Canyon Creek, Oregon: 3D Terrain Visualization and Data Preprocessing for Dam Break Analysis Using HEC-RAS

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Digital Terrain Analysis (GEOG 593)

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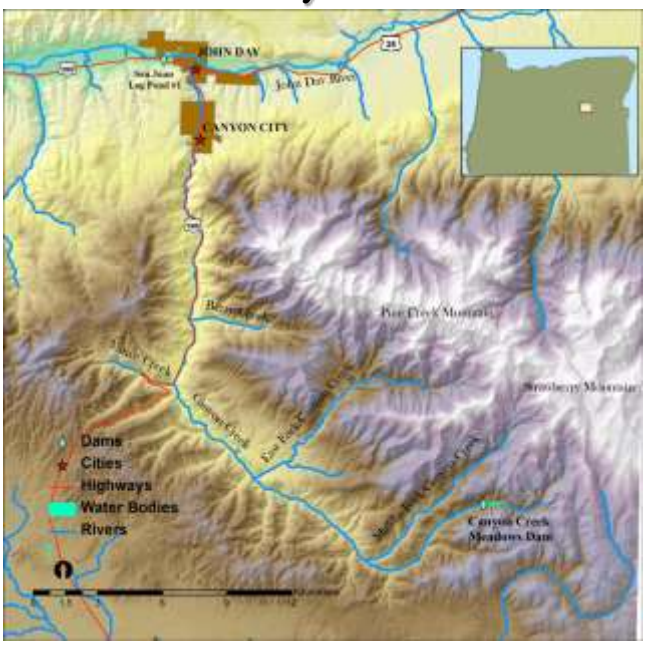
Study Area



Canyon Creek Meadows Dam: Background

- Built 1963
- Owned and operated by Oregon Department of Fish and Wildlife (ODFW)
- Rockfill (earthen) construction
- Recreational purpose
- "High risk" classification
  - Failure of the dam would likely result in the loss of human life, significant property damage, and extensive environmental damage
  - Outlet gate left open since 1998 to prevent reservoir fill-up

Project Goals

- Process terrain and hydrography for dam failure simulation
  - "Unsteady flow" model
- Determine the downstream community impacts of dam-break flood
- Create 3D visualization of terrain and hydrography

Data and Sources

Dataset	Source	Resolution	Year
Digital Elevation Model (DEM)	US Geological Survey (USGS)	30 meter GRID	1998
Hydrography	Pacific Northwest Hydrography Framework Group	1:24,000 vector	2006
Dams	Oregon Water Resources Department (ORWD)	1:24,000 vector	2010
Cities	Oregon Department of Transportation (ODOT)	1:24,000 vector	2010
Aerial Imagery	National Agriculture Imagery Program (NAIP)	1 meter	2011

Projection: NAD 1983 UTM Zone 11

Software

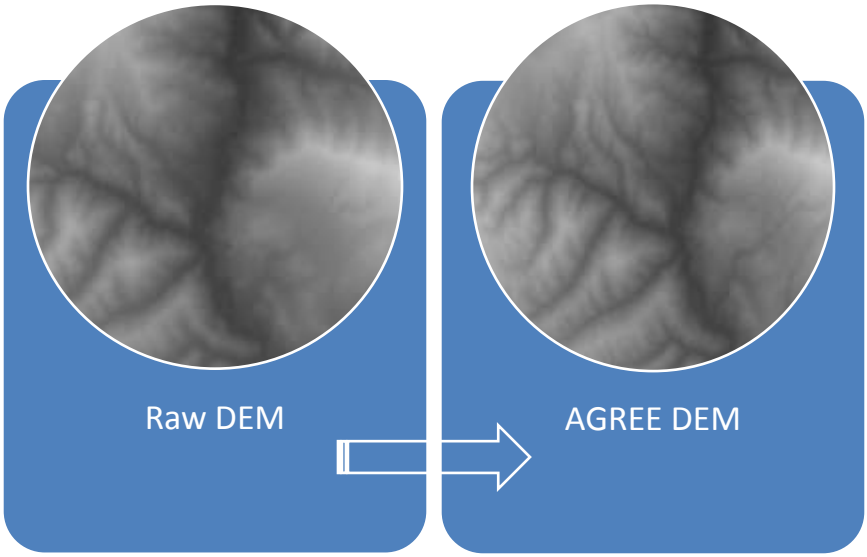
- Enivronmental Systems Research Institute (ESRI)
  - ArcMap v. 10
  - ArcScene v. 10
  - ArcHydro plugin v. 2.0

- US Army Corps of Engineers
  - Hydrologic Engineering Centers River Analysis System (HEC-RAS) v. 4.1.0
  - HEC-GeoRAS plugin for ArcMap v. 10

