Reliability of Two-Dimensional (2D) Hydrodynamic Models for Assessing Susceptibility of Stream Restorations to Flood Damage and Potential Effects of Climate Change

Research Question: How can different restoration approaches or techniques reduce the impacts of future climate change?

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Are 2D Hydrodynamic Models a reliable tool for stream restoration design?

Research Questions Addressed:

- Research Phase I: Evaluate a design approach for stability: use of 2D models to develop engineering design of restoration sites

- Research Phase II: current and future climate conditions are evaluated through different simulated flows

Expected Findings

- Areas of restoration sites with expected low or high velocities/stresses will be effectively predicted by 2D models. Moderate values / threshold conditions will help refine use of the 2D model as a tool

- 2D models will be conditionally effective- better definition of areas where models are reliable under current and future flooding scenarios

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Reliability Analysis: Detailed Site Surveys

- 5 Sites in total

- 2D Hydrodynamic modeling requires a water-tight container (no holes)

- Resolution must be appropriate to capture key features

Aerial SFM

Ground Survey

MD LiDAR

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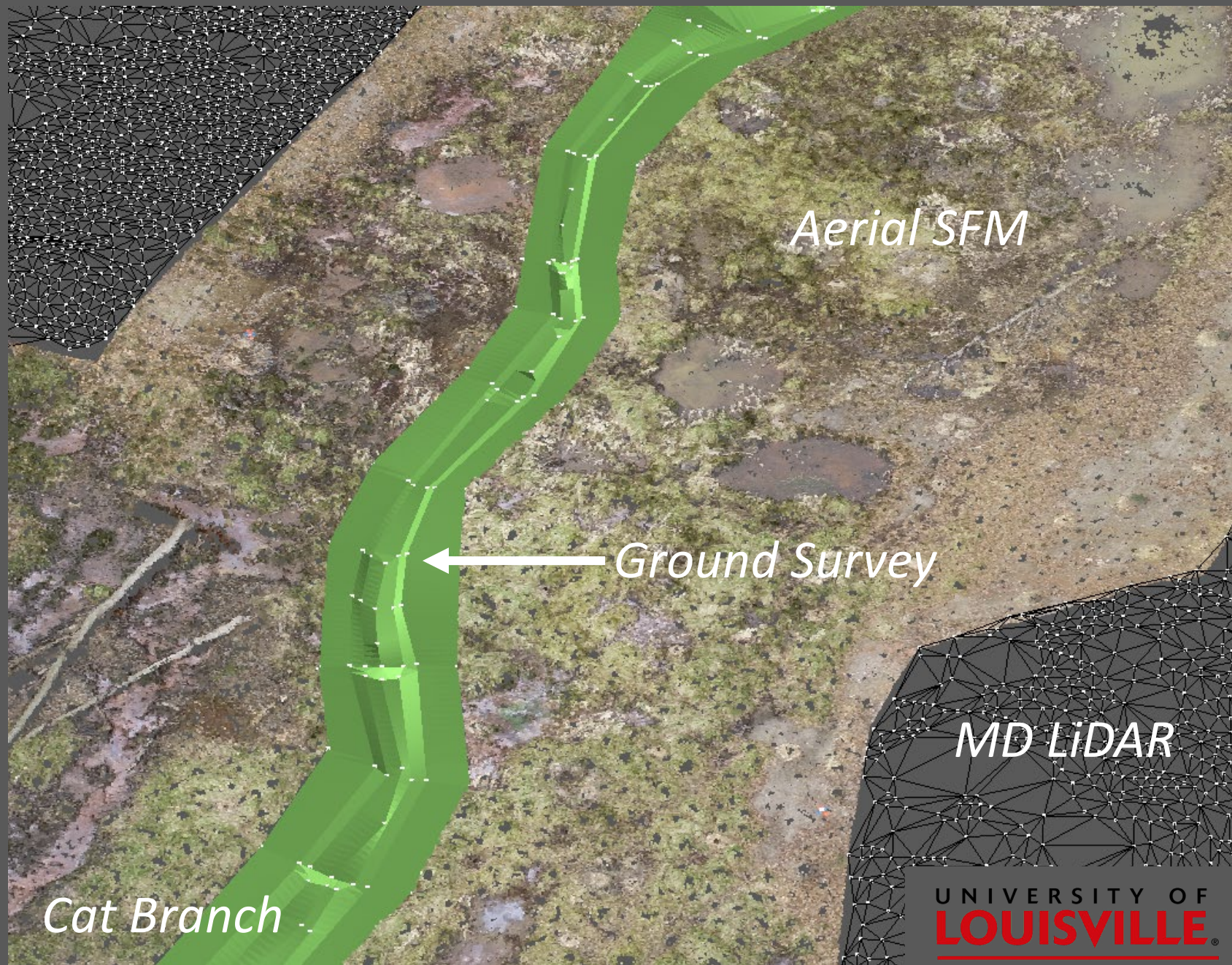
Reliability Analysis: Ground and Aerial Imagery to Define "Damaged" Areas

