

A City-Wide Erosion Potential Mapping Tool for Fort Worth

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TPW/Stormwater Service Areas

- Maintenance
- Mitigation
- Warning
- Development review

















Objective

Develop a planning level erosion potential tool for
CFW & ETJ

(with capability to identify “hot spots” and “reach-
wide” erosion)

“1965” Contours

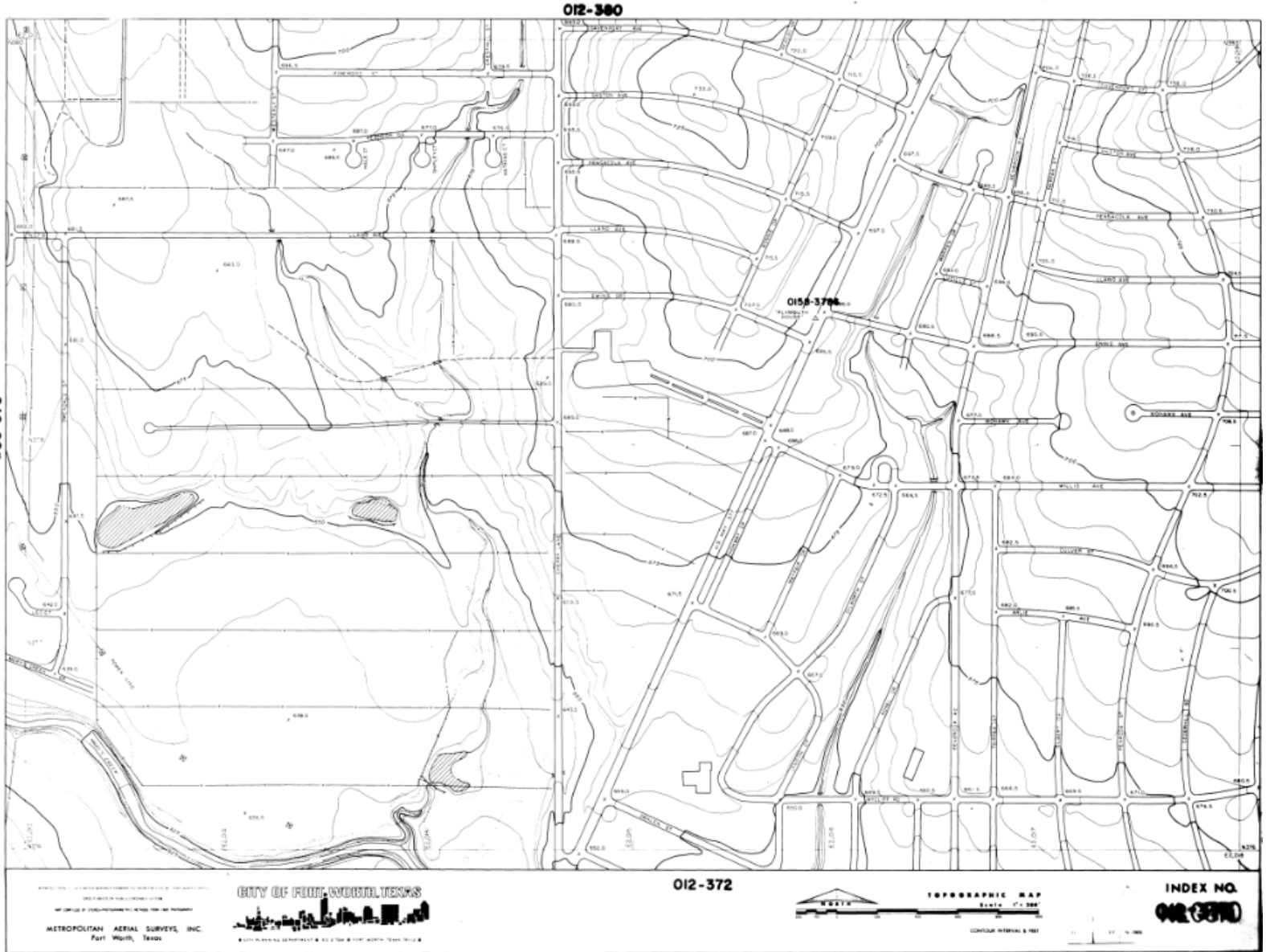
- Derived from stereo pairing of aerial imagery
- 5' contours
- Covers a range of years from the early-mid 1960s
- Coverage limited to Fort Worth of the 1960s
- Limited number of ground control survey points
- Contours extracted from paper scans by manual digitization of lines
- Comparison to 2009 LIDAR at invariant locations (parking lots) showed diff of +/- 2'

