

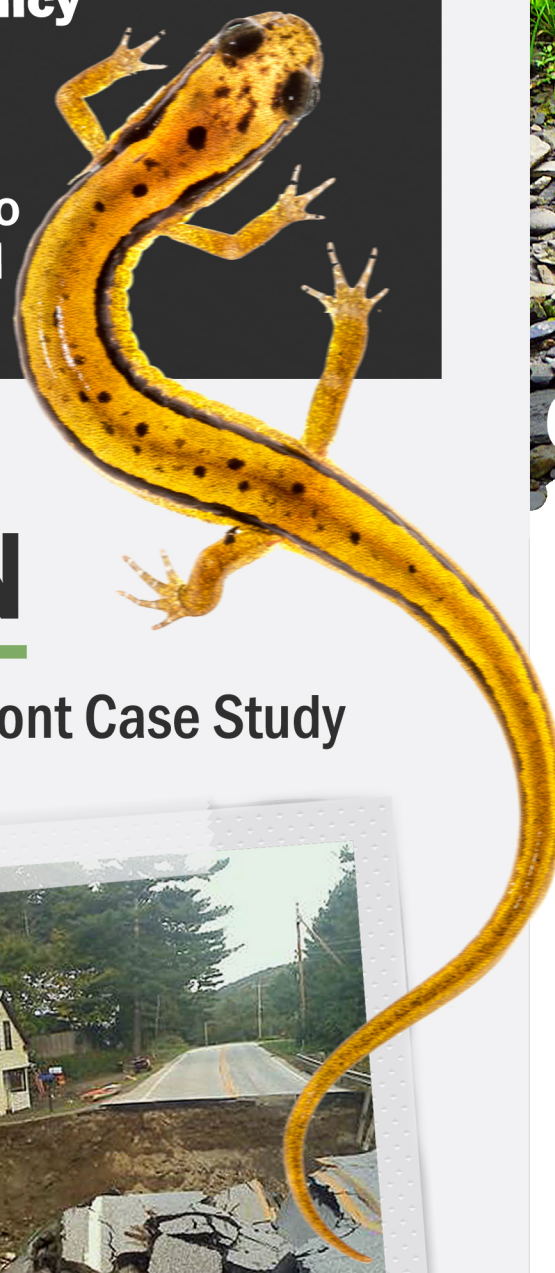
# Designed for Life

## BANKFULL CROSSING STRUCTURES THAT DON'T FAIL OR FRAGMENT

### STREAM SIMULATION

Smart, Safe, and Long-Lived

- Double the **life-span**
- **Natural** channel design
- **Bankfull** structures = full channel width
- 100% aquatic organism **passage** at all life stages
- Highest level of flood **resiliency**
- Hydrology and stream processes **maintained**
- 10-30% cost increase with no future maintenance required



### NOT JUST SPECULATION

Tropical Storm Irene: 2011 Vermont Case Study

- **\$1 billion** in transportation damage
- **1,240** structures damaged or destroyed
- **83** traditional culverts failed
- **Zero** failed Stream Simulation designs



Damage from undersized culvert failure

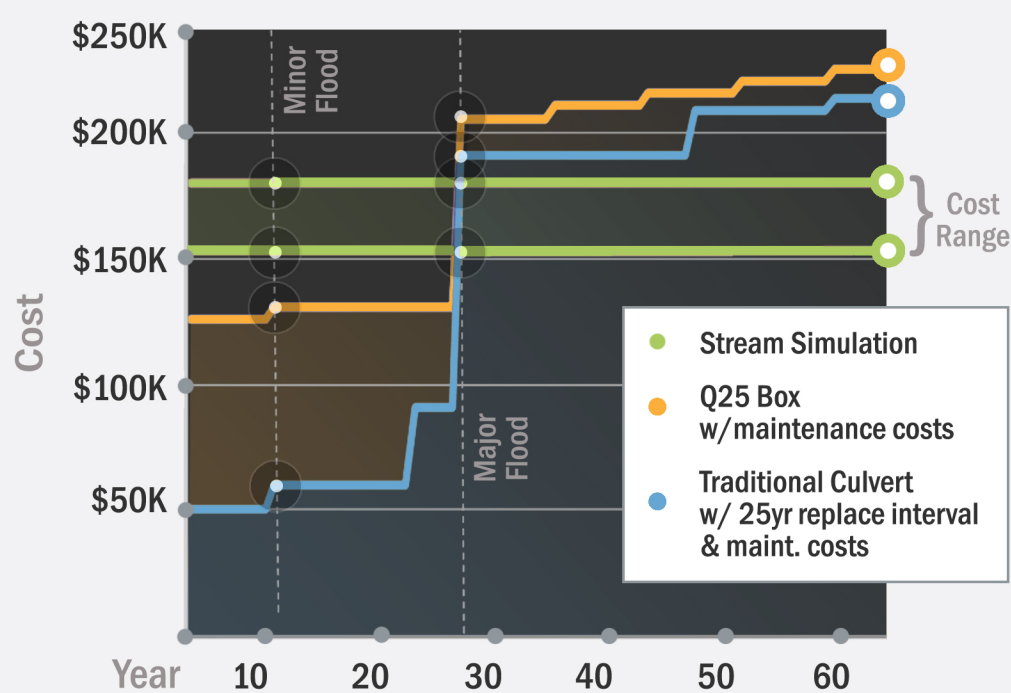


### GET THE FACTS

	✓ STREAM SIMULATION	✗ Q25 BOX	✗ TRADITIONAL CULVERT
LIFESPAN	50-75 years	25-50 years	n/a
FLOOD RESILIENCY	High: Q100	Moderate: Q25	Low: Q25 or lower
AQUATIC ORGANISM PASSAGE	100% passage at all life stages	Targets Specific Fish	Restricted Passage
HYDROLOGY	Maintained	Altered	Restricted
STREAM BED	Natural	Modified	None

Q=design flood; Q100=predicted peak runoff from a 100-year storm. This graphic is based on NCDOT flood design requirements for secondary roads not located in a detailed flood study zone.

### STREAM CROSSING COSTS OVER TIME



(theoretical watershed, model of three designs over same period of time assuming catastrophic failure at undersized structures in flood event and annual maintenance of undersized culverts)

“ We have found that stream simulation is a significant net gain for long-term economics and the aquatic ecosystem. It is an extremely flood resilient design methodology with no maintenance required and passes all aquatic biota in the stream. ”

—Robert Gubernick, R.G., USFS Watershed Restoration Geologist, Recipient of Career Achievement Award from the International Conference on Engineering and Ecohydrology for Fish Passage



THIS PROJECT FUNDED BY THE WILDLIFE CONSERVATION SOCIETY'S CLIMATE ADAPTATION FUND



### LEARN MORE

Visit [www.tu.org/southeastpassage](http://www.tu.org/southeastpassage) to find more information about Stream Simulation Design including text you can use for proposals, published research, and resources available for funding your stream simulation project.