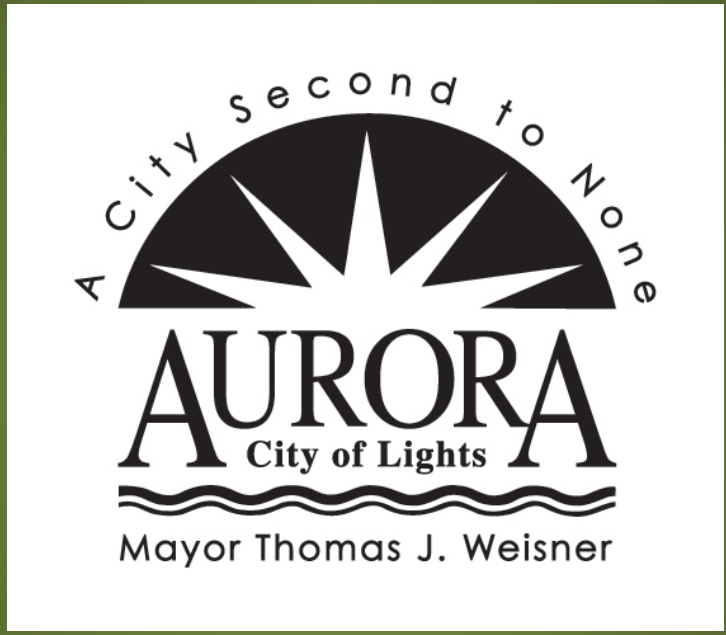
City of Aurora



Using Green Infrastructure to Control Combined Sewer Overflows

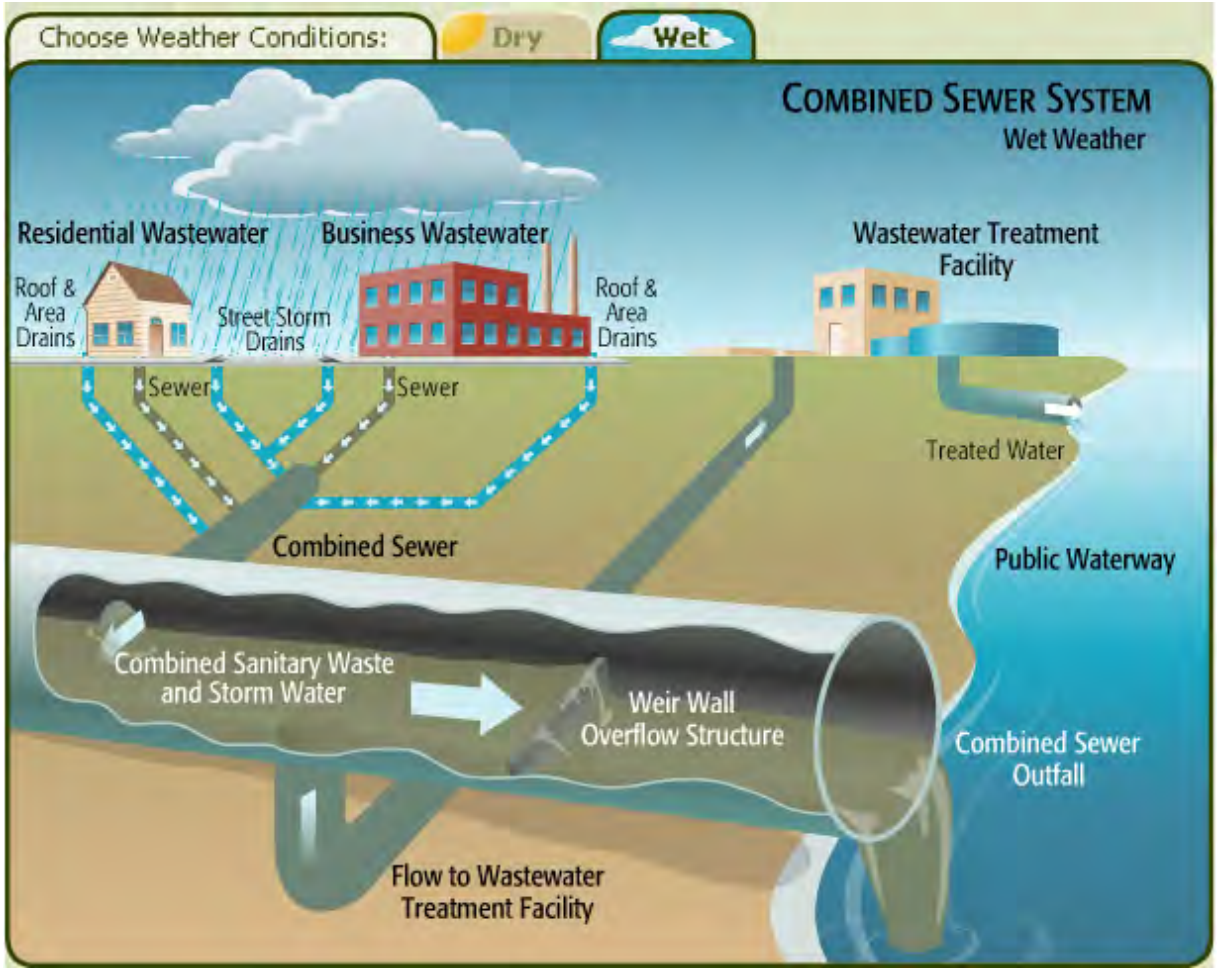
Fox River Watershed

- Headwaters near Waukesha WI
- 2,658 Sq. Mi. Drainage area
- 1,720 Sq. Mi. within Illinois
- Over 1,000,000 residents live within the Fox River Valley
- Population expected to grow by 30% over the next 30 years
- Listed on the 303(d) list of impaired waterways