INDEX NO
012-376

006-376

REVISIONS

INDEX NO



METROPOLITAN AERIAL SURVEYS, INC.
Fort Worth, Texas

CITY OF FORT WORTH, TEXAS
CITY PLANNING DEPARTMENT • 502 TOWER • FORT WORTH, TEXAS 76102

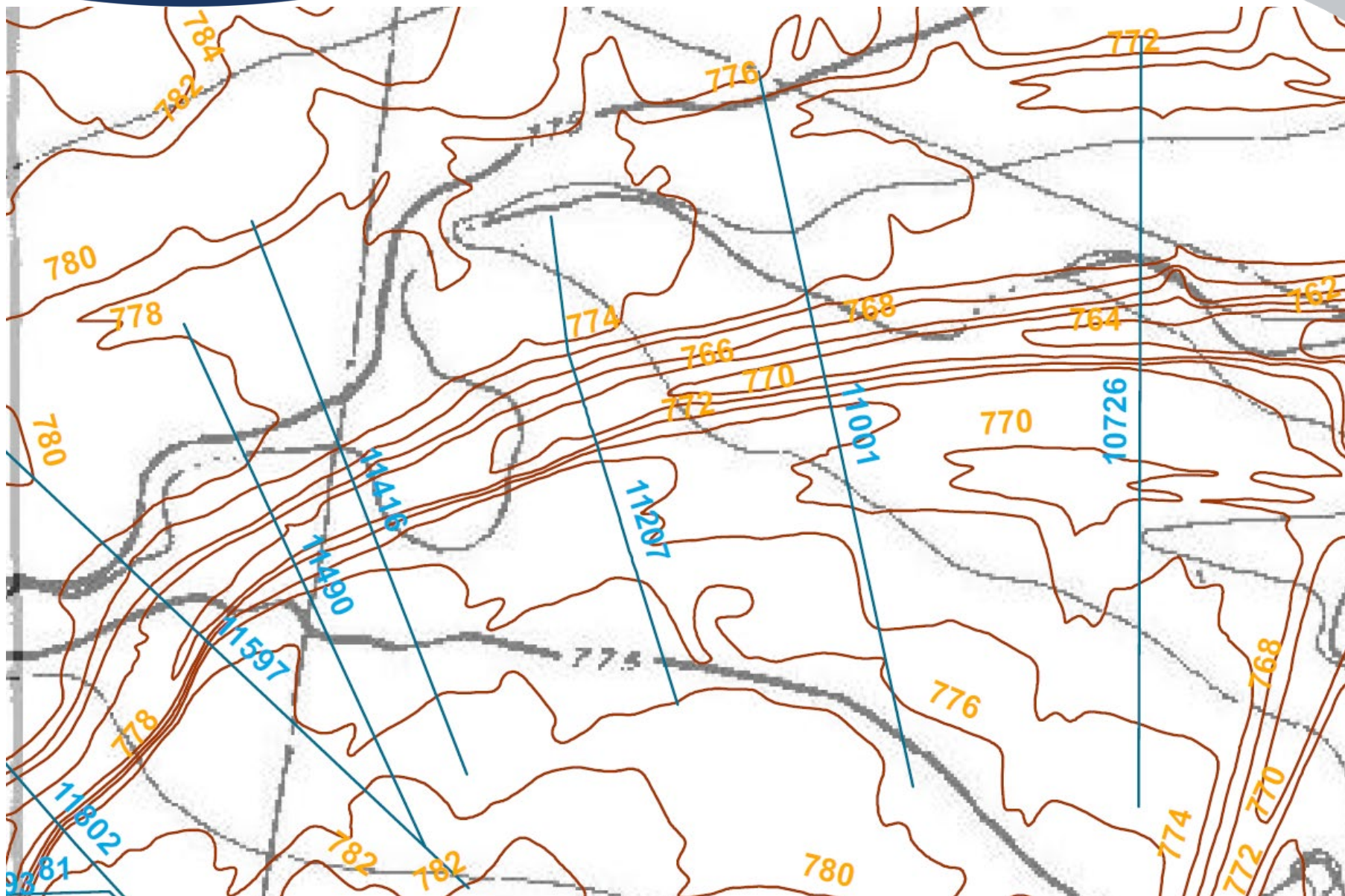
012-372

TOPOGRAPHIC MAP
Scale: 1" = 500'
CONTOUR INTERVAL: 5 FEET

INDEX NO
012-376

“2009” LIDAR contours

- Collected during March 15-29, 2009
- Multiple photon returns
- 2' contours

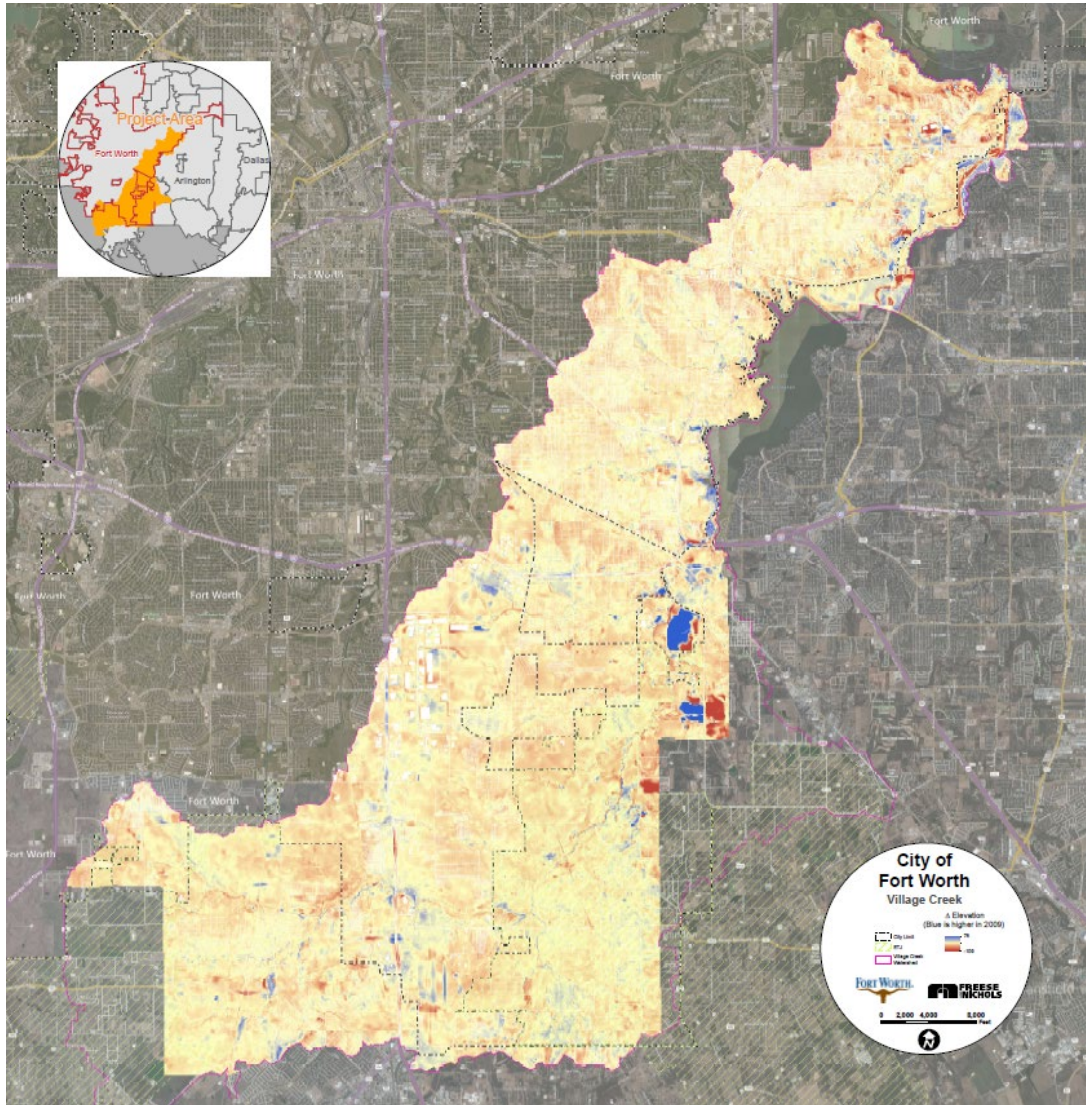


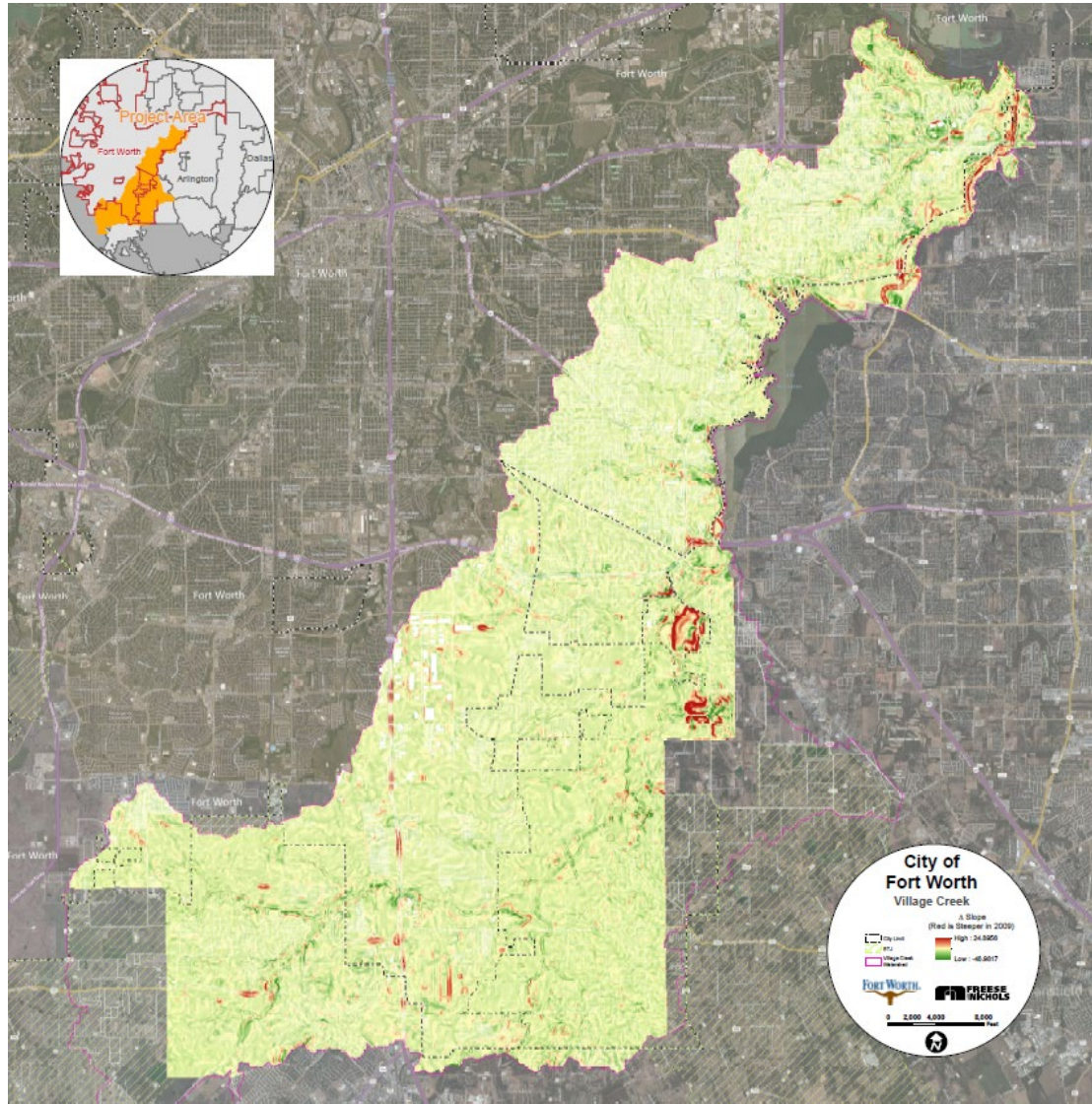


