SECTION SEVEN

CONCEPTUAL DESIGN AND RECOMMENDATIONS

7.1 OVERVIEW

Based on the evaluation of project benefits, and cost effectiveness, the preferred alternatives selected for implementation are projects with a ranking between 1 and 22, as listed in Table 6.7. These projects were designed conceptually to confirm performance and probable construction cost. Project cost estimates were refined based on the conceptual designs, and are summarized in Table 7.1.

Proposed new detention ponds are shown on Figure 7.1. With these regional and sub-regional detention ponds in place, smaller channel and culvert improvements are required to convey future condition flood flows and development can occur anywhere within these watersheds without the need to provide small, local detention ponds. In some basins conveyance and selected structure improvements are proposed. The locations of these improvements are shown on Figure 7.2 and conceptual drawings of the proposed improvements are provided in Appendix F. Continued floodplain management is an inherent component of this SWMMP in all study reaches.

The overall goal for this Stormwater Management Master Plan for Casper is to minimize potential for flood damages, provide facilities that make periodic maintenance more efficient, and create opportunities for public amenities, open space, and enhancement of wildlife corridors and wetlands. The elements of the conceptual design of the selected projects are summarized in this section. The proposed improvements have been designed to meet the stated objectives. They have been qualitatively evaluated, and presented to the City of Casper and other interested agencies and individuals.

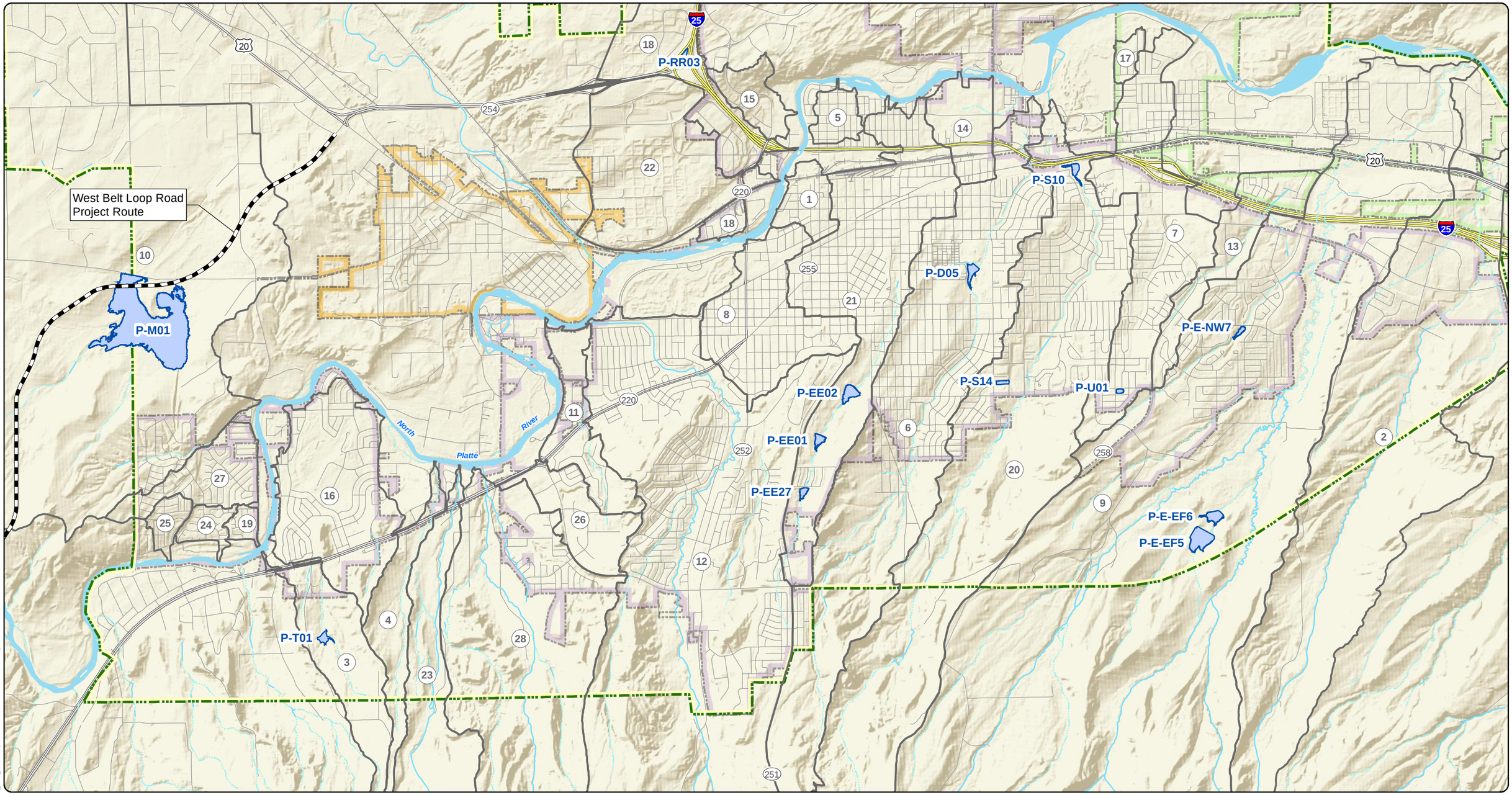
Table 7.1
Proposed Project Costs by Watershed

Casper Stormwater Management Master Plan			
Proposed Projects by Watershed	**Land Cost (x$1,000)**	**Construction Cost (x$1,000)**	**Total Cost (x$1,000)**
B-C Street/Wolcott Street Outfalls (10-Yr Protection)	$ -	$ 378	$ 378
Claude Creek (100-Yr Protection)	$ 554	$ 2,148	$ 2,702
Coates Draw (100-Yr Protection)	$ -	$ 78	$ 78
Eastdale Creek (100-Yr & 10-Yr Protection Combination)	$ 101	$ 3,385	$ 3,486
Eastridge Outfall (Evansville Swale) (10-Yr Protection)	$ -	$ 68	$ 68
El Rancho Road Outfall (10-Yr Protection)	$ 37	$ 2,412	$ 2,449
Elkhorn Creek (100-Yr Protection)	$ 450	$ 4,279	$ 4,729
Emigrant Gap Draw (100-Yr Protection)	$ 75	$ 2,065	$ 2,140
Garden Creek (100-Yr Protection)	$ 414	$ 425	$ 839
Paradise Valley (10-Yr Protection)	$ -	$ 1,608	$ 1,608
Poplar Street Storm System (100-Yr Protection)	$ -	$ 3,235	$ 3,235
Sage Creek (100-Yr & 10-Yr Protection Combination)	$ 616	$ 2,444	$ 3,060
Saint Mary's Street Outfall (10-Yr Protection)	$ 34	$ 8,047	$ 8,081
Squaw Creek (100-Yr Protection)	$ -	$ 213	$ 213
Total Cost of Proposed Projects	$ 2,281	$ 30,785	$ 33,066

