

6.0 CAPITAL IMPROVEMENT PLAN

6.1 CAPITAL IMPROVEMENT PROJECTS AND OPERATIONAL CHANGES

Evaluations were completed to determine the overall solution that reduces flooding for the design criteria. When an operational change could be used to control flows through spills, operational changes were selected as the best alternative to reduce costs. Adjustments to spill capacity were also high on the list of selected alternatives. Next, capital improvements in the form of pipes, channels, and detention areas were evaluated. Since the City has voiced concerns about the availability of land for detention, this was considered as the last alternative.

The recommendations presented in this report will continue to evolve with each phase of implementation, and the model should be reviewed in the early stages of predesign for each improvement to determine how the proposed project will have an effect on the rest of the system. One example would be fixing conveyance upstream which causes increased flooding downstream because downstream improvements have not yet been completed. Whenever possible, it is best to start with the most downstream improvements and work upstream.

The models created for this study were regionally calibrated to evaluate the overall functionality of the system and to determine the alignments to improve overall system drainage. Predesign for each project should include:

- An investigation of local boundary conditions including a reevaluation with the model.
- There are several adverse grades in the system, before any final design is completed, these should be verified. If the adverse grades do not actually exist, remodel the area to determine if still exists, or if the flooding has moved up- or downstream.
- All new pipe is assumed to have a roughness of concrete, if corrugated pipes are installed, the capacity needs to be matched to the modeled assumption.
- Parallel pipes could always be installed as an alternative to upsizing.
- 3 feet of cover was included in improvements with a few exceptions. Some pipe segments will not need to be upsized if less cover is provided. However special pipe materials and backfill materials are needed for cover less than 3 feet.
- Rectangular pipe was used in areas with little cover available and for links needing a large capacity. Other pipe shapes may be used if special backfill is used with sufficient structural capacity. Parallel circular or squash pipes could also replace a singular rectangular pipe if the City desires.
- Pipe bursting could be used in some locations to save money and minimize impacts to the existing ground cover, the cost estimates here assume open trench costs to provide a more conservative cost estimate.
- The cost estimates assume that all pipe will be replaced, some pipes only need to be regraded, so where possible, the pipe could be salvaged and reused to save money.

- The City should coordinate with the County and GPID to prevent flows upstream of the City from escaping the South Highline canal and overloading the stormwater network.

The following paragraphs list each improvement in more detail. A visual representation of these can be referenced in Figures 11A through 11D, and prioritization can be referenced in Figures 12A through 12D in Appendix A. The colors correspond to the colors shown in Figures 11A through 11D in Appendix A for easy reference.

6.1.1 Method of Prioritization

Figures 12A through 12D in Appendix A show project prioritization for the capital improvements. The following prioritization criteria were used to determine the order of improvements.

Priority 1:

- 1A - reduces flooding from frequent flooding areas with high potential risk (generally residential 2-year storm)
- 1B - reduces flooding from highest risk areas that experiences flooding in a 2-year or 5-year event (generally areas of existing commercial development)

Priority 2:

- 2A - reduces flooding from residential areas during a 5-year event
- 2B - reduces flooding from commercial areas during a 10-year event

Priority 3:

- 3A - reduces flooding from residential 25 year storm
- 3B - reduces flooding from commercial 25-year storm
- 3C - reduces flooding in field/park from 5-year event

Priority 4: reduces all other flooding caused by the 25-year event

6.1.2 Allen-Fruitdale Recommended Improvements and Operational Changes

Project AF-1: Golf Course		
<i>priority: 1A</i>		<i>cost: \$371,000</i>
<i>related problem area(s): Z</i>	<i>prerequisites: none</i>	<i>basin: Allen</i>

This improvement consists of regrading and upsizing the pipe in Arroyo Drive to 27-inch and the pipes connecting Arroyo to the creek to 30-inch.

Project AF-2: South Highline Canal near Allen Creek		
<i>priority: 1A</i>		<i>cost: \$1,211,000</i>
<i>related problem area(s): K</i>	<i>prerequisites: none</i>	<i>basin: Allen</i>

This improvement consists of regrading and piping the canal with a 54-inch pipe between Wagon Wheel Drive and the creek. Catch basins should be added to collect flows currently accepted by channel. The concrete should be added to the bottom and sides of the channel under the bridge immediately upstream of this section to increase flow capacity.

Project AF-3: Harbeck Road, Nebraska Avenue

<i>priority:1A</i>	<i>cost: \$200,000</i>
<i>related problem area(s): M</i>	<i>prerequisites: none</i>
	<i>basin: Allen</i>

This improvement consists of upsizing and regrading the pipe from Nebraska Avenue to the creek to 36-inch and upsizing the pipe in Nebraska Avenue from Princeton Place to the next manhole downstream.

Project AF-4: Pond Near Calvary Chapel off Harbeck Road

<i>priority:1A</i>	<i>cost: \$629,000</i>
<i>related problem area(s): Y</i>	<i>prerequisites: AF-7, AF-15,AF-16</i>
	<i>basin: Allen</i>

This improvement consists of converting the existing slough upstream of the canal in the vicinity of Calvary Chapel to a detention pond, and add an outfall structure to control flow.

Project AF-5: Grandview Avenue and the Hospital

<i>priority:1A</i>	<i>cost: \$611,000</i>
<i>related problem area(s): V</i>	<i>prerequisites: none</i>
	<i>basin: Allen</i>

This improvement consists of regrading the pipe that connects the manhole in Ringuette Street and Grandview Avenue to the open ditch to allow more flow through. The pipe downstream of the open ditch on Grandview Avenue should be upsized to 30-inch and regraded to connect in with the existing line on Ramsey Avenue. A new 24' canal spill should be constructed downstream of this connection through the hospital.