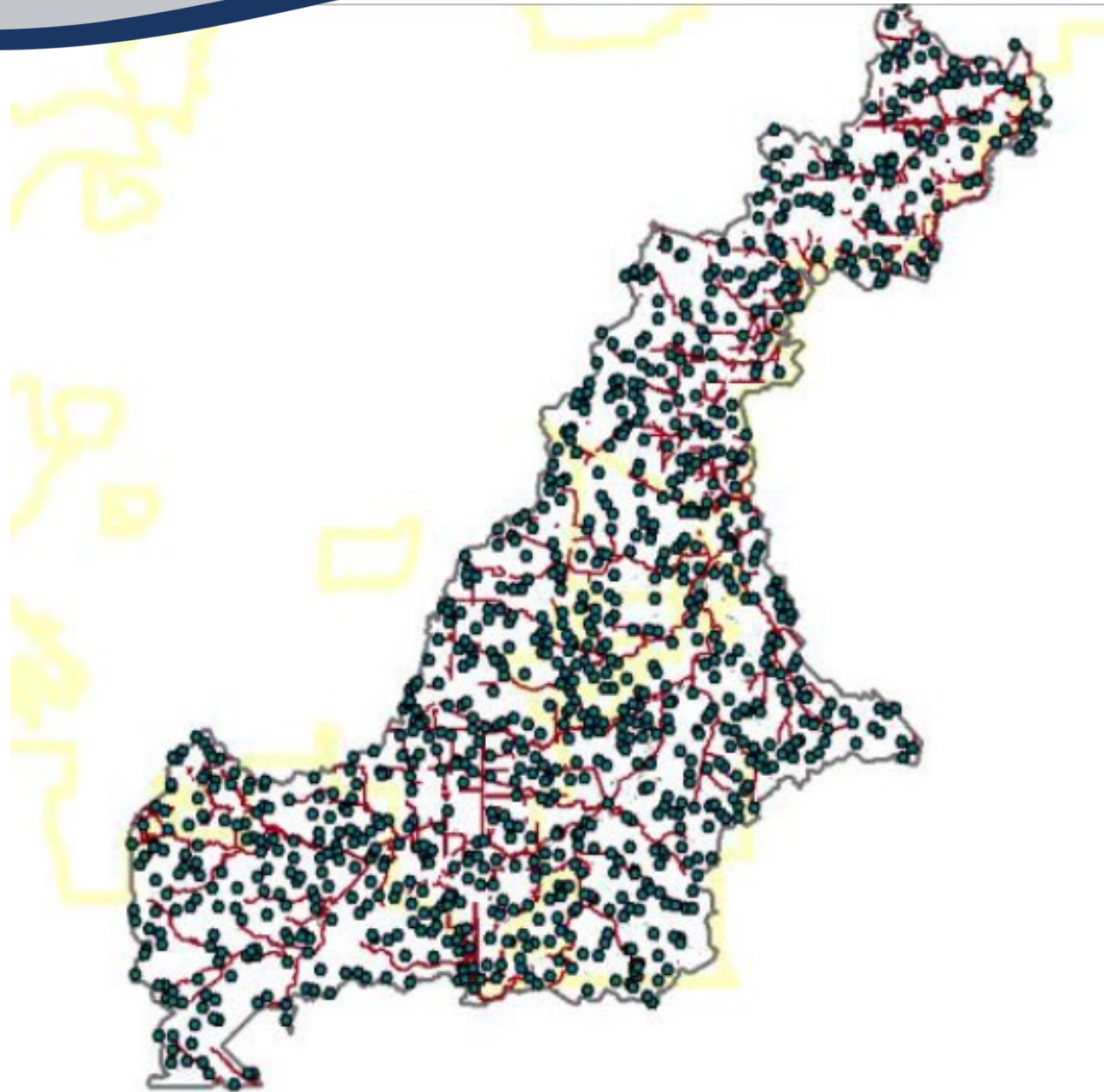


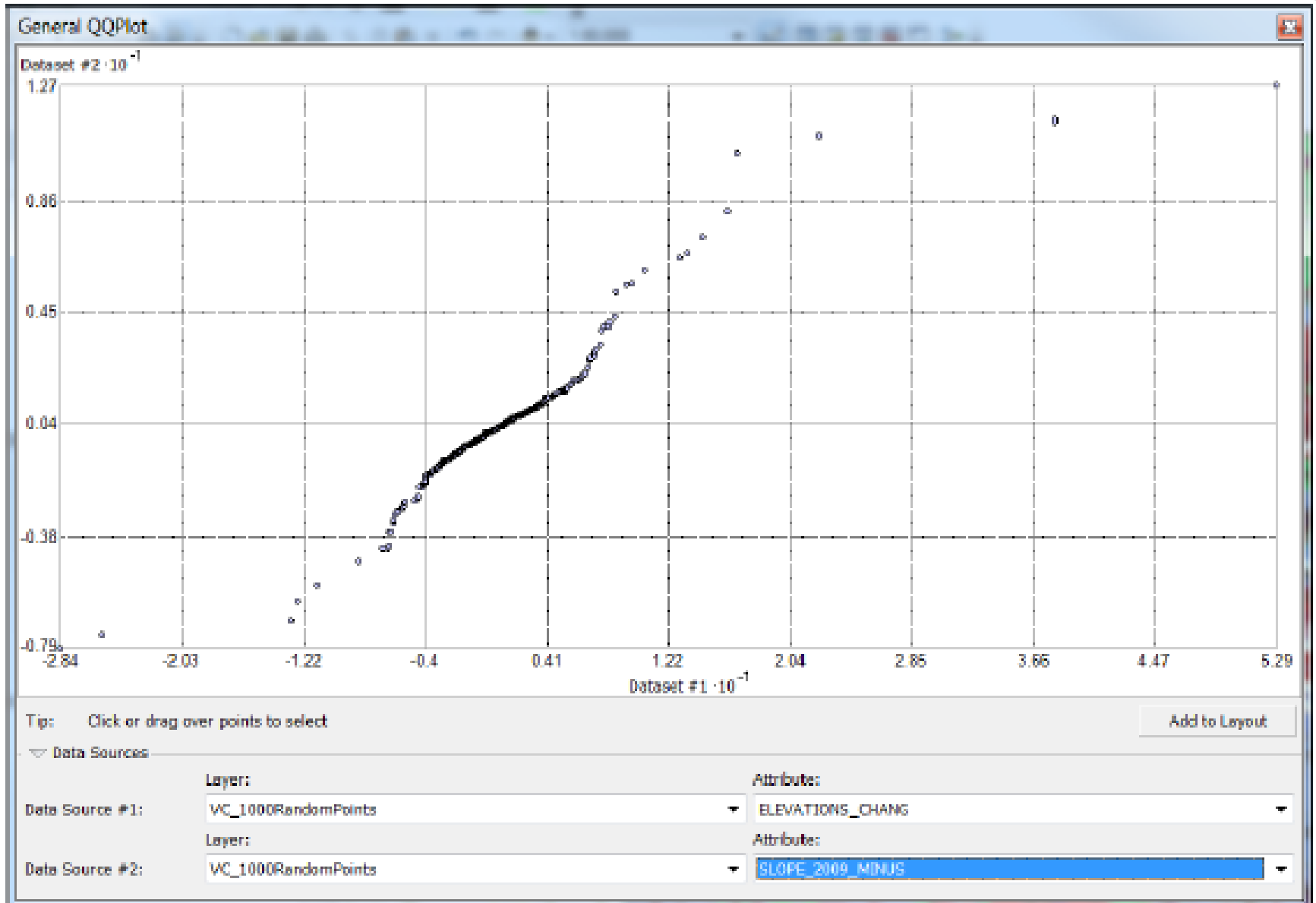
ArcGIS/ANUDEM Topo To Raster

- Thin plate splines with penalty function representation of elevation
- Uses iterative finite difference
- Iteration starts with coarse resolution until user specified resolution
- Connected drainage structure while following ridges and valleys defined by the contours
- Modifies DEM to removes spurious drainage sinks
- DEM for erosion potential generated without stream and lake vector lines



