Combined Sewer Backup and Major Street Flooding Recommended Approach Summary TM

TO: Document Control Center, CH2M HILL

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DATE: July 23, 2008

Executive Summary

On October 1, 2007, the City of Omaha (City) submitted a Substantively Complete Long Term Control Plan (SCLTCP) to the Nebraska Department of Environmental Quality (NDEQ). The overall cost for this program is estimated at $1.5 billion (2006 dollars). A portion of these funds is planned for the separation of combined sewers, which can reduce sewer backup (SB) and street flooding (SF) problems in addition to reducing combined sewer overflows (CSOs). In addition to the sewers identified to be separated as part of the SCLTCP, the City plans to continue the on-going sewer separation (RNC) program that is intended to specifically address SBs into basements.

An investigation was completed for each of the Complex and Less-Complex Basins in Spring 2008 to evaluate approaches to addressing SB and SF problems known to-date within each Basin. The revised draft Technical Memorandums (TMs) for each basin are located in the Appendices A-J. This TM provides a summary of the data in the revised draft TMs to allow the City to clearly identify the separation plan for the combined sewer areas as it relates to both the CSO and RNC programs and also to allow the City to establish a preliminary cost for these two programs. In addition to those costs, the information compiled provides the City with the following:

- Information on reported sewer related problems that will require additional investigation.
- Identification of known areas of major street flooding.
- Combined sewer area and basin maps that indicate the areas that will be separated upon completion of the proposed work.

Table ES-1 summarizes the project costs for future RNC/sewer separation outside of the CSO Control Program, future sewer separation projects that are included in the CSO Control Plan, the Minne Lusa Basin Stormwater Tunnel, and the Cole Creek Basin Storage Tanks. The Minne Lusa Basin Tunnel and Cole Creek Basin Storage Tanks are individual projects included in the CSO Control Program.

Table ES-1: Summary of Future CSO Program and RNC Program Sewer Separation Project Costs

Description	Estimated Project Costs ($ Mil)
Future RNC/Sewer Separation (Outside of CSO Control Program)	$134.71
Future CSO Control Program Sewer Separation	$458.66
Minne Lusa Basin Stormwater Tunnel	$83.82
Cole Creek Basin Storage Tanks	$19.58

Known Areas of Major Street Flooding

Each Basin Consultant (BC) provided a summary of areas with reported major street flooding issues or other issues that would be left unresolved with study areas designated for sewer separation to relieve sewer backup issues in this TM. Major street flooding includes areas where street flooding could impair driving conditions across the entire roadway. These issues are not included in the CSO program and may need to be resolved through other funding mechanisms. Specific details for each basin can be found in the Appendices. The following is a summary of these major street flooding areas in each basin.

Bridge Street Basin – No issues.

Burt-Izard Basin – No issues.

Cole Creek Basin – The East and West Interceptors which convey sanitary sewer flows were identified to have inadequate capacity that causes surcharging during relatively frequent storm events resulting in sewer backup issues. Separation within the combined sewer system (CSS) area will not recapture sufficient capacity to eliminate this surcharging. Street flooding in the basin is a result of flooding from the Cole Creek stream capacity. Further evaluation will be necessary to determine what improvements beyond sewer separation will address all of the SB and SF issues within the basin.

Leavenworth Basin – No issues.

Minne Lusa Basin - There are four locations in the Minne Lusa Basin with major street flooding issues not addressed by any RNC or CSO study areas. These locations include: 16th & Ames Area (bounded by Ames Avenue to Ogden St. and 13th to 19th Streets); Sharon Dr. & Minne Lusa Dr. (area bounded by Titus Avenue to Weber St. and 23rd to 28th Streets); 35th & Corby (area bounded by Miami St. to Maple St. and 34th to 36th Streets); and 51st and Curtis (area bounded by Curtis St. to Redick Avenue 51st street to 51st Avenue).

Ohern/Monroe Basin – There are two locations in the Ohern/Monroe Basin with major street flooding issues not addressed by any RNC or CSO study areas. These locations are 32nd Street and F Street and 35th Street and Vinton Street.

Papio Creek North – No issues.

Papio Creek South – No issues.