Project AF-6: West Park Street, Josephine County Yard, Tussing Park

<i>priority:1B</i>	<i>cost: \$407,000</i>
<i>related problem area(s): L,U</i>	<i>prerequisites: none</i>
	<i>basin: Allen</i>

This improvement consists of connecting the siphon in the county yard in a continually descending 36-inch pipe, which will intersect the existing pipe at the bottom of the hill before the park. The outfall in Tussing Park should be upsized to 30-inch. The pipe along West Park Street should be upsized to 21-inch between Plummer Street and Short Street.

Project AF-7: Lower Parkdale Drive/Highway 199 Trunkline

<i>priority:1A</i>	<i>cost: \$1,590,000</i>
<i>related problem area(s): O</i>	<i>prerequisites: none</i>
	<i>basin: Allen</i>

This improvement consists of creating a 54-inch trunkline from Fruitdale Drive to Golden Park Drive along Parkdale Drive, and an 83-inch by 53-inch trunkline from Golden Park drive to the open channel. The open channel should be regraded to match in with the proposed pipes.

Project AF-8: Haviland Drive and Grandview Avenue

<i>priority:3A</i>	<i>cost: \$3,000</i>
<i>related problem area(s): P</i>	<i>prerequisites: AF-7, AF-15</i>
	<i>basin: Fruitdale</i>

This improvement consists of widening the channel on Haviland Drive and tributary to the east to a 3-foot bottom. The canal wall in that area, just north of Grandview Avenue needs to be raised to maintain sufficient freeboard.

Project AF-9: Spill North of Harpazo Lane

<i>priority: 4</i>	<i>cost: \$280,000</i>
<i>related problem area(s): N,X</i>	<i>corequisites: AF-10</i>
	<i>basin: Fruitdale</i>

This improvement consists of creating a new 36-inch canal spill and pipe to creek north of the houses on Harpazo Lane.

Project AF-10: Canal spill East of UGB

<i>priority: 3A</i>	<i>cost: \$306,000</i>
<i>related problem area(s): N,X</i>	<i>corequisites: AF-9</i>
	<i>basin: Allen</i>

This improvement consists of a new 30-inch canal spill and pipe to river just outside the UGB to prevent flows from outside the City entering the system and causing problems.

Project AF-11: Sugar Beet Line, East Park Street

<i>priority: 1A</i>	<i>cost: \$1,330,000</i>
<i>related problem area(s): T</i>	<i>prerequisites: AF-17</i>
	<i>basin: Allen</i>

This improvement consists of rehabilitating the old sugar beet line, since it has an unknown number of connections, and regrading and upsizing the line in East Park Street to 21-inch.

Project AF-12: Sunset Way and Tributary Pipes

<i>priority: 1A</i>	<i>cost: \$2,226,000</i>
<i>related problem area(s): O,T</i>	<i>prerequisites: AF-7</i>
	<i>basin: Allen</i>

This improvement consists of changing the direction of flow along Sunset Way to the East by adding a flow diversion structure at Maple Lane and upsizing and regrading the pipe from Maple Lane to Playford Lane to 36-inch; from Playford Lane to where the Tobin Lane line connects in to Sunset Way to 42-inch; and adding a 48-inch line connecting where the Tobin Lane line connects in to Sunset Way until Parkdale Drive. In addition, the line from Tobin Court to Sunset Way should be upsized to 18-inch and regraded. The line in Playford Lane should be upsized to 15-inch from the southern end to the railroad tracks, and 24-inch from the railroad tracks to Sunset Way.

Project AF-13: Harbeck Road and Southridge Way

<i>priority: 1A</i>	<i>cost: \$1,082,000</i>
<i>related problem area(s): S,V</i>	<i>prerequisites: AF-5</i>
	<i>basin: Allen</i>

This improvement regrades and upsizes the pipes along Harbeck Road shown in the following table, and Southridge Way is regraded and upsized to 21-inch. The concrete plug currently at the corner of Grandview Avenue and Harbeck Road should be removed to allow flow to the north. The pipe flowing west from that intersection needs to be regraded.

From	To	Size
Grandview Avenue	Southridge Way	24-inch
Southridge Way	North of Hilltop Drive	30-inch
North of Hilltop Drive	South Main Canal	33-inch

Project AF-14: Highway 238

<i>priority: 1A</i>		<i>cost: \$661,000</i>
<i>related problem area(s): V</i>	<i>prerequisites: AF-5,AF-13</i>	<i>basin: Allen</i>

This improvement consists of upsizing the pipe along Highway 238 to 15-inch from Liberty Drive to Grandview Avenue., and upsizing the line off highway 238 that runs from Harbeck Village to Subway to 15-inch, and from subway to the highway to 18-inch.

Project AF-15: Main Gravity Canal Spills and Central Parkdale Drive Trunkline

<i>priority:1A</i>		<i>cost: \$889,000</i>
<i>related problem area(s): O</i>	<i>prerequisites: AF-7</i>	<i>basin: Allen</i>

This improvement consists of upsizing and regrading to a 54-inch trunkline on Fruitdale Drive between Parkdale and Gaffney Way; constructing a canal spill, and 42-inch trunkline along Gaffney Way from the Main Gravity Canal to Fruitdale Drive; regrading the channel along Fruitdale Drive from Gardendale Lane to Cloverlawn Drive; adding a new canal spill on Drury Lane to connect to the 2014 improvements; and upsizing and regrading the line on Idle Court to 21-inch.