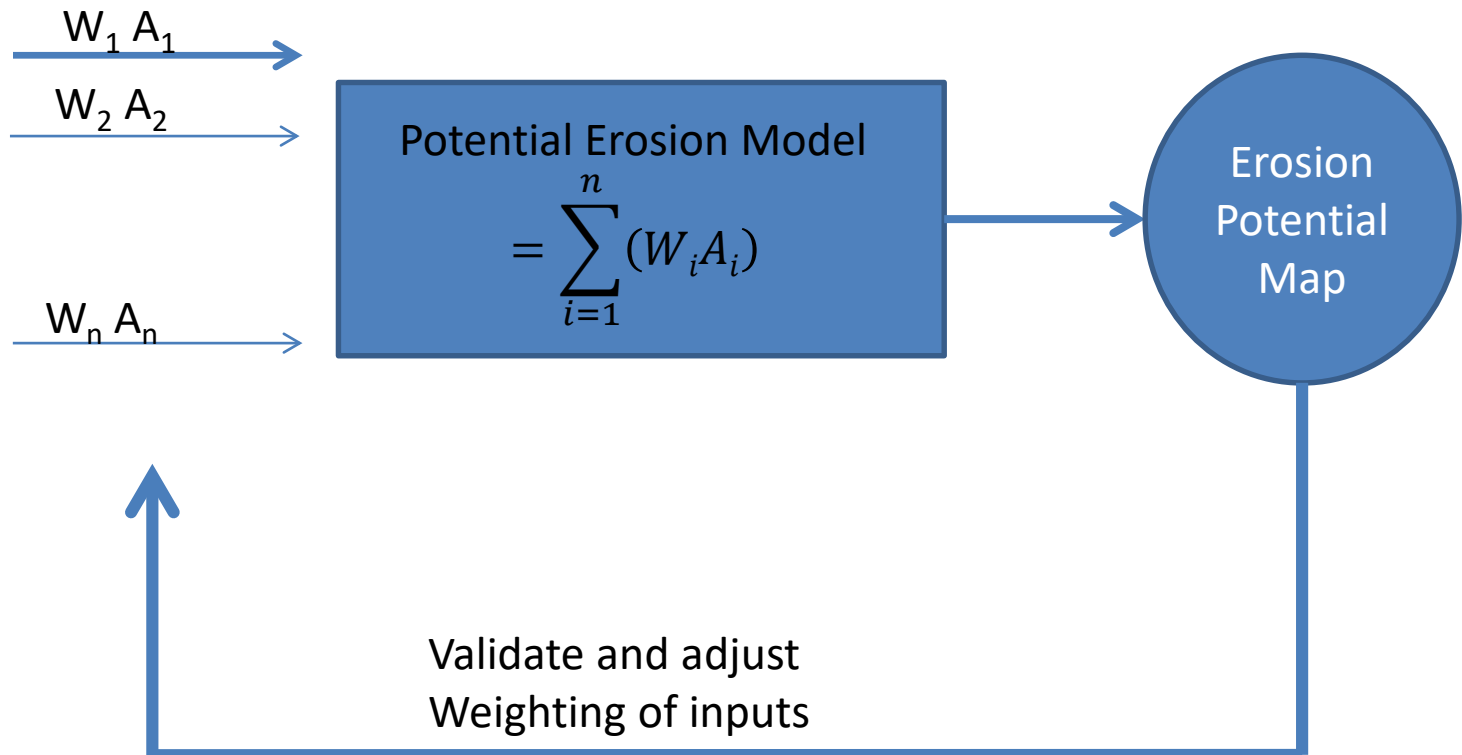






Raster Weighting Approach

Raster inputs, **A**



Raster Inputs

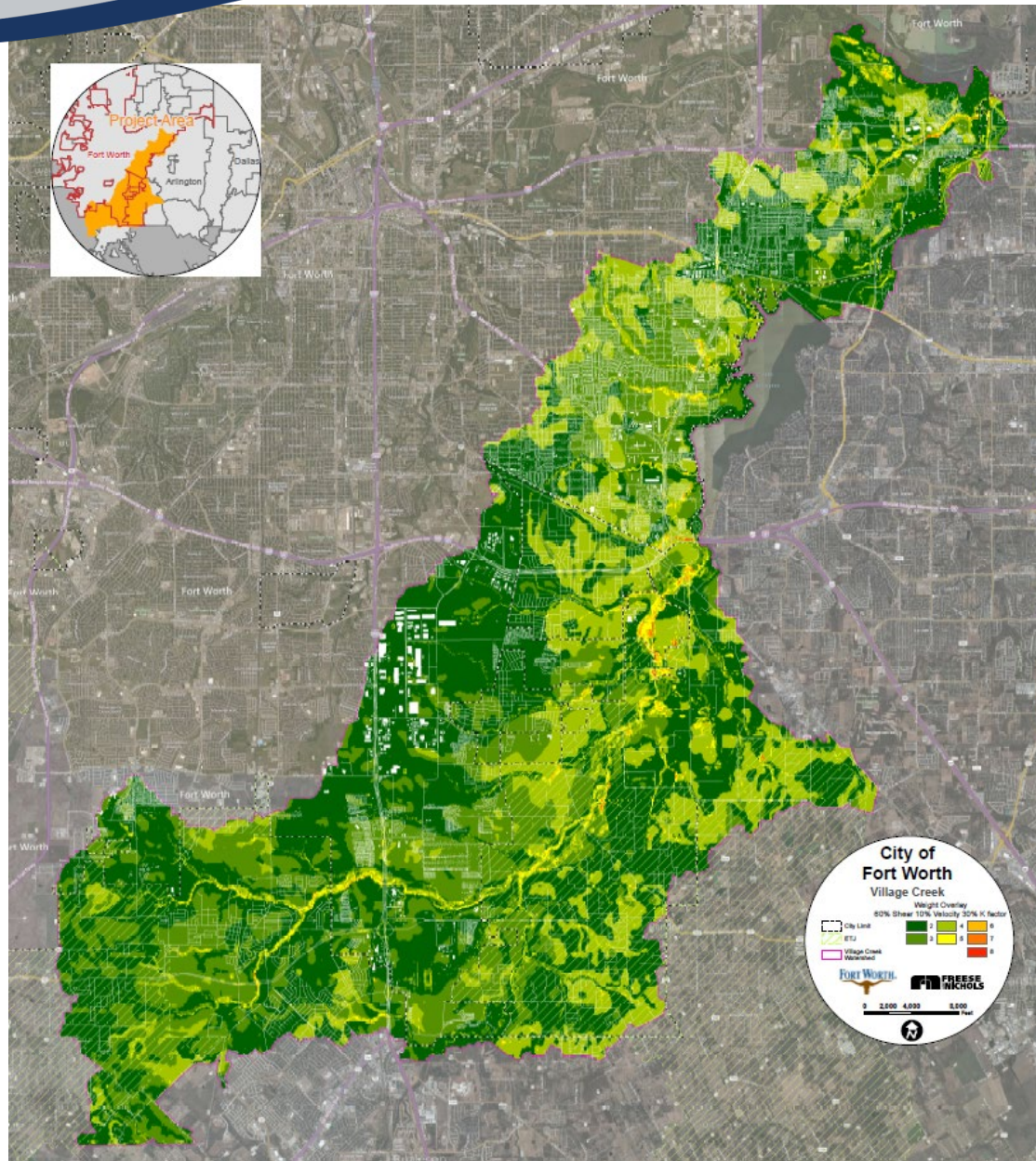
- Grid size set at 100 feet
- A_1 , Shear stress: depth from 25-year design storm (ICM model), slope from 2009 elev. Raster
- A_2 , Flow velocities from 25-year design storm (ICM model)
- A_3 , Soil K-factor from NRCS/SSURGO
- Factors ranked and scaled from 1-9

Weighting:

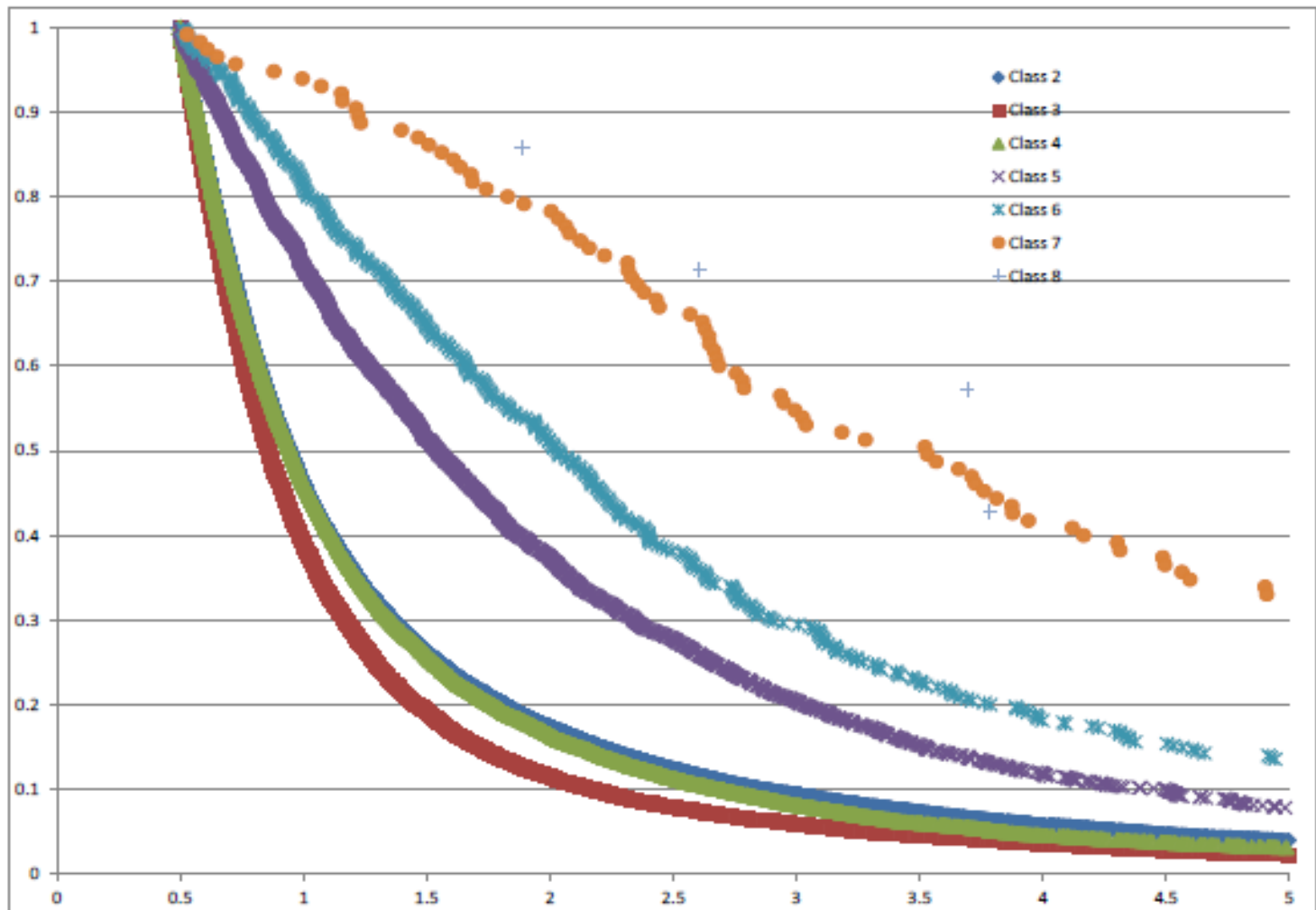
W_1 , Shear stress at 60%,

W_2 , Velocity at 10%

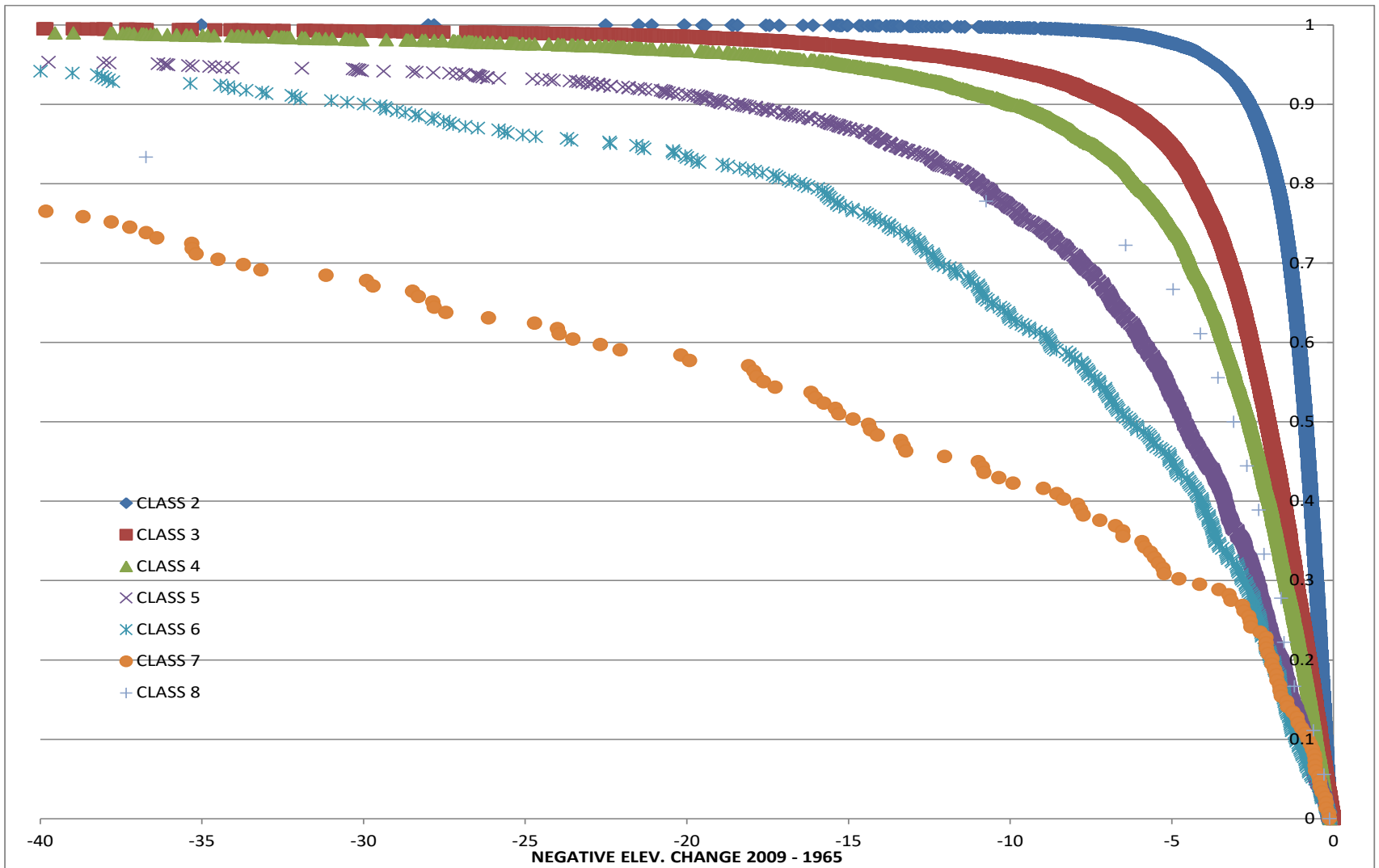
W_3 , K-factor at 30%

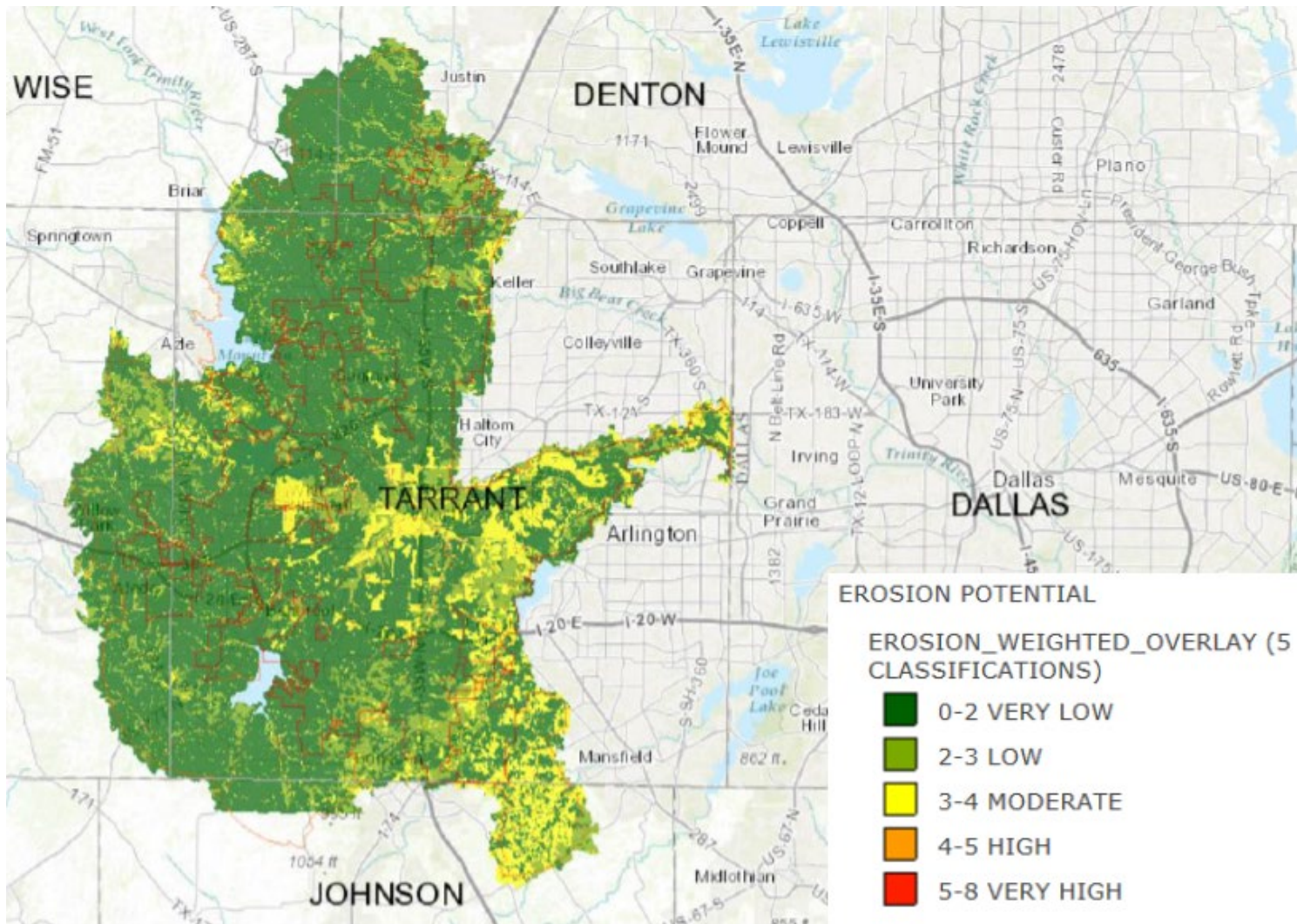


Class Distribution, 2009 – 1965 (+ve slopes)



Class Distribution Elev. 2009 – 1965





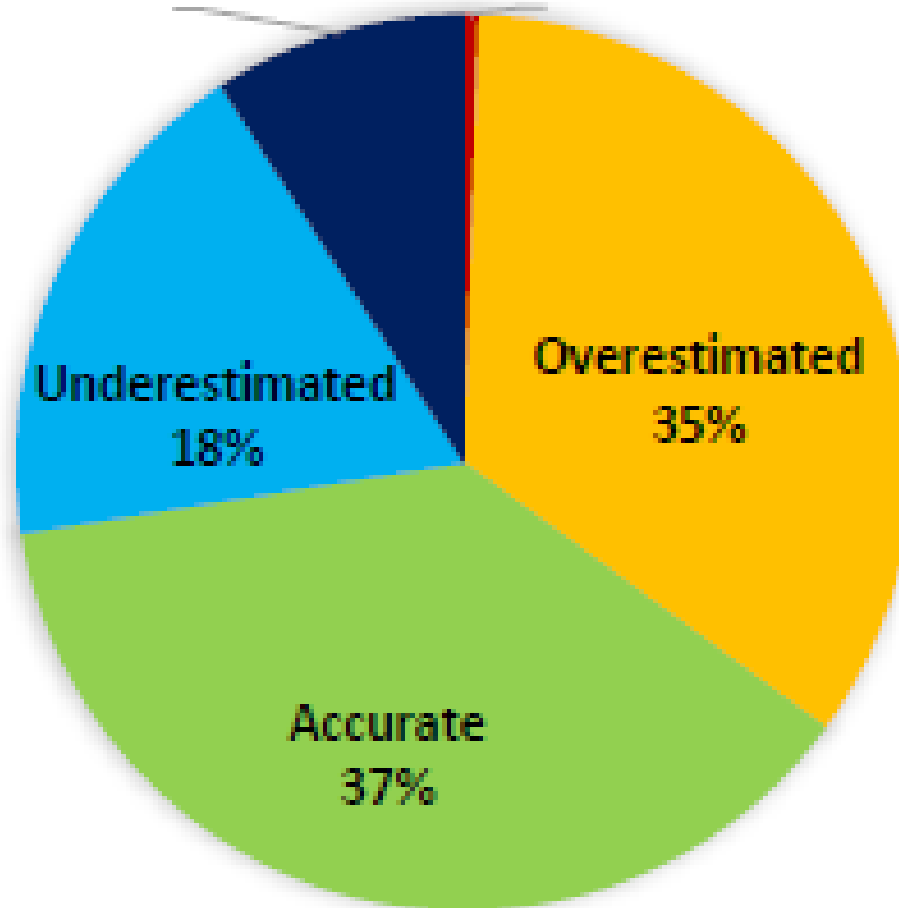
Creek Classification	Field Assessment	GIS Erosion Potential map
Good	60%	43%
Fair	22%	56%
Poor	19%	1%