- Damaged and un-damaged areas are used as training data in the model

- Damage does not mean poor design

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Reliability Analysis: 2D Hydrodynamic Modeling

- Determine predicted velocities and stresses in damaged/un-damaged areas

- Evaluate 2D model effectiveness in different restoration types and components
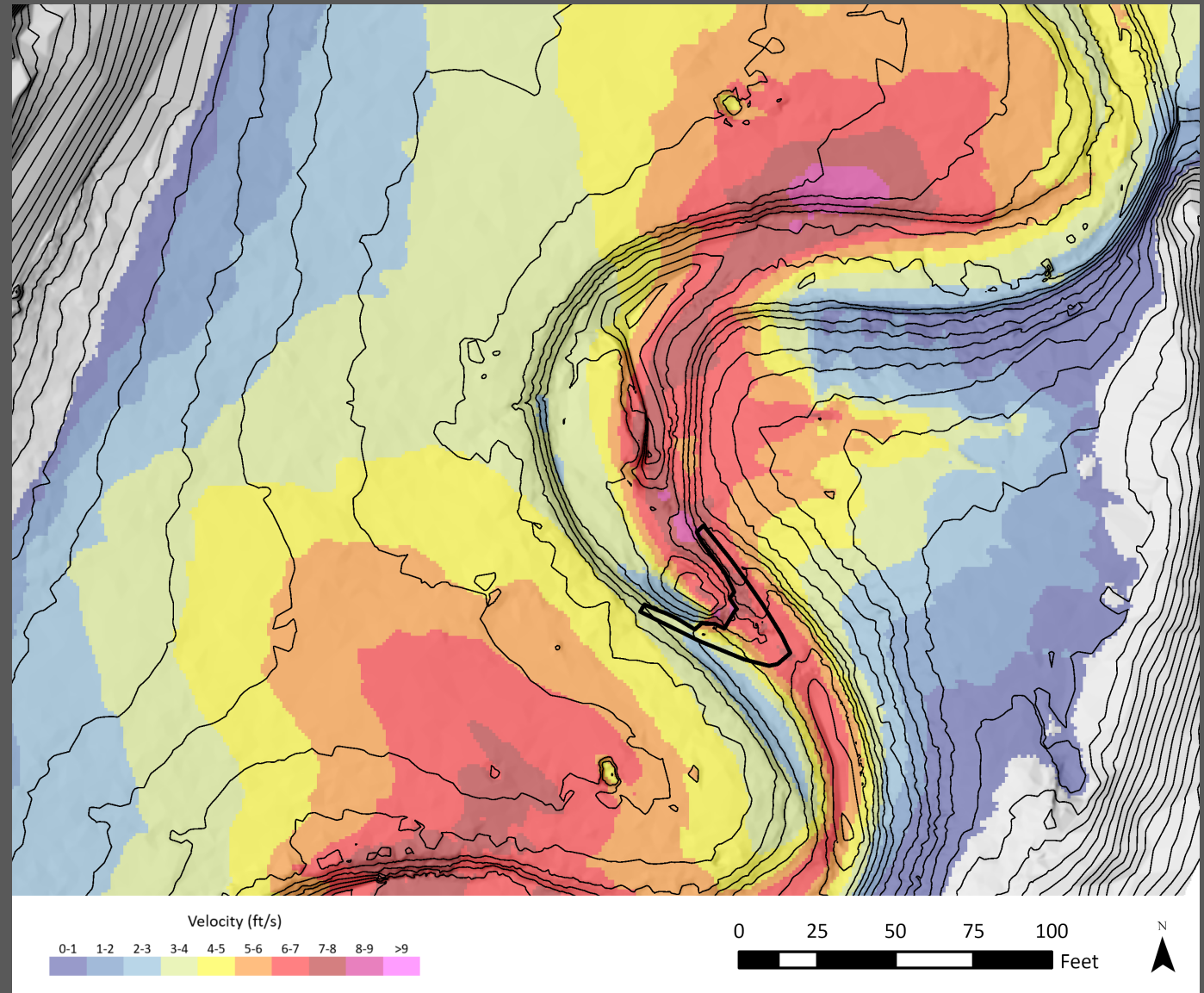
Reliability Analysis: 2D Hydrodynamic Modeling