7.2 GENERAL RECOMMENDATIONS

As part of master planning for urbanizing watersheds, it is generally recommended that the City implement the following:

- The City should request that WDEQ place all projects identified in the Master Plan on the Intended Use Plan.
- Take steps to stabilize all major drainageways as the watersheds urbanize, rehabilitate existing degraded reaches of the major drainageways and their tributaries, and aggressively control erosion and sediment transport during construction activities. Existing natural drainageways should be preserved as much as possible when development occurs.
- The City should require new land development, significant redevelopment and publicly funded projects to provide runoff volume control practices (i.e., minimize directly connected impervious areas and employ Best Management Practices) whenever site conditions permit.
- The City should take steps to require that all new development, redevelopment, and publicly funded projects provide stormwater quality BMPs as recommended in Section 11 of the Casper SMDM.
- The City should continue to enforce floodplain management regulations, including regulation of the 100-year floodplain and floodway, and continue to participate in FEMA's flood insurance Community Rating System and public education programs.
- Coordinate projects that have beneficial effects on stormwater quality, e.g., Emigrant Gap Draw channel improvements, with the Natrona County Conservation District (NCCD) to leverage water quality related grants and funding sources.
- Coordinate projects that have beneficial effects on state highways with WYDOT to leverage state highway funds.
- The City should also initiate new detailed flood insurance studies of Garden Creek, northwest branch of Elkhorn Creek, and Emigrant Gap Draw from its confluence to the limit of the current planning area boundary.
- Land-use changes to the contributing watersheds affect the flood hazard nature (i.e., runoff rates, volumes and depths), the transport of sediment, and the water quality of the receiving natural drainageways. The City and County, who have land use control powers in the watershed, should monitor land use changes. Whenever the land-use changes result in imperviousness ratios that exceed the projections identified in this study, steps should be taken to further limit increases in stormwater runoff through the use of additional on-site detention BMPs, thereby reducing runoff rates, volumes and potential for increasing future flood damages.



Legend

- Detention Pond
- Major Basins
- Service Boundary-Utility Service

City Boundaries

- Casper
- Evansville
- Mills

Map Key	Major Basin	Map Key	Major Basin
1	B-C Street/Wolcott Street Outfalls	15	North Poplar Street
2	Claude Creek	16	Paradise Valley
3	Coates Draw	17	Platte Park Rd Direct Flow Area
4	Dowler Draw	18	Poplar Street Storm System
5	Durbin Street Outfall	19	S Robertson Road Outfall
6	Eastdale Creek	20	Sage Creek
7	Eastridge Outfall (Evansville Swale)	21	Saint Mary's Street Outfall
8	El Rancho Road Outfall	22	Salt Creek Playa
9	Elkhorn Creek	23	Squaw Creek
10	Emigrant Gap Draw	24	Trails West Estates (East) Outfall
11	Fairgrounds, Treatment Plant, Fort Caspar Museum	25	Trails West Estates (West) Outfall
12	Garden Creek	26	Walmart Direct Flow Area
13	Landmark Draw	27	West Platte River Estates Outfall
14	Midtown Direct Flow Area (East)	28	Wolf Creek

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Casper SWMMP Project
Casper, Wyoming

Detention Sites Recommended

7.1

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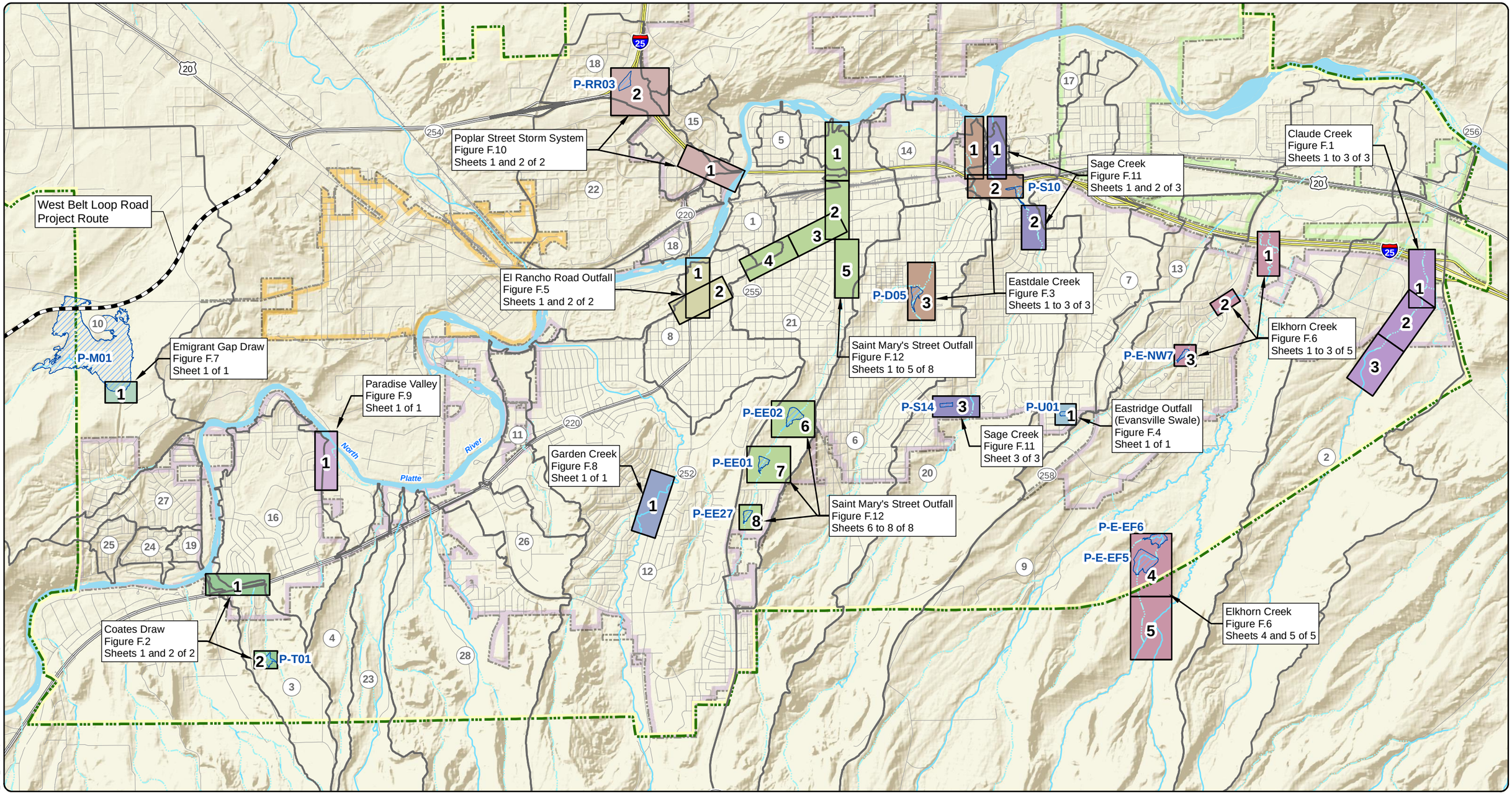