City of Aurora Wastewater Collection System

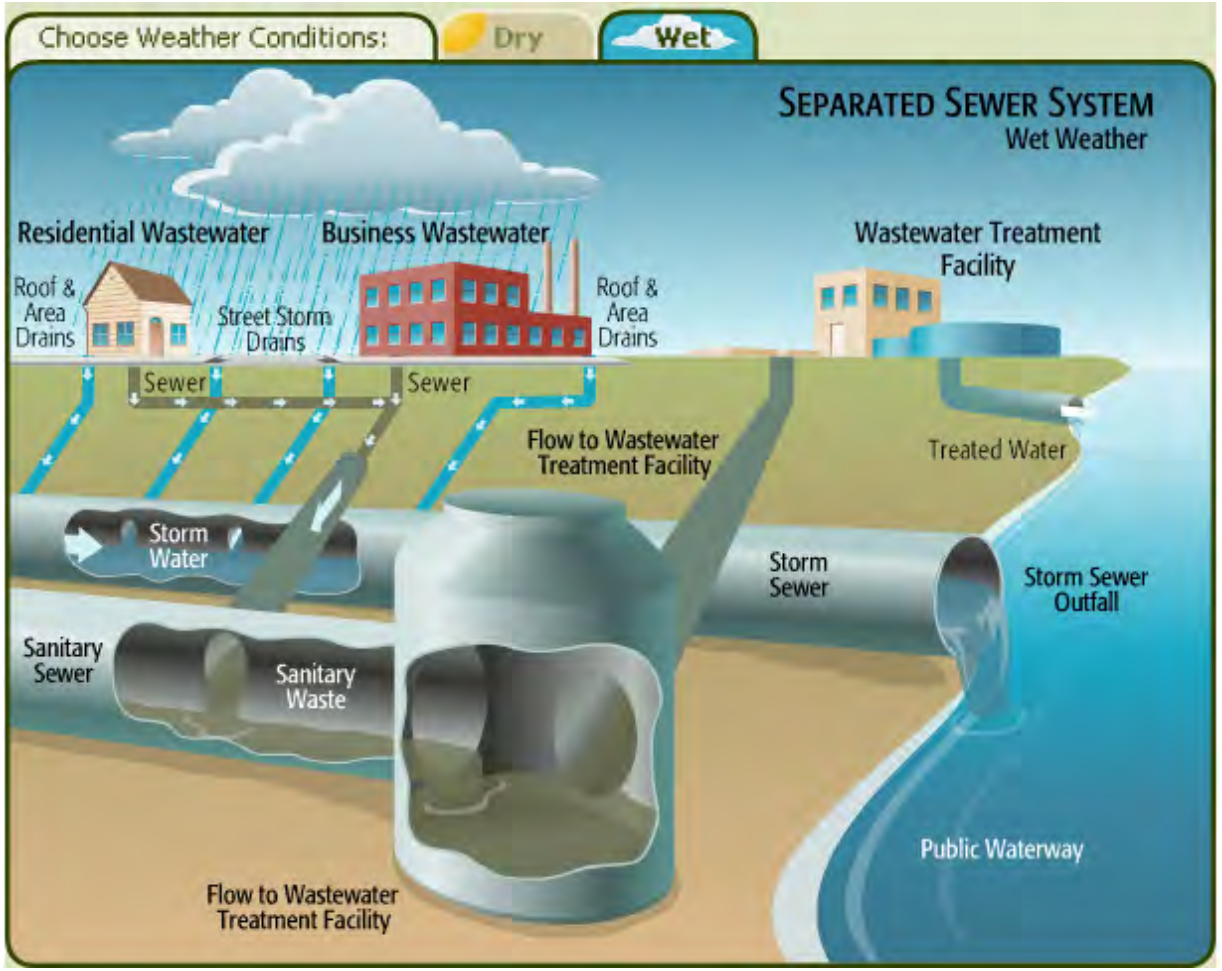
- Aurora covers about 45 sq. miles
- Population of about 200,000
- Aurora's sanitary sewage is treated at the Fox Metro Water Reclamation District in Oswego
- Aurora has both combined and separate sewer systems along with a combined sewage treatment plant
- 11 sq. miles are served by combined sewers

What are Combined Sewer Systems and How Do they Operate?



Courtesy of SD #1 of Northern Kentucky

What are Separate Sewer Systems and How Do they Operate?



Courtesy of SD #1 of Northern Kentucky

We are not alone

According to the US EPA there are currently 772 CSO communities nation wide. Illinois is home to approximately 100 CSO communities.

Grey infrastructure is an important part of the solution

Grey infrastructure is an important part of the solution

Benefits of sewer separation include:

- Reduction in the frequency of basement backups
- Helps protect private property from flood damage
- Reduction of street flooding – increases the level of safety to the motoring public
- Increases sewer capacity for future re-development
- BUT…….

