

Appendix A
Green Infrastructure in Coordination with Long Term Control Plan Projects

LTCP Project Name	OPW No.	CSO Study Basin	Reviewed for GS?	Green Solutions Selected for Design	Comments	Benefits (Including costs)
20th & Poppleton Sewer Separation (RNC)	51661	Leavenworth	NA	Buried detention/infiltration	Buried detention/infiltration Basin is provided to reduce the peak discharge from the drainage area to the interceptor. (Project is under construction, but detention is complete.)	Flow rate reduction
24th Street & Ogden Street Sewer Separation Project	51497	Minne Lusa	NA	Dry detention	This project included sewer separation that directed separated storm flows to the existing Pershing detention basin. (Project is complete.)	Water Quality
26th and Corby Sewer Separation Phase 1	51778	Burt Iazard	Yes	Bump outs with bioretention areas	24th Street will have bump outs to provide increased pedestrian safety and traffic calming. As part of this, bioretention areas will be evaluated for use inside the bump outs as low-cost green infrastructure.	Water Quality
36th Street Sewer Separation	51698	Bridge Street	No		Located along an unimproved road section with narrow ROW and steep side slopes. No feasible alternatives.	
39th & Fontenelle Sewer Separation (RNC)	51817	Minne Lusa	No		No feasible alternatives.	
42nd & Q Sewer Separation	52257	Papio Creek South	Yes	Vegetated swales and bioretention gardens	Approximately 26 acres of runoff from residential area diverted to Hitchcock Park. Conceptual design includes vegetated swales and bioretention gardens ultimately draining to the existing pond in Hitchcock Park. During the initial stages of the preliminary design, it appears draining the swales and bioretention gardens to the pond may be cost prohibitive, and it was decided that the storm sewer discharge from the vegetated swales and bioretention gardens would drain back into the storm sewer system.	The elimination of a storm sewer pipe parallel to 42nd Street from Orchard Avenue to P Street will be attained. This will save approximately \$50,000 on construction costs. In addition to the savings, the storm water from the neighborhood to the east of Hitchcock Park will be detained and some level of pre-treatment will be attained.
42nd Street & X Street Sewer Separation Project	50986	Papillion Creek South	NA	Dry detention	This project included sewer separation for a small drainage basin. Stormwater was routed through a dry detention facility to reduce peak flows to the existing creek and provide water quality benefit to the discharge. Coordinated with Omaha Public Schools for stormwater control. (Project is complete.)	Flow rate reduction and water quality
48th & Burt Area (RNC)	51796	Saddle Creek	Yes		Green Solutions were studied and determined to be unfeasible. Reasons they were unfeasible included topography, existing land use density, and the downstream constraints the project will connect to.	Flow Reduction and water quality.
49th & Caldwell Sewer Separation (RNC)	52193	Saddle Creek	Yes	Currently under preliminary design.	Evaluating bioswales, rain gardens, etc. No Green Solutions found that were considered feasible. Reasons for elimination included land availability, land ownership, topography, existing trees and vegetation, and cost.	
Aksarben Village Phase A	51151	Papillion Creek North	Yes	Dry Detention, Rain Gardens, Vegetated Swale	Approx. 29 Acres of runoff from Residential area diverted through park. Design includes trash screening structure, two dry detention basins, seven slotted weir structures, vegetated swale, and 3 bioretention gardens. Bioretention gardens include native grasses and wildflowers. Vegetated swales and dry detention basins include native grasses. (Project is currently under construction. The Green Infrastructure Project portion is complete.)	Flow rate reduction and water quality
Bohemian Cemetery Sewer Separation	51777	Saddle Creek	Yes	Dry Detention, Open Channel Conveyance	Dry detention basins include micro-pools and wetlands for additional water quality improvement. Approximately 700 lf of open channel will be created in lieu of storm pipe. All grasses and trees are native species. (Currently under construction)	The detention basins provide reduced peak discharge from major storm events and water quality benefits. The open channel provides water quality benefits and aquatic and riparian habitats. There was essentially no cost savings associated with the Green Solutions vs. installing conduits, however, the implementation of these green solutions provided the project with grant funding through the Papio-Missouri River Natural Resources District and the Nebraska Environmental Trust.
