Drainage Project Feasibility

Addendum A
Improvement Alternative 5

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ADDENDUM A. IMPROVEMENT ALTERNATIVE 5

This addendum to the West Yuba City Master Drainage Study (prepared for the City of Yuba (City) by West Yost & Associates, March 2006) was developed to evaluate a fifth alternative drainage plan (Alternative 5) for the West Yuba City Area (WYCA) that would provide 100-year level of flood protection, but at a cost significantly lower than the previous alternatives.

Development in the WYCA could cause increased runoff rates and increased flooding above that which occurs under existing conditions. Improvements to the existing drainage system will be needed because of the increased runoff and the need for a higher level of flood protection. Future development results in the construction of homes, buildings, and other high value infrastructure in areas that are currently agricultural lands. Minor flooding of agricultural lands from relatively small storms has been acceptable because it has not caused significant damage. However, after development, flooding will no longer be acceptable, even from a 100-year storm. Consequently, several sets of improvements have been developed to provide flood protection throughout the WYCA in accordance with the planning criteria discussed in Chapter 3. For each set of improvements, the Live Oak Canal (LOC) will be enlarged to provide sufficient conveyance capacity, with 1 foot of freeboard, for a 100-year, 4-day storm.

FUTURE DEVELOPMENT AREAS & TRUNK DRAINS

The City of Yuba (City) provided several documents related to recent planned future development projects, including:

- North Township Road Area Master Plan (NTRAMP, July 1, 2008) – This document described a proposed storm drain system for the area north of Highway 20, south of Butte House Road, east of Township Road, and generally west of Western Parkway. Alternative 5 is consistent with this proposed drainage system, with the following two exceptions. First, the proposed 84-inch drain from Royo Ranchero Drive to the LOC was upsized from an 84-inch drain to a 96-inch drain. Second, the area south of the old railroad was not connected to the old railroad drain, and was instead drained to the LOC via a new 60-inch drain in Monroe Road (it is unclear from the NTRAMP if the Monroe Road drain is part of the proposed facilities or not). This drainage system will accept flow from the rural residential area northwest of the intersection of the Township Road and the old railroad.
- Draft Lincoln East Specific Plan – This document describes a proposed drainage system for the area north of Bogue Road, south of Franklin Road, East of George Washington Boulevard, and generally west of Sanborn Road. The proposed drainage system includes a north system with a 40.7 acre foot (ac-ft) detention basin and a 410 cubic feet per second (cfs) pump station. It also includes a south system with a 41.5 ac-ft detention basin and a 310 cfs pump station. None of these facilities were included in Alternative 5 because the improvements proposed in Alternative 5 result in lowering the water level in the LOC sufficiently that the Lincoln East Specific Plan Area can drain by gravity to the LOC.

- Basis of Design Report, Northwest Yuba City Drainage Area Master Drainage Plan (March 4, 2002) – This report described a proposed drainage system for the area north of State Route (SR) 20, south of Pease Road, generally east of Terra Buena Road, and west of Blevin Road. This report described two detention basins for this area, but these basins were not included in Alternative 5. These basins are not essential for Alternative 5 to perform as described below.

Included in the Alternative 5 set of improvements were trunk storm drains for many of the subsheds that will be developed. The future trunk drains are shown on Figure A-1A. Presented in Table A-1 are the Alternative 5 subsheds, the nodes to which they are tributary, the subshed size, and the impervious percentage for the buildout condition. Most of this data is the same as in Chapter 6, except for the subsheds that were redefined to be tributary to a future trunk drain. The future trunk drain nodes mostly start with the letters "FT", and they are shown in bold type in Table A-1.

For the future trunk drain model nodes, the ground surface elevation was estimated from USGS quad maps (Table A-2), and consequently is not highly accurate. Each future trunk drain was represented in the model with one, two, or three nodes and links; thus, much of the future storm drain system serving any individual neighborhood was not modeled since the actual systems are not known at this time. Model links were also developed to represent the streets above the trunk drains since the 100-year flow would be temporarily detained and conveyed in the street sections. For modeling the future trunk systems and the potential for temporary surface ponding during peak rainfall events, it was assumed that the gutter elevation was 0.5 feet below the ground estimated from the USGS quad maps, and that flooding in the streets at a depth of 0.5 feet above the gutter elevation would cover 2 percent of the total subshed area tributary to that node. At a depth of 1.5 feet above the gutter elevation, flooding in the streets was assumed to cover 10 percent of the total subshed area tributary to that node.

As shown in Table A-2, at most of the future trunk nodes, the design criterion of having the 10-year water level 1 foot below the gutter elevation was achieved. However, at node TWP0030 a freeboard of only 0.60 feet was achieved. At node FT1760-2 a freeboard of only 0.9 feet was achieved. The 100-year criterion of having the street ponding depth less than 1.5 feet was also achieved at all nodes except TWP0030. This node represents the existing Walnut Park pump station. The NTRAMP says this area will be redirected to drain to the north and into the proposed storm drain system, but that the pump station will be retained for emergency use. This modeling supports the need to retain this pump station for emergency use. Additionally, the capacity of the pump station may need to be increased.

ALTERNATIVE 5 DESCRIPTION

Figures A-1A and A-1B schematically show the Alternative 5 improvements. Alternative 5 includes two detention basins. One located at the north end of the LOC just south of Pease Road and one located just south of Bogue Road and west of the LOC. There would also be a 50 cfs (firm capacity) pump station associated with each detention basin. Presented in Table A-3 is the detailed information for each model link and node that represent the Alternative 5 improvements. As shown on Figures A-1A and A-1B, Alternative 5 includes (from north to south):

- The LOC would end just south of Pease Road at a 50 cfs (firm capacity) pump station, which would lift water into the East Intercepting Canal (along the north side of Pease Road).
- The North Detention Basin (NDB) would have a storage volume of 276 ac-ft. It would detain flows from all areas north of the old railroad. Flow greater than 50 cfs would overtop a weir near the north end of the LOC and flow into the NDB. After the peak of the storm had passed, the NDB would be drained by the pump station and a 36-inch drain under the old railroad flowing into the LOC system south of the old railroad.
- To help force the peak flows northward, the LOC would be enlarged in segments and replaced with a 108-inch drain in other segments from the old railroad to the North Pump Station. In this area, the channel segments would be 10 to 14 feet deep, have a 16 foot bottom width, and have 3H:1V (horizontal:veritical) side slopes.
- Along the Jefferson Street Channel, the Hooper Road culverts would be replaced with a single 96-inch reinforced concrete pipe (RCP) culvert with headwalls. Also, downstream of the new culvert, the Jefferson Street channel bottom would be leveled to eliminate areas where water permanently pools.
- Piping of the LOC under the old railroad with a single 36-inch RCP storm drain.
- Piping of the LOC from south of the old railroad through SR 20 with a single 66-inch to 72-inch RCP storm drain. This includes use of the existing 72-inch drain under SR 20, eliminating the need to construct improvements crossing SR 20.
- Enlarging the LOC from SR 20 to the confluence with the existing 96-inch Del Monte Square storm drain outlet. Along this reach, the channel segments would have a bottom width of 10 feet, a depth of 11 to 13 feet, and side slopes of 2H:1V. The culverts along this reach would each consist of a single 96-inch RCP pipes with headwalls (Ke = 0.2).
- Enlarging the LOC from the 96-inch Del Monte Square storm drain outlet to the bend to the south. Along this reach, the channel segments would have a bottom width of 12 feet, a depth of about 12 feet, and side slopes of 2H:1V. There would be no culverts along this reach of the LOC.
- Enlarging the LOC from the bend to the south to Franklin Road. Along this reach, the channel would have a bottom width of 15 feet, a depth of 12 to 14 feet, and side slopes of 2H:1V. The Franklin Road crossing would be a single 108-inch RCP culvert.
- Enlarging the LOC from Franklin Road through Lincoln Road. Along this reach, the channel would have a bottom width of 15 feet, a depth of 11 to 13 feet, and side slopes of 2H:1V. The Lincoln Road crossing would be a single 108-inch RCP culvert.
- Enlarging the LOC from Lincoln Road through Bogue Road. Along this reach, the channel would have a bottom width of 20 feet, a depth of 11 to 13 feet, and side slopes of 2H:1V. The Bogue Road crossing would be twin 120-inch RCP culverts.

- Enlarging the LOC south of Bogue Road for about 1,000 feet to the inlet weir to the South Detention Basin (SDB). This channel segment would end at a new 48-inch RCP culvert in the LOC that restricts the flow continuing down the LOC and forces peak flows over a side flow weir and into the SDB. Along this reach, the channel would have a bottom width of 25 feet, a depth of 11 to 13 feet, and side slopes of 2H:1V.
- Enlarging the LOC from the SDB 48-inch RCP inlet culvert to the South Pump Station. Along this reach, the channel would have a bottom width of 8 feet, a depth of 11 to 13 feet, and side slopes of 2H:1V.
- The SDB would have a volume of 890 ac-ft. The peak flows crossing Bogue Road would be diverted over a weir into the basin. After the peak of the storm had passed, the SDB would slowly drain through a 60-inch pipe back to the South Pump Station.
- The South Pump Station would be located in the LOC channel by filling a segment of the channel downstream of the SDB outlet pipe. It would have a firm capacity of 50 cfs and would have a 36-inch RCP culvert with a flap gate that allows flow to bypass the pump station when the downstream water levels are lower than the upstream water level. This pump station and culvert allow only enough flow to pass to prevent increased downstream flooding.
- At Township Road, a flow with a peak of 20 cfs was assumed to enter the LOC from the rural residential area northwest of the intersection of Township and Bogue Roads.
- Downstream of the South Pump Station, the LOC channel would not be enlarged, but the culverts would be replaced with 72-inch CMP culverts without headwalls. The existing Township Road crossing has twin 60-inch culverts and would not be replaced.
- Enlarging the single culvert along the State Drain south of the junction with the LOC to a 120-inch corrugated metal pipe (CMP) culvert (or an equivalent culvert) without headwalls. The State Drain Channel and the Oswald Road Bridge would remain as they are now.
- No additional pumping capacity would be required at the O'Banion Pump Station. This pump station has six pumps, each with a capacity of 120 cfs. The pump on/off elevations of the first three pumps would not be changed. However, the pump on/off elevations of pump 4 would be lowered 0.5 feet. The pump on/off elevations of pump 5 would be lowered 1.0 foot. The pump on/off elevations of pump 6 would be lowered 1.5 feet. The current pump on and off elevations were taken from a plan sheet provided by Mr. Casey Wilder, California Department of Water Resources, Flood Management Division. The plan sheet was Drawing E5-12, Flood Control Facilities, Sutter Bypass – Pumping Plants, Control Systems Rehabilitation, Pump and Motor Operations Water Surface Elevations. The pump on and off elevations from the plan sheet were converted from the USCE datum to the NGVD datum for use in the XP-SWMM model of the drainage system.

ALTERNATIVE 5 MODEL RESULTS

Upstream of Bogue Road, the Alternative 5 Live Oak Canal facilities were sized to achieve the 100-year storm design criterion of 1 foot of freeboard. However, at a few locations this criterion was not quite achieved. At these locations, the 100-year water level is lowered as compared to existing conditions. However, it appeared preferable to raise the lower channel bank than to further enlarge the channel.

The model results for Alternative 5 are described below:

- LOC Freeboard – The maximum water surface elevations and resulting freeboard for the LOC are presented in Table A-4 for the 10-year and 100-year storms. Compliance of Alternative 5 with the recommended design criteria is discussed below.
  - North of Roosevelt Road a freeboard of 1 foot is achieved for the 100-year storm.
  - From Roosevelt Road to Mantia Drive, minor street flooding would continue to occur at up to 0.1 foot deep. However, the water surface elevation is lowered by at least 0.9 foot.
  - At the confluence of the LOC with the Jefferson Road channel, a freeboard of 1.5 feet would be achieved.
  - In the Jefferson Road channel, the water level decreases by 0.2 to 0.6 feet, resulting in continued flooding with a depth of up to 0.1 feet over the lower of the two channel banks. The lower channel back is about 1.1 feet lower than the other bank, and this flooding could be eliminated by raising the lower channel bank.
  - Just south of the old railroad, the LOC channel would be replaced with a storm drain system. Thus, the appropriate criterion is to achieve 1 foot of freeboard in the 10-year storm, which is achieved. In the 100-year storm, minor flooding of up to 0.8 foot would occur, but the water surface elevation would be lowered from 0.1 to 1.8 feet compared to existing conditions.
  - From SR 20 to Franklin Road, the LOC would remain an open channel, and the design criterion is 1 foot of freeboard in a 100-year storm. In this reach, the design criterion is achieved, with freeboards ranging from 1.9 to 3.0 feet.
  - From Franklin Road to Lincoln Road, there is a segment of the LOC in which the freeboard is less than 1 foot. However, in this reach, the water surface elevation is lowered by 2.0 to 2.1 feet. This freeboard could be achieved by raising the lower channel bank to the level of the higher channel bank along this channel reach or raising both channel banks to the level of the banks downstream of this reach with dirt excavated during enlargement of the LOC.
  - From Lincoln Road to Bogue Road, there is one location of the LOC in which the freeboard is less than 1 foot, and at one location a flooding dept of 0.4 feet would occur. However, in this reach, the water surface elevation is lowered by 2.1 to 2.6 feet from existing conditions. In this reach, the freeboard could be achieved by raising the lower channel bank with dirt excavated during enlargement of the LOC.

— The proposed urban growth ends at Bogue Road and achieving 1.0 foot of freeboard is not essential in the agricultural areas. However, it is essential that Alternative 5 not cause increased flooding depths. South of Bogue Road, either the water surface elevation is lowered or the water level remains below the channel top. Consequently, Alternative 5 results in no increased flooding.

— Along the State Drain, the freeboard ranges from 0.4 to over 5 feet for the 100-year storm. However, for much of this channel, the water level actually increases by up to about 1.0 feet over the water level for existing conditions. In the lower reach of the State Drain, the water level decreases by about 0.1 foot because of the lower pump on/off elevations for the O'Banion Pump Station.

— At the O'Banion Pump Station, the maximum 100-year water surface elevation is lowered by about 0.1 foot, and the required freeboard is achieved.

- North Detention Basin – Presented in Figure A-2 are the flow rates into and out of the NDB. As shown, the peak flow rate into the NDB in the 10-year storm, is about 340 cfs. About 12 hours after the peak of the storm, the flow rate out of the NDB reaches it maximum rate of about 50 cfs. In the 100-year storm, the peak flow rate into the NDB is 603 cfs. About 18 hours after the peak of the storm, the flow rate out of the NDB reaches it maximum rate of about 64 cfs.

- Flow under the old railroad - Presented in Figure A-3 are hydrographs of the flow crossing under the old railroad for both the 10-year and 100-year storms for existing conditions and buildout conditions. For full development, with Alternative 5, in the 10-year storm the flow at this location increases from 73 cfs to 76 cfs. In the 100-year storm the flow at this location increases from 87 cfs to 97 cfs.

- Flow under the SR20 - Presented in Figure A-4 are hydrographs of the flow crossing under SR20 for both the 10-year and 100-year storms under existing conditions and buildout conditions. For full development, with Alternative 5, the flow at this location increases from 88 cfs to 177 cfs in the 10-year storm. In the 100-year storm the flow at this location increases from 126 cfs to 237 cfs.

- Flow under Franklin Road - Presented in Figure A-5 are hydrographs of the flow crossing under Franklin Road for both the 10-year and 100-year storms under existing conditions and buildout conditions. For full development, with Alternative 5, the flow at this location increases from 248 cfs to 533 cfs in the 10-year storm. In the 100-year storm the flow at this location increases from 400 cfs to 775 cfs.

- Flow under Lincoln Road - Presented in Figure A-6 are hydrographs of the flow crossing under Lincoln Road for both the 10-year and 100-year storms under existing conditions and buildout conditions. For full development, with Alternative 5, in the 10-year storm the flow at this location increases from 189 cfs to 678 cfs. In the 100-year storm the flow at this location increases from 202 cfs to 938 cfs.

- Flow under Bogue Road - Presented in Figure A-7 are hydrographs of the flow crossing under Bogue Road for both the 10-year and 100-year storms under existing conditions and buildout conditions. For full development, with Alternative 5, in the 10-year storm the flow at this location increases from 223 cfs to 982 cfs. In the 100-year storm the flow at this location increases from 229 cfs to 1,365 cfs.

- South Detention Basin – Presented in Figure A-8 are the flow rates into and out of the SDB. As shown, the peak flow rate into the SDB is 905 cfs in the 10-year storm, About 1 day after the peak of the storm, the flow rate out of the SDB reaches it maximum rate of about 43 cfs. In the 100-year storm, the peak flow rate into the SDB is 1,284 cfs. Over 2 days after the peak of the storm, the flow rate out of the SDB reaches it maximum rate of over 94 cfs.
- Flow under the Township Road - Presented in Figure A-9 are hydrographs of the flow crossing under Township Road for both the 10-year and 100-year storms under existing conditions and buildout conditions. For full development, with Alternative 5 including the SDB, the 10-year storm flow at this location decreases from 158 cfs to 97 cfs. In the 100-year storm, the flow at this location increases from 139 cfs to 155 cfs. At this location for existing conditions, the flow is higher for a 10-year storm than for a 100-year storm because the downstream channel segment fills to a lower level in a 10-year storm than in a 100-year storm.
- Flow into the State Drain - Presented in Figure A-10 are hydrographs of the flow entering the State Drain for both the 10-year and 100-year storms under existing conditions and buildout conditions. For full development, with Alternative 5, the 10-year storm flow at this location increases from 97 cfs to 99 cfs. In the 100-year storm the flow at this location increases from 98 cfs to 161 cfs.
- O'Banion Pump Station – Presented in Figure A-11 are the flows through the O'Banion Pump Station. The pumped flow rate for the 10-year storm is unchanged due to buildout development. The pumped flow rate for the 100-year is unchanged at 720 cfs, but the pumps turn on sooner and stay on slightly longer. Presented in Figure A-12 are the stagegraphs for the wet well of the O'Banion Pump Station. As shown, for the 10-year storm, the maximum water surface is decreased by about 0.4 feet and for the 100-year storm the water surface is decreased by about 0.3 feet.

ALTERNATIVE 5 COST ESTIMATE

The estimated construction cost of the Alternative 5 improvements are presented in Table A-5. These costs are based on the unit costs presented in Table 7-6 of the West Yuba City Master Drainage Study. The estimated construction cost includes:

- Line items for each major construction element. The excavation unit costs appear reasonable at this time; however, the excavation cost can vary significantly depending on the haul distance, traffic interference, and the demand for dirt for other projects at the time of bidding.
- A construction contingency of 10 percent has been included to account for details of the alternative that have not been specifically identified in the cost estimate line items and for variability in the bidding climate at the time of the bids.

The estimated capital cost for each of the Alternative 5 improvements are also presented in Table A-5. The capital cost is developed from the construction cost by adding costs for:

- Easements and land at $131,680 per acre ($3 per square foot) within the City's growth boundary and at $10,000 per acre outside the City's growth boundary.

- Engineering, construction management and inspection, CEQA environmental review and mitigation, and City administration at 20 percent of the construction cost.

The total estimated construction cost and capital cost of the Alternative 5 improvements are $27.5 million and $38.8 million, respectively. These estimates are based on unit costs as of May 2005, (ENR 20 Cities CCI of 7,309).

Construction and Capital costs for Alternatives 1 through 5 are compared in Table A-6. The costs for alternatives 1 through 4 are from the April 4, 2007 letter to Mr. George Musallam. This letter revised the alternative costs by excluding the trunk drain costs, lowering the land costs, and reducing the cost multipliers. Thus, the costs shown in table A-6 represent comparable cost that are based on similar unit costs, land cost, and cost multipliers. Prior to this addendum, Alternative 3 was the preferred project. Alternative 5 provides a $25.0 million reduction from the capital cost of Alternative 3 (a 40 percent reduction). Based on this evaluation, Alternative 5 is recommended as the preferred project.