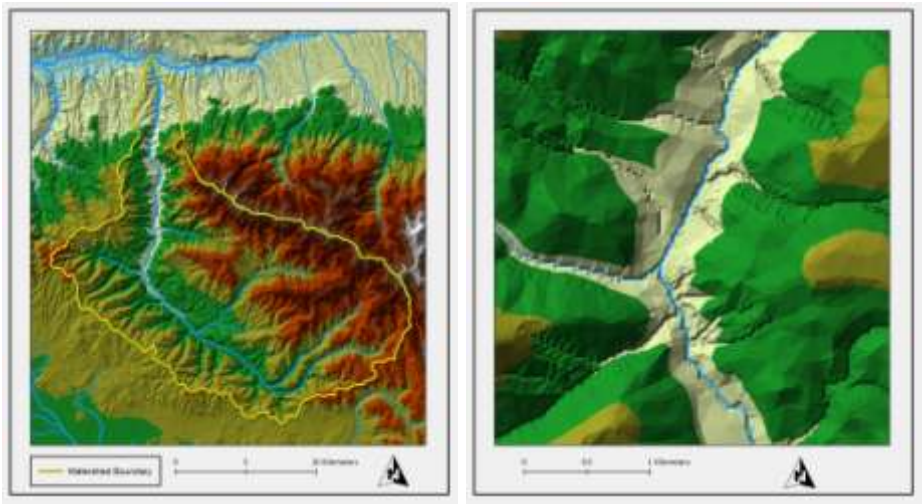
Project Workflow

ArcHydro	• DEM Processing and TIN creation • Stream burning (AGREE method) • Watershed delineation
HEC-GeoRAS	• Stream network (re-)delineation • Cross-sections • Storage areas
HEC-RAS	• Import RAS layers • Attempt to run unsteady flow simulation • Unsuccessful ➔ missing some required data
ArcScene	• Aerial image overlay • 3D visualization • Flythrough animation

Terrain Processing with ArcHydro



Terrain Processing with ArcHydro



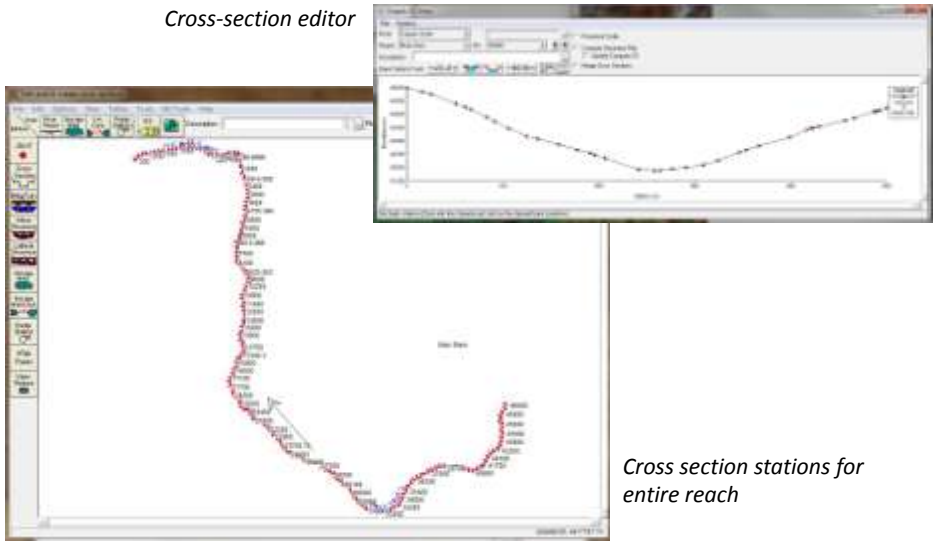
For HEC-GeoRAS, re-digitized stream based on AGREE TIN

Terrain Processing with HEC-GeoRAS

- Cross sections inserted at ~400m intervals
  - Perpendicular to stream
  - Include floodplain area
  - Capture changes in hydrography

