



City of Omaha CSO Program

Task 19 – Hybrid Alternatives

Cole Creek Basin



Task 19 - Hybrid Alternatives TM Cole Creek Basin

TO: Document Control Center
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FROM: Cole Creek Basin Study Team

DATE: February 16, 2009

Purpose

This technical memorandum develops, evaluates and identifies costs for “hybrid alternatives” for CSO control in the Cole Creek basin. The *CC Basin Sewer Separation Confirmation TM (June 2007) and Addendum 1A (August 27, 2007)* identified and developed alternatives for CSO control. The alternative recommended for Control Level 2 (less than 4 overflows) was sewer separation and two small storage tanks at CSO 203 and CSO 204 outfalls. The goal of this TM is to evaluate the feasibility of eliminating storage tanks at CSO 203 and CSO 204. The control level 2 alternative as identified in *CC Basin Sewer Separation Confirmation TM (June 2007) and Addendum 1A (August 27, 2007)* involved:

- Sewer separation of the basin (Subbasins 202, 203, 204)
- Raising of the weir at CSO 202 by 6” to reduce the number of overflows to 4 (Control level 2)
- 0.13 MG storage at CSO 203 and 0.78 MG storage at CSO 204 to reduce the number of overflows to 4 (Control level 2).

Model Review

The long term control plan (LTCP) model version 14 was used to run simulations for the evaluation of hybrid alternatives. The LTCP model run was compared against the calibrated model from 2008 to compare the CSO volumes and events at each outfall in Cole Creek basin

Table 1 summarizes model run results of sewer separation for the Cole Creek basin.

Table 1: CSO Volume & number of overflows reduction for Public Separation

CSO #	Cumulative CSO Volume with No Separation (MG) <i>(From Calibrated Model)</i>	CSO volume removed by Sewer Separation (MG) <i>(From LTCP Model)</i>	Estimated Remaining CSO Volume (MG)	CSO Volume Percent Reduction for Sewer Separation (%)	Remaining number of untreated overflows
202	10.269	10.269	0	100.00%	0
203	8.057	8.053	0.004	99.95%	2
204	60.643	59.621	1.022	98.32%	38

Hybrid Alternative - CSO 202

As can be seen from Table 1 – Sewer Separation will achieve control level 2 for CSO 202. Raising the weir six inches in CSO 202 will not be needed as identified in *CC Basin Sewer Separation Confirmation TM (June 2007) and Addendum 1A (August 27, 2007)*. No hybrid alternative is needed to achieve control level 2 for CSO 202.

Sewer Separation in CSO 202 will be completed in two (2) projects as documented in *Refinement Task 21 – Cole Creek Basin (01/16/09)*. Table 2 summarizes the sewer separation projects in CSO 202.

Table 2: CSO 202 Sewer Separation Projects Summary

Project #	New Sanitary Sewer (FT)	New Storm Sewer (FT)	Total Capital Cost (\$)	50-YR Present Worth Cost (\$)
SA-202-01	960 (12"-15")	5,295 (18"-72")	\$6,709,000	\$6,866,000
SA-202-02	1,540 (8")	5,040 (18"-60")	\$6,487,000	6,678,000
Total	2,500 (8"-15")	10,335 (18"-72")	\$13,196,000	\$13,544,000

Hybrid Alternative - CSO 203

As can be seen from Table 1 – Sewer Separation will achieve control level 2 for CSO 203. Sewer separation will reduce the number of overflows to two in a typical year 1969. A 0.13 MG storage tank in CSO 203 will not be needed as identified in *CC Basin Sewer Separation Confirmation TM (June 2007) and Addendum 1A (August 27, 2007)*. No hybrid alternative is needed to achieve control level 2 for CSO 202.

Sewer Separation in CSO 203 will be completed in one (1) project as documented in *Refinement Task 21 – Cole Creek Basin (01/16/09)*. Table 3 summarizes the sewer separation projects in CSO 203.

Table 3: CSO 203 Sewer Separation Projects Summary

Project #	New Sanitary Sewer (FT)	New Storm Sewer (FT)	Total Capital Cost (\$)	50-YR Present Worth Cost (\$)
SA-203-01	1,570 (8"-15")	4,330 (18"-42")	\$6,819,000	\$7,123,000

Hybrid Alternative - CSO 204

As can be seen from Table 1, sewer separation, by itself, will not achieve control level 2 for CSO 204. Sewer Separation in CSO 204 will be completed in eight (8) projects as documented in *Refinement Task 21 – Cole Creek Basin (01/16/09)*. Table 4 summarizes the sewer separation projects in CSO 204.

Table 4: CSO 204 Sewer Separation Projects Summary

Project #	New Sanitary Sewer (FT)	New Storm Sewer (FT)	Total Capital Cost (\$)	50-YR Present Worth Cost (\$)
SA-204-01	-	2,555 (96")	\$6,560,000	\$6,585,000
SA-204-2	1,150 (12"-15")	3,325 (18"-90")	\$6,527,000	\$6,618,000
SA-204-3	1,767 (12"-15")	982 (18"-72")	\$3,917,000	\$4,156,000
SA-204-4	-	2,405 (84"-108")	\$7,028,000	\$7,128,000
SA-204-5	-	6,189 (18"-72")	\$6,376,000	\$6,490,000
SA-204-6	1,487 (8"-15")	5,167 (18"-96")	\$8,379,000	\$8,797,000
SA-204-7	1,023 (8"-12")	3,671 (18"-72")	\$5,570,000	\$5,640,000
SA-204-8	2,168 (8"-12")	5,359 (18"-60")	\$8,610,000	\$8,845,000
Total	7,595 (8"-15")	29,653 (18"-108")	\$53,327,000	\$54,259,000

Sewer separation will reduce the CSO volume by 98.32% but there will still be 38 overflows in a typical year 1969. The total cumulative volume of these overflows is 1.022 MG.

Two alternatives were considered to achieve control level 2 at CSO 204.