Table A-1. Hydrologic Model Future Conditions

Subshed	Tributary Node	Subshed Area, acres	Impervious Percent
L01	**FT1910-21**	159.8	38
L02	**FT1910-20**	200.9	31
L03	L1910	166.0	39
L04	L1890	6.3	40
L05	**FT1910-03**	10.6	40
L06	**FT1910-03**	21.4	40
L07	**FT1910-02**	140.2	36
L08	**FT1910-01**	109.7	36
L09	**FT1910-01**	24.4	40
L10	**FT1860-02**	38.9	45
L11	**FT1860-01**	73.7	50
L12	L1880	24.6	40
L13	L1880	87.9	39
L14A	TBH0010	46.4	40
L15	TBH0010	26.0	42
L16	TBH0020	94.3	46
L17	TBH0020	19.6	44
L18	TBH0020	26.2	49
L19	J0200	140.8	37
L20	TBH0020	9.3	36
L21	J0200	11.6	40
L22	J0200	14.6	47
L23	**W0030 and FTW0040-1**	60.0 133.9	34
L24	**W0030**	20.7	40
L25	**FTW0020-1**	79.0	40
L26	L1850	42.5	40
L27	L1826	40.6	40
L28	L1840	29.9	40
L29	L1852	12.9	40
L30	L1830	32.8	40
L31	J0040	42.3	42
L31A	J0040	11.6	50
L32	J0050	4.7	90
L32A	J0050	18.4	20
L33	J0080	38.1	41
L34	J0090	27.1	38
L35	J0100	46.3	83
L36	J0100	41.4	90
L37	**FT1760-01**	72.1	35
L38	**FT1760-01**	63.0	51
L39	**FT1760-01**	4.8	51
L40	L1750	19.0	40
L41	L1780	10.7	31
L42	L1770	19.9	38
L43	L1770	12.1	40
L44	L1760	24.1	40
L45	L1750	9.7	81
L46	J0030	9.2	45
L47	**FT1740-21**	10.1	40
L48	**FT1740-20**	23.0	40
L49	**FT1740-01**	18.4	58
L50	**FT1740-02**	75.1	40
L51	J0090	12.8	40
L52	J0090	29.4	72
L53	J0100	34.8	31
L54	J0110	23.6	37
L55	**FT1760-02**	64.3	32
L56	TWP0030	69.6	35
L57	TWP0010	36.8	38
L58	**FT1300-01**	218.8	42
L59	L1240	13.9	40
L60	L1420	61.6	90
L61	**FT1420-01**	13.2	90

Table A-1. Hydrologic Model Future Conditions

Subshed	Tributary Node	Subshed Area, acres	Impervious Percent
L62	**FT1420-01**	27.3	90
L63	L1430	60.4	90
L64	L1450	8.9	40
L65A	L1320	33.9	40
L65B	L1410	31.0	40
L65C	L1240	14.3	40
L65D	L1450	47.1	40
L65E	L1450	24.9	40
L66	L1730	61.5	87
L67	L1502	10.2	40
L68	L1500	203.0	48
L69	L1240	40.3	40
L70	TrkL1500B	38.2	94
L71	TrkL1500B	12.7	92
L72	TrkL1500B	49.4	50
L73	TrkL1500B	16.6	95
L74	TrkL1500A	123.0	41
L75	TrkL1500B	51.4	41
L76	TrkL1500A	7.0	60
L77	TrkL1500A	15.9	90
L78	**FT1010-01**	243.5	38
L79	L1230	9.9	40
L80	**FT1010-01**	7.2	22
L81	**FT1040-01**	336.4	42
L82	**FT1110-01**	86.0	40
L83	**FT1110-02**	130.5	47
L84	**FT1110-02**	21.4	40
L85	**FT1110-03**	20.8	40
L86	**FT0980-01**	136.3	44
L87	**FT0980-03**	136.9	44
L88	**FT0980-03**	20.0	40
L89	**FT0980-02**	49.9	40
L90	**FT0640-01**	266.7	38
L91	**FT0680-01**	306.0	44
L92	**FT0680-02**	34.4	40
L93	**FT0680-03**	557.9	39

Table A-2. Future Development Area Model Results

Subshed	Approximate Ground Surface Elevation from USGS Quad Map, feet	Assumed Gutter Elevation, ft	10-Yr Max WSEL, feet	10-Yr Flood Depth Flooding (+) Freeboard (-), feet[a]	100-yr Max WSEL, feet	100-Yr Flood Depth Flooding (+) Freeboard (-), feet[b]
FT0640-01	46.0	45.5	42.76	-2.7	44.57	-0.9
FT0680-01	46.0	45.5	44.26	-1.2	45.20	-0.3
FT0680-02	47.0	46.5	44.95	-1.5	45.87	-0.6
FT0680-03	49.0	48.5	47.05	-1.4	47.70	-0.8
FT0980-01	50.0	49.5	45.76	-3.7	48.30	-1.2
FT0980-02	51.0	50.5	47.42	-3.1	49.78	-0.7
FT0980-03	52.0	51.5	48.75	-2.7	50.93	-0.6
FT1010-01	48.0	47.5	45.18	-2.3	46.91	-0.6
FT1040-01	50.0	49.5	48.09	-1.4	48.92	-0.6
FT1110-01	51.0	51.5	47.81	-3.7	49.43	-2.1
FT1110-02	51.0	50.5	49.43	-1.1	50.25	-0.2
FT1110-03	52.0	51.5	49.46	-2.0	50.43	-1.1
FT1300-01	51.0	50.5	49.07	-1.4	49.99	-0.5
FT1420-01	52.0	51.5	48.37	-3.1	50.80	-0.7
FT1740-01	54.0	53.5	49.59	-3.9	52.48	-1.0
FT1740-02	55.0	54.5	50.51	-4.0	53.72	-0.8
FT1740-20	55.0	54.5	49.95	-4.6	53.64	-0.9
FT1740-21	55.0	54.5	49.92	-4.6	53.74	-0.8
FT1760-01	53.0	52.5	50.44	-2.1	52.17	-0.3
FT1760-02	52.0	51.5	50.55	-0.9	52.23	0.7
FT1860-01	55.0	54.5	49.28	-5.2	52.07	-2.4
FT1860-02	55.0	54.5	50.47	-4.0	52.09	-2.4
FT1910-01	57.0	56.5	52.37	-4.1	53.37	-3.1
FT1910-02	58.0	57.5	54.50	-3.0	56.34	-1.2
FT1910-03	59.0	58.5	55.10	-3.4	57.50	-1.0
FT1910-20	56.0	55.5	51.31	-4.2	52.22	-3.3
FT1910-21	55.0	54.5	50.13	-4.4	52.09	-2.4
FTW0020-1	53.8	53.3	50.47	-2.8	53.07	-0.2
FTW0040-1	54.3	53.8	50.53	-3.2	53.28	-0.5
TWP0010	50.0	49.5	46.80	-2.7	48.60	-0.9
TWP0020	50.5	50.0	47.80	-2.2	50.11	0.1
TWP0030	50.0	49.5	48.88	-0.6	51.84	2.3
W-Dresser	54.0	53.5	50.53	-3.0	53.26	-0.2
W0010	53.2	52.7	50.31	-2.4	52.68	0.0
W0020	53.3	52.8	50.41	-2.4	52.92	0.1
W0030	53.8	53.3	50.47	-2.8	53.08	-0.2
W0040	54.3	53.8	50.50	-3.3	53.18	-0.6

[a] 10-year flood depth should be 1 foot below assumed gutter elevation

[b] 100-year flood depth should be less than 1.5 feet above assumed gutter elevation

Table A-3. Alternative 5 Details

Link Name	Upstream Node Name	Downstream Node Name	Type	Number of Barrels	Upstream Invert Elevation, feet	Downstream Invert Elevation, feet	Roughness	Length, feet	Diameter or Depth, feet	Bottom Width, feet	Left-hand Side Slope __H:1V	Right-hand Side Slope __H:1V	Culvert Entrance Loss Coefficient	Upstream Node Ground Elevation, feet	Upstream Node Invert Elevation, feet	Downstream Node Ground Elevation, feet	Downstream Node Invert Elevation, feet
North Park Site																	
L1920A	L1910	L1920	Trapezoidal	1	43.34	43.15	0.030	1180	0.00	12.0	3.0	3.0	-	57.01	43.34	56.96	43.15
L1910A	L1900	L1910	Trapezoidal	1	43.49	43.34	0.030	1370	0.00	16.0	3.0	3.0	0.2	57.18	43.49	57.01	43.34
L1900A	L1892	L1900	Trapezoidal	1	43.68	43.49	0.030	625	0.00	16.0	3.0	3.0	-	58.28	43.68	57.18	43.49
L1892A	L1890	L1892	Trapezoidal	1	43.83	43.68	0.015	260	0.00	16.0	3.0	3.0	-	57.92	43.83	58.28	43.68
L1890A	L1880	L1890	Circular	1	44.13	43.83	0.013	778	9.00	-	-	-	0.2	57.20	44.13	57.92	43.83
L1880A	L1870	L1880	Circular	1	44.48	44.13	0.013	918	9.00	-	-	-	-	56.76	44.48	57.20	44.13
Butte House Road																	
L1870A	L1860	L1870	Circular	1	44.50	44.48	0.013	100	9.00	-	-	-	-	58.00	44.50	56.76	44.48
L1860A	L1852	L1860	Trapezoidal	1	44.40	44.50	0.030	277	0.00	16.0	3.0	3.0	-	57.76	44.40	58.00	44.50
L1852A	L1851	L1852	Trapezoidal	1	44.30	44.40	0.030	248	0.00	16.0	3.0	3.0	-	57.70	44.30	57.76	44.40
L1851A	L1850	L1851	Trapezoidal	1	44.20	44.30	0.030	100	0.00	16.0	3.0	3.0	-	57.06	44.20	57.70	44.30
L1850A	L1840	L1850	Trapezoidal	1	43.70	44.20	0.030	1108	0.00	16.0	3.0	3.0	-	54.42	43.70	57.06	44.20
L1840A	L1830	L1840	Circular	1	43.60	43.70	0.013	100	9.00	-	-	-	0.2	53.71	43.60	54.42	43.70
L1830A	L1826	L1830	Trapezoidal	1	43.40	43.60	0.030	555	0.00	16.0	3.0	3.0	-	53.41	43.40	53.71	43.60
L1826A	L1820	L1826	Circular	1	43.21	43.40	0.013	150	9.00	-	-	-	0.2	58.05	42.70	53.41	43.40
Old Railroad																	
L1820A	L1820	L1790	Circular	1	42.70	42.50	0.015	93	3.00	-	-	-	-	58.05	42.70	55.29	42.50
L1800A	L1790	L1780	Circular	1	42.50	41.62	0.015	538	5.00	-	-	-	-	55.29	42.50	54.80	41.62
L1780A	L1780	L1770	Circular	1	41.62	41.50	0.015	510	5.00	-	-	-	-	54.80	41.62	52.54	41.50
L1770A	L1770	L1760	Circular	1	41.50	41.49	0.015	430	5.00	-	-	-	-	52.54	41.50	52.14	41.49
L1760A	L1760	L1750	Circular	1	41.49	41.37	0.015	312	6.00	-	-	-	-	52.14	41.49	53.23	41.37
L1750A	L1750	L1740	Circular	1	41.37	41.26	0.015	517	6.00	-	-	-	-	53.23	41.37	53.23	41.26
L1740A	L1740	L1730	Circular	1	41.26	41.00	0.015	330	6.00	-	-	-	-	53.23	41.26	51.94	40.83
Downstream Side of SR20																	
L1730A	L1730	L1720	Trapezoidal	1	40.83	40.75	0.030	137	11.11	15.0	2.0	2.0	-	51.94	40.83	52.61	40.75
L1720A	L1720	L1710	Trapezoidal	1	40.75	40.51	0.030	425	11.86	15.0	2.0	2.0	-	52.61	40.75	52.82	40.51
L1710A	L1710	L1700	Trapezoidal	1	40.51	40.40	0.030	189	11.46	15.0	2.0	2.0	-	52.82	40.51	51.86	40.40
L1700B	L1700	L1690	Circular	1	40.40	40.37	0.015	54	8.00	-	-	-	0.2	51.86	40.40	51.73	40.37
L1690A	L1690	L1680	Trapezoidal	1	40.37	40.31	0.030	107	11.36	10.0	2.0	2.0	-	51.73	40.37	52.48	40.31
L1680A	L1680	L1670	Trapezoidal	1	40.31	40.24	0.030	123	11.33	10.0	2.0	2.0	-	52.48	40.31	51.57	40.24
L1670B	L1670	L1660	Circular	1	40.24	40.20	0.015	68	8.00	-	-	-	0.2	51.57	40.24	52.29	40.20
L1660A	L1660	L1650	Trapezoidal	1	40.20	40.15	0.030	85	11.99	10.0	2.0	2.0	-	52.29	40.20	52.14	40.15

Table A-3. Alternative 5 Details

Link Name	Upstream Node Name	Downstream Node Name	Type	Number of Barrels	Upstream Invert Elevation, feet	Downstream Invert Elevation, feet	Roughness	Length, feet	Diameter or Depth, feet	Bottom Width, feet	Left-hand Side Slope __H:1V	Right-hand Side Slope __H:1V	Culvert Entrance Loss Coefficient	Upstream Node Ground Elevation, feet	Upstream Node Invert Elevation, feet	Downstream Node Ground Elevation, feet	Downstream Node Invert Elevation, feet
L1650A	L1650	L1640	Trapezoidal	1	40.15	40.11	0.030	68	11.99	10.0	2.0	2.0	-	52.14	40.15	52.56	40.11
L1640B	L1640	L1630	Circular	1	40.11	40.09	0.013	43	8.00	-	-	-	0.2	52.56	40.11	52.53	40.09
L1630A	L1630	L1620	Trapezoidal	1	40.09	40.06	0.030	55	12.32	10.0	2.0	2.0	-	52.53	40.09	52.38	40.06
L1620A	L1620	L1610	Trapezoidal	1	40.06	40.02	0.030	55	12.32	10.0	2.0	2.0	-	52.38	40.06	52.52	40.02
L1610B	L1610	L1600	Circular	1	40.02	39.99	0.015	62	8.00	-	-	-	0.2	52.52	40.02	52.17	39.99
L1600A	L1600	L1590	Trapezoidal	1	39.99	39.96	0.030	58	12.01	10.0	2.0	2.0	-	52.17	39.99	51.97	39.96
L1590A	L1590	L1580	Trapezoidal	1	39.96	39.92	0.030	56	12.01	10.0	2.0	2.0	-	51.97	39.96	52.24	39.92
L1580B	L1580	L1570	Circular	1	39.92	39.90	0.015	41	8.00	-	-	-	0.2	52.24	39.92	52.17	39.90
L1570A	L1570	L1560	Trapezoidal	1	39.90	39.88	0.030	37	12.03	10.0	2.0	2.0	-	52.17	39.90	51.91	39.88
L1560B	L1560	L1550	Circular	1	39.88	39.85	0.015	55	8.00	-	-	-	0.2	51.91	39.88	51.66	39.85
L1550A	L1550	L1540	Trapezoidal	1	39.85	39.80	0.030	90	11.81	10.0	2.0	2.0	-	51.66	39.85	51.90	39.80
L1540A	L1540	L1530	Trapezoidal	1	39.80	39.72	0.030	132	11.77	10.0	2.0	2.0	-	51.90	39.80	51.49	39.72
L1530B	L1530	L1525	Circular	1	39.72	39.69	0.015	54	8.00	-	-	-	0.2	51.49	39.72	51.77	39.69
L1525B	L1525	L1520	Circular	1	39.69	39.66	0.015	54	8.00	-	-	-	0.2	51.77	39.69	51.29	39.66
L1520A	L1520	L1510	Trapezoidal	1	39.66	39.60	0.030	102	11.63	10.0	2.0	2.0	-	51.29	39.66	51.73	39.60
L1510A	L1510	L1502	Trapezoidal	1	39.60	39.51	0.030	161	11.60	10.0	2.0	2.0	-	51.73	39.60	51.11	39.51
Confluence with Del Monte Square Trunk Drain																	
L1500B	L1502	L1500	Circular	1	39.51	39.48	0.015	50	8.00	-	-	-	0.2	51.11	39.51	51.68	39.48
L1490A	L1500	L1480	Trapezoidal	1	39.48	39.46	0.030	54	12.00	12.0	2.0	2.0	-	51.68	39.48	51.24	39.46
L1480A	L1480	L1470	Trapezoidal	1	39.46	39.41	0.030	160	12.00	12.0	2.0	2.0	-	51.24	39.46	51.07	39.41
L1470A	L1470	L1460	Trapezoidal	1	39.41	39.35	0.030	208	12.00	12.0	2.0	2.0	-	51.07	39.41	51.32	39.35
L1460A	L1460	L1450	Trapezoidal	1	39.35	39.30	0.030	182	12.00	12.0	2.0	2.0	-	51.32	39.35	51.36	39.30
L1450A	L1450	L1440	Trapezoidal	1	39.30	39.20	0.030	320	12.00	12.0	2.0	2.0	-	51.36	39.30	51.43	39.20
L1440A	L1440	L1430	Trapezoidal	1	39.20	39.13	0.030	228	12.00	12.0	2.0	2.0	-	51.43	39.20	51.23	39.13
L1430A	L1430	L1420	Trapezoidal	1	39.13	39.06	0.030	236	12.00	12.0	2.0	2.0	-	51.23	39.13	50.67	39.06
L1420A	L1420	L1410	Trapezoidal	1	39.06	39.00	0.030	204	12.00	12.0	2.0	2.0	-	50.67	39.06	50.13	39.00
L1410A	L1410	L1400	Trapezoidal	1	39.00	38.91	0.030	281	12.00	12.0	2.0	2.0	-	50.13	39.00	49.97	38.91
L1400A	L1400	L1390	Trapezoidal	1	38.91	38.84	0.030	242	12.00	12.0	2.0	2.0	-	49.97	38.91	51.21	38.84
L1390A	L1390	L1380	Trapezoidal	1	38.84	38.77	0.030	221	12.00	12.0	2.0	2.0	-	51.21	38.84	50.95	38.77
L1380A	L1380	L1370	Trapezoidal	1	38.77	38.71	0.030	200	12.00	12.0	2.0	2.0	-	50.95	38.77	51.45	38.71
Bend in the LOC north of Franklin Road																	
L1370A	L1370	L1360	Trapezoidal	1	38.71	38.68	0.030	93	11.98	15.0	2.0	2.0	-	51.45	38.71	50.66	38.68
L1360A	L1360	L1350	Trapezoidal	1	38.68	38.59	0.030	306	11.98	15.0	2.0	2.0	-	50.66	38.68	51.71	38.59

