Unique Approaches to Monitor Surface Water Flow in Lake County

Mike Novotney, P.E.
Lake County Stormwater Management Commission

Dan Bounds, P.E., D.WRE
CDM Smith

Scott Banjavecic
CDM Smith

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Project Background

- Applied for (6/10) and received (11/10) GLRI grant from US EPA to study surface water hydrology around downstream end of Glen Flora Tributary in Waukegan, IL
  - Identify and document hydrologic connections to study area
  - Quantify the flow that passes through these connections into the study area
- Goal: Inform future vegetation management, wetland and stream restoration, and redevelopment decision in Waukegan Harbor EAOC
  - Support implementation of RAP
Current
Past (1908)
Future (?)

Waukegan Lakefront-Downtown Master Plan
Skidmore, Owings & Merrill LLP
Project Tasks

- **SMC**
  - Investigate study area and identify hydrologic connections
  - Select monitoring sites and design monitoring study
  - Identify and obtain necessary permits and landowner approvals
  - Develop QAPP

- **CDM Smith**
  - Review monitoring sites and study design
  - Design monitoring stations
  - Install monitoring equipment
  - Collect, download, and analyze flow monitoring data

- **SMC**
  - Evaluate and QA/QC flow monitoring data
  - Reporting and public outreach
Study Challenges

- **Complex hydrology**
  - Ravine streams feed extensive wetland complex along foot of bluff
  - Flow paths within and leaving wetland not particularly well defined, moving north, east, south and all directions in between

- **Challenging monitoring conditions**
  - Shallow flow depths, intermittent flow, backwater effects, naturally dynamic ravine system

- **Number of landowners**
  - 6 landowners (incl. utilities, railroads, private, corporate and public landowners) = 6 landowner agreements

- **USACE permit required**
  - Nationwide permit (NWP) No. 5, *Scientific Measuring Devices*
Project Details

• Schedule
  – Site Investigation & Study Design 04/2011
  – Monitoring Station Design 05/2011 06/2011
  – Equipment Installation 06/2011 09/2011
  – Data Collection 06/2012 10/2012

• Funding
  – $118,000 GLRI Grant + $5,000 Local Funds

• Original schedule and funding didn’t account for the permits & landowner agreements that would be needed (+ 4 months)...nor the observations that would be made during wet weather conditions (+ 1 monitoring site)...
Monitoring Equipment Selection

- Site 1, 3, 4 have backwater effects, stage / discharge rating not applicable
  - Side-looking acoustic Doppler velocity meter (ADVM) supplemented with a high-accuracy pressure transducer
- Sites 2, 5 have culverts controlling the flow
  - Pressure transducers / stage discharge ratings
- Site 6 and 7 are very small channels with very shallow flows
  - Temporary flume / pressure transducer
- Site 8 pressure transducer / stage discharge rating
Design Plans
Equipment Installation

- Equipment installation was completed in just a few days
  - Crew of four
- Overall challenges
  - Remote locations - no mules
  - Field fabrication - no power outlets
  - Steep ravines
  - Water safety, weather safety - HSP was developed
  - Railroad / private property access
Data Collection

- Monthly site visits
- Make flow and general observations
- Download data
- Inspect and adjust instruments
- Change batteries for velocity meters
Data Collection Observations

- Seasonal changes in wetland hydrology
  - Ice
  - Leaves
  - Beavers
  - Debris dams
  - Spring/summer storms
- Conveyance changes
  - Site 8 (Ganster) is ponding
  - Culvert at Site 2 is mostly blocked and being bypassed
Data Collection Depth Data

PROVISIONAL DATA SUBJECT TO REVISION
Data Collection Velocity Data

SITE 1

PROVISIONAL DATA SUBJECT TO REVISION
Data Collection Flow Tracker Measurements

- To develop stage-discharge relationships at the gauge sites, we take hand held Flow Tracker flow measurements during site visits.
- Most sites have had small flows to date.
- Will take measurements during spring rains to capture larger flow events.

PROVISIONAL DATA SUBMITTED TO REVISION
Data Collection Challenges

• **Weather**
  - Little rain causes low flow/no flow conditions
  - Ice can affect instruments and hydrology
    • RV anti-freeze
  - Debris dams causing blockages

• **Equipment**
  - Replacing and calibrating pressure transducers
  - Making sense of velocity sensor and flow tracker data
Stage – Discharge Relationships

- Ultimate goal to develop a stage discharge relationship for each meter
- This relationship will be used to determine a continuous flow record
- It will need to be revised in future based on changes in hydrology

PROVISIONAL RATINGSUBJECT TO REVISION
Questions?