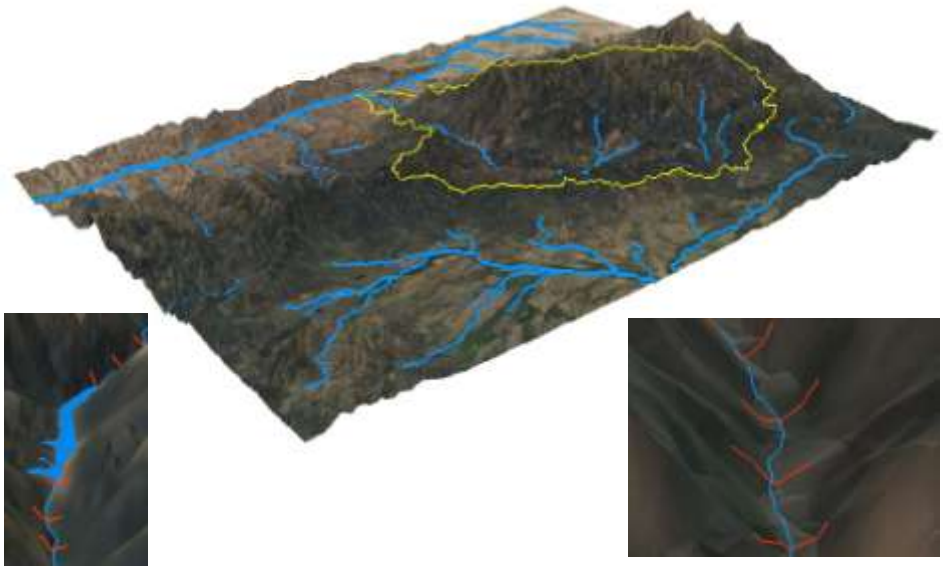
HEC-RAS

Cross-section editor

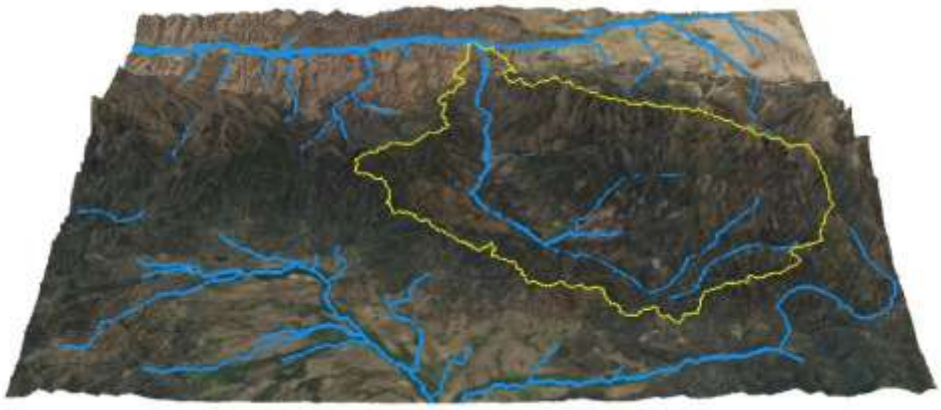


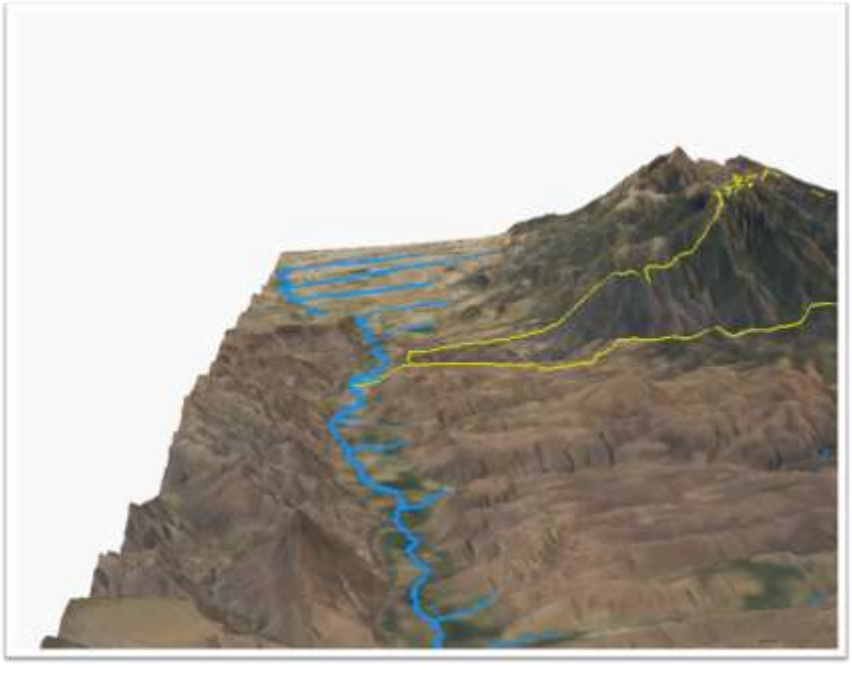
Cross section stations for entire reach

3D Visualization in ArcScene



3D Visualization in ArcScene





Limitations

- Low resolution DEM (30m) generalizes terrain
- Insufficient information on dam structure to run HEC-RAS
- No survey data to complement/confirm GIS data

Assumptions

- DEM and hydrography are spatially accurate
- All datasets have been through QA/QC processing
- AGREE DEM is an improvement on raw DEM in representing stream channels

References

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