Legend

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Casper SWMMP Project
Casper, Wyoming

Index of Plan Sheets for Selected Improvements

7.2

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7.3 SELECTED PROJECTS BY BASIN

7.3.1 B-C Street/Wolcott Street Outfalls

A new storm sewer consisting of an area inlet and 190 feet of 18-inch RCP is proposed to drain a depressed area next to the BNSF railroad with no outlet (DP H-08). The new storm sewer would run from the depressed area (DP H-08) and connect to the existing manhole at DP H-05, and convey the 10-year event. This project ranks more highly than the other proposed storm sewer upgrades in the B-C/Wolcott basin primarily because it has the maximum score for "Reduction in Frequency of Flooding," since the depressed area has no outlet. It would benefit the Laurel Gardens complex.

The proposed upgrades to the storm sewer system from South Wolcott Street and East 1st Street (DP H-06) to North Center Street along the major B-C Street/Wolcott Street study reach (DP H-05) do not rank as highly because of cost and the reduction in frequency of flooding isn't as great. These storm sewer upgrades could be made in conjunction with redevelopment or major street upgrades in the project area.

7.3.2 Claude Creek

The proposed open channel and culvert improvements for Claude Creek, shown on Figure F.1, are designed to convey the 100-year storm event with one foot of freeboard in improved open channel sections that reduce the expansive floodplains and protect the existing wetland channel and wildlife corridor. Proposed channel improvements extend from upstream of I-25 to upstream of downstream of a private road, a total length of approximately 4,600 feet, and would be necessary at the time these properties are developed. The proposed channel has 30-foot to 70-foot "benches" with 4H:1V side slopes graded to preserve the existing riparian and wetland areas along the existing channel bottom. The channel bench would widen to 40 feet at East 2nd Street, up and downstream of East 2nd Street. The existing channel is at a 1 percent slope, and grade control structures could be needed to reduce the slope to keep maximum velocities within acceptable limits.

Culvert improvements are proposed at East 2nd Street and I-25 to pass the 100-year flow within allowable HW/D criteria. At East 2nd Street, two additional 7-foot by 6-foot RCBCs would be added to the west of the existing culverts.

The proposed additional 96-inch RCP at I-25 does not rank as highly as the channel improvements because it does not remove structures from the floodplain. However, it does provide an improvement to public safety. It is a WYDOT facility, and possibly eligible for cost sharing.

7.3.3 Coates Draw

Formalizing the flood control storage volume in the Horsch Stockwater reservoir in the top 10 feet below the spillway crest elevation results in an available storage volume of approximately 24 ac-ft, which reduces the 100-year future condition peak discharge at CY Avenue by approximately 280 cfs. This allows the existing 96-inch CMP culvert under CY Avenue to pass the 100-year flow with only modifications to the inlet to prevent surcharging along CY Avenue to the east. These improvements are shown on Figure F.2.

Downstream of CY Avenue, the proposed conveyance improvements consist of replacing the existing 66-inch CMP culvert under Indian Paintbrush Road with a 90-inch RCP culvert. The formalized flood control detention and the culvert improvements will substantially reduce the potential surcharging in the 100-year event over Sequoia Drive to the north, and take numerous structures out of the floodplain, as shown previously on Figure 6.2.

The existing storm sewer outfall downstream of Yucca Circle has 10-year capacity, which meets Casper's criteria for closed systems. If the upstream detention and conveyance improvements are made, there will be a residual 100-year floodplain that results from the upstream channel overtopping in a 100-year event and surcharging approximately 250 cfs through the neighborhoods to the north.

7.3.4 Eastdale Creek

The Highland Park Detention Reservoir, pond P-D05, was found to be the most effective detention alternative within the Eastdale Creek major basin and it is also the most highly ranked of all the flood control alternatives evaluated. This project has the maximum scores in public safety, reduction in frequency of flooding, water quality improvements, community use opportunities, and wetland/wildlife habitat enhancement benefits.

The existing dam crest would be raised approximately 3 feet to elevation 5190 feet and the crest of the spillway would be placed at the current dam crest elevation of 5188.75 feet. The storage area would be excavated by placing a 5-foot drop structure at the upstream end of the pond area and lowering the outlet structure by approximately 2 feet to elevation 5177 feet. Overall detention storage volume would be increased from 11.7 ac-ft to 33 ac-ft. The existing outlet pipe would remain at the same invert elevation, and a proposed 24-inch RCP low level outlet would be added to attenuate flows for the 10-year event. The earthen spillway is sized to convey the 100-year flow of approximately 960 cfs with a crest length of 200 feet, a top width of 350 feet, and 6H:1V side slopes. The modified detention area is estimated to attenuate 100-year inflows of 1,580 cfs to 1,234 cfs, a 22 percent peak reduction, and to attenuate 10-year inflows of 774 cfs to 222 cfs, a 71 percent 10-year peak reduction, which allows existing downstream infrastructure to safely convey the 10-year event. It provides opportunities for wetlands and wildlife habitat enhancement, and community use opportunities because of its proximity to the Frontier Middle School.