Cole Creek CSO 204 Sewer Separation Project	51995	Cole Creek Basin	Yes		No cost effective Green Solutions were identified. Reasons for elimination included land availability, land ownership, topography, and cost. The only sites extensively reviewed within the study area were at the extreme upstream and downstream portions of the basin and no cost savings could be realized from the construction of Green Solutions. No economical alternatives within this established residential area.	

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CSO 211 Sewer Separation (Pacific St. from 63rd to 66th St.)	51686	Papillion Creek North	Yes		No feasible or cost effective green solutions were found for this project. The site is on a 7 to 10 percent slope with dense residential development on one side of the street and well-established City park on the other side.	
Gilmore Avenue Sewer Separate	52184	Ohern/Monroe	Yes	Detention Basin with constructed wetland, bioretention, and bioswales.	Four areas of Green Infrastructure are in the design process - a detention basin with constructed wetlands to improve level of service in Gilmore and South Barrel; bioretention area in Albright park for reduction in infrastructure, water quality, and education; detention/bioretention under HWY 75/JFK Freeway to improve level of service in the South Barrel and improve water quality by treating the first flush from the freeway. Options are being evaluated for treatment of saline runoff; and Highland Elementary School - bioswale and bioretention. The bioswale will improve level of service downstream, improve water quality, educate, and treat snow and snow melt runoff.	Flow Reduction and water quality.
JCB Conveyance Sewer / JCB & Miami Sewer Separation Project/Adams Park Detention Improvements	52078 / 52165 / 52390	Minne Lusa	Yes	Dry Detention, Constructed Wetland	Past and proposed separated stormwater is to be discharged into an 13.5+ acre wetland complex to be constructed in the western portion of Adams Park. The wetland will receive stormwater flows from a 378-acre watershed consisting of predominantly residential development. The wetland concept will include emergent wetland areas that are frequently inundated, wet meadow areas that are inundated less frequently and upland areas for peak storage of larger storms. The volume above the emergent wetland zone is essentially dry detention providing peak flow attenuation for large storms up to the 100-year, 24-hour event. This facility will also provide capture and treatment for smaller events enhancing stormwater quality. Trails and interpretive and educational elements will ultimately be incorporated into the wetland by the Parks and Recreation Dept.	Peak stormwater flow attenuation, capture of water quality event, park amenity. Cost: \$5.1M (est)
Leavenworth Lift Station Replacement	51874	Leavenworth	Yes	Filter Strips, Grass Pavers, Gravel Surface Storage, Rain Gardens, Vegetated Swales, Disconnected Roof Drains		Flow Reduction and water quality.
Martha Street Sewer Separation Phase 1 / Residential	51880	South Interceptor	Yes		No Green Solutions found that were considered feasible. Reasons for elimination included land availability, land ownership, topography, existing trees and vegetation, and cost.	
Martha Street Sewer Separation Phase 1 Lauritzen Gardens / Gardens Grading / Martha to Riverview Ph 1	52134 / 52187 / 52188	South Interceptor	Yes		Green Solutions will not be incorporated into the Project. The majority of the project will be installed using trenchless construction methods due to site constraints. The south portion of the Phase I project that will be constructed by open cut methods will be located on NDOR and BNSFR right of way. The segment on the NDOR ROW is located under the Interstate 80 Missouri River. The area under the bridge is currently used for storm water detention. The BNSFR property in the area of the sewer construction is currently used as an intermodal facility. Both areas are not conducive to the implementation of Green Solutions. The north portion of the Phase I project that will be constructed by open cut methods will be located in an area used by the Gardens for maintenance and storage. Construction of Green Solutions will require the Gardens to relocate these operations.	
Miller Park to Pershing Detention Basin Sewer Separation	51941	Minne Lusa	Yes	Grass Swale. Rain Gardens and Filter Strip. Diversion of stormwater pond overflows to the Pershing Detention Basin.	A 160 LF grass swale was incorporated into the project that will divert stormwater runoff from the combined sewer and replace the need for 40 LF of 30" RCP and a manhole. Green Solutions information is from Study Phase. Expansion and updates to the existing Miller Park pond, including a trash screening structure, during LTCP development are considered Green Solutions improvements.	WQ Improvement and \$9000 savings. Flow Reduction and water quality.