- a) a storage tank at CSO 204 outfall
- b) raising the weirs at the two CSO 204 diversion structures

Storage Tank Option: In addition to sewer separation, a 0.046-MG storage tank would need to be constructed near the outfall to capture additional overflows. InfoWorks LTCP model run results show that a combination of sewer separation and 0.046-MG storage tank would limit the number of overflows to 4 in a typical year 1969. The amount of storage capacity needed was calculated based on CSO volumes for the fifth largest storm event in 1969. A 72-hour period was used to dewater the storage facility; for the storm event based on PMT guidance. However, considering the size of the storage tank, flows could be dewatered at a much faster rate. No other events occurred within the 72-hour time frame. The dewatered flows were assumed to be discharged into the east interceptor along Cole Creek. The capacity available in the interceptors, just downstream of the proposed storage location, to carry the wet weather flows (in addition to dry weather flows) is 2.5 MGD.

Based on the 0.046-MG CSO volume and the 72-hour dewatering rate (0.015 MGD), the existing interceptor has adequate capacity to handle these flows. The storage tank would be constructed below ground and would be located beneath the parking lot in Benson Park at the intersection of Ames Avenue and 66th Streets as shown on Figure 1 (Attachment 1). Wet weather flows would drain by gravity through a 15-inch storm sewer into the tank and would be dewatered by pumping through a 6-inch forcemain to the interceptors after a storm event. The storm sewer and forcemain were sized to carry the peak flow of 1.11 MGD. The approximate site area needed would be 0.74 acres and the approximate tank dimensions would be 25 feet by 25 feet by 10 feet deep. Based on the topography of the site and influent pipe invert elevations, the top of the tank would be approximately 25 feet below grade. Miscellaneous costs were added in the cost tool to account for a temporary parking lot during construction and replacement of the existing concrete parking lot after construction has been completed. Additional O&M costs were added to treat the dewatered flows from the storage tank at the Papillion Creek Wastewater Treatment Plant. An annual volume stored of 0.45 million gallons and a cost of \$670/MG was used to arrive at the additional O&M cost of \$302.

Detailed cost breakdown can be found in the Cost Tool Results in Attachment 2. The capital cost for 0.046-MG storage tank is approximately \$9,118,000. The 50-year present worth costs are approximately \$9,666,000.

Raising the Weir at CSO 204 Outfall Structure: Under this option the two weirs at the CSO diversion structures would be raised 1-foot. Raising the weir by 1-foot at CSO 204 would reduce the number of overflows to 3 at CSO 204. Raising the weir at 204, will however, cause three (3) overflows to occur at CSO 203 and two (2) overflows to occur at CSO 202 due to surcharging of the east interceptor along Cole Creek. A simulation with the raised weir and sluice gates at the CSO 204 outfall structure completely open was also run to see the results. This run produced zero (0) overflows at CSO 204 and three (3) overflows each at CSO 202 and CSO 203.

Both the simulations produced surcharging of the east interceptor along Cole Creek. However, the surcharging appeared to be at the low points in the interceptor. Surcharging along the main sewers from the interceptor upstream to the diversion structures appears to be minimal in the LTCP model runs. It therefore appears at this time that raising the weir would be a feasible option, however, a detailed analysis during preliminary design would be needed to determine if the hydraulic grade line in the Cole Creek interceptors or in main sewers near the diversion structures would be raised to the extent that sewer backups would be problematic at storm events larger than the 1969 model year.

Larger storms events would raise head conditions over the diversion weirs, thereby sending more flow down the main and interceptor sewers downstream of the diversion structures. Raising the weirs will also have some affect on hydraulic grade line upstream of the diversion structures, especially during these larger events. The affect of these larger storms should be fully evaluated before implementation of this alternative. If flow heads over the diversion weirs appears to be problematic during larger storms it may also be an option to redesign the diversion structures and lengthen the weirs to reduce overflow heads during peak overflow rates.

Model runs were also performed with the control gates at the two CSO 204 diversion structures locked completely open and not operating. This has the effect of not restricting flow in the sewer lines downstream of the diversion structures when the sewers become surcharged. More flow is transported downstream thereby causing higher hydraulic grade lines. This situation was modeled both with the weir at the current height, and with the weir raised 1 foot.

With the weir at existing height and the gates locked open very little change in hydraulic grade line and no change in overflow volumes was observed from the model runs. However with the weir heights increased one foot, keeping the gates locked open showed measureable rises in hydraulic grade line during model year storms. This shows that the gates perform a significant function to limit flows in the sewers and the Cole Creek interceptor pipes downstream of the diversion structures and will be of definite benefit, especially on larger storms than that which occur in the 1969 model year. Attachment 3 contains the HGL profiles of the east interceptor sewer from the two diversion structures in CSO 204.

Estimated construction costs for raising the weir would be negligible when compared to the cost of sewer separation or storage tanks.

Basin Alternatives

The following two alternatives are available for the Cole Creek basin to achieve control level 2 for CSO control.

- Alternative 1 – Sewer separation of CSO 202, CSO 203 and CSO 204 subbasins and 0.10 MG storage at CSO 204
- Alternative 2 –Sewer separation of CSO 202, CSO 203 and CSO 204 subbasins and raising the weir 1-foot at CSO 204 outfall structure.

Table 5 summarizes the capital costs, 50-year present worth costs and remaining number of overflows for each alternative.

Table 5 – Alternative Cost Summary

Alternative	Capital Costs \$	50-year Present Worth Costs (\$)	Number of Overflows remaining
Alternative 1	\$ 82,460,000	\$84,592,000	5 (total) CSO 204 – 3 CSO 203 - 2 CSO 202 - 0
Alternative 2	\$73,342,000	\$74,926,000	8 (total) CSO 204 – 3 CSO 203 – 3 CSO 202 - 2

Conclusions and Recommendations

As shown above, two hybrid alternatives are proposed to achieve control level 2 for CSO control in the Cole Creek basin. Alternative 1 uses a small storage tank at CSO 204 and Alternative 2 raises the weir at the outfall structure of CSO 204 by 1-foot. While Alternative 2, appears to meet the requirements of the program at a lesser capital and 50-year present worth costs, additional analysis is required to fully verify and confirm this alternative.