Project AF-16: Upper Parkdale Drive Trunkline and South Highland Canal Spill

<i>priority: 1A</i>		<i>cost: \$601,000</i>
<i>related problem area(s): O,Q</i>	<i>prerequisites: AF-7, AF15</i>	<i>basin: Allen</i>

This improvement consists of constructing a new canal spill on the South Highland Canal including a new 21-inch pipe from the canal to the location of the existing pipe on Gaffney Way, just north of Jeffery Court, then upsizing and regrading the pipe on Gaffney Way from just north of Jeffery Court to Grandview Avenue to 30-inch, and then upsizing and regrading From Grandview Avenue to underneath the main gravity canal to connect into the next segment of the trunkline.

Project AF-17: Highways 238/199/99 Intersection Detention

<i>priority: 1A</i>		<i>cost: \$959,000</i>
<i>related problem area(s): T</i>	<i>prerequisites: AF-11</i>	<i>basin: Allen</i>

This improvement consists of constructing two detention facilities: one 0.77 acre--foot facility on the southeast corner of Highway 99 and Highway 199, and one 5.24 acre--foot facility on the southwest corner of Highway 199 and Highway 238.

Project AF-18: Union Avenue

<i>priority: 1A</i>		<i>cost: \$646,000</i>
<i>related problem area(s): V</i>	<i>prerequisites: none</i>	<i>basin: Allen</i>

This improvement consists of upsizing the pipe along Union Avenue from the beginning of the line to the Eastern edge of the hospital buildings to 21-inch and regrading the farthest east segment.

Project AF-19: Meadow Glen

<i>priority:1A</i>		<i>cost: \$236,000</i>
<i>related problem area(s): W</i>	<i>prerequisites: AF-5</i>	<i>basin: Allen</i>

This improvement consists of upsizing the pipes from Meadow Glen and Lark Ellen Way to the Main Gravity Canal to 21-inch.

Project AF-20: Liberty Drive

<i>priority:1A</i>	<i>cost: \$473,000</i>
<i>related problem area(s): V</i>	<i>prerequisites: AF-5, AF-13</i>
	<i>basin: Allen</i>

This improvement consists of regrading and upsizing pipes on Liberty Drive and the connection to Grandview Avenue to 27-inch.

6.1.3 Gilbert Recommended Improvements and Operational Changes

Project G-1: 5th Street, 6th Street

<i>priority:1A</i>	<i>cost: \$1,656,000</i>
<i>related problem area(s): AB, AT</i>	<i>prerequisites: none</i>
	<i>basin: Gilbert</i>

This improvement upsizes the pipes along 5th Street shown in the following table, and upsizing the outfall on 6th Street to 18-inch.

From	To	Size
South of G Street	H Street	18-inch
H Street	South of J Street	24-inch
South of J Street	South of L Street	27-inch
South of L Street	M Street	30-inch
M Street	River	36-inch

Project G-2: 9th Street

<i>priority:2A</i>	<i>cost: \$457,000</i>
<i>related problem area(s): AA</i>	<i>prerequisites: none</i>
	<i>basin: Gilbert</i>

This improvement consists of upsizing the line down 9th Street from I Street to L Street to 18-inch and from L Street to M Street to 21-inch.

Project G-3: G Street, I Street, Alder Street, L Street

<i>priority:1A</i>	<i>cost: \$795,000</i>
<i>related problem area(s): AC</i>	<i>prerequisites: none</i>
	<i>basin: Gilbert</i>

This improvement consists of upsizing the most upstream pipe in the model on G Street to 15-inch, regrading the pipe on I Street, upsizing to a 2-foot by 2-foot box pipe and regrading along Alder from I Street to K Street, and upsizing and regrading the pipe on L Street to 30-inch.

Project G-4: Demoray Canal Spills- Southwest

<i>priority:1A</i>	<i>cost: \$127,000</i>
<i>related problem area(s): AF, AH</i>	<i>prerequisites: none</i>
	<i>basin: Gilbert</i>

This improvement consists of several related parts. The first is to open the Copeland spill in winter. The second is to adjust the spill on Valley View Drive and Highland Ave so that the flow is directed east to Gilbert Creek. The channel upstream of Valley View Drive should be expanded to a 6-foot bottom, and regraded. The channel berms should be restored to an elevation that maintains adequate freeboard in the canal. The spill to Gilbert Creek near Buddy Lane needs to be expanded.

Project G-5: Demoray Canal Spills- Central West

<i>priority:1A</i>	<i>cost: \$29,000</i>
<i>related problem area(s): AH</i>	<i>prerequisites:G-4</i> <i>basin: Gilbert</i>

This improvement consists of installing a new 12-inch spill to the existing large ravine. The downstream siphon should be closed off in winter to avoid the entry of debris from carried by runoff.

Project G-6: Hilcrest Drive, 6th Street, 7th Street

<i>priority:1A</i>	<i>cost: \$1,664,000</i>
<i>related problem area(s): AE</i>	<i>prerequisites: none</i> <i>basin: Gilbert</i>

This improvement consists of upsizing and regrading the line along Hilcrest from 6th Street to Hawthorne Ave, upsizing and regrading the 6th Street crossing to 42-inch, upsizing and regrading the line north along 7th Street to 27-inch, upsizing the segment just downstream of the 'Y' on 7th Street to 21-inch, and adjusting the pond outfall behind the trailer park by adding an additional 24-inch outlet pipe.