CSO No. 15 (West Benton)
July 23-24 2010 Rain Event
Sampling by Walter E. Deuchler Associates

West Benton (CSO No. 15)	Sequential Bottle ID											
Parameter	Initial	--	--	--	--	--	--	--	--			
	1-2	3-4	5-6	7-8	9-10	11-12	--	--	--			
Collection Date	7/23/10	7/23/10	7/23/10	7/23/10	7/23/10	7/23/10						
Collection Time (24hr)	18:17	18:20	18:23	18:26	18:29	18:32						
Flow Meter Time	18;15	18:18	18:21	18:24	18:27	18:30						
Temperature (ºC)*	ND	ND	ND	ND	ND	ND	NS	NS	NS			
D.O. (mg/L)*	ND	ND	ND	ND	ND	ND	NS	NS	NS			
pH (S.U.)*	ND	ND	ND	ND	ND	ND	NS	NS	NS			
Conductivity (uS/cm)*	ND	ND	ND	ND	ND	ND	NS	NS	NS			
BOD (mg/L)	87	101	62	38	30	20	NS	NS	NS			
TSS (mg/L)	572	660	492	564	288	216	NS	NS	NS			
Fecal Coliforms (#/100mL)*	1.02E+06	6.40E+05	8.60E+05	1.10E+06	9.20E+05	8.80E+05	NS	NS	NS			
TKN (mg/L)	11.30	13.50	7.10	6.33	5.24	4.80	NS	NS	NS			
Ammonia N (mg/L)	1.47	1.26	0.66	0.92	0.97	1.08	NS	NS	NS			
Nitrate N (mg/L)	< 0.09	< 0.09	< 0.09	< 0.09	< 0.09	< 0.09	NS	NS	NS			
Nitrite N (mg/L)	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	NS	NS	NS			
Organic N (mg/L)	9.83	12.24	6.44	5.41	4.27	3.72	NS	NS	NS			
Total P (mg/L)	2.58	3.25	1.83	1.40	1.17	1.02	NS	NS	NS			
Soluble, Unreactive P (mg/L)[1]	0.37	0.34	0.21	0.20	0.19	0.19	NS	NS	NS			
Soluble, Reactive P (mg/L)[2]	< 0.02	< 0.02	< 0.02	0.09	0.03	0.06	NS	NS	NS			
Chloride (mg/L)	18	15	12	18	14	14	NS	NS	NS			
Fluoride (mg/L)	0.04	0.06	< 0.03	0.04	< 0.03	< 0.03	NS	NS	NS			
Sulfate (mg/L)	7.7	7.5	6.9	6.8	5.9	6.6	NS	NS	NS			

CSO No. 1 (Rathbone Avenue)
July 23-24 2010 Rain Event
Sampling by Walter E. Deuchler Associates

Rathbone (CSO No. 1)	Sequential Bottle ID											
Parameter	**Initial**	**5 min.**	**10 min.**	**15 min.**	**20 min.**	**30 min.**	**45 min.**	**--**	**--**	**7 hr.**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**--**	**--**	**16**		
Collection Date	7/23/10	7/23/10	7/23/10	7/23/10	7/23/10	7/23/10	7/23/10			7/24/10		
Collection Time (24hr)	18:23	18:28	18:33	18:38	18:43	18:53	19:03			2:03		
Flow Meter Time	18:20	18:25	18:30	18:35	18:40	18:50	19:00			2:00		
Temperature (ºC)*	ND	ND	ND	ND	ND	ND	ND	NS	NS	ND		
D.O. (mg/L)*	ND	ND	ND	ND	ND	ND	ND	NS	NS	ND		
pH (S.U.)*	ND	ND	ND	ND	ND	ND	ND	NS	NS	ND		
Conductivity (uS/cm)*	ND	ND	ND	ND	ND	ND	ND	NS	NS	ND		
BOD (mg/L)	64	71	68	66	76	44	83	NS	NS	19		
TSS (mg/L)	472	572	520	412	436	336	344	NS	NS	108		
Fecal Coliforms (#/100mL)*	1.68E+06	8.80E+05	1.44E+06	1.28E+06	1.36E+06	1.68E+06	1.44E+06	NS	NS	1.60E+06		
TKN (mg/L)	10.20	14.70	16.00	15.40	13.60	11.90	15.40	NS	NS	6.43		
Ammonia N (mg/L)	2.28	3.51	5.05	4.90	2.29	1.97	4.26	NS	NS	3.19		
Nitrate N (mg/L)	< 0.09	< 0.09	< 0.09	< 0.09	< 0.09	< 0.09	< 0.09	NS	NS	0.44		
Nitrite N (mg/L)	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	NS	NS	< 0.05		
Organic N (mg/L)	7.92	11.19	10.95	10.50	11.31	9.93	11.14	NS	NS	3.24		
Total P (mg/L)	2.11	2.89	2.93	3.21	3.10	2.54	3.34	NS	NS	1.02		
Soluble, Unreactive P (mg/L)[1]	0.26	0.41	0.65	0.63	0.55	0.37	0.92	NS	NS	0.32		
Soluble, Reactive P (mg/L)[2]	< 0.02	0.15	0.41	0.40	0.15	0.18	0.53	NS	NS	0.18		
Chloride (mg/L)	36	45	48	43	35	26	41	NS	NS	49		
Fluoride (mg/L)	0.13	0.15	0.16	0.11	0.09	0.07	0.13	NS	NS	0.10		
Sulfate (mg/L)	22.7	19.9	18.4	15.7	14.2	11.4	14.8	NS	NS	17.6		

Ashland Avenue Storm Sewer
July 23-24 2010 Rain Event
Sampling by Walter E. Deuchler Associates