This detention alternative does not attenuate 100-year flow rates enough to benefit the interstate highway or properties downstream of I-25 on Eastdale Creek, so a diversion structure is proposed at DP D-06, upstream of the Casper Rail Trail, to divert flows in excess of 700 cfs to Sage Creek through an open grass-lined channel and new culvert system under I-25. In the 100-year event, approximately 830 cfs, would be conveyed under I-25 in dual jacked RCP culverts that would discharge into an RCBC under the East Yellowstone Highway. The open channel in Sage Creek downstream of East Yellowstone Highway would need to be improved to convey the combined 100-year flow of approximately 1,950 cfs to the City limits downstream of the BNSF railroad crossing. This project should be eligible for cost sharing with WYDOT, as it greatly reduces the frequency of flooding in I-25 at the East Yellowstone Highway underpass and improves public safety. The Sage Creek detention area, P-S10, would also have to be constructed as part of this project for the downstream conveyance improvements to be effective.

Downstream of I-25 at DP D-03 on Eastdale Creek, an open channel section is proposed to be improved to convey the residual 10-year flow of 460 cfs to Bryan-Evansville Road. Eastdale Creek projects are shown on Figure F.3.

7.3.5 Eastridge Outfall

The proposed detention improvement at the existing Fun Valley detention area (pond P-U01) involves lowering the pond invert by approximately 1.2 feet (from El. 5351.2 feet to El. 5350 feet) and installing a 30-inch RCP outlet to replace the existing 24-inch RCP under East 21st Street as shown on Figure F.4. The 30-inch RCP outlet would eliminate overtopping and surface flow during the 10-year event and allow the existing 30-inch RCP downstream storm sewer system to convey the 10-year event. No alterations would be made to the current pond spillway at East 21st Street. Minimal storage would be added by lowering the pond invert (approximately 0.05 ac-ft).

This pond discharges approximately 235 cfs during the future conditions100-year event, a 12 percent peak reduction from the 267 cfs 100-year inflow to the pond. During the 10-year event, the peak is reduced by approximately 63 percent, from 131 cfs to 49 cfs, as a result of installing the proposed 30-inch RCP outlet structure. The main benefit of this project is reduction in frequency of flooding downstream. A water quality outlet structure could be added to this facility to further enhance the pond's functionality.

7.3.6 El Rancho Road Outfall

As shown on Figure F.5, the proposed storm sewer trunk mains and outfall improvements for this watershed are sized to collect and convey the 10-year event along West Collins Drive and South Poplar Street. The proposed 8-foot by 6-foot RCBC outfall in South Poplar Street was sized with the 10-year tailwater effect from the North Platte River. This new outfall should be eligible for cost sharing as Poplar Street is a WYDOT facility.

A trapezoidal grass-lined open channel 485 feet in length is proposed from north of West Collins Drive (DP X-03) to the eastern edge of South Poplar Street. The open channel would have a 9-foot bottom width and 4H:1V side slopes with a maximum normal depth of 5 feet plus 1 foot of freeboard. At South Poplar Street an 8-foot by 6-foot RCBC is proposed to convey the 10-year flow to the North Platte River.

New 66-inch and 72-inch RCP storm sewer trunk mains are proposed in West Collins Drive in the West Tributary (DP X-11 to DP X-03), and a new 60-inch RCP storm sewer trunk main is proposed in West Collins Drive from DP X-03 to DP X-11. These new trunk mains are sized for the 10-year event and will reduce frequency and severity of flooding in known problem areas along West Collins Drive and the Old West Yellowstone commercial district.

7.3.7 Elkhorn Creek

The 1983 Plan recommended diverting high flows from the East Branch of Elkhorn Creek to Duhling Reservoir, pond P-E-EF5. That recommendation is carried forward in this study.

A diversion structure is proposed in the East Branch of Elkhorn Creek to divert flood flows in an open channel and convey up to 1,500 cfs to the existing reservoir to attenuate flood flows in the

main stem of Elkhorn Creek in downstream reaches. The channel would be approximately 1,700 feet in length, have a bottom width of 25 feet, 4H:1V side slopes and a maximum normal depth of 5 feet. The necessary volume would be increased by raising the embankment and grading within the existing reservoir footprint. Outlet works consisting of 48-inch RCP in both the P-E-EF5 and P-E-EF6 ponds were found to be effective in attenuating the 100-year flow downstream.

Another proposal is to formalize the inadvertent detention in the Northwest Branch of Elkhorn Creek upstream of East 12th Street (P-E-NW7). A new outlet structure equivalent to dual 42-inch RCPs is proposed in conjunction with building a berm along East 12th Street. With these modifications, this detention pond attenuates the 100-year peak flow from 670 cfs to 292 cfs, a 56 percent reduction.

Downstream of pond P-E-NW7 at Newport Street on the Northwest Branch (DP E-25), two 54-inch RCPs were found to be adequate to convey the attenuated 100-year flow of 587 cfs (down from 1,058 cfs). The proposed dual RCPs would run beneath Newport Rd (approximately 450 feet) and discharge into the existing channel that conveys flows to Pond P-E-NW11.

Using the attenuated flows from proposed ponds P-E-EF5 and P-E-NW7, a new bridge is proposed to convey the 100-year *detained* flow of 3,306 cfs (down from 4,150 cfs) on Elkhorn Creek at East 2nd Street. An 80-foot wide, clear-span bridge with a 4-foot deck was found to be adequate to pass the 100-year *detained* flow with 1 foot of freeboard to the roadway. The tailwater at the bridge could be reduced further by increasing conveyance under I-25.

