MULTIPLE USES OF DATA FROM AN AUTOMATED MONITORING NETWORK IN A 6-MILE URBAN STORMWATER TUNNEL

BRITTA SUPPES
CRWD MONITORING COORDINATOR
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1. CRWD Background
   – Organization
   – Watershed Description
   – CRWD Monitoring Program

2. Trout Brook Interceptor/Subwatershed
   – History
   – Monitoring Goals
   – Monitoring Methods
   – Data & Results
   – Practical Application
Capitol Region Watershed District

- Local unit of gov’t
- Drainage area: 41 mi²
  - Storm sewer network
  - 5 lakes
  - 13 mi. of Mississippi
- Population: 245,000
- Highly urbanized
  - 42%+ impervious
CRWD Monitoring Program

• Monitoring data foundation of CRWD
  – 10-yr program
• To Identify water quality problem areas
• Quantify runoff pollutant loading to Mississippi R.
• Evaluate BMP performance
• Data for model calibration
• Promote understanding of CRWD water resources
MONITORING CASE STUDY:

Trout Brook Interceptor & Subwatershed
Background:
Trout Brook Subwatershed

• 8,000 ac urban subwatershed
• Originally a natural channel
  – 1900-1950s: Put underground
• Drains to Mississippi R.
• 2 Lakesheds
  – Como & McCarrons
• Trout Brook Interceptor (TBI)
  Storm tunnel owned & operated by CRWD
Trout Brook Interceptor (TBI)

- 6-mile storm tunnel
- 5-12 ft in diameter
- CRWD acquired TBI in 2006
- CRWD has MS4 Permit for TBI
  - Municipal Separate Storm Sewer System
  - Goals:
    1. Reduce discharge of pollutants
    2. Protect and improve water quality
    3. Comply with water quality requirements of Clean Water Act
TBI Questions --

- How much water is discharging?
- What is the quality of the water?
- What is the quantity of annual pollutant loads to Mississippi R. from TB subwatershed?
- Are there trends in water quantity and quality?
- Where is the polluted water coming from?
- Does TBI safely & adequately convey runoff?
Trout Brook Monitoring

• Monitoring began in 2005 (to present)
  – 9 year record

• Data to Characterize TB Sub-WS:
  – Precipitation
  – Discharge
  – Water Quality
  – Stormwater Pond Levels
  – Lakes:
    • Water Quality
    • Level
  – BMP Performance
Discharge & Water Quality Stations
Trout Brook Monitoring Stations

LAKES & PONDS:
- Lake Water Quality
- Level & Discharge
- 2 Lakes
- 6 Ponds
What is Data Used For?
What Is Data Used For?

1. Pollutant Loading Calculations:
   - Discharge, TP, & TSS

2. Hydraulic & Hydrologic Modeling:
   - Conveyance & surcharge evaluation
   - Operation & maintenance of TBI

3. Inform Project Design:
   - Optimal BMP locations
   - BMP construction
   - Compliance verification for permits
   - Tunnel replacement and rehabilitation
Loading Calculations
Trout Brook Sub-WS Results

Total Suspended Solids (TSS)
Trout Brook Sub-WS Results

CHLORIDE (Cl-)

Combined Baseflow + Stormflow

2013

Mean (2005-2012)

Cumulative Cl Yield (lb/ac)
Regional Uses of Loading Data

• TMDL development:
  – South Metro Mississippi R. Turbidity TMDL
  – Upper Mississippi R. Bacteria TMDL
  – Twin Cities Metro Area Chloride Project

• CRWD Annual Report

• Other regional uses of data:
  – Research/Academia
  – Other local orgs or municipalities
Hydraulic & Hydrologic Modeling
Hydraulic & Hydrologic Modeling

• **XP-SWMM:**
  – Hydraulics within tunnel
  – Document conveyance & surcharge issues in TBI

• **P8 Model:**
  – BMP Performance
  – BMP location identification

• Monitoring data to calibrate & validate models
  – Models rely on monitoring data
Project Design
Project Design

• Trout Brook Nature Sanctuary Project
  – Creation of 3,000 ft natural stream channel
  – “Daylighting” stormwater
MONITORING DATA USED for:

- Water source identification & flow calculations for perennial baseflow
- Diversion structure & lift station design
- Channel & floodplain design
- Stormwater treatment ponds
- Water chemistry—can stream support aquatic life?
Project Design

MONITORING DATA USED for:

• Tunnel Design & Sizing

• Bypass & water diversion structure design during construction

• Real-time flow data for day-to-day maintenance & tunnel entry
Summary

• TBI monitoring will continue into future
  – Climate adaptation
  – Sub-sub watershed monitoring
  – Remote data access

• A comprehensive monitoring network is beneficial and allows us to:
  – Calculate loads
  – Calibrate/validate models
  – Inform project design & management decisions
QUESTIONS?

Britta Suppes
Monitoring Coordinator
britta@capitolregionwd.org

Capitol Region Watershed District

www.capitolregionwd.org