Table A-3. Alternative 5 Details

Link Name	Upstream Node Name	Downstream Node Name	Type	Number of Barrels	Upstream Invert Elevation, feet	Downstream Invert Elevation, feet	Roughness	Length, feet	Diameter or Depth, feet	Bottom Width, feet	Left-hand Side Slope __H:1V	Right-hand Side Slope __H:1V	Culvert Entrance Loss Coefficient	Upstream Node Ground Elevation, feet	Upstream Node Invert Elevation, feet	Downstream Node Ground Elevation, feet	Downstream Node Invert Elevation, feet
L1350A	L1350	L1340	Trapezoidal	1	38.59	38.50	0.030	272	12.85	15.0	2.0	2.0	-	51.71	38.59	51.35	38.50
L1340A	L1340	L1330	Trapezoidal	1	38.50	38.44	0.030	225	12.85	15.0	2.0	2.0	-	51.35	38.50	51.64	38.44
L1330A	L1330	L1320	Trapezoidal	1	38.44	38.35	0.030	267	12.89	15.0	2.0	2.0	-	51.64	38.44	51.24	38.35
L1320A	L1320	L1310	Trapezoidal	1	38.35	38.27	0.030	292	12.56	15.0	2.0	2.0	-	51.24	38.35	50.83	38.27
L1310A	L1310	L1300	Trapezoidal	1	38.27	38.23	0.030	128	12.56	15.0	2.0	2.0	-	50.83	38.27	51.01	38.23
L1300A	L1300	L1290	Trapezoidal	1	38.23	38.17	0.030	184	12.60	15.0	2.0	2.0	-	51.01	38.23	50.77	38.17
L1290A	L1290	L1280	Trapezoidal	1	38.17	38.11	0.030	211	12.41	15.0	2.0	2.0	-	50.77	38.17	50.52	38.11
L1280A	L1280	L1270	Trapezoidal	1	38.11	38.05	0.030	184	12.41	15.0	2.0	2.0	-	50.52	38.11	50.54	38.05
L1270A	L1270	L1260	Trapezoidal	1	38.05	37.99	0.030	213	11.92	15.0	2.0	2.0	-	50.54	38.05	49.91	37.99
L1260A	L1260	L1250	Trapezoidal	1	37.99	37.91	0.030	234	11.92	15.0	2.0	2.0	-	49.91	37.99	51.38	37.91
L1250A	L1250	L1240	Trapezoidal	1	37.91	37.87	0.030	148	13.45	15.0	2.0	2.0	-	51.38	37.91	51.36	37.87
Franklin Road																	
L1240B	L1240	L1230	Circular	1	37.87	37.85	0.013	76	9.00	-	-	-	0.2	51.36	37.87	49.96	37.85
L1230A	L1230	L1220	Trapezoidal	1	37.85	37.82	0.030	70	12.06	15.0	2.0	2.0	-	49.96	37.85	49.91	37.82
L1220A	L1220	L1210	Trapezoidal	1	37.82	37.77	0.030	169	12.09	15.0	2.0	2.0	-	49.91	37.82	50.30	37.77
L1210A	L1210	L1200	Trapezoidal	1	37.77	37.73	0.030	133	12.53	15.0	2.0	2.0	-	50.30	37.77	50.86	37.73
L1200A	L1200	L1190	Trapezoidal	1	37.73	37.66	0.030	247	12.24	15.0	2.0	2.0	-	50.86	37.73	49.97	37.66
L1190A	L1190	L1180	Trapezoidal	1	37.66	37.57	0.030	276	12.31	15.0	2.0	2.0	-	49.97	37.66	50.34	37.57
L1180A	L1180	L1170	Trapezoidal	1	37.57	37.51	0.030	211	12.59	15.0	2.0	2.0	-	50.34	37.57	50.16	37.51
L1170A	L1170	L1160	Trapezoidal	1	37.51	37.42	0.030	280	12.65	15.0	2.0	2.0	-	50.16	37.51	50.82	37.42
L1160A	L1160	L1150	Trapezoidal	1	37.42	37.34	0.030	291	12.96	15.0	2.0	2.0	-	50.82	37.42	50.38	37.34
L1150A	L1150	L1140	Trapezoidal	1	37.34	37.27	0.030	229	12.97	15.0	2.0	2.0	-	50.38	37.34	50.31	37.27
L1140A	L1140	L1130	Trapezoidal	1	37.27	37.20	0.030	216	12.35	15.0	2.0	2.0	-	50.31	37.27	49.62	37.20
L1130A	L1130	L1120	Trapezoidal	1	37.20	37.12	0.030	256	12.40	15.0	2.0	2.0	-	49.62	37.20	49.60	37.12
L1120A	L1120	L1110	Trapezoidal	1	37.12	37.06	0.030	212	11.98	15.0	2.0	2.0	-	49.60	37.12	49.10	37.06
L1110A	L1110	L1100	Trapezoidal	1	37.06	36.98	0.030	249	10.66	15.0	2.0	2.0	-	49.10	37.06	47.72	36.98
L1100A	L1100	L1090	Trapezoidal	1	36.98	36.90	0.030	255	10.74	15.0	2.0	2.0	-	47.72	36.98	47.90	36.90
L1090A	L1090	L1080	Trapezoidal	1	36.90	36.84	0.030	225	11.00	15.0	2.0	2.0	-	47.90	36.90	47.91	36.84
L1080A	L1080	L1070	Trapezoidal	1	36.84	36.75	0.030	284	10.66	15.0	2.0	2.0	-	47.91	36.84	47.50	36.75
L1070A	L1070	L1060	Trapezoidal	1	36.75	36.64	0.030	345	10.75	15.0	2.0	2.0	-	47.50	36.75	48.33	36.64
L1060A	L1060	L1050	Trapezoidal	1	36.64	36.59	0.030	168	10.72	15.0	2.0	2.0	-	48.33	36.64	47.36	36.59
L1050A	L1050	L1040	Trapezoidal	1	36.59	36.53	0.030	196	10.77	15.0	2.0	2.0	-	47.36	36.59	47.62	36.53
L1040A	L1040	L1030	Trapezoidal	1	36.53	36.48	0.030	183	11.09	15.0	2.0	2.0	-	47.62	36.53	47.69	36.48

Table A-3. Alternative 5 Details

Link Name	Upstream Node Name	Downstream Node Name	Type	Number of Barrels	Upstream Invert Elevation, feet	Downstream Invert Elevation, feet	Roughness	Length, feet	Diameter or Depth, feet	Bottom Width, feet	Left-hand Side Slope __H:1V	Right-hand Side Slope __H:1V	Culvert Entrance Loss Coefficient	Upstream Node Ground Elevation, feet	Upstream Node Invert Elevation, feet	Downstream Node Ground Elevation, feet	Downstream Node Invert Elevation, feet
L1030A	L1030	L1020	Trapezoidal	1	36.48	36.42	0.030	192	11.21	15.0	2.0	2.0	-	47.69	36.48	47.76	36.42
L1020A	L1020	L1010	Trapezoidal	1	36.42	36.36	0.030	195	11.34	15.0	2.0	2.0	-	47.76	36.42	47.78	36.36
L1010A	L1010	L1000	Trapezoidal	1	36.36	36.31	0.030	182	11.42	15.0	2.0	2.0	-	47.78	36.36	48.36	36.31
L01000A	L1000	L0990	Trapezoidal	1	36.31	36.26	0.030	145	12.05	15.0	2.0	2.0	-	48.36	36.31	48.36	36.26
Lincoln Road																	
L0990A	L0990	L0980	Circular	1	36.26	36.24	0.013	80	10.00	-	-	-	0.2	48.36	36.26	48.72	36.24
L0980A	L0980	L0970	Trapezoidal	1	36.24	36.21	0.030	120	12.48	20.0	2.0	2.0	-	48.72	36.24	48.72	36.21
L0970A	L0970	L0960	Trapezoidal	1	36.21	36.14	0.030	201	11.68	20.0	2.0	2.0	-	48.72	36.21	47.89	36.14
L0960A	L0960	L0950	Trapezoidal	1	36.14	36.08	0.030	196	11.49	20.0	2.0	2.0	-	47.89	36.14	47.63	36.08
L0950A	L0950	L0940	Trapezoidal	1	36.08	36.02	0.030	202	11.34	20.0	2.0	2.0	-	47.63	36.08	47.42	36.02
L0940A	L0940	L0930	Trapezoidal	1	36.02	35.96	0.030	211	11.40	20.0	2.0	2.0	-	47.42	36.02	47.48	35.96
L0930A	L0930	L0920	Trapezoidal	1	35.96	35.90	0.030	206	11.41	20.0	2.0	2.0	-	47.48	35.96	47.37	35.90
L0920A	L0920	L0910	Trapezoidal	1	35.90	35.83	0.030	220	11.46	20.0	2.0	2.0	-	47.37	35.90	47.36	35.83
L0910A	L0910	L0900	Trapezoidal	1	35.83	35.79	0.030	129	11.04	20.0	2.0	2.0	-	47.36	35.83	46.87	35.79
L0900A	L0900	L0800	Trapezoidal	1	35.79	35.75	0.030	145	11.08	20.0	2.0	2.0	-	46.87	35.79	46.99	35.75
L0800A	L0800	L0790	Trapezoidal	1	35.75	35.66	0.030	278	11.08	20.0	2.0	2.0	-	46.99	35.75	46.83	35.66
L0790A	L0790	L0780	Trapezoidal	1	35.66	35.59	0.030	228	10.97	20.0	2.0	2.0	-	46.83	35.66	46.63	35.59
L0780A	L0780	L0770	Trapezoidal	1	35.59	35.53	0.030	196	11.04	20.0	2.0	2.0	-	46.63	35.59	46.84	35.53
L0770A	L0770	L0760	Trapezoidal	1	35.53	35.47	0.030	209	11.31	20.0	2.0	2.0	-	46.84	35.53	47.08	35.47
L0760A	L0760	L0750	Trapezoidal	1	35.47	35.43	0.030	112	11.61	20.0	2.0	2.0	-	47.08	35.47	47.94	35.43
L0750A	L0750	L0740	Trapezoidal	1	35.43	35.38	0.030	183	11.90	20.0	2.0	2.0	-	47.94	35.43	47.33	35.38
L0740A	L0740	L0730	Trapezoidal	1	35.38	35.32	0.030	199	11.75	20.0	2.0	2.0	-	47.33	35.38	47.13	35.32
L0730A	L0730	L0720	Trapezoidal	1	35.32	35.25	0.030	221	11.48	20.0	2.0	2.0	-	47.13	35.32	46.80	35.25
L0720A	L0720	L0710	Trapezoidal	1	35.25	35.19	0.030	194	11.43	20.0	2.0	2.0	-	46.80	35.25	46.68	35.19
L0710A	L0710	L0700	Trapezoidal	1	35.19	35.14	0.030	182	11.44	20.0	2.0	2.0	-	46.68	35.19	46.63	35.14
L0700A	L0700	L0690	Trapezoidal	1	35.14	35.08	0.030	184	11.45	20.0	2.0	2.0	-	46.63	35.14	46.59	35.08
L0690A	L0690	L0680	Trapezoidal	1	35.08	35.04	0.030	119	11.41	20.0	2.0	2.0	-	46.59	35.08	46.49	35.04
L0680A	L0680	L0670	Trapezoidal	1	35.04	34.97	0.030	235	11.13	20.0	2.0	2.0	-	46.49	35.04	46.17	34.97
L0670A	L0670	L0660	Trapezoidal	1	34.97	34.92	0.030	183	10.91	20.0	2.0	2.0	-	46.17	34.97	45.88	34.92
L0660A	L0660	L0650	Trapezoidal	1	34.92	34.84	0.030	255	10.96	20.0	2.0	2.0	-	45.88	34.92	46.60	34.84
L0650A	L0650	L0640	Trapezoidal	1	34.84	34.80	0.030	125	11.23	20.0	2.0	2.0	-	46.60	34.84	46.07	34.80
L0640A	L0640	L0630	Trapezoidal	1	34.80	34.74	0.030	195	10.71	20.0	2.0	2.0	-	46.07	34.80	45.45	34.74
L0630A	L0630	L0620	Trapezoidal	1	34.74	34.67	0.030	228	10.65	20.0	2.0	2.0	-	45.45	34.74	45.32	34.67

Table A-3. Alternative 5 Details

Link Name	Upstream Node Name	Downstream Node Name	Type	Number of Barrels	Upstream Invert Elevation, feet	Downstream Invert Elevation, feet	Roughness	Length, feet	Diameter or Depth, feet	Bottom Width, feet	Left-hand Side Slope __H:1V	Right-hand Side Slope __H:1V	Culvert Entrance Loss Coefficient	Upstream Node Ground Elevation, feet	Upstream Node Invert Elevation, feet	Downstream Node Ground Elevation, feet	Downstream Node Invert Elevation, feet
L0620A	L0620	L0610	Trapezoidal	1	34.67	34.65	0.030	79	10.65	20.0	2.0	2.0	-	45.32	34.67	46.41	34.65
Bogue Road																	
L0610A	L0610	L0600	Circular	2	34.65	34.63	0.013	51	10.00	-	-	-	0.2	46.41	34.65	45.70	34.63
L0600A	L0600	L0590	Trapezoidal	1	34.63	34.62	0.030	67	11.07	25.0	2.0	2.0	-	45.70	34.63	45.70	34.62
L0590A	L0590	L0580	Trapezoidal	1	34.62	34.60	0.030	102	11.08	25.0	2.0	2.0	-	45.70	34.62	45.82	34.60
L0580A	L0580	L0570	Trapezoidal	1	34.60	34.57	0.030	197	11.20	25.0	2.0	2.0	-	45.82	34.60	46.63	34.57
L0570A	L0570	L0560	Trapezoidal	1	34.57	34.53	0.030	202	12.06	25.0	2.0	2.0	-	46.63	34.57	47.09	34.53
L0560A	L0560	L0540	Trapezoidal	1	34.53	34.50	0.030	198	11.89	25.0	2.0	2.0	-	47.09	34.53	46.39	34.50
L0540A	L0540	L0530	Trapezoidal	1	34.50	34.47	0.030	195	11.89	25.0	2.0	2.0	-	46.39	34.50	47.26	34.47
L0530A	L0530	L0520	Trapezoidal	1	34.47	34.43	0.030	208	12.79	25.0	2.0	2.0	-	47.26	34.47	48.14	34.43
L0520A	L0520	L0510	Trapezoidal	1	34.43	34.40	0.030	199	11.81	12.0	1.6	1.9	-	48.14	34.43	46.21	34.40
L0510A	L0510	L0500	Trapezoidal	1	34.40	34.36	0.030	199	11.60	12.0	1.8	1.9	-	46.21	34.40	46.01	34.36
L0500A	L0500	L0490	Trapezoidal	1	34.36	34.33	0.030	201	11.15	8.0	1.9	2.2	-	46.01	34.36	45.48	34.33
L0490A	L0490	L0480	Trapezoidal	1	34.33	34.30	0.030	203	10.10	8.0	1.9	2.2	-	45.48	34.33	44.49	34.30
L0480A	L0480	L0470	Trapezoidal	1	34.30	34.26	0.030	194	10.10	8.0	1.9	2.0	-	44.49	34.30	45.50	34.26
L0470A	L0470	L0460	Trapezoidal	1	34.26	34.23	0.030	202	10.63	8.0	1.9	1.5	-	45.50	34.26	44.86	34.23
L0460A	L0460	L0450	Trapezoidal	1	34.23	34.21	0.030	116	10.63	8.0	1.3	1.7	-	44.86	34.23	45.21	34.21
L0450A	L0450	L0440	Trapezoidal	1	34.21	34.19	0.030	90	11.00	8.0	2.0	2.3	-	45.21	34.21	46.13	34.19
Bend in LOC at Township Road																	
L0440B	L0440	L0440a	Trapezoidal	1	34.19	34.18	0.030	48	11.90	8.0	2.2	3.7	-	46.13	34.19	46.41	34.18
L0440A2	L0440a	L0430	Trapezoidal	1	34.18	34.17	0.030	73	11.10	8.0	3.0	2.3	-	46.41	34.18	45.36	34.17
L0430A	L0430	L0420	Trapezoidal	1	34.17	34.14	0.030	200	11.10	8.0	2.4	2.3	-	45.36	34.17	45.49	34.14
L0420A	L0420	L0410	Trapezoidal	1	34.14	34.10	0.030	202	11.30	8.0	1.9	1.6	-	45.49	34.14	45.44	34.10
L0410A	L0410	L0400	Trapezoidal	1	34.10	34.00	0.030	202	11.30	8.0	1.7	1.7	-	45.44	34.10	45.44	34.00
L0400A	L0400	L0390	Trapezoidal	1	34.00	33.90	0.030	198	11.44	8.0	1.7	1.7	-	45.44	34.00	45.91	33.90
L0390A	L0390	L0380	Trapezoidal	1	33.90	33.80	0.030	193	11.34	8.0	1.8	2.1	-	45.91	33.90	45.14	33.80
L0380A	L0380	L0370	Trapezoidal	1	33.80	33.70	0.030	210	11.34	8.0	1.8	2.3	-	45.14	33.80	45.41	33.70
L0370A	L0370	L0360	Trapezoidal	1	33.70	33.60	0.030	195	11.59	8.0	2.0	2.2	-	45.41	33.70	45.19	33.60
L0360A	L0360	L0350	Trapezoidal	1	33.60	33.50	0.030	202	11.59	8.0	1.9	2.4	-	45.19	33.60	45.48	32.00
L0350A	L0350	L0340	Circular	1	37.00	36.93	0.015	50	3.00	-	-	-	-	45.48	32.00	46.62	36.93
L0340A	L0340	L0332	Trapezoidal	1	36.93	36.89	0.030	138	8.71	9.0	1.6	2.4	-	46.62	36.93	45.61	36.89
L0332A	L0332	L0330	Trapezoidal	1	36.89	36.87	0.030	64	8.71	14.0	1.4	2.0	-	45.61	36.89	46.42	36.87
L0330A	L0330	L0320	Trapezoidal	1	36.87	36.82	0.030	142	8.48	14.0	1.4	2.0	-	46.42	36.87	45.31	36.82

Table A-3. Alternative 5 Details

Link Name	Upstream Node Name	Downstream Node Name	Type	Number of Barrels	Upstream Invert Elevation, feet	Downstream Invert Elevation, feet	Roughness	Length, feet	Diameter or Depth, feet	Bottom Width, feet	Left-hand Side Slope __H:1V	Right-hand Side Slope __H:1V	Culvert Entrance Loss Coefficient	Upstream Node Ground Elevation, feet	Upstream Node Invert Elevation, feet	Downstream Node Ground Elevation, feet	Downstream Node Invert Elevation, feet
L0320A	L0320	L0310	Trapezoidal	1	36.82	36.76	0.030	199	7.56	12.0	1.8	1.6	-	45.31	36.82	44.33	36.76
L0310A	L0310	L0300	Trapezoidal	1	36.76	36.73	0.030	96	7.56	11.0	1.5	1.7	-	44.33	36.76	44.81	36.73
L0300B	L0300	L0290	Circular	1	36.73	36.71	0.024	40	6.00	-	-	-	0.9	44.81	36.73	44.80	36.71
L0290A	L0290	L0280	Trapezoidal	1	36.71	36.69	0.030	69	8.08	11.0	1.5	1.7	-	44.80	36.71	44.81	36.69
L0280A	L0280	L0270	Trapezoidal	1	36.69	36.63	0.030	203	7.72	13.0	1.8	2.0	-	44.81	36.69	44.36	36.63
L0270A	L0270	L0260	Trapezoidal	1	36.63	36.56	0.030	198	7.09	11.0	1.5	1.7	-	44.36	36.63	43.66	36.56
L0260A	L0260	L0250	Trapezoidal	1	36.56	36.50	0.030	200	6.73	13.0	1.7	2.1	-	43.66	36.56	43.24	36.50
L0250A	L0250	L0240	Trapezoidal	1	36.50	36.43	0.030	196	6.73	19.0	1.4	1.6	-	43.24	36.50	43.17	36.43
L0240A	L0240	L0230	Trapezoidal	1	36.43	36.37	0.030	200	5.96	18.0	1.5	2.0	-	43.17	36.43	42.34	36.37
L0230A	L0230	L0210	Trapezoidal	1	36.37	36.30	0.030	211	5.96	18.0	1.4	1.6	-	42.34	36.37	42.96	36.30
L0210B	L0210	L0200	Circular	1	36.30	36.29	0.024	29	6.00	-	-	-	0.9	42.96	36.30	42.34	36.29
L0200A	L0200	L0190	Trapezoidal	1	36.29	36.24	0.030	142	6.04	18.0	1.4	1.6	-	42.34	36.29	42.96	36.24
L0190A	L0190	L0180	Trapezoidal	1	36.24	36.18	0.030	200	6.43	16.0	1.7	1.2	-	42.96	36.24	42.62	36.18
L0180A	L0180	L0170	Trapezoidal	1	36.18	36.11	0.030	195	6.43	18.0	1.2	1.8	-	42.62	36.18	42.85	36.11
L0170A	L0170	L0160	Trapezoidal	1	36.11	36.05	0.030	201	6.66	17.0	1.2	1.5	-	42.85	36.11	42.72	36.05
L0160A	L0160	L0150	Trapezoidal	1	36.05	36.00	0.030	149	6.66	16.0	1.5	1.7	-	42.72	36.05	44.60	36.00
Township Road																	
L0150B	L0150	L0140	Circular	1	37.16	36.54	0.024	70	5.00	-	-	-	0.9	44.60	36.00	44.60	35.26
L0140A	L0140	L0130	Trapezoidal	1	35.26	34.60	0.030	974	9.01	14.9	1.5	2.1	-	44.60	35.26	44.60	34.60
L0130A	L0130	L0120	Trapezoidal	1	34.60	33.96	0.030	1254	9.00	14.9	1.5	2.1	-	44.60	34.60	44.59	33.73
L0120B	L0120	L0110	Circular	1	33.73	34.17	0.024	80	6.00	-	-	-	0.9	44.59	33.73	43.79	34.17
L0110A	L0110	L0102	Trapezoidal	1	34.17	33.94	0.030	1257	8.86	16.5	1.8	1.6	-	43.79	34.17	42.80	33.94
L0100A	L0100	L0090	Trapezoidal	1	33.94	33.71	0.030	1194	8.37	16.5	1.8	1.6	-	42.80	33.94	42.08	33.21
L0090B	L0090	L0080	Circular	1	33.21	32.99	0.024	35	6.00	-	-	-	0.9	42.08	33.21	43.48	32.99
L0080A	L0080	L0070	Trapezoidal	1	33.65	33.65	0.030	1159	9.83	17.9	1.6	1.7	-	43.48	32.99	43.48	33.65
L0070A	L0070	L0060	Trapezoidal	1	33.65	33.24	0.030	1207	7.27	17.9	1.6	1.7	-	43.48	33.65	40.51	33.24
L0060B	L0060	L0050	Circular	1	33.25	32.63	0.024	31	6.00	-	-	-	0.9	40.51	33.24	40.22	32.12
L0050A	L0050	L0040	Trapezoidal	1	32.12	31.75	0.030	614	8.09	15.2	1.6	1.2	-	40.22	32.12	40.22	31.75
L0040A	L0040	L0030	Trapezoidal	1	31.75	31.39	0.030	1817	7.89	15.2	1.6	1.2	-	40.22	31.75	39.28	31.39
L0030A	L0030	L0020	Trapezoidal	1	31.39	29.88	0.030	1950	7.89	13.2	1.2	1.4	-	39.28	31.39	39.83	29.88
L0020A	L0020	L0010	Trapezoidal	1	29.88	28.43	0.030	518	9.95	13.3	1.0	1.3	-	39.83	29.88	39.50	28.43
End of the Live Oak Canal, Discharge into the State Drain																	

Note: A Manning's n-value for concrete pipe of 0.015 was usually used, but for some large diameter pipes a value of 0.013 was used along with entrance losses.