Saddle Creek – There are two locations in the Saddle Creek Basin with major street flooding issues not addressed by any RNC or CSO study area. These areas are located along Saddle Creek Road at the Dodge Street and Woolworth Avenue intersections. It is assumed that street flooding problems at Saddle Creek Road and Dodge Street will be addressed with the proposed relocation of Saddle Creek Road to accommodate expansion of the University of Nebraska Medical Center.

Two potential solutions to the flooding at the Woolworth Avenue intersection were identified.

- Regrade the intersection to eliminate the sump at the intersection.
- Construct a new combined sewer parallel to the existing Saddle Creek Trunk Sewer from Leavenworth Street to Center Street. The parallel sewer together with the existing trunk sewer should be sized to provide sufficient capacity to handle a 10-year storm event without street flooding.

South Interceptor – No issues.

Purpose

The purpose of this Summary Technical Memorandum (TM) is to identify methods for addressing the sewer backup (SB) and major street flooding (SF) problems within the combined sewer basins. This TM addresses only those SB/SF problems that have been reported to date and are the result of wet weather events and related combined sewer overloading. This TM identifies RNC/sewer separation projects completed, future RNC/sewer separation study areas outside of the CSO Control Program, and future sewer separation study areas that are included in the CSO Control Plan.

Potential solutions to address the SB/SF problem areas may include:

- Sewer separation
  - City identified sewer separation study areas for the RNC program
  - Sewer separation as part of the CSO Control Program
  - Basin Consultant (BC) identified sewer separation study areas to be added to the existing RNC program
  - Additional sewer separation projects required for the CSO program.
- Backflow prevention valves
- Green solutions (stormwater management projects)
- Hybrid projects (projects that include both sewer separation and other CSO technologies).

Verification and validation of identified problems in each study area will be performed as part of the preliminary design stage for sewer separation. If at any time prior to or during design of RNC projects further investigation of the identified SB/SF problems shows that inconsistent and/or significant problems cannot be validated, then the proposed separation study area may be modified or eliminated. Additional SB/SF issues may be reported to the City as a result of future wet weather events. These SB/SF issues may require additional sewer separation study areas to address the issues beyond what is indicated in this TM.

Project Background

The City of Omaha (City) contains over 1,950 miles of sewers. In the eastern portion of the City, most of the storm and sanitary sewers are combined. This combined sewer system (CSS) area encompasses approximately 51 square miles in two watersheds: the Missouri River and the Papillion Creek watersheds. The entire CSS area has been divided into ten basins for evaluation as part of the Omaha CSO Program. Each basin is being evaluated by a separate engineering team. The overall goal of the data analysis is to develop a Final Basin Plan, which will be incorporated into the Program's Long Term Control Plan (LTCP) for the City's CSS.

Sewer Backup and Street Flooding Issues

In addition to implementation of the City's LTCP, the City intends to minimize the SB/SF problems in the combined sewer service area. This will be accomplished through the continuation of its Sewer Separation/Sewer Relief program, referred to as the RNC

Program, and additional sewer separation projects that are not part of the CSO program. Each basin prepared a *Sewer Backup and Street Flooding Existing Conditions TM* in 2007 to identify existing problem areas using available information, including the City's GIS database, previous sewer reports, the InfoWorks model, community outreach efforts, Basin Advisory Panel (BAP) meetings, and plans of projects completed to date. The SB/SF Existing Conditions TMs summarized the available information from each of these sources.

In order to get a more complete picture of the historical SB/SF problems, maps illustrating reported SB and SF problems for each basin are included in Appendices A-J. These reported SB and SF issues have been sorted into three categories. The categories are listed and defined below:

1. Flood of 1999: A problem labeled in this manner indicates that it was reported as a result of the August 6, 1999 flood. This was a large storm and exceeded the level of protection that that City can economically afford to resolve with sewer improvement projects. Therefore, these problems may well be legitimate SB and SF issues, however no sewer improvement projects will be recommended solely because of their existence.

2. Reports not Addressed to Date: A problem labeled in this manner indicates that it appears to be unresolved and not addressed by an already completed RNC project. Problems classified in this manner (and located in clusters) indicate areas in need of additional sewer improvement projects.