Validation

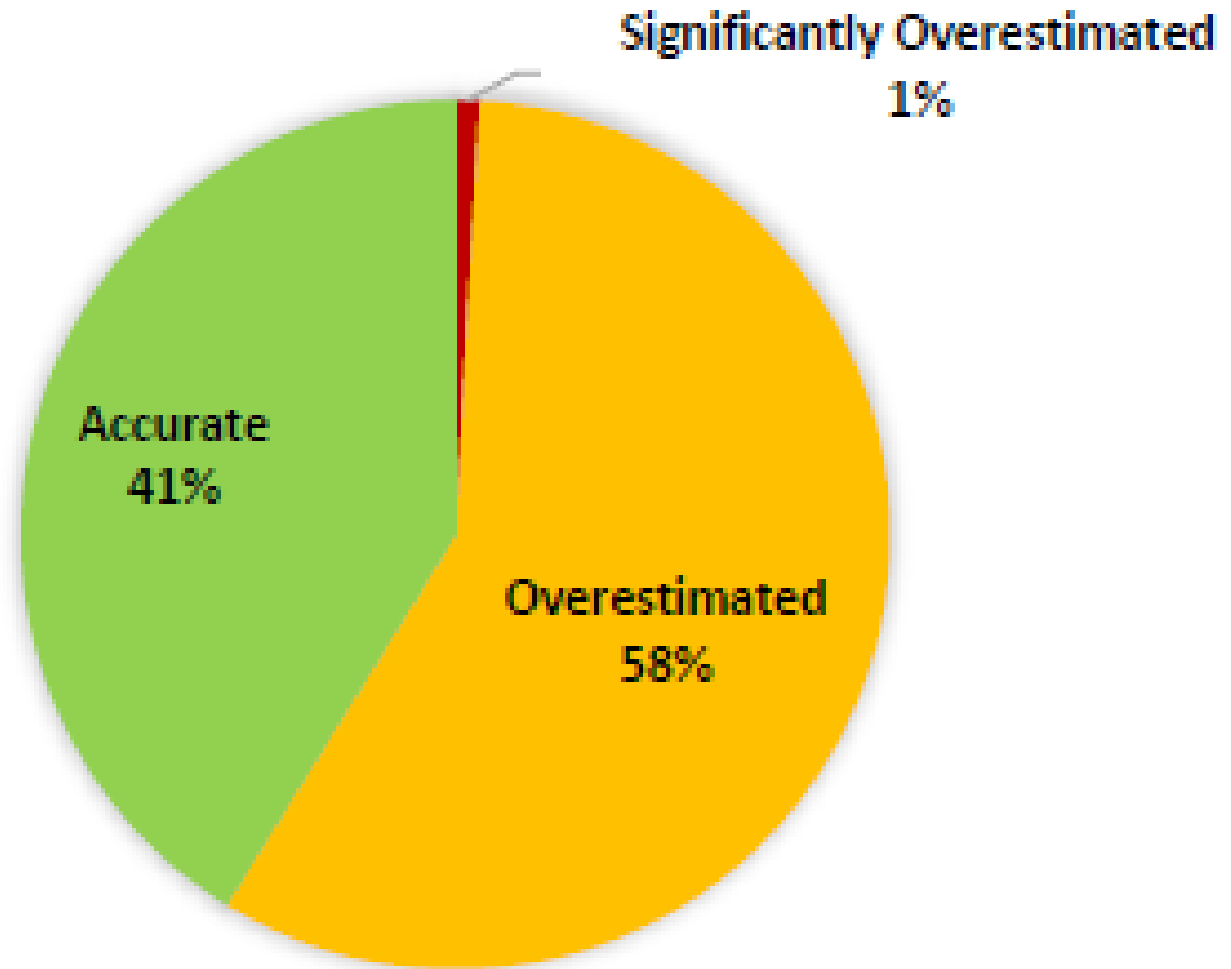
	Prediction	Creek Survey
Significant over estimate	Poor	Good
Over estimate	Fair	Poor
	Poor	Fair
Accurate	Poor	Poor
	Fair	Fair
	Good	Good
Under estimate	Fair	Poor
	Good	Fair
Significant Underestimate	Good	Poor