Table A-4. Comparison of Water Surface Elevations for Future Land Uses with Existing Conditions

Model Input Data				10-Year Storm (Note 1) Existing Conditions		Future Conditions		Elevation Difference between Future and Existing Max WSEL	100-Year Storm (Note 2) Existing Conditions		Future Conditions		Elevation Difference between Future and Existing Max WSEL	Note / Location
Node	Invert Elev	Modeled Ground Elevation (Maintenance Hole Rim or High Channel Bank)	Maintenance Hole Rim or Low Channel Bank Elevation	Max WSEL	Depth of Flooding (+) or Freeboard (-)	Max WSEL	Depth of Flooding (+) or Freeboard (-)		Max WSEL	Depth of Flooding (+) or Freeboard (-)	Max WSEL	Depth of Flooding (+) or Freeboard (-)		
	ft, NGVD	ft, NGVD	ft, NGVD	ft, NGVD	ft, NGVD	ft, NGVD	ft, NGVD	ft	ft, NGVD	ft, NGVD	ft, NGVD	ft, NGVD	ft	
Live Oak Canal														
L1920	51.6	57.0	54.6	57.0	2.6	49.3	-5.3	-7.8	57.7	3.1	52.1	-2.5	-5.6	Just south of Pease Road
L1910	51.9	57.0	54.6	57.0	2.6	49.3	-5.3	-7.8	57.6	3.1	52.1	-2.5	-5.6	
L1900	51.7	57.2	56.1	57.0	1.1	49.3	-6.9	-7.8	57.6	1.6	52.1	-4.1	-5.6	
L1892	44.1	58.3	56.1	57.0	1.1	49.3	-6.9	-7.8	57.6	1.6	52.1	-4.1	-5.6	Upstream side of True Road
L1890	44.0	57.9	56.1	53.8	-1.9	49.3	-6.9	-4.5	56.2	0.3	52.1	-4.1	-4.1	Downstream side of True Road
L1880	50.6	57.2	56.1	53.8	-1.9	49.5	-6.6	-4.3	56.2	0.3	52.1	-4.1	-4.1	Clearview Drive
L1870	44.7	56.8	56.1	53.8	-1.9	50.1	-6.1	-3.7	56.2	0.3	52.2	-3.9	-4.0	Upstream Side of Butte House Drive
L1860	44.3	58.0	54.4	53.7	-0.2	50.1	-4.3	-3.6	55.8	1.6	52.3	-2.1	-3.5	Downstream Side of Butte House Drive
L1852	49.6	57.8	54.4	53.7	-0.2	50.1	-4.2	-3.6	55.8	1.6	52.3	-2.1	-3.4	
L1851	49.4	57.7	57.7	53.7	-3.6	50.1	-7.6	-3.6	55.8	-1.7	52.3	-5.4	-3.4	
L1850	49.4	57.1	54.8	52.9	-1.8	50.2	-4.6	-2.7	53.8	-0.8	52.3	-2.5	-1.5	
L1840	47.1	54.4	53.6	52.8	-0.6	50.2	-3.4	-2.6	53.8	0.4	52.4	-1.2	-1.4	North side of Roosevelt Road (road at 53.9)
L1830	46.7	53.7	52.4	52.7	0.4	50.2	-2.2	-2.5	53.4	1.1	52.5	0.1	-0.9	South side of Roosevelt Road
L1826	46.9	53.4	53.0	52.7	-0.2	50.3	-2.7	-2.5	53.4	0.5	52.5	-0.5	-0.9	North side of Mantia Drive
L1824	45.0	51.9	53.0	52.6	-0.3	-	-	-	53.0	0.0	-	-	-	South side of Mantia Drive
L1820	43.2	58.1	54.2	52.6	-1.6	50.3	-3.9	-2.2	53.0	-1.2	52.7	-1.5	-0.3	Confluence of Jefferson Street Channel and Live Oak Canal
L1800	41.7	55.0	54.0	52.5	-1.5	-	-	-	52.9	-1.1	-	-	-	Upstream side of abandoned railroad
L1790	44.0	55.3	52.0	52.4	0.5	49.7	-2.3	-2.7	52.8	0.9	52.8	0.8	-0.1	Downstream side of abandoned railroad
L1780	43.6	54.8	52.0	52.4	0.5	49.5	-2.5	-2.9	52.8	0.9	51.8	-0.1	-1.0	Downstream side of Jefferson Avenue (Jefferson Avenue is at 55.6 feet)
L1770	43.2	52.5	51.2	52.4	1.3	49.3	-2.0	-3.1	52.8	1.6	51.6	0.4	-1.2	Upstream side of Monore Road (Monroe Road is at 52.0 feet)
L1760	43.1	52.1	51.6	52.3	0.8	49.1	-2.5	-3.2	52.7	1.2	51.3	-0.3	-1.4	Downstream side of Monore Road
L1750	42.7	53.2	52.0	52.3	0.4	48.8	-3.2	-3.5	52.7	0.8	51.0	-1.0	-1.8	
L1740	41.3	53.2	52.0	52.3	0.4	48.2	-3.7	-4.1	52.7	0.8	50.3	-1.6	-2.4	Upstream side of State Route 20 (Headwall at 52.8 feet)
L1730	40.8	51.9	51.2	52.1	1.0	47.7	-3.5	-4.4	52.5	1.3	49.5	-1.7	-3.0	Downstream side of State Route 20 (Headwall at 50.9 feet)
L1720	44.7	52.6	51.2	52.1	1.0	47.7	-3.5	-4.4	52.5	1.4	49.5	-1.6	-3.0	

Table A-4. Comparison of Water Surface Elevations for Future Land Uses with Existing Conditions

Model Input Data				10-Year Storm (Note 1)					100-Year Storm (Note 2)					
				Existing Conditions		Future Conditions			Existing Conditions		Future Conditions			
Node	Invert Elev	Modeled Ground Elevation (Maintenance Hole Rim or High Channel Bank)	Maintenance Hole Rim or Low Channel Bank Elevation	Max WSEL	Depth of Flooding (+) or Freeboard (-)	Max WSEL	Depth of Flooding (+) or Freeboard (-)	Elevation Difference between Future and Existing Max WSEL	Max WSEL	Depth of Flooding (+) or Freeboard (-)	Max WSEL	Depth of Flooding (+) or Freeboard (-)	Elevation Difference between Future and Existing Max WSEL	Note / Location
	ft, NGVD	ft, NGVD	ft, NGVD	ft, NGVD	ft, NGVD	ft, NGVD	ft, NGVD	ft	ft, NGVD	ft, NGVD	ft, NGVD	ft, NGVD	ft	
L1710	45.0	52.8	51.5	52.1	0.7	47.7	-3.8	-4.4	52.5	1.0	49.5	-2.0	-3.0	
L1700	44.6	51.9	51.4	52.1	0.8	47.7	-3.7	-4.4	52.5	1.1	49.5	-1.9	-3.0	
L1690	44.6	51.7	51.2	51.8	0.7	47.6	-3.6	-4.2	52.2	1.1	49.4	-1.7	-2.8	
L1680	44.8	52.5	51.3	51.8	0.6	47.6	-3.7	-4.2	52.2	0.9	49.4	-1.9	-2.8	
L1670	44.7	51.6	51.6	51.8	0.3	47.6	-4.0	-4.2	52.2	0.7	49.4	-2.1	-2.8	
L1660	44.5	52.3	51.3	51.5	0.2	47.5	-3.8	-4.0	52.0	0.7	49.3	-2.0	-2.6	
L1650	44.9	52.1	51.9	51.5	-0.3	47.5	-4.4	-4.0	52.0	0.1	49.3	-2.5	-2.6	
L1640	44.5	52.6	51.5	51.5	0.1	47.5	-4.0	-4.0	52.0	0.5	49.3	-2.2	-2.6	
L1630	44.5	52.5	52.5	51.2	-1.2	47.5	-5.1	-3.8	51.8	-0.6	49.2	-3.3	-2.6	
L1620	44.7	52.4	52.3	51.2	-0.9	47.5	-4.8	-3.8	51.8	-0.4	49.2	-3.0	-2.6	
L1610	44.7	52.5	52.2	51.2	-0.8	47.5	-4.7	-3.8	51.8	-0.3	49.2	-2.9	-2.6	
L1600	44.6	52.2	51.9	51.0	-0.8	47.4	-4.5	-3.6	51.7	-0.1	49.1	-2.7	-2.5	Commercial Drive
L1590	44.9	52.0	51.8	50.9	-0.7	47.4	-4.4	-3.6	51.7	0.0	49.1	-2.6	-2.5	
L1580	44.4	52.2	51.7	50.9	-0.6	47.4	-4.3	-3.6	51.7	0.1	49.1	-2.5	-2.5	
L1570	44.4	52.2	51.7	50.7	-0.8	47.3	-4.4	-3.4	51.6	0.0	49.1	-2.6	-2.5	
L1560	44.4	51.9	51.6	50.7	-0.7	47.3	-4.3	-3.4	51.6	0.0	49.1	-2.5	-2.5	
L1550	44.4	51.7	51.6	50.4	-0.9	47.2	-4.4	-3.2	51.4	-0.1	49.0	-2.6	-2.4	
L1540	44.6	51.9	51.5	50.4	-0.8	47.2	-4.2	-3.2	51.4	0.1	49.0	-2.5	-2.4	Lynnwood Drive
L1530	44.1	51.5	51.6	50.4	-1.0	47.2	-4.4	-3.2	51.4	-0.1	49.0	-2.7	-2.4	
L1525	44.1	51.8	51.8	50.3	-1.2	47.2	-4.6	-3.1	51.4	-0.2	48.9	-2.9	-2.5	
L1520	44.1	51.3	51.0	50.0	-0.7	47.1	-3.9	-2.9	51.2	0.3	48.8	-2.2	-2.4	
L1510	44.1	51.7	51.4	50.0	-1.1	47.1	-4.3	-2.9	51.2	-0.1	48.8	-2.6	-2.4	
L1502	44.8	51.1	51.0	50.0	-0.8	47.1	-3.9	-2.9	51.2	0.3	48.8	-2.3	-2.4	
L1500	39.5	51.7	50.9	49.5	-1.0	47.0	-3.8	-2.4	51.0	0.3	48.7	-2.2	-2.3	Confluence with Del Monte Square Trunk Drain
L1480	44.2	51.2	50.9	49.5	-1.0	47.0	-3.8	-2.4	51.0	0.3	48.7	-2.2	-2.3	
L1470	44.2	51.1	50.8	49.4	-1.0	47.0	-3.8	-2.4	50.9	0.3	48.7	-2.2	-2.3	
L1460	44.2	51.3	50.7	49.4	-0.9	47.0	-3.7	-2.4	50.9	0.4	48.6	-2.0	-2.2	

Table A-4. Comparison of Water Surface Elevations for Future Land Uses with Existing Conditions

Model Input Data				10-Year Storm (Note 1)					100-Year Storm (Note 2)					
				Existing Conditions		Future Conditions			Existing Conditions		Future Conditions			
Node	Invert Elev	Modeled Ground Elevation (Maintenance Hole Rim or High Channel Bank)	Maintenance Hole Rim or Low Channel Bank Elevation	Max WSEL	Depth of Flooding (+) or Freeboard (-)	Max WSEL	Depth of Flooding (+) or Freeboard (-)	Elevation Difference between Future and Existing Max WSEL	Max WSEL	Depth of Flooding (+) or Freeboard (-)	Max WSEL	Depth of Flooding (+) or Freeboard (-)	Elevation Difference between Future and Existing Max WSEL	Note / Location
	ft, NGVD	ft, NGVD	ft, NGVD	ft, NGVD	ft, NGVD	ft, NGVD	ft, NGVD	ft	ft, NGVD	ft, NGVD	ft, NGVD	ft, NGVD	ft	
L1450	43.9	51.4	50.4	49.4	-0.6	47.0	-3.4	-2.4	50.8	0.6	48.6	-1.7	-2.2	
L1440	43.5	51.4	50.5	49.4	-0.8	46.9	-3.6	-2.4	50.8	0.4	48.6	-1.9	-2.2	
L1430	43.5	51.2	50.1	49.3	-0.4	46.9	-3.2	-2.4	50.8	0.9	48.6	-1.5	-2.2	
L1420	43.2	50.7	50.7	49.3	-1.0	46.9	-3.8	-2.4	50.7	0.2	48.5	-2.1	-2.2	
L1410	43.7	50.1	49.9	49.3	-0.3	46.8	-3.1	-2.4	50.6	0.9	48.5	-1.4	-2.1	Leanne Drive
L1400	42.9	50.0	49.9	49.2	-0.4	46.8	-3.2	-2.5	50.6	0.8	48.5	-1.5	-2.1	
L1390	42.4	51.2	50.9	49.2	-1.3	46.7	-4.2	-2.5	50.5	-0.3	48.4	-2.5	-2.1	
L1380	42.0	51.0	50.0	49.2	-0.5	46.7	-3.3	-2.5	50.5	0.6	48.4	-1.6	-2.1	
L1370	42.4	51.5	49.8	49.2	-0.3	46.7	-3.1	-2.5	50.5	0.8	48.4	-1.4	-2.1	
L1360	42.9	50.7	49.9	49.2	-0.4	46.7	-3.2	-2.5	50.5	0.7	48.4	-1.5	-2.1	Confluence with the Walnut Park Channel
L1350	42.6	51.7	50.4	49.1	-0.9	46.6	-3.8	-2.5	50.4	0.1	48.3	-2.1	-2.1	
L1340	42.6	51.4	50.3	49.1	-1.0	46.6	-3.8	-2.5	50.3	0.1	48.3	-2.1	-2.1	
L1330	42.8	51.6	50.2	49.0	-0.9	46.5	-3.6	-2.5	50.3	0.2	48.2	-1.9	-2.0	
L1320	42.6	51.2	50.9	49.0	-1.6	46.5	-4.4	-2.5	50.2	-0.6	48.2	-2.7	-2.0	
L1310	41.8	50.8	50.4	48.9	-1.2	46.4	-3.9	-2.5	50.2	-0.1	48.2	-2.2	-2.0	
L1300	42.0	51.0	50.4	48.9	-1.2	46.4	-3.9	-2.5	50.1	-0.1	48.1	-2.2	-2.0	
L1290	42.0	50.8	50.3	48.9	-1.1	46.4	-3.9	-2.5	50.1	-0.1	48.1	-2.2	-2.0	
L1280	42.8	50.5	50.5	48.8	-1.4	46.4	-4.1	-2.5	50.0	-0.4	48.1	-2.4	-2.0	
L1270	42.3	50.5	50.2	48.8	-1.1	46.3	-3.9	-2.5	50.0	-0.1	48.0	-2.2	-2.0	
L1260	42.0	49.9	49.1	48.8	-0.1	46.3	-2.8	-2.5	49.9	0.9	48.0	-1.1	-1.9	
L1250	42.4	51.4	50.0	48.7	-1.0	46.2	-3.7	-2.4	49.8	0.0	48.0	-2.0	-1.9	
L1240	40.9	51.4	50.0	48.7	-1.0	46.2	-3.7	-2.5	49.8	0.0	47.9	-2.0	-1.9	Upstream side of Franklin Road
L1230	41.2	50.0	49.6	48.5	-0.8	45.8	-3.7	-2.7	49.4	-0.1	47.3	-2.3	-2.1	Downstream side of Franklin Road
L1220	42.5	49.9	49.8	48.5	-1.1	45.8	-4.0	-2.7	49.4	-0.3	47.3	-2.5	-2.1	
L1210	42.0	50.3	48.9	48.5	-0.2	45.8	-3.1	-2.7	49.3	0.5	47.2	-1.7	-2.1	
L1200	41.5	50.9	49.7	48.5	-1.0	45.8	-3.9	-2.7	49.3	-0.3	47.2	-2.5	-2.1	
L1190	41.9	50.0	49.1	48.5	-0.5	45.7	-3.4	-2.7	49.2	0.2	47.2	-2.0	-2.1	

Table A-4. Comparison of Water Surface Elevations for Future Land Uses with Existing Conditions

Model Input Data				10-Year Storm (Note 1)					100-Year Storm (Note 2)					
				Existing Conditions		Future Conditions			Existing Conditions		Future Conditions			
Node	Invert Elev	Modeled Ground Elevation (Maintenance Hole Rim or High Channel Bank)	Maintenance Hole Rim or Low Channel Bank Elevation	Max WSEL	Depth of Flooding (+) or Freeboard (-)	Max WSEL	Depth of Flooding (+) or Freeboard (-)	Elevation Difference between Future and Existing Max WSEL	Max WSEL	Depth of Flooding (+) or Freeboard (-)	Max WSEL	Depth of Flooding (+) or Freeboard (-)	Elevation Difference between Future and Existing Max WSEL	Note / Location
	ft, NGVD	ft, NGVD	ft, NGVD	ft, NGVD	ft, NGVD	ft, NGVD	ft, NGVD	ft	ft, NGVD	ft, NGVD	ft, NGVD	ft, NGVD	ft	
L1180	41.4	50.3	49.0	48.4	-0.4	45.7	-3.3	-2.8	49.2	0.3	47.1	-1.9	-2.1	
L1170	41.3	50.2	49.0	48.4	-0.4	45.6	-3.4	-2.8	49.2	0.3	47.1	-1.9	-2.1	
L1160	41.5	50.8	48.3	48.4	0.3	45.6	-2.7	-2.8	49.1	1.0	47.0	-1.3	-2.1	
L1150	42.5	50.4	47.4	48.4	1.1	45.5	-1.9	-2.9	49.0	1.7	46.9	-0.5	-2.1	
L1140	41.2	50.3	47.5	48.4	1.0	45.5	-2.0	-2.9	49.0	1.6	46.9	-0.6	-2.1	
L1130	41.0	49.6	47.3	48.3	1.2	45.4	-1.9	-2.9	49.0	1.8	46.9	-0.4	-2.1	
L1120	41.0	49.6	48.4	48.3	0.0	45.4	-3.0	-2.9	48.9	0.6	46.8	-1.6	-2.1	
L1110	41.8	49.1	47.5	48.3	0.8	45.3	-2.2	-3.0	48.8	1.3	46.8	-0.8	-2.0	
L1100	40.7	47.7	47.7	48.3	0.6	45.3	-2.4	-3.0	48.7	1.0	46.7	-1.0	-2.0	
L1090	41.2	47.9	47.3	48.3	1.0	45.2	-2.1	-3.0	48.6	1.3	46.7	-0.7	-2.0	
L1080	40.6	47.9	47.7	48.2	0.6	45.2	-2.5	-3.1	48.6	1.0	46.6	-1.0	-2.0	
L1070	40.9	47.5	47.5	48.2	0.8	45.1	-2.4	-3.1	48.5	1.1	46.6	-0.9	-2.0	
L1060	41.1	48.3	47.4	48.2	0.9	45.0	-2.3	-3.2	48.5	1.1	46.5	-0.9	-2.0	
L1050	41.3	47.4	46.8	48.2	1.4	45.0	-1.8	-3.2	48.5	1.6	46.5	-0.4	-2.0	
L1040	41.2	47.6	47.2	48.1	1.0	45.0	-2.2	-3.2	48.4	1.3	46.4	-0.7	-2.0	
L1030	41.3	47.7	46.9	48.1	1.3	44.9	-1.9	-3.2	48.4	1.6	46.4	-0.5	-2.0	
L1020	41.1	47.8	47.4	48.1	0.7	44.9	-2.6	-3.2	48.4	1.0	46.3	-1.1	-2.1	
L1010	41.5	47.8	47.7	48.1	0.4	44.8	-2.9	-3.2	48.3	0.7	46.3	-1.4	-2.1	
L1000	41.3	48.4	47.9	48.0	0.2	44.8	-3.1	-3.3	48.3	0.5	46.2	-1.6	-2.1	
L0990	40.3	48.4	47.9	48.0	0.2	44.7	-3.1	-3.3	48.3	0.5	46.2	-1.7	-2.1	Upstream side of Lincoln Road (Centerline of Lincoln Road at 49.4 feet)
L0980	40.3	48.7	48.5	46.4	-2.0	44.2	-4.3	-2.2	47.0	-1.2	45.4	-3.1	-1.6	Downstream side of Lincoln Road
L0970	40.5	48.7	48.5	46.4	-2.0	44.2	-4.3	-2.2	47.0	-1.2	45.4	-3.1	-1.7	
L0960	40.4	47.9	46.8	46.4	-0.3	44.1	-2.6	-2.3	47.0	0.5	45.3	-1.4	-1.7	
L0950	39.8	47.6	46.6	46.4	-0.2	44.0	-2.6	-2.3	47.0	0.6	45.2	-1.4	-1.8	
L0940	40.2	47.4	46.5	46.3	-0.1	44.0	-2.6	-2.4	47.0	0.7	45.2	-1.4	-1.8	
L0930	40.7	47.5	46.3	46.3	0.1	43.9	-2.4	-2.4	47.0	0.9	45.1	-1.2	-1.9	