Project G-7: Demoray Spill-South East

<i>priority:1A</i>	<i>cost: \$106,000</i>
<i>related problem area(s): AG</i>	<i>prerequisites: none</i> <i>basin: Gilbert</i>

This project consists of improvements to the spill northeast of Greenfield Road on the Demoray Canal. The pipe and channel immediately downstream of the spill need to be regraded to match in with the next pipe segment which should be upsized to a 2-foot by 3-foot. regraded rectangular pipe. The segment of the line that faces flows west needs to be upsized to a 2-foot bottom natural channel and regraded.

Project G-8: Demoray Canal Spills- North Central

<i>priority:1A</i>	<i>cost: \$810,000</i>
<i>related problem area(s): AD, AG</i>	<i>corequisites: G-10</i> <i>basin: Gilbert</i>

This improvement consists of expanding and regrading the section of the canal shown in the figures, but north of Scenic Drive to the Gilbert Creek Spill to 30-inch, modifying the spill, and continuing the 30-inch pipe south which will take the place of the existing small irrigation detention and shallow brick channel until it intersects the channel from the trailer park. South of the trailer park, the channel should be widened to an 8-foot bottom and a 12-foot top, regraded, and lined with concrete. The culvert sizes are unknown at this time, but should be evaluated to see if they have sufficient capacity. The cost estimates include a 54-inch culvert.

Project G-9: Demoray Canal Spills- Northwest

<i>priority:1A</i>	<i>cost: \$460,000</i>
<i>related problem area(s): AD, AI</i>	<i>prerequisites: G-8</i> <i>basin: Gilbert</i>

This improvement raises the channel bank elevations on the Demoray canal between the pedestrian entrance to Highland Heights Estates and the southern portion of Wightwood Circle. A new 24-inch pipe should be installed parallel to the existing channel and culverts through highland heights Estates. The most downstream section of channel in Highland Heights Estates should be regraded and the bank should be raised to get sufficient freeboard. The highland avenue crossing at approximately 2555 Highland Avenue should be upsized to a 1-foot by 1-foot box pipe. The pipe segments on Highland Avenue, upstream and downstream of 2555

Highland Avenue should be upsized to 24-inch. The section from approximately Creekside Circle to the open ditch to the south should be upsized to 36-inch.

Project G-10: Demoray Canal Spills- Northeast		
<i>priority:</i> 1A		<i>cost:</i> \$438,000
<i>related problem area(s):</i> AG	<i>corequisites:</i> G-8	<i>basin:</i> Gilbert

This improvement consists of expanding the East Gilbert Creek spill to a 25-foot wide opening, and regrading and increasing the channel upstream to 8 to 12-foot bottom, and raise bank elevations to get sufficient freeboard.

6.1.4 Sand Recommended Improvements and Operational Changes

Project S-1: Trunkline from South Main Canal to River along Dowell Road		
<i>priority:</i> 1A		<i>cost:</i> \$3,412,000
<i>related problem area(s):</i> V	<i>prerequisites:</i>	<i>basin:</i> Sand

This improvement creates a trunkline from the South Main Canal to the River along Dowell Road. Currently there is a canal spill on either side of Dowell Road, draining to different lines. The spill on the East side should be closed for the winter as the pipes downstream are too small to handle the large flows entering. The spill on the West side of Dowell Road should be expanded to 48-inch. The pipes should be expanded to 48-inch from the spill until Redwood Avenue. From Redwood Avenue to the northern end of the trailer park, the pipe should be upsized to 60-inch. The pipe needs to maintain sufficient slope and cover throughout the line, so the entire line was regraded. The channel that connects the pipe to the river needs to be regraded to connect in with the pipe.

Project S-2: Flow-split Kellenback Avenue to Dowell Road		
<i>priority:</i> 1A		<i>cost:</i> \$691,000
<i>related problem area(s):</i> AL, AM	<i>prerequisites:</i> S-2, S-6, S-7, S-8	<i>basin:</i> Sand

The pipe segment just north of Shane Way needs to be upsized to 18-inch. The pipes in Sun Glo Drive need to be upsized to 21-inch, and the pipe in Redwood Avenue needs to be upsized to 30-inch. To minimize improvements, a flow split was created at the corner of Kellenback Avenue and Shane Way. This redirects flow upstream (south) of Kellenback Avenue along Shane Way to Claudia Way to Mendi Way to eventually join in with Sun Glo Drive improvements. There are existing un modeled pipes along some of these lines. These pipes should be analyzed further to determine if they should connect to these improvements, or if new catch basins and associated piping should be installed.

Project S-3: Expansion of South Main Canal		
<i>priority:</i> 1A		<i>cost:</i> \$583,000
<i>related problem area(s):</i> AK	<i>prerequisites:</i> S-1	<i>basin:</i> Sand

This improvement consists of expanding the channel and raising the channel berms to meet the design criteria with acceptable freeboard. The extents of this project are the canal from just west of the pond near Schutzwahl Lane until Dowell Road where it crosses Redwood Highway. In addition to channel expansion, an identical rectangular box pipe should be installed in parallel with the existing box, in the middle of a field in the middle of the improvement. The farthest west segment of the improvement should be transitioned into a 3-foot by 6-foot rectangular pipe.