Hartway (Storm Sewer)	Sequential Bottle ID											
Parameter	**Initial**	**5 min.**	**10 min.**	**15 min.**	**20 min.**	**30 min.**	**--**	**--**	**--**	**--**	**7 hr.**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	
Collection Date	7/23/10	7/23/10	7/23/10	7/23/10	7/23/10	7/23/10					7/24/10	
Collection Time (24hr)	18:11	18:16	18:21	18:26	18:31	18:41					2:16	
Flow Meter	18:05	18:10	18:15	18:20	18:25	18:35					2:10	
Temperature (°C)*	ND	ND	ND	ND	ND	ND	NS	NS	NS	NS	ND	
D.O. (mg/L)*	ND	ND	ND	ND	ND	ND	NS	NS	NS	NS	ND	
pH (S.U.)*	ND	ND	ND	ND	ND	ND	NS	NS	NS	NS	ND	
Conductivity (uS/cm)*	ND	ND	ND	ND	ND	ND	NS	NS	NS	NS	ND	
BOD (mg/L)	5	6	5	5	4	6	NS	NS	NS	NS	5	
TSS (mg/L)	216	224	172	184	148	356	NS	NS	NS	NS	228	
Fecal Coliforms (#/100mL)*	TNTC(>200K)	TNTC(>200K)	TNTC(>200K)	TNTC(>200K)	TNTC(>200K)	TNTC(273K)	NS	NS	NS	NS	TNTC(346K)	
TKN (mg/L)	1.68	1.83	1.50	1.50	1.21	2.36	NS	NS	NS	NS	1.42	
Ammonia N (mg/L)	0.03	0.03	0.03	0.04	0.06	0.01	NS	NS	NS	NS	0.07	
Nitrate N (mg/L)	0.30	0.44	0.11	0.29	0.47	0.60	NS	NS	NS	NS	0.74	
Nitrite N (mg/L)	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	NS	NS	NS	NS	< 0.05	
Organic N (mg/L)	1.65	1.80	1.47	1.46	1.16	2.35	NS	NS	NS	NS	1.35	
Total P (mg/L)	0.30	0.45	0.35	0.35	0.29	0.68	NS	NS	NS	NS	0.30	
Soluble, Unreactive P (mg/L)[1]	0.02	0.03	0.02	0.03	0.03	0.05	NS	NS	NS	NS	0.06	
Soluble, Reactive P (mg/L)[2]	< 0.02	< 0.02	< 0.02	< 0.02	0.03	AF	NS	NS	NS	NS	< 0.02	
Chloride (mg/L)	49	24	33	21	36	43	NS	NS	NS	NS	78	
Fluoride (mg/L)	0.10	0.10	0.05	< 0.03	0.03	0.09	NS	NS	NS	NS	0.09	
Sulfate (mg/L)	39.9	20.4	22.7	14.9	20.3	21.8	NS	NS	NS	NS	40.3	
FMWRD ID Number-Grab	AF06992	AF06993	AF06994	AF06995	AF06996	AF06997	NS	NS	NS	NS	AF06998	

North River Street Storm Sewer
July 23-24 2010 Rain Event
Sampling by Walter E. Deuchler Associates

N. River Street (Storm Sewer)	Sequential Bottle ID											
Parameter	**Initial**	**5 min.**	**10 min.**	**15 min.**	**20 min.**	**30 min.**	**45 min.**	**1 hr.**	**--**	**6 hr.**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**--**	**9**		
Collection Date	7/23/10	7/23/10	7/23/10	7/23/10	7/23/10	7/23/10	7/23/10	7/23/10		7/24/10		
Collection Time (24hr)	18:10	18:15	18:20	18:25	18:30	18:40	18:55	19:10		1:15		
Flow Meter	18:05	18:10	18:15	18:20	18:25	18:35	18:50	19:05		1:10		
Temperature (^{o}C)*	ND	ND	ND	ND	ND	ND	ND	ND	NS	ND		
D.O. (mg/L)*	ND	ND	ND	ND	ND	ND	ND	ND	NS	ND		
pH (S.U.)*	ND	ND	ND	ND	ND	ND	ND	ND	NS	ND		
Conductivity (uS/cm)*	ND	ND	ND	ND	ND	ND	ND	ND	NS	ND		
BOD (mg/L)	18	20	6	19	6	6	< 6	3	NS	< 42		
TSS (mg/L)	292	304	244	248	120	68	24	16	NS	400		
Fecal Coliforms (#/100mL)*	TNTC(326K)	TNTC(>200K)	TNTC(622K)	TNTC(>400K)	TNTC(>400K)	TNTC(442K)	3.20E+04	1.13E+05	NS	1.14E+05		
TKN (mg/L)	2.34	2.76	2.68	2.56	1.66	0.99	0.71	0.78	NS	1.44		
Ammonia N (mg/L)	0.20	0.21	0.22	0.22	0.07	0.05	0.05	0.05	NS	0.13		
Nitrate N (mg/L)	0.24	0.13	< 0.09	0.19	0.28	0.32	0.40	0.55	NS	0.48		
Nitrite N (mg/L)	0.09	0.13	0.15	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	NS	0.05		
Organic N (mg/L)	2.14	2.55	2.46	2.34	1.59	0.95	0.66	0.73	NS	1.31		
Total P (mg/L)	0.54	0.46	0.42	0.42	0.31	0.20	0.16	0.18	NS	0.30		
Soluble, Unreactive P (mg/L)[1]	0.11	0.17	0.14	0.17	0.16	0.09	0.10	0.10	NS	0.06		
Soluble, Reactive P (mg/L)[2]	< 0.02	< 0.02	0.02	< 0.02	0.05	0.07	0.08	0.09	NS	< 0.02		
Chloride (mg/L)	9.6	8.0	6.3	5.2	4.5	4.2	6.8	12	NS	14		
Fluoride (mg/L)	0.19	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	NS	< 0.03		
Sulfate (mg/L)	6.9	4.4	4.5	3.9	3.2	2.8	3.2	4.3	NS	6.1		