Table A-4. Comparison of Water Surface Elevations for Future Land Uses with Existing Conditions

Model Input Data				10-Year Storm (Note 1)					100-Year Storm (Note 2)					
				Existing Conditions		Future Conditions			Existing Conditions		Future Conditions			
Node	Invert Elev	Modeled Ground Elevation (Maintenance Hole Rim or High Channel Bank)	Maintenance Hole Rim or Low Channel Bank Elevation	Max WSEL	Depth of Flooding (+) or Freeboard (-)	Max WSEL	Depth of Flooding (+) or Freeboard (-)	Elevation Difference between Future and Existing Max WSEL	Max WSEL	Depth of Flooding (+) or Freeboard (-)	Max WSEL	Depth of Flooding (+) or Freeboard (-)	Elevation Difference between Future and Existing Max WSEL	Note / Location
	ft, NGVD	ft, NGVD	ft, NGVD	ft, NGVD	ft, NGVD	ft, NGVD	ft, NGVD	ft	ft, NGVD	ft, NGVD	ft, NGVD	ft, NGVD	ft	
L0920	40.2	47.4	46.3	46.3	0.1	43.9	-2.5	-2.5	47.0	0.9	45.0	-1.3	-2.0	
L0910	40.0	47.4	46.1	46.3	0.3	43.8	-2.3	-2.5	47.0	1.1	44.9	-1.1	-2.0	
L0900	40.4	46.9	46.1	46.3	0.3	43.7	-2.4	-2.6	47.0	1.1	44.9	-1.2	-2.1	
L0800	39.7	47.0	46.1	46.3	0.3	43.7	-2.4	-2.6	47.0	1.1	44.8	-1.2	-2.1	
L0790	40.1	46.8	45.8	46.2	0.6	43.6	-2.2	-2.6	47.0	1.4	44.7	-1.0	-2.2	
L0780	39.8	46.6	45.7	46.2	0.7	43.5	-2.1	-2.7	46.9	1.5	44.7	-1.0	-2.3	
L0770	39.7	46.8	45.9	46.2	0.4	43.5	-2.5	-2.8	46.9	1.2	44.6	-1.3	-2.4	
L0760	40.5	47.1	46.1	46.2	0.2	43.4	-2.7	-2.8	46.9	1.0	44.5	-1.6	-2.4	
L0750	40.5	47.9	47.1	46.2	-0.9	43.4	-3.8	-2.8	46.9	-0.1	44.5	-2.7	-2.4	
L0740	39.9	47.3	47.3	46.2	-1.1	43.3	-4.0	-2.9	46.8	-0.3	44.4	-2.9	-2.4	
L0730	39.1	47.1	46.9	46.1	-0.7	43.2	-3.7	-2.9	46.8	0.1	44.3	-2.6	-2.5	
L0720	39.3	46.8	46.7	46.1	-0.5	43.2	-3.5	-3.0	46.8	0.3	44.3	-2.4	-2.6	
L0710	39.0	46.7	46.6	46.1	-0.3	43.1	-3.5	-3.0	46.8	0.4	44.2	-2.3	-2.5	
L0700	39.2	46.6	46.4	46.1	-0.2	43.0	-3.3	-3.1	46.8	0.6	44.2	-2.1	-2.5	
L0690	38.8	46.6	46.3	46.1	-0.1	43.0	-3.3	-3.1	46.7	0.5	44.2	-2.1	-2.4	
L0680	38.6	46.5	46.2	46.1	-0.1	42.9	-3.3	-3.2	46.6	0.6	44.2	-2.0	-2.4	
L0670	38.4	46.2	45.7	46.1	0.5	42.8	-2.9	-3.3	46.5	1.0	44.2	-1.4	-2.3	
L0660	38.4	45.9	45.7	46.0	0.4	42.7	-3.0	-3.4	46.5	0.9	44.2	-1.4	-2.2	
L0650	38.4	46.6	45.9	46.0	0.2	42.6	-3.3	-3.5	46.4	0.6	44.2	-1.7	-2.2	
L0640	38.8	46.1	45.4	46.0	0.7	42.5	-2.9	-3.5	46.4	1.1	44.2	-1.1	-2.1	
L0630	38.1	45.5	45.4	46.0	0.7	42.3	-3.0	-3.7	46.4	1.0	44.2	-1.1	-2.1	
L0620	39.1	45.3	43.8	46.0	2.2	42.2	-1.7	-3.8	46.3	2.5	44.2	0.4	-2.1	
L0610	39.0	46.4	45.4	46.0	0.7	42.1	-3.2	-3.8	46.3	1.0	44.2	-1.1	-2.1	Upstream side of Bogue Road (Edge of pavement at 46.6 feet)
L0600	38.8	45.7	45.3	44.5	-0.8	41.8	-3.5	-2.6	44.8	-0.6	44.2	-1.1	-0.5	Downstream side of Bogue Road
L0590	38.8	45.7	45.3	44.5	-0.8	41.8	-3.5	-2.7	44.7	-0.6	44.2	-1.1	-0.5	
L0580	38.4	45.8	45.8	44.5	-1.3	41.7	-4.1	-2.7	44.7	-1.0	44.2	-1.6	-0.5	

Table A-4. Comparison of Water Surface Elevations for Future Land Uses with Existing Conditions

Model Input Data				10-Year Storm (Note 1)					100-Year Storm (Note 2)					
				Existing Conditions		Future Conditions			Existing Conditions		Future Conditions			
Node	Invert Elev	Modeled Ground Elevation (Maintenance Hole Rim or High Channel Bank)	Maintenance Hole Rim or Low Channel Bank Elevation	Max WSEL	Depth of Flooding (+) or Freeboard (-)	Max WSEL	Depth of Flooding (+) or Freeboard (-)	Elevation Difference between Future and Existing Max WSEL	Max WSEL	Depth of Flooding (+) or Freeboard (-)	Max WSEL	Depth of Flooding (+) or Freeboard (-)	Elevation Difference between Future and Existing Max WSEL	Note / Location
	ft, NGVD	ft, NGVD	ft, NGVD	ft, NGVD	ft, NGVD	ft, NGVD	ft, NGVD	ft	ft, NGVD	ft, NGVD	ft, NGVD	ft, NGVD	ft	
L0570	38.5	46.6	45.1	44.4	-0.6	41.6	-3.4	-2.8	44.7	-0.3	44.2	-0.8	-0.5	
L0560	38.2	47.1	45.0	44.4	-0.5	41.5	-3.5	-3.0	44.7	-0.2	44.2	-0.7	-0.5	
L0540	38.4	46.4	44.7	44.4	-0.3	41.3	-3.4	-3.1	44.7	0.0	44.2	-0.5	-0.5	
L0530	37.9	47.3	45.0	44.4	-0.6	41.2	-3.8	-3.2	44.7	-0.3	44.2	-0.7	-0.5	
L0520	37.9	48.1	44.9	44.4	-0.5	41.0	-3.9	-3.4	44.7	-0.2	44.2	-0.7	-0.4	
L0510	37.8	46.2	44.8	44.3	-0.4	41.0	-3.8	-3.3	44.6	-0.1	44.2	-0.5	-0.4	
L0500	38.3	46.0	45.0	44.3	-0.7	40.7	-4.3	-3.6	44.6	-0.4	44.0	-1.0	-0.6	
L0490	38.1	45.5	44.8	44.3	-0.4	40.7	-4.0	-3.6	44.6	-0.1	44.0	-0.8	-0.6	
L0480	37.9	44.5	44.1	44.3	0.2	40.7	-3.4	-3.6	44.6	0.5	44.0	-0.1	-0.6	
L0470	37.5	45.5	45.4	44.3	-1.1	40.7	-4.7	-3.6	44.6	-0.8	44.0	-1.4	-0.6	
L0460	37.4	44.9	44.5	44.3	-0.1	40.7	-3.7	-3.6	44.6	0.1	44.0	-0.5	-0.6	
L0450	37.8	45.2	44.1	44.3	0.2	40.7	-3.4	-3.6	44.6	0.5	44.0	-0.1	-0.6	
L0440a	38.0	46.4	44.7	44.3	-0.4	40.7	-4.0	-3.5	44.6	-0.1	44.0	-0.7	-0.6	
L0440	37.9	46.1	44.1	44.3	0.2	40.7	-3.4	-3.6	44.6	0.5	44.0	-0.1	-0.6	Bend in the Live Oak Canal
L0430	37.9	45.4	44.8	44.3	-0.5	40.7	-4.1	-3.5	44.6	-0.3	44.0	-0.9	-0.6	
L0420	37.5	45.5	44.9	44.3	-0.6	40.7	-4.1	-3.5	44.6	-0.3	44.0	-0.9	-0.6	
L0410	37.6	45.4	45.1	44.2	-0.8	40.7	-4.3	-3.5	44.6	-0.5	44.0	-1.1	-0.6	
L0400	38.3	45.4	45.1	44.2	-0.8	40.7	-4.3	-3.5	44.5	-0.5	44.0	-1.1	-0.6	
L0390	38.0	45.9	45.7	44.2	-1.4	40.7	-5.0	-3.5	44.5	-1.1	44.0	-1.7	-0.5	
L0380	37.5	45.1	44.2	44.2	0.0	40.7	-3.5	-3.5	44.5	0.3	44.0	-0.2	-0.5	
L0370	37.3	45.4	45.0	44.2	-0.8	40.7	-4.3	-3.5	44.5	-0.5	44.0	-1.0	-0.5	
L0360	37.1	45.2	43.3	44.2	0.9	40.7	-2.6	-3.5	44.5	1.2	44.0	0.6	-0.5	
L0350	36.8	45.5	43.4	44.2	0.8	40.7	-2.7	-3.5	44.5	1.1	44.0	0.6	-0.5	
L0340	37.1	46.6	43.7	44.2	0.5	40.6	-3.1	-3.5	44.5	0.8	42.5	-1.2	-2.0	
L0332	36.8	45.6	43.8	44.2	0.4	40.6	-3.2	-3.5	44.5	0.7	42.5	-1.3	-2.0	
L0330	36.7	46.4	46.4	44.1	-2.2	40.6	-5.8	-3.6	44.5	-1.9	42.5	-4.0	-2.0	Bend in the Live Oak Canal at Township Road
L0320	36.6	45.3	45.1	44.1	-0.9	40.6	-4.5	-3.6	44.5	-0.6	42.5	-2.6	-2.0	

Table A-4. Comparison of Water Surface Elevations for Future Land Uses with Existing Conditions

Model Input Data				10-Year Storm (Note 1)					100-Year Storm (Note 2)					
				Existing Conditions		Future Conditions			Existing Conditions		Future Conditions			
Node	Invert Elev	Modeled Ground Elevation (Maintenance Hole Rim or High Channel Bank)	Maintenance Hole Rim or Low Channel Bank Elevation	Max WSEL	Depth of Flooding (+) or Freeboard (-)	Max WSEL	Depth of Flooding (+) or Freeboard (-)	Elevation Difference between Future and Existing Max WSEL	Max WSEL	Depth of Flooding (+) or Freeboard (-)	Max WSEL	Depth of Flooding (+) or Freeboard (-)	Elevation Difference between Future and Existing Max WSEL	Note / Location
	ft, NGVD	ft, NGVD	ft, NGVD	ft, NGVD	ft, NGVD	ft, NGVD	ft, NGVD	ft	ft, NGVD	ft, NGVD	ft, NGVD	ft, NGVD	ft	
L0310	36.9	44.3	43.9	44.1	0.3	40.6	-3.3	-3.6	44.5	0.6	42.4	-1.5	-2.0	
L0300	35.6	44.8	44.8	44.1	-0.6	40.5	-4.3	-3.6	44.4	-0.4	42.4	-2.4	-2.0	
L0290	36.1	44.8	44.8	43.5	-1.2	40.1	-4.7	-3.4	43.8	-1.0	41.8	-3.0	-2.1	
L0280	36.9	44.8	44.7	43.5	-1.2	40.1	-4.6	-3.4	43.8	-0.9	41.7	-3.0	-2.1	
L0270	37.1	44.4	43.8	43.5	-0.3	40.1	-3.7	-3.4	43.8	0.0	41.7	-2.1	-2.1	
L0260	37.3	43.7	43.1	43.5	0.4	40.1	-3.1	-3.4	43.8	0.7	41.7	-1.5	-2.1	
L0250	37.3	43.2	42.9	43.5	0.6	40.0	-2.9	-3.5	43.8	0.8	41.6	-1.3	-2.1	
L0240	36.9	43.2	42.9	43.5	0.6	40.0	-2.9	-3.5	43.7	0.8	41.6	-1.3	-2.1	
L0230	36.8	42.3	41.8	43.5	1.7	40.0	-1.8	-3.5	43.7	1.9	41.6	-0.2	-2.1	Township Road edge of pavement at 43.86 feet
L0210	36.3	43.0	41.8	43.5	1.7	40.0	-1.9	-3.5	43.7	1.9	41.6	-0.2	-2.1	Township Road edge of pavement at 43.76 feet
L0200	36.3	42.3	42.3	43.2	0.9	39.6	-2.8	-3.6	43.5	1.1	40.9	-1.4	-2.6	
L0190	36.5	43.0	42.5	43.2	0.8	39.6	-2.9	-3.6	43.5	1.0	40.9	-1.6	-2.6	Township Road edge of pavement at 44.18 feet
L0180	36.9	42.6	42.5	43.2	0.7	39.5	-2.9	-3.7	43.4	1.0	40.8	-1.7	-2.6	Township Road edge of pavement at 44.07 feet
L0170	36.7	42.9	42.8	43.2	0.5	39.5	-3.2	-3.7	43.4	0.7	40.8	-1.9	-2.6	Township Road edge of pavement at 44.13 feet
L0160	36.6	42.7	41.7	43.2	1.5	39.5	-2.2	-3.7	43.4	1.7	40.8	-1.0	-2.7	Township Road edge of pavement at 43.48 feet
L0150	36.0	44.6	43.3	43.2	-0.1	39.5	-3.8	-3.7	43.4	0.2	40.8	-2.5	-2.7	Upstream side of Township Road (Crown of Township Road at 44.0 feet)
L0140	35.3	44.6	43.3	43.0	-0.2	38.5	-4.8	-4.6	43.3	0.0	40.1	-3.2	-3.2	Downstream side of Township Road
L0130	34.6	44.6	43.3	43.0	-0.2	38.3	-5.0	-4.8	43.3	0.0	40.0	-3.3	-3.3	
L0120	33.7	44.6	42.3	43.0	0.7	38.1	-4.3	-4.9	43.3	0.9	39.9	-2.5	-3.4	
L0110	34.2	43.8	42.4	41.3	-1.1	37.6	-4.8	-3.7	41.5	-1.0	39.0	-3.4	-2.5	
L0102	33.9	42.8	42.8	41.3	-1.5	37.4	-5.4	-3.8	41.5	-1.3	38.8	-4.0	-2.6	
L0100	33.9	42.8	42.8	41.3	-1.5	37.4	-5.4	-3.9	41.4	-1.4	38.8	-4.0	-2.7	
L0090	33.2	42.1	41.6	41.2	-0.4	37.2	-4.4	-4.0	41.4	-0.2	38.6	-3.0	-2.8	
L0080	33.0	43.5	41.2	37.0	-4.1	36.9	-4.3	-0.2	37.2	-4.0	37.9	-3.2	0.7	
L0070	33.7	43.5	41.2	36.8	-4.3	36.6	-4.5	-0.2	37.0	-4.1	37.7	-3.5	0.7	
L0060	33.2	40.5	40.5	36.6	-3.8	36.4	-4.1	-0.2	36.9	-3.5	37.4	-3.0	0.5	

Table A-4. Comparison of Water Surface Elevations for Future Land Uses with Existing Conditions

Model Input Data				10-Year Storm (Note 1)					100-Year Storm (Note 2)					
				Existing Conditions		Future Conditions			Existing Conditions		Future Conditions			
Node	Invert Elev	Modeled Ground Elevation (Maintenance Hole Rim or High Channel Bank)	Maintenance Hole Rim or Low Channel Bank Elevation	Max WSEL	Depth of Flooding (+) or Freeboard (-)	Max WSEL	Depth of Flooding (+) or Freeboard (-)	Elevation Difference between Future and Existing Max WSEL	Max WSEL	Depth of Flooding (+) or Freeboard (-)	Max WSEL	Depth of Flooding (+) or Freeboard (-)	Elevation Difference between Future and Existing Max WSEL	Note / Location
	ft, NGVD	ft, NGVD	ft, NGVD	ft, NGVD	ft, NGVD	ft, NGVD	ft, NGVD	ft	ft, NGVD	ft, NGVD	ft, NGVD	ft, NGVD	ft	
L0050	32.1	40.2	40.0	35.4	-4.6	35.2	-4.8	-0.2	35.7	-4.3	36.2	-3.8	0.5	
L0040	31.8	40.2	40.0	35.2	-4.8	35.0	-5.0	-0.2	35.6	-4.4	36.0	-4.0	0.4	
L0030	31.4	39.3	38.9	34.9	-4.1	34.5	-4.5	-0.4	35.3	-3.6	35.5	-3.5	0.1	
L0020	29.9	39.8	38.1	34.4	-3.7	33.9	-4.2	-0.5	35.0	-3.0	34.7	-3.3	-0.3	
L0010	28.4	39.5	39.5	34.3	-5.2	33.8	-5.7	-0.5	35.0	-4.5	34.6	-4.9	-0.4	Downstream end of Live oak Canal at the State Drain
State Drain (from Bogue Road to the O'Banion Pump Station)														
S0250	30.0	38.0	38.0	35.0	-3.0	35.0	-3.0	-0.1	35.5	-2.5	35.5	-2.5	0.0	At Bogue Road
S0240	28.3	39.4	36.0	34.0	-2.0	33.8	-2.2	-0.2	34.6	-1.4	35.6	-0.4	1.0	At live oak Canal
S0232	26.8	39.1	36.0	33.7	-2.3	33.5	-2.5	-0.2	34.4	-1.6	34.3	-1.7	0.0	
S0230	26.8	39.0	36.0	32.5	-3.5	32.8	-3.2	0.3	32.9	-3.1	34.0	-2.0	1.0	
S0222	27.2	38.2	36.4	32.2	-4.2	32.7	-3.7	0.4	32.7	-3.7	33.1	-3.3	0.4	At 30" Irrig Pipe Crossing (Pipe Invert at 33.8, pipe top at 36.3 ft
S0220	27.2	38.2	36.4	32.2	-4.2	32.5	-3.9	0.3	32.7	-3.7	33.1	-3.3	0.4	At 30" Irrig Pipe Crossing (Pipe Invert at 33.8, pipe top at 36.3 ft
S0212	27.0	36.4	38.2	31.9	-6.3	32.1	-6.1	0.2	32.4	-5.8	32.8	-5.4	0.4	At 36" Irrig Pipe Crossing (Pipe Invert at 33.5, pipe top at 36.5 ft
S0210	27.0	36.4	38.2	31.9	-6.3	32.0	-6.2	0.1	32.3	-5.9	32.8	-5.4	0.4	At 36" Irrig Pipe Crossing (Pipe Invert at 33.5, pipe top at 36.5 ft
S0190	26.9	36.4	36.0	31.5	-4.5	31.5	-4.5	0.0	32.0	-4.0	32.5	-3.5	0.4	At Oswald Road, bridge deck at 36.1 ft, bridge underside at 35. ft)
S0150	26.0	35.3	33.0	30.7	-2.3	30.7	-2.3	0.0	31.2	-1.8	31.7	-1.3	0.5	At bend of State Drain
S0130	23.6	36.6	34.0	29.4	-4.6	29.3	-4.7	0.0	30.3	-3.7	30.7	-3.3	0.4	At bend of State Drain
S0070	21.3	34.8	33.0	27.8	-5.2	27.7	-5.3	-0.1	29.4	-3.6	29.5	-3.5	0.1	
S0030	19.8	33.6	32.0	27.7	-4.3	27.5	-4.5	-0.2	29.3	-2.7	29.2	-2.8	-0.1	
S0010	19.0	32.0	31.9	27.6	-4.3	27.4	-4.5	-0.2	29.3	-2.6	29.1	-2.8	-0.1	O'Banion Pump Station Wet Well, top of channel at 31.9 ft
Lower Snake River (Tributary to the State Drain)														
S0330	38.0	45.0	45.0	44.3	-0.7	44.3	-0.7	0.0	44.8	-0.2	44.8	-0.2	0.0	Upstream side of Franklin Road
S0320	37.5	44.5	44.0	43.6	-0.4	43.6	-0.4	0.0	43.9	-0.1	43.9	-0.1	0.0	Downstream side of Franklin Road

