What is a TMDL?

- **Total Maximum Daily Load (TMDL)**
  - TMDL: “Greatest amount of a pollutant that a waterbody can accept and still meet water-quality standards.”

- **Water-Quality Standards**
  - Required by Clean Water Act
  - Based on beneficial uses
  - Numeric or narrative criteria

- **All Impaired Waterbodies Must Be Evaluated Using a TMDL Study**
How is a TMDL Calculated?

TMDL = Waste Load Allocation + Load Allocation + Margin of Safety

Waste Load Allocation:
- Point Sources Permitted

Load Allocation:
- Nonpoint Sources
- Overland Flow

Margin of Safety:
- Safety Factor

Safety First: The Safe Way is the Best Way
Why Is Total Suspended Solids (TSS) an Issue?

- Inhibits habitat for aquatic life
- Aesthetically unappealing
- Standard written to protect warm-water fishery (158 mg/L)
Why Is Bacteria an Issue?

Fecal Coliform/E-Coli Facts:

- Intestines of warm-blooded animals
- Used as indicator for other pathogens
- Standard written to protect immersion recreators (235 cfu/100 mL)
Project Area
Project Phases

PHASE 1:
Data Acquisition and Analysis
5/1/08 – 8/31/08

PHASE 2:
Monitoring and Assessment
3/2/09 – 10/31/09

PHASE 3:
TMDL Analysis/Modeling
11/3/08 – 8/31/10

PHASE 4:
Final Report and Deliverables
8/2/10 – 11/30/10
Phase 2: Monitoring

- March–October 2009
- Weekly Grab Samples
- Discharge Measurements
  - Develop stage discharge relationships
- Storm Events
- NPDES Sampling
- Microbial Source Tracking
Phase 2: Monitoring

Stream Sampling Locations
Phase 2: Monitoring

- Urban Storm Water Sampling Sites
STW 150 - Benson Road
*Water Quality Standard only applies to the Big Sioux River
*Water Quality Standard only applies to the Big Sioux River
Urban Watershed Locations

- Drainages for older residential sites
Monitoring Preliminary Conclusions

- Sioux Falls stormwater BMPs effective at controlling sediment

- Skunk Creek may be significant contributor to bacteria loading

- Significant bacteria are may be originating from Sioux Falls stormwater outfalls
Phase 3: Modeling

Focus of Mathematical Modeling

- Understand rate and transport
- Allocate loads to sources
- Evaluate effectiveness of BMPs
Phase 3: Modeling

Project Area

Sioux Falls NPDES Loads

- Residential
- Industrial
- Commercial
- Undeveloped
- Septics
- WWTP

Q_total x C_total = Load

Tributary Loads

- Stunk Creek
- Silver Creek
- Slip-Up Creek

Upstream

Q x C = Load

Big Sioux River

Upstream 55%
NPDES 15%
Tributaries 30%
Phase 3: Modeling

How Do We Reduce Loadings?

- Model existing and suggested BMPs
  - Allocate loads to sources
  - Evaluate/predict effectiveness of BMPs

BMP Prioritization

- Based on primary stressors, BMP effectiveness and cost-benefit analysis
Questions?