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Minne Lusa Stormwater Conveyance Sewer / Pershing-Storz Detention Basin Improvements / Gunderson Demolition	52004	Minne Lusa	Yes	Dry Detention, Wetlands, Community Recreation, Property Restoration	The proposed concepts include enhancements to the existing dry detention basins, including upgraded storage capacity, wetlands construction and improvements to the existing rugby fields. Furthermore, a former industrial facility on a 2-acre site has been demolished to restore the site with full vegetation. A future project may further enhance this site with bioretention gardens, permeable sidewalks, trees, bushes and grasses.	Benefits include use of dry detention to reduce construction of concrete conveyance conduits, enhancement of wetlands, improvements to community recreation facilities, and restoration of vacant industrial facilities for green space use.
Missouri Avenue/ Spring Lake Park	51997	South Interceptor	Yes	Multi-use pond, constructed wetland with submerged gravel beds, constructed stream segment, infiltration basin, bioretention garden, six water-quality basins with high-flow bypasses, mechanical separation manholes to trap oil and remove large-sized sediment.	The treatment train created by the mechanical separation manholes, six water-quality basins, constructed stream segment, constructed wetland with submerged gravel beds, infiltration basin, bioretention garden, progressively treat stormwater from the contributing watershed to remove sediment and cleanse stormwater before it reaches the multi-use pond. Re-establishment of a fishing lake within the basin to provide stormwater detention. Water quality basins and wetland upstream of the wet pond for water quality benefit. All plantings will be of native species.	The multi-use pond will be utilized to attenuate flows, provide recreational opportunities, expand habitat diversity and reduce project costs by allowing reuse of existing downstream combined sanitary/storm pipes to convey separated storm flows. All green infrastructure practices within the project are designed to demonstrate their ability to create a synergy to improve water quality and protect the multi-use pond which is sited on the location of a historic pond which was lost to siltation from the contributing watershed. The total estimated cost savings for the project by including green infrastructure is \$4,500,000. Flow reduction and water quality.
Missouri River WWTP Improvements	51875 / 52200	South Interceptor	Yes	Dry Detention, Vegetated Swales	The Green Solutions provide water quality treatment for the first 0.5-inch of runoff for the planned Project facilities, as well as some of the existing facilities at the MRWWTP.	Flow Reduction and water quality.
Nicholas Street Phase 1 (10th Street to 16th Street)	51892	Burt Iazard	Yes		Since this project includes the extension of downstream trunk sewers that are designed to provide maximum capacity, green solutions are not appropriate to reduce the trunk sewer sizes or the length of sewers required. However, green solutions should be evaluated during future re-development of the area to provide for required storage. The City of Omaha has developed a Master Plan for this area entitled "North Downtown: Omaha's New Urban Neighborhood". However, because it is not yet clear how the area will be re-developed, no specific green solutions are recommended for incorporation into the Nicholas Street Sewer Extension – Phase I project. During design of future separation of the northern portion of the basin, green solutions should be evaluated to replace "unintentional" storage areas into green storage facilities.	
Nicholas Street Phase 2 Sewer Extension	52297	Burt Iazard	Yes	Currently in preliminary design. Considering pervious pavements and bioretention.	Evaluating rain gardens, bioswales, bio-retention, pervious pavement, etc. Green infrastructure for this project will not reduce pipe sizes or reduce project cost. The goal for green infrastructure for this project is to provide water quality storage.	Water Quality
Ohern/Monroe Industrial Lift Station, Force Main & Gravity Sewer	51956	Ohern/Monroe	Yes	Bioretention Facility, Permeable Underground Storage System, and Grass Swales	Bioretention and a permeable underground storage system were used to maintain pre-project runoff conditions. Grass swales were used to reduce the quantity and size of storm sewers on site.	Reducing costs of on site storm sewers. Improving quality of runoff.