Table A-4. Comparison of Water Surface Elevations for Future Land Uses with Existing Conditions

Model Input Data				10-Year Storm (Note 1) Existing Conditions		Future Conditions		Elevation Difference between Future and Existing Max WSEL	100-Year Storm (Note 2) Existing Conditions		Future Conditions		Elevation Difference between Future and Existing Max WSEL	Note / Location
Node	Invert Elev	Modeled Ground Elevation (Maintenance Hole Rim or High Channel Bank)	Maintenance Hole Rim or Low Channel Bank Elevation	Max WSEL	Depth of Flooding (+) or Freeboard (-)	Max WSEL	Depth of Flooding (+) or Freeboard (-)		Max WSEL	Depth of Flooding (+) or Freeboard (-)	Max WSEL	Depth of Flooding (+) or Freeboard (-)		
	ft, NGVD	ft, NGVD	ft, NGVD	ft, NGVD	ft, NGVD	ft, NGVD	ft, NGVD	ft	ft, NGVD	ft, NGVD	ft, NGVD	ft, NGVD	ft	
S0310	35.5	43.0	42.0	40.8	-1.2	40.8	-1.2	0.0	41.1	-0.9	41.1	-0.9	0.0	Upstream side of Lincoln Road
S0300	35.0	42.5	42.0	40.7	-1.3	40.7	-1.3	0.0	40.9	-1.1	40.9	-1.1	0.0	Downstream side of Lincoln Road
Little Blue Creek (Tributary to the State Drain)														
S0510	36.0	42.0	41.0	41.4	0.4	41.4	0.4	0.0	41.9	0.9	41.9	0.9	0.0	Upstream side of Lincoln Road
S0500	35.0	40.0	40.0	39.5	-0.5	39.4	-0.6	0.0	39.7	-0.3	39.6	-0.4	0.0	Downstream side of Lincoln Road
Sutter Bypass														
Sut BP (Levee)	29.0	55.0	55.0	34.3	-20.8	34.3	-20.7	0.0	35.0	-20.0	35.0	-20.0	0.0	
Butte House Drive Trunk Drain														
TBH0020	48.6	56.0	54.4	54.6	0.3	54.7	0.3	0.1	55.1	0.7	55.0	0.6	-0.1	
TBH0010	47.0	55.1	54.4	54.2	0.0	53.4	-1.0	-0.7	55.1	0.8	54.7	0.3	-0.4	
Monroe Drive Trunk Drain														
TL1760-01	43.9	53.0	53.0	52.3	-0.6	-	-	-	52.7	-0.2	-	-	-	Monroe Drain at Royo Ranchero
Del Monte Square Commercial Park Trunk Drain														
TrkL1500B	40.2	54.0	54.0	49.5	-4.1	47.5	-6.5	-2.0	52.3	-1.0	50.8	-3.2	-1.5	At El Margarita
TrkL1500A	40.0	53.0	53.0	49.5	-3.1	47.3	-5.7	-2.2	52.0	-0.8	50.0	-3.0	-1.9	
Walnut Park Channel, force Main and Pump Station														
TWP0030	40.0	50.0	50.0	46.0	-2.0	48.9	-1.1	2.9	56.6	8.8	51.8	1.8	-4.8	At Pump station
TWP0020	48.0	50.5	50.5	49.9	-0.4	47.8	-2.7	-2.1	50.7	0.3	50.1	-0.4	-0.6	At downstream end of force main
TWP0010	45.2	50.0	50.0	49.2	-0.5	46.8	-3.2	-2.4	50.5	0.6	48.6	-1.4	-1.9	At bend of channel
Jefferson Street Channel and Trunk Drain														
J0200	46.0	58.0	58.0	52.7	-4.8	50.9	-7.1	-1.8	55.1	-2.9	54.8	-3.2	-0.2	Upstream end of trunk drain
J0110	44.7	56.8	56.8	52.6	-4.0	50.7	-6.1	-1.9	54.4	-1.9	53.7	-3.1	-0.6	
J0100	44.7	56.9	56.9	52.6	-4.1	50.7	-6.2	-1.9	54.3	-2.1	53.7	-3.2	-0.6	
J0090	43.5	57.4	57.4	52.6	-4.6	50.7	-6.7	-1.9	54.2	-2.8	53.6	-3.8	-0.5	Harter Road
J0080	43.1	56.6	56.6	52.6	-3.9	50.4	-6.2	-2.1	53.4	-3.2	52.8	-3.8	-0.6	Transition from trunk drain to open channel
J0060	43.1	52.7	54.1	52.6	-1.4	50.4	-3.6	-2.1	53.4	-0.7	52.8	-1.2	-0.6	

Table A-4. Comparison of Water Surface Elevations for Future Land Uses with Existing Conditions

Model Input Data				10-Year Storm (Note 1) Existing Conditions		Future Conditions		Elevation Difference between Future and Existing Max WSEL	100-Year Storm (Note 2) Existing Conditions		Future Conditions		Elevation Difference between Future and Existing Max WSEL	Note / Location
Node	Invert Elev	Modeled Ground Elevation (Maintenance Hole Rim or High Channel Bank)	Maintenance Hole Rim or Low Channel Bank Elevation	Max WSEL	Depth of Flooding (+) or Freeboard (-)	Max WSEL	Depth of Flooding (+) or Freeboard (-)		Max WSEL	Depth of Flooding (+) or Freeboard (-)	Max WSEL	Depth of Flooding (+) or Freeboard (-)		
	ft, NGVD	ft, NGVD	ft, NGVD	ft, NGVD	ft, NGVD	ft, NGVD	ft, NGVD	ft	ft, NGVD	ft, NGVD	ft, NGVD	ft, NGVD	ft	
J0050	43.0	55.2	54.1	52.6	-1.4	50.4	-3.6	-2.1	53.4	-0.7	52.8	-1.2	-0.6	
J0040	41.3	55.2	55.2	52.6	-2.5	50.4	-4.9	-2.2	53.4	-1.8	52.8	-2.4	-0.6	Upstream side of Hooper Road
J0030	41.2	53.7	52.6	52.6	0.1	50.3	-2.2	-2.2	53.0	0.4	52.7	0.1	-0.3	Downstream side of Hooper Road
J0020	42.1	53.7	52.6	52.6	0.1	50.3	-2.2	-2.2	53.0	0.4	52.7	0.1	-0.3	
J0010	43.8	55.4	54.0	52.6	-1.4	50.3	-3.7	-2.2	53.0	-1.0	52.7	-1.3	-0.3	Just east of confluence with the Live Oak Canal
Gilsizer Slough														
G0310	40.0	50.0	50.0	50.1	0.1	50.2	0.2	0.1	52.4	2.4	52.5	2.5	0.1	
G0300	39.0	49.0	49.0	47.7	-1.3	47.7	-1.3	0.0	48.6	-0.4	48.6	-0.4	0.0	Upstream side of George Washington Boulevard
G0210	30.0	40.0	40.0	36.2	-3.8	36.2	-3.8	0.0	37.7	-2.3	37.6	-2.4	0.0	Downstream side of George Washington Boulevard
G0200	29.0	39.0	39.0	33.4	-5.6	33.2	-5.8	-0.2	34.5	-4.5	34.0	-5.0	-0.5	Upstream side of Highway 99
G0100	22.0	30.0	30.0	29.9	-0.1	27.6	-2.4	-2.4	31.5	1.5	29.3	-0.7	-2.2	Downstream side of Highway 99

Note 1: For a 10-year storm, the water level is to remain at least 1-foot below the gutter invert and maintenance hole rim elevations.

Note 2: For a 100-year storm, the water level is to remain at least 1-foot below the open channel top of bank.

Table A-5. Cost Estimate for Alternative 5

Item	Unit of Measure	Unit Cost	Quantity	Item Cost
1. Open Channel from NDB to Just South of True Road				
Channel Excavation	cubic yards	4	97,703	390,812
Chain link fence	feet	20	7,030	140,600
Vegetative Channel Stabilization	acres	2,000	7.8	15,680
Conflicts with Existing Utilities at (at 2 percent)				10,942
Mobilization/demobilization (at 5 percent)				27,355
Construction Contingency (at 10 percent)				54,709
Estimated Construction Cost				640,097
Land/Easements (Two segments, Ex at 50 to 100 feet wide, 1 segment at 100 feet wide)	acres	131,680	2.5	330,107
Engineering, CM/Insp, CEQA, City Admin (Note 1, at 20 percent)				128,019
Estimated Capital Cost				1,098,223
2. Pipe the LOC from Just South of True Road to the South Side of Butte House Road				
108-inch RCP	feet	1,416	1,990	2,817,840
Headwall	each	10,000	2	20,000
Vegetative soil stabilization	acres	2,000	3.3	6,501
Conflicts with Existing Utilities at (at 2 percent)				56,887
Mobilization/demobilization (at 5 percent)				142,217
Construction Contingency (at 10 percent)				284,434
Estimated Construction Cost				3,327,879
Land/Easements (Ex at 20 to 100 feet wide, Require 100 feet)	acres	131,680	0.0	0
Engineering, CM/Insp, CEQA, City Admin (Note 1, at 20 percent)				665,576
Estimated Capital Cost				3,993,455
3. Open Channel from Butte House Road to the Old Railroad				
Channel Excavation	cubic yards	4	28,311	113,244
Two 108-inch Culverts	feet	1,416	100	141,600
Headwalls	each	10,000	4	40,000
Chain link fence	feet	20	4,000	80,000
Vegetative Channel Stabilization	acres	2,000	4.0	8,035
Conflicts with Existing Utilities at (at 2 percent)				7,658
Mobilization/demobilization (at 5 percent)				19,144
Construction Contingency (at 10 percent)				38,288
Subtotal				447,969
Land/Easements (Ex at 50 to 100 feet wide)	acres	131,680	1.9	252,870
Engineering, CM/Insp, CEQA, City Admin (Note 1, at 20 percent)				89,594
Estimated Capital Cost				790,433
4. Pipe the LOC from the downstream side of the old railroad through SR 20				
36-inch RCP	feet	252	93	23,436
60-inch RCP	feet	420	1,262	530,040
72-inch RCP	feet	504	1,120	564,480
Vegetative soil stabilization	acres	2,000	5.7	11,364
Conflicts with Existing Utilities at (at 2 percent)				22,586
Mobilization/demobilization (at 5 percent)				56,466
Construction Contingency (at 10 percent)				112,932
Subtotal				1,321,304
Land/Easements (Ex at 100 feet wide)	acres	131,680	0	0
Engineering, CM/Insp, CEQA, City Admin (Note 1, at 20 percent)				264,261
Estimated Capital Cost				1,585,565
5. Enlarge the LOC from the downstream side of SR 20 to the Confluence with the Del Monte 96-inch outlet				
Channel Excavation	cubic yards	15	18,405	276,081
96-inch Culvert (8 culverts in the reach)	feet	1,056	431	455,136
Headwalls	each	10,000	16	160,000
Chain link fence	feet	20	4,623	92,462
Vegetative Channel Stabilization	acres	2,000	5	10,836
Conflicts with Existing Utilities at (at 10 percent)				99,452
Mobilization/demobilization (at 5 percent)				49,726
Construction Contingency (at 10 percent)				99,452
Subtotal				1,243,144
Land/Easements (Ex at 100 feet wide)	acres	131,680	0	0
Engineering, CM/Insp, CEQA, City Admin (Note 1, at 20 percent)				248,629
Estimated Capital Cost				1,491,773
6. Enlarge the LOC from the Del Monte 96-inch outlet to the Bend to the South				
Channel Excavation	cubic yards	15	23,852	357,784
Chain link fence	feet	20	6,454	129,072

Table A-5. Cost Estimate for Alternative 5

Item	Unit of Measure	Unit Cost	Quantity	Item Cost
Vegetative Channel Stabilization	acres	2,000	5.4	10,836
Conflicts with Existing Utilities at (at 10 percent)				49,769
Mobilization/demobilization (at 5 percent)				24,885
Construction Contingency (at 10 percent)				49,769
Subtotal				622,115
Land/Easements (Ex at 100 feet wide)	acres	131,680	0	0
Engineering, CM/Insp, CEQA, City Admin (Note 1, at 20 percent)				124,423
Estimated Capital Cost				746,538
7. Enlarge the LOC from the bend to the north side of Franklin Road				
Channel Excavation	cubic yards	15	30,300	454,501
Chain Link fence	feet	20	5,514	110,280
Vegetative Channel Stabilization		2,000	6.1	12,167
Conflicts with Existing Utilities at (at 10 percent)				57,695
Mobilization/demobilization (at 5 percent)				28,847
Construction Contingency (at 10 percent)				57,695
Subtotal				721,186
Land/Easements (Ex at 40 feet wide, Require 100 feet wide)	acres	131,680	3.6	473,032
Engineering, CM/Insp, CEQA, City Admin (Note 1, at 20 percent)				144,237
Estimated Capital Cost				1,338,456
8. Enlarge the LOC from the north side of Franklin Road to the north side of Lincoln Road				
Channel Excavation	cubic yards	15	51,015	765,228
120 inch Culvert	feet	1,740	240	417,600
Headwalls	each	10,000	2	20,000
Chain Link Fence	feet	20	10,569	211,389
Vegetative Channel Stabilization	acres	2,000	12.1	24,242
Conflicts with Existing Utilities at (at 2 percent)				28,769
Mobilization/demobilization (at 5 percent)				71,923
Construction Contingency (at 10 percent)				143,846
Subtotal				1,682,997
Land/Easements (Ex at 100 to 150 feet wide, Require 100 feet wide)	acres	131,680.0	2.7	355,536
Engineering, CM/Insp, CEQA, City Admin (Note 1, at 20 percent)				336,599
Estimated Capital Cost				2,375,133
9. Enlarge the LOC from the north side of Lincoln Road through the south side of Bogue Road				
Channel Excavation	cubic yards	15	57,060	855,906
Twin 120 inch Culvert at Bogue Road	feet	3,100	120	372,000
Headwalls	each	20,000	2	40,000
Chain link fence	feet	20	10,632	212,634
Vegetative Channel Stabilization	acres	2,000	12.1	24,242
Conflicts with Existing Utilities at (at 2 percent)				30,096
Mobilization/demobilization (at 5 percent)				75,239
Construction Contingency (at 10 percent)				150,478
Subtotal				1,760,596
Land/Easements (Ex at 100 to 150 feet wide, Require 100 feet wide)	acres	131,680.0	2.4	316,032
Engineering, CM/Insp, CEQA, City Admin (Note 1, at 20 percent)				352,119
Estimated Capital Cost				2,428,747
10. Enlarge the LOC from the downstream Side of Bogue Road through the South Detention Basin Outlet				
Channel Excavation	cubic yards	15	21,471	322,069
48-inch Culvert	feet	336	50	16,800
36-inch Culvert	feet	252	50	12,600
Headwalls (for 2 culverts)	each	10,000	4	40,000
Chain link fence	feet	20	5,280	105,600
Vegetative Channel Stabilization	acres	2,000	18	36,364
Conflicts with Existing Utilities at (at 2 percent)				10,669
Mobilization/demobilization (at 5 percent)				26,672
Construction Contingency (at 10 percent)				53,343
Subtotal				624,116
Land/Easements (Ex at 100 feet wide, Require 100 feet wide)	acres	10,000.0	0.5	5,000
Engineering, CM/Insp, CEQA, City Admin (Note 1, at 20 percent)				124,823
Estimated Capital Cost				753,939
11. Replace the Culverts in the LOC from the SDB outlet to the State Drain and One Culvert in the State Drain				
72 inch CMP Culverts	feet	504	290	146,160
120 inch CMP Culvert	feet	1,740	60	104,400
Dewatering (at each culvert)	each	30,000	7	210,000
Vegetative Channel Stabilization	acres	2,000	1.0	2,000

Table A-5. Cost Estimate for Alternative 5

Item	Unit of Measure	Unit Cost	Quantity	Item Cost
Conflicts with Existing Utilities at (at 5 percent)				23,128
Mobilization/demobilization (at 5 percent)				23,128
Construction Contingency (at 10 percent)				46,256
Subtotal				555,072
Land/Easements (Ex at 100 feet wide, Require 100 feet wide)	acres	10,000	0	0
Engineering, CM/Insp, CEQA, City Admin (Note 1, at 20 percent)				111,014
Estimated Capital Cost				666,086
12. North Detention Basin and pump station				
Pond Excavation	cubic yards	4	445,000	1,780,000
Inlet Weir Excavation	cubic yards (of concrete)	4	30,000	120,000
Access Road	foot	20	4,800	96,000
Fence	foot	20	4,600	92,000
Outlet pipe	foot	336	200	67,200
Flap Gate	each	10,000	2	20,000
Headwalls	each	10,000	1	10,000
Pump Station (50 cfs firm capacity 75 cfs total capacity)	LS	25,000	75	1,875,000
Vegetative Soil Stabilization	acres	2,000	30	60,000
Conflicts with Existing Utilities (at 2 percent)				82,404
Mobilization/demobilization (at 5 percent)				206,010
Construction Contingency (at 10 percent)				412,020
Subtotal				4,820,634
Land/Easements	acres	131,680	25	3,292,000
Engineering, CM/Insp, CEQA, City Admin (Note 1, at 20 percent)				964,127
Estimated Capital Cost				9,076,761
13. South Detention Basin				
Pond Excavation	cubic yards	4	1,448,800	5,795,200
Inlet Weir	cubic yards (of concrete)	1,000	25	25,000
Access Road	foot	20	7,200	144,000
Fence	foot	20	7,000	140,000
Outlet pipe	foot	420	200	84,000
Flap Gate	each	10,000	2	20,000
Headwalls	each	10,000	2	20,000
Pump Station (50 cfs firm capacity 75 cfs total capacity)	LS	25,000	75	1,875,000
Small Maintenance Building/Yard	LS	200,000	1	200,000
Vegetative Bank Stabilization	acres	2,000	80	160,000
Mobilization/demobilization (at 5 percent)				423,160
Construction Contingency (at 10 percent)				846,320
Subtotal				9,732,680
Land/Easements	acres	10,000	80	800,000
Engineering, CM/Insp, CEQA, City Admin (Note 1, at 20 percent)				1,946,536
Estimated Capital Cost				12,479,216
14. Replace the Culverts in the Jefferson Avenue Channel at Hooper Road				
96-inch RCP Culvert	feet	1,056	110	116,160
Headwalls	each	10,000	2	20,000
Vegetative Channel Stabilization	acres	2,000	1.0	2,000
Conflicts with Existing Utilities at (at 5 percent)				6,908
Mobilization/demobilization (at 5 percent)				6,908
Construction Contingency (at 10 percent)				13,816
Subtotal				165,792
Land/Easements (Ex at 100 feet wide, Require 100 feet wide)	acres	10,000	0	0
Engineering, CM/Insp, CEQA, City Admin (Note 1, at 20 percent)				33,158
Estimated Capital Cost				198,950
Total Estimated Construction Cost				**27,499,789**
Total Land/Easement Cost				**5,824,578**
Total Engineering, CM/Insp, CEQA, City Admin (Note 1), at 20 percent				**5,499,958**
Total Estimated Capital Cost				**38,824,000**

Note 1:
Engineering (planning and detailed design) Construction Management/Inspection, CEQA review and mitigation, and City administration during the design and construction are included at 20 percent.

Table A-6. Alternative Cost Summary		
Alternative	Construction Cost, $Mil	Capital Cost, $Mil
1	65.2	80.2
2	47.9	60.3
3	48.2	63.8
4	58.2	75.5
5	27.5	38.8

50 CFS North Pump Station

North Detention Basin (276 ac-ft)

Pease Rd

CHANNEL SIZE
BOTTOM WIDTH: 16'
DEPTH: 13' TO 14'
SIDE SLOPE: 3H:1V

604 CFS

617 CFS

108" RCP

Live Oak Canal

Zone 2

377 CFS

CHANNEL SIZE
BOTTOM WIDTH: 16'
DEPTH: 10' TO 13'
SIDE SLOPE: 3H:1V

341 CFS

Zone 4

Old Railroad

Zone 9

Zone 5

96" RCP

Jefferson Blvd

36" RCP

66" RCP

97 CFS

Zone 6

135 CFS

72" RCP

Highway 20

CHANNEL SIZE
BOTTOM WIDTH: 10'
DEPTH: 11' TO 13'
SIDE SLOPE: 2H:1V
CULVERTS: SINGLE 96" RCP

221 CFS

Zone 7

582 CFS

CHANNEL SIZE
BOTTOM WIDTH: 15'
DEPTH: 12' TO 14'
SIDE SLOPE: 3H:1V

Zone 8

CHANNEL SIZE
BOTTOM WIDTH: 12'
DEPTH: 12'
SIDE SLOPE: 2H:1V

755 CFS

CHANNEL SIZE
BOTTOM WIDTH: 15'
DEPTH: 11' TO 13'
SIDE SLOPE: 2H:1V
CULVERTS: SINGLE 108" RCP

George Washington Blvd

Highway 99

Lincoln Rd

1,042 CFS

CHANNEL SIZE
BOTTOM WIDTH: 20'
DEPTH: 11' TO 13'
SIDE SLOPE: 2H:1V
CULVERTS: TWIN 120" RCP

Bogne Rd

1,366 CFS

1,284 CFS

South Detention Basin (890 ac-ft)

CHANNEL SIZE
BOTTOM WIDTH: 25'
DEPTH: 11' TO 13'
SIDE SLOPE: 2H:1V

83 CFS

154 CFS

50 CFS South Pump Station and 36" RCP

Notes
1.
2.

