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High and Dry
Uncovering the Pitfalls in Upland Flood Risk Assessment

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civil • structural • landscape architecture • surveying • planning • assessments

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Importance of Upland Flood Risk

Flood Insurance Statistics

- 25% of claims outside of SFHA[1]

- <3%* of properties outside SFHA[2]

- Increasing cost and frequency[3]

NATIONAL FLOOD INSURANCE PROGRAM

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Importance of Upland Flood Risk (ctd.)

Uninsured Loss Predictions

- SOA 2020 Report:
  - $7 billion flood damage houses annually[4]
  - 87% uninsured[4]

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Upland Area Definition

Drainage Divide · Interfluve · Tributary Stream · Mouth · Main Stream
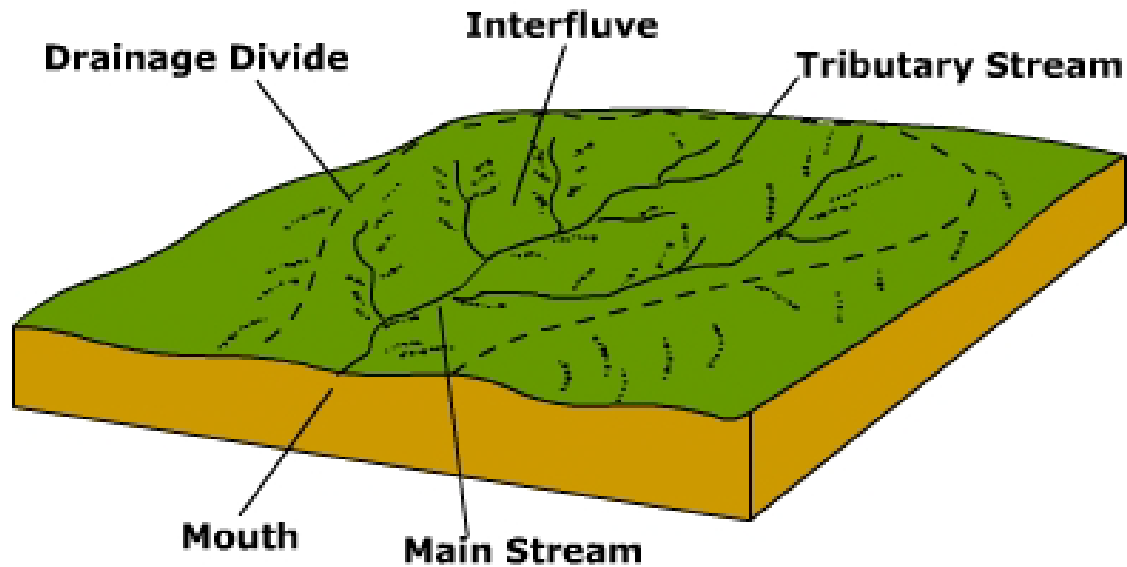
Small defined channel
– Often unnamed