3. Reports Addressed to Date: A problem labeled in this manner indicates that it appears to have already been resolved by completed RNC project. Problems classified in this manner indicate that the surrounding area, most likely, does not need additional sewer improvement projects.

During the various BAP meetings in 2007, BAP members from each basin were shown the existing SB/SF problem area map (based on historic GIS data) and were given an opportunity to provide input on other known problem areas. In addition, members of the BAP were given a flyer entitled "City of Omaha CSO Sewer Backup and Street Flooding Questionnaire". An updated version of this document entitled "CSO Sewer Backup and Street Flooding Questionnaire" was also distributed to residents and included in neighborhood newsletters as a means of obtaining further information on actual storm related sewer problems.

The specific results of this community outreach are included in each of the Appendices.

Categorization for Addressing SB/SF Issues

The categories and costs for addressing the SB/SF issues are identified in the following sections. These categories represent the progression of analysis to address the SB/SF issues. Each Basin utilized the following five categories for their respective analysis.

Category 1 - Completed RNC/Sewer Improvement Projects. This category includes all the SB/SF issues that have been addressed to date by projects already completed or currently under construction in each of the basins. SB/SF issues in this category have been addressed

through City RNC projects or various other sewer separation projects that were completed prior to the start of the RNC program in 1990. These older projects were classified as SOS, STS, or with other various identifiers. These completed projects can be further categorized into either "separation" or "conveyance relief" projects as defined below:

> Separation - Projects that separated combined sewers within the right-of-way by either: (1) providing a dedicated sanitary sewer that conveys the sanitary flows downstream, or, (2) providing a dedicated storm sewer to convey the storm sewer flows downstream, leaving the existing sewer for sanitary flows only. Separation within the right-of-way does not include separation of any private sewer laterals or taps.
>
> Conveyance Relief - Projects that provided relief for the existing combined system to address SB/SF issues. In most cases, these projects provided a new sewer that provided relief to the existing combined system. The new sewers were sized in accordance with the City of Omaha Stormwater Manual unless downstream conditions required a modification to the design.

Category 2 – Planned Sewer Separation in Existing City RNC Program. This category includes the SB/SF issues that have been previously identified by the City to be addressed by planned sewer separation projects through the RNC program. Note that some of these planned RNC projects provide water quality benefits and are listed under the CSO Program. The summary data and costs for such projects are included under Category 4 or 5.

Category 3 – Additional Sewer Separation Projects, Identified by Basin Consultant, and Not Part of CSO Program. This category includes all the SB/SF issues that have been proposed to be addressed by additional sewer separation projects identified in this TM. The projects in this category are intended solely to address SB and do not provide water quality benefits for the receiving streams.

Category 4 – Sewer Separation included in the Substantively Complete LTCP. This category includes all the SB/SF issues that have been proposed to be addressed by sewer separation through the CSO program as part of the SCLTCP. These projects can be shown to produce water quality benefits for the receiving streams.

Category 5 – Additional Sewer Separation Projects, Added to the CSO Program. This category includes both the following:

- Additional combined sewer separation projects beyond the areas identified in the SCLTCP because they provide water quality benefits;
- Projects previously listed under Category 2 that, because they have been determined to provide water quality benefits, have been reclassified to be a part of the Final LTCP.

The remaining SB/SF reports that were not resolved are referred to as isolated SB/SF reports (outliers). These outliers have been investigated further through a windshield survey.

Areas with major street flooding that were not addressed with sewer separation projects to relieve SBs are identified at the conclusion of this TM.

Costs

Costs for projects in the five categories are presented below. The costs for Category 1 projects were based on completed construction costs and were not escalated to reflect current year prices. The costs for study areas/projects in Categories 2 through 5 are based on engineer's project cost estimates. The detailed cost break-outs are included in Attachment 2 and Appendices A-J. The costs shown include **a)** the construction cost as provided by the Program's Cost Tool, **b)** 67% soft cost markup as indicated in the Cost Tool, and **c)** the addition of MUD costs for the length of sanitary sewer reconstruction included in the study area. Summaries of each project cost are shown in Tables 1 through 6 and described more fully below.

