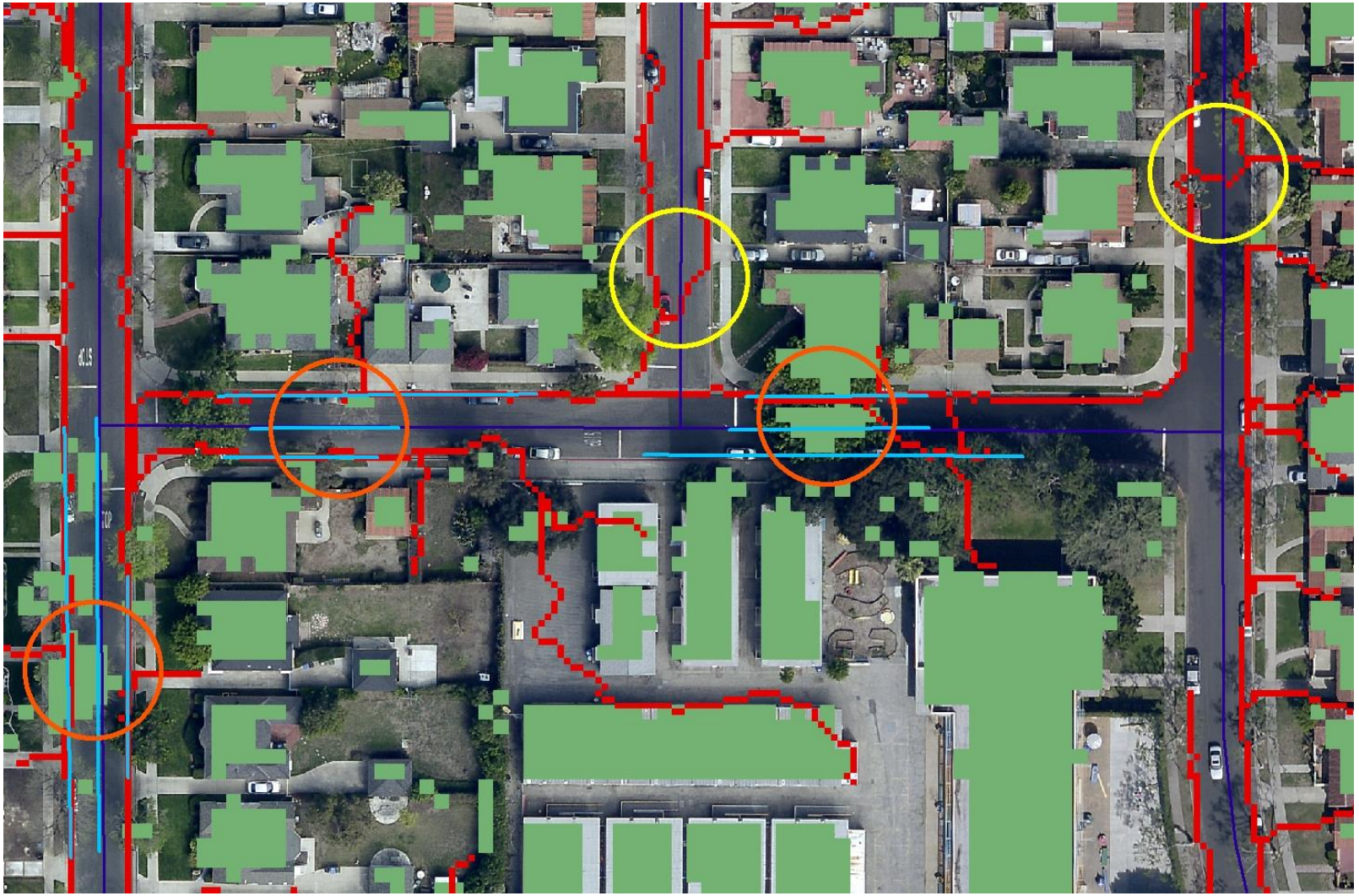
Fill Sinks



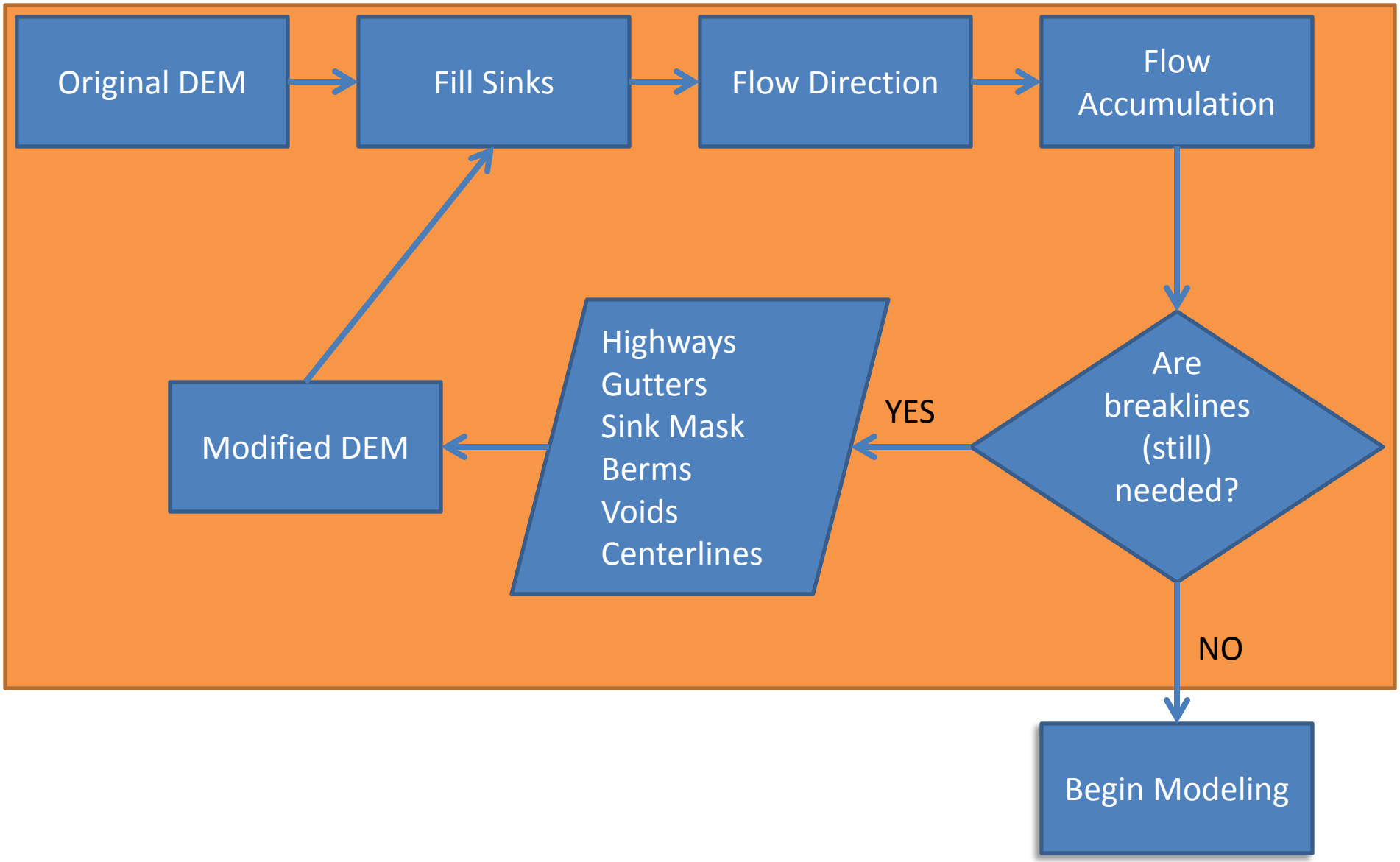