It is therefore recommended to use Alternative 1 as a recommended path forward in Cole Creek basin. Alternative 1 involves sewer separation of CSO 202, 203 and 204 and construction of 0.10 MG storage tank at CSO 204. The capital cost for Alternative 1 is approximately \$82,448,000. The 50-year present worth costs are approximately \$84,507,000.

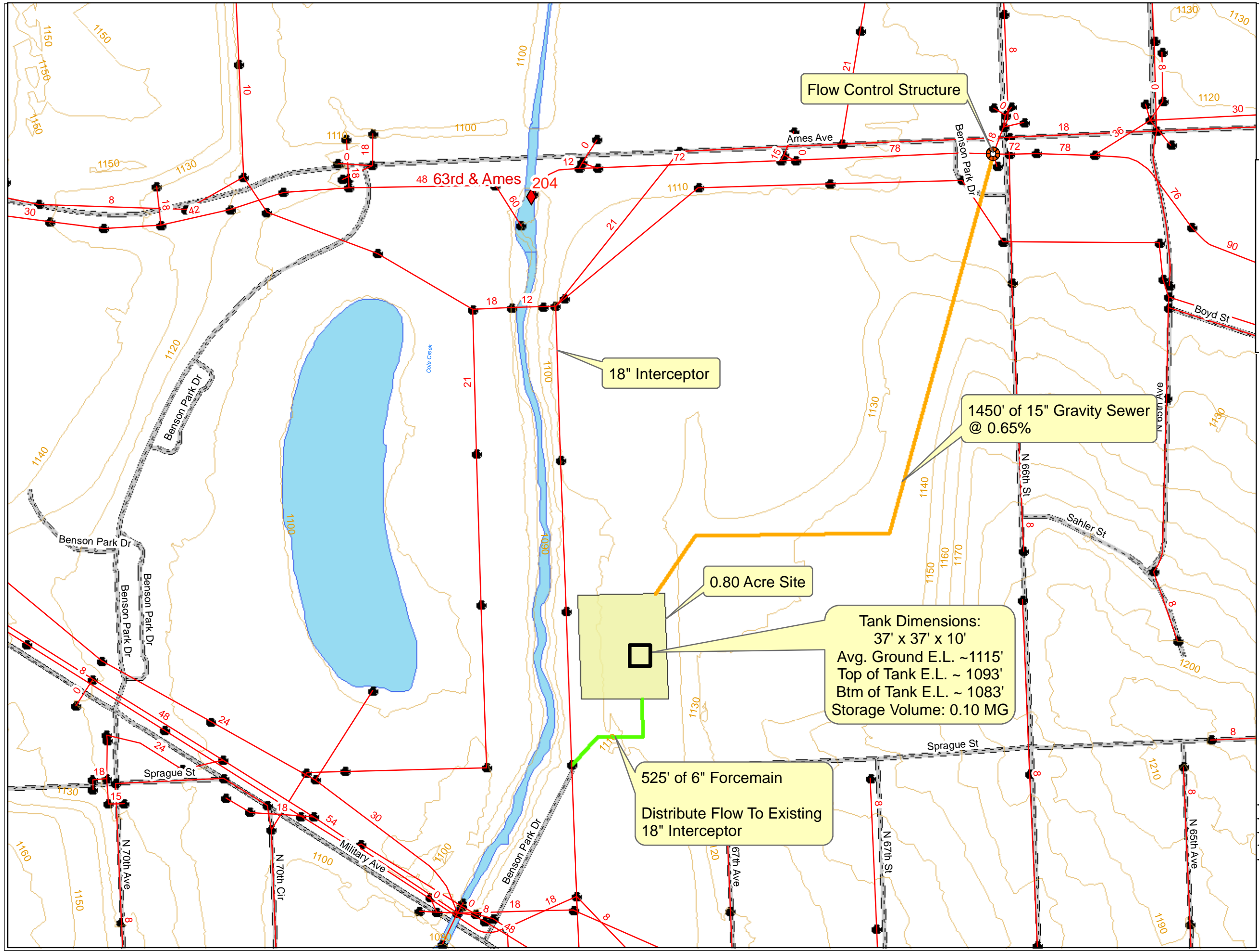
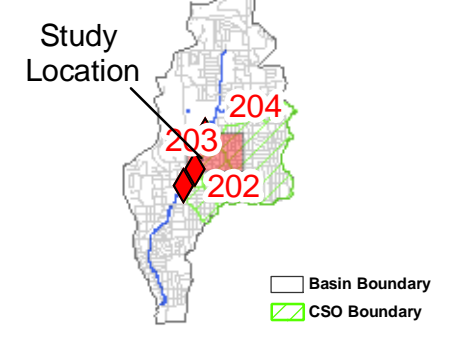
Acronym/Term	Definition
AC	Acre
BC	Basin Consultant
City	City of Omaha
CFS	Cubic Feet per Second
CSO	Combined Sewer Overflow
CSS	Combined Sewer System
DS	Diversion Structure
FPS	Feet per Second
GIS	Geographic Information System
GPD	Gallons Per Day
GPCD	Gallons Per Capita per Day
HA	Hybrid Alternative
ID	Identification
IW	InfoWorks
LS	Lift Station
LTCP	Long Term Control Plan
MGD	Million Gallons per Day
MUD	Metropolitan Utilities District
PMT	Program Management Team
RNC	Combined Sewer Renovation/Separation Project
SCADA	Supervisory Control and Data Acquisition
SSCT TM	Sewer Separation Control Technology Technical Memorandum
TBM	Tunnel Boring Machine
TM	Technical Memorandum
SSO	Sanitary Sewer Overflows

References and Resources

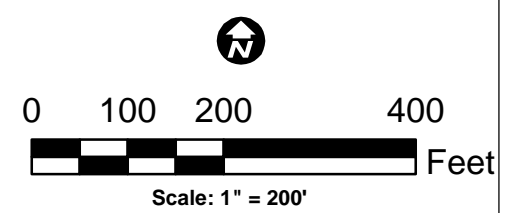
Attachment 1 – Figures

Cole Creek Basin

CSO 204 STORAGE



- ◆ CSO Outfall
- Existing Sewers
- Gravity Sewer
- Forcemain
- Storage Tank Site
- Drainage
- Streets
- 10ft Contours
- Manholes/Inlets
- Diversion