Category 1 – Completed RNC/Sewer Improvement Projects

The existing RNC/sewer improvement projects completed to date in the City are listed in Table 1 and illustrated on Figure 1. The table identifies the type of project (separation or conveyance relief), street length of the project disturbed, street length of the ultimate area for separation/conveyance relief benefiting from the project, separated watershed area, and construction cost. Table 1 also identifies projects that were included in the SCLTCP; therefore, the project costs were moved from Category 1 to Category 4.

Table 1 – Category 1 (Completed Sewer Improvement/RNC Projects)

Basin	Construction Cost ($ Mil)	Costs Moved Between Categories[1]		
		Costs ($Mil)	To/From	Category
Bridge Street	No Projects			
Burt-Izard	$4.25	$2.67	to	4
Cole Creek	$2.14	-	-	-
Leavenworth	$6.35	-	-	-
Minne Lusa	$22.92	$11.12	to	4
Ohern/Monroe	$9.32	$2.73	to	4
Papio North	$0.44	-	-	-
Papio South	$1.52	-	-	-
Saddle Creek	$13.91	-	-	-
South Interceptor	$0.70	$6.75	to	4
Summary	**$61.56**	**$23.27**	**to**	**4**

[1]Specific completed RNC projects were included in the SCLTCP; therefore, the costs were moved to Category 4.

Category 2 – Planned Sewer Separation in Existing City RNC Program

The City has identified areas for planned sewer separation in the existing RNC program. These are referred to as "planned RNC study areas". The City's planned RNC project study areas address many of the clustered SB/SF issues. The study areas for the combined sewer areas that fall into Category 2 are illustrated on Figure 2. Table 2 summarizes the project costs for the planned sewer separation in the existing City RNC Program. Specific study areas for each basin are identified in Appendices A-J.

Table 2 – Category 2 (Planned Sewer Separation in Existing City RNC Program)

Basin	Project Cost ($ Mil)	Costs Moved Between Categories[1,2]		
		Costs ($Mil)	To/From	Category
Bridge Street	No Projects			
Burt-Izard	$10.41	$72.34	to	4
		$21.56	to	5
Cole Creek	-	$57.14	to	4
Leavenworth	$25.02	-	-	-
Minne Lusa	$5.31	$93.98	to	5
Ohern/Monroe	$30.02	-	-	-
Papio North	No Projects			
Papio South	-	$1.11	to	4
Saddle Creek	$23.78	-	-	-
South Interceptor	No Projects			
Summary	**$94.53**	**$130.59**	**to**	**4**
		$115,54		**5**

[1] Project costs are identified in the section for Category 4 (Sewer Separation included in the SCLTCP)
[2] Project data and costs are identified in the section for Category 5 (Additional Sewer Separation Projects, Added to the CSO Program, but not included in the SCLTCP)

Category 3 – Additional Sewer Separation Proposed Study Areas, Identified by Basin Consultant, and Not Part of the CSO Program

Category 3 addresses the remaining SB problem areas with clustered reports that were not included in a planned RNC project area (Category 2) or covered by a completed RNC/Sewer Separation project (Category 1). These projects are not part of the CSO Control Program, as flow from separated sanitary/storm sewers is eventually directed back into the combined sewer system. There are several of these areas identified by each basin study team that are included in the Appendices.

In each identified area, a sewer separation project is the recommended method of addressing these SB/SF project areas. Figure 2 shows the proposed new study areas and the reports that would be addressed. A preliminary sewer separation layout for these areas was based on the previously prepared sewer separation layouts in each of the specific basin Alternative Evaluation TMs. Table 3 identifies the project costs for each basin.

Table 3 – Category 3 (Additional Sewer Separation Projects, Identified by the BC, and Not Part of the CSO Program)

Basin	Project Cost ($ Mil)	Comments
Bridge Street	-	No Projects
Burt-Izard	$10.41	
Cole Creek	-	No Projects
Leavenworth	-	No Projects
Minne Lusa	$10.23	
Ohern/Monroe	$2.40	
Papio North	-	No Projects
Papio South	-	No Projects
Saddle Creek	$17.14	
South Interceptor	-	No Projects
Summary	**$40.18**	

Verification and validation of identified problems will be done as part of the preliminary design stage for sewer separation. If at any time prior to or during design of RNC projects further investigation of the identified SB/SF problems shows that inconsistent and/or significant problems cannot be validated, then the proposed separation study area may be modified or eliminated.