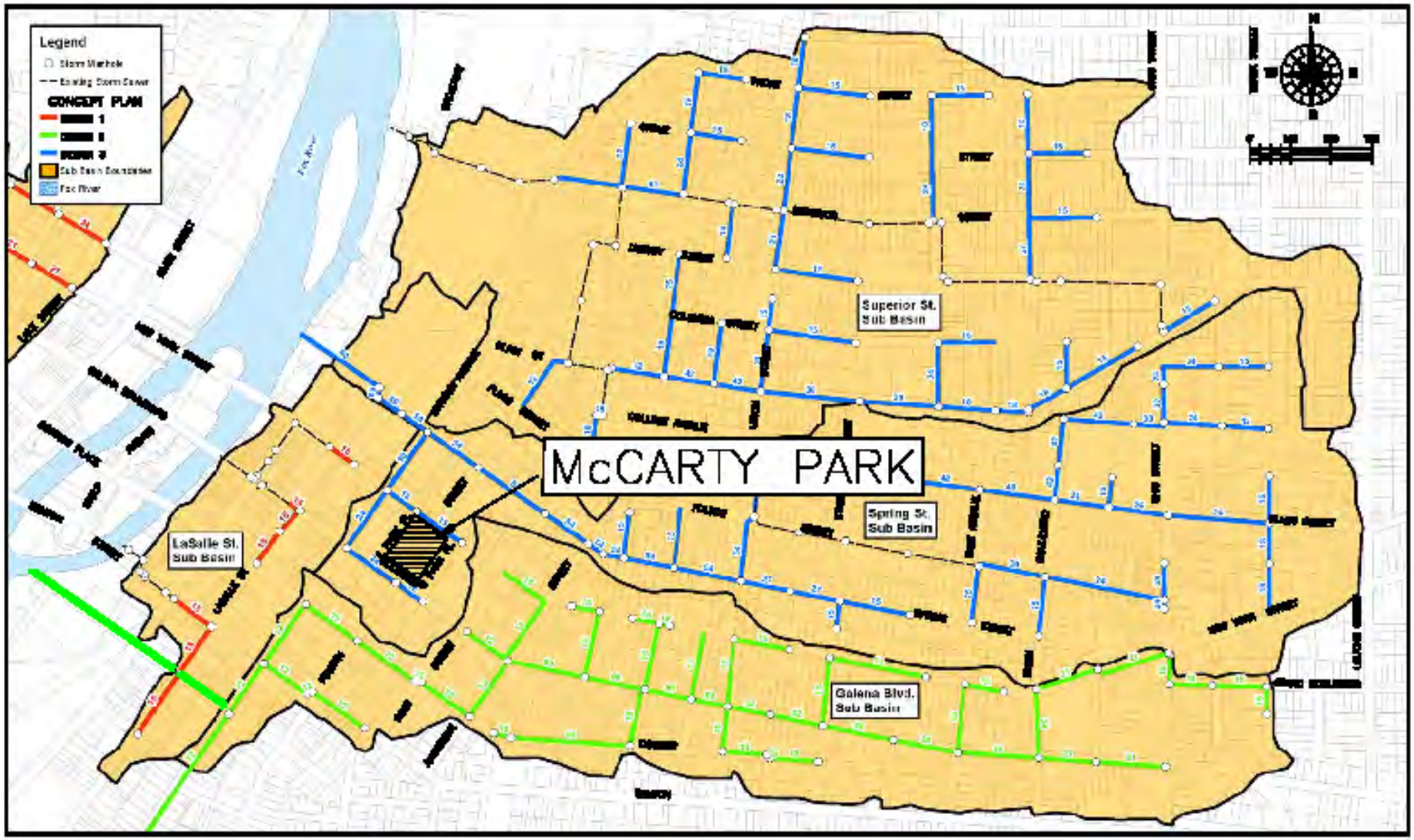
2009 American Recovery and Reinvestment Act (ARRA) Green Reserve Program

- The funding assistance provided through the existing State Revolving Loan Program:
  - 75% of the principal paid back over 20 years at 0%
  - "Principal Forgiveness" for the remaining 25%

2009 American Recovery and Reinvestment Act (ARRA)
Green Reserve Program

- Primary Goal:
  - Reduce peak runoff rates to the combined sewer system
- Secondary Goals:
  - Reduce discharge of stormwater pollutants to surface waters
  - Enhance stormwater infiltration
  - Create an aesthetic amenity for local residents

The McCarty Park location met all of the above criteria ….and then some….


Legend
Storm Manhole
Existing Storm Sewer
CONCEPT PLAN
Sub Basin Boundaries
Fox River
McCARTY PARK
Superior St.
Sub Basin
Spring St.
Sub Basin
LaSalle St.
Sub Basin
Galena Blvd.
Sub Basin

2010 ARRA McCarty Park Bioinfiltration Project
Green Infrastructure Pilot Project

Green versus Grey cost comparison

- McCarty Park Project cost: $69,513.20
- Storm sewer alternative: $140,000

Green infrastructure saved us $70,000 !!

But wait, there's more

2010 ARRA McCarty Park Bioinfiltration Project
Green Infrastructure Pilot Project

- The $140,000 storm sewer would just *transport* stormwater to the Fox River
- The $70,000 green infrastructure alternative does much more:
  - Reduces peak stormwater flows to the River
  - Recharges shallow ground water supplies
  - Provides an aesthetic amenity to the public
  - Reduces pollutant loadings to the River