Tank Dimensions:
 37' x 37' x 10'
 Avg. Ground E.L. ~1115'
 Top of Tank E.L. ~ 1093'
 Btm of Tank E.L. ~ 1083'
 Storage Volume: 0.10 MG

525' of 6" Forcemain
 Distribute Flow To Existing
 18" Interceptor

1450' of 15" Gravity Sewer
 @ 0.65%

0.80 Acre Site

18" Interceptor

Flow Control Structure

Alternative:	HYBRID ALTERNATIVE 1
Project:	CSO - OMAHA
Date:	12/12/09
Figure:	1



Attachment 2 – Cost Tool Results

City of Omaha

CSO CONTROL PROGRAM
Project Cost Summary Sheet

Project ID: SA-204-09 - Storage

Description: Cost estimate for storage for CL-2 Storm Volume of the CSO 204 sub-basin of Cole Creek.

Estimate Date: 2/12/2009

Prepared By: Kirkham Michael

Printed Date: 2/16/2009

Cost Estimate Description		Totals
Estimated Open Cut Sewer Construction Cost		\$ 715,000
Estimated Tunneling Construction Cost		\$ -
Estimated Off-line Storage Facilities Construction Cost		\$ 1,472,000
Estimated I/I Removal Cost		\$ -
Estimated Pump Station Cost		\$ 1,749,000
Estimated Flow Control Structure		\$ 275,000
Estimated Bioretention Cost		\$ -
Estimated Force Main Cost		\$ 74,000
Estimated High Rate Treatment Cost		\$ -
Estimated Screening Cost		\$ -
Misc. Extra Cost	Description: Cost for Parking lot replacement	\$ 1,142,362
Total Estimated Construction Cost =		\$ 5,427,362
Construction Performance Incentive	Check if in Business District	\$ 54,000
Cost for MUD utility relocation		\$ 456,000

Real Estate Costs Description		Totals
Easement Cost	# of Properties = 0	\$ -
Property Acquisition		\$ -
Misc. Extra Cost	Description:	\$ -
Total Additional Costs =		\$ -

Multipliers Description	Multiplier	
Administration Costs-Design, R/W, Legal Fees, & Construction	5%	
Contingencies	25%	
Interest	5%	
Miscellaneous - PTI, test bore, ECI Inspector	4%	
Field Engineering & Inspection	5%	
Design & Eng. Services	15%	
Program Management	2%	
Planning & Preliminary Design	5%	
Performance Bond	1%	
Total Multipliers =		67%

Data File Base ENRCCI	7312	PROJECT CAPITAL COST ESTIMATE =	\$ 9,118,000
Data File ENRCCI in use	7888	Project 50 Year Present Worth Estimate =	\$ 9,666,000

ENRCCI overwrite by Estimator 7888

PROJECT CAPITAL COST ESTIMATE =	\$ 9,118,000
Project 50 Year Present Worth Estimate =	\$ 9,666,000
Construction Cost Estimate =	\$ 5,427,362

City of Omaha

CSO CONTROL PROGRAM

Project Values Summary Sheet

Value Description	Totals
Length of Open Cut Sewer Conveyance (Feet)	1,400
Length of Tunnel Sewer Conveyance (Feet)	0
Off-line Storage Annual Volume Stored (Million Gallons)	0
Off-line Storage Estimated # of Annual Occurrence	34
Flow Control Structure Annual Volume Stored (Million Gallons)	0
Flow Control Structure Estimated # of Annual Occurrence	34
Bioretention Structure Annual Volume Stored (Million Gallons)	0
Bioretention Structure Estimated # of Annual Occurrence	0
Length of I/I Removal Lining (Feet)	0
Annual Volume of Pumping (Million Gallons)	0
Estimated Total Dynamic Head of Pumping (Feet)	20
Length of Force Main Conveyance (Feet)	375
Annual Volume of High Rate Treatment (Million Gallons)	0
High Rate Treatment Estimated # of Annual Occurrences	0
Screening Estimated # of Annual Occurrences	0
Screening Annual Volume Disinfected	0
Length of Sanitary Sewer Open Cut Requiring cost for MUD (Feet)	1,588

Miscellaneous Costs

Additional Cost added for Parking Lot Replacement

Area of existing parking lot / 2 =	55,000 ft ²
Assuming 8" Thick Concrete	
Total Volume of Concrete =	1358 yd ³
Assuming \$500/yd ³	\$679,012

Additional Cost added for Temporary Parking Lot

Proposed Area for Temp Parking =	1.5 acres
=	65340 ft ²
Assuming 6" thick gravel	32670 ft ³
Assuming \$5/ft ³	
for White Rock	\$163,350

Site Grading for Drive and Parking **\$300,000**

Total Miscellaneous Costs = \$1,142,362

OPEN CUT SEWER CONSTRUCTION VALUE ENTRY SHEET

Project ID: SA-204-09 - Storage

Estimate Date: 2/12/2009

Printed Date: 2/16/2009

Prepared By: Kirkham Michael

Segment ID	*Pipe Size (in)	Length of Pipe in Street (ft)	Length of Pipe out of Street (ft)	**Average Depth (ft)	# of San. Service Laterals	# of Aband'd Inlets	# of New Inlets	# of Water Services Replaced	Street Width (ft)	# of Manholes	# of Diversion Structures	# of Existing MH Surface Rehabs	Small Medium or Large Creek Crossing (S,M, or L)	Sanitary Sewer Construction	Dewatering Required	Maintenance of Flow	Brownfields	Clearing and Grubbing	Traffic Maintenance Required	Urban Alignment	Total Cost Per Segment	
204 Storage	15		1400	20						3	1			x				x			\$ 555,009	
																					\$ -	
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Project ID: SA-204-09 - Storage