Project S-4: Redwood Circle to River

<i>priority: 1B</i>		<i>cost: \$650,000</i>
<i>related problem area(s): AJ</i>	<i>prerequisites: none</i>	<i>basin: Sand</i>

Upsize pipes in Redwood Circle to 24-inch. Upsize pipe east-west pipe segment partially on Molly Lane to 27-inch and regrade to get sufficient cover and capacity. Regrade the pipe downstream of Molly Lane. If it isn't possible to reuse the existing pipe at a different slope, a circular or rectangular pipe with the same capacity as the existing pipe can be used to reduce costs of purchasing a new arch pipe. The cost includes purchase of a new arch pipe. This pipe needs special backfill under the gravel road since it cannot get sufficient cover without replacing more pipes.

Project S-5: Mesman Drive to River

<i>priority: 3A</i>		<i>cost: \$240,000</i>
<i>related problem area(s): AV</i>	<i>prerequisites:</i>	<i>basin: Sand</i>

This improvement consists of upsizing the pipe from the northern end of Mesman Drive to the river outfall to 36-inch.

Project S-6: Leonard Road to Ditch

<i>priority: 3A</i>		<i>cost: \$926,000</i>
<i>related problem area(s): AN, AU</i>	<i>prerequisites: none</i>	<i>basin: Sand</i>

This improvement expands capacity for problem area AU, and also matches in, and/or prepares for other improvements. The pipes south of Leonard Road should be upsized to 27-inch. The pipes crossing Leonard should now be three parallel 36-inch pipes. The channel section north of Leonard to the river should be regraded to match new upstream pipes, and the proposed elevation of pipes in S-7.

Project S-7: Willow Lane to Ditch

<i>priority: 1A</i>		<i>cost: \$975,000</i>
<i>related problem area(s): AN</i>	<i>prerequisites: S-6</i>	<i>basin: Sand</i>

This project consists of replacing the pipeline from the manhole south of Blue Spruce Lane along Willow Lane until the last pipe segment. The last pipe segment should be upsized to two 48-inch pipes. The entire line should be regraded, including the channel downstream to tie into the new pipes, as well as project S-6.

Project S-8: Willow Court, Estates Lane

<i>priority: 1A</i>		<i>cost: \$696,000</i>
<i>related problem area(s): AM, AN</i>	<i>prerequisites: S-6, S-7</i>	<i>basin: Sand</i>

This improvement consists of upsizing the most upstream segment on Willow Court to 24-inch, and the rest of Willow Court to 27-inch. Estates Lane should be upsized to 30-inch. The upstream end of the project consists of a new flow diversion to reduce flow to the east, and prevent the brand new pipes along Redwood Avenue from being replaced.

Project S-9: George Tweed Boulevard and Spurs

<i>priority:3A</i>	<i>cost: \$464,000</i>
<i>related problem area(s): AQ</i>	<i>prerequisites: S-10, S-11, S-16</i> <i>basin: Sand</i>

This improvement increases the pipe size on George Tweed Boulevard to 18-inch north of Redwood Avenue, for two pipe segments, and regrading. The section of George Tweed Boulevard between Eastwood Lane and the improvements completed in 2014 should be upsized to 21-inch. A special backfill will be needed to match into the newly constructed project, since it does not have 3 feet of cover. Along Eastwood Lane, the pipes need to be regraded and the one immediately adjacent to George Tweed Boulevard needs to be upsized to 21-inch.

Project S-10: Kokanee Lane, Leonard Road

<i>priority:1A</i>	<i>cost: \$1,613,000</i>
<i>related problem area(s): AQ, AR</i>	<i>prerequisites: S-16</i> <i>basin: Sand</i>

This improvement begins at Kokanee Lane and Redwood Avenue with a new flow split diverting some flows north along Kokanee Lane in an 18-inch line up to the second existing manhole. The next segment should be upsized to 24-inch, followed by a 30-inch for the next segment, and a 36-inch for the segment up to Leonard Road. Leonard Road should be increase to 36-inch to the west side of Darnelle Lane, where it is upsized to 42-inch to cross the street and join in with the existing line to the north.

Project S-11: Pond South of Redwood Highway

<i>priority:3A</i>	<i>cost: \$72,000</i>
<i>related problem area(s): AQ</i>	<i>prerequisites: S-16</i> <i>basin: Sand</i>

This improvement upsizes the pipe crossing Darnelle Lane, north of Redwood Avenue, to 42-inch. This line was replaced in 2014, but it is still undersized to meet the design criteria.

Project S-12: Rainwood Lane to Leonard Road

<i>priority:1A</i>	<i>cost: \$141,000</i>
<i>related problem area(s): AO</i>	<i>prerequisites: none</i> <i>basin: Sand</i>

This improvement consists of upsizing and regrading the pipe from Rainwood Lane to Leonard Road to 24-inch.

Project S-13: ODOT Pond South of Redwood Highway

<i>priority:1A</i>	<i>cost: \$1,353,000</i>
<i>related problem area(s): AK</i>	<i>prerequisites: S-1</i> <i>basin: Sand</i>

This improvement consists of modifying the outlet structure of the ODOT pond south of Redwood Highway to direct flow east, toward the proposed new canal spill through a 42-inch pipe.

Project S-14: New Flow Diversion to Sand Creek at Redwood Hwy

<i>priority:1A</i>	<i>cost: \$167,554</i>
<i>related problem area(s): AP</i>	<i>prerequisites: none</i> <i>basin: Sand</i>

This improvement redirects upland flow directly to the Sand Creek. The Summerfield Estates neighborhood ponds were only designed to hold the flow from that neighborhood, but they currently take on large flows from the upland areas. In order to reduce flooding in this area it is recommended the increase the outlet size of the pond south of the Redwood Highway to 18-

inch, tie in with the existing catch basin on the south side of the highway, and divert the flows through an open channel to the creek. The highway crossing should be blocked off to avoid overloading the Summerfield Estates ponds.