Undefined channel
– Upper sq. mi. of DA

Between year-round streams and drainage divide

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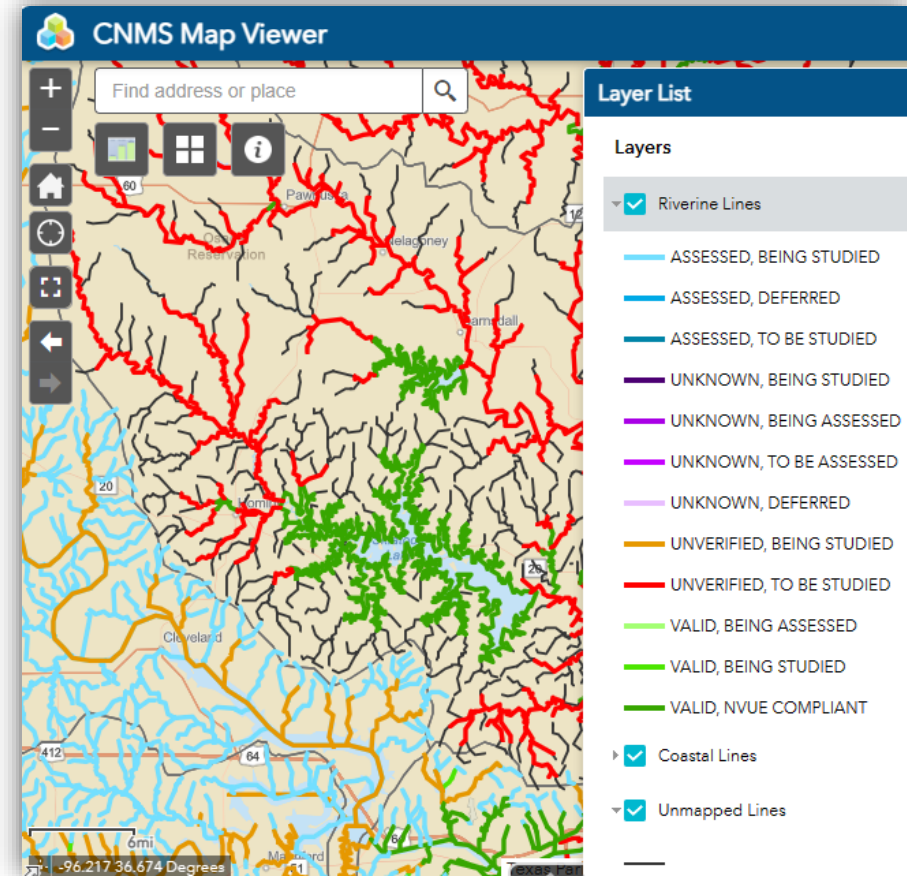# Risk Assessment Deficiencies

Low Priority
- Hazard level
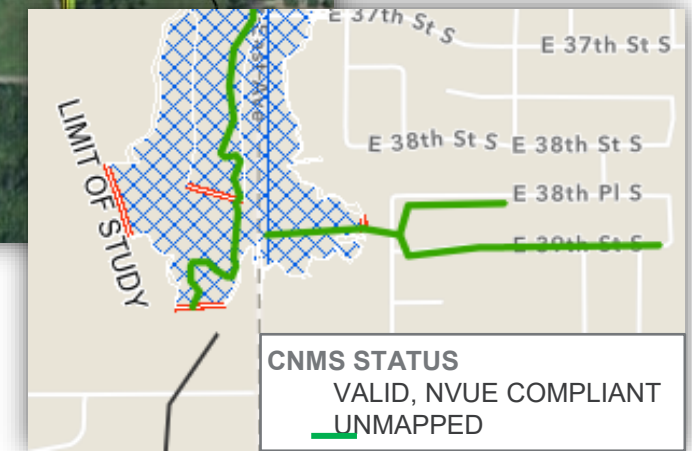- Flood impact

Result
- Unstudied/ Unmapped
- Zone A
  - Mapped/ partially mapped
  - Undetailed

# Unmapped Areas: 1D Limits of Study

Limit of Study:

- 1 sq. mi. drainage area extent
- NOT the limit of RISK
- > 50% of "stream miles" unmapped

CNMS STATUS
VALID, NVUE COMPLIANT
UNMAPPED

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Unmapped Areas: 1D Study Fringe

1D Study Maps:

– Appear to cover floodplain fringe

– Misleading for adjoining tributaries

– Modeling limitations

  • No tributary interaction

  • Only in-line hydraulic structures

2D BLE STUDY

1D DETAILED STUDY

E Highway 72
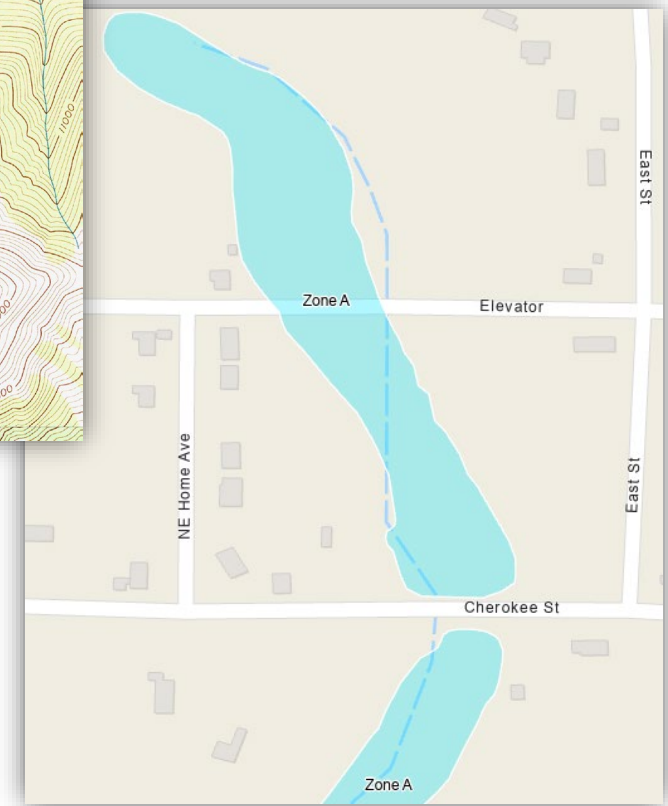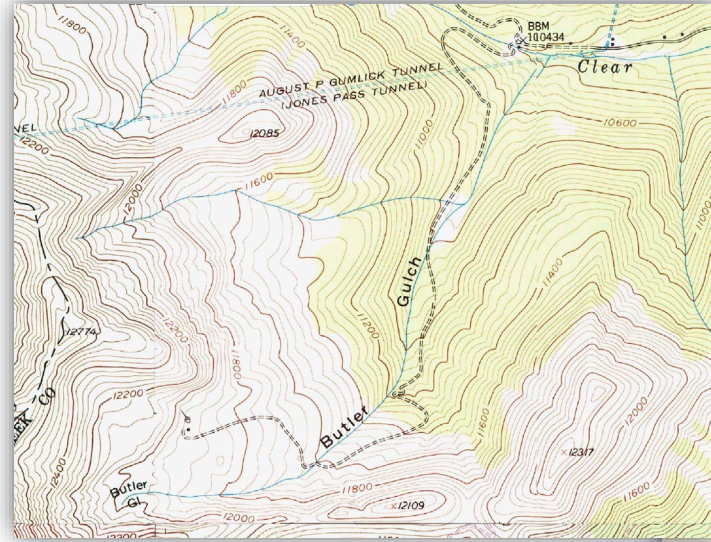
Sugar Creek Rd

72

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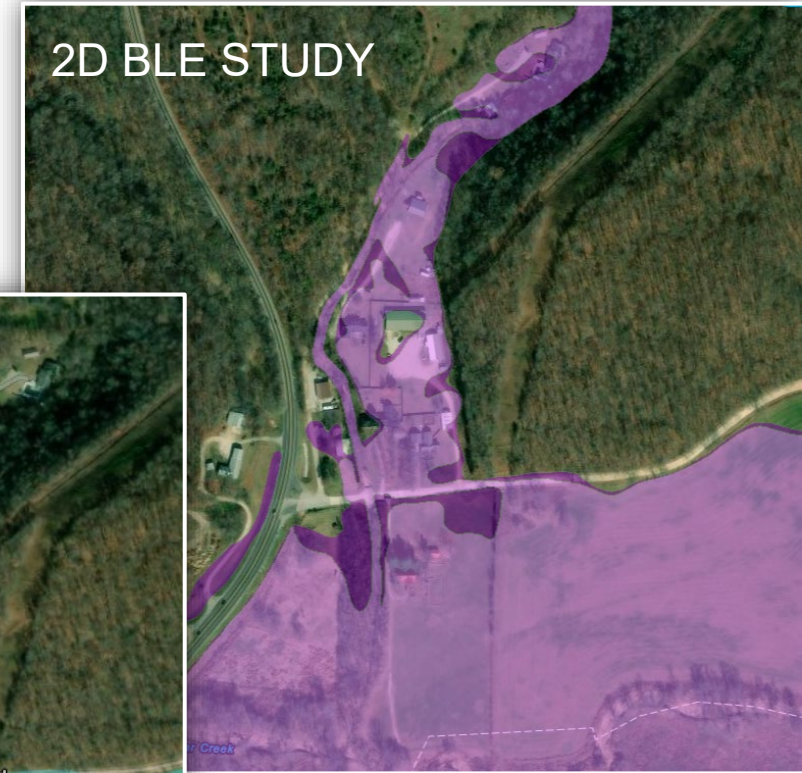
Unstudied Areas: Zone A