Additional conveyance could be provided under I-25 by jacking a 114-inch RCP beneath I-25 next to the two existing 9-foot by 9-foot RCBCs, which would lower the headwater depth to be within the criteria. This project could be eligible for cost sharing with WYDOT. Without attenuating the 100-year flows from the proposed detention ponds, there is no feasible alternative to eliminate overtopping of East 2nd Street without fixing the downstream backwater effects from I-25. Conceptual plans for Elkhorn Creek are shown on Figure F.6.

7.3.8 Emigrant Gap Draw

One of the most effective sites for major detention in the Emigrant Gap Draw watershed is in a natural depression in sub-basin M-01, just downstream of the new West Belt Loop Road. It could generate 585 acre-feet of storage volume with a maximum depth of 7 feet and 1 foot of freeboard, and would not require significant excavation or earthwork. To create the detention pond, a berm with an outlet works consisting of three, 12-foot by 6-foot RCBCs and an emergency spillway is proposed near the outlet of sub-basin M-01 in the existing excavated channel section. The proposed outlet works would convey the 100-year flows from the future, fully developed conditions with freeboard of 1 foot relative to the West Poison Spider Road top of road elevation. With the pond in place, the 100-year future condition flow rate at Robertson Road is reduced by approximately 3,690 cfs.

Even though this proposed detention pond ranked highly because it is cost-effective and would remove buildings that are inside the City limits from the floodplain, this facility was determined to be difficult to permit because of high selenium concentrations within the drainageway, and the project would meet resistance from landowners, the U.S. Bureau of Reclamation and the CAID. Consequently, this alternative has been removed from further consideration in this SWMMP.

On the other hand, the proposed conveyance improvements include channel improvements upstream of Robertson Road and two 10-foot by 9-foot RCBCs at Robertson Road (currently proposed in preliminary design drawings obtained from WYDOT). The proposed Robertson Road crossing will have capacity for the existing condition 100-year flow and the future condition 100-year *detained* flow rate. The proposed channel improvements would extend approximately 2,100 feet upstream of Robertson Road. The channel sections would consist of a trapezoidal grass-lined section with a bottom width varying from 50-feet to 80-feet and 4H:1V side slopes and a concrete-lined section with a 20-foot bottom width and 2H:V1 side slopes. In addition, the existing berm on along the south side of the channel would need to be rebuilt and the concrete flume downstream of Robertson Road removed. The channel should be designed and constructed to cover exposed Cody Shale and stabilize the channel invert and banks to reduce potential selenium contamination of stormwater discharges to the North Platte River.

Even though these proposed improvements are outside the current City limits, they rank highly because they are cost-effective, remove buildings that are inside the City limits from the floodplain and offer good opportunities for water quality improvements, community use, wetland/wildlife enhancement and cost sharing. These improvements are shown on Figure F.7.

7.3.9 Garden Creek

Shown on Figure F.8, the only channel improvements proposed on Garden Creek are for a 1,500-foot reach from Green Meadows Drive to South Coffman Avenue. It is also proposed that an 8-foot by 5-foot RCBC be placed under Green Meadows Drive to convey the 10-year flow. This project would remove 4 buildings from the floodplain, improve public safety and reduce frequency of flooding at the roadway crossings.

No channel improvements are proposed at any other location along the main stem of Garden Creek to preserve the wetland and habitat areas and refrain from acquiring residential property.

7.3.10 Landmark Draw

Of the roadway crossing improvements evaluated in Landmark Draw, the only project that is proposed as part of this plan is 145 feet of 54-inch RCP at SE Wyoming Boulevard to convey the 10-year event. The primary benefits of this project are improved public safety and reduction in the frequency of flooding.

7.3.11 Paradise Valley

In the Paradise Valley watershed, conveyance improvements consisting of large diameter RCP and RCBC improvements are required along the northern and southern storm sewer outfalls on Daffodil Drive, and along the Paradise Drive Outfall to pass flows at the 10-year flow rates. These projects are expensive, and the only project that had a ranking score of 1 or greater is improving the outfall in Paradise Valley Drive.

As shown on Figure F.9, the proposed outfall improvement consists of approximately 1,092 feet of 9-foot by 5-foot RCBC and 675 feet of 66-inch RCP. The primary benefits of this project are improvements to public safety and reduction in the frequency of flooding along South Paradise Valley Drive.

7.3.12 Poplar Street Storm System

There are two outfalls from the Poplar Street watershed, one along I-25 and the other along English Avenue. Both converge on Poplar Street at the I-25 interchange, and both are small diameter storm sewer systems on flat grades with minor capacity. Two new storm sewer outfalls are proposed for these two systems, one on the north side of I-25 and the other on the south side, as shown on Figure F.10.

To attenuate flows from the upper watershed on the I-25 outfall, a new detention pond in the infield of the I-25/Events Drive interchange is proposed. The excavated pond volume would be approximately 24.0 ac-ft to the spillway and 31 ac-ft to the crest. The spillway is approximately 5 feet long with 4H:1V side slopes, and a 24-inch RCP outlet is proposed for the 100-year event. The depth of the pond is 8 feet to the dam crest and 6 feet to the spillway crest. The 100-year inflow of approximately 853 cfs is attenuated by the 24-inch RCP outlet pipe to 43 cfs, a peak reduction of approximately 93 percent.

Discharges from this pond are conveyed within the I-25 right-of-way along the northbound side to Poplar Street. Roadway crossings on Poplar Street are proposed for the *detained* 100-yr event. Culverts in the I-25 right-of-way above the main study reach at DPs RR-05, RR-13, and RR-12 would require 2-42-inch RCPs, a 24-inch RCP, and 2-36-inch RCPs, respectively. These improvements are needed to avoid surcharges into the North Poplar Street watershed during high flow events. Downstream of RR-06 along the main study reach, 48-inch RCP and a 7-foot by 4-foot RCBC are proposed from DP RR-04 downstream to convey the *detained* 100-year event. The large box culvert is needed at DP RR-11 because of the tailwater effects from the North Platte River.

On the west side of I-25, a new concrete-lined channel outfall is proposed for the English Avenue system along the southbound side of I-25 from Poplar Street to the North Platte River. This channel would divert surcharge flows from English Avenue and the existing 24-inch RCP storm sewer under North Poplar Street and convey them approximately 1,320 feet to the North Platte River. An intake structure and two 60-inch RCPs are proposed under Poplar Street. The concrete-lined channel would require acquisition of two lots in the mobile home subdivision on the west side of the highway.