Estimate Date: 2/12/2009

Printed Date: 2/16/2009

Prepared By: Kirkham Michael

Segment ID	*Pipe Size (in)	Length of Pipe in Street (ft)	Length of Pipe out of Street (ft)	**Average Depth (ft)	# of San. Service Laterals	# of Aband'd Inlets	# of New Inlets	# of Water Services Replaced	Street Width (ft)	# of Manholes	# of Diversion Structures	# of Existing MH Surface Rehab	Small Medium or Large Creek Crossing (S,M, or L)	Sanitary Sewer Construction	Dewatering Required	Maintenance of Flow	Brownfields	Clearing and Grubbing	Traffic Maintenance Required	Urban Alignment	Total Cost Per Segment	
																						\$ -
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OFF-LINE STORAGE FACILITY VALUE ENTRY SHEET

Project ID: SA-204-09 - Storage

Estimate Date: 2/12/2009

Prepared By: Kirkham Michael

Printed Date: 2/16/2009

Facility ID	***Tank Volume (MG)	Annual Volume Stored (MG)	# of Times Operated per Year	Below Ground	Above Ground	Vertical Storage	Odor Control*	Dewatering Required	Brownfields	Total Cost Per Facility**
204 Storage	0.046	0.45	34	x			x	x		\$ 1,472,416
-	0	0	0							\$ -
-	0	0	0							\$ -
-	0	0	0							\$ -
-	0	0	0							\$ -
-	0	0	0							\$ -
-	0	0	0							\$ -
-	0	0	0							\$ -
-	0	0	0							\$ -
-	0	0	0							\$ -
-	0	0	0							\$ -
-	0	0	0							\$ -
-	0	0	0							\$ -
-	0	0	0							\$ -
-	0	0	0							\$ -

Estimated Total Facility Construction Cost = \$ 1,472,416

List documentation for decision to use above or below ground storage facility:

* - Odor control is not necessary with flushing used unless in a residential area.
 ** - Pumping is not included in storage facility cost curves. Use the pump station cost estimating sheet for the additional costs.
 *** - Limit to Cost curve for storage tanks are 50 MG. If over 50 MG use multiple tanks.

FLOW CONTROL STRUCTURE VALUE ENTRY SHEET

Project ID: SA-204-09 - Storage

Estimate Date: 2/12/2009

Printed Date: 2/16/2009

Prepared By: Kirkham Michael

TYPE (CHOOSE ONE)													
Facility ID	Inflatable Dam	Adjustable Gate	Equivalent Pipe Diameter (inches)	Depth to invert (ft)	Storage Volume in Pipe (MG)	Annual Volume Stored (MG)	# of Times Operated per Year	Include SCADA Equip.	Pump Back Station Req'd	Odor Control*	Dewatering Required	Structure in Floodplain	Total Cost Per Facility
204 Storage		x	15	10	0	0.45	34	x		x			\$ 274,968
B			0	0	0	0	0						\$ -
C			0	0	0	0	0						\$ -
D			0	0	0	0	0						\$ -
E			0	0	0	0	0						\$ -

Estimated Total Facility Construction Cost = \$ 274,968

* - Odor control is not necessary unless in a residential area with long storage periods anticipated.

PUMP STATIONS VALUE ENTRY SHEET

Project ID: SA-204-09 - Storage

Estimate Date: 2/12/2009

Printed Date: 2/16/2009

Prepared By: Kirkham Michael

Facility ID	**Estimated Depth (ft)	Estimated Total Head (ft)	*Estimated Peak Flow Rate (MGD)	***In Rock	Odor Control	Grinders Required	Add Grit Pit	Dewatering Required	Brownfields	Exclude Structure (-%)	Total Cost Per Facility
CSO 204 Storage	32	20	1.11		X	X	X	X		0%	\$ 1,748,758
B	0	0	0							0%	\$ -
C	0	0	0							0%	\$ -
D	0	0	0							0%	\$ -
E	0	0	0							0%	\$ -

Enter Description if Exclude Structure -% used:

--

Estimated Total Pump Station Construction Cost = \$ 1,748,758

- * - Pump station cost curve limits out at 200 MGD. If over 200 MGD use multiple pump stations and do not check box any extras or reenter the same depth.
- ** - Cost per linear foot increases at depths of 20, 50, 100 and 150 feet.
- *** - Being in rock is beneficial at depths greater than 50 feet. In Rock should not be checked at these depths.

FORCE MAIN CONSTRUCTION VALUE ENTRY SHEET

Project ID: SA-204-09 - Storage

Estimate Date: 2/12/2009

Printed Date: 2/16/2009

Prepared By: Kirkham Michael

Segment ID	*Pipe Size (in)	Length of Pipe in Street (ft)	Length of Pipe out of Street (ft)	Average Depth (ft)	# of Utility crossings	Street Width (ft)	# of Manholes	# of Air Release Valves	Small Medium or Large Creek Crossing (S,M, or L)	Dewatering Required	Brownfields	Clearing and Grubbing	Traffic Maintenance Required	Total Cost Per Segment
CSO 204	6		375	15						x				\$ 74,427
B	0	0	0	0	0	0	0	0						\$ -
C	0	0	0	0	0	0	0	0						\$ -
D	0	0	0	0	0	0	0	0						\$ -
E	0	0	0	0	0	0	0	0						\$ -
F	0	0	0	0	0	0	0	0						\$ -
G	0	0	0	0	0	0	0	0						\$ -
H	0	0	0	0	0	0	0	0						\$ -
I	0	0	0	0	0	0	0	0						\$ -
J	0	0	0	0	0	0	0	0						\$ -
K	0	0	0	0	0	0	0	0						\$ -
L	0	0	0	0	0	0	0	0						\$ -
M	0	0	0	0	0	0	0	0						\$ -
N	0	0	0	0	0	0	0	0						\$ -
O	0	0	0	0	0	0	0	0						\$ -
P	0	0	0	0	0	0	0	0						\$ -
Q	0	0	0	0	0	0	0	0						\$ -
R	0	0	0	0	0	0	0	0						\$ -
S	0	0	0	0	0	0	0	0						\$ -
T	0	0	0	0	0	0	0	0						\$ -
U	0	0	0	0	0	0	0	0						\$ -
V	0	0	0	0	0	0	0	0						\$ -
W	0	0	0	0	0	0	0	0						\$ -
X	0	0	0	0	0	0	0	0						\$ -
Y	0	0	0	0	0	0	0	0						\$ -

*Note - pipe sizes range from 6" to 54". If a larger forcemain may be required it is recommended that the estimator cost out dual forcemains of smaller diameter.