Category 4 - Sewer Separation Included in the Substantively Complete LTCP

Sewer separation areas were identified in the Substantively Complete LTCP as the CSO control technology in each of the Less Complex Basins and in targeted areas of the Complex Basins. In addition, a number of baseline projects included sewer separation projects that were recently completed or currently under design or construction. These baseline projects were initially identified as Category 1 or Category 2 projects, but since the projects provided water quality or CSO volume reduction the project costs were included in the SCLTCP. Specifically, these projects will allow for stormwater to be separated and removed from the combined sewer system for direct conveyance to the Missouri River or Papillion Creek.

The CSO controls presented in the SCLTCP will address some of the existing SB problems in the CSS areas. The CSO Sewer Separation study area project costs for each basin are summarized in Table 4. The project costs for baseline projects that have already been completed in each basin are also indicated in the table.

Table 4 – Category 4 (Sewer Separation Included in the SCLTCP)

Basin	Project Cost ($ Mil)	Costs Moved Between Categories[1]			Completed Project Costs ($Mil)	Remaining Project Costs ($Mil)
		Costs ($Mil)	To/From	Category		
Bridge Street	$6.79	-	-	-	-	$6.79
Burt-Izard	$117.95	$72.34	from	2	$2.67	$115.28
Cole Creek	$65.75	$57.14	from	2	-	$65.75
Leavenworth	-	-	-	-	-	-
Minne Lusa	$54.98	$11.12	from	1	$18.20	$36.78
Ohern/Monroe	$32.17	$2.79	from	1	$2.73	$29.44
Papio North	$12.75	-	-	-	-	$12.75
Papio South	$8.32	$1.11	from	2	-	$8.32
Saddle Creek	$5.50	-	-	-	$5.50	-
South Interceptor	$67.73	$6.75	from	1	$6.75	$60.98
Summary	**$371.94**	**$20.60**	**from**	**1**	**$35.85**	**$336.09**
		$130.59		**2**		

[1] Project costs moved from either Category 1 or Category 2

The Basin Consultants for the Minne Lusa Basin and Cole Creek Basin identified additional projects that are interrelated to the sewer separation study areas for each basin. In the ML basin, a stormwater tunnel was included to convey separated stormwater out of the combined sewer system to relieve SB issues. In the Cole Creek Basin, two storage tanks were included to reduce the number of CSO events to four in the representative year. The sizing of these storage tanks is dependant on the sewer separation projects in the basin. The project costs for these CSO controls are identified in Table 5.

Table 5 – Category 4 (Additional Projects Related to Sewer Separation Included in the SCLTCP)

Project Description	Project Cost ($ Mil)
Minne Lusa Basin Tunnel	$83.82
Cole Creek Storage Tanks	$19.58
Total	**$103.40**

Category 5 – Additional Sewer Separation Projects Added to the CSO Program

This category includes sewer separation projects that meet the following requirements:

- Additional CSO sewer separation projects, identified by the BC, beyond the areas identified in the Substantively Complete LTCP. These projects are identified as CSO sewer separation projects because they will provide water quality benefits for the receiving stream.
- Projects previously listed under Category 2, and not included in the Substantively Complete LTCP, that have been determined to provide water quality benefits for the receiving stream.

The Category 5 project costs to be included into the CSO Program for each basin are indicated in Table 6.

Table 6 – Category 5 (Additional Sewer Separation Projects Added to the CSO Program)

Basin	Project Cost ($ Mil)	Costs Moved Between Categories[1]		
		Costs ($Mil)	To/From	Category
Bridge Street	No Projects			
Burt-Izard	$21.56	$21.56	from	2
Cole Creek	No Projects			
Leavenworth	No Projects			
Minne Lusa	$93.98	$93.98	from	2
Ohern/Monroe	$7.03			
Papio North	No Projects			
Papio South	No Projects			
Saddle Creek	No Projects			
South Interceptor	No Projects			
Summary	**$122.57**	**$115.54**	**from**	**2**

[1] Project costs moved from Category 2

Known Areas of Major Street Flooding

Each basin provided a summary of areas with reported major street flooding issues or other issues that were left unresolved with projects designated for sewer separation to relieve sewer backup issues in this TM. Specific details for each basin can be found in the Appendices. The following is a summary of these major street flooding areas in each basin.