Water quality could be enhanced by adding sediment traps in these systems.

These improvements are mainly in the I-25 right-of-way, but they are highly ranked because they provide benefits to Casper residents in terms of public safety, reduction in the frequency of flooding and potential water quality improvements. These projects should be eligible for cost sharing with the WYDOT.

7.3.13 Sage Creek

The proposed "Casper Rail Trail" regional detention pond, pond P-S10, is a highly ranked facility that involves enlarging the current inadvertent detention area adjacent to the existing Casper Rail Trail embankment on Sage Creek. Storage volume would be increased from 8.8 ac-ft to 21.8 ac-ft by excavating the vacant area to the east. The existing dual 84-inch RCP culvert would remain as the outlet structure. Since this pond is next to the Casper Rail Trail, opportunities for multiple uses should be explored. Enlarging this detention area was found to attenuate the 100-year event on Sage Creek with a 42 percent peak reduction, and is necessary

for the diversion from Eastdale Creek to be constructed and not adversely affect the downstream reaches of Sage Creek. Benefits of this proposed pond include increase in public safety, mainly at I-25 and East Yellowstone Highway, opportunities for community use and water quality improvements. Because I-25 would be protected from the 100-year event on Sage Creek, the facility could be eligible for cost sharing with WYDOT.

The diversion from Eastdale Creek would divert approximately 830 cfs in the 100-year event to a proposed crossing just west of the existing Sage Creek culverts under I-25, and discharge into the existing Sage Creek open channel downstream of the East Yellowstone Highway. The proposed open channel improvements to Sage Creek downstream of the East Yellowstone Highway are a trapezoidal channel with a 27-foot bottom width and 4H:1V side slopes. It would have a normal depth of 5 feet with 1 foot of freeboard. This scenario was modeled in HEC-RAS to redefine the "residual" floodplain in Sage Creek shown previously on Figure 6.2. The benefits of the proposed channel improvements are primarily related to stabilization and thus provide water quality improvements, opportunities for enhanced wetlands and wildlife habitat, and access for maintenance.

Another detention pond that ranked highly in the Sage Creek watershed is the Beverly Street sub-regional pond, P-S14. This is a new detention area that provides attenuation along the Pinyon Parkway Tributary. By acquiring the site and excavating, approximately 15 ac-ft of storage volume could be provided on this tributary. The outlet structure would have a 24-inch orifice plate and connect to the existing 48-inch RCP storm sewer. This proposed pond provides a peak reduction of 85 percent and enables the downstream storm sewer system to reach 100-year capacity. Water quality could be provided at this facility.

Structure improvements along the main stem of Sage Creek are proposed at Second Street. A new triple 10-foot by 6-foot RCBC, 585 feet in length, is sized for the 100-year event. The proposed 60-inch RCP on the Second Street tributary is sized for the 10-year event. The benefits of this project are primarily reducing the frequency of flooding on Second Street and improving public safety. These improvements are shown on Figure F.11.

7.3.14 Saint Mary's Street Outfall

Regional detention ponds at Casper Parks Nos. 1 and 2, ponds P-EE01 and P-EE02, and upstream at West 29th Street, pond P-EE27, are recommended for implementation. Pond P-EE27 is the natural stream channel upstream of West 29th Street that would be formalized into detention using the stage-storage geometry associated with the existing topography, i.e., no grading or earthwork is proposed. It would be necessary to modify the existing 48-inch RCP culvert entrance by adding a structure with a 12-inch orifice plate to attenuate flows through the development downstream. Pond P-EE27 should have at least 1 foot of freeboard during the 100-year event before overtopping 29th Street. The proposed modifications for pond P-EE27 provide an 89 percent peak reduction during the 100-year event and a 78 percent reduction during the 10-year event.

Likewise, the existing stage-storage geometry for detention ponds P-EE01 and PEE02 remains the same and no modifications to the outlet structures are proposed. The flood control storage volume above the normal water surface elevations would need to be formalized by agreement with Casper Parks. At pond P-EE01, the normal water surface elevation was set at 5383.0 feet, approximately 2 feet lower than the existing spillway crest, which provides approximately 7.7

ac-ft of storage volume to attenuate the peak 100-year flow by approximately 49 percent. Pond P-EE02 was modeled with a normal water surface elevation of 5326 feet, approximately 5 feet below the existing spillway, and this provides approximately 26.6 ac-ft of additional storage. With this volume, the pond would completely contain the 100-year flood.

However, none of these detention improvements benefits the study reaches downstream of East 8th Street (DP EE-13).

It is recommended that all storm sewer outfalls in the Saint Mary's watershed be sized for the 10-year event. Downstream of East 8th Street peak runoff is generated within the developed areas of central Casper and no feasible sites for detention are available. New outfalls consisting of 42-inch RCP in South McKinley Street, 108-inch RCP in North Jefferson Street and West Collins Avenue are proposed on the main Saint Mary's Street Outfall alignment. Along the Jefferson Street Tributary outfall, 66-inch RCP and 6-foot by 6-foot RCBC are proposed to replace the existing 60-inch RCP from East C Street to the N. Platte River. In the West Collins Drive tributary, it is recommended that all flows upstream of the confluence at East 2nd and Kimball Street (DP EE-09/EE-10) be conveyed in the East Yellowstone Highway Branch and into the main Saint Mary's Street Outfall to alleviate flows downstream on the Jefferson Street Tributary. Upstream of East 2nd Street, all parallel systems would be replaced with a new single box culvert or equivalent RCP, with the exception of the parallel system downstream of the diversion to the Yellowstone Highway branch. These improvements are shown on Figure F.12.

7.3.15 Squaw Creek

It is proposed that two 10-foot by 6-foot RCB culverts 60 feet in length be installed under Alcova Road. Implementing this alternative will modify the water surface of the existing pond (unknown name) upstream of Alcova Road. At the request of the City, this pond was not modeled in InfoSWMM.

7.4 COST ESTIMATES

The total estimated capital costs for each project in this master plan, shown in Table 7.2, are based on the sum of the cost of the proposed facilities including construction contingencies, plus costs for engineering and land costs as determined in the alternatives analysis. Detailed cost estimates for each alternative for each basin are included in the spreadsheets in Appendix D.