375 = Total Length of Force Main

Estimated Total Force Main Construction Cost = \$ 74,427

Project Life Cycle Analysis Summary

Project ID: SA-204-09 - Storage

Estimate Date 2/12/2009

Prepared by: Kirkham Michael

Printed Date 2/16/2009

Life Cycle Period:	50 years	ENRCCI	7888
Interest Rate Assumed:	6%	BASE ENRCCI	7888

Cost Input Variables:			
Electric, \$/kwh	0.054	Disinfection Chemicals only Cost	0.70
Chemicals, \$/mg	118.67		
Nat. Gas, \$/mcf	5.39		
Labor, \$/hr	27.51	**Including fringes	
Annual Conveyance Maintenance, \$/foot	1.24		
Annual Treatment, \$/mg	668.84		

ONLY IN USE IF ALL INFORMATION IS FILLED OUT PROPERLY ON THE APPROPRIATE WORKSHEETS

Description	Input Parameter	Periodic Cost	Present Worth Cost
Conveyance/ In Line Storage			
Life Cycle Period Present Worth Cost Assuming 70 Year Life of Sewers			\$ 1,175,529
Length of conveyance (feet)	1400		
Maintenance		\$ 1,739	
Total Annual O&M Cost		\$ 1,739	\$ 27,412
Off Line Storage			
Life Cycle Period Present Worth Cost			\$ 2,458,240
Percent of Capital for Equipment	10%	\$ 245,824	
Annual volume stored (million gallons)	0		
Estim. number of annual storage events	34		
Annual Costs			
Fixed Maintenance		\$ 11,444	
Event Maintenance		\$ 7,482	
Total O&M Cost		\$ 18,926	\$ 298,310
Lining			
Life Cycle Period Present Worth Cost			\$ -
Length of Lining (feet)	0		
Fixed Maintenance		\$ -	
Total O&M Cost		\$ -	\$ -
Flow Control Structure			
Life Cycle Period Present Worth Cost			\$ 459,250
Percent of Capital for Equipment	10%	\$ 45,925	
Annual volume stored (million gallons)	0		
Estim. number of annual storage events	34		
Annual Costs			
Fixed Maintenance		\$ 11,444	
Event Maintenance		\$ 7,482	
Total O&M Cost		\$ 18,926	\$ 298,310
Pumping			
Life Cycle Period Present Worth Cost			\$ 2,920,830
Percent of Capital for Equipment	20%	\$ 584,166	
Annual volume pumped (million gallons)	0		
Estimated total dynamic head pumped (ft)	20		
Energy consumption, kwh/yr	84		
Annual Costs			
Energy		\$ 5	
Fixed Maintenance		\$ 5,722	
Total O&M Cost		\$ 5,726	\$ 90,258
Force Mains			
Life Cycle Period Present Worth Cost			\$ 123,580.00
Length of conveyance (feet)	375		
Maintenance		\$ 466	
Total O&M Cost		\$ 466	\$ 7,342.62
Treatment			
Life Cycle Period Present Worth Cost			\$ -
Percent of Capital for Equipment	25%	\$ -	
Annual volume treated (million gallons)	0		

Description	Input Parameter	Periodic Cost	Present Worth Cost
Estimated Number of HRT Occurrences	0		
Annual Costs			
Cost of Treatment		\$ -	
HRT Chemicals		\$ -	
Disinfection O&M		\$ -	
Fixed Maintenance		\$ -	
Event Maintenance		\$ -	
<i>Total O&M Cost</i>		\$ -	\$ -
Screening			
Life Cycle Period Present Worth Cost			\$ -
Percent of Capital for Equipment	10%	\$ -	
Estimated Number of Occurrences	0		
Annual Volume Disinfected	0		
Annual Costs			
Cost of Treatment		\$ -	
Fixed Maintenance		\$ -	
Disinfection Chemicals		\$ -	
Event Maintenance		\$ -	
<i>Total O&M Cost</i>		\$ -	\$ -
Bioretention			
Life Cycle Period Present Worth Cost			\$ -
Percent of Capital for Plantings	2%	\$ -	
Annual volume stored (million gallons)	0		
Estim. number of annual storage events	0		
Annual Costs			
Fixed Maintenance		\$ -	
Event Maintenance		\$ -	
<i>Total O&M Cost</i>		\$ -	\$ -
Miscellaneous (including Real Estate)			
Life Cycle Period Present Worth Cost			\$ 1,907,745
Total Present Worth Summary			
<i>Conveyance/In Line Storage</i>		\$ 1,739	\$ 27,412
<i>Off Line Storage</i>		\$ 18,926	\$ 298,310
<i>Pumping</i>		\$ 5,726	\$ 90,258
<i>Lining</i>		\$ -	\$ -
<i>Flow Control Structure</i>		\$ 18,926	\$ 298,310
<i>Force Mains</i>		\$ 466	\$ 7,343
<i>Treatment</i>		\$ -	\$ -
<i>Screening</i>		\$ -	\$ -
<i>Bioretention</i>		\$ -	\$ -
<i>Total O&M Cost</i>		\$ 45,783	\$ 721,633
<i>Equipment Replacement Cost</i>		\$ 875,915	\$ 358,249
<i>Total Present Worth of Capital Cost (at current ENRCCI)</i>			\$ 8,586,000
<i>Total Present Worth Cost - Equiv Annual</i>		\$ 614,000	
<i>Total Present Worth Cost - 50 Year</i>			\$ 9,666,000