LEGEND
Detention Basin
Low Cost MDS Alternative Improvements
Trunk Drains

N

0 1,100 2,200
Scale in Feet

FIGURE A-1A

Sutter County Drainage Project Feasablility

Low Cost Alternative Improvements

WEST YOST ASSOCIATES Consulting Engineers

N:\Clients\305 Sutter County\00-10-03 Drainage Project Feasibility\GIS\Figures\WYA Proposed Facilities.mxd 12/7/2010

West Interceptor Canal
East Interceptor Canal
Pease Rd
Jefferson Blvd
Highway 20
Franklin Rd
Lincoln Rd
Bogne Rd
Wadsworth Canal
Little Blue Creek
Snake River
Live Oak Canal
Township Rd
George Washington Blvd
Highway 99
South Detention Basin
159 CFS
154 CFS
72" CMP
72" CMP
72" CMP
72" CMP
72" CMP
72" CMP
425 CFS
120" CMP
Schlage Road
Oswald Road
Boulton Road
435 CFS
Gilsizer Slough
Hutchinson Road
O' Banion Road
Sutter Bypass

O'Banion Pump Station

Lower Pump On/Off Elevations:
Pump 1 - No Change
Pump 2 - No Change
Pump 3 - No Change
Pump 4 - Lowered By 0.5'
Pump 5 - Lowered By 1.0'
Pump 6 - Lowered By 1.5'

LEGEND
- Main Channel
- Culvert
- Detention Basin
- Live Oak Canal Watershed Boundary
- Gilsizer Shed
- Lower Snake River Shed
- Wadsworth Shed

N

0 2,750 5,500
Scale in Feet

FIGURE A-1B

Sutter County
Drainage Project Feasablility
Low Cost Alternative Improvements
Downstream Facilities

WEST YOST ASSOCIATES
Consulting Engineers

N:\Clients\305 Sutter County\00-10-03 Drainage Project Feasibility\GIS\Figures\WYA Downstream Facilites.mxd 12/7/2010

Figure A-2. Flow into the North Detention Basin

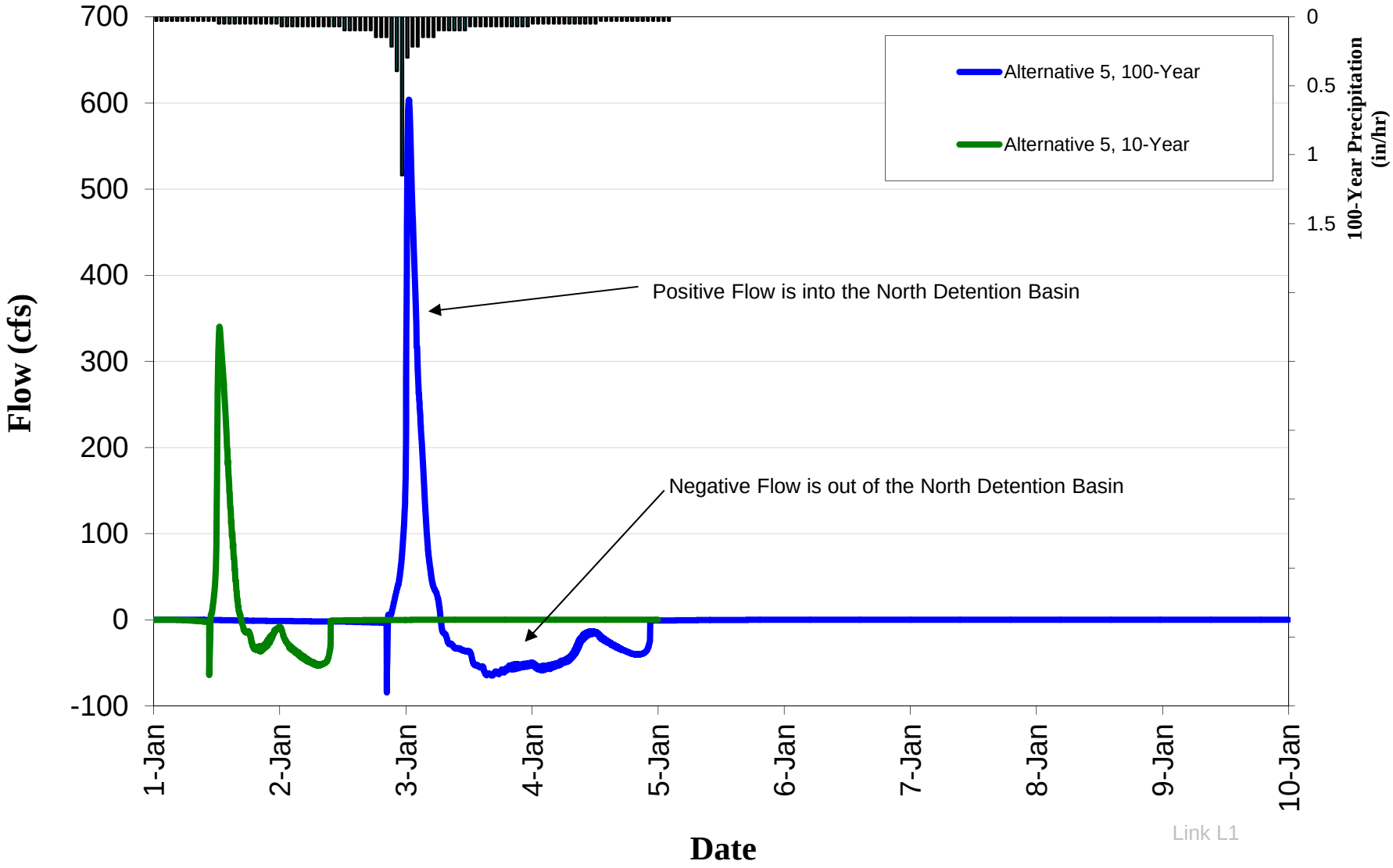

Figure A-3. Flow in the Live Oak Canal at the Old Railroad Crossing for Existing Conditions and at Buildout with Alternative 5 Improvements

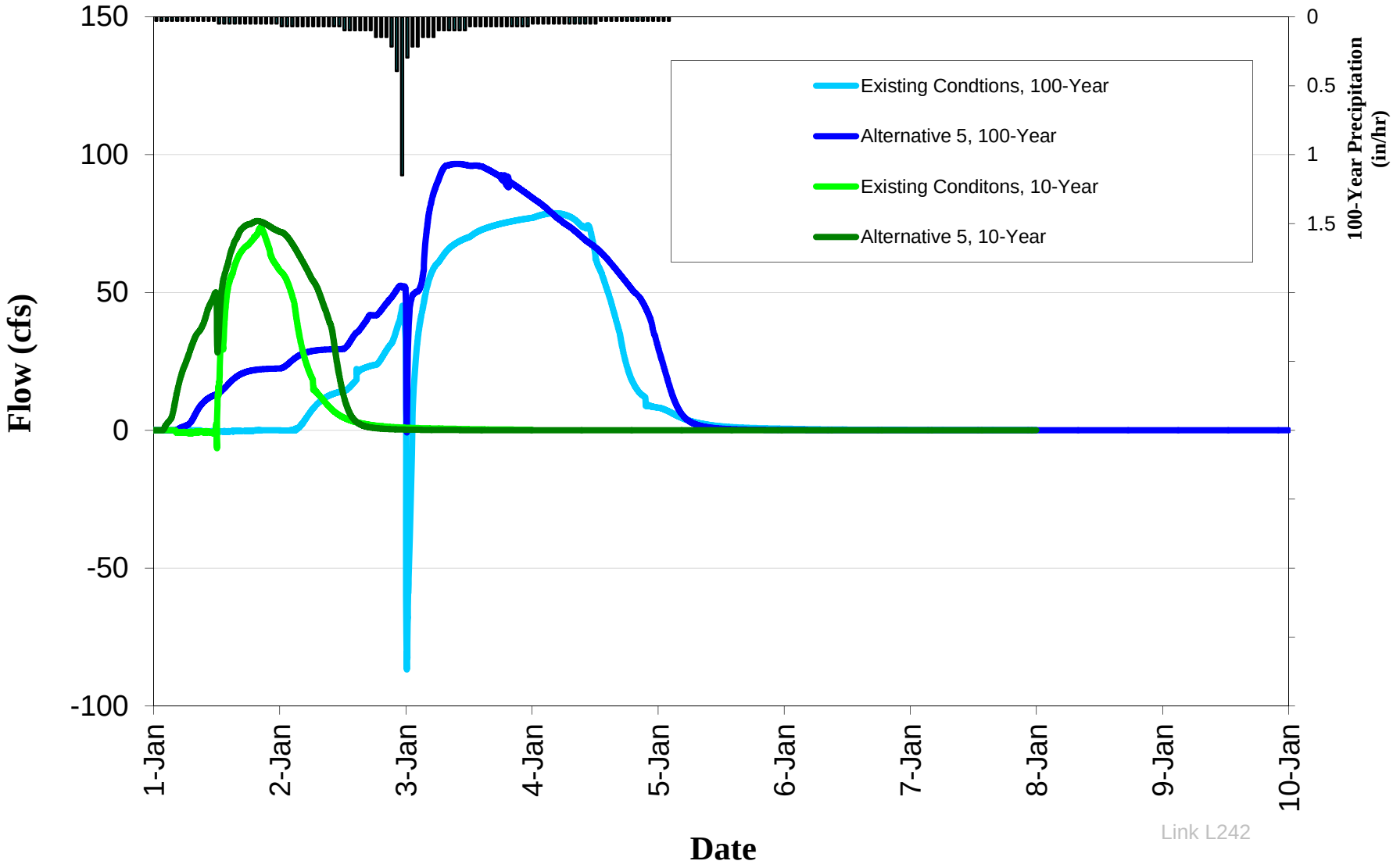

Figure A-4. Flow in the Live Oak Canal at State Route 20 for Existing Conditions and at Buildout with the Alternative 5 Improvements

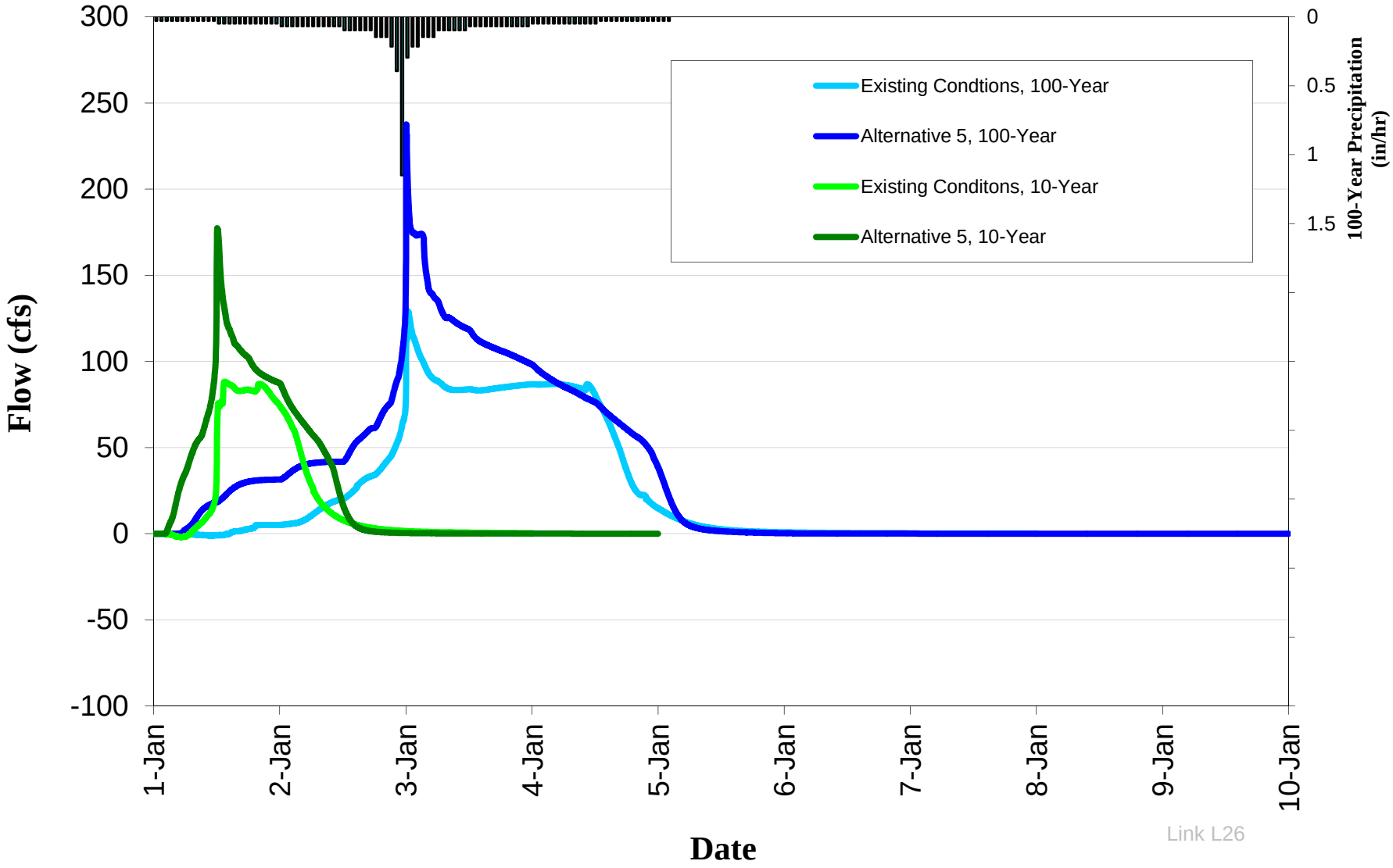

Figure A-5. Flow in the Live Oak Canal at Franklin Road for Existing Conditions and at Buildout with the Alternative 5 Improvements

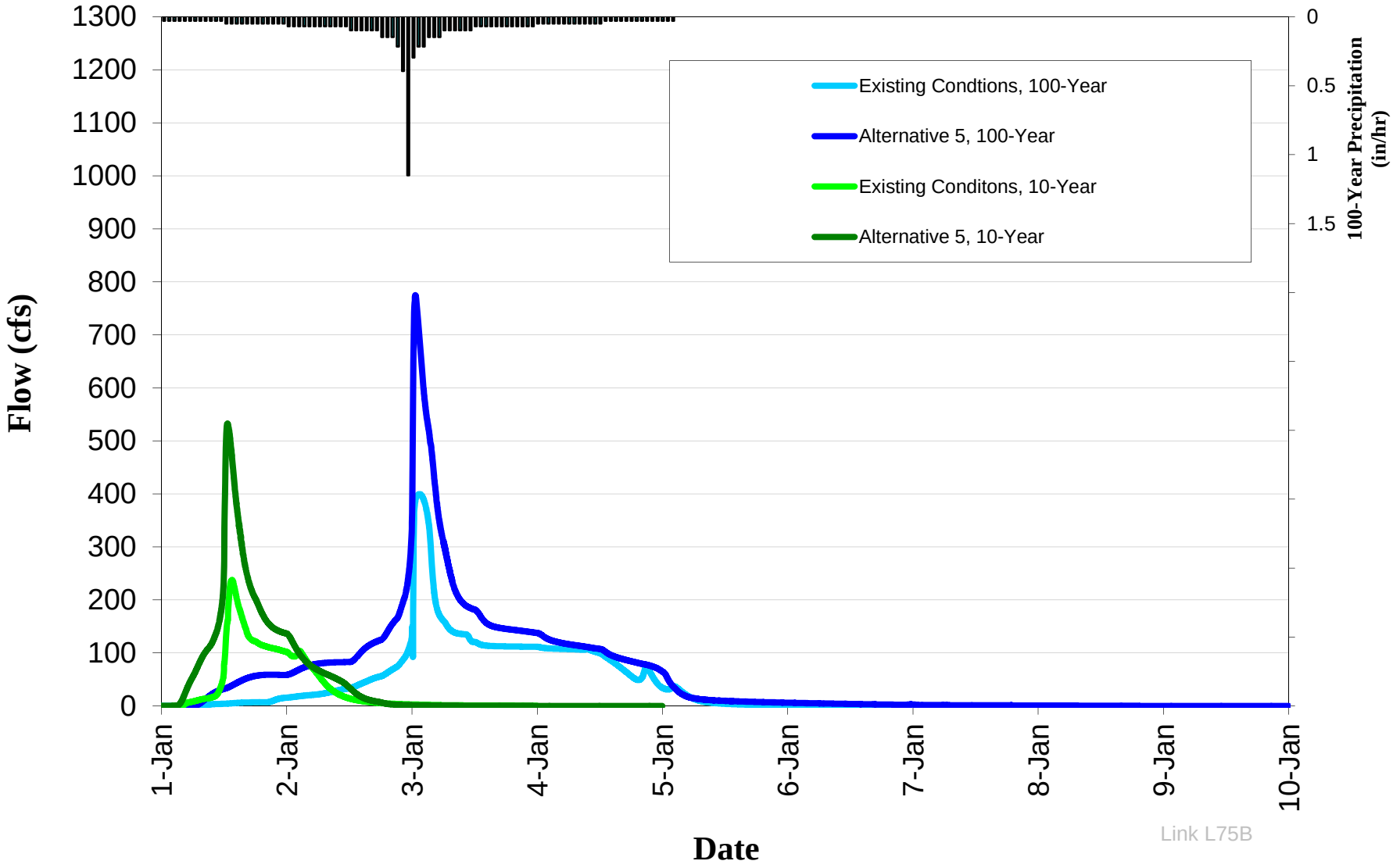

Figure A-6. Flow in the Live Oak Canal at Lincoln Road for Existing Conditions and at Buildout with the Alternative 5 Improvements

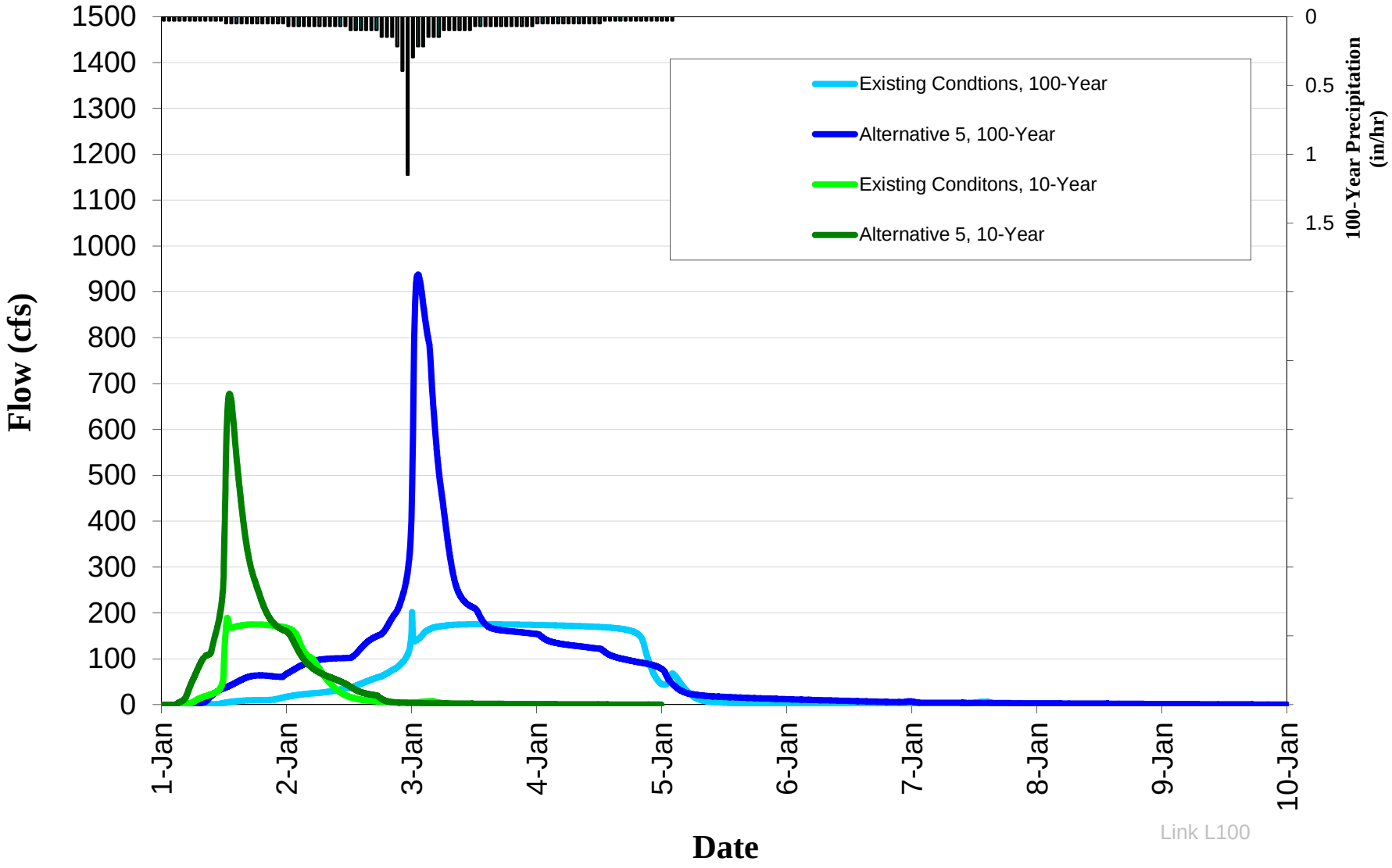

Figure A-7. Flow in the Live Oak Canal at Bogue Road for Existing Conditions and at Buildout with the Alternative 5 Improvements

