North Sandwich Sanitary Sewer System
Flow Monitoring & Stormwater Conveyance Analysis Studies

City of Sandwich Flood Reduction Program

Presented By:
Jeffrey W. Freeman, P.E., CFM, LEED AP
Timothy N. Paulson, P.E., CFM
Engineering Enterprises, Inc.

Stakeholder Outreach Meeting
City of Sandwich, IL

July 16, 2018
DAF = Design Average Flow
DMF = Design Maximum Flow
gpm = Gallons Per Minute
MGD = Million Gallons Per Day
NPDES = National Pollutant Discharge Elimination System
O,M&R = Operation, Maintenance & Rehabilitation
SSO = Sanitary Sewer Overflow
SSS = Sanitary Sewer System
WWTF = Wastewater Treatment Facility
Sewer System Operation

Typical House Plumbing Overview
Sewer System Operation

Home Drainage & City Sanitary and Storm Sewer Systems Cross Section
Sewer System Operation

City of Sandwich Sanitary Sewer Network

WWTF
DAF = 1.50 MGD
DMF = 3.75 MGD
Sewer System Operation

City of Sandwich Storm Sewer Network
Sewer System Operation

Surcharged Sanitary Sewer System Causing Basement Backup
(No Overhead Sewer)
Sewer System Operation

Surcharged Sanitary Sewer System Causing Basement Backup
(No Overhead Sewer)
Sewer System Operation

Surcharged Sanitary Sewer System
(Overhead Sewer)
Typical Components of Sanitary Sewer Flow

- Wastewater Baseflow
- Infiltration
- Inflow

Sanitary Sewer Pipe Cross Section
**I/I Background**

- **Infiltration** – water entering a sewer system and service connections through the ground, through such means as, but not limited to:
  - Defective pipes
  - Pipe joints
  - Connections
  - Manhole walls

Infiltration does not include, and is distinguished from inflow.
Inflow – water discharged into a sewer system, including service connections, from such sources as, but not limited to:

- Roof leaders
- Cellar
- Yard and area drains
- Foundation drains
- Drains from springs and swampy areas
- Manhole covers
- Cross connections from storm sewers and combined sewers
- Surface run-off
- Street wash waters

Inflow does not include, and is distinguished from infiltration.
Infiltration & Inflow (I/I) – the total quantity of water from both infiltration and inflow without distinguishing the source.

Source: http://www.oregonohio.org/Engineering/inflow-infiltration.html
Potential Effects Of Excessive I/I:

- Reduced Sanitary Sewer Conveyance Capacity
- Sanitary Sewer System Damages
- Sanitary Sewer System Surcharging, Potentially Leading To:
  - Combined Sewer Overflow (CSO)
  - Sewer System Overflow (SSO)
- Additional Flows To Treat At Wastewater Treatment Facility (WWTF), Potentially Leading To:
  - Additional Costs of Treatment
  - Inundation of Treatment Processes
- NPDES Permit Violations
I/I Reduction Planning
Phase 1: Infiltration/Inflow (I/I) Analysis

- System Wide I/I Characterization
- Sanitary Sewer System Basin Delineation & Prioritization
- Sub-Basin I/I Characterization (Flow Monitoring & Modeling)
I/I Background

I/I Reduction Planning
Phase 2: Sewer System Evaluation Survey (SSES)

Sub-Basin I/I Source Identification (SSES Field Work & Modeling)
I/I Reduction Cost-Effective Evaluation
I/I Reduction Plan
I/I Reduction Planning
Phase 3: Rehabilitation

- Storm Sewer Disconnection/Drainage Improvements
- Sewer Lining/Sewer Replacement
- Private Defect Correction
North Sandwich Flow Monitoring Study

- Base Mapping Updates
- Stakeholder Outreach
- Basin Delineation
- Monitor Rainfall & Sanitary Sewer Flows
- Analyze Flows & Determine I/I Severity By Basin
- Ordinance Review
- Report
Project Approach

North Sandwich Flow Monitoring Study
Project Approach

North Sandwich Flow Monitoring Study

WWTF Influent Flow

![Graph showing WWTF Influent Flow with DMF = 3.75 MGD and DAF = 1.50 MGD]
Project Approach

North Sandwich Flow Monitoring Study

Historical Sanitary Sewer I/I - Estimated Water Usage vs. Wastewater Flow (01/2016-04/2018)

City of Sandwich, IL

*Estimated Water Usage consists of Non-Irrigation Billed Water Usage: Billed Water Usage assumed to be 60% of Pumped Water Usage, and Irrigation assumed to account for 5% of Billed Water Usage, per City feedback.

**Precipitation data from January 2016 - July 2017 taken from City WWTF monitoring data. Precipitation data from August 2017 - April 2018 taken from CoCoRaHS (online precipitation monitoring).
North Sandwich Flow Monitoring Study

Average Water Usage, Wastewater Treated, & I/I Per Capita (01/2016-12/2017)
City of Sandwich, IL

- Water Usage Per Capita
- Wastewater Treated Per Capita
- I/I Treated Per Capita

<table>
<thead>
<tr>
<th>Year</th>
<th>Potable Water</th>
<th>Wastewater</th>
<th>Potable Water</th>
<th>Wastewater</th>
</tr>
</thead>
<tbody>
<tr>
<td>2016</td>
<td>60 GPCD</td>
<td>70 GPCD</td>
<td>60 GPCD</td>
<td>70 GPCD</td>
</tr>
<tr>
<td>2017</td>
<td>60 GPCD</td>
<td>70 GPCD</td>
<td>60 GPCD</td>
<td>70 GPCD</td>
</tr>
</tbody>
</table>
Stormwater System Conveyance Analysis