Attachment 3 – HGL Profiles

Cole Creek Interceptor Profile Notes

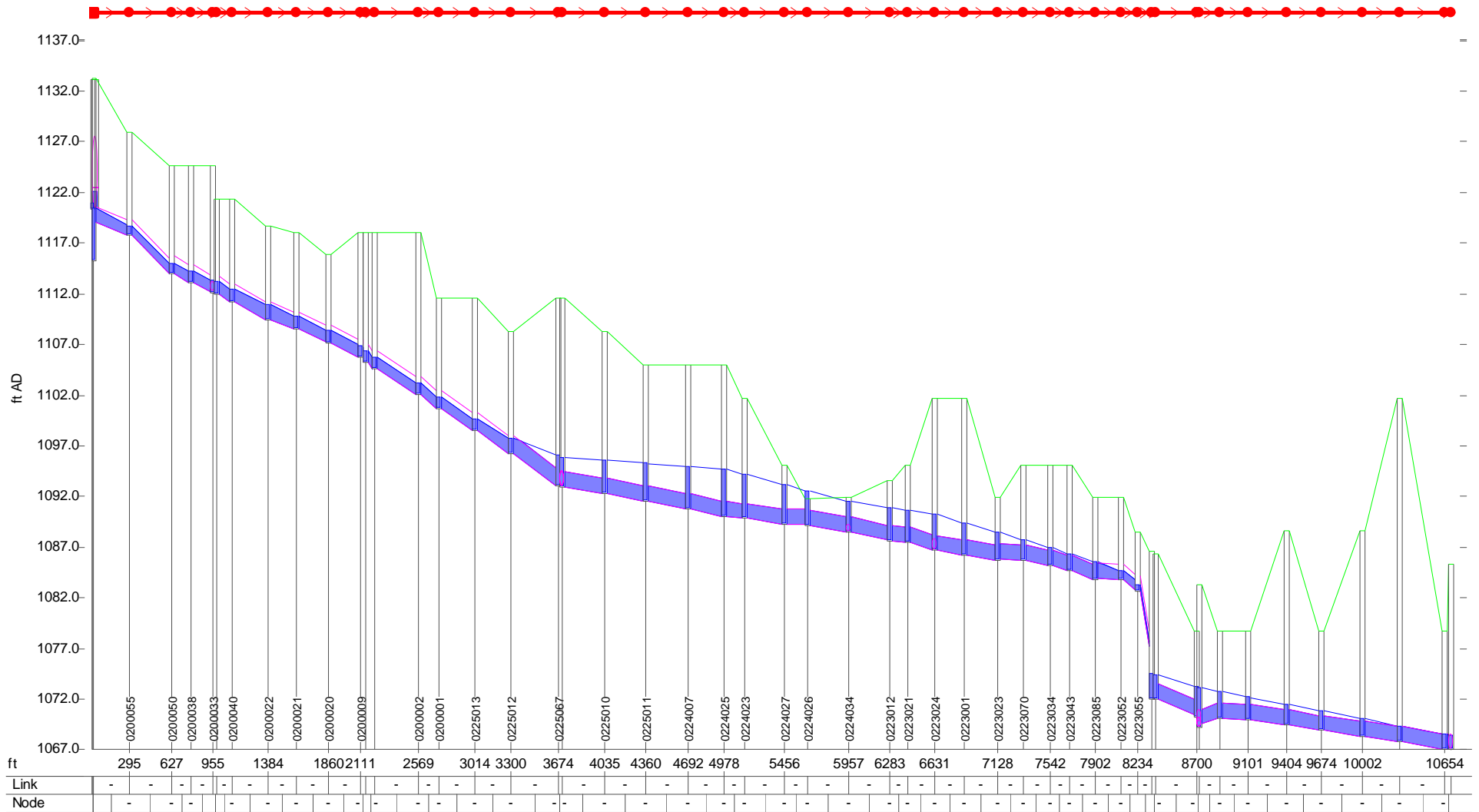
- The following sewer/HGL profile were based on the 1969-year storm events
- Three model scenarios:
 - LTCP Model Version 14
 - LTCP Model Version 14 with the CSO 204 Weirs (2 Weirs) raised 1-ft and sluice gates in operation
 - LTCP Model Version 14 with the CSO 204 Weirs (2 Weirs) raised 1-ft and sluice gates fully open for the full year model run