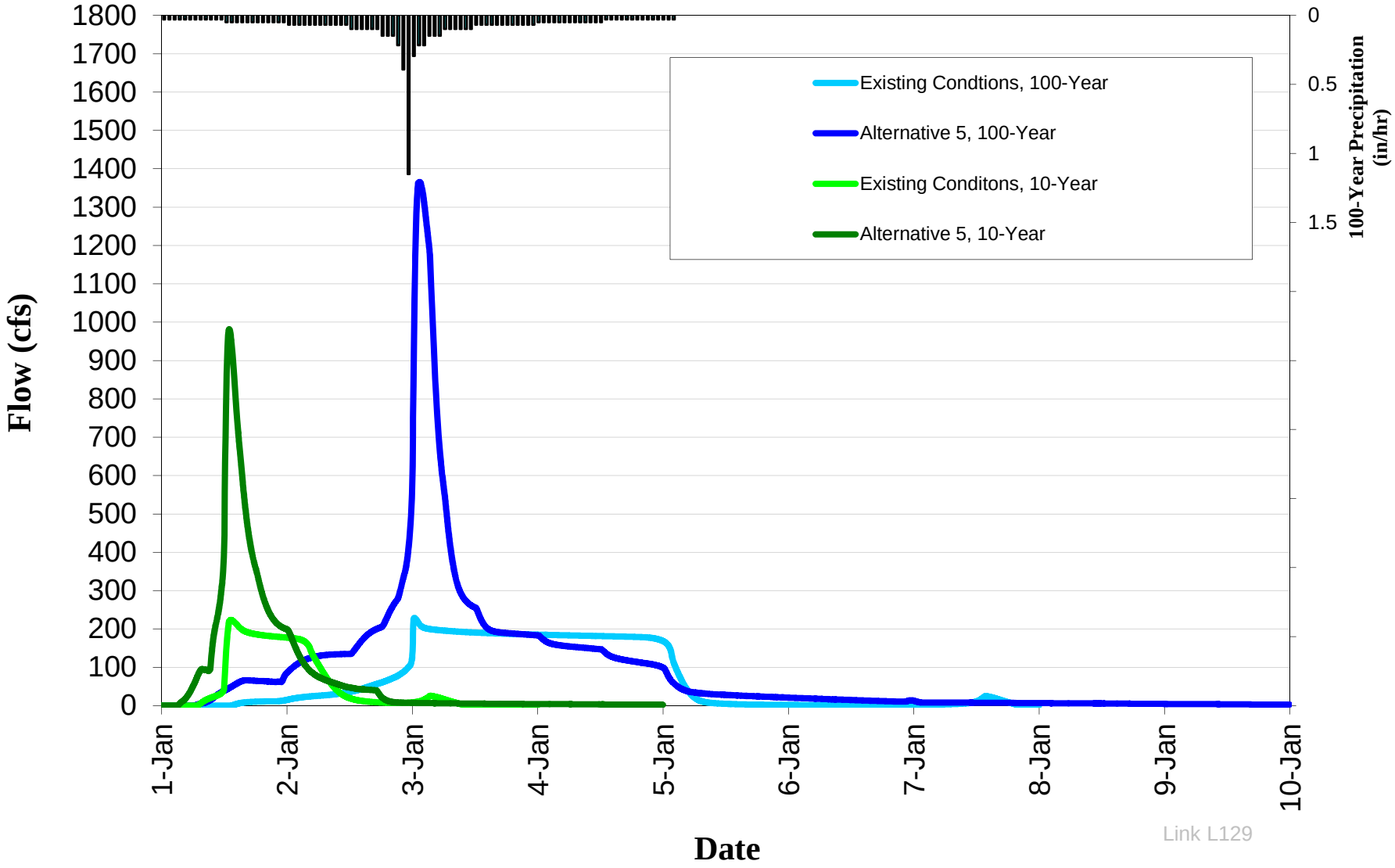

Figure A-8. Flow into the South Detention Basin at Buildout with the Alternative 5 Improvements

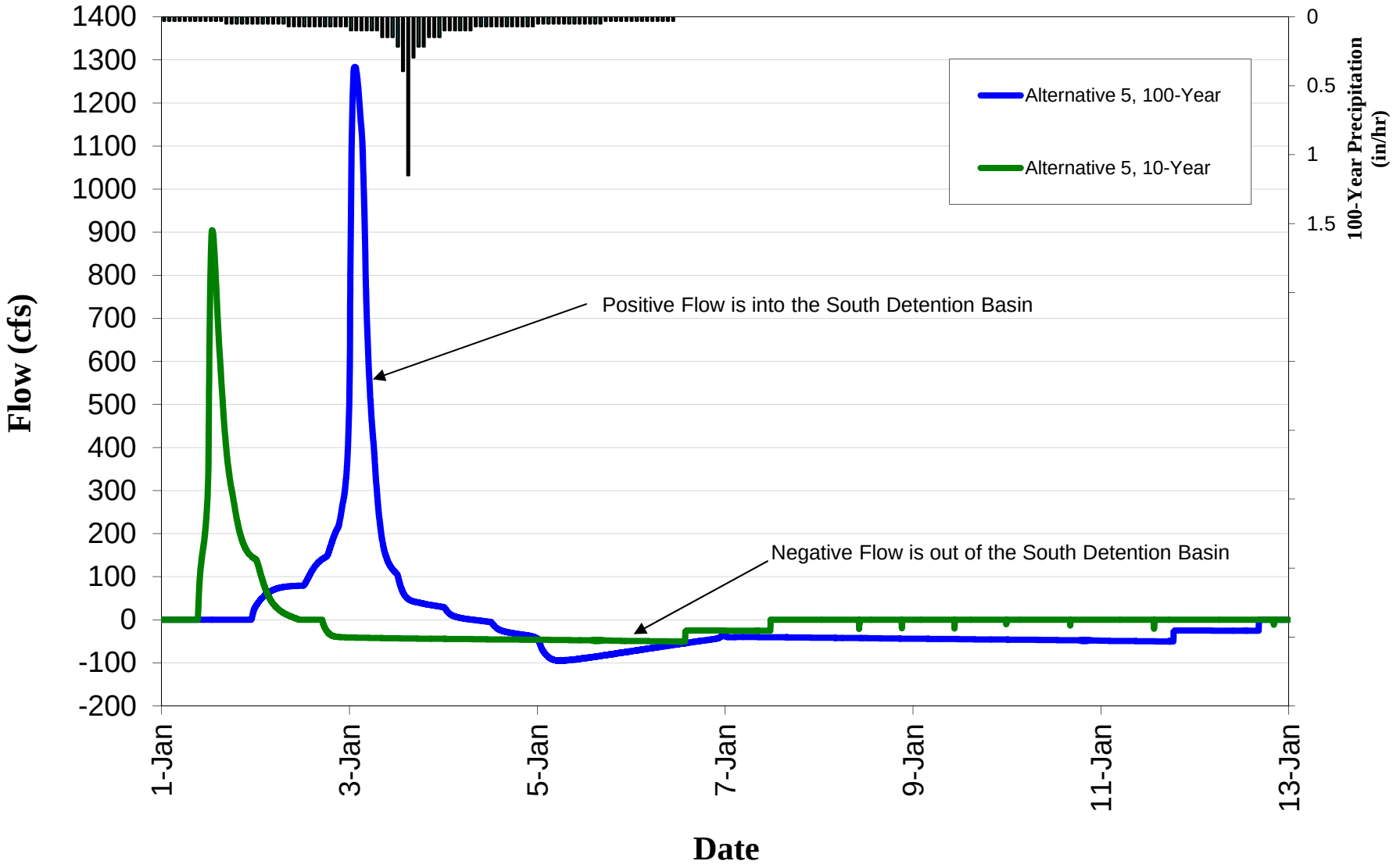

Figure A-9. Flow in the Live Oak Canal at Township Road for Existing Conditions and at Buildout with the Alternative 5 Improvements

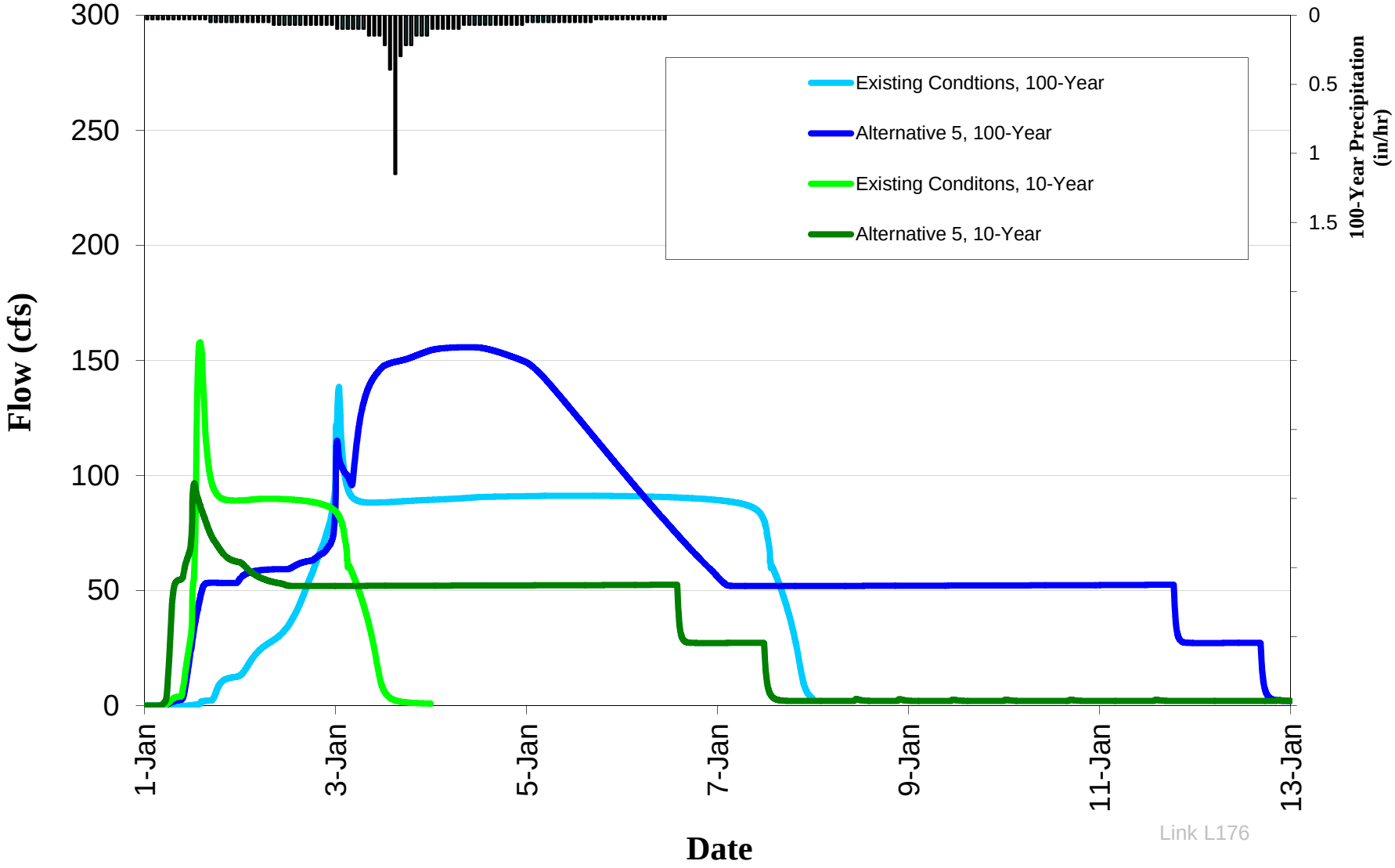

Figure A-10. Flow From the Live Oak Canal Into the State Drain for Existing Conditions and at Buildout with the Alternative 5 Improvements

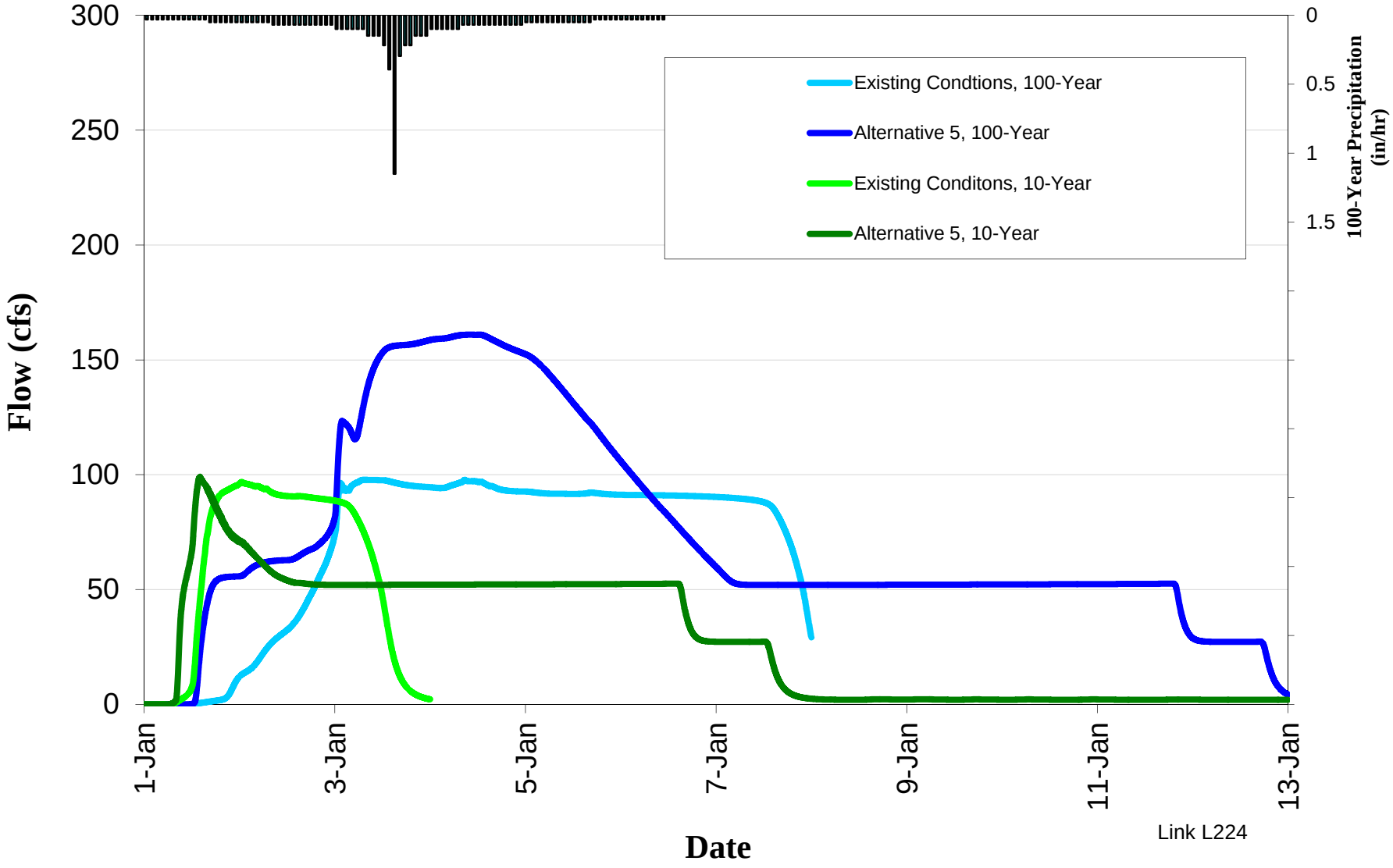

Figure A-11. Pumped Flow Rate Through the O'Banion Pump Station for Existing Conditions and at Buildout with the Alternative 5 Improvements

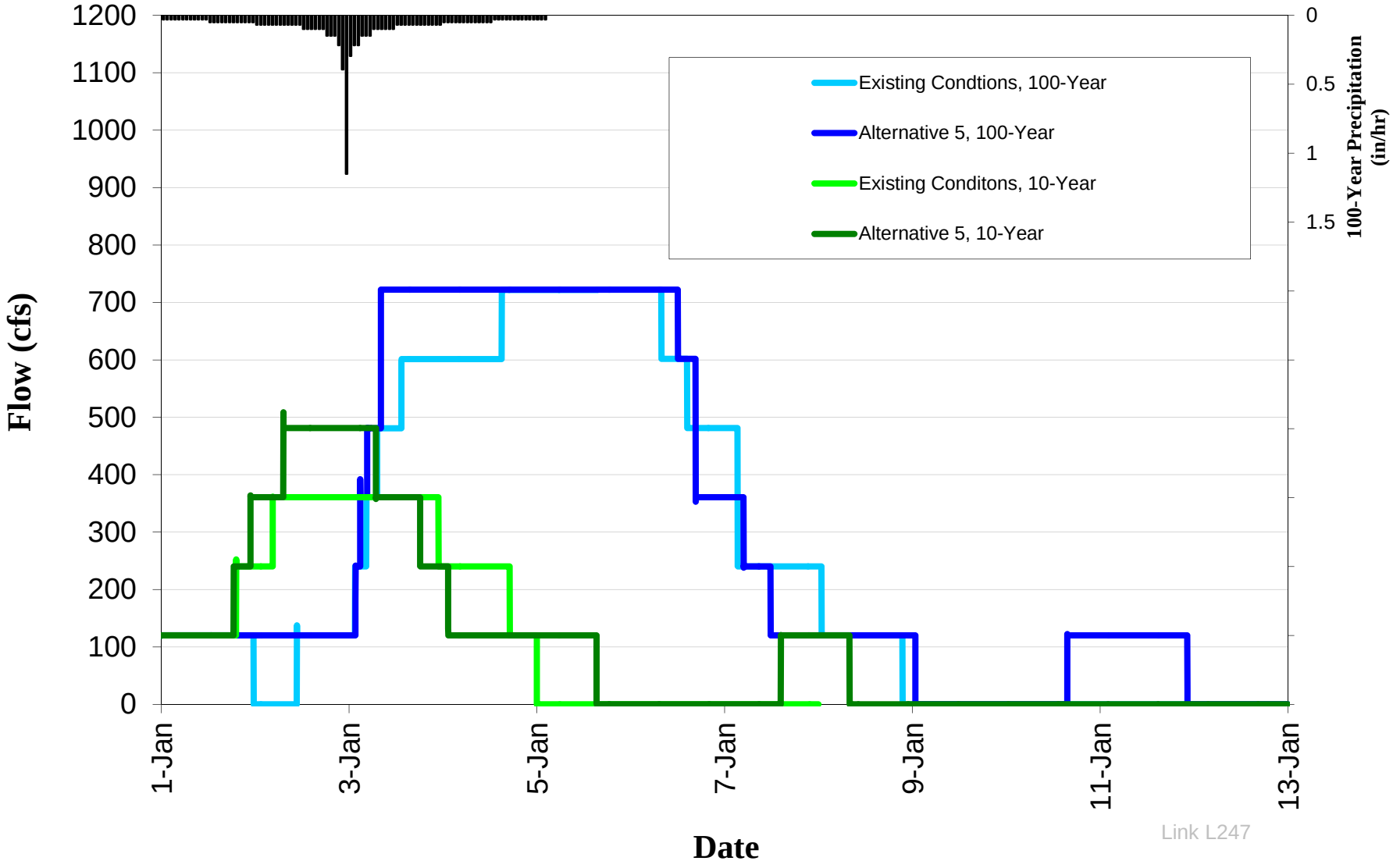

Figure A-12. Stage at the O'Banion Pump Station Wet Well