Legacy Approaches:
- Course
- Flow approximations
- Flood photographs
- Topographic maps
- Still in effect

Newer Approach
- Adopt BLE

BLE Study Limitations: 1D

1D Models:
- Directly apply DA flows to channel
- Route flows parallel to channel
- Survey data
  - Detailed studies

Limitations:
- Limits of Study
- Regression equation flows
- Lack hydraulic structure
- Uncalibrated

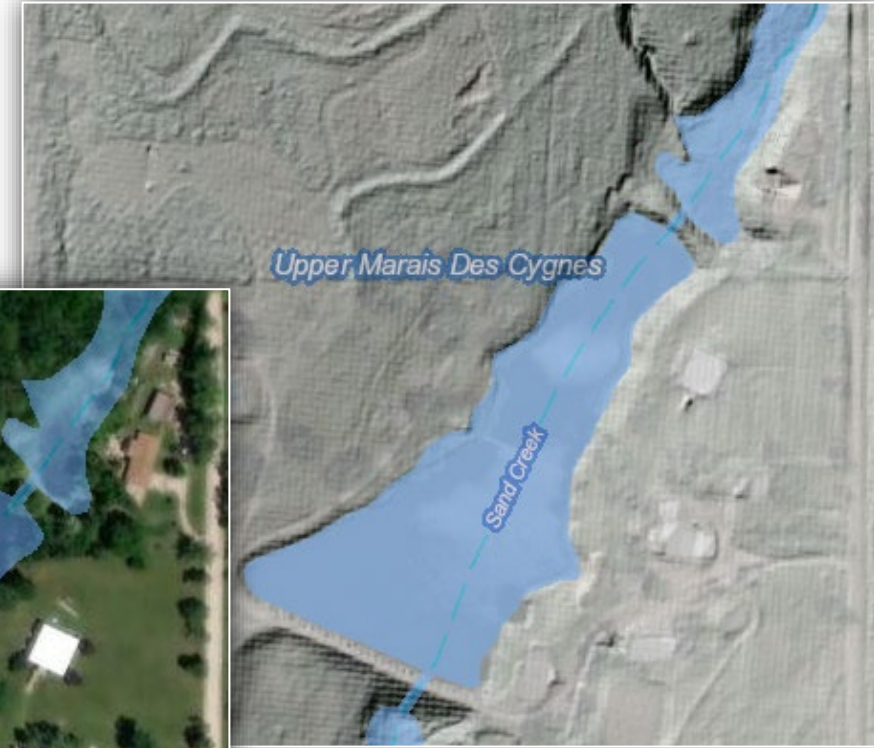wallace
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BLE Study Limitations: 2D

- 2D BLE:
  - Direct Rainfall
  - Hydraulic Routing
  - Dynamic
- Limitations
  - Structure data
    - Assumptions
  - Validation only