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Paxton Boulevard Stormwater Conveyance Sewer and 33rd & Taylor Sub-Basin Sewer Separation	52077	Minne Lusa	Yes	Fontenelle Lake Expansion, Natural Stream Design in Park, Lake James Green Retrofits, and Green Solutions Along Paxton Blvd.	<p>Green Infrastructure is planned for several locations touched by this project.</p> <p>Fontenelle Park Lake is planned to be expanded and a natural stream design is planned to be incorporated to convey stormwater through the park to the lake. The exact size and dimension of the expansions are still being established.</p> <p>Lake James will likely also be retrofitted to accommodate additional detention and bioretention/sediment forebays. The exact size is still being established.</p> <p>Paxton Boulevard will likely be retrofitted to incorporated green infrastructure within the ROW. The exact number and location of facilities is still being considered.</p>	<p>Fontenelle Park/Lake (~\$3.5 million) - Will allow the downstream stormwater conveyance elements to be downsized and/or eliminated (To be determined). Sediment forebays within the Lake will help reduce sediment loads to the lake and improve water quality. A natural channel will help provide aeration to the influent stormwater and improve downstream water quality.</p> <p>Lake James Park (< \$2 million) - Additional stormwater from the upstream areas will be delivered to the Park and existing detention facility. Multiple objectives will be balanced. No new downstream stormwater infrastructure will be built between Lake James and Fontenelle Park lake. Therefore, Lake James must be optimized to provide enough attenuation for the new inflows to ensure that the downstream infrastructure is within design standards. At the same time, costs at Lake James needs to be minimized because improvements at Fontenelle Park are more cost effective than improvements at Lake James. The \$2 million value for this project is a "worst case" scenario, it is likely that the selected improvements at Lake James will be significantly less expensive than this.</p> <p>Paxton Boulevard (~\$500,000) - When new stormwater conveyance infrastructure is constructed within Paxton Boulevard, the plan is to rebuild the street with bioretention and green solutions in the Right-of-Way (i.e., Green Street). The benefits will be reducing the size of downstream stormwater infrastructure while also reducing the amount of secondary stormwater infrastructure (i.e., inlets).</p>
Saddle Creek Retention Treatment Basin	52049	Saddle Creek		Bioretention Ponds	The proposed concept includes bioretention and possibly a green roof. Green infrastructure will continue to be evaluated as design progresses.	Reducing costs of on site storm sewers. Improving quality of runoff.
SC 205-1; Country Club Phase 2 Sewer Separation (RNC)	50588	Saddle Creek	Yes	Rain Garden(s)	Bioretention garden selected for the intersection of Blondo Street and Country Club Avenue for water quality and neighborhood education. Other options were considered unfeasible. (Project is currently under construction.)	
South Interceptor Force Main	51873 / 52222 / 52223	South Interceptor, Leavenworth, Burt-Izard	Yes		Due to the linear nature of the SIFM project, opportunities for implementation of the Green Solutions Program on the project are limited. From Pierce Street to the Martha Street Diversion Structure, there are several small opportunities to increase the hydrologic function of the area. However, the timing for installation of these Green Solutions is better applied after completion of the SIFM to allow for future construction activities to take place without damaging any work completed. Therefore, Green Solutions in this area should be evaluated as part of the Pierce St Sewer Separation Project and the Hickory Street Sewer Separation Project. The area that will be purchased by Private parties should also be reviewed for a joint Public/Private opportunity to place Green Solutions near new railroad spurs as that development occurs in the future.	
South Omaha Industrial Area Sewer Separation (SOIASS)	51861	Ohern/Monroe	No		No feasible alternatives in establish industrial area. (Project is complete.)	
Spring Street Sewer Separation	51784	South Interceptor	No		Short 120-feet of sewer under a railroad corridor to an existing lift station. (Project is complete.)	
Webster Street Sewer Separation Phase 2	51503	Burt Izard	NA		This linear alignment is through an established industrial/commercial area along a major arterial with no feasible green alternative. (Project is complete.)	

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Webster-Nicolas Street Separation East of 27th Street	51962	Burt Iazard	Yes		Green infrastructure opportunities were evaluated as part of the 30% study phase of this project. The design team determined that sewer separation within the area containing Creighton University may not be effective and thus little, if any, sewer separation work is planned within this area. With no effective means of achieving sewer separation within the Creighton area, the benefits of any Green Solutions within this area are significantly reduced. Providing Green Solutions in the Creighton University area would, however, slightly reduce stormwater flows into the combined sewer system. No feasible alternatives within established industrial area.	