Significantly Underestimated
9%

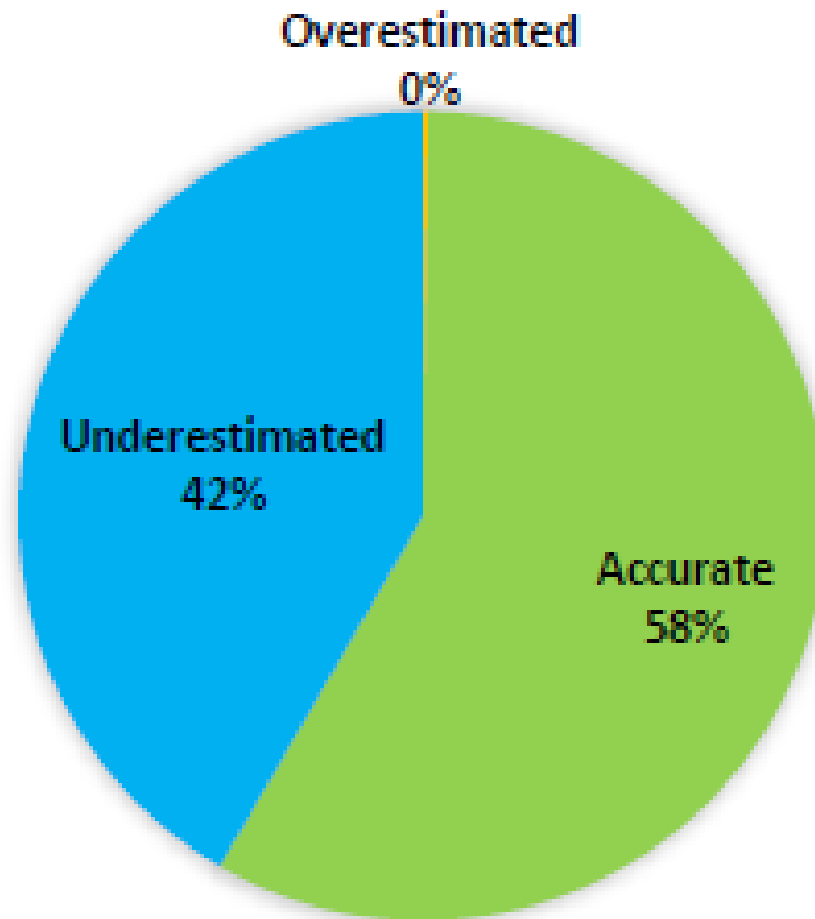
Significantly Overestimated
1%



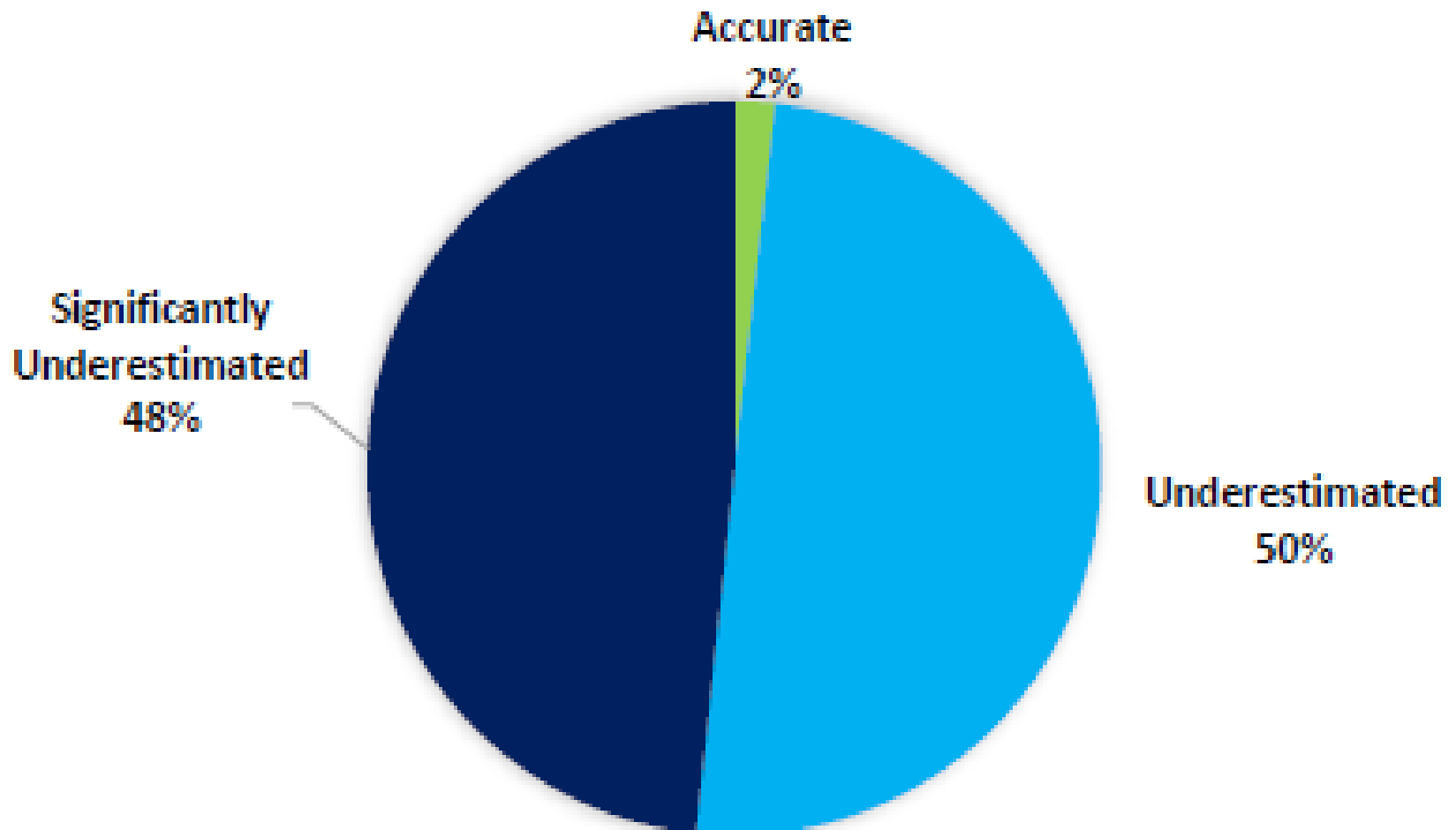
Prediction: Good

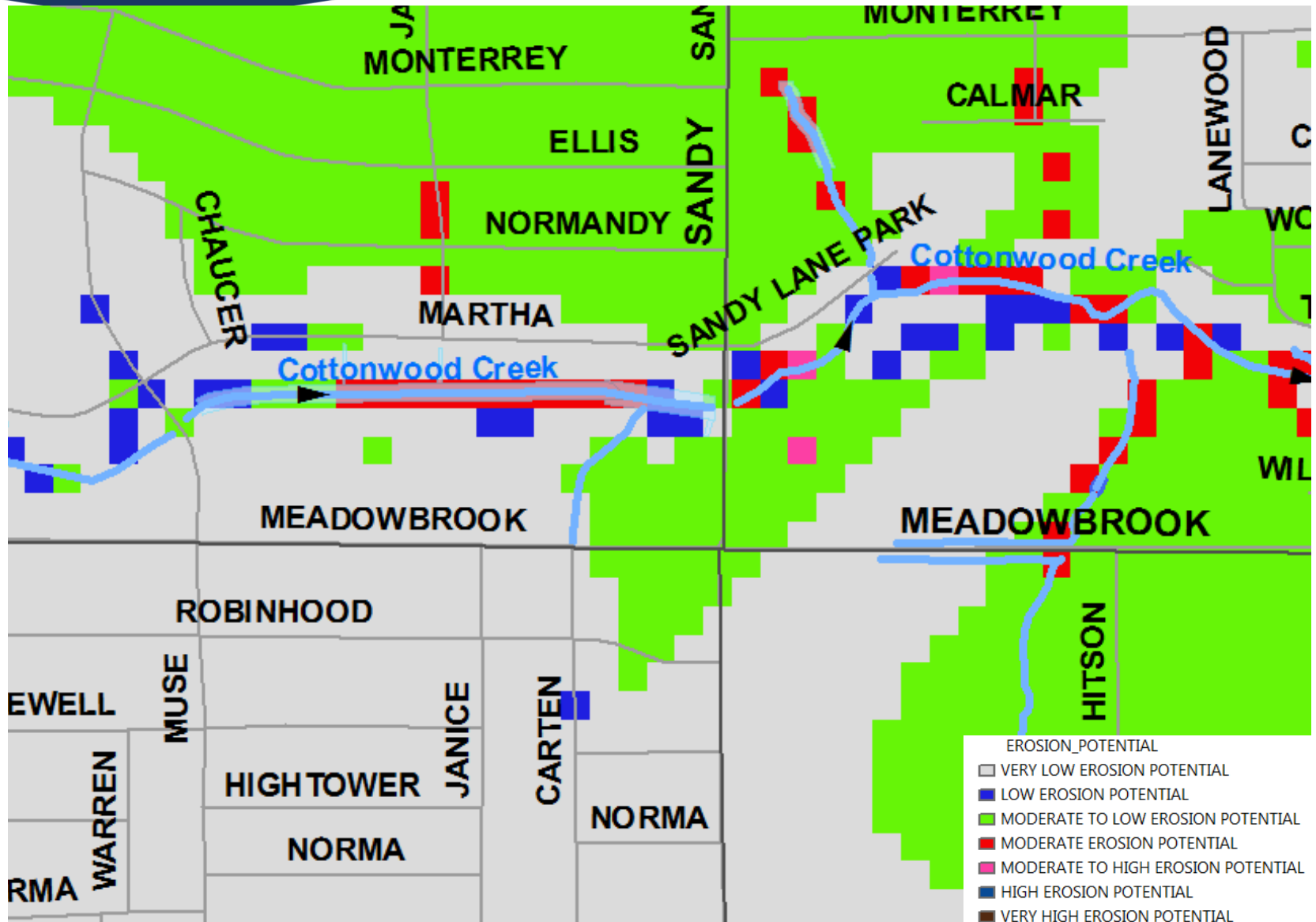


Prediction: Fair

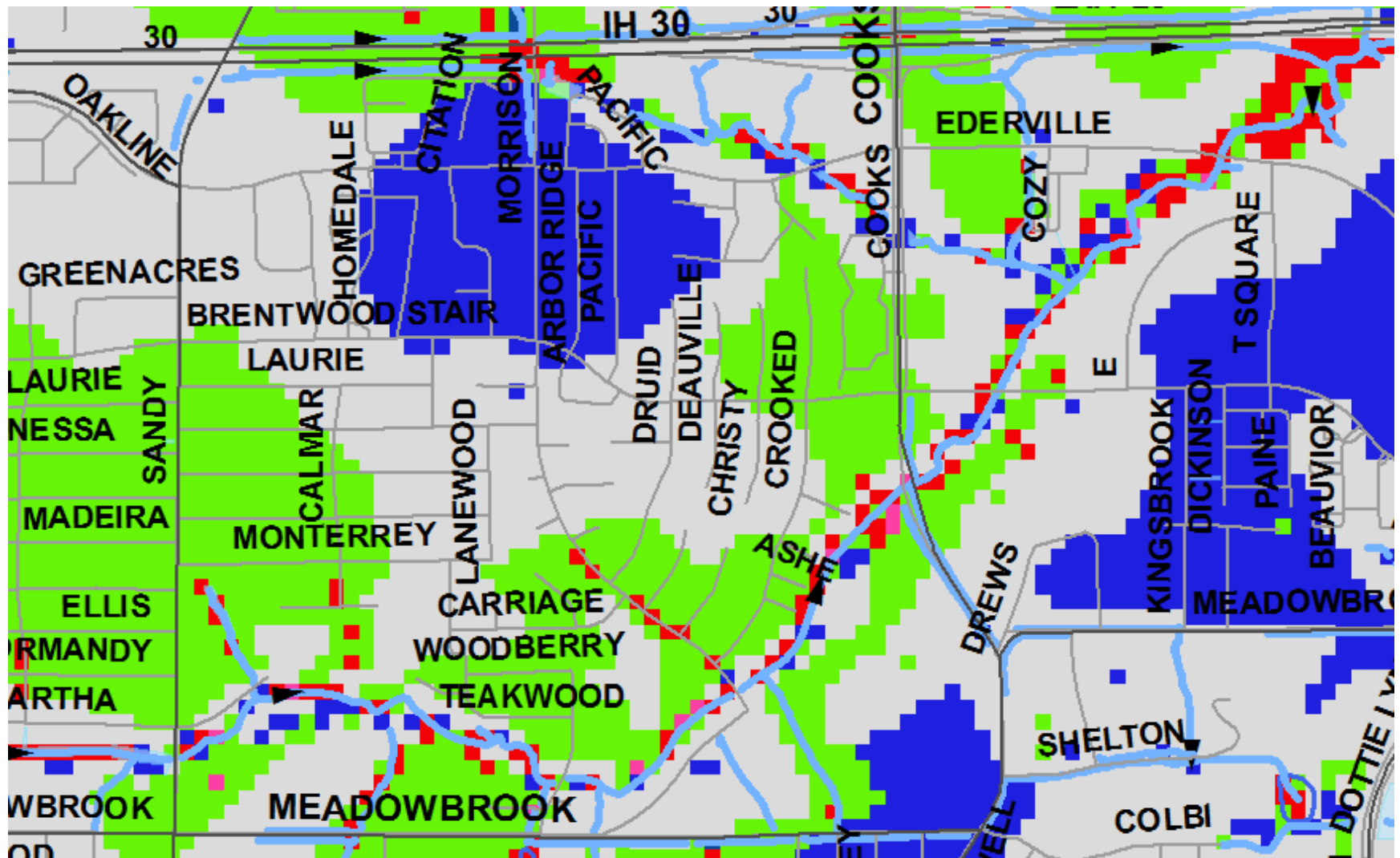


Prediction: Poor

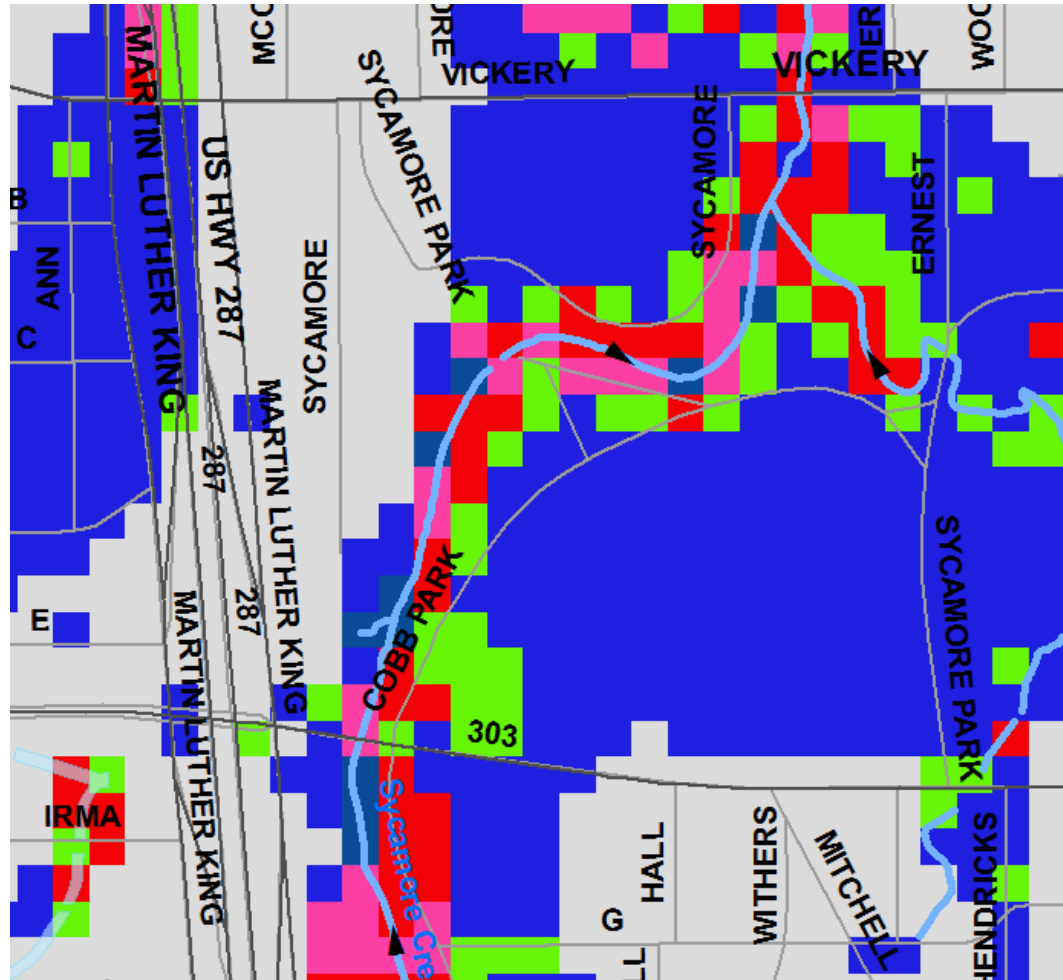




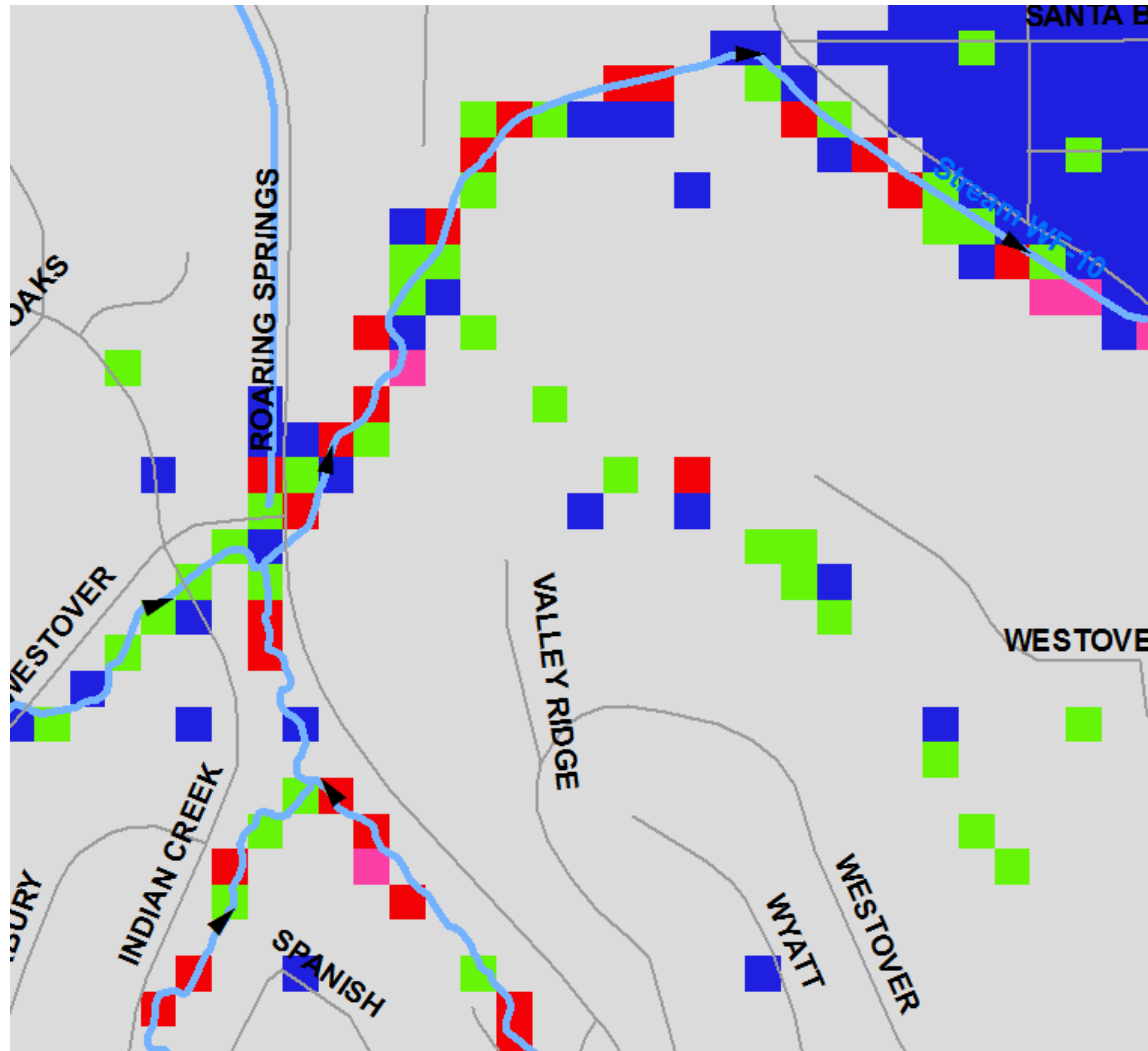
Cottonwood Creek



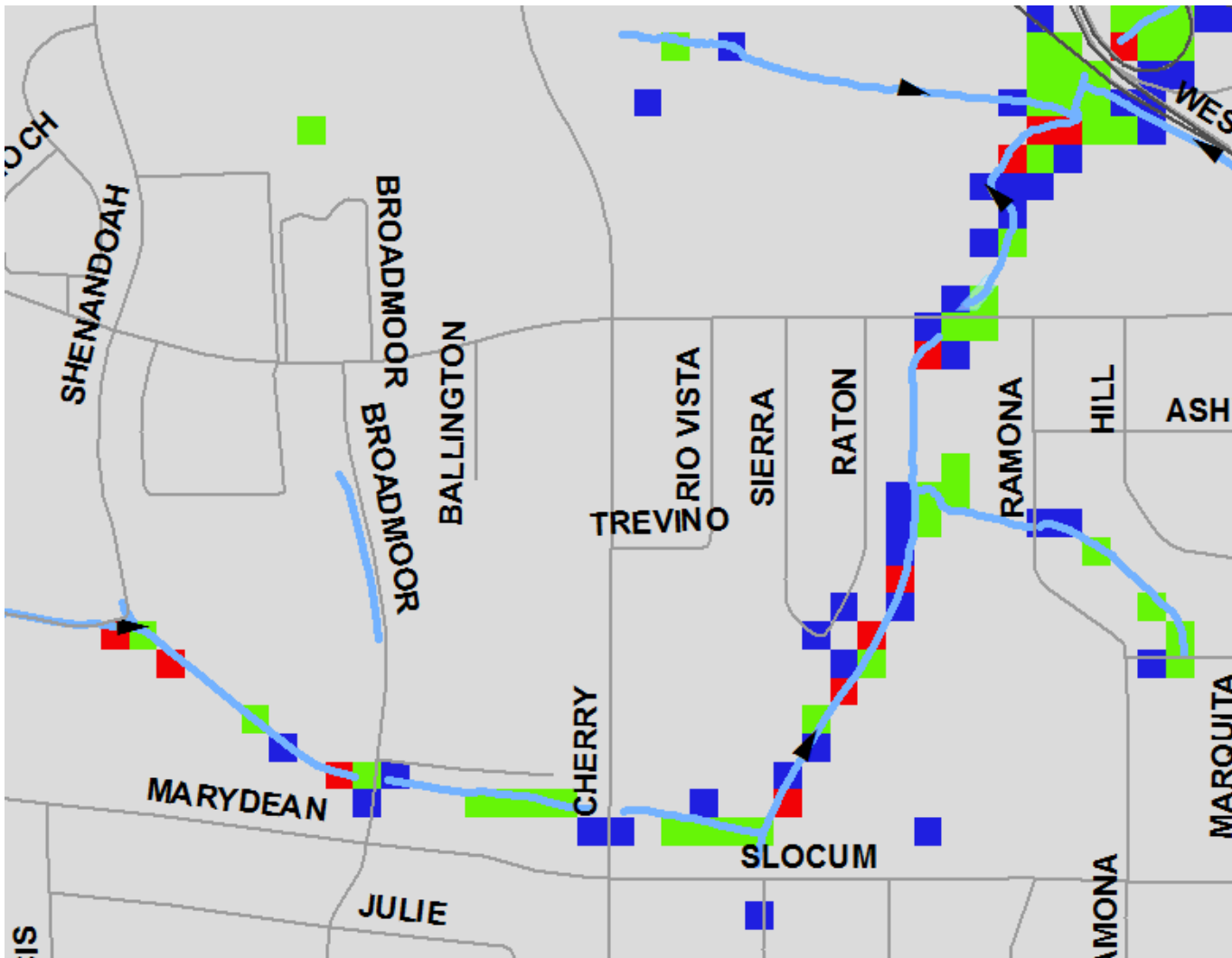
Sycamore Creek



Indian Creek



Broadmoor Creek



Factors for Refined Mapping of Creeks

- Land use: change from historical aerials
- Geology/Soil: depth to bedrock, soil erodibility
- Hydrology: Stream order, shear stress, velocity
- Channel morphology:
 - Channel slope, sinuosity, bank full width/depth
- Vegetation: Tree cover → rooting depth?
- Structures at creek crossings
- Proximity to structures (culverts, bridges)

Future Validation

- Historical contours and aerials
- More field check of “hot spots”
- Comparison against detailed models (e.g., BEHI) at erosive segments
- Prediction vs. channel inventory
- Prediction vs. Field Maintenance records

Statistical/Neural Net/Machine Learning Classification