Land acquisition costs are included where necessary, and are estimated based on assessor's valuations for the affected parcels. The calculations are in the "Land Costs" spreadsheet and parcel values are shown on Figure D1, Land Costs, in Appendix D.

Table 7.2
Stormwater Capital Improvement Program, Phasing 2013 – 2032

Rank	Watershed	Project Name	Land Cost (x $1,000)	Construction Cost (x $1,000)	2013 Proposed	2014 Planned	2015 Planned	2016 Planned	2017 Planned	2018 Planned	2019 Planned	2020 Planned	2021 Planned	2022 Planned	2023 Planned	2024 Planned	2025 Planned	2026 Planned	2027 Planned	2028 Planned	2029 Planned	2030 Planned	2031 Planned	2032 Planned	Potential Funding Sources
1	Eastdale Creek	Highland Park Floodwater Detention Reservoir	$ -	$ 669		$ 669																			MRG, Sec. 319
2	Sage Creek	P-S10: Casper Rail Trail Regional Detention Pond	$ 171	$ 175			$ 346																		MRG, Sec. 319
3	Emigrant Gap Draw	Robertson Rd. Crossing 2-10'x9' RCBC	$ -	$ 346	$ 346																				WYDOT
4	Emigrant Gap Draw	Emigrant Gap Draw Channel Improvement	$ 75	$ 2,065				$ 2,140																	MRG, Sec. 319
5	St. Mary's St. Outfall	Formalize P-EE27, add 12" orifice plate to outlet structure	$ 5	$ 20	$ 25																				MRG
6	Eastdale Creek	Diversion to Sage Creek, including D/S Channel Improvements on Sage Creek	$ 101	$ 2,483					$ 2,584																WYDOT
7	Claude Creek	Channel Improvements	$ 554	$ 763																					By Development
8	Eastdale Creek	Lower Eastdale Channel Improvements	$ 182	$ 232			$ 414																		MRG
10	Poplar St. Storm System	U/S Events Drive Regional Detention Pond	$ -	$ 665					$ 665																MRG
10	Poplar St. Storm System	129' - 2-42" RCP, 134' - 48" RCP, 817' - 7'x4' RCBC	$ -	$ 866						$ 866															WYDOT
10	Poplar St. Storm System	113' - 2-60" RCP, 1,320' conc.-lined channel	$ -	$ 2,058							$ 2,058														WYDOT
11	Poplar St. Storm System	951' Conc.-lined channel, 2-36" RCP	$ -	$ 1,061								$ 1,061													WYDOT
11	St. Mary's St. Outfall	Casper Parks No. 1 (P-EE01)	$ -	$ -																					--
11	St. Mary's St. Outfall	Casper Parks No. 2 (P-EE02)	$ -	$ -																					--
12	Elkhorn Creek	P-E-NW7- Formalize detention	$ 412	$ 225									$ 637												MRG
12	Garden Creek	Grass-lined Channel w/ drop structures & 8'x5' RCBC	$ 414	$ 425										$ 839											Consensus, CWSRF
13	Coates Draw	Culvert Entrance Improvements at CY Ave	$ -	$ 3					$ 3																WYDOT
13	Elkhorn Creek	Upper Elkhorn Creek Detention Improvement	$ 2	$ 1,508									$ 1,510												Consensus, CWSRF
14	Eastridge Outfall	Fun Valley Detention Outlet Improvement	$ -	$ 15			$ 15																		MRG
15	Coates Draw	Conveyance Improvements D/S of CY Ave	$ -	$ 75					$ 75																--
15	Sage Creek	Beverly St. Regional Detention Pond - Pond P - S15	$ 348	$ 200											$ 548										MRG, Sec. 319
16	El Rancho Road Outfall	S. Poplar St. Drainage Improvement (Outfall)	$ 37	$ 1,393												$ 1,430									WYDOT
17	Poplar St. Storm System	I-25 & Events Dr. Interchange Ramp Culverts, 430' 2-7'x5' RCBC, 88'-24" RCP	$ -	$ 547						$ 547															WYDOT
18	B-C Wolcott St.	N. David Street Improvement	$ -	$ 17	$ 17																				MRG
18	Elkhorn Creek	2nd Street Bridge Improvement	$ -	$ 1,260															$ 1,260						Consensus, CWSRF
19	El Rancho Road Outfall	W. Collins Drive Drainage Improvement - 66" RCP	$ -	$ 318													$ 318								MRG
19	El Rancho Road Outfall	W. Collins Drive Drainage Improvement - 72" RCP	$ -	$ 236													$ 236								MRG
19	Elkhorn Creek	Newport Rd., 2 - 54" RCP Slopes	$ -	$ 255																$ 255					MRG
20	Claude Creek	I-25 Culvert Improvement	$ -	$ 871																					WYDOT
20	Sage Creek	D/S I-25 Channel Improvement (w/o Eastdale Diversion)	$ 131	$ 560						$ 691															MRG
20	St. Mary's St. Outfall	McKinley St. Storm Sewer Improvements, 2,170' - 42" RCP	$ -	$ 406																$ 406					MRG
20	St. Mary's St. Outfall	Jefferson St. Storm Sewer Improvements, 1,278' - 108" RCP	$ 13	$ 1,726																	$ 1,739				Consensus, CWSRF
20	St. Mary's St. Outfall	E. Yellowstone Branch Storm Sewer Improvements, 1,709' - 108" RCP	$ -	$ 2,159																		$ 2,159			Consensus, CWSRF
20	St. Mary's St. Outfall	1,738' - 5'x5' RCBC, 777' -6'x5' RCBC	$ -	$ 2,041																			$ 2,041		Consensus, CWSRF
20	St. Mary's St. Outfall	1994' 66" RCP, 1,289' 6'x6' RCBC	$ 16	$ 2,813																			$ 2,829		Consensus, CWSRF
21	Coates Draw	Horsch Stockwater Reservoir Detention	$ -	$ -																					
21	Paradise Valley	Paradise Dr. - 1,149'-9'x5' RCBC & 675'-66" RCP	$ -	$ 1,608																				$ 1,608	Consensus, CWSRF
21	Squaw Creek	Alcova Rd. - 60' - 2-10'x6' RCBC	$ -	$ 213																	$ 213				MRG
22	El Rancho Road Outfall	W. Collins Drive Drainage Improvement - 60" RCP	$ -	$ 466														$ 466							MRG
22	Elkhorn Creek	I-25 Pipe Addition (partially jacked)	$ -	$ 911																$ 911					WYDOT
22	Landmark Draw	Wyoming Blvd. - 54" RCP x 145'	$ -	$ 51																			$ 51		MRG
22	Sage Creek	E. 2nd Street Strom Sewer, 585' - 3-10'x6' RCBC, 536' - 60" RCP	$ 97	$ 2,069																				$ 2,166	Consensus, CWSRF
		TOTAL	**$ 2,558**	**$ 33,774**	**$ 388**	**$ 669**	**$ 775**	**$ 2,140**	**$ 3,327**	**$ 2,104**	**$ 2,058**	**$ 1,061**	**$ 2,147**	**$ 839**	**$ 548**	**$ 1,430**	**$ 554**	**$ 466**	**$ 1,260**	**$ 1,572**	**$ 1,952**	**$ 2,159**	**$ 4,921**	**$ 3,774**	