Workflow- Surface Prep



Workflow- Surface Prep



Workflow- Surface Prep



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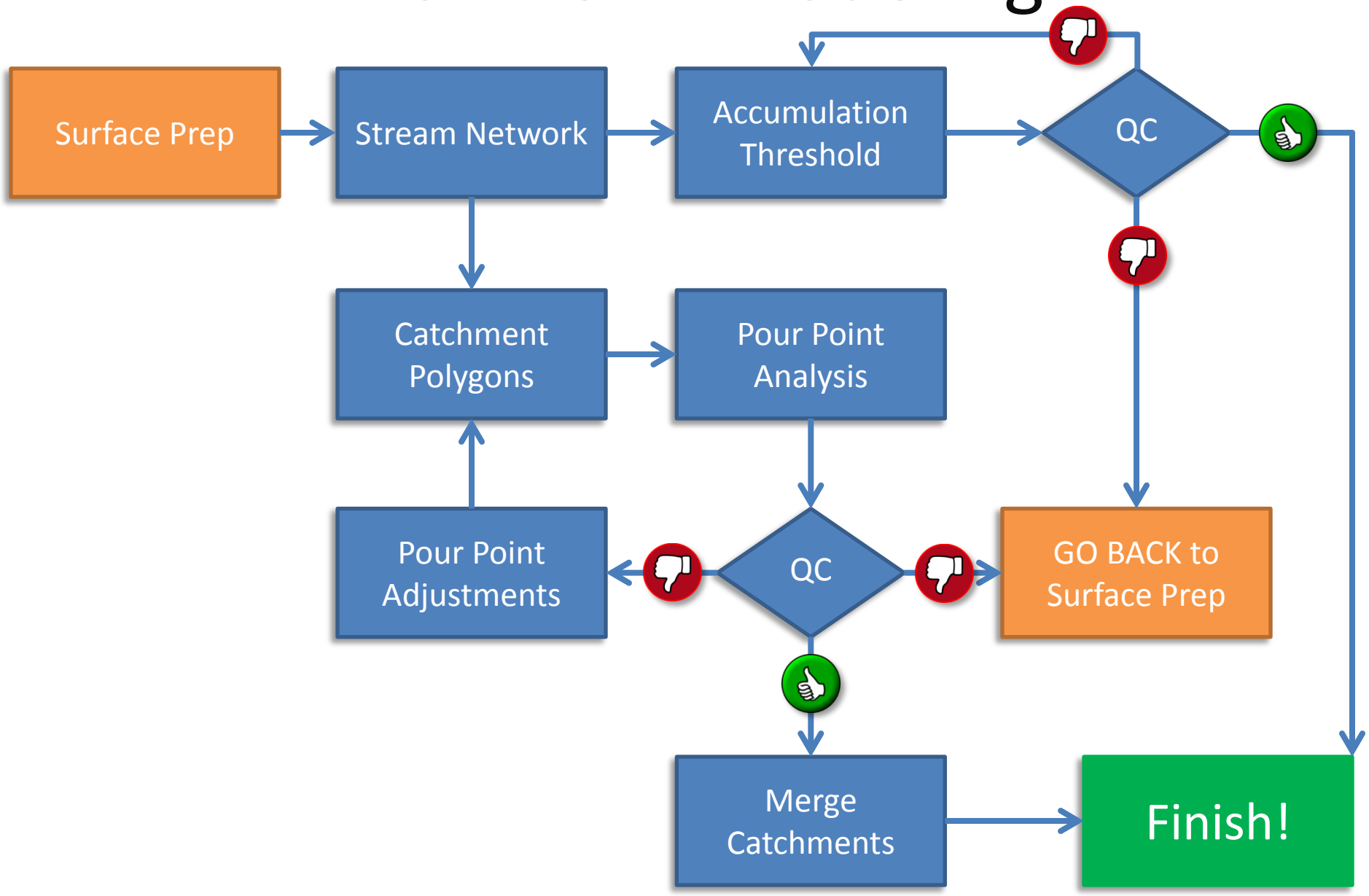
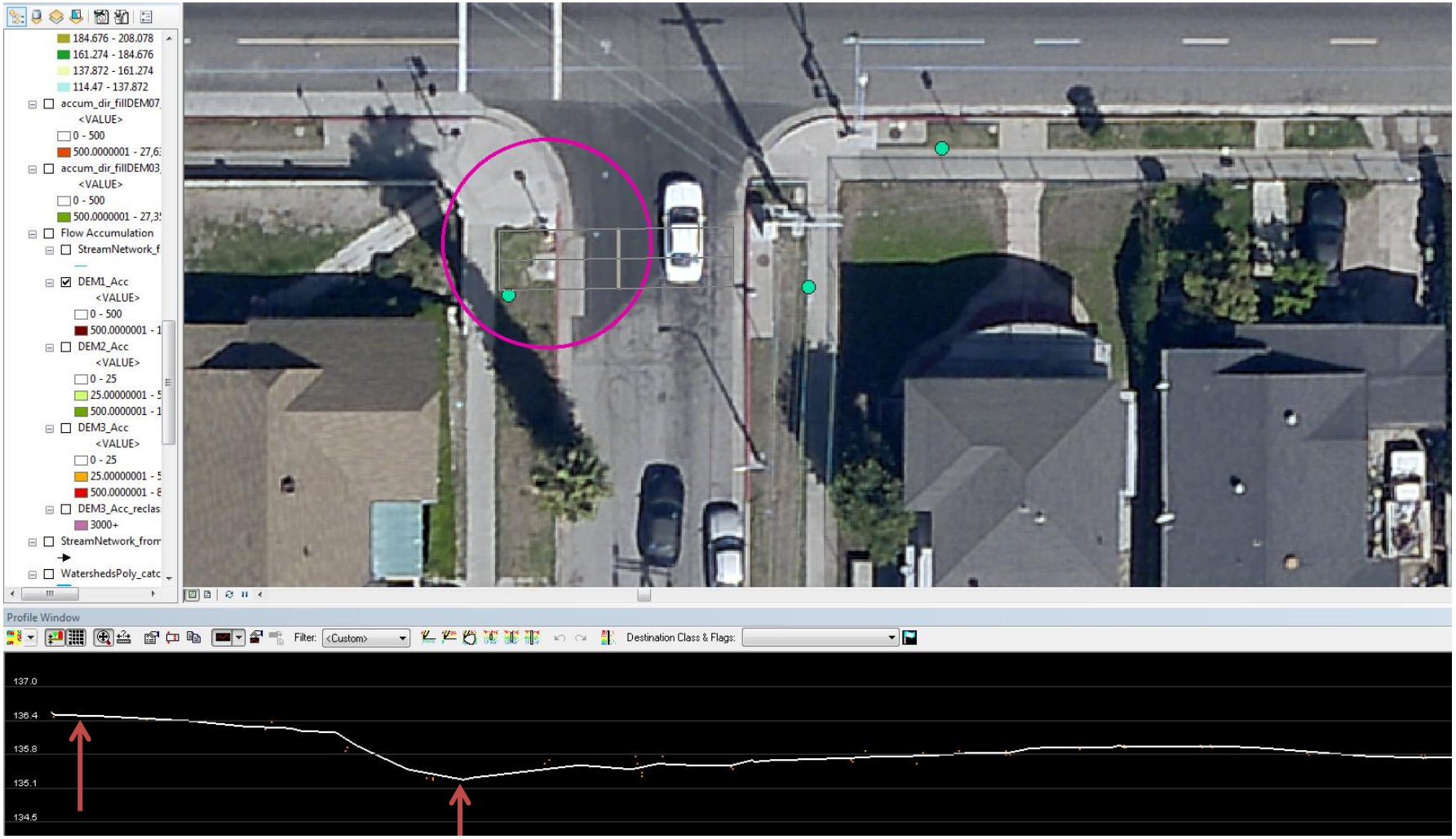