2010 ARRA McCarty Park Bioinfiltration Project

Green Infrastructure Pilot Project

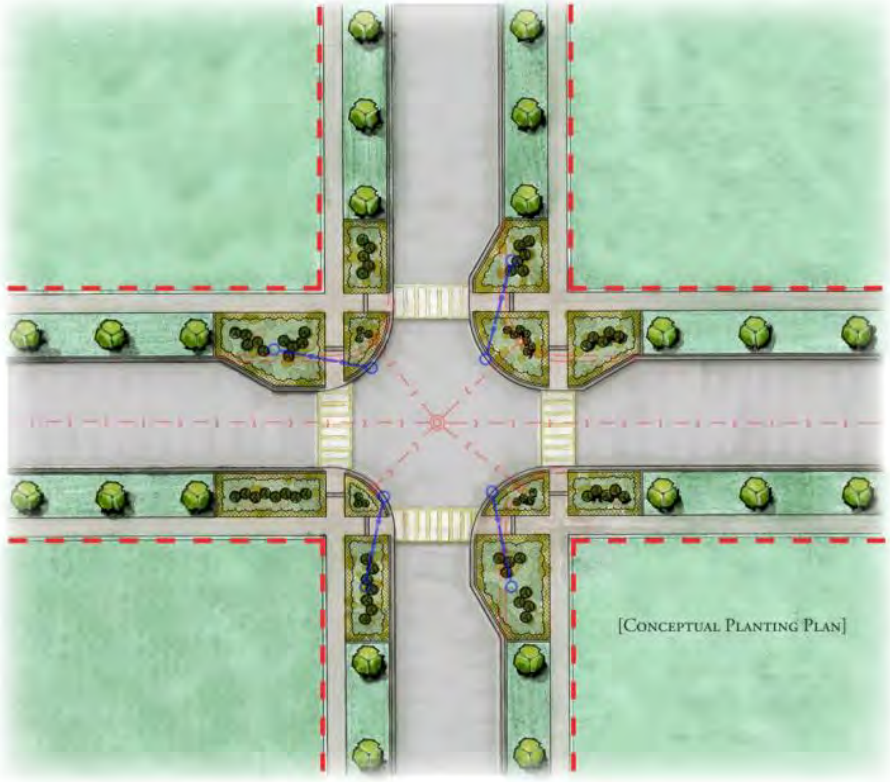
2010 ARRA McCarty Park Bioinfiltration Project
Green Infrastructure Pilot Project

Illinois Green Infrastructure Grant Green Infrastructure for CSO Control Program

- Partnership with Fox Metro Water Reclamation District, Valley of the Fox Group of the Sierra Club, and the City of Aurora.
- Project focuses on 3 CSO drainage basins where future sewer separation projects are planned.
- Rain gardens are proposed for 28 intersections within the CSO basins.
- GI improvements should eliminate the need for several thousand feet of new storm sewers.
- $1.45M in funding from the IEPA IGIG Program.
- Total project cost is estimated to be around $2.45M

Green Infrastructure Combined Sewer Overflow Control Program

Typical Rain Garden 4-Way Intersection Improvements



Grasses & Perennials


Penstemon digitalis - Beardtongue


Echinacea purpurea - Purple Coneflower


Physostegia virginiana - Obedient plant

Shrubs & Trees


Comptonia peregrina - Sweet fern


Quercus bicolor - Swamp White Oak

Hey and Associates, Inc.

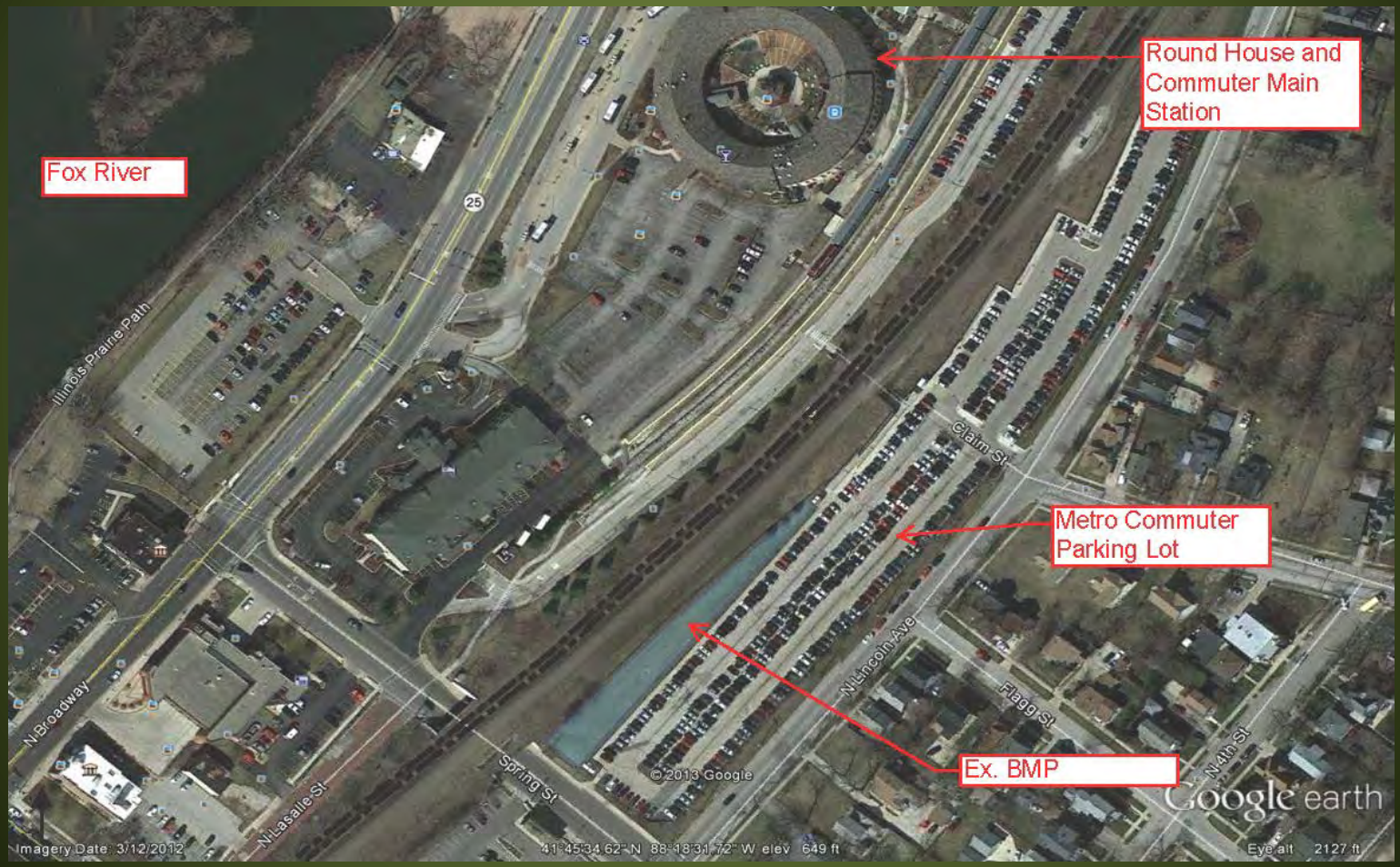
Engineering, Ecology and Landscape Architecture