Bridge Street Basin – No issues.

Burt-Izard Basin – No issues.

Cole Creek Basin – The East and West Interceptors which convey sanitary sewer flows were identified to have inadequate capacity that causes surcharging during relatively frequent storm events resulting in sewer backup issues. Separation within the combined sewer system (CSS) area will not recapture sufficient capacity to eliminate this surcharging. Street flooding in the basin is a result of flooding from the Cole Creek stream capacity. Further evaluation will be necessary to determine what improvements beyond sewer separation will address all of the SB and SF issues within the CC basin.

Leavenworth Basin – No issues.

Minne Lusa Basin - There are four locations in the Minne Lusa Basin with major street flooding issues not addressed by any RNC or CSO study areas. These locations include: 16th and Ames Area (bounded by Ames Avenue to Ogden St. and 13th to 19th Streets); Sharon Dr. & Minne Lusa Dr. (area bounded by Titus Avenue to Weber St. and 23rd to 28th Streets); 35th & Corby (area bounded by Miami St. to Maple St. and 34th to 36th Streets); and 51st and Curtis (area bounded by Curtis St. to Redick Avenue 51st street to 51st Avenue).

Ohern/Monroe Basin – There are two locations in the Ohern/Monroe Basin with major street flooding issues not addressed by any RNC or CSO study areas. These locations include 32nd Street and F Street and 35th Street and Vinton Street.

Papio Creek North – No issues.

Papio Creek South – No issues.

Saddle Creek – There are two locations in the Saddle Creek Basin with major street flooding issues not addressed by any RNC or CSO study area. These areas are located along Saddle Creek Road at the Dodge Street and Woolworth Avenue intersections. It is assumed that street flooding problems at Saddle Creek Road and Dodge Street will be addressed with the proposed relocation of Saddle Creek Road to accommodate expansion of the University of Nebraska Medical Center.

Two potential solutions to the flooding at the Woolworth Avenue intersection were identified.

- Regrade the intersection to eliminate the sump at the intersection.
- Construct a new combined sewer parallel to the existing Saddle Creek Trunk Sewer from Leavenworth Street to Center Street. The parallel sewer together with the existing trunk sewer should be sized to provide sufficient capacity to handle a 10-year storm event without street flooding.

South Interceptor – No issues.

Isolated Problem Areas (Outliers)

Isolated problem areas (outliers) are any single complaint or scattered complaint reported in the City's GIS database that fall outside the sewer separation areas previously described in this TM. Each basin provided a listing of outliers, which can be found in the respective appendices. A windshield survey was conducted for each of these outliers to note any obvious factors that could be causing SB/SF problems. These windshield surveys were then transmitted to the City for additional evaluation to determine if an issue exists and to determine the best method to mitigate the issue.

Green Solutions

Each BC evaluated the potential of reducing sewer backup areas through the implementation of Green Solutions. In general, it appears that the sewer backup issues can be resolved through sewer separation projects. Green solutions will be investigated further as part of another 2008/2009 refinement task.

Hybrid Projects

Each BC evaluated the potential of reducing sewer backup areas through the implementation of Hybrid Projects. In general it appears that the sewer backup issues can be resolved through sewer separation projects. Hybrid projects will be investigated further as part of another 2008/2009 refinement task.

Impacts to CSO Volumes and Flowrates

Refined estimates of the reductions in volume and flow rate for each sewer separation study area/project will be calculated in late 2008 using the updated InfoWorks Model.