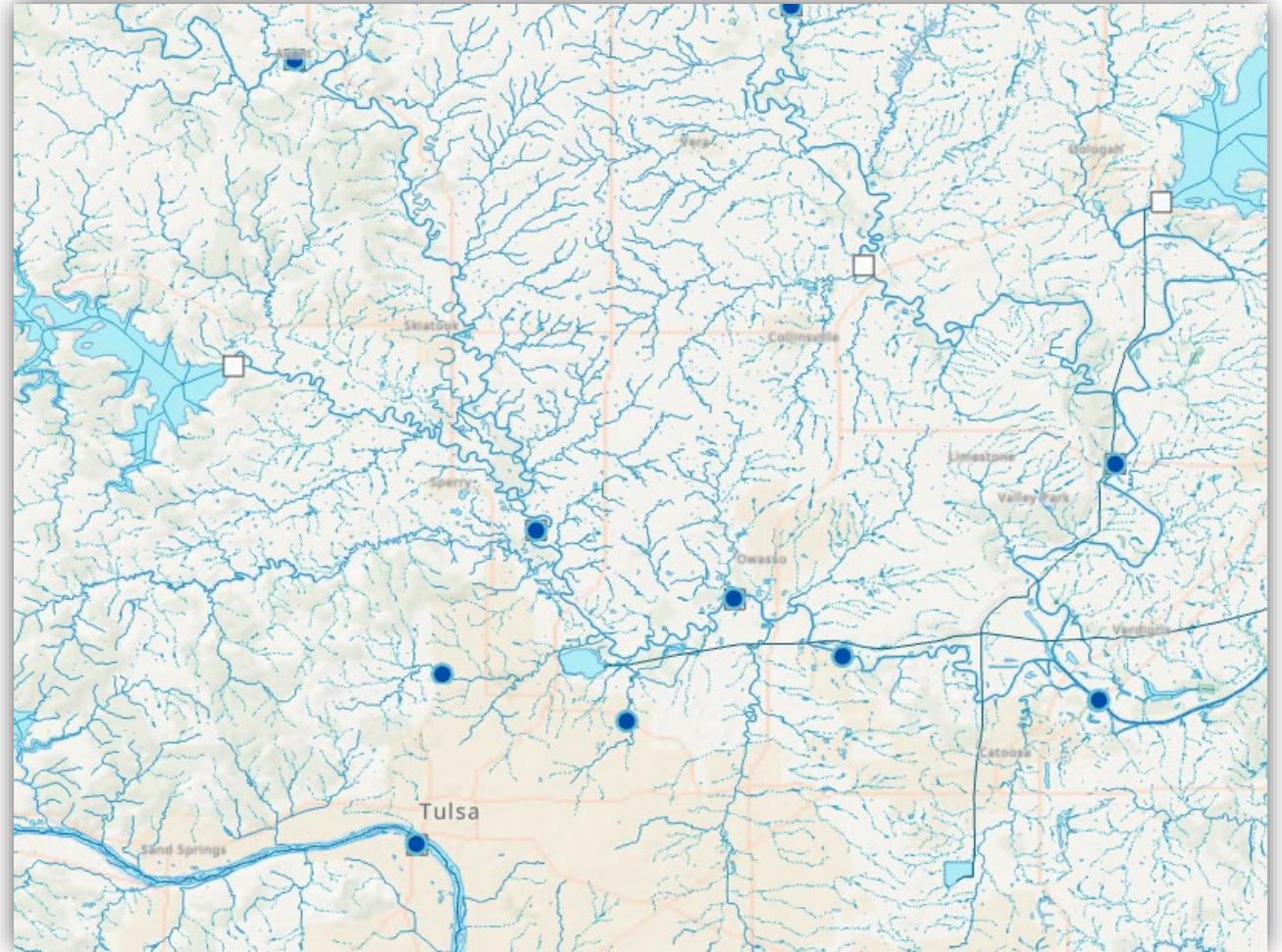wallace
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Calibration Limitations

Basis:

- Stream Gage Records
- High water marks
- Flood photographs
- Insurance information

Limitations

- Data: large channels
- Modeling approach: hydrology + watershed characteristics

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Solutions: Overview

| Data Development
 – Collect
 – process

| Data Management
 – Inventory

| Data Use
 – Modeling
 – Policies
 – Asset management

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Data Development

Data collection
- Drone
- Satellite
- Survey
- Photographs
- Gage/sensor

Data Processing
– Analytics
- Machine learning
- automation

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Data Management

GIS Inventory

- State repository
- Municipal asset managemet

HydroBreakline Download Links

Kansas DASC
Kansas State Government GIS

Summary

HydroBreakline download links from multiple Kansas LiDAR collection projects. Hydro features may include streams, lakes or ponds depending on area of interest.

