CSO Siphon Design: Proper Planning Eliminates Constructability Issues and Saves Costs

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Collection Systems Session

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Project Team

• Owner, City of Kokomo
• Engineer, American Structurepoint
• Contractor, Atlas Excavating, Inc.
Background

• Current CSO 041 control structure activates for storms less than 2-month recurrence interval

• Per LTCP, the design needed to eliminate overflows for storms less than or equal to 6-month recurrence interval

• Proposed plan: construct a siphon for 96” Storm flow
Existing Diversion Structure

- 96” Storm
- 84” Combined
- Weir Wall (17”)
- 12” Low Flow Storm Sewer
Project Drivers

• Accelerated Schedule to meet Funding Deadline
  – 100% Design due within 2 ½ months
• Budget of $2.9 million
• Physically restricted site layout
Site Layout

Siphon Project Area

Legend
Site Layout

40-ft ROW

Legend
- Right of Way

Siphon Project Area

Walnut St
Site Layout

Legend
- Right of Way
- Overhead Electric
- Light Pole
- Gas Main
- Water Main
- Fire Hydrant
- Water Valve

Siphon Project Area

Walnut St
Site Layout

Legend
- Right of Way

Sewer Structures
- ABANDONED
- COMBINATION
- SANITARY
- STORM

Sewer Pipes
- COMBINATION
- STORM

Existing Utilities
- Overhead Electric
- Light Pole
- Gas Main
- Water Main
- Fire Hydrant
- Water Valve

96” Storm
84” Combined
Walnut St
Siphon Project Area
Site Layout

Buildings Demolished for Project

Legend
- Right of Way
- Sewer Structures
  - ABANDONED
  - COMBINATION
  - SANITARY
  - STORM
- Sewer Pipes
  - COMBINATION
  - STORM
- Existing Utilities
  - Overhead Electric
  - Light Pole
  - Gas Main
  - Water Main
  - Fire Hydrant
  - Water Valve

Siphon Project Area

Walnut St
Design Considerations

• Bypass Pumping
  – 96” Storm pipe can carry up to 250 MGD
  – Bypass system to pump 250 MGD would require 30 large pumps and cost over $2.5 million
  – Needed to find a way to reduce bypass pumping

• Utility Coordination
  – Water Main from 1905
  – 6” low pressure Gas main
  – Power feed to light pole would pose problems for excavator
• Pipe Installation Methods
  
  **Siphon required three 115 foot barrels**
  
  **Two – 63” pipes, One – 30” pipe (low flow)**

  – Microtunneling ($4,000/ft)
  – Pilot Tube Microtunneling ($600/ft + pipe cost)
  – Hand Tunneling ($1200/ft + pipe cost)
  – Jack and Bore ($500/ft + pipe cost)
  – Open Cut ($400 - $700/ft)

• MOT
  – Walnut Street used for public and school buses
  – Access to alley for homeowners, trash pickup
• Sequence of Construction
  – Visualized how to build using open cut installation without bypass pumping
  – Decided siphon structures needed to be phased

1. Relocate Utilities
2. Construct S. Siphon Structure with stubs
3. Construct N. Siphon Structure, 96” remains active
4. Construct 63” E. Siphon pipe using shoring
5. Activate E. Siphon pipe
6. Demo existing Diversion Structure for CSO 041 (requires bypass pumping on 84”)
7. Install 30” Center and 63” W. Siphon pipes
8. Connect 48” Combined Sewer Overflow Structure
Construction Schedule

• Advertising opened November 7, 2012 and Bids were due on December 5, 2012
  – Received 8 bids
• Notice to Proceed was February 27, 2013
• Substantial Completion on November 26, 2013
Sequence of Construction – In Practice

Construct South Siphon Structure
Construct North Siphon Structure
Construct East Siphon Pipe
Activate East Siphon Pipe
Demo Existing Diversion Structure
Reconnect 84” Pipe
Install Center and West Siphon Pipes
Siphon is Active
Connect Combined Sewer Overflow Structure
Start to Finish
Conclusions

• Communication is KEY
• As the Engineer, don’t have control of means and methods
• Planning and designing the project phasing provided confidence to Engineer and Client that project could be constructed
• BONUS – The project came in $1 million under budget
Questions?

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