East Interceptor

From Diversion Structure 0200083 (60th and Taylor) to Maple St

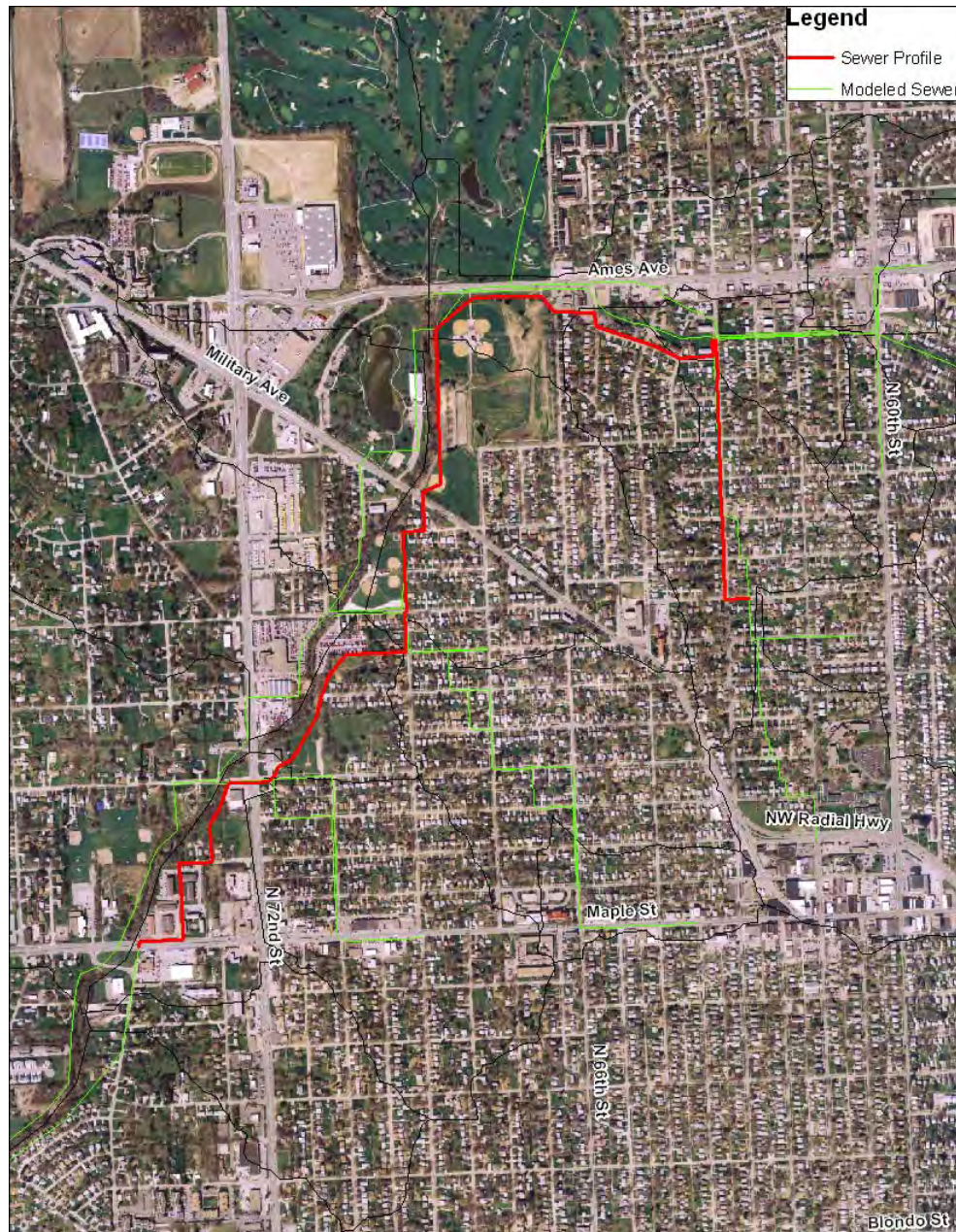


Cole Creek V14 – Weir Raised Sluice Gates Open

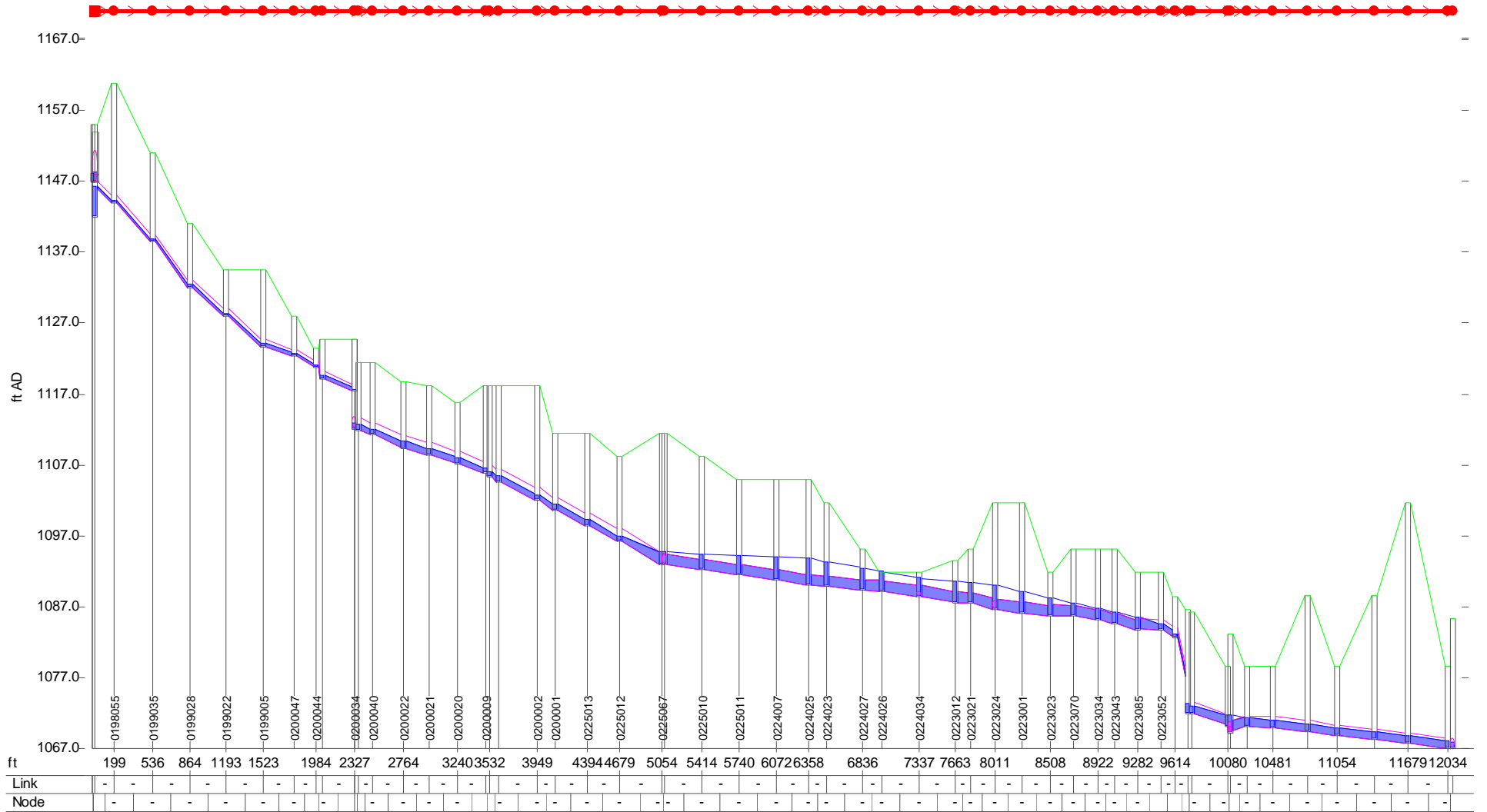


East Interceptor

From Diversion Structure 0198057 (63rd and Pratt) to Maple St



Cole Creek LTCP V14



Cole Creek V14 – Weir Raised Sluice Gates Open