Project S-15: Yellowtail Lane to Mary Lynn Lane		
<i>priority:1A</i>		<i>cost: \$392,000</i>
<i>related problem area(s): AR</i>	<i>prerequisites: S-10, S-16</i>	<i>basin: Sand</i>

This project regrades and upsizes the pipe in Yellowtail Lane to 18-inch, the pipe on Sturgeon Court to 24-inch, and upsizes the pipe connecting Sturgeon Court to the pond to 24-inch. The pipe connecting Mary Lynn Lane to Kokanee Lane should be upsized to 24-inch and regraded.

Project S-16: Darnelle Lane		
<i>priority:1A</i>		<i>cost: \$1,138,000</i>
<i>related problem area(s): AQ, AR</i>	<i>prerequisites: none</i>	<i>basin: Sand</i>

This improvement upsizes and regrades the pipe on Darnell Lane, from one manhole south of Coffman Lane to South River Road, to two parallel 42-inch pipes.

6.1.5 Skunk-Jones Recommended Improvements and Operational Changes

Project SJ-1: F Street		
<i>priority:1B</i>		<i>cost: \$1,829,000</i>
<i>related problem area(s): E,F</i>	<i>prerequisites: SJ-3, SJ-11, SJ-13</i>	<i>basin: Skunk</i>

This improvement consists of upsizing the two pipe segments behind Walmart along F Street to 33-inch and regrading. The next segment downstream should be replaced with a smooth pipe and regraded. The remaining pipes up to Beacon Drive should be upsized to 42-inch and regraded. Continuing south on Beacon, the next segment should be upsized to 42-inch, and the next segment should be regraded to match other proposed improvements. The line continuing west beside the railroad tracks should be converted to an overflow pipe, with a new diversion structure that will send the majority of the flows south through other proposed improvements.

Another portion of this improvement is a new flow division structure and 24-inch spill pipe along Agness Avenue from F Street to the existing line. A new 24-inch overflow pipe should be installed on the eastern end of F, connecting the end of the upstream end of the line to the creek.

Project SJ-2: D Street		
<i>priority:2B</i>		<i>cost: \$2,181,000</i>
<i>related problem area(s): I</i>	<i>prerequisites: SJ-1, SJ-3, SJ-13</i>	<i>basin: Skunk</i>

The pipe from Royal Drive to Sovereign Avenue along D Street should be upsized to 18-inch and regraded. The segment from Sovereign Avenue to Beacon Drive should be upsized to 21-inch. The pipe from Beacon Drive to the line coming in from the north west of 12th Street should be upsized to 30-inch. The line connecting D Street and F Street should be upsized to a 60-inch by 38-inch squash pipe. The line northeast of D Street and Anderson Street should be upsized to 24-inch and regraded. The line northwest of D Street and Anderson Street should be upsized to 18-inch and regraded. The line between these two lines should be upsized to 30-inch and regraded. The pipe immediately downstream of D Street should be upsized to 30-inch and

regraded. The next two segments of pipe should be regraded. The last segment that connect in with the new squash pipe should be upsized to 36-inch and regraded.

Project SJ-3: A Street - East

<i>priority:3B</i>		<i>cost: \$526,000</i>
<i>related problem area(s): E,F,I</i>	<i>prerequisites: S-13</i>	<i>basin: Skunk & Jones</i>

This improvement consists of a new 15-inch pipe and flow split at the existing pipe near 10th Street and A Street leading to the new flow split near 9th Street and A Street.

Project SJ-4: Madrone Street

<i>priority:3B</i>		<i>cost: \$631,000</i>
<i>related problem area(s): B</i>	<i>prerequisites: SJ-1, SJ-13</i>	<i>basin: Skunk</i>

This improvement connects the canal to the existing 48-inch under-utilized line in 9th Street through a flow diversion structure and a 2-foot by 3-foot box pipe.

Project SJ-5: Tokay Canal from Savage Street to Dewey Drive

<i>priority:3A</i>		<i>cost: \$236,000</i>
<i>related problem area(s): J</i>	<i>prerequisites: none</i>	<i>basin: Skunk</i>

This improvement consists of adding a channel parallel to the existing pipes from the incoming channel to the Northeast to Savage Street to change flow direction and allow the spill at Savage to be better utilized. The segment going east-west out of 10th Street needs to be regraded.

Project SJ-6: Dewey Drive to 6th Street

<i>priority:3C</i>		<i>cost: \$795,000</i>
<i>related problem area(s): A</i>	<i>prerequisites: none</i>	<i>basin: Skunk</i>

This improvement consists of increasing the channel size between the ponds that are south of Dewey Drive, installing a new outfall structure and regrading and replacing pipes downstream to 7th Street with smooth pipes. The pipe crossing 7th Street should be upsized to a single 30-inch line. The pipes and channel in between 6th and 7th Street should be regraded to match in with improvements.

Project SJ-7: Demoray Canal

<i>priority:2A</i>		<i>cost: \$61,000</i>
<i>related problem area(s): C</i>	<i>prerequisites: none</i>	<i>basin: Skunk</i>

This improvement consists of expanding the channel cross section and creating a uniform slope in the areas shown on Figure 11D west of Beacon Drive. It also regrades part of the channel downstream of the expanded section, and expands the spill capacity by regrading the first two channel sections and increasing the first culvert size to 21-inch.