Notes:

' = feet
" = inches
CWSRF = Clean Water State Revolving Fund
D/S = downstream
MRG = Mineral Royalty Grant
I-25 = Interstate 25
RCBC = reinforced concrete box culvert
RCP = reinforced concrete pipe
U/S = upstream
WYDOT = Wyoming Department of Transportation

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7.5 PRIORITIZATION AND PHASING

Prioritization of the selected projects is shown in Table 7.2, and is based on priority rank unless the project depends on other improvements, such as upstream detention, to be effective. In that case, highly ranked projects are grouped with other related projects in sequence that allows for full functionality at the completion of construction. Project phasing will also be driven by financing and cost sharing opportunities. For example, new major culverts under I-25 would be most cost effective to construct when WYDOT is proposing to construct other highway upgrades in the project area. Other projects could be eligible for grants or loans, which would drive the timing of these projects.

Proposed project phasing over the next 20 years is suggested in Table 7.2. It should be revisited every year as part of the City's budgeting process.

7.6 WATER QUALITY IMPACTS

Stormwater regulations cross jurisdictional boundaries to include the county, neighboring jurisdictions, local agencies such as the NCCD, Casper College, and WYDOT. Coordination and communication with these entities is a critical part of the development of an effective stormwater quality program. It is recommended that the City consider establishing a watershed stakeholders group that can discuss and share information as it applies to stormwater policies and strategies for the North Platte River and tributaries in the Casper area.

Coordination and collaboration among the various districts, the county, and local jurisdictions are also critical in making sure policies and design standards are consistently applied. This will facilitate consistent expectations across the watershed among project developers.

The WDEQ is in the process of preparing a Total Maximum Daily Load (TMDL) for selenium in the North Platte River, which should be available in March 2013. In 2011, the NCCD submitted the North Platte River Watershed Project Implementation Plan – Segment I proposal to the WDEQ to restore designated uses on the North Platte River and its tributaries by 2024, through implementing the recommended Best Management Practices from the North Platte River Selenium TMDL. The objectives of the Segment I project include implementing BMPs on irrigated and non-irrigated lands upstream of and adjacent to the City of Casper to achieve selenium reductions and other objectives. The Segment I project is described in more detail in a memorandum from RESPEC, the consultant working for the NCCD, provided in Appendix E. The memorandum includes a map of the Segment 1 project area, which includes the Emigrant Gap Draw watershed. The other watersheds within the City of Casper addressed by this plan are not included in the Segment 1 plan.

Once this TMDL is implemented, the Casper's NOI and SWMP need to be reviewed and modified, if necessary, to meet any applicable requirements of the TMDL allocation.

Also in 2011, the NCCD requested the Wyoming Water Development Commission to conduct a comprehensive study of the Middle North Platte Watershed and its land and water resources. The NCCD requested the study to evaluate watershed function, and the condition of wetlands and riparian areas; to develop a geomorphic classification; and to identify needs and opportunities on irrigated lands, rangelands, wetlands, and streams. The study will provide baseline information

for the NCCD to pursue implementation of management practices that can address natural resource issues within the study area. This project is scheduled for completion in June 2013.

The Middle North Platte Watershed covers approximately 2,112 square miles, and includes the communities of Casper, Alcova, Bar Nunn, Evansville, and Mills. The watershed includes one primary river system, the North Platte River, and the Bates Creek, Casper Creek, Garden Creek, Elkhorn Creek, Iron Creek, Poison Spider Creek, Stinking Creek, and Willow Creek tributaries, which overlaps the study area of the Casper SWMMP. A summary of this project is provided in a memo dated January 3, 2013, from RESPEC, the consulting firm working for the NCCD, and is also included in Appendix E.

The most effective ways to reduce selenium concentrations in stormwater runoff are to limit the exposure of soils that contain selenium to flowing water. Therefore, effective implementation of erosion and sediment control BMPs during and after construction, and stabilization of open channels and drainageways within the City of Casper are key elements of a stormwater quality plan. The City has design criteria and standards for these BMPs in place in the SMDM and the City of Casper Erosion and Sediment Control Best Management Practices Manual. A stormwater ordinance provides enforcement authority to the City of Casper. Continued effective implementation of temporary and permanent erosion and sediment control BMPs is the most direct means to address stormwater quality in Casper.

7.7 OPERATION AND MAINTENANCE

The City currently performs routine maintenance for detention ponds and some open channels that includes debris removal, mowing, and channel stability issues as they arise. The City also provides routine maintenance on City owned storm sewer systems and those within WYDOT right-of-way, and periodically removes sediment from the inlets and storm sewer systems. Regular street sweeping is also performed by the City, which benefits the storm drain system and stormwater quality.

Operations and maintenance costs have not been specifically estimated for the improvements proposed in this plan, and there are no specific recommendations to increase or enhance the current level of service. In general, there will be additional costs for maintenance of large detention facilities as they are built and put into operation, which will be at least partially off-set by savings in repair costs for damage to channels and structures caused by flooding.

SECTION EIGHT

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