Workflow - Modeling

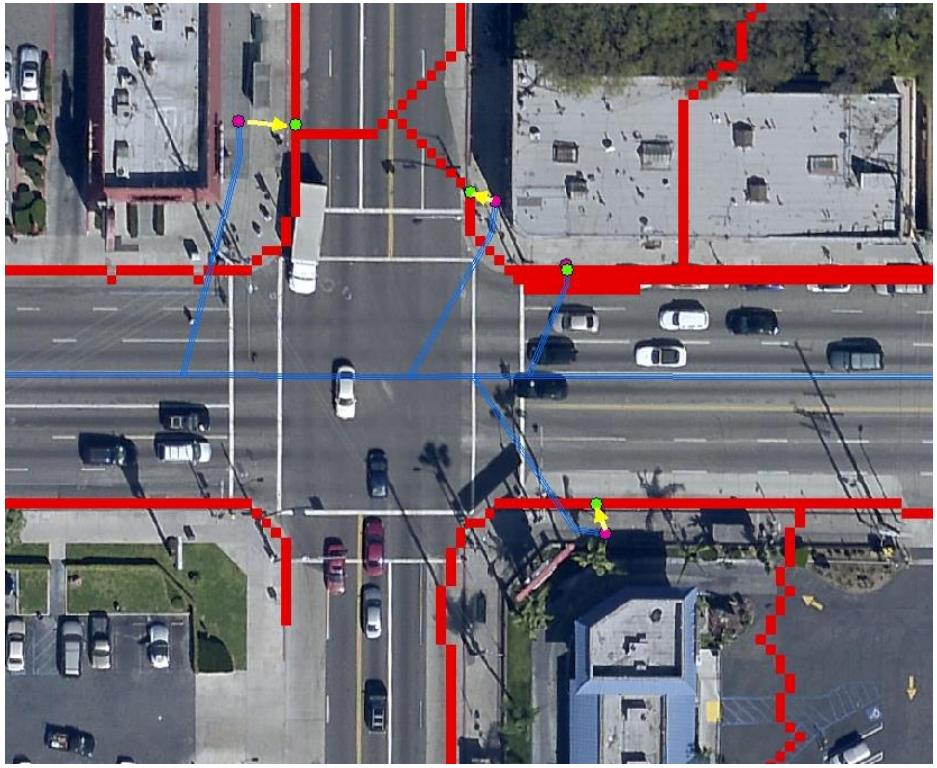
- **Pour points must be moved**




137.0
136.4
135.8
135.1
134.5

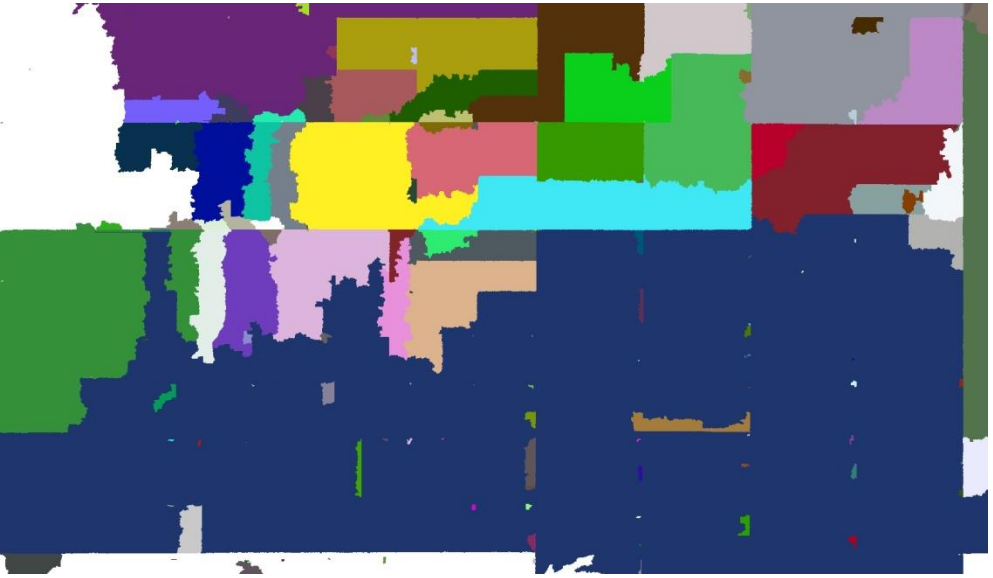
Workflow - Modeling

- **Pour points must be moved**

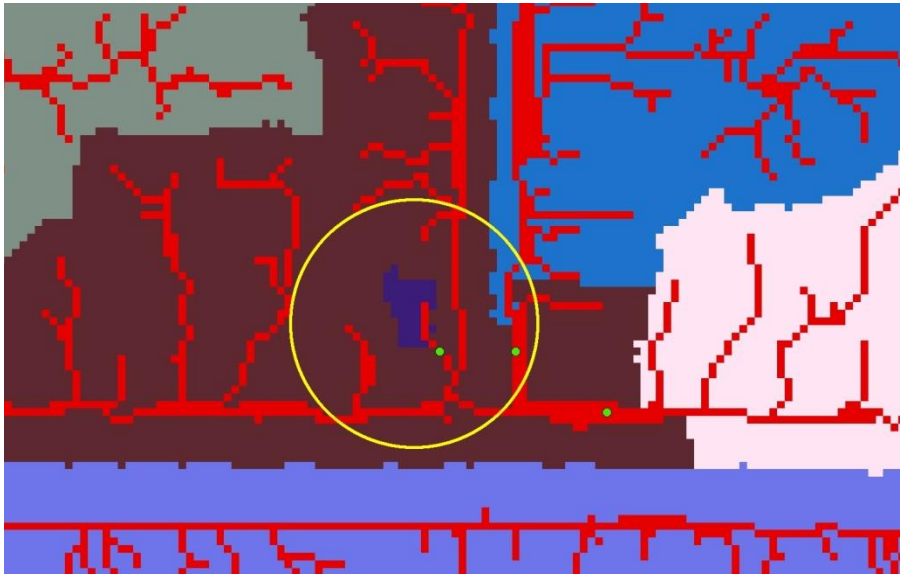


Workflow - Modeling

Unexpected results



Dark Blue Watershed Too Large – surface prep issue - need a sink mask.



Flow Accum Threshold too low – tiny watershed, surface is correct.

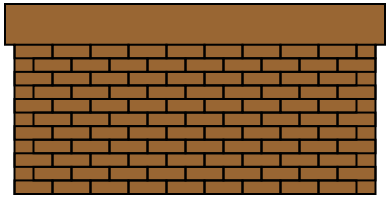
Lessons Learned

- **You have to Prepare the Surface!**
  - **Modified DEM**
    - **Fill sinks**
    - **Mask areas – don't fill**
    - **Build Walls- block flow**
    - **Dig Trenches**
      - **Edge of road breaklines**
      - **Culverts**

Mask the Stadium so that it doesn't get filled.

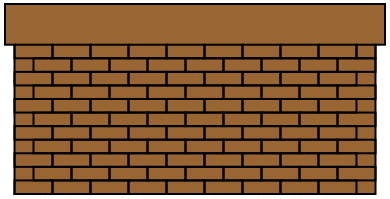
Lessons Learned

Build Walls



Lessons Learned

Build Walls



Lessons Learned

- **Stakeholder engagement**
  - **Get them involved in QC**
  - **Expectations: goals and priorities**
- **Process is iterative**
  - **You don't just line it up and hit the "GO" button!**
- **Not Perfect. But still FAR FAR better than field surveying method.**

Conclusions

- LiDAR for 1’ contours (QL 2) is sufficient
- ArcGIS still comes out ahead
- Prepare the surface!
  - Prepare the surface
    - Prepare the surface
      - Prepare the surface
- Workflow is iterative
- Save 20+ years.
- Save 70-80% of manual labor.