Project SJ-8: Spill Northwest of I-5 and Hilcrest Drive to 7th Street

<i>priority:1B</i>		<i>cost: \$386,000</i>
<i>related problem area(s): H</i>	<i>prerequisites: SJ-7</i>	<i>basin: Skunk</i>

This project consists of surveying the spill northwest of I-5 and Hilcrest Drive all the way to Hilcrest Drive. During field investigations the spill was completely inundated with blackberries, so it could not be accessed, so the best available records were used to determine what was

there. After a survey, the model should be reassessed to determine what, if any, changes would improve spill.

The pipe downstream crossing Hilcrest Drive should be upsized to a 21-inch pipe and regraded. The next segment down hillcrest Drive to the west, should be upsized to 21-inch, followed by two segments continuing west, then North, should be upsized to 27-inch.

Project SJ-9: Rose Lane to River		
<i>priority:3A</i>		<i>cost: \$212,000</i>
<i>related problem area(s): D</i>	<i>prerequisites: none</i>	<i>basin: Skunk</i>

This improvement consists of upsizing all modeled lines in this street to the river to 21-inch.

Project SJ-10: Channel Northwest of Dewey Drive and 10 th Street		
<i>priority:1A</i>		<i>cost: \$3,000</i>
<i>related problem area(s): G</i>	<i>prerequisites: none</i>	<i>basin: Skunk</i>

The channel northwest of Dewey Drive and 10th Street, needs to be upsized and regraded.

Project SJ-11: Rogue Drive Trunkline		
<i>priority:1B</i>		<i>cost: \$2,938,000</i>
<i>related problem area(s): E,F</i>	<i>prerequisites: SJ-3,SJ-13</i>	<i>basin: Skunk</i>

This improvement consists of a new pipe and flow diversion structure from F Street, encouraging the flow to continue down a new 48-inch pipe crossing under the rail yard and connects to the existing line on M Street with another flow diversion structure diverting flow to the south. The flow continues down to connect to Rogue Drive through a new 48-inch pipe. The pipe along Rogue Drive needs to be upsized to 54-inch until the outfall segment. The outfall segment can be 48-inch due to the steep slope.

Project SJ-12: M Street		
<i>priority:1B</i>		<i>cost: \$759,000</i>
<i>related problem area(s): E</i>	<i>prerequisites: SJ-1, SJ-3, SJ-11, SJ-13</i>	<i>basin: Skunk</i>

This improvement consists of upsizing the two pipe segments starting east from M Street and Highway 199, including the highway crossing to 30-inch. The pipe segment on M Street immediately west of Milbank Street needs to be upsized to 24-inch.

Project SJ-13: A Street-West		
<i>priority:1B</i>		<i>cost: \$1,126,000</i>
<i>related problem area(s): B,E,F,I</i>	<i>prerequisites: none</i>	<i>basin: Skunk</i>

This improvement creates a flow split near 9th Street and A Street that diverts flows through a new 3-foot by 5-foot box pipe to the creek.

6.2 COSTS

A summary of the recommended improvements organized by priority is presented in the following table. The costs presented in Table 6-1 represent all the respective priority improvements regardless of jurisdiction.

Table 6-1: Priority 1A Improvements

ID#	Priority	Item	Total Estimated Cost (2015)
Priority 1A Improvements (0-15 years)			
<i>Allen Fruitdale</i>			
AF-1	1A	Golf Course	\$ 371,000
AF-2	1A	South Highline Canal near Allen Creek	\$ 1,211,000
AF-3	1A	Harbeck Road, Nebraska Avenue	\$ 200,000
AF-4	1A	Pond Near Calvary Chapel off Harbeck Road	\$ 629,000
AF-5	1A	Grandview Avenue and the Hospital	\$ 611,000
AF-7	1A	Lower Parkdale Drive/Highway 199 Trunkline	\$ 1,590,000
AF-11	1A	Sugar Beet Line, East Park Street	\$ 1,330,000
AF-12	1A	Sunset Way and Tributary Pipes	\$ 2,226,000
AF-13	1A	Harbeck Road and Southridge Way	\$ 1,082,000
AF-14	1A	Highway 238	\$ 661,000
AF-15	1A	Main Gravity Canal Spills and Central Parkdale Drive Trunkline	\$ 889,000
AF-16	1A	Upper Parkdale Drive Trunkline and South Highland Canal Spill	\$ 601,000
AF-17	1A	Highways 238/199/99 Intersection Detention	\$ 959,000
AF-18	1A	Union Avenue	\$ 646,000
AF-19	1A	Meadow Glen	\$ 236,000
AF-20	1A	Liberty Drive	\$ 473,000
<i>Gilbert</i>			
G-1	1A	5th Street, 6th Street	\$ 1,656,000
G-3	1A	G Street, I Street, Alder Street, L Street	\$ 795,000
G-4	1A	Demoray Canal Spills- Southwest	\$ 127,000
G-5	1A	Demoray Canal Spills- Central West	\$ 29,000
G-6	1A	Hilcrest Drive, 6th Street, 7th Street	\$ 1,664,000
G-7	1A	Demoray Spill-South East	\$ 106,000
G-8	1A	Demoray Canal Spills- North Central	\$ 810,000
G-9	1A	Demoray Canal Spills- Northwest	\$ 460,000
G-10	1A	Demoray Canal Spills- Northeast	\$ 438,000
<i>Sand</i>			
S-1	1A	Trunkline from South Main Canal to River along Dowell Road	\$ 3,412,000
S-2	1A	Flow-split Kellenback Avenue to Dowell Road	\$ 691,000
S-3	1A	Expansion of South Main Canal	\$ 583,000
S-6	1A	Leonard Road to Ditch	\$ 926,000
S-7	1A	Willow Lane to Ditch	\$ 975,000
S-8	1A	Willow Court, Estates Lane	\$ 696,000
S-10	1A	Kokanee Lane, Leonard Road	\$ 1,613,000
S-12	1A	Rainwood Lane to Leonard Road	\$ 141,000
S-13	1A	ODOT Pond South of Redwood Highway	\$ 1,353,000
S-14	1A	New Flow Diversion to Sand Creek at I-5	\$ 168,000
S-15	1A	Yellowtail Lane to Mary Lynn Lane	\$ 392,000
S-16	1A	Darnelle Lane	\$ 1,138,000
<i>Skunk Jones</i>			
SJ-10	1A	Channel Northwest of Dewey Drive and 10th Street	\$ 3,000
Total Priority 1A Improvements			\$ 31,891,000