GREEN VS. GREY CSO CONTROL COST COMPARISON

GREEN INFRASTRUCTURE ALTERNATIVE = $3,470,000

GREY INFRASTRUCTURE ALTERNATIVE = $4,850,000

Advice: Be Careful When Choosing Sites for Infiltration BMP's



Metra Commuter Parking Lot Retrofit

Metra Commuter Parking Lot Retrofit

Metra Commuter Parking Lot Retrofit

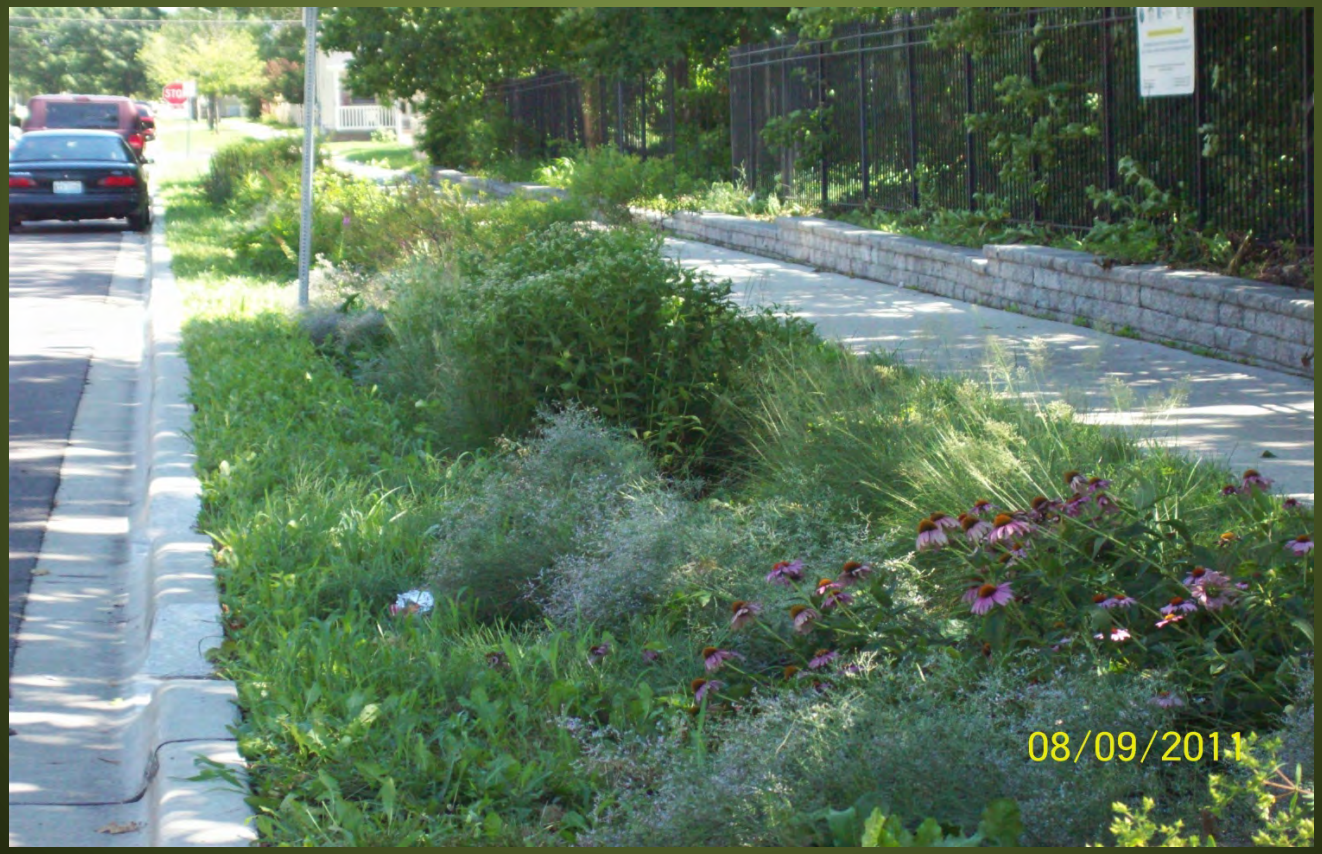
Metra Commuter Parking Lot Retrofit

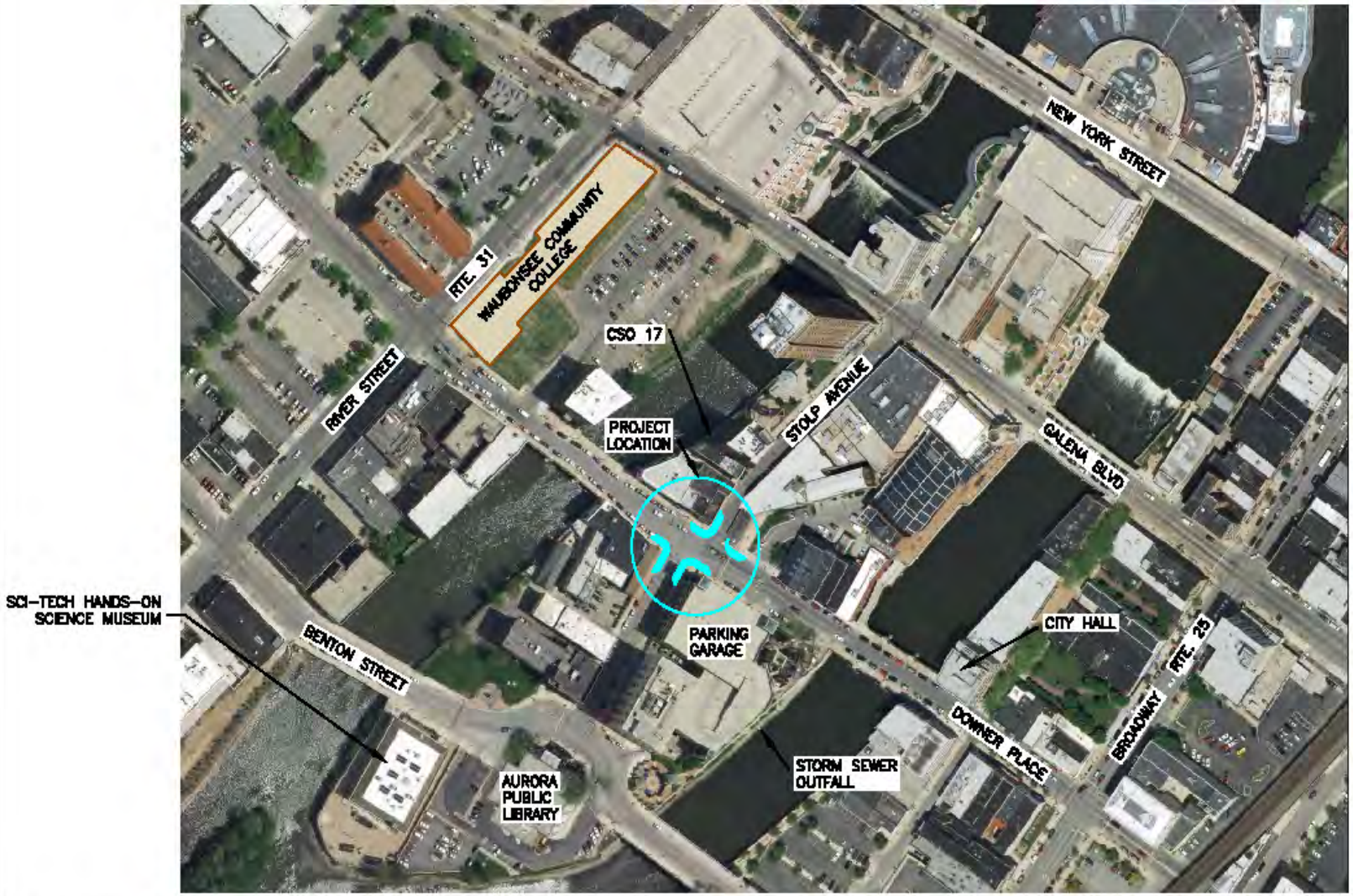
Metra Commuter Parking Lot Retrofit

Metra Commuter Parking Lot Retrofit

Metra Commuter Parking Lot Retrofit

Get The Public Involved Early In The Planning Process





CITY OF AURORA
DIVISION OF PUBLIC WORKS
44 EAST DOWNER PLACE

REVISIONS:

DESIGNED BY: LES	CHECKED BY: LES	SCALE: 1" = 160'
DRAWN BY: JJ	APPROVED BY: LES	DATE: 12/2010

PROJECT: DOWNER PLACE AND STOLP AVENUE BIOFILTRATION BASINS

SHEET TITLE: APPENDIX A

SHEET NUMBER: 1

TOTAL SHEETS: 1

Downer Place Visioning Workshop

- Organized by the Aurora Downtown Business Association
- Purpose: To get local stakeholder ideas on how Downer Place might be reshaped during the construction of the Downer Place Bridges
- 60 area residents and business owners along with a few interested students participated
- Attendees were broken into 6 work groups


PARKING
FOX THEATRE B'LD'G. AND PROME

Workshop outcome

- All 6 work groups recommended adding curb bump outs
  - Increase pedestrian safety: The existing cross walks are over 55 feet long
  - Traffic calming: the existing driving lanes are excessively wide, which results in faster vehicle speeds
  - Create gathering areas that are inviting to potential consumers and increase foot traffic to local shops
  - Create areas for café seating
- Early participation has resulted in a tremendous amount of local support for the project

DOWNER & STOLP IMPROVEMENT

Choose Site-Appropriate Planting Plan

SIMPLE, ORGANIZED

COMPLEX, NATURAL

SIMPLE, ORGANIZED

SIMPLE, ORGANIZED

Lessons Learned

- One size does NOT fit all. Choose BMP's that are appropriate for the site.
- Get me involved in the beginning and I will be your ally, get me involved I the end and I will be your critic

Several small victories over time can add up to a big win!

Every community needs a Champion

Questions ?

(AKA Stump the Chump)

This has been a
presentation of the
Engineering Division of the
Public Works Department
for the
City of Aurora