Study Area Priorities

Each BC provided suggestions and recommendations to assist the City and PMT in creating a schedule based on priorities for each basin. The priorities included, but were not limited to: addressing specific sewer backups and street flooding areas, development/redevelopment projects, phased projects, water quality benefits, planned street improvement and MUD water/gas replacement projects, funding levels for the sewer separation portion of the CSO Program, and will generally be completed from downstream to upstream in the basins. These study areas included in the CSO Control Program will be subdivided into individual projects as part of Task 21 (Refinement of Sewer Separation Design Approach & Project Costs) and compiled with comparable study areas from other basins. These projects will then be scheduled as part of the Final LTCP.

The study areas identified to be included in the RNC Program will be compiled by the City with study areas from other basins. The analysis and design of specific RNC projects will be dependent on funding available for this program and coordination with CSO activities.

Acronym/Term	Definition
BAP	Basin Advisory Panel
BC	Basin Consultant
BS	Bridge Street
BI	Burt-Izard
Category 1	Completed RNC/Sewer Improvement Projects.
Category 2	Planned Sewer Separations in Existing City RNC Program.
Category 3	Additional Sewer Separation Projects, Identified by Basin Consultant, and Not Part of CSO Program.
Category 4	Sewer Separation included in the Substantively Complete LTCP.
Category 5	Additional Sewer Separation Projects, Added to the CSO Program.
CC	Cole Creek
City	City of Omaha
CSO	Combined Sewer Overflow
CSS	Combined Sewer System
GIS	Geographic Information System
ES	Executive Summary
LTCP	Long Term Control Plan
LV	Leavenworth
ML	Minne Lusa
MRWWTP	Missouri River Wastewater Treatment Plant
MUD	Metropolitan Utilities District
NDEQ	Nebraska Department of Environmental Quality
OM	Ohern/Monroe
OPW	Omaha Public Works
PCN	Papillion Creek North
PCS	Papillion Creek South
Program	Omaha CSO Control Program
PMT	Program Management Team

RNC/SOS/STS	Combined Sewer Renovation/Separation (Project)
SA	Study Area
SB	Sewer Backup
SF	Street Flooding
SCLTCP	Substantively Complete Long Term Control Plan
SC	Saddle Creek
SI	South Interceptor
TM	Technical Memorandum

Attachment 1 – Figures

Figure 1 **Separation Completed**

Figure 2 **Proposed Future Separation**

Figure 3 **Final Basin Plan**

Attachment 2 – Cost Summaries

Cost Rollup for all Categories

Category 1 Cost Summary

Category 2 Cost Summary

Category 3 Cost Summary

Category 4 Cost Summary

Category 5 Cost Summary

List of Appendices (Provided on Attached CD)

Appendix A – Bridge Street Sewer Backup and Major Street Flooding Recommended Approach TM (dated April 25, 2008)

Appendix B – Burt-Izard Sewer Backup and Major Street Flooding Recommended Approach TM (dated February 29, 2008)

Appendix C – Cole Creek Sewer Backup and Major Street Flooding Recommended Approach TM (dated April 28, 2008)

Appendix D – Leavenworth Sewer Backup and Major Street Flooding Recommended Approach TM (dated April 21, 2008)

Appendix E – Minne Lusa Sewer Backup and Major Street Flooding Recommended Approach TM (dated May 15, 2008)

Appendix F – Ohern/Monroe Sewer Backup and Major Street Flooding Recommended Approach TM (dated May 6, 2008)

Appendix G – Papillion Creek North Sewer Backup and Major Street Flooding Recommended Approach TM (dated April 18, 2008)

Appendix H – Papillion Creek South Sewer Backup and Major Street Flooding Recommended Approach TM (dated April 11, 2008)

Appendix I – Saddle Creek Sewer Backup and Major Street Flooding Recommended Approach TM (dated April 29, 2008)

Appendix J – South Interceptor Sewer Backup and Major Street Flooding Recommended Approach TM (dated April 17, 2008)

Appendix A – Bridge Street Basin TM

Appendix B – Burt-Izard Basin TM

Appendix C – Cole Creek Basin TM

Appendix D – Leavenworth Basin TM

Appendix E – Minne Lusa Basin TM

Appendix F – Ohern/Monroe Basin TM

Appendix G – Papillion Creek North Basin TM

Appendix H – Papillion Creek South Basin TM

Appendix I – Saddle Creek Basin TM

Appendix J – South Interceptor Basin TM