Table 6-2: Priority 1B, 2A, & 2B Improvements

ID#	Priority	Item	Total Estimated Cost (2015)
Priority 1B Improvements (15-20 years)			
<i>Allen Fruitdale</i>			
AF-6	1B	West Park Street, Josephine County Yard, Tussing Park	\$ 407,000
<i>Sand</i>			
S-4	1B	Redwood Circle to River	\$ 650,000
<i>Skunk Jones</i>			
SJ-1	1B	F Street	\$ 1,829,000
SJ-8	1B	Spill Northwest of I-5 and Hilcrest Drive to 7th Street	\$ 386,000
SJ-11	1B	Rogue Drive Trunkline	\$ 2,938,000
SJ-12	1B	M Street	\$ 759,000
SJ-13	1B	A Street-West	\$ 1,126,000
Total Priority 1B Improvements			\$ 8,095,000
Priority 2A Improvements (20-25 years)			
<i>Gilbert</i>			
G-2	2A	9th Street	\$ 457,000
<i>Skunk Jones</i>			
SJ-7	2A	Demoray Canal	\$ 61,000
Total Priority 2A Improvements			\$ 518,000
Priority 2B Improvements (20-25 years)			
<i>Skunk Jones</i>			
SJ-2	2B	D Street	\$ 2,181,000
Total Priority 2B Improvements			\$ 2,181,000

Table 6-3: Priority 3A, 3B, 3C, & 4 Improvements

ID#	Priority	Item	Total Estimated Cost (2015)
Priority 3A Improvements (25-30 years)			
<i>Allen Fruitdale</i>			
AF-8	3A	Haviland Drive and Grandview Avenue	\$ 3,000
AF-10	3A	Canal spill East of UGB	\$ 306,000
<i>Sand</i>			
S-5	3A	Mesman Drive to River	\$ 240,000
S-9	3A	George Tweed Boulevard and Spurs	\$ 464,000
S-11	3A	Pond South of Redwood Highway	\$ 72,000
<i>Skunk Jones</i>			
SJ-5	3A	Tokay Canal from Savage Street to Dewey Drive	\$ 236,000
SJ-9	3A	Rose Lane to River	\$ 212,000
Total Priority 3A Improvements			\$ 1,533,000
Priority 3B Improvements (25-30 years)			
<i>Skunk Jones</i>			
SJ-3	3B	A Street - East	\$ 526,000
SJ-4	3B	Madrone Street	\$ 631,000
Total Priority 3B Improvements			\$ 1,157,000
Priority 3C Improvements (25-30 years)			
<i>Skunk Jones</i>			
SJ-6	3C	Dewey Drive to 6th Street	\$ 795,000
Total Priority 3C Improvements			\$ 795,000
Priority 4 Improvements (30-35years)			
<i>Allen Fruitdale</i>			
AF-9	4	Spill North of Harpazo Lane	\$ 280,000
Total Priority 4 Improvements			\$ 280,000
TOTAL STORMWATER IMPROVEMENTS COSTS (rounded)			\$ 46,450,000

* All costs in 2015 Dollars. Costs include contractor overhead and profit (OH&P; 15%), contingency (30%), engineering and construction management services (CMS; 20%), and legal, administrative, and permitting services (2%).

** Costs assume open cut construction. Alternative technologies (i.e. pipe bursting) should be explored during pre-design phase.

The cost estimate herein is concept level information only based on our perception of current conditions at the project location and its accuracy is subject to significant variation depending upon project definition and other factors. This estimate reflects our opinion of probable costs at this time and is subject to change as the project design matures. This cost opinion is in 2015 dollars and does not include escalation to time of actual construction. Keller Associates has no control over variances in the cost of labor, materials, equipment, services provided by others, contractor's methods of determining prices, competitive bidding or market conditions, practices or bidding strategies. Keller Associates cannot and does not warrant or guarantee that proposals, bids, or actual construction costs will not vary from the cost presented herein.

6.3 COORDINATION WITH OTHER JURISDICTIONS, ONE SYSTEM

The recommendations presented above were created as if the system was owned and operated by one single owner. This methodology provides the best overall recommendation with the system needs in mind, without regards to ownership or other political factors. Several owners including the City of Grants Pass, Josephine County, Grants Pass Irrigation District, and homeowner's associations own the stormwater infrastructure within the UGB. Coordination and cost sharing will be required among the parties to minimize potential flooding in the study area.