- Constrain / approximately calibrate models based on estimates of observed flooding (Phase 1)

- Use direct sensing of floods, partner observations and surrounding gage data

- Use extreme flood estimates for current and future conditions analysis (Phase 2)

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Phase I: 2D Model Reliability Analysis
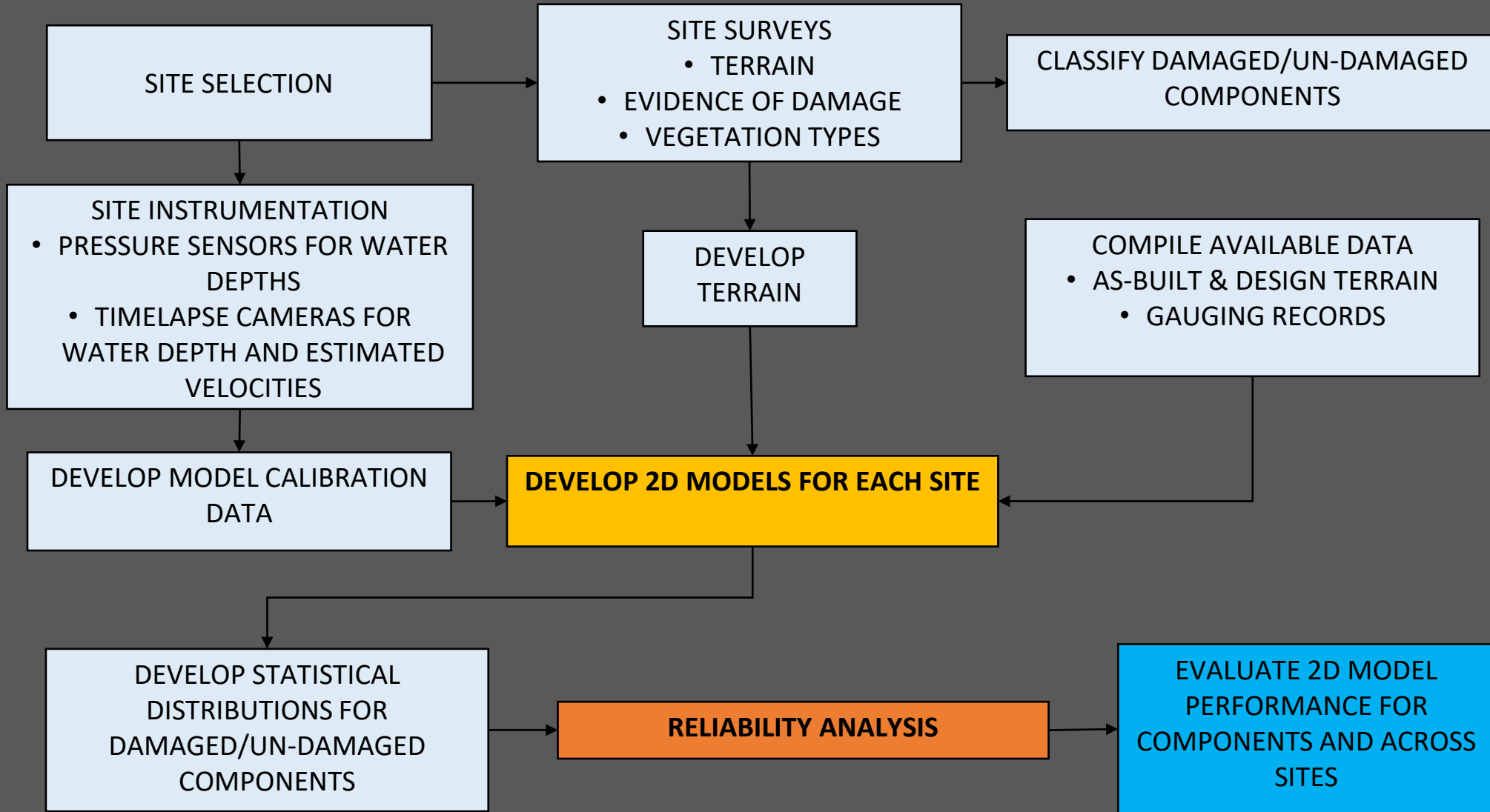
Phase II: Current and Future Conditions Analysis
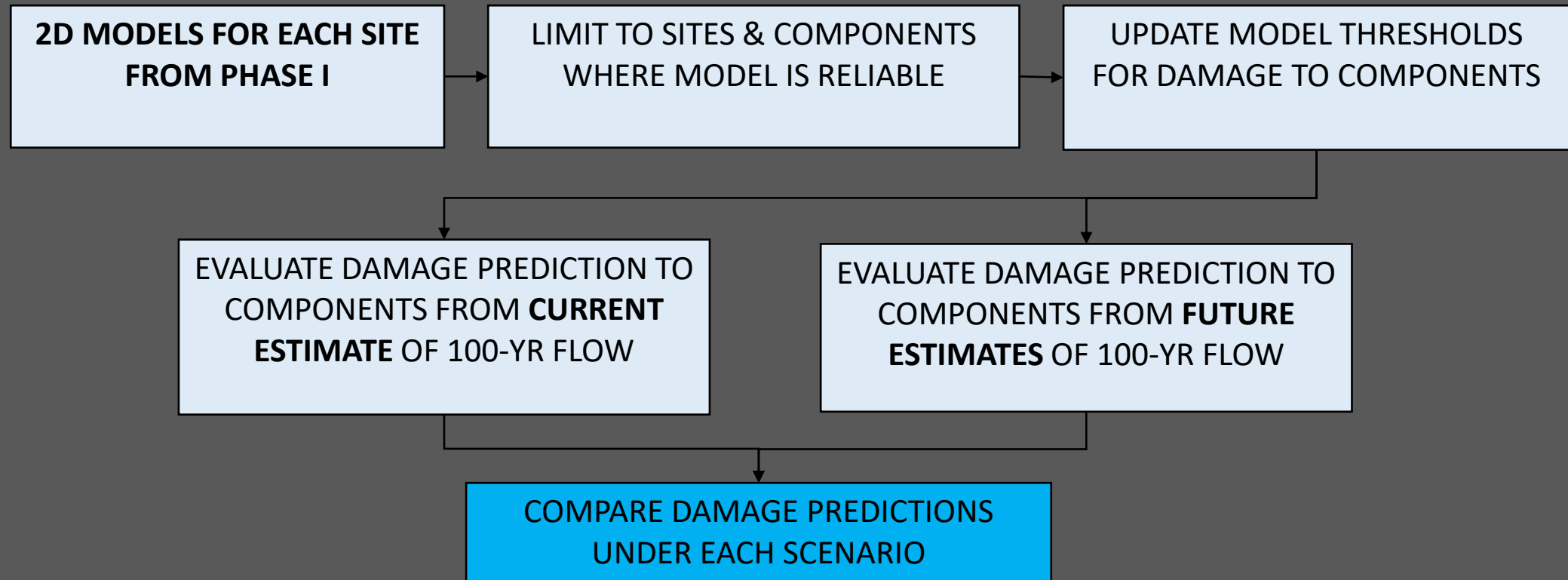
Acknowledgements

Thanks to the Chesapeake Bay Trust and all the funding partners for supporting this work. Thanks to Sadie and the collaborators who are making this project possible.