View Full Details

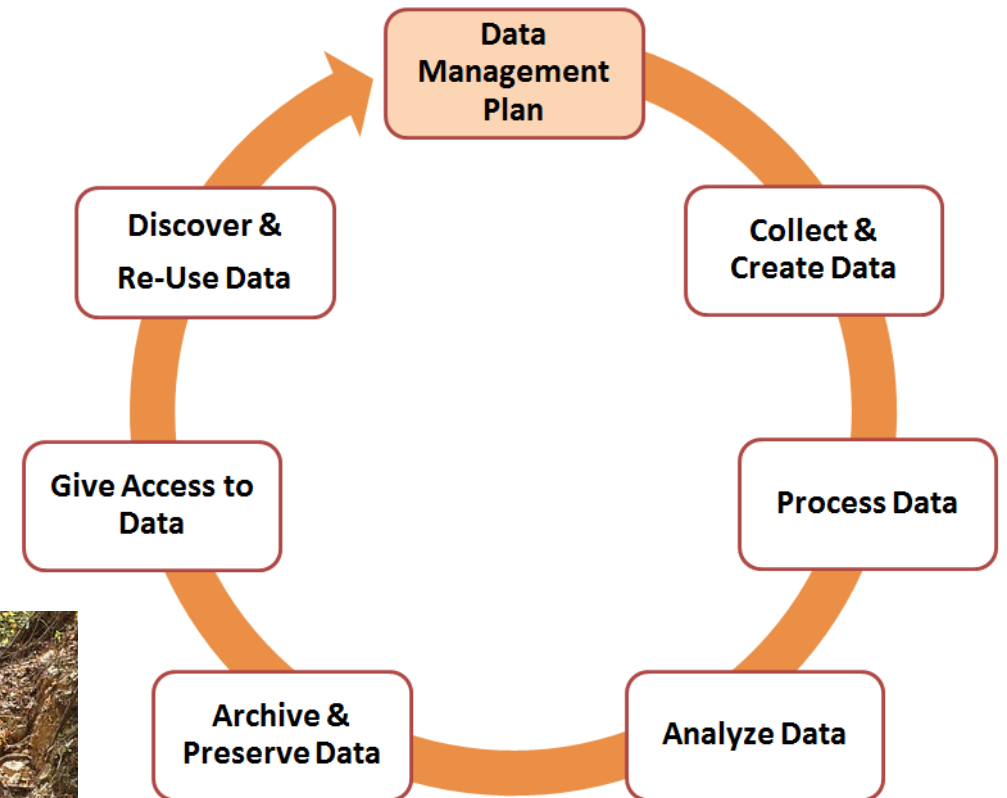Download

Data Use

| Modeling
  – Full drainage area (2D)
  – Calibration
| Policies
  – Floodplain permitting
    • Modeling
    • Flood boundary extrapolation
  – Design criteria
    • Quality
    • Assumptions
| Infrastructure Management
  – Prioritization
  – maintenance

Takeaways

| **Importance**
  – Major flood losses
  – Increasing risk

| **Contributing Factors**
  – Inadequate Data
  – Assumptions

| **Solutions**
  – Advanced Processes
    • Develop Data
    • Manage Data
    • Use Data

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Questions?

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References

1. [Understanding Non-Special Flood Hazard Area (NSFHA)? | FEMA.gov](#)
2. [Flood | Impact (fema.gov)](#)
3. [Flood Risk Mapping Priorities (floods.org)](#)
4. [soa-flood-report.pdf](#)
5. [Federal Flood Risk Management Standard | FEMA.gov](#)

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