- Base Mapping & Surveying
- Stakeholder Outreach
- Sub-Watershed Delineations
- Existing Conditions Model
- Overland Flow Route Analysis
- Proposed Conditions Model
- Cost Estimates
- Implementation Plan
- Ordinance Review
- Report
Project Approach

Stormwater System Conveyance Analysis

Sub-Watersheds Along Center St.
Project Approach

Stormwater System Conveyance Analysis

Bayberry Ct. to Fairwinds Blvd. Storm Sewer Profile (10 yr, 2 hr Event)
## Project Approach

### Overall Schedule

<table>
<thead>
<tr>
<th>Task</th>
<th>Dates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Initiation</td>
<td>May 2018</td>
</tr>
<tr>
<td>Flow Monitoring</td>
<td>May 15 – July 15, 2018</td>
</tr>
<tr>
<td>Storm Sewer Model Development</td>
<td>May 15 – July 15, 2018</td>
</tr>
<tr>
<td>Stakeholder Meeting No. 1</td>
<td>July 16, 2018</td>
</tr>
<tr>
<td>I/I Data Analysis</td>
<td>August 1 – August 20, 2018</td>
</tr>
<tr>
<td>Proposed Storm Sewer Modeling</td>
<td>July 15 – August 15, 2018</td>
</tr>
<tr>
<td>Cost Estimates</td>
<td>August 1 – August 15, 2018</td>
</tr>
<tr>
<td>Progress Review Meeting</td>
<td>August 24, 2018</td>
</tr>
<tr>
<td>Stakeholder Meeting No. 2</td>
<td>September 17, 2018 +/-%</td>
</tr>
<tr>
<td>Report Submittal</td>
<td>November 1, 2018</td>
</tr>
</tbody>
</table>
City of Sandwich Public Works Department
Resident Flooding Survey

**Purpose:** The purpose of conducting this survey is to collect pertinent information to be considered during the professional engineering evaluation of the surface water and basement flooding issues in the City of Sandwich. This initial focus of the study will be generally north of the railroad tracks, but surveys from all locations are being requested.

**Instructions:** Please provide accurate responses to the questions regarding the flooding issues associated with your residence. Please reference the diagram on the back side of this form when completing the form. In the space provided, include additional information that you would like the engineering consultant to be aware of and consider during the analysis. Once you have completed the survey, please deliver the completed form to the following location:

City of Sandwich
144 E. Railroad Street
Sandwich, IL 60548

**Questions:** If you have any questions relative to this form, please contact Tom Horak, Director of Public Works, at (815) 786-8802 or city.engineer@sANDwich.IL.us.

**Meeting:** The City intends to hold a stakeholders’ meeting on Monday, July 16, 2018 at 7:00 P.M. at 128 E. Railroad Street as part of the normal Committee-As-A-Whole Council Meeting to discuss the existing sanitary and storm systems and to answer questions regarding the evaluation process. The public is encouraged and invited to attend.

Name: ___________________________________________________________

Address: _________________________________________________________

Contact Information:
Telephone: ___________________________ Email Address: ________________________________

1. Has storm or sewage water ever flooded your property? Yes:_____ No:_____

If so, what were the limits of the flooding? Yard:_____ Street:_____ basement:_____ Other:_____

2. In the past ten years, how many times has your home flooded?

Never:____ 1 time:_____ 2 times:_____ 3 times:_____ 4 times:_____ 5 or more times:_____ __________

If you have experienced flooding, how did the flood water enter your home? (check all that apply)?
Sewer Drain:_____ Door:_____ Window:_____ Cracks in Wall:_____ Other:_____ N/A:_____ ________

3. Have you experienced sanitary sewer backups (through drain, toilet, etc.)

Yes:____ No:____ If yes, how deep was the basement flooding? __________

(Please complete the back side of the survey, also.)
4. During the flood events that occurred on June 21/22, 2017 and/or October 16/17, 2017, what area of your home flooded (check all that apply)?

   No Flooding:     Crawl Space:     Basement:     First Floor:     Garage:     

5. Do you have a basement?   Yes:     No:     

   If so, please provide the measurement from the floor slab, to the top of your foundation (Dimension “A” in the diagram):     

6. Do you have a crawl space?   Yes:     No:     

   If so, please provide the measurement from the floor slab, to the top of your foundation (Dimension “B” in the diagram):     

7. Do you have a sump pump?   Yes:     No:     Not Sure:     

   If so, where does the sump pump discharge?   Yard:     Plumbing:     

   Not Sure:     Other:     

8. Do you have a waste (sewer) ejector pump?   Yes:     No:     Not Sure:     

9. Do you employ any of the following sanitary sewer backup protections?  

   Floor Drain Plug:     Standpipe:     Overhead Sewer:     Check Valve:     Other:     

   Typical House Foundation  

Additional Comments:     

Thank you for taking the time to complete the survey!
Survey Results To Date

Survey Statistics (7/15/18)
- 1,855 Delivered
- 310 Respondents
- 231 Currently Mapped
- 16.7% Return Rate
Survey Results To Date

Percentage of Respondents With Flooding

- 54% Respondents with Flooding
- 46% Respondents without Flooding

Sanitary Sewer v. Surface Water Flooding

- 72% Surface Water Flooding
- 28% Sanitary Sewer Flooding
Jeffrey W. Freeman, P.E., CFM, LEED AP
Vice President
Engineering Enterprises, Inc.
jfreeman@eeiweb.com
(630) 466-6700

Timothy N. Paulson, P.E., CFM
Project Manager
Engineering Enterprises, Inc.
tpaulson@eeiweb.com
(630) 466-6700